Agriculture and Agri Food Canada | Agriculture et Agroalimentaire Canada

2002 Pest Management Research Report (PMRR)
2002 Growing Season

2002 Rapport de recherches sur la lutte dirigée (RRLD)
pour le saison 2002

Compiled for
The Expert Committee on Integrated Pest Management (ECIPM)

Compilé par
le Comité d'experts sur la lutte intégrée (CELI)

February, 2003 / Février, 2003

Canada

English

2002 PEST MANAGEMENT RESEARCH REPORT

Compiled for: **THE EXPERT COMMITTEE ON INTEGRATED PEST MANAGEMENT (ECIPM)**

Chairperson: **Michel Letendre**

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[1] This is the third year that the Report has been issued a volume number. It is based on the number of years that it has been published. See history on page iii.

This annual report is designed to encourage and facilitate the rapid dissemination of pest management research results, particularly of field trials, amongst researchers, the pest management industry, university and government agencies, and others concerned with the development, registration and use of effective pest management strategies. The use of alternative and integrated pest management products is seen by the ECIPM as an integral part in the formulation of sound pest management strategies. If in doubt about the registration status of a particular product, consult the Pest Management Regulatory Agency, Health Canada at 1-800-267-6315.

This year there were 164 reports. The Expert Committee on Integrated Pest Management is indebted to the researchers from provincial and federal departments, universities, and industry who submitted reports, for without their involvement there would be no report. Special thanks is also extended to the section editors for reviewing the scientific content and merit of each report, and to Andrea Labaj for editorial and computer compilation services.
Suggestions for improving this publication are always welcome.

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Procedures for the 2003 Annual PMR Report will be sent in September, 2003. They will also be published on the web site, or contact PMRR EDITOR, Andrea Labaj.

Pest Management Research Report History.

1961 - The National Committee on Pesticide Use in Agriculture (NCPUA) was formed by its parent body, the National Coordinating Committee of Agricultural Services. It had three main duties: to define problems in crop and animal protection and to coordinate and stimulate research on pesticides; to establish principles for drafting local recommendations for pesticide use; and to summarize and make available current information on pesticides.

1962 - The first meeting of the NCPUA was held, and recommended the Committee should provide an annual compilation of summaries of research reports and pertinent data on crop and animal protection involving pesticides. The first volume of the Pesticide Research Report was published in 1962.

1970 - The NCPUA became the Canada Committee on Pesticide Use in Agriculture (CCPUA).

1978 - Name was changed to the Expert Committee of Pesticide Use in Canada (ECPUA).

1990 - The scope of the Report was changed to include pest management methods and therefore the name of the document was changed to the Pest Management Research Report (PMRR). The committee name was the Expert Committee on Pest Management (1990-1993) and the Expert Committee on Integrated Pest Management since 1994.

The publication of the Report for the growing season 2002 has been assigned a Volume number for the third year. Although there was a name change since it was first published, the purpose and format of the publication remains the same. Therefore based on the first year of publication of this document, the Volume Number will be Volume 41.

An individual report will be cited as follows:
Author(s). 2003. Title. 2002 Pest Management Research Report - 2002 Growing Season. Expert Committee on Integrated Pest Management. February, 2003. Report No. x. Vol. 41: pp-pp.

Français

Rapport de recherches sur la lutte dirigée - 2002

Préparé pour: **LE COMITÉ D'EXPERTS SUR LA LUTTE INTÉGRÉE**

Président: **Michel Letendre**

Préparé par: **Agriculture et Agroalimentaire Canada**
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Titre officiel du document
2002 Rapport de recherches sur la lutte dirigée - pour le saison 2002. Compilé par le Comité d'experts sur la lutte intégrée, par Agriculture et Agroalimentaire Canada, London (Ontario) Canada N5V 4T3. Février, 2003. 428 pp.
Publié sur l'Internet à http://www.carc-crac.ca/french/ECIPM/ecipmf.htm

La compilation du rapport annuel vise à faciliter la diffusion des résultats de la recherche dans le domaine de la lutte anti-parasitaire, en particulier, les études sur la terrain, parmi les chercheurs, l'industrie, les universités, les organismes gouvernementaux et tous ceux qui s'intéressent à la mise au point, à l'homologation et à l'emploi de stratégies antiparasitaires efficaces. L'utilisation de produits de lutte intégrée ou de solutions de rechange est perçue par Le Comité d'experts sur la lutte intégrée (CELI) comme faisant parti intégrante d'une stratégie judicieuse en lutte antiparasitaire. En cas de doute au sujet du statut d'enregistrement d'un produit donné, veuillez consulter Health Canada, Agence de Réglementation de la lutte anti-parasitaire à 1-800-267-6315.

Cette année, nous avons donc reçu 164 rapports. Les membres du Comité d'experts sur la lutte intégrée tiennent à remercier chaleureusement les chercheurs des ministères provinciaux et fédéraux, des universités et du secteur privé sans oublier les rédacteurs, qui ont fait la révision scientifique de chacun des rapports et en ont assuré la qualité, et Andrea Labaj qui ont fourni les services d'édition et de compilation sur ordinateur. Vos suggestions en vue de l'amélioration de cette publication sont toujours très appréciées.

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Historique du *Rapport de recherche sur la lutte antiparasitaire*
Le Comité national sur l'emploi des antiparasitaires en agriculture (CNEAA) a été formé en 1961 par le Comité national de coordination des services agricoles. Il s'acquittait d'un triple mandat : cerner les problèmes touchant la protection des cultures et des animaux et coordonner et stimuler la recherche sur les pesticides; établir des principes pour l'élaboration de recommandations de portée locale sur l'utilisation des pesticides; synthétiser et diffuser l'information courante sur les pesticides.

À la première réunion du CNEAA, en 1962, il a été recommandé que celui-ci produise un recueil annuel des sommaires des rapports de recherche et des données pertinentes sur la protection des cultures et des animaux impliquant l'emploi de pesticides. C'est à la suite de cette recommandation qu'a été publié, la même année, le premier volume du *Rapport de recherche sur les pesticides*.

En 1970, le CNEAA est devenu le Comité canadien de l'emploi des pesticides en agriculture. Huit ans plus tard, on lui a donné le nom de Comité d'experts de l'emploi des pesticides en agriculture. En 1990, on a ajouté les méthodes de lutte antiparasitaire aux sujets traités dans le rapport, qui est devenu le *Rapport de recherche sur la lutte antiparasitaire*. Par la suite, le nom du comité a changé deux fois : Comité d'experts de la lutte antiparasitaire de 1990 à 1993 puis, en 1994, Comité d'experts de la lutte antiparasitaire intégrée.

Il y a deux ans, on a commencé à attribuer un numéro de volume au rapport annuel. Même si ce dernier a changé de titre depuis sa création, sa vocation et son format demeurent les mêmes. Ainsi, si l'on se reporte à la première année de publication, le rapport portant sur la saison de croissance de 2002 correspond au volume 41.

Modèle de référence :
[Nom de l'auteur ou des auteurs. Année de parution 2003. Titre (*2002 Rapport de recherche sur la lutte antiparasitaire*). Comité d'experts de la lutte antiparasitaire intégrée. Fev. 2003. Rapport n^{o} x. 41:** pp-pp.]

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STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: Tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois)

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TITLE: TEST OF INSECTICIDES APPLIED AT CALYX AGAINST TARNISHED PLANT BUG ON APPLE IN 2001

MATERIALS: ACTARA 25 WG (thiamethoxam), ADMIRE 240 F (imidacloprid), CALYPSO 480 SC (thiacloprid), IMIDAN 50 WP (phosmet), MALATHION 500 E, MATADOR 120 EC (cyhalothrin lambda), SUCCESS 480 SC (spinosad)

METHODS: The trial was done in an 22 yr-old orchard of McIntosh apple trees planted at a spacing of 6 x 5.5 m and a density of 260 trees/ ha in an experimental orchard at Sheffield Mills, Nova Scotia. Treatments were applied in a randomized complete block design with four single-row blocks of trees. Treated trees were separated by at least one untreated guard tree from those in the same row given other treatments. Untreated guard rows also separated treated rows from each other. Pesticides were diluted to a rate comparable to 600 litres/ha. and were applied by a backpack mounted, gasoline powered, mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany). Adult TPB were collected by sweep net at Sheffield Mills NS from a weedy field (primarily shepherd's purse, dandelion, vetch, and mullein) bordering strawberry and raspberry plantations. TPB were held outdoors for 24 h in 30 cm tall x 25 cm diameter 11. 4 L plastic buckets ventilated with mesh openings on the top and two sides and supplied with bean pods and potato tubers as food. On 7 June 2001, when apple trees were at the calyx stage of development, each treated tree received 2 L of spray solution delivered at 60% throttle with the flow control valve set at 2, except for the control trees which received 2 L of water. On that same day, four pollen bags, each containing 10 healthy field-collected adult tarnished plant bugs (TPB), were placed on each treated tree or water-sprayed control tree. Care was taken to position each bag over 5 clusters of fruitlets. The bags were removed and live, dead and moribund insects (only moving when prodded) were counted 12 June (5 days exposure, 0-5 DAT). On 11 June, 4 days after treatment (4 DAT), two bags with TPB were placed on each treated and control tree as described above. One bag was removed from each tree after 1 day exposure (12 June, 4-5 DAT). The other bags were removed and examined 14 June (4 days exposure, 4-8 DAT).

RESULTS: Data for combined mortality and morbidity of TPB exposed to treated fruitlets and foliage are shown in Table 1. Data for fruit injury are in Table 2.

CONCLUSIONS: There was high control mortality where TPB were held 3 days (63%, 4-7 DAT) or 5 days (55%, 0-5 DAT) in the pollen bags, perhaps indicating that shoots and fruitlets were not particularly nutritious (Table 1). Mortality was only 13.6% for insects held one day in the bags. For the 5 day exposure, only 2.5% of the TPB on the control trees and none on the treated trees were moribund. All treatments had significantly higher mortality than the control. A low percentage of insects were moribund with the one day (11-12 June, 4-5 DAT) exposure: 3.6% with ACTARA, 2.5% with MALATHION and 7.5% with the 280 g rate of CALYPSO, none with other treatments. All treatments except SUCCESS had higher mortality than the control. A low percentage of insects were moribund with the 3 day exposure

(11-14 June, 4-7 DAT): 2.5% with ACTARA, 4.8% with ADMIRE, 2.5% with the 280 g rate of CALYPSO and 5% with IMIDAN. The neonicotinoids ACTARA, ADMIRE and CALYPSO plus the pyrethroid MATADOR had higher mortality than the control.

When fruit were assessed for injury in September, there were no differences between treatments and control. Possible reasons include: a) at least some injury may have been done before treatments were applied; and b) only a few trees were treated in the whole orchard. Given the mobility of TPB and pentatomids and given their long period of attack compared with the residual toxicity of most treatments, it is likely that insects moving onto treated trees after residues dissipate could cause injury, thereby masking treatment effects. One would likely obtain better fruit protection where substantial areas are treated and where insects would be subjected to direct-contact as well as residual-contact mortality.

Table 1. Percent mortality for adult tarnished plant bugs placed in pollen bags over treated apple shoots each holding 5 clusters of fruitlets. Means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after arc sine transformation of the data ($P = 0.05$).

Treatment	Rate g [AI]/ha	5 days exposure 7-12 June 0-5 DAT		1 day exposure 11-12 June 4-5 DAT		3 days exposure 11-14 June 4-7 DAT	
ACTARA 25 WG	96.00	100	a	70.4	ab	86.4	ab
ADMIRE 240 F	91.00	100	a	32.4	ab	82.3	ab
CALYPSO 480 SC	70.00	100	a	37.1	ab	94.9	a
CALYPSO 480 SC	140.00	83.7	a	50.8	ab	97.2	a
CALYPSO 480 SC	280.00	100	a	84.7	a	95	a
IMIDAN 50WP	1000.00	100	a	45	ab	58.1	c
MALATHION 500E	1000.00	100	a	53.9	ab	68.4	bc
MATADOR 120EC	9.96	100	a	93.8	a	100	a
SUCCESS 480 SC	87.00	79.2	a	19	bc	36.9	d
Control		55.4	b	13.6	c	63.3	c

Table 2. Percentage of apples stung by tarnished plant bug or stink bugs (Heteroptera: Pentatomidae) based on examination of 100 apples from 4 trees per treatment examined 20-21 September 2001. Means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after arc sine transformation of the data ($P = 0.05$).

Treatment	Rate g [AI]/ha	Tarnished plant bug Mean	SE		Stink bug Mean	SE	
ACTARA 25 WG	96.00	1	0.71	a	1	0.41	a
ADMIRE 240 F	91.00	1.5	0.5	a	0	0	a
CALYPSO 480 SC	70.00	2.5	1.19	a	0.25	0.25	a
CALYPSO 480 SC	140.00	2.25	0.63	a	0.5	0.5	a
CALYPSO 480 SC	280.00	2	0.71	a	1.75	1.18	a
IMIDAN 50WP	1000.00	1	0.58	a	1	1	a
MALATHION 500E	1000.00	0.75	0.48	a	0.25	0.25	a
MATADOR 120EC	9.96	1.67	0.88	a	0.67	0.67	a
SUCCESS 480 SC	87.00	1.25	0.75	a	1	1	a
Control		1.5	0.29	a	0	0	a

2002 PMR REPORT # 2 **SECTION A: FRUIT- Insect Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: Tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois)

NAME AND AGENCY:
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TITLE: TEST OF PRE-BLOOM INSECTICIDES AGAINST TARNISHED PLANT BUG ON APPLE IN 2001

MATERIALS: CALYPSO 480 SC (thiacloprid), SUCCESS 480 SC (spinosad), ACTARA 25 WG (thiamethoxam), MALATHION 500 E, MATADOR 120 EC (cyhalothrin lambda), IMIDAN 50 WP (phosmet)

METHODS: The trial was done in an 22 yr-old orchard of McIntosh apple trees planted at a spacing of 6 x 5.5 m and a density of 260 trees/ ha in an experimental orchard at Sheffield Mills, Nova Scotia. Treatments were applied in a randomized complete block design with four single-row blocks of trees. Treated trees were separated by at least one untreated guard tree from those in the same row given other treatments. Untreated guard rows also separated treated rows from each other. Pesticides were diluted to a rate comparable to 600 litres/ha. and were applied by a backpack mounted, gasoline powered, mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany). On 17 May 2001 each treated tree received 2 L of spray solution delivered at 60% throttle with the flow control valve set at 2, except for the control trees which received 2 L of water. On 23 May, 6 days after treatment (6 DAT), when trees were at the pink bud stage of development, eight pollen bags, each containing 10 healthy adult tarnished plant bugs (TPB) were placed on each treated tree. Care was taken to place 2 bags on a limb in each compass direction and each bag was positioned over 5 blossom clusters. Active adult TPB had been collected by sweep net up to 4 days previously from a weedy field at Sheffield Mills, Nova Scotia and were housed in ventilated plastic buckets (30 bugs per bucket) supplied with mature greenhouse grown bean plants for food. On 25 May, after 2 days exposure from 6 DAT to 8 DAT, half of the bags on each tree were taken to the lab. Bugs were examined and classed as live, moribund (only moving when prodded), or dead. The remaining half of the bags were removed and TPB were examined 28 May after 5 days exposure (6 DAT-11 DAT).

RESULTS: Data for TPB exposed two days to treated blossoms and foliage are shown in Table 1 and data for those exposed 5 days in Table 2.

CONCLUSIONS: In the 2 day exposure trial, only MATADOR had significantly higher mortality than the control (Table 1). The percentage of moribund insects varied from 0% for most treatments to 25.0% for the highest rate of CALYPSO. High variability between replicates prevented any significant contrasts. When mortality and morbidity were combined, only MATADOR and the highest rate of CALYPSO had higher total losses than the control. In the 5 day exposure trial control mortality was virtually identical to that seen in the 2 day trial (compare Tables 1 and 2). ACTARA, the three CALYPSO treatments, MALATHION, MATADOR and SUCCESS had higher mortality and higher total losses (mortality and morbidity combined) than the control (Table 2).

Table 1. Percent mortality, morbidity and total losses of adult tarnished plant bugs placed in pollen bags over treated apple shoots each holding 5 blossom clusters. Means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after arc sine transformation of the data ($P = 0.05$).

	Rate g	Two days exposure (23-25 May, 2001)					
Treatment	[AI]/ha	Dead		Moribund		Total	
ACTARA 25 WG	96.00	20.7	ab	0	a	20.7	ab
CALYPSO 480 SC	70.00	27.3	ab	0	a	27.3	ab
CALYPSO 480 SC	140.00	41	ab	8.3	a	49.4	ab
CALYPSO 480 SC	280.00	42.2	ab	25	a	67.2	a
IMIDAN 50WP	1000.00	14.6	ab	0	a	14.6	ab
MALATHION 500E	1000.00	8.1	b	0	a	8.1	b
MATADOR 120EC	9.96	79.4	a	2.5	a	81.9	a
SUCCESS 480 SC	87.00	15	ab	0	a	15	ab
Control		12.3	b	2.3	a	14.5	b

Table 2. Percent mortality, morbidity and total losses of adult tarnished plant bugs placed in pollen bags over treated apple shoots each holding 5 blossom clusters. Means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after arc sine transformation of the data ($P = 0.05$).

	Rate g	Five days exposure (23-28 May, 2001)					
Treatment	[AI]/ha	Dead		Moribund		Total	
ACTARA 25 WG	96.00	83.9	a	5.3	a	89.2	a
CALYPSO 480 SC	70.00	52.9	ab	0	a	52.9	ab
CALYPSO 480 SC	140.00	79.4	ab	0	a	79.4	ab
CALYPSO 480 SC	280.00	57.1	ab	10.8	a	67.9	ab
IMIDAN 50WP	1000.00	13.1	cd	0	a	13.1	cd
MALATHION 500E	1000.00	26.7	abc	4.2	a	30.8	abc
MATADOR 120EC	9.96	80.2	ab	0	a	80.2	ab
SUCCESS 480 SC	87.00	21.7	bc	0	a	21.7	bc
Control		12.1	d	0	a	12.1	d

2002 PMR REPORT #3 **SECTION A: INSECT PESTS OF FRUIT**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv.. Idared
PESTS: Apple Maggot (AM), *Rhagoletis pomonella* (Walsh)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST APPLE MAGGOT IN 2001.

MATERIALS: ADMIRE 240 F (imidacloprid), CALYPSO 480 SC (thiacloprid), GUTHION 50 WP (azinphos-methyl), SUCCESS 480 SC (spinosad)

METHODS: The trial was done in an 22 yr-old orchard of Idared apple trees planted at a spacing of 6 x 5.5 m and a density of 260 trees/ ha in an experimental orchard at Sheffield Mills, Nova Scotia. Eight treatments and the water controls were arranged in randomized complete block design with four single-tree replicates per treatment. Each block included sixteen trees, spanning 2 rows of the orchard. Each treated tree was surrounded by guard trees to minimize the effects of spray drift. Pesticides were diluted to a rate comparable to 600 litres/ha. and were applied by a backpack mounted, gasoline powered, mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany). Each treated tree received 2 L of spray solution delivered at 60% throttle with the flow control valve set at 2, except for the control trees which received 2 L of water. Apple maggot fly activity was monitored in the orchard block using three yellow sticky cards baited with synthetic apple lure volatiles (Rhagoletis Yellow Sticky Traps®, Phero Tech Inc., Delta, B.C.) All treatments were applied on 26 July (within 10 days of first maggot fly capture and at which point traps had a cumulative mean capture of three flies) and one additional application was made to the SUCCESS 480 SC × 2 on 6 August (cumulative mean capture of four flies per trap) . Total seasonal captures averaged 17.3 maggot flies per monitoring trap indicating a moderate to high population level of *Rhagoletis pomonella*, not uncommon to commercial orchards. On 18 September 100 fruit were collected from each tree, held in an outdoor screened insectary for 10 days, and then sliced open and examined for the presence of apple maggot larvae.

RESULTS: Data are shown in Table 1.

CONCLUSIONS: All treatments, with the exception of the SUCCESS 480 SC treatment applied twice, had lower mean injury counts than the control (Table 1). However, because of large tree-to-tree variations within treatment, only CALYPSO applied at 280 g/ha had significantly less maggot infestation than the control. All treatments, with the exception of SUCCESS 480 SC applied twice, had statistically similar mean infestation levels.

Table 1. Percentage of apples infested by apple maggots (100 fruit sampled per tree). For a given column and a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after arc sine transformation of the data ($P = 0.05$).

Treatment	Rate g [ai]/ha	Percentage of apples infested by maggots	
ADMIRE 240 F	91	0.98	bc
CALYPSO 480 SC	70	1.03	bc
CALYPSO 480 SC	140	0.76	bc
CALYPSO 480 SC	280	0.25	c
GUTHION 50 WP	1000	0.48	bc
SUCCESS 480 SC × 1	87	2.82	abc
SUCCESS 480 SC × 2	87	6.38	a
Control		4.30	ab

2002 PMR REPORT #4 **SECTION A: FRUIT- Insect Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: Tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois)

NAME AND AGENCY:
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TITLE: TEST OF INSECTICIDES APPLIED AT PETAL FALL AGAINST TARNISHED PLANT BUG ON APPLE IN 2002

MATERIALS: ADMIRE 240 F (imidacloprid), ASSAIL 70 WP (acetimiprid), AVAUNT 30 WG (indoxacarb), CALYPSO 480 SC (thiacloprid), MALATHION 500 E, MATADOR 120 EC (cyhalothrin lambda)

METHODS: The trial was done in an 15 yr-old orchard of alternating rows of McIntosh and Cortland apple trees planted at a spacing of 4.3 x 6.1 m and a density of 384 trees/ ha at Sheffield Mills, Nova Scotia. The design was a randomized complete block with four separate rows serving as blocks. Treated trees were adjacent to untreated guard trees within the same row and in the adjacent rows to minimize drift. Pesticides were diluted to a rate comparable to 600 litres/ha. and were applied by a backpack mounted, gasoline powered, mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany). On 7 June 2002, when trees were at petal fall, each treated tree received 1.5 L of spray solution delivered at 60% throttle with the flow control valve set at 2, except for the control trees which received 1.5 L of water. On 11 June, 4 days after treatment (DAT), 10 active adult TPB were placed in pollen bags at the end of a branch containing 5 clusters of fruitlets. Two days later, 13 June (6 DAT) bugs were examined and classed as live, moribund (only moving when prodded), or dead. Pollen bags were placed on the branches to protect fruit from further insect injury and removed when fruit were examined 21 October, shortly before harvest. Stung fruit were dissected to ensure injury was caused by TPB.

RESULTS: Data for insect mortality are in Table 1. Data for fruit injury are in Table 2.

CONCLUSIONS: Mortality of adult tarnished plant bug was higher than the control with MATADOR and the higher rate of CALYPSO (Table 1). Totals for mortality and % moribund were higher than the control with ADMIRE and MATADOR. The average number of apples per pollen bag varied from 2.75 with MATADOR to 9.00 with MALATHION (Table 2). The percentage of apples with at least one TPB sting varied from 0% with ADMIRE and MATADOR to 46.7% with the lower rate of CALYPSO. Wide variations from replicate to replicate meant there were no significant differences among treatments. Both ADMIRE and MATADOR had significantly fewer stings per apple than the control. It should be mentioned that TPB pressure on fruit in the pollen bags was much higher than would be expected in commercial apple orchards. Secondly all of these data are for residual rather than direct-contact mortality.

Table 1. Percent mortality and morbidity of tarnished plant bugs placed in pollen bags over treated apple shoots each holding 5 clusters of fruitlets. Means in the same column followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after arc sine transformation of the data ($P = 0.05$).

		48 h exposure		
	Rate g		11-13 June	
Treatment	[AI]/ha	Dead	Moribund	Total
ADMIRE 240 F	91.20	68.4ab	8.3a	76.7a
ASSAIL 70 WP	63.00	29.5c	0.0a	29.5c
AVAUNT 30 WG	50.10	24.2c	0.0a	24.2c
CALYPSO 480 SC	70.00	61.5abc	3.1a	64.7abc
CALYPSO 480 SC	280.00	70.8a	2.5a	73.3ab
MALATHION 500 E	1000.00	36.8bc	0.0a	36.8c
MATADOR 120 EC	9.96	85.8a	0.0a	85.8a
Control		37.5bc	0.0a	37.5bc

Table 2. Injury to fruit in pollen bags exposed 48 h to adult TPB assessed 21 October 2002. Means in the same column followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after arc sine transformation of the data ($P = 0.05$).

		Fruit in pollen bags		
Treatment	Rate g [AI]/ha	No. of apples	Percent of fruit stung	Stings/ apple
ADMIRE 240 F	91.20	4	0.0a	0.00b
ASSAIL 70 WP	63.00	7	24.9a	0.44ab
AVAUNT 30 WG	50.10	7.5	22.9a	0.47ab
CALYPSO 480 SC	70.00	5.25	46.7a	0.47ab
CALYPSO 480 SC	280.00	9.75	19.7a	0.24ab
MALATHION 500 E	1000.00	9	30.4a	0.44ab
MATADOR 120 EC	9.96	2.75	0.0a	0.00b
Control		8	37.5a	0.68a

2002 PMR REPORT # 5 **SECTION A: FRUIT- Insect Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: Tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois)

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TITLE: TEST OF PRE-BLOOM INSECTICIDES AGAINST TARNISHED PLANT BUG ON APPLE IN 2002

MATERIALS: ACTARA 25 WG (thiamethoxam), ASSAIL 70 WP (acetimiprid), CALYPSO 480 SC (thiacloprid), DIPEL WP (*Bacillus thuringiensis* var. *kurstaki*), MALATHION 500 E, MATADOR 120 EC (cyhalothrin lambda), RIPCORD 400 EC (cypermethrin)

METHODS: Trials 1 and 2 were done in an 15 yr-old orchard of McIntosh apple trees planted at a spacing of 4.3 x 6.1 m and a density of 384 trees/ ha in an experimental orchard at Sheffield Mills, Nova Scotia. The design was a randomized complete block with four single-tree replicates per treatment. Treated trees were in two parallel rows but staggered so that each treated tree was adjacent to untreated guard trees both within and between rows to minimize drift. Pesticides were diluted to a rate comparable to 600 litres/ha. and were applied by a backpack mounted, gasoline powered, mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany). On 27 May 2002, when trees were at 10-15% bloom, each treated tree received 2 L of spray solution delivered at 60% throttle with the flow control valve set at 2, except for the control trees which received 2 L of water. In Trial 1, ten active adult TPB collected up to 4 days previously and housed 30 bugs per bucket with bean plants for food, were placed in pollen bags, one per tree in the afternoon of 28 May, then removed 24 h later on the 29th which was 2 DAT. Bugs were examined and classed as live, moribund (only moving when prodded), weak (sluggish movement, would not fly when prodded) or dead. In Trial 2, on the 29 May, pollen bags containing 10 healthy adult tarnished plant bugs were again placed over ends of branches containing 5 blossom clusters. The insects were examined and counted 48 h later on 31 May, 4 DAT.

RESULTS: Data for Trials 1 and 2 are shown in Table 1.

CONCLUSIONS: In Trial 1 mortality was 16.8% for tarnished plant bugs held 24 h on water-sprayed control trees. The control had no moribund individuals (Table 1). Mortality rates on treated trees varied from 40% for ASSAIL to 81% for MALATHION. The percent moribund varied from 0% for MALATHION to 38% for the higher rate of CALYPSO. Combined mortality plus morbidity was significantly above control for all treatments except ASSAIL. In Trial 2, TPB held 48 h on the control trees (29-31 May, 2002) had 40% mortality. Mortality was significantly higher than the control with ACTARA, both rates of CALYPSO, the DIPEL/RIPCORD mixture and MATADOR. There were no moribund insects in this second trial. Mortality with MALATHION for Trial 2 (2-4 DAT) was markedly less than for Trial 1 (1-2 DAT) possibly because of short residue activity. With other treatments, total losses (mortality plus morbidity) in Trial 2 either matched or exceeded those for Trial 1, suggesting the likelihood of longer residual effectiveness than for MALATHION.

Table 1. Percent mortality of tarnished plant bugs placed in pollen bags over treated apple shoots each holding 5 blossom clusters. Means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after arc sine transformation of the data ($P = 0.05$).

		Trial 1 24 h exposure 28-29 May			Trial 2 48 h exposure 29-31 May		
Treatment	Rate g [AI]/ha	Dead	Moribund	Total	Dead	Moribund	Total
Control		16.8c	0.0c	16.8d	40.0d	0	40.0d
ACTARA 25 WG	96.00	66.2ab	33.8a	100.0a	100.0a	0	100.0a
ASSAIL 70 WP	63.00	40.0bc	16.3ab	56.3cd	48.1cd	0	48.1cd
CALYPSO 480 SC	140.00	51.1bc	15.6ab	66.7bc	69.2bc	0	69.2bc
CALYPSO 480 SC	280.00	47.4bc	37.6a	85.0ab	100.0a	0	100.0a
DIPEL WP +	560.00	58.0ab	7.5bc	65.5bc	73.9b	0	73.9b
RIPCORD 400 EC	5.00						
MALATHION 500 E	1000.00	80.8a	0.0c	80.8abc	54.4cd	0	54.4cd
MATADOR 120 EC	9.96	68.1ab	11.3bc	79.4bc	80.3b	0	80.3b

2002 PMR REPORT # 6 **SECTION A: FRUIT - Insect Pests**

CROP: Apples cv. Crispin
PEST: European Red Mite, *Panonychus ulmi* (Koch)

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TITLE: MANAGEMENT OF EUROPEAN RED MITE ON APPLE WITH ACARICIDES; 2002

MATERIALS: AGRI-MEK 1.9 EC (abamectin), APOLLO 500 SC (clofentezine), KELTHANE 50W (dicofol), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a mature apple (cv. Crispin) orchard in Vineland Station, Ontario. Two rates of APOLLO (150 and 300 ml ai/ha) were compared to AGRI-MEK (9.5mL ai/ha), KELTHANE (1.1 kg ai/ha), PYRAMITE (150 g ai/ha) and an unsprayed control. Treatments were assigned to one-tree plots, replicated four times in a randomized complete block design. Treatments were applied at 3000L/ha and sprayed to run-off with a hydraulic sprayer equipped with a handgun at 1400 kPa. KELTHANE and APOLLO were applied approximately 10 days after petal fall (13 June) and PYRAMITE was applied when motiles were detected (20 June). Each plot was sampled before treatment and at 7-10 day intervals following treatment. A total of 25 randomly selected leaves were collected from each plot. Leaves were examined under a stereo-microscope and the numbers of living European Red Mite (ERM) eggs and motiles (nymphs and adults) were recorded. Data were analyzed using analysis of variance and Student-Newman-Keuls' mean separation test was applied ($P < 0.05$).

RESULTS: Data are summarized in Tables 1 and 2. No phytotoxicity was observed in any of the plots.

CONCLUSIONS: Natural precipitation recorded from the time of treatment was well below normal for the entire period. This led to reduced shoot development with leaves that possessed heavy cuticular wax. Daily maximum temperatures exceeded 30ºC from mid-July through to mid-August with a high of 34.2º C recorded on 22 July and temperatures exceeding 33 º C for 3 consecutive days in August (11-13). All products limited the expansion of active populations compared to the untreated check for 7 weeks after treatment. Peak egg counts occurred 7 August; however in untreated plots, this was not followed by an increase in the number of motiles at the next sampling date. Egg mortality due to high temperatures (greater than 32.5ºC) may have been responsible for this lower than expected number of motiles on subsequent sample dates. APOLLO at lowest rates provided acceptable control. Increasing the rate of APOLLO improved control, measured as number of mites or duration of control. PYRAMITE achieved control comparable to APOLLO. KELTHANE and AGRI-MEK did not significantly reduce the number of eggs or nymphs compared to the untreated control.

Table 1. Mean number of ERM eggs per leaf

Treatment	June 12	June 19	July 3	July 17	July 24	Aug 7	Aug 14	Aug 21	Aug 28	Sept 4
Untreated	8.5b	9.0c	6.3c	11.3c	13.7b	30.3b	14.5c	25.9c	10.3bc	5.1b
AGRI-MEK	3.6a	2.7a	4.0bc	7.1d	14.0b	50.3c	18.9d	7.4a	6.6b	5.7b
APOLLO @ 300 g/ha	2.8a	3.7ab	4.3bc	5.1b	7.2a	24.2b	12.2c	18.3b	13.7c	12.7c
APOLLO @ 600g/ha	2.4a	6.0ab	2.6ab	4.8b	4.5a	10.3a	5.6b	5.0a	8.5b	2.8b
KELTHANE	3.2a	7.4bc	4.2bc	20.4	20.2c	61.1d	29	27.3c	13.7c	11.3c
PYRAMITE	2.9a	8.2c	0.9a	0.4a	5.2a	0.6a	1.0a	0.7a	0.5a	0.4a

Means in the same column followed by the same letter are not significantly different, Student-Newman-Keuls multiple range test, "=0.5

Table 2. Mean number of ERM motiles (nymphs + adults) per leaf

Treatment	377 83	377 90	July 3	July 17	July 24	Aug 7	Aug 14	Aug 21	Aug 28	Sept 4
Untreated	0.8b	0.3a	0.8c	1.0b	1.2b	3.3c	2.3b	1.9b	1.2cd	0.4b
AGRI-MEK	0.8b	0.1a	0.3b	1.8c	1.0b	4.1cd	3.5b	0.4a	0.4ab	0
APOLLO @ 300 g/ha	0.4a	0.1a	0.2ab	0.5a	0.2a	1.8ab	2.1b	1.4b	1.5d	0.6c
APOLLO @ 600 g/ha	0.4a	0.1a	0.2ab	0.3a	0.1a	0.8a	0.7a	0.4a	0.7bc	0.1a
KELTHANE	0.4a	0.3a	0.3ab	2.4d	1.0b	5.2d	5.3c	1.5b	0.5ab	0.1a
PYRAMITE	0.3a	0.7b	0.0a	0.1a	0.4a	0.1a	0.1a	0.1a	0.1a	0.0a

Means in the same column followed by the same letter are not significantly different, Student-Newman-Keuls multiple range test, "=0.5

2002 PMR REPORT # 7 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Empire
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck), Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee)

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TITLE: CONTROL OF FIRST-GENERATION ORIENTAL FRUIT MOTH, MULLEIN LEAF BUG, AND WHITE APPLE LEAFHOPPER ON APPLE WITH ASSAIL; 2002

MATERIALS: ASSAIL 70 WP (acetamiprid), DECIS 5 EC (deltamethrin)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. Empire were spaced 4.6 m by 2.4 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Four rates of ASSAIL were compared to a DECIS standard and an unsprayed control. ASSAIL application was timed for early egg hatch of the first generation of Oriental fruit moth (OFM), DECIS application was timed for peak egg hatch of the first generation, determined from pheromone trap catches of male moths. All ASSAIL treatments were applied 28 May, 94.9 degree days (DD) (base 7.2 C) after first male moth catch (May 6); the DECIS standard was applied 30 May (112 $DD_{7.2}$). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. On 19 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays. Numbers of MB and WALH per six taps were recorded for each plot. Plots were sampled for OFM post-treatment 27 June; all infested terminals and fruit were removed and counted. Damaged twigs and fruit were dissected; all larvae found were examined under a stereomicroscope and identified. Data were transformed (log(x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. Laboratory identification revealed that 67% of larvae recovered from plots were OFM, while the remainder were codling moth, *Cydia pomonella* (L.). No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 27 June sample of terminals for OFM damage, only the 240 g a.i./ha rate of ASSAIL and the DECIS treatment showed a difference from the control (Table 1). All treated plots except the 28 g and 56 g a.i./ha rates of ASSAIL contained significantly less damaged fruit than the control; the plots treated with DECIS and the 120 g and 240 g a.i./ha rates of ASSAIL had less fruit damage than the 28 g a.i./ha rate of ASSAIL. When total OFM damage was analysed, only the 28 and 56 g a.i./ha rates of ASSAIL were not different from the control; the plots treated with DECIS and the 120 and 240 g a.i./ha rates of ASSAIL contained less OFM damage than those treated with the 28 g a.i./ha rate; also, DECIS and the 240 g a.i./ha rate of ASSAIL were more effective than the 56 g a.i./ha rate. In the 19 June MB sample all treated plots contained fewer MB than the control, but treatments were not different from each other (Table 2). Only the plots treated with DECIS, the 120 g and 240 g a.i./ha rates

of ASSAIL had significantly fewer WALH than the control, but these treatments were not different from each other.

Table 1. OFM damage per plot

Treatment	Rate (a.i./ha)	Infested Terminals per Plot 27 June	Damaged Fruit per Plot 27 June	Total OFM Damage 27 June
DECIS 5 EC[1]	12.5 g	0.00 B	0.50 B	0.50 C[3]
ASSAIL 70 WP[2]	240 g	0.00 B	0.75 B	0.75 C
ASSAIL 70 WP[2]	120 g	1.00 AB	1.50 B	2.50 BC
ASSAIL 70 WP[2]	56 g	2.75 A	3.50 AB	6.25 AB
ASSAIL 70 WP[2]	28 g	1.00 AB	9.75 A	10.75 A
CONTROL	-	2.75 A	8.00 A	10.75 A

[1] Applied 30 May
[2] Applied 28 May
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on numbers of mullein leaf bug and white apple leafhopper.

Treatment	Rate (a.i./ha)	MB/6 taps per plot 19 June	WALH/6 taps per plot 19 June
DECIS 5 EC[1]	12.5 g	0.50 B	1.00 B[3]
ASSAIL 70 WP[2]	240 g	0.00 B	1.00 B
ASSAIL 70 WP[2]	120 g	0.75 B	1.00 B
ASSAIL 70 WP[2]	56 g	0.00 B	3.25 AB
ASSAIL 70 WP[2]	28 g	0.00 B	3.50 AB
CONTROL	-	7.25 A	17.25 A

[1] Applied 30 May
[2] Applied 28 May
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 8 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. McIntosh
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck), Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee)

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TITLE: CONTROL OF FIRST-GENERATION ORIENTAL FRUIT MOTH, MULLEIN LEAF BUG, AND WHITE APPLE LEAFHOPPER ON APPLE; 2002

MATERIALS: CALYPSO 480 SC (thiacloprid), DECIS 5 EC (deltamethrin), GUTHION 50 WP (azinphos-methyl)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. Empire were spaced 4.8 m by 3.0 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. CALYPSO was compared to DECIS, a GUTHION standard and an unsprayed control. Applications were timed for peak egg hatch of the first generation of Oriental fruit moth (OFM), determined from pheromone trap catches of male moths. All treatments were applied 3 June, 164 degree days (DD) (base 7.2 C) after first male moth catch (May 6). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. On 19 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays. Numbers of MB and WALH per six taps were recorded for each plot. Plots were sampled for OFM post-treatment 2 July; all infested terminals and fruit were removed and counted. Damaged twigs and fruit were dissected; all larvae found were examined under a stereomicroscope and identified. Data were transformed (log(x+1)) and analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2; laboratory identification revealed that 67% of larvae recovered from plots were OFM, while the remainder were codling moth (*Cydia pomonella* (L.)). No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 2 July sample of terminals for OFM damage, none of the treatments showed a difference from the control (Table 1). Plots treated with DECIS and GUTHION contained less fruit damage than the control, but were not significantly different from those treated with CALYPSO. When total OFM damage was analysed, none of the treatments were different from each other, but the DECIS and GUTHION treatments were different from the control. In the 19 June MB sample none of the treated plots contained fewer MB than the control (Table 2). All treated plots had significantly fewer WALH than the control, but treatments were not different from each other.

Table 1. OFM damage per plot

Treatment[1]	Rate (a.i./ha)	Infested Terminals per Plot 2 July	Damaged Fruit per Plot 2 July	Total OFM Damage 2 July
DECIS 5 EC	12.5 g	0.00 A	1.50 B	1.50 B[2]
GUTHION 50 WP	1.0 kg	0.00 A	1.00 B	1.00 B
CALYPSO 480 SC	140 g	0.00 A	3.50 AB	3.50 AB
CONTROL	-	1.00 A	6.25 A	7.25 A

[1] Applied 3 June

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on numbers of mullein leaf bug and white apple leafhopper.

Treatment[1]	Rate (a.i./ha)	MB/6 taps per plot 19 June	WALH/6 taps per plot 19 June
DECIS 5 EC	12.5 g	0.50 A	3.00 B[2]
GUTHION 50 WP	1.0 kg	2.00 A	5.50 B
CALYPSO 480 SC	140 g	1.00 A	2.50 B
CONTROL	-	2.50 A	34.00 A

[1] Applied 3 June

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 9 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Empire
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck), Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee)

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TITLE: CONTROL OF FIRST-GENERATION ORIENTAL FRUIT MOTH, MULLEIN LEAF BUG, AND WHITE APPLE LEAFHOPPER ON APPLE WITH INSECTICIDES; 2002

MATERIALS: DECIS 5 EC (deltamethrin), INTREPID 2 F (methoxyfenozide), SUCCESS 480 SC (spinosad)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. Empire were spaced 4.6 m by 2.4 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application was timed for egg hatch of the first generation, determined from pheromone trap catches of male moths. Treatments were applied 30 May, 112 DD (base 7.2 C) after first male moth catch (May 6); insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. On 19 June, plots were examined for Mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays. Numbers of MB and WALH per six taps were recorded for each plot. Plots were sampled for Oriental fruit moth (OFM) post-treatment 2 July; all infested terminals and fruit were removed and counted. Damaged twigs and fruit were dissected; all larvae found were examined under a stereomicroscope and identified. Data were transformed (log(x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2; laboratory identification revealed that 78% of larvae recovered from plots were OFM, while the remainder were codling moth (*Cydia pomonella* (L.)). No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 2 July sample of terminals for OFM damage, all treatments showed a significant difference from the control (Table 1). All treated plots except the 87.5 g a.i./ha rate of SUCCESS contained significantly less damaged fruit than the control; the plots treated with the 120 g a.i./ha rate of SUCCESS showed less fruit damage than the 87.5 g a.i./ha rate of SUCCESS. Only the DECIS-treated plots contained fewer MB than the control, and this treatment was significantly different from all others in the 19 June MB sample (Table 2). The plots treated with DECIS contained significantly fewer WALH than the control and all treatments except the 120 g a.i./ha rate of SUCCESS.

Table 1. OFM damage per plot

Treatment[1]	Rate (a.i./ha)	Infested Terminals per Plot 2 July	Damaged Fruit per Plot 2 July	Total OFM Damage 2 July
SUCCESS 480 SC	120 g	0.00 B	3.75 C	3.75 C[2]
INTREPID 2 F	360 g	0.00 B	4.75 BC	4.75 BC
INTREPID 2 F	120 g	0.00 B	5.00 BC	5.00 BC
DECIS 5 EC	12.5 g	0.00 B	5.25 BC	5.25 BC
INTREPID 2 F	240 g	0.00 B	7.25 BC	7.25 BC
SUCCESS 480 SC	87.5 g	0.00 B	11.50 AB	11.50 AB
CONTROL	-	1.25 A	15.50 A	16.75 A

[1] Applied 30 May

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on numbers of Mullein leaf bug and white apple leafhopper.

Treatment[1]	Rate (a.i./ha)	MB/6 taps per plot 19 June	WALH/6 taps per plot 19 June
DECIS 5 EC	12.5 g	1.25 B	19.50 B[2]
SUCCESS 480 SC	120 g	4.00 A	61.50 AB
INTREPID 2 F	360 g	2.50 A	84.25 A
INTREPID 2 F	240	4.50 A	81.50 A
INTREPID 2 F	120	5.00 A	81.00 A
SUCCESS 480 SC	87.5 g	2.75 A	90.50 A
CONTROL	-	4.00 A	87.25 A

[1] Applied 30 May

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 10 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Royal Gala
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck)

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TITLE: CONTROL OF ORIENTAL FRUIT MOTH ON APPLE WITH INSECTICIDES; 2002

MATERIALS: CYMBUSH 250 EC (cypermethrin), GUTHION 50 WP (azinphos-methyl), INTREPID 2 F (methoxyfenozide), MATADOR 120 EC (lambda cyhalothrin)

METHODS: The trial was conducted in a mature orchard in the Simcoe, Ontario area; trees cv. Royal Gala were spaced 4.6 m by 2.4 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Applications were timed for egg hatch of the first and second generations, determined from pheromone trap catches of male moths. Treatments were applied for the first generation 6 June, 142 DD (base 7.2 C) after first male moth catch (May 6); treatments were applied for the second generation 12 July, and repeated 24 July (677 and 868 $DD_{7.2}$ after first male moth catch). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled for Oriental fruit moth (OFM) post-treatment 26 June and 2 August; all infested terminals and fruit were removed and counted. Damaged twigs and fruit were dissected; all larvae found were examined under a stereomicroscope and identified. Data were transformed (log(x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. Laboratory identification revealed that 93% of larvae recovered from all plots in generation 1 were OFM, while the remainder were codling moth, *Cydia pomonella* (L.). In the second-generation sample, 71% of larvae recovered from control plots were OFM, while all larvae collected from treated plots were identified as codling moth. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 26 June sample for first generation OFM damage, all treatments except INTREPID showed a significant difference from the control (Table 1). All treated plots contained significantly less second generation OFM damage than the control in the 2 August sample (Table 2).

Table 1. First generation OFM damage per plot.

Treatment[1]	Rate (a.i./ha)	Infested Terminals per Plot 26 June	Damaged Fruit per Plot 26 June	Total OFM Damage 26 June
GUTHION 50 WP	1.15 kg	1.00 B	0.50 B	1.50 B[2]
CYMBUSH 250 EC	100 g	1.75 B	0.25 B	3.00 B
MATADOR 120 EC	10 g	3.50 B	0.50 B	4.00 B
INTREPID 2 F	240 g	8.75 A	1.00 A	9.75 A
CONTROL	-	15.75 A	2.25 A	18.00 A

[1] Applied 6 June

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Second generation OFM damage per plot.

Treatment[1]	Rate (a.i./ha)	Infested Terminals per Plot 2 August	Damaged Fruit per Plot 2 August	Total OFM Damage 2 August
GUTHION 50 WP	1.15 kg	0.25 B	0.00 B	0.25 B[2]
CYMBUSH 250 EC	100 g	0.25 B	0.75 B	1.00 B
MATADOR 120 EC	10 g	1.00 B	1.25 B	2.25 B
INTREPID 2 F	240 g	1.25 B	1.00 B	2.25 B
CONTROL	-	8.50 A	53.75 A	62.25 A

[1] Applied 12 July, 24 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 11 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Empire
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck), Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee), Potato Leafhopper, *Empoasca fabae* (Harris), European Red Mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF ORIENTAL FRUIT MOTH, MULLEIN LEAF BUG, WHITE APPLE LEAFHOPPER AND POTATO LEAFHOPPER ON APPLE AND EFFECTS ON EUROPEAN RED MITE POPULATIONS; 2002

MATERIALS: AVAUNT 30 WG (indoxacarb), CYMBUSH 250 EC (cypermethrin), DIPEL 2X (*Bacillus thuringiensis*, subsp. *kurstaki*), GUTHION 50 WP (azinphos-methyl), MATADOR 120 EC (lambda cyhalothrin**)**

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. Empire were spaced 4.6 m by 2.4 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Treatments were compared to an unsprayed control; applications were timed for egg hatch of the first and second generations of Oriental fruit moth (OFM), determined from pheromone trap catches of male moths. Treatments were applied 30 May for the first generation of OFM, 112 DD (base 7.2 C) after first male moth catch (May 6); treatments were applied 11 July for the second generation, and repeated 23 July (666.6 and 868 $DD_{7.2}$ after first male moth catch). Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. On 19 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays. Numbers of MB and WALH per six taps were recorded for each plot. Plots were sampled for OFM post-treatment 2 July (generation 1) and 1 August (generation 2), when 100 apples and 100 terminals per plot were examined on the tree for damage; all infested terminals and fruit were removed after each generation. Data were expressed as percent damaged fruit and percent infested terminals. Damaged terminals and fruit were dissected; all larvae found were examined under a stereomicroscope and identified. Fifty terminals per plot were examined on 22 July for the presence of potato leafhopper (PLH) nymphs; percent terminals infested were recorded. Effects on populations of European Red Mite (ERM) were also examined 48 days (28 August) after the first application. Fifty leaves per plot were picked randomly at arm's length into the canopy. Mite numbers were estimated using a stereomicroscope (leaves were brushed with a Henderson McBurnie mite brushing machine), and numbers of live ERM motiles and beneficial mite motiles were recorded. Data were transformed (log(x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1-5 below; laboratory identification revealed that 78% of larvae recovered from all plots in generation 1 were OFM, while the remainder were codling moth (*Cydia pomonella* (L.)). In generation 2, 15% of larvae recovered from control plots were OFM, the remainder

were CM; 100% of larvae recovered from treated plots were codling moth. A higher percentage of OFM was expected in the sample taken from control plots at the end of the second generation, but the OFM larvae had likely matured and left the fruit by the time of sampling. In generation 2, numbers of terminals damaged by OFM were too few to analyse. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 2 July sample of fruit assessed for OFM damage, all treatments except DIPEL contained significantly less damaged fruit than the control (Table 1); all treatments were different from the control in the sample of damaged terminals, although numbers of damaged terminals were small in all plots. Similar results were observed in the second generation fruit sample (Table 2), only the DIPEL treatment was not different from the control; however, damage in the GUTHION-treated plots was significantly lower than in the plots treated with DIPEL and AVAUNT. Only the MATADOR and CYMBUSH treatments lowered numbers of MB in the 19 June sample (Table 3), while MATADOR, CYMBUSH, and AVAUNT all significantly reduced numbers of WALH. In the 22 July PLH sample, only the plots treated with CYMBUSH and MATADOR had lower PLH infestations than the control, but these were not different from each other (Table 4). The plots treated with CYMBUSH and MATADOR contained significantly more ERM than all other plots in the 28 August sample (Table 5); no differences were observed in numbers of beneficial mites.

Table 1. Effect of insecticides on first generation OFM damage.

Treatment[1]	Rate	% Infested Terminals 2 July	% Damaged Fruit 2 July
CYMBUSH 250 EC	100 g a.i./ha	0.0 B	2.5 B[2]
MATADOR 120 EC	10.1 g a.i./ha	0.0 B	3.0 B
GUTHION 50 WP	1.0 kg a.i./ha	0.0 B	2.7 B
AVAUNT 30 WG	75 g a.i./ha	0.5 B	4.5 B
DIPEL 2X	1.125 kg/ha	0.0 B	11.0 AB
CONTROL	-	1.5 A	15.3 A

[1] Applied 30 May

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effect of insecticides on second generation OFM damage.

Treatment[1]	Rate	% Damaged Fruit 1 August
CYMBUSH 250 EC	100 g a.i./ha	10.6 BC[2]
MATADOR 120 EC	10.1 g a.i./ha	9.9 BC
GUTHION 50 WP	1.0 kg a.i./ha	1.5 C
AVAUNT 30 WG	75 g a.i./ha	17.75 B
DIPEL 2X	1.125 kg/ha	36.5 AB
CONTROL	-	46.4 A

[1] Applied 11 July, reapplied 23 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 3. Effects of insecticides on numbers of mullein leaf bug and white apple leafhopper.

Treatment[1]	Rate	MB/6 taps per plot 19 June	WALH/6 taps per plot 19 June
CYMBUSH 250 EC	100 g a.i./ha	0.2 C	18.75 C[2]
MATADOR 120 EC	10.1 g a.i./ha	0.7 BC	32.25 BC
GUTHION 50 WP	1.0 kg a.i./ha	2.5 ABC	80.25 A
AVAUNT 30 WG	75 g a.i./ha	4.0 A	10.7 C
DIPEL 2X	1.125 kg/ha	3.5 AB	74.0 AB
CONTROL	-	4.0 A	118.8 A

[1] Applied 30 May

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 4. Effects of insecticides on potato leafhopper damage.

Treatment[1]	Rate	% PLH Infested Terminals 22 July
CYMBUSH 250 EC	100 g a.i./ha	12.0 B[2]
MATADOR 120 EC	10.1 g a.i./ha	11.0 B
GUTHION 50 WP	1.0 kg a.i./ha	49.5 A
AVAUNT 30 WG	75 g a.i./ha	54.0 A
DIPEL 2X	1.125 kg/ha	59.0 A
CONTROL	-	54.0 A

[1] Applied 11 July, reapplied 23 July

[2]Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 5. Effects of insecticides on numbers of motile phytophagous and predatory mites.

Treatment[1]	Rate	European Red Mite/leaf 28 August	*A. fallacis*/leaf 28 August
CYMBUSH 250 EC	100 g a.i./ha	49.0 B	7.6 A[2]
MATADOR 120 EC	10.1 g a.i./ha	37.0 B	5.5 A
GUTHION 50 WP	1.0 kg a.i./ha	3.5 A	3.6 A
AVAUNT 30 WG	75 g a.i./ha	3.6 A	5.9 A
DIPEL 2X	1.125 kg/ha	2.9 A	3.2 A
CONTROL	-	2.9 A	1.9 A

[1] Applied 30 May, reapplied 11 July, 23 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 12 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Empire
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck), Potato Leafhopper, *Empoasca fabae* (Harris), European Red Mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF ORIENTAL FRUIT MOTH (SECOND GENERATION) AND POTATO LEAFHOPPER ON APPLE WITH INSECTICIDES; 2002

MATERIALS: ASSAIL 70 WP (acetamiprid), DECIS 5 EC (deltamethrin), INTREPID 2 F (methoxyfenozide), SUCCESS 480 SC (spinosad)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. Empire were spaced 4.6 m by 2.4 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Two rates of ASSAIL were compared to SUCCESS, two rates of INTREPID, a DECIS standard, and an unsprayed control. Applications were timed for egg hatch of the second generation of Oriental fruit moth (OFM), determined from pheromone trap catches of male moths. Treatments were applied 11 July and reapplied 23 July, 666.6 degree days (DD) (base 7.2 C) and 868 $DD_{7.2}$ respectively after first male moth catch (May 6). Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. Fifty terminals per plot were examined on 22 July for the presence of potato leafhopper (PLH) nymphs; percent terminals infested were recorded. Plots were sampled for OFM post-treatment 1 August; all infested terminals and fruit were removed and counted. Damaged twigs and fruit were dissected; all larvae found were examined under a stereomicroscope and identified. Effects on populations of European Red Mite (ERM) were also examined; 47 days (27 August) after first application, 50 leaves per plot were picked randomly at arm's length into the canopy. Mite numbers were estimated using a stereomicroscope (leaves were brushed with a Henderson McBurnie mite brushing machine), and numbers of live ERM motiles and beneficial mite motiles were recorded. Data were transformed (log(x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1, 2, and 3; laboratory identification revealed that 15% of larvae recovered from control plots were OFM, while the remainder were codling moth (*Cydia pomonella* (L.)); 100% of larvae recovered from treated plots were codling moth. A higher percentage of OFM was expected in the control sample, but the OFM larvae had likely matured and left the fruit by the time of sampling. Numbers of terminals damaged by OFM were too few to analyse. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 1 August sample of fruit for OFM damage, all treatments except SUCCESS contained significantly less damaged fruit than the control (Table 1); however, only the plots treated with the 240 g a.i./ha rate of ASSAIL showed significantly less fruit damage than the SUCCESS treatment. In the 22 July PLH sample only the plots treated with DECIS and ASSAIL had lower PLH infestations than the control, but these were not different from each other (Table 2). The plots treated with DECIS

contained significantly more ERM and beneficial mites than all other plots in the 27 August sample (Table 3).

Table 1. OFM damage per plot

Treatment[1]	Rate (a.i./ha)	Damaged Fruit per Plot 1 August
ASSAIL 70 WP	240 g	1.7 C[2]
ASSAIL 70 WP	120 g	6.9 BC
DECIS 5 EC	12.5 g	5.0 BC
INTREPID 2F	360 g	5.7 BC
INTREPID 2F	240 g	6.4 BC
SUCCESS 480 SC	120 g	16.1 AB
CONTROL	-	23.8 A

[1] Applied 11 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on potato leafhopper damage.

Treatment[1]	Rate (a.i./ha)	% PLH Infested Terminals 22 July
ASSAIL 70 WP	240 g	24.5 BC[2]
ASSAIL 70 WP	120 g	17.5 C
DECIS 5 EC	12.5 g	12.0 C
INTREPID 2F	360 g	45.0 AB
INTREPID 2F	240 g	32.5 ABC
SUCCESS 480 SC	120 g	43.5 AB
CONTROL	-	49.0 A

[1] Applied 11 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 3. Effects of insecticides on numbers of motile phytophagous and predatory mites.

Treatment[1]	Rate (a.i./ha)	European Red Mite/leaf 27 August	*A. fallacis*/leaf 27 August
ASSAIL 70 WP	240 g	2.01 A	2.52 A[2]
ASSAIL 70 WP	120 g	0.86 A	2.55 A
DECIS 5 EC	12.5 g	81.12 B	13.55 B
INTREPID 2F	360 g	1.02 A	1.32 A
INTREPID 2F	240 g	1.32 A	1.62 A
SUCCESS 480 SC	120 g	1.74 A	2.82 A
CONTROL	-	1.65 A	1.35 A

[1] Applied 11 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 13 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. McIntosh
PESTS: Plum Curculio, *Conotrachelus nenuphar* (Herbst), Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee), Oriental Fruit Moth, *Grapholita molesta* (Busck), Codling Moth, *Cydia pomonella* (L.)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST PLUM CURCULIO, MULLEIN LEAF BUG, WHITE APPLE LEAFHOPPER, AND ORIENTAL FRUIT MOTH ON APPLE; 2002

MATERIALS: ACTARA 25 WG (thiamethoxam), GUTHION 50 WP (azinphos-methyl), MATADOR 120 EC (lambda cyhalothrin)

METHODS: The trial was conducted in a four-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 3.0 m by 4.8 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Treatments, timed for first appearance of plum curculio (PC) damage, were applied at petal fall (3 June); applications were repeated 11 days later (14 June). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled 14 June and 4 July (11 and 31 days after first application, respectively); 100 apples per plot were examined on the tree for plum PC damage, and results expressed as percent fruit damage. On 18 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays. Numbers of MB and WALH per six taps were recorded for each plot. Plots were sampled for Oriental fruit moth (OFM) and codling moth (CM) damage post-treatment 4 July; 100 apples per plot were examined on the tree and the percentage damaged was recorded. Data were transformed (square root (x+1/2)) and analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1-3 below; PC infestations were considered heavy. Proportions of OFM versus CM damage were not determined. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 14 June and 4 July samples for PC damage, all treated plots showed significantly lower damage than the control (Table 1). All treatments reduced numbers of MB and WALH in the 18 June sample (Table 2). The plots treated with GUTHION, MATADOR, and the 79 g a.i./ha rate of ACTARA contained less OFM and CM damage than the control (Table 3), but were not different from the other rates of ACTARA.

Table 1. Percent fruit damaged by plum curculio.

Treatment[1]	Rate (a.i./ha)	14 June[2] (11 days after first application)	4 July (31 days after first application)
GUTHION 50 WP	1.05 kg	16.75 B	9.62 B[3]
ACTARA 25 WG	96 g	8.50 B	4.87 B
ACTARA 25 WG	79 g	18.00 B	9.75 B
ACTARA 25 WG	40 g	23.00 B	12.87 B
MATADOR 120 EC	12.7 g	21.00 B	11.87 B
CONTROL	-	56.75 A	41.13 A

[1] Applied 3 June, reapplied 14 June

[2] Samples taken before second application of treatments

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on numbers of mullein leaf bug and white apple leafhopper.

Treatment[1]	Rate (a.i./ha)	MB/6 taps per plot 18 June	WALH/6 taps per plot 18 June
GUTHION 50 WP	1.05 kg	0.00 B	0.75 B[2]
ACTARA 25 WG	96 g	0.25 B	0.75 B
ACTARA 25 WG	79 g	0.25 B	1.50 B
ACTARA 25 WG	40 g	0.50 B	2.75 B
MATADOR 120 EC	12.7 g	0.75 B	0.50 B
CONTROL	-	3.50 A	6.25 A

[1] Applied 3 June, reapplied 14 June

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 3. Effect of insecticides on incidence of Oriental fruit moth and codling moth damage.

Treatment[1]	Rate (a.i./ha)	% Damaged Fruit 4 July
GUTHION 50 WP	1.05 kg	0.75 B
ACTARA 25 WG	96 g	7.75 AB
ACTARA 25 WG	79 g	5.2 B
ACTARA 25 WG	40 g	9.2 AB
MATADOR 120 EC	12.7 g	3.00 B
CONTROL	-	15.0 A

[1]Applied 3 June, reapplied 14 June

[2]Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 14 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. McIntosh

PESTS: Plum Curculio, *Conotrachelus nenuphar* (Herbst), Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee), Oriental Fruit Moth, *Grapholita molesta* (Busck), Codling Moth, *Cydia pomonella* (L.)

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TITLE: ASSESSMENT OF ACTARA AND GUTHION AGAINST PLUM CURCULIO, MULLEIN LEAF BUG, WHITE APPLE LEAFHOPPER AND ORIENTAL FRUIT MOTH ON APPLE; 2002

MATERIALS: ACTARA 25 WG (thiamethoxam), GUTHION 50 WP (azinphos-methyl)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 3.0 m by 4.8 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Treatments, timed for first appearance of plum curculio (PC) damage, were applied at petal fall (3 June); applications were repeated 11 days later (14 June). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled 14 June and 3 July (11 and 30 days after first application, respectively); 100 apples per plot were examined on the tree for plum PC damage, and results expressed as percent fruit damage. On 14 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays. Numbers of MB and WALH per six taps were recorded for each plot. Plots were sampled for Oriental fruit moth (OFM) and codling moth (CM) damage post-treatment 3 July; 100 apples per plot were examined on the tree and the percentage damaged was recorded. Data were transformed (square root (x+1/2)) and analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1-3 below; PC infestations were considered heavy. Proportions of OFM versus CM damage were not determined. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 14 June and 3 July samples for PC damage, all treated plots showed significantly lower damage than the control (Table 1); the GUTHION and 96 g a.i./ha rate of ACTARA treatments were lower than the 40 g a.i./ha rate of ACTARA. All ACTARA treatments reduced numbers of MB in the 14 June sample (Table 2), and all treated plots contained less WALH than the control. All treated plots contained less OFM and CM damage than the control (Table 3), but the GUTHION treatment was different from the 96 g a.i./ha rate of ACTARA.

Table 1. Percent fruit damaged by plum curculio.

Treatment[1]	Rate (a.i./ha)	14 June[2] (11 days after first application)	3 July (30 days after first application)
GUTHION 50 WP	1.05 kg	0.00 C	0.25 C[3]
ACTARA 25 WG	96 g	0.00 C	0.25 C
ACTARA 25 WG	79 g	0.50 BC	0.62 BC
ACTARA 25 WG	40 g	1.50 B	1.62 B
CONTROL	-	10.25 A	6.75 A

[1] Applied 3 June, reapplied 14 June

[2] Samples taken before second application of treatments

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on numbers of mullein leaf bug and white apple leafhopper.

Treatment[1]	Rate (a.i./ha)	MB/6 taps per plot 14 June[2]	WALH/6 taps per plot 14 June[2]
ACTARA 25 WG	96 g	0.25 B	2.00 B[3]
ACTARA 25 WG	79 g	0.50 B	2.75 B
ACTARA 25 WG	40 g	0.50 B	5.00 B
GUTHION 50 WP	1.05 kg	3.00 AB	7.25 B
CONTROL	-	7.50 A	22.50 A

[1] Applied 3 June, reapplied 14 June

[2] Samples taken before second application of treatments

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 3. Effect of insecticides on incidence of Oriental fruit moth and codling moth damage.

Treatment[1]	Rate (a.i./ha)	% Damaged Fruit 3 July
GUTHION 50 WP	1.05 kg	0.75 C
ACTARA 25 WG	96 g	5.00 B
ACTARA 25 WG	79 g	3.25 BC
ACTARA 25 WG	40 g	2.75 BC
CONTROL	-	10.50 A

[1] Applied 3 June, reapplied 14 June

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 15 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. McIntosh

PESTS: Plum Curculio, *Conotrachelus nenuphar* (Herbst), Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee), Oriental Fruit Moth, *Grapholita molesta* (Busck), Codling Moth, *Cydia pomonella* (L.)

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TITLE: CONTROL OF PLUM CURCULIO, MULLEIN LEAF BUG, WHITE APPLE LEAFHOPPER AND ORIENTAL FRUIT MOTH ON APPLE; 2002

MATERIALS: CALYPSO 480 SC (thiacloprid), GUTHION 50 WP (azinphos-methyl), TM 44401 50 WDG (clothianidin)

METHODS: The trial was conducted in a four-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 3.0 m by 4.8 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Treatments, timed for first appearance of plum curculio (PC) damage, were applied at petal fall (3 June) insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled 14 June and 4 July (11 and 31 days after application, respectively); 100 apples per plot were examined on the tree for plum PC damage, and results expressed as percent fruit damage. On 18 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays. Numbers of MB and WALH per six taps were recorded for each plot. Plots were sampled for Oriental fruit moth (OFM) and codling moth (CM) damage post-treatment 4 July; 100 apples per plot were examined on the tree and the percentage damaged was recorded. Data were transformed (log (x+1)) and analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1-3 below; PC infestations were considered heavy. Proportions of OFM versus CM damage were not determined. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 14 June and 4 July samples for PC damage, all treated plots showed significantly lower damage than the control (Table 1), but were not different from each other. All treatments reduced numbers of MB and WALH in the 18 June sample (Table 2). Similar results were observed in Table 3; all treated plots contained less OFM and CM damage than the control.

Table 1. Percent fruit damaged by plum curculio.

Treatment[1]	Rate (a.i./ha)	14 June (11 days after application)	4 July (31 days after application)
GUTHION 50 WP	1.05 kg	5.75 B	3.75 B[2]
TM 444 50 WDG	104 g	4.00 B	2.50 B
CALYPSO 480 SC	210 g	9.00 B	4.75 B
CALYPSO 480 SC	140 g	9.50 B	5.25 B
CONTROL	-	26.00 A	20.25 A

[1] Applied 3 June

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on numbers of mullein leaf bug and white apple leafhopper.

Treatment[1]	Rate (a.i./ha)	MB/6 taps per plot 18 June	WALH/6 taps per plot 18 June
GUTHION 50 WP	1.05 kg	0.50 B	0.50 B[2]
TM 444 50 WDG	104 g	0.00 B	0.50 B
CALYPSO 480 SC	210 g	0.25 B	1.00 B
CALYPSO 480 SC	140 g	0.25 B	2.00 B
CONTROL	-	2.25 A	6.00 A

[1] Applied 3 June

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 3. Effect of insecticides on incidence of Oriental fruit moth and codling moth damage.

Treatment[1]	Rate (a.i./ha)	% Damaged Fruit 4 July
GUTHION 50 WP	1.05 kg	1.25 B
TM 444 50 WDG	104 g	4.25 B
CALYPSO 480 SC	210 g	1.75 B
CALYPSO 480 SC	140 g	3.25 B
CONTROL	-	12.75 A

[1] Applied 3 June

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 16 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apple cv. McIntosh
PESTS: Codling Moth, *Cydia pomonella* (L.), Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST CODLING MOTH, MULLEIN LEAF BUG AND WHITE APPLE LEAFHOPPER ON APPLE; 2002

MATERIALS: GUTHION 50 WP (azinphos-methyl), INTREPID 2 F (methoxyfenozide), SUCCESS 480 SC (spinosad)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 3.0 m by 4.8 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male codling moths (CM). The trial compared two rates of SUCCESS to INTREPID, a GUTHION standard, and an unsprayed control. The GUTHION standard was applied according to the standard CM degree day (DD) model; all other treatments were targeted for first egg hatch as determined by the DD model. The GUTHION treatment was applied 7 June for the first generation, 102.2 DD (base 10C) after first male CM catch, and reapplied 27 June, 301.7 DD (base 10C) 20 days after first application. All other treatments were applied for the first generation 7 June (102.2 DD_{10}) and 25 June (270.8 DD_{10}), 18 days after the first application. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 10-12 L of spray mix were used per plot; pressure was set at 2000 kPa. On 19 June, plots were examined for Mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays. Numbers of MB and WALH per six taps were recorded for each plot. A sample was taken to assess first generation codling moth (CM) damage on 10 July, when 100 apples per plot were examined on the tree. Efficacy was expressed as percent fruit damaged by CM. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 10 July sample for first-generation CM damage, all treated plots showed significantly lower damage than the control (Table 1) but were not different from each other. Numbers of Mullein leaf bug in the INTREPID treated plots were not significantly different from the control (Table 2), but were lower in the GUTHION and SUCCESS treated plots. No differences in numbers of white apple leafhopper were observed in any treatments.

Table 1. Percent fruit damaged by codling moth.

Treatment	Rate (a.i./ha)	Generation 1 10 July
GUTHION 50 W [1]	1.05 kg	0.25 B[3]
INTREPID 2 F[2]	240 g	2.20 B
SUCCESS 480 SC[2]	120 g	2.22 B
SUCCESS 480 SC[2]	87.5 g	4.40 B
CONTROL	-	11.63 A

[1] Applied 7 June, reapplied 27 June

[2] Applied 7 June, reapplied 25 June

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on Mullein leaf bug and white apple leafhopper.

Treatment	Rate (a.i./ha)	MB/6 taps per plot 19 June	WALH/6 taps per plot 19 June
GUTHION 50 W [1]	1.05 kg	1.25 B	23.00 A[3]
SUCCESS 480 SC[2]	87.5 g	1.25 B	20.00 A
SUCCESS 480 SC[2]	120 g	2.00 B	21.00 A
INTREPID 2 F[2]	240 g	5.00 A	23.00 A
CONTROL	-	6.75 A	25.25 A

[1] Applied 7 June, reapplied 27 June

[2] Applied 7 June, reapplied 25 June

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 17 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apple cv. McIntosh

PESTS: Codling Moth, *Cydia pomonella* (L.), Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee)

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TITLE: CONTROL OF CODLING MOTH, MULLEIN LEAF BUG, AND WHITE APPLE LEAFHOPPER ON APPLE; 2002

MATERIALS: CALYPSO 480 SC (thiacloprid), ESTEEM 35 WP (pyriproxifen), GUTHION 50 WP (azinphos-methyl)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 3.0 m by 4.8 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male codling moths (CM). The trial compared two rates of CALYPSO to ESTEEM, a GUTHION standard, and an unsprayed control. The GUTHION standard was applied according to the standard CM degree day (DD) model; all other treatments were targeted for first egg hatch as determined by the DD model. The GUTHION treatment was applied 7 June for the first generation, 102.2 DD (base 10C) after first male CM catch, and reapplied 27 June, 301.7 DD (base 10C) 20 days after first application. GUTHIONwas applied for the second generation 25 July and repeated 15 August (672 DD_{10} and 978 DD_{10} after first male moth catch). The CALYPSO and ESTEEM treatments were applied for the first generation 4 June (88.6 DD_{10}) and 18 June (188.6 DD_{10}), 14 days after the first application; and for the second generation 22 July and 12 August (635 DD_{10} and 909 DD_{10} after first male moth catch, respectively). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 10-12 L of spray mix were used per plot; pressure was set at 2000 kPa. On 19 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally-spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays. Numbers of MB and WALH per six taps were recorded for each plot. A sample was taken to assess first generation codling moth (CM) damage on 10 July, when 100 apples per plot were examined on the tree. Second generation CM damage was assessed 13 September, when 100 apples per plot were harvested from the canopy and the ground; damaged fruit were dissected, and all larvae found were examined under a stereomicroscope and identified. Efficacy was expressed as percent fruit damaged by CM. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. Laboratory identification revealed that 67% of larvae recovered from all control plots were CM, while the remainder were Oriental fruit moth (OFM), *Grapholita molesta* (Busck). In the treated plots, 63% of larvae recovered were OFM, while the remainder were identified as CM. No phytotoxic effects were observed in any of the plots.

CONCLUSIONS: In the 10 July sample for first-generation CM damage, all treated plots showed significantly lower damage than the control (Table 1) but were not different from each other; similar results were observed at harvest. Numbers of mullein leaf bug were lower in all treated plots than in the control (Table 2). Only the plots treated with CALYPSO contained fewer numbers of white apple leafhopper than the control; however, no differences were observed between rates.

Table 1. Percent fruit damaged by codling moth.

Treatment	Rate (a.i./ha)	Generation 1 10 July	Generation 2 13 September
GUTHION 50 WP[1]	1.05 kg	1.0 B	7.0 B[3]
CALYPSO 480 SC[2]	210 g	0.7 B	11.5 B
CALYPSO 480 SC[2]	140 g	2.4 B	16.5 B
ESTEEM 35 WP[2]	121 g	2.0 B	17.0 B
CONTROL	-	14.9 A	59.5 A

[1] Applied 7 June, reapplied 27 June, 25 July, 15 August

[2] Applied 4 June, reapplied 18 June, 22 July, 12 August

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on Mullein leaf bug and white apple leafhopper.

Treatment	Rate (a.i./ha)	MB/6 taps per plot 19 June	WALH/6 taps per plot 19 June
GUTHION 50 WP[1]	1.05 kg	1.50 B	19.25 A[3]
CALYPSO 480 SC[2]	210 g	0.50 B	8.75 B
CALYPSO 480 SC[2]	140 g	0.50 B	6.00 B
ESTEEM 35 WP[2]	121 g	1.00 B	24.75 A
CONTROL	-	4.25 A	28.50 A

[1] Applied 7 June, reapplied 27 June, 25 July, 15 August

[2] Applied 4 June, reapplied 18 June, 22 July, 12 August

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 18 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Red Delicious
PEST: European Red Mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF EUROPEAN RED MITE ON APPLE WITH ACARICIDES; 2002

MATERIALS: PYRAMITE 75 WP (pyridaben), TM 413 15 SC (acequinocyl)

METHODS: The trial was conducted in an eight-year-old orchard in the Jordan Station, Ontario area; trees cv. Red Delicious were spaced 4.3 m by 2.4 m, and were on M9 rootstock. A single rate of TM 413 (340 g a.i./ha) with and without the spreader/sticker AGRAL 90 at 0.1 % of the final spray volume was compared to a PYRAMITE standard and an unsprayed control. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. On 31 July, acaricides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Blocks were sampled pre-treatment, and individual plots sampled 7, 14, and 21 days after treatment. Samples consisted of counts made on 50 leaves per plot, picked randomly at arm's length into the canopy. Samples were examined using a stereomicroscope (leaves were brushed with a Henderson-McBurnie mite-brushing machine), and numbers of live European Red Mite (ERM) eggs and motiles (nymphs and adults) recorded. Total numbers of motile beneficial mites observed were also recorded for each plot. Data were transformed (square root (x+1/2)), and analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. Pre-treatment samples 30 July showed similar numbers of ERM motiles (approximately 2.0 motiles per leaf) in all plots. Mite numbers were observed to increase naturally in August.

CONCLUSIONS: In the 7, 14, and 21-day samples, all treated plots had significantly fewer ERM motiles than the control (Table 1), but were not different from each other. None of the treated plots had fewer beneficial mites than the control in the 7, 14, or 21-day samples (Table 2).

Table 1. Numbers of ERM motiles per leaf.

Treatment[1]	Rate a.i./ha	Days After Treatment		
		7 days (7 August)	14 days (14 August)	21 days (21 August)
PYRAMITE 75 WP	225 g	1.14 B	0.59 B	1.38 B[2]
TM 413 15 SC	340 g	0.93 B	0.20 B	1.22 B
TM 413 15 SC + AGRAL 90	340 g	0.51 B	0.55 B	1.89 B
CONTROL	-	2.24 A	3.20 A	10.56 A

[1] Applied 31 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Numbers of beneficial mite motiles per leaf.

Treatment[1]	Rate a.i./ha	Days After Treatment		
		7 days (7 August)	14 days (14 August)	21 days (21 August)
PYRAMITE 75 WP	225 g	0.09 A	0.10 A	0.00 A[2]
TM 413 15 SC	340 g	0.26 A	0.58 A	0.03 A
TM 413 15 SC + AGRAL 90	340 g	0.63 A	0.58 A	0.18 A
CONTROL	-	0.54 A	0.54 A	0.34 A

[1] Applied 31 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 19 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Red Delicious
PEST: European Red Mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: ASSESSMENT OF ACARICIDES FOR EUROPEAN RED MITE ON APPLE; 2002

MATERIALS: FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben), V 1283 72 WDG (etoxazole)

METHODS: The trial was conducted in an eight-year-old orchard in the Jordan Station, Ontario area; trees cv. Red Delicious were spaced 4.3 m by 2.4 m, and were on M9 rootstock. Three rates of FLORAMITE (140 g a.i./ha, 280 g a.i./ha, and 560 g a.i./ha) were compared to V 1283, a PYRAMITE standard, and an unsprayed control. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. On 30 July, acaricides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Blocks were sampled pre-treatment, and individual plots sampled 7, 14, and 21 days after treatment. Samples consisted of counts made on 50 leaves per plot, picked randomly at arm's length into the canopy. Samples were examined using a stereomicroscope (leaves were brushed with a Henderson-McBurnie mite-brushing machine), and numbers of live European Red Mite (ERM) eggs and motiles (nymphs and adults) recorded. Total numbers of motile beneficial mites observed were also recorded for each plot. Data were transformed (log (x+1)) and analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. Pre-treatment samples 26 July showed similar numbers of ERM motiles (approximately 1.8 motiles per leaf) in all plots. Mite numbers were observed to increase naturally in August.

CONCLUSIONS: In the 7-day sample, only the plots treated with V 1283, PYRAMITE, and the 560 g a.i./ha rate of FLORAMITE contained significantly fewer ERM motiles than the control (Table 1). All treated plots except the 140 g a.i./ha rate of FLORAMITE were significantly different from the control in the 14-day sample; the plots treated with V 1283 and the 560 g a.i./ha rate of FLORAMITE had fewer ERM motiles than those treated with the 140 g a.i./ha rate of FLORAMITE. Similar results were observed in the 21-day sample, only the 140 g a.i./ha rate of FLORAMITE was not different from the control; the V 1283 and PYRAMITE treatments contained fewer ERM motiles than the 280 g a.i./ha and 140 g a.i./ha rates of FLORAMITE. Numbers of beneficial mites in treated plots were not different than in the control in the 7-day and 14-day samples (Table 2), while numbers in the plots treated with V 1283 were

significantly lower than in control plots in the 21-day sample. Whether these differences were due to toxic effects or a lack of prey was not determined.

Table 1. Numbers of ERM motiles per leaf

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		7 days (6 August)	14 days (13 August)	21 days (20 August)
V 1283 72 WDG	100 g	0.13 B	0.00 C	0.06 C[2]
PYRAMITE 75 WP	225 g	0.21 B	0.24 BC	0.15 C
FLORAMITE 50 W	560 g	0.76 B	0.02 C	0.66 BC
FLORAMITE 50 W	280 g	0.98 AB	0.20 BC	1.98 B
FLORAMITE 50 W	140 g	0.96 AB	0.94 AB	5.19 AB
CONTROL	-	2.00 A	1.48 A	5.83 A

[1] Applied 30 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Numbers of beneficial mite motiles per leaf

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		7 days (6 August)	14 days (13 August)	21 days (20 August)
V 1283 72 WDG	100 g	0.05 A	0.03 A	0.00 B[2]
PYRAMITE 75 WP	225 g	0.19 A	0.03 A	0.09 AB
FLORAMITE 50 W	560 g	0.23 A	0.25 A	0.18 AB
FLORAMITE 50 W	280 g	0.24 A	0.11 A	0.15 AB
FLORAMITE 50 W	140 g	0.31 A	0.14 A	0.48 A
CONTROL	-	0.86 A	0.30 A	0.51 A

[1] Applied 30 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 20 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Spartan
PEST: Two Spotted Spider Mite, *Tetranychus urticae* Koch
PREDATORS: *Amblyseius fallacis* (Garman), *Zetzellia mali* (Ewing)

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TITLE: CONTROL OF TWO SPOTTED SPIDER MITE ON APPLE WITH ACARICIDES; 2002

MATERIALS: FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a ten-year-old orchard in the Brighton, Ontario, area; trees cv. Spartan were spaced 3.4 m by 4.2 m and were on M7 rootstock. Treatments were replicated four times and assigned to one-tree plots, and arranged according to a randomised complete block design. Three rates of FLORAMITE (140, 280, and 560 g a.i./ha) were compared to a PYRAMITE standard and an unsprayed control. On 16 August, acaricides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled pre-treatment 15 August, and three times post-treatment, 19 August, 23 August, and 30 August (3, 7, and 14 days after treatment). Efficacy ratings consisted of counts of motiles of Two Spotted Spider Mite (TSSM) on 25 leaves per plot, picked randomly at arm's length into the canopy. Leaves were examined using a stereomicroscope and numbers of live TSSM motiles (nymphs and adults) were recorded. Numbers of beneficial mite motiles (*Amblyseius* fallacis and *Zetzellia mali*) were also recorded. Data were analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2 below. Prespray samples 15 August showed similar numbers of TSSM motiles (approximately 30 TSSM motiles per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots. Mite numbers were observed to decrease naturally in August.

CONCLUSIONS: In the 3, 7, and 14-day samples, all treated plots had fewer TSSM than the control (Table 1), but treatments were not different from each other. Plots treated with PYRAMITE had fewer *A. fallacis* than the control in the 7 and 14-day samples (Table 2), but were not different from the other treatments. In the 3 and 7-day samples, no differences in numbers of *Zetzellia* mali were observed between treatments (Table 3); plots treated with the 280 and 560 g a.i./ha rates of FLORAMITE had more *Zetzellia mali* than those treated with PYRAMITE in the 14-day sample. Plots treated with PYRAMITE contained fewer total beneficial mites than the control plots in the 7 and 14-day samples (Table 4); numbers of beneficial mites in FLORAMITE-treated plots were not different from the control in any samples.

Table 1. Numbers of TSSM motiles per leaf.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		3 days 19 August	7 days 23 August	14 days 30 August
FLORAMITE 50 W	560 g	1.5 B	0.9 B	0.2 B[2]
FLORAMITE 50 W	280 g	3.4 B	3.4 B	0.9 B
FLORAMITE 50 W	140 g	6.2 B	9.8 B	2.9 B
PYRAMITE 75 WP	450 g	3.7 B	6.6 B	2.5 B
CONTROL	-	23.7 A	24.9 A	13.8 A

[1] Applied 16 August
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Numbers of *Amblyseius fallacis* motiles per leaf.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		3 days 19 August	7 days 23 August	14 days 30 August
FLORAMITE 50 W	560 g	0.38 B	1.14 AB	0.54 AB[2]
FLORAMITE 50 W	280 g	1.00 A	0.59 AB	0.53 AB
FLORAMITE 50 W	140 g	0.56 AB	1.43 AB	1.07 AB
PYRAMITE 75 WP	450 g	0.11 B	0.43 B	0.20 B
CONTROL	-	0.65 AB	1.74 A	1.37 A

[1] Applied 16 August
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 3. Numbers of *Zetzellia mali* motiles per leaf.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		3 days 19 August	7 days 23 August	14 days 30 August
FLORAMITE 50 W	560 g	0.20 A	0.63 A	0.62 A[2]
FLORAMITE 50 W	280 g	0.11 A	0.44 A	0.61 A
FLORAMITE 50 W	140 g	0.54 A	0.26 A	0.15 AB
PYRAMITE 75 WP	450 g	0.07 A	0.08 A	0.01 B
CONTROL	-	0.33 A	0.50 A	0.26 AB

[1] Applied 16 August
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 4. Total numbers of beneficial mite motiles (both species) per leaf

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		3 days 19 August	7 days 23 August	14 days 30 August
FLORAMITE 50 W	560 g	0.58 AB	1.77 AB	1.16 A[2]
FLORAMITE 50 W	280 g	1.11 A	1.03 AB	1.14 A
FLORAMITE 50 W	140 g	1.10 A	1.69 AB	1.22 A
PYRAMITE 75 WP	450 g	0.18 B	0.51 B	0.21 B
CONTROL	-	0.98 AB	2.24 A	1.63 A

[1] Applied 16 August

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2002 PMR REPORT # 21 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Empire

PESTS: Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee)

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TITLE: CONTROL OF EARLY SEASON PESTS OF APPLE; 2002

MATERIALS: ADMIRE 240 F (imidacloprid), ESTEEM 35 WP (pyriproxifen), MATADOR 120 EC (lambda cyhalothrin)

METHODS: The trial was conducted in a six-year-old orchard in the Jordan, Ontario area; trees cv. Empire were spaced 4.6 m by 2.4 m, and were on M9 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. ESTEEM applied at pink (28 May) was compared to ADMIRE and MATADOR applied at petal fall (13 June), and an unsprayed control; applications targeted first-generation spotted tentiform leafminer (STLM). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 10-11 L of spray mix were used per plot; pressure was set at 2000 kPa. On 30 June, a sample of 30 leaf clusters per plot was collected from the lower central part of the tree canopy. Samples were examined using a stereomicroscope, and the percentage of clusters mined by STLM and the number of mines per cluster were recorded. On 18 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays; numbers of MB and WALH per six taps were recorded for each plot. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Due to several heavy frost events in May, numbers of STLM were too few to analyse. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the sample taken 18 June to assess the effects of treatments on MB, all treated plots had significantly fewer MB than the control (Table 1), but were not different from each other. However, only the plots treated with ADMIRE showed significantly lower numbers of WALH than the control.

Table 1. Effects of insecticides on mullein leaf bug and white apple leafhopper.

Treatment	Rate (a.i./ha)	MB/6 taps per plot 18 June	WALH/6 taps per plot 18 June
ADMIRE 240 F[2]	91.2 g	3.50 B	2.5 B[3]
MATADOR 120 EC[2]	10 g	0.75 B	22.2 A
ESTEEM 35 WP[1]	121 g	4.25 B	43.5 A
CONTROL	-	9.25 A	43.0 A

[1] Applied 28 May (pink)

[2] Applied 13 June (petal fall)

[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2002 PMR REPORT # 22 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Empire
PESTS: Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee), European Red Mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF MULLEIN LEAF BUG AND WHITE APPLE LEAFHOPPER; 2002

MATERIALS: ACTARA 25 WG (thiamethoxam), ADMIRE 240 F (imidacloprid), MATADOR 120 EC (lambda cyhalothrin)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan, Ontario area; trees cv. Empire were spaced 4.6 m by 2.4 m, and were on M9 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Three rates at two different application timings were tested for ACTARA, one applied at pink (1 May); the second at petal fall (13 June). All treatments were compared with ADMIRE and a MATADOR standard, applied at petal fall (13 June). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 10-11 L of spray mix were used per plot; pressure was set at 2000 kPa. On 28 June, a sample of 30 leaf clusters per plot was collected from the lower central part of the tree canopy. Samples were examined using a stereomicroscope, and the percentage of clusters mined by spotted tentiform leafminer (STLM) and the number of mines per cluster were recorded. On 18 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays; numbers of MB and WALH per six taps were recorded for each plot. Effects on populations of European Red Mite (ERM) were also examined; six weeks (12 August) after application, 50 leaves per plot were picked randomly at arm's length into the canopy. Leaves were examined using a stereomicroscope (leaves were brushed with a Henderson McBurnie mite brushing machine), and numbers of live ERM motiles and beneficial mite motiles were recorded. Data were analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2. Due to several heavy frost events in May, numbers of STLM were too few to analyse. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the sample taken 18 June to assess the effects of treatments on MB, all plots treated at petal fall with MATADOR and ACTARA had significantly fewer MB than the control (Table 1), but the ADMIRE treatment and treatments of ACTARA applied at pink were not different from the control. In the 18 June sample for WALH, the plots treated with ADMIRE, the petal fall applications of

ACTARA, and the 79 g a.i./ha rate of ACTARA applied at pink showed significantly lower numbers of WALH than the control (Table 1). However, numbers in the ADMIRE and petal fall treatments of ACTARA were significantly lower than the 79 g a.i./ha rate of ACTARA applied at pink. No differences in numbers of European red mite or beneficial mites were observed in plots treated with ACTARA or ADMIRE (Table 2), but the plots treated with MATADOR had significantly more ERM and beneficial mites than the control.

Table 1. Effects of insecticides on numbers of mullein leaf bug and white apple leafhopper.

Treatment	Rate (a.i./ha)	MB/6 taps per plot	WALH/6 taps per plot
		18 June	18 June
ADMIRE 240 F[1]	91.2 g	3.50 AB	2.5 E[3]
ACTARA 25 WG[1]	96 g	0.75 B	2.0 E
ACTARA 25 WG[1]	79 g	1.25 B	4.0 DE
ACTARA 25 WG[1]	40 g	1.50 B	10.0 CDE
MATADOR 120 EC[1]	10 g	0.75 B	22.25 ABC
ACTARA 25 WG[2]	79 g	5.50 AB	17.0 BCD
ACTARA 25 WG[2]	48 g	4.75 AB	36.75 AB
ACTARA 25 WG[2]	24 g	5.25 AB	45.00 AB
CONTROL	-	7.25 A	76.75 A

[1] Applied 13 June (petal fall)

[2] Applied 1 May (pink)

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test

Table 2. Effects of insecticides on numbers of motile phytophagous and predatory mites.

Treatment	Rate (a.i./ha)	European Red Mite/leaf	*A. fallacis*/leaf
		12 August	12 August
ADMIRE 240 F[1]	91.2 g	0.71 A	0.19 A[3]
ACTARA 25 WG[1]	96 g	0.34 A	0.24 A
ACTARA 25 WG[1]	79 g	0.08 A	0.23 A
ACTARA 25 WG[1]	40 g	0.11 A	0.09 A
MATADOR 120 EC[1]	10 g	11.15 B	2.16 B
ACTARA 25 WG[2]	79 g	0.34 A	0.30 A
ACTARA 25 WG[2]	48 g	0.11 A	0.18 A
ACTARA 25 WG[2]	24 g	0.13 A	0.23 A
CONTROL	-	0.10 A	0.32 A

[1] Applied 13 June (petal fall)

[2] Applied 1 May (pink)

[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test

2002 PMR REPORT # 23 **SECTION A: FRUIT-Insect Pests**

STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. McIntosh

PESTS: Mullein Leaf Bug, *Campylomma verbasci* (Meyer), White Apple Leafhopper, *Typhlocyba pomaria* (McAtee)

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TITLE: CONTROL OF MULLEIN LEAF BUG AND WHITE APPLE LEAFHOPPER WITH INSECTICIDES; 2002

MATERIALS: ACTARA 25 WG (thiamethoxam)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan, Ontario area; trees cv. McIntosh were spaced 4.8 m by 3.0 m, and were on M26 rootstock.Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design.Three rates of ACTARA applied at pink (1 May) were compared to an unsprayed control. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 10-11 L of spray mix were used per plot; pressure was set at 2000 kPa. On 19 June, plots were examined for mullein leaf bug (MB) and white apple leafhopper (WALH) by tapping each tree at three equally spaced locations (six taps per plot), and counting MB nymphs and WALH nymphs on 45 cm x 45 cm tapping trays; numbers of MB and WALH per six taps were recorded for each plot. Data were analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the sample taken 19 June to assess the effects of treatments on MB, all plots treated at pink with ACTARA had significantly fewer MB than the control (Table 1). In the 19 June sample for WALH, the plots treated with ACTARA contained significantly lower numbers of WALH than the control.

Table 1. Effects of insecticides on numbers of mullein leaf bug and white apple leafhopper.

Treatment[1]	Rate (a.i./ha)	MB/6 taps per plot	WALH/6 taps per plot
		19 June	19 June
ACTARA 25 WG	79 g	0.50 B	7.25 B[2]
ACTARA 25 WG	48 g	0.25 B	7.75 B
ACTARA 25 WG	24 g	0.25 B	21.00 B
CONTROL	-	2.25 A	43.25 A

[1] Applied 1 May (pink)

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test

2002 PMR REPORT # 24 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Red Delicious

PESTS: Oblique-Banded Leaf Roller, *Choristoneura rosaceana* (Harris), Potato Leafhopper, *Empoasca fabae* (Harris)

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TITLE: CONTROL OF OBLIQUE-BANDED LEAF ROLLER AND POTATO LEAFHOPPER WITH INSECTICIDES; 2002

MATERIALS: CALYPSO 480 SC (thiacloprid), MATADOR 120 EC (lambda-cyhalothrin)

METHODS: The trial was conducted in an 11-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 4.9 m by 3.0 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male oblique-banded leafroller (OBLR) moths. The trial compared CALYPSO to a MATADOR standard and an unsprayed check. Treatments were applied 3 July, 266 $DD_{6.1}$ after first male moth catch; insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 12-13 L of spray mix were used per plot; pressure was set at 2000 kPa. Fifty terminals per plot were examined on 22 July for the presence of potato leafhopper (PLH) damage; percent terminals damaged were recorded. On 2 August, 50 terminals were examined per plot, and the number of terminals containing live OBLR larvae was recorded. Efficacy ratings were expressed as percent terminals infested; data were analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Numbers of OBLR were low in all plots. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 22 July sample for PLH damage, all treated plots contained significantly less damage than the control (Table 1). In the 2 August sample for OBLR, all of the treatments were different from the control.

Table 1. Control of potato leafhopper and oblique-banded leafroller.

Treatment[1]	Rate (a.i./ha)	% PLH Damaged Terminals	% OBLR Infested Terminals
		22 July	2 August
MATADOR 120 EC	10.1 g	4.0 B	0.0 B[2]
CALYPSO 480 SC	210 g	0.0 B	0.0 B
CONTROL	-	67.5 A	2.5 A

[1] Applied 3 July (266 DD from first male moth catch)

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2002 PMR REPORT # 25 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Apple cv. Red Delicious

PESTS: Oblique-Banded Leaf Roller, *Choristoneura rosaceana* (Harris), Potato Leafhopper, *Empoasca fabae* (Harris)

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TITLE: ASSESSMENT OF INSECTICIDES FOR CONTROL OF OBLIQUE-BANDED LEAF ROLLER AND POTATO LEAFHOPPER ON APPLE; 2002

MATERIALS: ASSAIL 70 WP (acetamiprid), MATADOR 120 EC (lambda-cyhalothrin), SUCCESS 480 SC (spinosad)

METHODS: The trial was conducted in an 11-year-old orchard in the Jordan Station, Ontario area; trees cv. McIntosh were spaced 4.9 m by 3.0 m, and were on M26 rootstock. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application timing was determined from pheromone trap catches of male moths. The trial compared two rates of SUCCESS to ASSAIL, a MATADOR standard, and an unsprayed check. Treatments were applied 3 July, 266 $DD_{6.1}$ after first male moth catch; insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 12-13 L of spray mix were used per plot; pressure was set at 2000 kPa. Fifty terminals per plot were examined on 22 July for the presence of potato leafhopper (PLH) nymphs; percent terminals infested were recorded. On 2 August, 50 terminals were examined per plot, and the number of terminals containing live oblique-banded leafroller (OBLR) larvae was recorded. Efficacy ratings were expressed as percent terminals infested; data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Numbers of OBLR were low in all plots. No phytotoxic effects were observed in any plots.

CONCLUSIONS: one of the treatments were statistically different from the control.

Table 1. Control of potato leafhopper and oblique-banded leafroller.

Treatment[1]	Rate (a.i./ha)	% PLH Infested Terminals 22 July	% OBLR Infested Terminals 2 August
MATADOR 120 EC	10.1 g	6.5 C	1.0 A[2]
ASSAIL 70 WP	120.0 g	13.5 C	0.0 A
SUCCESS 480F	120.0 g	44.0 B	0.0 A
SUCCESS 480F	87.5 g	53.5 AB	0.0 A
CONTROL	-	65.5 A	2.5 A

[1] Applied 3 July (266 DD from first male moth catch)

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2002 PMR REPORT # 26 **SECTION A: BERRY CROPS - Insect Pests**
STUDY DATA BASE: 390 1252 9201

CROP: Highbush Blueberry (*Vaccinium corymbosum*)
PEST: Aphids

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TITLE: EFFICACY OF DORMANT OIL FOR THE CONTROL OF APHIDS IN HIGHBUSH BLUEBERRIES IN 2002.

MATERIALS: DORMANT OIL

METHODS: Dormant Oil is already registered for use on blueberries and is a low toxicity pesticide. There is a need for more products for aphid control with the development of Scorch Virus in British Columbia. Little is known of the effect of dormant oil on aphids. Thus, a trial was conducted in 2002 in a blueberry planting near Abbotsford, B.C. in a field known to be infested with aphids. Each treatment was applied to a block of bushes consisting of 4 bushes long x 3 bushes wide replicated four times in a randomized complete block design. Only the middle two bushes within each plot were assessed. Two untreated bushes at either end of each plot were left as a buffer between each treatment. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 1000 L/ha of water at a pressure of 345 kPa on February 12, 2002. Plants were in a dormant state. Temperature was 8.1 C with 42.7% RH. A visual inspection of plants was done for crop tolerance.

RESULTS: No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: The winged aphid form developed early in the season and there were inconsistent results. The trial will be repeated in 2003.

2002 PMR REPORT # 27 **SECTION A: BERRY CROPS - Insect Pests**
STUDY DATA BASE: 390 1252 9201

CROP: Highbush Blueberry (*Vaccinium corymbosum*)
PEST: Aphids

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TITLE: **EFFICACY OF SEVERAL INSECTICIDES FOR THE CONTROL OF APHIDS IN HIGHBUSH BLUEBERRIES, 2002.**

MATERIALS: ADMIRE 240 (imidacloprid), ACTARA 25WG (thiamethoxam), ASSAIL 70WP (acetamiprid), and SUPERIOR OIL

METHODS: The trial was conducted in 2002 in a two year old blueberry planting in Chilliwack, B.C. in a field known to be infested with aphids. Each treatment was applied to a block of bushes consisting of 6 bushes long x 3 bushes wide replicated four times in a randomized complete block design. Plot size was 5.4 m x 9 m. Each bush was approximately 60 cm tall x 40 cm wide. The middle four bushes within each plot were assessed. Two untreated bushes at either end of each plot were left as a buffer between each treatment. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 500 L/ha of water at a pressure of 345 kPa on July 23 and August 8, 2002. Aphid counts were taken July 23, 2002 prior to the first spray and then repeated on August 1, August 8 (just prior to second spray), August 16, August 21, August 29, September 11, and September 16. Infested terminals, total aphids, adults and colonies on 20 randomly selected tender leaf terminals were counted. A group of 5 or more aphids with at least one adult aphid was counted as a colony. 3 - 5 leaf terminals were randomly sampled from all sections of the plants. The first spray was applied July 24, 2002 at 25.8 C with 39.8% RH and the second spray was applied August 8, 2002 at 25.8 C with 29.3% RH. Aphids are still to be positively identified but have tentatively been identified as *Aphis vaccinni*. The plants were also checked for any midge damage. A visual inspection of plants was done for crop tolerance.

RESULTS: No phytotoxic effects were observed in any of the treated plots. See tables 1- 8 for aphid counts.

CONCLUSIONS: Both rates of imidacloprid, thiamethoxam and acetamiprid were effective in reducing the aphid populations. There were no live aphids in any of the insecticide treatments on the August 16 and 23rd counts. The reduction in aphid population lasted for approximately 4 weeks. Superior oil did not effect the aphid population. The aphids are still to be positively identified, however there is a strong indication that *Aphis vaccinni* was the aphid. This aphid had previously not been identified in British Columbia. There was no indication of any midge damage on the plants so a rating could not be made.

Table 1. Aphids counts taken on July 23, 2002 prior to the first spray application. Aphid counts taken on 20 random terminals. Colonies contained at least one adult aphid.

Treatment	Rate (g ai/ha)	No of Appn [1]	Infested Terminals	Total Aphids	Total Adults	Colonies	% Infested Terminals
Check	-	-	4.8 a	17.3 a	4.0 a	1.3 a	23.8 a
Imidacloprid	42	0	7.3 a	21.3 a	6.5 a	1.3 a	36.3 a
Imidacloprid	56	0	8.5 a	41.3 a	10.8 a	2.5 a	42.5 a
Thiamethoxam	55	0	6.0 a	21.3 a	6.8 a	1.0 a	30.0 a
Acetamiprid	84	0	8.0 a	31.0 a	5.5 a	1.8 a	40.0 a
Superior Oil	1% v/v	0	7.0 a	39.5 a	9.5 a	1.8 a	35.0 a

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. Counts taken on August 1, 2002 after being treated on July 24, 2002. Aphid counts taken on 20 random terminals. Colonies contained at least one adult aphid.

Treatment	Rate (g ai/ha)	No of Appn [1]	Infested Terminals	Total Aphids	Total Adults	Colonies	% Infested Terminals
Check	-	-	6.5 a	19.0 a	7.0 a	0.8 a	32.5 a
Imidacloprid	42	1	0.3 b	0.3 b	0.3 b	0.0 b	1.3 b
Imidacloprid	56	1	0.5 b	0.5 b	0.3 b	0.0 b	2.5 b
Thiamethoxam	55	1	0.3 b	0.3 b	0.3 b	0.0 b	1.3 b
Acetamiprid	84	1	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
Superior Oil	1% v/v	1	5.0 a	18.5 a	7.3 a	1.3 a	25.0 a

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 3. Counts taken on August 8, 2002 after being treated on July 24, 2002. Aphid counts taken on 20 random terminals. Colonies contained at least one adult aphid.

Treatment	Rate (g ai/ha)	No of Appn [1]	Infested Terminals	Total Aphids	Total Adults	Colonies	% Infested Terminals
Check	-	-	6.3 a	23.8 a	8.5 a	1.0 a	31.3 a
Imidacloprid	42	1	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
Imidacloprid	56	1	0.3 b	0.3 b	0.3 b	0.0 b	1.3 b
Thiamethoxam	55	1	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
Acetamiprid	84	1	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
Superior Oil	1% v/v	1	6.3 a	17.3 a	6.5 a	1.3 a	31.3 a

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 4. Counts taken on August 16, 2002 after being treated on July 23 and August 8, 2002. Aphid counts taken on 20 random terminals. Colonies contained at least one adult aphid.

Treatment	Rate (g ai/ha)	No of Appn [1]	Infested Terminals	Total Aphids	Total Adults	Colonies	% Infested Terminals
Check	-	-	4.0 a	12.5 a	3.5 a	0.5 a	20.0 a
Imidacloprid	42	2	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
Imidacloprid	56	2	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
Thiamethoxam	55	2	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
Acetamiprid	84	2	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b
Superior Oil	1% v/v	2	3.5 a	27.3 a	7.0 a	0.8 a	17.5 a

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 5. Counts taken on August 23, 2002 after being treated on July 23 and August 8, 2002. Aphid counts taken on 20 random terminals. Colonies contained at least one adult aphid.

Treatment	Rate (g ai/ha)	No of Appn [1]	Infested Terminals	Total Aphids	Total Adults	Colonies	% Infested Terminals
Check	-	-	3.5 a	5.8 a	4.0 a	0.4 a	17.5 a
Imidacloprid	42	2	0.0 b	0.0 b	0.0 b	0.0 a	0.0 b
Imidacloprid	56	2	0.0 b	0.0 b	0.0 b	0.0 a	0.0 b
Thiamethoxam	55	2	0.0 b	0.0 b	0.0 b	0.0 a	0.0 b
Acetamiprid	84	2	0.0 b	0.0 b	0.0 b	0.0 a	0.0 b
Superior Oil	1% v/v	2	3.0 a	7.8 a	2.8 a	0.8 a	15.0 a

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 6. Counts taken on August 29, 2002 after being treated on July 23 and August 8, 2002. Aphid counts taken on 20 random terminals. Colonies contained at least one adult aphid.

Treatment	Rate (g ai/ha)	No of Appn [1]	Infested Terminals	Total Aphids	Total Adults	Colonies	% Infested Terminals
Check	-	-	4.5 a	10.3 a	4.0 a	0.5 a	22.5 a
Imidacloprid	42	2	0.5 b	3.3 b	0.3 b	0.0 a	2.5 b
Imidacloprid	56	2	2.0 b	2.8 b	1.0 b	0.0 a	10.0 b
Thiamethoxam	55	2	1.5 b	3.5 b	2.0 b	0.3 a	7.5 b
Acetamiprid	84	2	0.3 b	0.3 b	0.0 b	0.0 a	1.3 b
Superior Oil	1% v/v	2	2.5 ab	8.0 a	4.0 a	0.8 a	12.5 ab

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 7. Counts taken on September 11, 2002 after being treated on July 23 and August 8, 2002. Aphid counts taken on 20 random terminals. Colonies contained at least one adult aphid.

Treatment	Rate (g ai/ha)	No of Appn [1]	Infested Terminals	Total Aphids	Total Adults	Colonies	% Infested Terminals
Check	-	-	5.6 a	13.2 a	2.0 a	0.3 a	28.0 a
Imidacloprid	42	2	5.2 a	19.6 a	3.6 a	0.8 a	26.0 a
Imidacloprid	56	2	5.6 a	19.6 a	2.8 a	0.3 a	28.0 a
Thiamethoxam	55	2	6.4 a	26.4 a	5.6 a	1.6 a	32.0 a
Acetamiprid	84	2	5.2 a	14.0 a	2.4 a	0.0 a	26.0 a
Superior Oil	1% v/v	2	6.4 a	17.2 a	6.0 a	0.8 a	32.0 a

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 8. Counts taken on September 16, 2002 after being treated on July 23 and August 8, 2002. Aphid counts taken on 20 random terminals. Colonies contained at least one adult aphid.

Treatment	Rate (g ai/ha)	No of Appn [1]	Infested Terminals	Total Aphids	Total Adults	Colonies	% Infested Terminals
Check	-	-	3.3 a	7.9 a	2.3 a	0.3 a	16.3 a
Imidacloprid	42	2	3.5 a	11.8 a	2.8 a	0.8 a	17.5 a
Imidacloprid	56	2	4.0 a	9.3 a	2.5 a	0.3 a	20.0 a
Thiamethoxam	55	2	3.8 a	6.5 a	1.8 a	0.0 a	18.8 a
Acetamiprid	84	2	2.5 a	3.3 a	2.0 a	0.0 a	12.5 a
Superior Oil	1% v/v	2	5.0 a	8.8 a	4.5 a	0.5 a	25.0 a

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

2002 PMR REPORT # 28 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Grapes cv. Riesling
PEST: European Red Mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF EUROPEAN RED MITE ON GRAPE; 2002

MATERIALS: FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a six-year-old vineyard in the Jordan Station, Ontario area; vines cv. Riesling were spaced 2.5 m by 1.5 m. Treatments were replicated four times, assigned to five-vine plots, and arranged according to a randomised complete block design. On 25 July, acaricides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Blocks were sampled pre-treatment, and individual plots sampled 7, 14, and 21 days after treatment. Samples consisted of counts made on 20 leaves per plot, picked randomly from both sides of the row. Samples were examined using a stereomicroscope (leaves were brushed with a Henderson-McBurnie mite-brushing machine), and numbers of live European Red Mite (ERM) eggs and motiles (nymphs and adults) recorded. Total numbers of beneficial mite motiles observed were also recorded for each plot. Data were analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Pre-treatment samples 18 July showed similar numbers of ERM motiles (approximately 4 motiles per leaf) in all plots. No phytotoxic effects were observed in any plots. Numbers of beneficial mites were too few to analyse in the 7-day sample.

CONCLUSIONS: In the 7-day sample, all treated plots had fewer ERM motiles than the control (Table 1), but the plots treated with PYRAMITE had significantly fewer ERM than the plots treated with the 140 g a.i./ha rate of FLORAMITE. In the 14-day sample, all treated plots had significantly fewer ERM motiles than the control and the 140 g a.i./ha rate of FLORAMITE, which was not different from the control. All treated plots contained fewer ERM than the control plots in the 21-day sample, but numbers of ERM in the plots treated with PYRAMITE and 560 g a.i./ha rate of FLORAMITE were lower than in plots treated with the 140 g a.i./ha rate of FLORAMITE. All treated plots had fewer beneficial mites than the control plots in the 14-day sample (Table 2); whether these differences were due to toxic effects or a lack of prey was not determined. No differences in numbers of beneficial mites were observed in the 21-day sample.

Table 1. Number of ERM motiles per leaf.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		7 days (1 August)	14 days (8 August)	21 days (15 August)
PYRAMITE 75 WP	225 g	1.2 C	0.7 B	0.5 C[2]
FLORAMITE 50 W	560 g	3.3 BC	1.2 B	1.8 C
FLORAMITE 50 W	280 g	2.9 BC	2.4 B	3.1 BC
FLORAMITE 50 W	140 g	7.1 B	18.3 A	8.4 B
CONTROL	-	13.5 A	28.2 A	20.4 A

[1] Applied 25 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Number of beneficial mite motiles per leaf.

Treatment[1]	Rate (a.i./ha)	Days After Treatment	
		14 days (8 August)	21 days (15 August)
PYRAMITE 75 WP	225 g	0.11 B	0.09 A[2]
FLORAMITE 50 W	560 g	0.13 B	0.05 A
FLORAMITE 50 W	280 g	0.23 B	0.20 A
FLORAMITE 50 W	140 g	0.90 B	0.73 A
CONTROL	-	3.30 A	0.64 A

[1] Applied 25 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 29 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Grapes cv. Concord
PEST: Grape Berry Moth, *Endopzia viteana* (Clemens)

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TITLE: **ASSESSMENT OF INSECTICIDES FOR CONTROL OF SECOND-GENERATION GRAPE BERRY MOTH; 2002**

MATERIALS: ASSAIL 70 WP (acetamiprid), GUTHION 240 SC (azinphos-methyl), IMIDAN 50 WP (phosmet)

METHODS: The trial was conducted in a mature vineyard in the Niagara-on-the-Lake, Ontario area; vines cv. Concord were spaced 3.0 m by 2.5 m. Treatments were replicated four times, assigned to five-vine plots, and arranged according to a randomised complete block design. Application timing was based on peak pheromone trap catch of male grape berry moths (GBM). Two rates of ASSAIL were compared to a single rate of IMIDAN, GUTHION, and an unsprayed control. On 16 July, insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were examined 29 July (13 days after application), 25 grape bunches per plot were examined on the vine for the presence of GBM. Data were analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 29 July sample, all treatments showed significantly lower GBM infestations than the control, but none of the treatments were significantly different from each other (Table 1).

Table 1. Percent grape bunches infested by grape berry moth 13 days after application.

Treatment[1]	Rate (a.i./ha)	% Infested Bunches (29 July)
ASSAIL 70 WP	84 g	2.0 B[2]
ASSAIL 70 WP	56 g	3.0 B
GUTHION 240 SC	1.8 kg	4.0 B
IMIDAN 50 WP	1.55 kg	4.0 B
CONTROL	-	28.8 A

[1] Applied 16 July

[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2002 PMR REPORT # 30 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Grapes cv. Concord
PEST: Grape Berry Moth, *Endopzia viteana* (Clemens)

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TITLE: CONTROL OF GRAPE BERRY MOTH WITH INSECTICIDES; 2002

MATERIALS: DIPEL 2X (*Bacillus thuringiensis*, subsp. *kurstaki*), GUTHION 240 SC (azinphos-methyl)

METHODS: The trial was conducted in a mature vineyard in the Niagara-on-the-Lake, Ontario area; vines cv. Concord were spaced 3.0 m by 2.5 m. Treatments were replicated four times, assigned to five-vine plots, and arranged according to a randomised complete block design. Application timing was based on peak pheromone trap catch of male grape berry moths (GBM). DIPEL was compared to GUTHION and an unsprayed control. On 16 July, insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were examined 29 July (13 days after application), 25 grape bunches per plot were examined on the vine for the presence of GBM. Data were analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 29 July sample, both treatments showed lower GBM infestations than the control, but neither treatment was significantly different from the other (Table 1).

Table 1. Percent grape bunches infested by grape berry moth 13 days after application.

Treatment[1]	Rate	% Infested Bunches (29 July)
GUTHION 240 SC	1.8 kg a.i./ha	7.0 B[2]
DIPEL 2X	1.125 kg/ha	10.7 B
CONTROL	-	30.1 A

[1] Applied 16 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 31 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Loring
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck)

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TITLE: CONTROL OF FIRST-GENERATION ORIENTAL FRUIT MOTH ON PEACH WITH INSECTICIDES; 2002

MATERIALS: LORSBAN 50 W (chlorpyrifos), INTREPID 2 F (methoxyfenozide)

METHODS: The trial was conducted in a six-year-old orchard in the Jordan Station, Ontario area; trees cv. Loring were spaced 4.6 m by 5.5 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application was timed for egg hatch of the first generation, determined from pheromone trap catches of male moths. Treatments were applied 3 June, 164 DD (base 7.2 C) after first male moth catch (May 6); insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 12-13 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled post-treatment 27 June; all infested terminals and fruit were removed and counted. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 27 June sample, all treatments showed a significant difference from the control (Table 1), but the LORSBAN treatment showed significantly less damage than the 120 g a.i./ha rate of INTREPID.

Table 1. OFM damage per plot.

Treatment[1]	Rate (a.i./ha)	Infested Terminals per Plot 27 June	Damaged Fruit per Plot 27 June	Total OFM Damage 27 June
LORSBAN 50 W	1.7 kg	2.75 C	0.00 B	2.75 C[2]
INTREPID 2 F	360.0 g	8.00 BC	0.50 B	8.50 BC
INTREPID 2 F	240.0 g	7.50 BC	1.50 AB	9.00 BC
INTREPID 2 F	120.0 g	9.75 B	3.00 AB	12.75 B
CONTROL	-	19.25 A	4.75 A	24.00 A

[1] Applied 3 June
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 32 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Loring
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck)

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TITLE: CONTROL OF FIRST-GENERATION ORIENTAL FRUIT MOTH ON PEACH WITH INSECTICIDES; 2002

MATERIALS: CALYPSO 480 SC (thiacloprid), LORSBAN 50 W (chlorpyrifos)

METHODS: The trial was conducted in a six-year-old orchard in the Jordan Station, Ontario area; trees cv. Loring were spaced 4.6 m by 5.5 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Two rates of CALYPSO were compared to a LORSBAN standard and an unsprayed control. Application of CALYPSO was timed for first egg hatch of the first generation; the LORSBAN treatment was timed for peak egg hatch, determined from pheromone trap catches of male moths. CALYPSO treatments were applied 28 May, 94.9 DD (base 7.2 C) after first male moth catch (6 May); the LORSBAN treatment was applied 3 June, 164 $DD_{7.2}$ after first male moth catch. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 12-13 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled for Oriental fruit moth (OFM) damage post-treatment 28 June; all infested terminals and fruit were removed and counted. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 28 June sample of OFM-damaged terminals, all treatments showed significantly less damage than the control (Table 1), but were not different from each other. All treated plots contained less fruit damage than the control; similar results were observed for total damage.

Table 1. OFM damage per plot.

Treatment	Rate (a.i./ha)	Infested Terminals per Plot 28 June	Damaged Fruit per Plot 28 June	Total OFM Damage 28 June
LORSBAN 50 W[1]	1.7 kg	3.5 B	0.2 B	3.7 B[3]
CALYPSO 480 SC[2]	210 g	9.5 B	2.2 B	11.7 B
CALYPSO 480 SC[2]	140 g	8.5 B	1.2 B	9.7 B
CONTROL	-	27.0 A	7.0 A	34.0 A

[1] Applied 3 June
[2] Applied 28 May
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 33 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Loring
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck)

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TITLE: CONTROL OF SECOND-GENERATION ORIENTAL FRUIT MOTH ON PEACH WITH INSECTICIDES; 2002

MATERIALS: DECIS 5 EC (deltamethrin), INTREPID 2 F (methoxyfenozide)

METHODS: The trial was conducted in a six-year-old orchard in the Jordan Station, Ontario area; trees cv. Loring were spaced 4.6 m by 5.5 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application was timed for egg hatch of the second generation, determined from pheromone trap catches of male moths. Treatments were applied 10 July, 666 DD (base 7.2 C) after first male moth catch (May 6), and repeated 23 July, 867 $DD_{7.2}$. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 12-13 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled for Oriental fruit moth (OFM) post-treatment 2 August; all infested terminals and fruit were removed and counted. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 2 August OFM terminal sample, all treatments showed a significant difference from the control (Table 1), but the DECIS treatment showed significantly less damage than the 120 g a.i./ha and 240 g a.i./ha rates of INTREPID. All treated plots contained significantly less fruit damage than the control; the DECIS-treated plots showed less fruit damage than the 120 g a.i./ha rate of INTREPID.

Table 1. OFM damage per plot.

Treatment[1]	Rate (a.i./ha)	Infested Terminals per Plot 2 August	Damaged Fruit per Plot 2 August	Total OFM Damage 2 August
DECIS 5 EC	10 g	19.25 C	0.00 C	19.25 C[2]
INTREPID 2 F	360 g	98.0 BC	3.5 BC	101.5 BC
INTREPID 2 F	240 g	124.0 B	5.5 BC	127.0 B
INTREPID 2 F	120 g	119.0 B	8.0 B	127.0 B
CONTROL	-	211.3 A	28.3 A	239.5 A

[1] Applied 10 July, 23 July
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 34 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Loring
PEST: Oriental Fruit Moth, *Grapholita molesta* (Busck)

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TITLE: CONTROL OF SECOND-GENERATION ORIENTAL FRUIT MOTH ON PEACH; 2002

MATERIALS: ASSAIL 70 WP (acetamiprid), AVAUNT 30 WG (indoxacarb), DECIS 5 EC (deltamethrin), SUCCESS 480 SC (spinosad)

METHODS: The trial was conducted in a six-year-old orchard in the Jordan Station, Ontario area; trees cv. Loring were spaced 4.6 m by 5.5 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application was timed for egg hatch of the second generation, determined from pheromone trap catches of male moths. Treatments were applied 10 July, 666 DD (base 7.2 C) after first male moth catch (May 6), and repeated 23 July (867 $DD_{7.2}$). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 12-13 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled for Oriental fruit moth (OFM) post-treatment 2 August; all infested terminals and fruit were removed and counted. Data were analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 2 August OFM sample of damaged terminals, only the ASSAIL and DECIS treatments showed a significant difference from the control (Table 1); similar results were observed for total damage. All treated plots contained significantly less fruit damage than the control; the ASSAIL and DECIS-treated plots contained less fruit damage than those treated with SUCCESS or AVAUNT.

Table 1. OFM damage per plot.

Treatment[1]	Rate (a.i./ha)	Infested Terminals per Plot 2 August	Damaged Fruit per Plot 2 August	Total OFM Damage 2 August
DECIS 5 EC	10 g	20.0 B	1.0 C	21.0 B[2]
ASSAIL 70 WP	240 g	18.7 B	0.0 C	18.7 B
ASSAIL 70 WP	120 g	21.2 B	0.0 C	21.2 B
SUCCESS 480 SC	120 g	101.7 A	4.5 B	106.2 A
AVAUNT 30 WG	75 g	103.2 A	4.7 B	108.0 A
CONTROL	-	202.7 A	16.2 A	219.0 A

[1] Applied 10 July, 23 July
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 35 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Peach cv. Loring
PEST: European Red Mite, *Panonychus ulmi* (Koch)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF EUROPEAN RED MITE ON PEACH; 2002

MATERIALS: FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in an eleven-year-old orchard in the Jordan Station, Ontario, area; trees cv. Loring were spaced 4.6 m by 6.0 m. Treatments were replicated four times, assigned to one-tree plots, and arranged according to a randomised complete block design. Three rates FLORAMITE were compared to a PYRAMITE standard and an unsprayed control. On 30 July, acaricides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled pre-treatment 26 July, and three times post-treatment, 6 August, 13 August, and 20 August (7, 14, and 21 days after treatment). Efficacy ratings consisted of counts of motiles of European Red Mite (ERM) on 50 leaves per plot, picked randomly at arm's length into the canopy. Mites were counted using a stereomicroscope (leaves were brushed with a Henderson-McBurnie mite-brushing machine and numbers of live ERM motiles (nymphs and adults) were recorded). Total numbers of beneficial mite motiles (primarily *A. fallacis*) observed were also recorded for each plot. Data were transformed (log(x+1)), and analysed using analysis of variance and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Tables 1 and 2 below. Prespray samples 26 July showed similar numbers of ERM motiles (approximately 7 ERM motiles per leaf) in all plots. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 7-day sample for ERM, all treated plots treated contained fewer ERM motiles than the control (Table 1). Numbers of ERM per leaf in all treated plots were significantly lower than the control in the 14-day sample; plots treated with PYRAMITE and the 560 g a.i./ha rate of FLORAMITE contained fewer ERM than those treated with the 140 g a.i./ha rate of FLORAMITE. Numbers of ERM were lower than the control in all treated plots in the 21-day sample, but were not different from each other. All treated plots contained fewer beneficial mites than the control in the 7-day sample (Table 2), but none of the treatments had a significant effect on beneficial mites in the 14-day sample. In the 21-day sample 20 August, numbers of beneficial mites were lower than the control in the plots treated with PYRAMITE and the 560 g a.i./ha rate of FLORAMITE, but no differences were observed between any acaricide treatments. Whether these differences were due to toxic effects or a lack of prey was not determined.

Table 1. Numbers of ERM motiles per leaf

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		7 days 6 August	14 days 13 August	21 days 20 August
PYRAMITE 75 WP	225 g	2.2 B	0.7 C	1.3 B[2]
FLORAMITE 50 W	560 g	6.5 B	1.8 C	4.3 B
FLORAMITE 50 W	280 g	5.0 B	3.4 BC	11.5 B
FLORAMITE 50 W	140 g	7.4 B	6.7 B	18.5 B
CONTROL	-	39.6 A	107.6 A	82.7 A

[1] Applied 30 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Numbers of beneficial mite motiles per leaf

Treatment[1]	Rate (a.i./ha	Days After Treatment		
		7 days 6 August	14 days 13 August	21 days 20 August
PYRAMITE 75 WP	225 g	0.17 B	0.08 A	0.12 B[2]
FLORAMITE 50 W	560 g	0.18 B	0.20 A	0.31 B
FLORAMITE 50 W	280 g	0.23 B	1.75 A	0.57 AB
FLORAMITE 50 W	140 g	0.55 B	0.69 A	0.60 AB
CONTROL	-	2.30 A	2.20 A	1.92 A

[1] Applied 30 July

[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2002 PMR REPORT # 36 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Pear cv. Bartlett
PEST: Pear Psylla, *Psylla pyricola* (Foerster)

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TITLE: CONTROL OF PEAR PSYLLA ON PEAR WITH INSECTICIDES; 2002

MATERIALS: ASSAIL 70 WP (acetamiprid), ESTEEM 35 WP (pyriproxifen), MITAC 50 W (amitraz)

METHODS: The trial was conducted in a sixteen-year-old orchard in the Fenwick, Ontario, area; trees cv. Bartlett were spaced 5.4 m by 6.0 m. Treatments were replicated four times, assigned to one-tree plots, and arranged according to a randomised complete block design. The ESTEEM treatment was applied pre-bloom (23 April) and was reapplied 28 May; all other treatments were applied at petal fall (7 June). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled for pear psylla (PP) 27 May (pre-treatment), and twice post-treatment, 10 June and 17 June (3 and 10 days after treatment). Efficacy ratings consisted of counts of nymphs of PP on 20 clusters per plot, picked randomly; clusters were examined using a stereomicroscope and numbers of live PP nymphs were recorded. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 level of significance.

RESULTS: Data are presented in Table 1. Prespray samples 27 May showed similar numbers of psylla nymphs (approximately 1.0 nymphs per cluster) in all plots. The ESTEEM treatment was applied pre-bloom, targeting the egg stage of pear psylla, but due to extended cold weather was reapplied 28 May. Plots were also sampled for aphids and plum curculio (PC) damage, but due to frost both the aphid pest pressure and number of pears per tree were extremely light, so no data was recorded. Numbers of pear psylla were also observed to decrease due to environmental conditions. No phytotoxic effects were observed.

CONCLUSIONS: All of the treated plots had fewer PP nymphs per cluster than the control in both the 3 and 10 day samples; none of the treatments were significantly different from each other (Table 1).

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment	Rate (a.i./ha)	Days After Treatment	
		3 days (10 June)	10 days (17 June)
MITAC 50 W[1]	1.25 kg	0.087 B	0.037 B[3]
ESTEEM 35 WP[2]	121 g	0.012 B	0.050 B
ASSAIL 70 WP[1]	120 g	0.075 B	0.025 B
ASSAIL 70 WP[1]	56 g	0.050 B	0.012 B
ASSAIL 70 WP[1]	28 g	0.100 B	0.012 B
ASSAIL 70 WP[1]	14 g	0.134 B	0.012 B
CONTROL	-	0.425 A	0.175 A

[1] Applied 7 June

[2] Applied 23 April, reapplied 28 May

[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2002 PMR REPORT # 37 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Pear cv. Bartlett
PEST: Pear Psylla, *Psylla pyricola* (Foerster)

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TITLE: CONTROL OF PEAR PSYLLA ON PEAR; 2002

MATERIALS: ACTARA 25 WG (thiamethoxam), MATADOR 120 EC (lambda cyhalothrin)

METHODS: The trial was conducted in a sixteen-year-old orchard in the Fenwick, Ontario, area; trees cv. Bartlett were spaced 5.4 m by 6.0 m. Treatments were replicated four times, assigned to one-tree plots, and arranged according to a randomised complete block design. Treatments were applied at petal fall (7 June); two treatments included a second application (17 June) of ACTARA at the 40 and 79 g a.i./ha rates. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 10-11 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled for pear psylla (PP) 27 May (pre-treatment), and three times post-treatment, 11 June, 17 June, and 24 June (4, 10, and 17 days after treatment). Efficacy ratings consisted of counts of nymphs of PP on 20 clusters per plot, picked randomly; clusters were examined using a stereomicroscope and numbers of live PP nymphs were recorded. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 level of significance.

RESULTS: Data are presented in Table 1. Prespray samples 27 May showed similar numbers of psylla nymphs (approximately 1.0 nymphs per cluster) in all plots. Plots were also sampled for aphids and plum curculio (PC) damage, but due to frost both the aphid pest pressure and number of pears per tree were extremely light, so no data was recorded. Pear psylla numbers declined due to environmental conditions. No phytotoxic effects were observed.

CONCLUSIONS: All of the treated plots had fewer PP nymphs per cluster than the control in both the 4 and 10 day samples; none of the treatments were significantly different from each other (Table 1). None of the treatments were different from each other in the 17-day (24 June) sample; however, the single application of 40 g a.i./ha ACTARA and the MATADOR treatment were not different from the control.

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment	Rate (a.i./ha)	Days After Treatment		
		4 days (11 June)	10 days (17 June)	17 days (24 June)
ACTARA 25 WG[1]	96 g	0.012 B	0.000 B	0.012 B[3]
ACTARA 25 WG[2]	79 g	0.000 B	0.012 B	0.062 B
ACTARA 25 WG[1]	79 g	0.000 B	0.012 B	0.012 B
ACTARA 25 WG[2]	40 g	0.050 B	0.050 B	0.075 B
ACTARA 25 WG[1]	40 g	0.062 B	0.050 B	0.300 AB
MATADOR 120 EC[1]	10 g	0.100 B	0.075 B	0.237 AB
CONTROL	-	0.762 A	0.487 A	0.475 A

[1] Applied 7 June

[2] Applied 7 June, reapplied 17 June (plots were sampled before second application)

[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2002 PMR REPORT # 38 **SECTION A: FRUIT-Insect Pests**
STUDY DATA BASE: 280-1261-9341

CROP: Pear cv. Bartlett
PEST: Pear Psylla, *Psylla pyricola* (Foerster)

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TITLE: CONTROL OF PEAR PSYLLA WITH ACTARA AND MATADOR; 2002

MATERIALS: ACTARA 25 WG (thiamethoxam), MATADOR 120 EC (lambda cyhalothrin)

METHODS: The trial was conducted in a sixteen-year-old orchard in the Fenwick, Ontario, area; trees cv. Bartlett were spaced 5.4 m by 6.0 m. Treatments were replicated four times, assigned to one-tree plots, and arranged according to a randomised complete block design. Treatments were applied at petal fall (7 June); two treatments included a second application (17 June) of ACTARA at the 40 and 79 g a.i./ha rates. Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 10-11 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled for pear psylla (PP) 27 May (pre-treatment), and three times post-treatment, 11 June, 17 June, and 24 June (4, 10, and 17 days after treatment). Efficacy ratings consisted of counts of nymphs of PP on 20 clusters per plot, picked randomly; clusters were examined using a stereomicroscope and numbers of live PP nymphs were recorded. Data were transformed (log (x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 level of significance.

RESULTS: Data are presented in Table 1. Prespray samples 27 May showed similar numbers of psylla nymphs (approximately 1.0 nymphs per cluster) in all plots. Plots were also sampled for aphids and plum curculio (PC) damage, but due to frost both the aphid pest pressure and number of pears per tree were extremely light, so no data was recorded. Pear psylla populations were observed to decline due to environmental conditions. No phytotoxic effects were observed.

CONCLUSIONS: All of the treated plots had fewer PP nymphs per cluster than the control in both the 4 and 10 day samples; none of the treatments were significantly different from each other (Table 1). None of the treatments were different from each other in the 17-day (24 June) sample; however, the single application of 40 g a.i./ha ACTARA treatment was not different from the control.

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment	Rate (a.i./ha)	Days After Treatment		
		4 days (11 June)	10 days (17 June)	17 days (24 June)
ACTARA 25 WG[1]	96 g	0.025 B	0.000 B	0.000 B[3]
ACTARA 25 WG[2]	79 g	0.012 B	0.000 B	0.012 B
ACTARA 25 WG[1]	79 g	0.025 B	0.000 B	0.025 B
ACTARA 25 WG[2]	40 g	0.025 B	0.000 B	0.050 B
ACTARA 25 WG[1]	40 g	0.037 B	0.012 B	0.313 AB
MATADOR 120 EC[1]	10 g	0.100 B	0.025 B	0.062 B
CONTROL	-	0.688 A	0.537 A	0.462 A

[1] Applied 7 June

[2] Applied 7 June, reapplied 17 June (plots were sampled before second application)

[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2002 PMR REPORT # 39 **SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests**
ICAR: 30601

CROP: Broccoli, cv. Eureka
PEST: Swede midge (SM), *Contarinia nasturtii* (Keiffer)

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TITLE: COMPARATIVE EFFICACY OF VARIOUS INSECTICIDES FOR CONTROL OF SWEDE MIDGE ON BROCCOLI, 2002

MATERIALS: DECIS 5 EC (deltamethrin 50 g/L), POUNCE 384 EC (permethrin 384 g/L), MATADOR 120 EC (lambda cyhalothrin 120 g/L), WARRIOR T (EC) (lambda cyhalothrin 114 g/L), GUTHION 50 WP (azinphos-methyl 50%), ADMIRE 240F (imidacloprid 240 g/L), TRACER (spinosad 480 g/L) and SYLGARD 309 (siloxylated polyether 76% + surfactant mixture 24%).

METHODS: Broccoli seedlings cv. Eureka were grown in plug trays and then machine-planted (mechanical cell transplanter) at a farm near Markham, ON (Site 1; clay soil), on 21 June, in 4 row plots, 5 m in length, with a row spacing of 90 cm and in-row plant spacing of 45 cm. Plots were separated by a 3 m spray lane (N-S) and a 3 m alley (E-W). Eight treatments were replicated 5 times in a randomized complete block design. The same experiment, but with five treatments, was repeated in the same field 32 m away from to the first experiment. The same experiment, but with thirteen treatments, was repeated at a farm near Stouffville, ON (Site 2; sandy soil) where broccoli was machine-planted (mechanical cell transplanter) on 19 June. To control cabbage maggot, GUTHION was added to the planting water for all treatments. All foliar treatments were applied using water equivalent to 350 L/ha with a Solo backpack sprayer with a flat spray nozzle #33, pressurized by a hand pump to 172 kPa. Applications took place on 28 June, 12 and 30 July. Sampling for SM-damage was performed weekly after the first insecticide application. SM-damage was rated on a scale of 0 to 3 (0 = no damage; 1 = mild crumpling of leaves; 2 = severe crumpling of leaves with plant deformities; 3 = blind plant, i.e. no head formation). Differences in damage ratings among treatments were determined using analysis of variance and Duncan's multiple range test.

RESULTS: The results are summarized in Table 1. At Site 1 (pyrethroid trial) plots treated with DECIS (Trt. 1) and the higher rate of POUNCE (Trt. 3) had significantly less SM-damage than the CONTROL ($P<0.05$). At Site 2 plots treated with both rates of MATADOR (Trts. 4 and 5) and the higher rates of POUNCE (Trt. 3) and WARRIOR (Trt. 7) had significantly less SM-damage than all other treatments ($P<0.05$). At Site 2, plots treated with the low rate of TRACER applied with surfactant (Trt. 10) had significantly less SM-damage than the CONTROL plots ($P<0.05$). However, at Site 1, damage levels were the same in all TRACER treated plots as in the CONTROL.

CONCLUSIONS: Differences observed between sites may have been due to differences in SM-infestation levels. All pyrethroids effectively reduced SM-damage levels. TRACER in combination with a surfactant has potential for use against SM, but further studies are needed to evaluate efficacy.

Table 1. Mean season damage rating (± standard error) of broccoli treated with various insecticides, near Markham (Site 1) and Stouffville (Site 2), ON, 2002.

Treatment No.	Insecticide	Rate (mL/ha)	Mean damage rating[1]		
			Site 1a	Site 1b	Site 2
1	DECIS	200	0.17 ± 0.03 c[2]	--	1.24 ± 0.08 cd
2	POUNCE	90	0.24 ± 0.04 bc	--	1.53 ± 0.09 ab
3	POUNCE	180	0.17 ± 0.03 c	--	1.13 ± 0.08 d
4	MATADOR	41.7	0.19 ± 0.04 bc	--	1.09 ± 0.08 d
5	MATADOR	83.3	0.25 ± 0.04 bc	--	1.02 ± 0.08 d
6	WARRIOR	43.9	0.22 ± 0.04 bc	--	1.50 ± 0.08 abc
7	WARRIOR	87.7	0.31 ± 0.05 b	--	1.05 ± 0.08 d
8	ADMIRE	200	--	--	1.51 ± 0.08 ab
9	TRACER (- surfactant)	210.4	--	0.23 ± 0.04 a	1.57 ± 0.08 a
10	TRACER (+ surfactant)	210.4	--	0.20 ± 0.03 a	1.28 ± 0.08 bcd
11	TRACER (- surfactant)	352.1	--	0.16 ± 0.03 a	1.48 ± 0.08 abc
12	TRACER (+ surfactant)	352.1	--	0.20 ± 0.04 a	1.44 ± 0.08 abc
13	Control	--	0.51 ± 0.06 a	0.19 ± 0.04 a	1.65 ± 0.08 a

[1] 0= no damage, 1 = mild crumpling of leaves, 2=severe crumpling of leaves with plant deformities, 3=blind plant, i.e. no head formation.

[2] Values followed by the same letter, within the same column for each site, are not significantly different (P>0.05); Duncan's multiple range test.

2002 PMR REPORT # 40 **SECTION: B VEGETABLES AND SPECIAL CROPS - Insect Pests**

CROP: Transplanted cabbage (Brassica oleracea) cv. Platinum Dynasty

PEST: Diamondback moth (DBM), *Plutella xylostella* (L.)
Cabbage looper (CL), *Trichoplusia ni* (Hubner)
Imported cabbage worm (ICW), *Pieris rapae* (L.).

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TITLE: **RELATIVE EFFICACY OF RIMON 10EC (NOVALURON) AND DECIS 25EC FOR CONTROL OF DIAMONDBACK MOTH, *Plutella xylostella* (L.), CABBAGE LOOPER, *Trichoplusia ni* (Hubner), AND IMPORTED CABBAGE WORM, *Pieris rapae* (L.), ON TRANSPLANTED CABBAGE, 2002.**

MATERIALS: RIMON 10EC (novaluron, 100 g/L), DECIS 25EC (deltamethrin, 250 g/L)

METHODS: Cabbage seedlings were transplanted at the Cambridge Research Farm on 23 May, 2002 in 4 row plots. Each row was 12.0 m in length, with a row spacing of 0.9 m and a plant spacing of 0.5 m. 3.0 m spray lanes were included between and around each plot. Five treatments were included, with four replicates for each treatment arranged in a randomized complete block design (RCBD). The foliar treatments were applied using a tractor mounted, four row boom sprayer delivering 844 L/ha at 450 kPa (Colorjet nozzle #80-28). Monitoring for early life stages of the three Lepidopteran pests (DBM, CL, and ICW) began one week after transplanting. The first RIMON treatment was applied as soon as pest eggs were discovered (29 May). The second application was applied 7 days later. RIMON was again applied when economic threshold was reached in the RIMON plots (20-30% plant infestation up to head fill stage; 10-15% from head fill to harvest) on 4, 12, and 18 July. DECIS was applied on 13 June, 4 and 18 July, when economic threshold was reached in the DECIS plots. Control for DBM, CL, and ICW was evaluated by counting both small and large larvae for each of the three pests on 5 cabbage heads per plot (Tables 1-4). All treatments were evaluated 1day prior to and 3 days after each RIMON application. Final evaluations occurred 14 and 21 days after the last RIMON treatment. Damage to the cabbage heads (Table 6) was assessed 14 and 21 days after the last application of RIMON, using a Percent Defoliation rating scale (Table 8). Marketability and weight of the cabbage heads (Table 5) was determined by harvesting 5 cabbage heads per plot. Marketability was based a 1-6 rating scale (Table 7). Cabbages with ratings of less than 3 were considered unmarketable. Results were analysed using ANOVA and Tukey's HSD Test.

RESULTS: See Tables 1-6.

CONCLUSIONS: Levels of small and large DBM larvae did not begin to be affected until 7 July; 3 days after the third RIMON application. On this date numbers of Large DBM larvae were significantly lower in all treated plots than in untreated CONTROL plots. Numbers of small DBM larvae were significantly lower only in plots treated with 25.0 g a.i./ha RIMON or DECIS, the commercial standard.

From 11 July until the end of the trial application of all rates of RIMON and the commercial standard equally and significantly lowered numbers of both large and small DBM in treated plots (Table 1, 2).

Throughout the trial, mean numbers of ICW larvae (both small and large) in any of the treatment plots were not significantly different from the control (Table 3, 4) except on Day 62, likely due to a low population of ICW. Application of foliar insecticides had no significant impact on the average weight of harvested cabbage (Table 5). All cabbage harvested from the treated plots were marketable while cabbage from the untreated CONTROL plots would not have been commercially acceptable (Table 5). On 1 August significantly more feeding damage was recorded in untreated CONTROL plots than in any treated plots (Table 6). On that date damage in plots treated with 12.5 g a.i./ha RIMON was significantly higher than damage in plots treated with higher rates of RIMON or the commercial standard. On 8 August feeding damage was significantly lower in all treated plots; on that date all rates of RIMON proved as effective as the commercial standard (Table 6). When all results are considered RIMON definitely appears to be a promising agent for control of Lepidoptera feeding on cabbage. Although RIMON acts more slowly than the commercial standard, weight and quality of cabbage harvested from plots treated with RIMON were equal to that recorded in plots treated with the commercial standard, DECIS.

Overall, although RIMON is slow acting, it is a comparable treatment to DECIS. The results show that RIMON controls larval populations and significantly decreases the defoliation they cause, increasing the marketability of cabbage heads compared to untreated plots.

Table 1. Relative impact of foliar treatments on Diamondback moth (DBM) larvae, 2002.

Treatment	Rate (g a.i./ha)	Mean # of Small DBM Larvae / Plant on Indicated Date											
		29/05	03/06	05/06	09/06	03/07	07/07	11/07	15/07	17/07	21/07	01/08	08/08
		Day -1	Day 3	Day 6	Day 10	Day 33	Day 37	Day 41	Day 45	Day 47	Day 51	Day 62	Day 69
CONTROL	Untreated	0.00 a *	0.00 a	0.00 a	0.20 a	0.65	1.80 a	3.10 a	2.60 a	4.55 a	1.65 a	1.30 a	1.40 a
RIMON	12.5	0.00 a	0.00 a	0.00 a	0.00 a	0.90ab	1.20 a	1.35 b	0.40 b	0.25 b	0.10 b	0.00 b	0.35 b
RIMON	25	0.00 a	0.05 a	0.00 a	0.05 a	1.15 a	0.20 b	0.25 c	0.10 b	0.10 b	0.00 b	0.00 b	0.05 b
RIMON	50	0.00 a	0.05 a	0.05 a	0.00 a	0.40ab	0.95ab	0.35bc	0.05 b	0.05 b	0.00 b	0.00 b	0.20 b
DECIS	10	-	-	-	-	0.20 b	0.05 b	0.00 c	0.15 b	0.20 b	0.05 b	0.00 b	0.10 b

***** Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

Table 2. Relative impact of foliar treatments on Diamondback moth (DBM) larvae, 2002.

Treatment	Rate (g a.i./ha)	Mean # of Large DBM Larvae / Plant on Indicated Date											
		29/05	03/06	05/06	09/06	03/07	07/07	11/07	15/07	17/07	21/07	01/08	08/08
		Day -1	Day 3	Day 6	Day 10	Day 33	Day 37	Day 41	Day 45	Day 47	Day 51	Day 62	Day 69
CONTROL	Untreated	0.00 a*	0.00 a	0.00 a	0.00 a	0.20 b	1.00 a	1.30 a	2.45 a	4.35 a	2.65 a	2.95 a	1.90 a
RIMON	12.5	0.00 a	0.00 a	0.00 a	0.00 a	1.00 a	0.25 b	0.85ab	0.25 b	0.00 b	0.00 b	0.00 b	0.00 b
RIMON	25	0.00 a	0.00 a	0.00 a	0.00 a	0.25 b	0.25 b	0.20 b	0.00 b	0.10 b	0.00 b	0.00 b	0.05 b
RIMON	50	0.00 a	0.00 a	0.00 a	0.00 a	0.30 b	0.30 b	0.20 b	0.00 b	0.05 b	0.00 b	0.00 b	0.00 b
DECIS	10	-	-	-	-	0.15 b	0.00 b	0.10 b	0.35 b	0.00 b	0.00 b	0.00 b	0.00 b

*Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

Table 3. Relative impact of foliar treatments on small Imported cabbage worm (ICW) larvae, 2002.

Treatment	Rate (g a.i./ha)	Mean # of Small ICW Larvae / Plant on Indicated Date											
		29/05	03/06	05/06	09/06	03/07	07/07	11/07	15/07	17/07	21/07	01/08	08/08
		Day -1	Day 3	Day 6	Day 10	Day 33	Day 37	Day 41	Day 45	Day 47	Day 51	Day 62	Day 69
CONTROL	Untreated	0.00 a*	0.00 a	0.00 a	0.00 a	0.00 a	0.10 a	0.20 a	0.00 a	0.65 a	0.20 a	0.20 a	0.10 a
RIMON	12.5	0.00 a	0.00 a	0.05 a	0.00 a	0.00 a	0.05 a	0.25 a	0.00 a	0.15 a	0.00 a	0.00 b	0.40 a
RIMON	25	0.00 a	0.00 a	0.10 a	0.10 a	0.05 a	0.00 a	0.30 a	0.20 a	0.30 a	0.05 a	0.00 b	0.20 b
RIMON	50	0.00 a	0.00 a	0.00 a	0.00 a	0.05 a	0.05 a	0.20 a	0.15 a	0.05 a	0.00 a	0.00 b	0.10 a
DECIS	10	-	-	-	-	0.10 a	0.00 a	0.00 a	0.10 a	0.30 a	0.00 a	0.00 b	0.15 a

***** Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

Table 4. Relative impact of foliar treatments on large Imported cabbage worm (ICW) larva, 2002.

Treatment	Rate (g a.i./ha)	Mean # of Large ICW Larvae / Plant on Indicated Date											
		29/05	03/06	05/06	09/06	03/07	07/07	11/07	15/07	17/07	21/07	01/08	08/08
		Day -1	Day 3	Day 6	Day 10	Day 33	Day 37	Day 41	Day 45	Day 47	Day 51	Day 62	Day 69
CONTROL	Untreated	0.00 a*	0.00 a	0.00 a	0.00 a	0.05 a	0.15 a	0.05 a	0.00 a	0.40 a	0.25 a	0.20 a	0.05 a
RIMON	12.5	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 b	0.05 a
RIMON	25	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 b	0.10 a
RIMON	50	0.00 a	0.00 a	0.00 a	0.00 a	0.05 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 b	0.00 a
DECIS	10	-	-	-	-	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 b	0.05 a

***** Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

Table 5. Relative impact of foliar treatments of RIMON 10EC and DECIS 25EC on mean marketability and mean weight of cabbage heads, 2002.

Treatment	Rate (g a.i./ha)	Mean Marketability* (1-6 Rating Scale) of Cabbage Heads	Mean Weight of Cabbage Heads (Kg)
CONTROL	Untreated	4.60 a**	1.67 a
RIMON	12.5	1.70 b	1.57 a
RIMON	25	1.75 b	1.54 a
RIMON	50	1.65 b	1.52 a
DECIS	10	1.85 b	1.81 a

* Marketability Rating Scale (Green *et al.*, 1969) where 1 = no apparent feeding; 2 = minor insect feeding on wrapper or outer leaves, 0-1% of leaf area eaten; 3 = moderate insect feeding on wrapper or outer leaves with minor feeding on head, 2-5% leaf area eaten; 4 = moderate insect feeding on wrapper or outer leaves with minor feeding on head, 6-10% leaf area eaten; 5 = moderate to heavy feeding on wrapper or outer leaves and a moderate number of feeding scars on head, 11-30% leaf area eaten; 6 = considerable insect feeding on wrapper and head leaves with head having numerous feeding scars, over 30% of leaf area eaten.

** Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

Table 6. Relative impact of foliar treatments of RIMON 10EC and DECIS 25EC on mean percent defoliation of cabbage heads, 2002.

Treatment	Rate (g a.i./ha)	Defoliation Index* Mean/Cabbage Head	
		01/08 (Day 63)	08/08 (Day 69)
CONTROL	Untreated	4.10 a**	4.10 a
RIMON	12.5	1.80 b	1.70 b
RIMON	25	1.45 bc	1.45 b
RIMON	50	1.15 c	1.35 b
DECIS	10	1.10 c	1.20 b

*Defoliation Index Rating where 1 = no defoliation; 2 = 0-1% defoliation; 3 = 2-5% defoliation; 4 = 6-10% defoliation; 5 = 11-30% defoliation; 6 = 30+% defoliation

** Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

2002 PMR REPORT # 41 **SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests**
ICAR: 30601

CROP: Cabbage, cv. Balbro
PEST: Swede midge (SM), *Contarinia nasturtii* (Keiffer)

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TITLE: COMPARATIVE EFFICACY OF VARIOUS INSECTICIDES FOR CONTROL OF SWEDE MIDGE ON CABBAGE, 2002

MATERIALS: DECIS 5 EC (deltamethrin 50 g/L), POUNCE 384 EC (permethrin 384 g/L), MATADOR 120 EC (lambda cyhalothrin 120g/L), WARRIOR T (EC) (lambda cyhalothrin 114 g/L), ORTHENE 75 SP (acephate 75%), and GUTHION 50 WP (azinphos-methyl 50%).

METHODS: Cabbage seedlings cv. Balbro were grown in plug trays and then machine-planted (mechanical cell transplanter) at a farm near Markham, ON (Site 1; clay soil), on 21 June, in 4 row plots, 5 m in length, with a row spacing of 90 cm and in-row plant spacing of 45 cm. Plots were separated by a 3 m spray lane (N-S) and a 3 m alley (E-W). Nine treatments were replicated 5 times in a randomized complete block design. The same experiment was repeated at a farm near Stouffville, ON (Site 2; sandy soil) where cabbage was machine-planted (mechanical cell transplanter) on 19 June. To control cabbage maggot, GUTHION was added to the planting water for all treatments. All foliar treatments were applied using water equivalent to 350 L/ha with a Solo backpack sprayer with a flat spray nozzle #33, pressurized by a hand pump to 172 kPa. Applications took place on 28 June and 12 July (both sites) and 30 July (Site 2). Sampling for SM-damage was performed weekly after the first insecticide application. Sampling was discontinued after 12 July at Site 1 due to a severe outbreak of cabbage yellows which affected the majority of plants in most plots. SM-damage was rated on a scale of 0 to 3 (0 = no damage; 1 = mild crumpling of leaves; 2 = severe crumpling of leaves with plant deformities; 3 = blind plant, i.e. no head formation). Cabbage were harvested on 19 and 20 August at Site 2. Differences in damage ratings and yield among treatments were determined using analysis of variance and Duncan's multiple range test.

RESULTS: The results are summarized in Tables 1 and 2. At Site 1, only plots treated with the lower rate of POUNCE (Trt. 2) had significantly less SM damage than CONTROL plots ($P<0.05$). At Site 2, all insecticides significantly reduced SM-damage relative to that recorded in CONTROL plots. Plots treated with the higher rate of POUNCE (Trt.3) and MATADOR at both rates (Trts. 4 and 5) had the least SM damage, but differences between these treatments were not significant ($P>0.05$) (Table 1). Application of the higher rate of POUNCE (Trt. 3) and the lower rate of MATADOR (Trt. 4) resulted in an increase in cabbage yield relative to yields in CONTROL plots, but these differences were not significant ($P>0.05$). However, cabbage heads from plots treated with the higher rate of POUNCE or the lower rates of MATADOR and WARRIOR were significantly heavier than those from CONTROL plots (Table 2).

CONCLUSIONS: Differences in efficacy of insecticides between the two sites may be due to pest infestation levels. In general, the pyrethroid insecticides were more effective than the organophosphorous insecticide ORTHENE at Site 2.

Table 1. Mean season damage rating (± standard error) of cabbage treated with various insecticides, near Markham (Site 1) and Stouffville (Site 2), ON, 2002.

Treatment No.	Insecticide	Rate (product/ha)	Mean damage rating[1]	
			Site 1	Site 2
1	DECIS	200 mL	0.14 ± 0.04 ab[2]	0.70 ± 0.06 cd
2	POUNCE	90 mL	0.07 ± 0.03 b	0.74 ± 0.06 c
3	POUNCE	180 mL	0.24 ± 0.06 a	0.53 ± 0.05 d
4	MATADOR	41.7 mL	0.20 ± 0.06 ab	0.64 ± 0.06 cd
5	MATADOR	83.3 mL	0.19 ± 0.05 ab	0.61 ± 0.06 cd
6	WARRIOR	43.9 mL	0.23 ± 0.05 a	0.71 ± 0.06 cd
7	WARRIOR	87.7 mL	0.13 ± 0.05 ab	0.93 ± 0.06 b
8	ORTHENE	1 kg	0.27 ± 0.06 a	0.92 ± 0.07 b
9	Control	--	0.27 ± 0.06 a	1.19 ± 0.07 a

[1] 0= no damage, 1 = mild crumpling of leaves, 2=severe crumpling of leaves with plant deformities, 3=blind plant, i.e. no head formation.

[2] Values followed by the same letter, within the same column for each site, are not significantly different (P>0.05); Duncan's multiple range test.

Table 2. Mean yield (t/ha) and mean weight per head (kg) of cabbage treated with various insecticides near Stouffville (Site 2), ON, 2002.

Treatment No.	Insecticide	Rate (product/ha)	Mean yield (t/ha)	Mean weight per head[2] (kg)
1	DECIS	200 mL	29.5 ± 4.9 a[1]	1.09 ± 0.21 ab
2	POUNCE	90 mL	28.8 ± 2.5 a	1.07 ± 0.10 ab
3	POUNCE	180 mL	36.7 ± 6.5 a	1.29 ± 0.23 a
4	MATADOR	41.7 mL	36.7 ± 6.9 a	1.22 ± 0.24 a
5	MATADOR	83.3 mL	27.3 ± 4.5 a	1.00 ± 0.13 ab
6	WARRIOR	43.9 mL	33.8 ± 4.4 a	1.19 ± 0.19 a
7	WARRIOR	87.7 mL	30.0 ± 3.6 a	1.02 ± 0.18 ab
8	ORTHENE	1 kg	31.4 ± 1.6 a	0.97 ± 0.08 ab
9	Control	--	21.5 ± 4.3 a	0.54 ± 0.14 b

[1] Values followed by the same letter, within the same column for each site, are not significantly different (P>0.05); Duncan's multiple range test.

[2] Cabbage plants damaged by swede midge early in the season often form two or more smaller than average heads which is reflected in the low mean weight per head for control plots.

2002 PMR REPORT # 42 **SECTION B:VEGETABLE and SPECIAL CROPS - Insect Pests**
ICAR: 206003

CROP: Cauliflower (*Brassica oleracea* var. *botrytis* L.) cv. Fremont
PEST: Cabbage aphid (*Brevicoryne brassicae* L.)

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TITLE: **EVALUATION OF ASSAIL FOR CONTROL OF APHIDS IN CAULIFLOWER, 2002**

MATERIALS: ASSAIL 70 WP (acetamiprid 70%), THIODAN 4 EC (endosulfan 38%)

METHODS: The trial was conducted on organic soil at the Muck Crops Research Station, Holland Marsh, Ontario. Cauliflower was seeded in 200 cell plastomer plug trays on 20 June and hand transplanted in to the field on 17 July. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of four 5m long rows, 84 cm apart, with in row plant spacing of 45 cm. Treatments were applied in 400 L/ha of water on 12, 21, 30 August and 10, 16, 25 September using a pull type plot sprayer with TeeJet D-2 hollow cone nozzles at 100 psi (boom). On each assessment date the same six plants in each plot were examined for aphid infestation. The first two assessments determined the presence or absence of aphids. On the remaining assessment dates infestation was rated according to the following scale: 0= no aphids; 1 = 1-5 aphids/plant; 2 = 6-10; 3 = 11-15; 4 = 16-20; and 5 = 20+. Cauliflower were harvested on 10 October. At harvest, the same six plants, plus an additional four, were destructively evaluated to assess infestation. A harvest sample of the 10 heads was also taken and weighed. The air temperatures in 2002 were above the long term (10 year) average for July (21.7^{O}C) and September (17.5^{O}C), below average for May (9.9^{O}C), and average for June (18.2^{O}C) and August (19.6^{O}C). Monthly rainfall was above the long term (10 year) average for May (113 mm) and June (106 mm), below average for August (18 mm) and September (40 mm) and average for July (76 mm). The insect severity index (ISI) was determined by the following equation:

$$ISI = \frac{\sum_{(\text{rating no.})} [(\text{rating no.})(\text{no. of plants in each rating class})]}{(\text{total no. plants})(\text{no. rating classes}-1)} \times 100$$

Data were analyzed using the general analysis of variance function of the linear models section of Statistix 7. Means separation was obtained using Fisher's Protected LSD test at P = 0.05.

RESULTS: As presented in Table 1.

CONCLUSIONS: On most assessment dates, the ISI was significantly lower in treated plots than in untreated CHECK plots. In the evaluations on 20 and 23 August, the ISI for plots treated with the highest rate of ASSAIL was significantly lower than the ISI in plots treated with THIODAN, the commercial standard. In remaining evaluations there were no significant difference between those treatments. In most evaluations the observed differences in the ISI among the different rates of ASSAIL were not statistically significant.

Table 1.Impact of insecticides on Insect Severity Index for aphids at the Muck Crops Research Station, 2002.

	Insect Severity Index for Indicated Treatment					
Date	CHECK	ASSAIL (20 g/ha)	ASSAIL (40 g/ha)	ASSAIL (55.7 g/ha)	ASSAIL (80 g/ha)	THIODAN (2.0 L/ha)
Aug. 12	62.5 ns[1]	62.5	70.9	83.3	62.5	83.3
Aug. 12 - First Application						
Aug. 16	79.2 ns	41.7	66.7	79.2	33.3	66.6
Aug. 20	72.2 c[2]	29.2 ab	22.2 ab	59.7 bc	9.8 a	61.1 bc
Aug. 21 -Second Application						
Aug. 23	83.3 c	23.6 b	7.0 a	19.4 ab	7.0 a	26.4 b
Aug. 28	57.5 b	10.8 a	4.2 a	11.7 a	4.2 a	15.8 a
Aug. 30 - Third Application						
Sept. 5	36.7 b	4.2 a	0.8 a	5.0 a	1.7 a	6.7 a
Sept. 10 - Fourth Application						
Sept. 12	37.5 ns	13.3	2.5	20	7.5	15
Sept. 16 - Fifth Application						
Sept. 18	29.2 ns	15	2.5	0	10	5.8
Sept. 24	54.2 b	17.5 a	9.2 a	10.9 a	5.8 a	3.3 a
Sept. 25 - Sixth Application						
Oct. 10	33.3 b	14.2 a	15.0 a	20.8 ab	13.3 a	5.8 a

[1] ns - no significant differences among treatments

[2] Means in a row followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

2002 PMR REPORT # 43

SECTION B:VEGETABLE and SPECIAL CROPS - Insect Pests
ICAR #: 206003

CROP: Cauliflower (*Brassica oleracea* var. *botrytis* L.), cv. Minuteman
PEST: Imported cabbageworm (ICW) (*Artogeia (=Pieris) rapae*)
Cabbage looper (CL) (*Trichoplusia ni*)
Diamondback moth (DBM) (*Plutella xylostella*)

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TITLE: EVALUATION OF ASSAIL FOR THE CONTROL OF IMPORTED CABBAGEWORM, CABBAGE LOOPER AND DIAMONDBACK MOTH IN CAULIFLOWER; 2002

MATERIALS: ASSAIL 70 WP (acetamiprid 70%)

METHODS: The trial was conducted on organic soil at the Muck Crops Research Station, Holland Marsh, Ontario. Cauliflower was seeded on 20 June in 200 cell plastomer plug trays and hand transplanted in the field on 17 July. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of four 5 m long rows, 86 cm apart, with in row plant spacing of 45 cm. Treatments were applied in 400 L/ha of water on 10, 17 and 23 September using a pull type plot sprayer with TeeJet D-2 hollow cone nozzles at 100 psi (boom). Assessments were done on 27 August and 6, 11, 16, 19 September. On each date the same five plants were examined for the presence of larvae and/or eggs. At harvest, 2 October, the same five plants, plus an additional five, were assessed and a yield sample of 10 heads was taken and weighed. The yield sample was assessed for percent marketability, determined by presence or absence of frass. The air temperatures in 2002 were above the long term (10 year) average for July (21.7^{O}C) and September (17.5^{O}C), below average for May (9.9^{O}C), and average for June (18.2^{O}C) and August (19.6^{O}C). Monthly rainfall was above the long term (10 year) average for May (113 mm) and June (106 mm), below average for August (18 mm) and September (40 mm), and average for July (76 mm). The Cabbage Looper Equivalent (CLE) was determined by the following equation:

$$\text{CLE} = \frac{[(\#\ \text{CL} \times 1.0) + (\#\ \text{ICW} \times 0.5) + (\#\ \text{DBM} \times 0.2)]}{\#\ \text{of plants}}$$

The CLE threshold for cauliflower is 0.2 - 0.3, (OMAF cole crop IPM manual). Data were analyzed using the general analysis of variance function of the linear models section of Statistix 7. Means separations was obtained using Fisher's Protected LSD test at P = 0.05.

RESULTS: As presented in Table 1.

CONCLUSIONS: While Lepidoptera were present in the crop when insecticide spraying was initiated, overall pest pressure was not high in the trial. On 11 and 16 September, when the insect pressure was the highest, significantly fewer larvae were found in treated plots. There was however, no significant difference between the ASSAIL treatments (Table 1). Although few larvae were found on harvested cauliflower, earlier feeding, evidenced by high amounts of frass, rendered many heads unmarketable. Significantly more marketable heads were harvested from the treated plots.

Table 1. Evaluation of ASSAIL for control of Lepidoptera species, in cauliflower at the Muck Crops Research Station, 2002.

	CLE for Indicated Date						
Treatment	Aug. 27	Sept. 6	Sept. 11	Sept. 16	Sept. 19	Oct. 2	% Marketable
CHECK	0.55 ns[2]	0.33 ns	1.68 b	1.38 b	1.28 ns	0.88 ns	7.5 b[1]
ASSAIL 120 g/ha	0.4	0.1	0.23 a	0.60 a	0.35	0.4	45.0 a
ASSAIL 240 g/ha	0.25	0.25	0.23 a	0.38 a	1.32	0.53	50.0 a

Treatments were applied on 10, 17 and 23 September.

[1] Means in a column followed by the same letter are not significantly different at P = 0.05, Fisher's Protected LSD test.

[2] ns - no significant differences among treatments

2002 PMR REPORT # 44 **SECTION B: VEGETABLES and SPECIAL CROPS – INSECT PESTS**
ICAR: 440204

CROP: Sweet corn (*Zea mays* L.), cvs., Precious Gem, Seneca Dancer, Bt corn cv., BC 0801 ATTRIBUTE™
PEST: European corn borer (ECB), *Ostrinia nubilalis* (Hübner)

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TITLE: **RELATIVE EFFICACY OF SUCCESS® 480 SC AND ATTRIBUTE™ COMPARED TO FURADAN® 4F AND MATADOR® 120 EC FOR THE CONTROL OF EUROPEAN CORN BORER, *Ostrinia nubilalis* (Hübner), ON SWEET CORN GROWN ON SANDY SOIL (Delhi Research Farm), 2002**

MATERIALS: SUCCESS® 480 SC (spinosad, 480 g a.i./L), FURADAN® 4F (carbofuran, 480 g a.i./L), MATADOR® 120 EC (8-cyhalothrin, 120 g a.i./L), Bt corn cv., BC 0801 ATTRIBUTE™

METHODS: Sweet corn was seeded at the Delhi Research Farm (Delhi, Ontario) in 4 row blocks, 15.0 m long. Rows were 0.75 m apart with 20.0-22.0 cm plant spacing. Four treatments were replicated four times in a randomized complete block design (RCBD). A separate field of Bt sweet corn (ATTRIBUTE) was seeded using the same planting parameters as the other two sweet corn varieties. Bt sweet corn and untreated control plots (cv. Seneca Dancer) were planted in 4 row blocks, with 4 buffer rows separating each block. The Bt corn was isolated from the conventional corn by 100 m to comply with government regulation (CFIA, 2001). Peak ECB flights were monitored using pheromone traps (univoltine Iowa strain lures). Foliar insecticides were applied to all four rows of each block, using a Hahn Hi-Boy™ (Hahn Corp.) that delivered 750 L/ha at 450 kPa (Teejet # 8003VS). The first application took place when the corn reached late whorl. Efficacy of treatments for ECB-control was determined at harvest by examining 25 ears from the centre two rows of each plot for tunnelling on the husk and the ear, yield, and assessing marketability of each ear. Marketability was determined using a standard processor's 1-9 scale (Warnock and Davis, 1998), where ratings of ≤ 3 were considered marketable. Results were analyzed using either analysis of variance (ANOVA) and Tukey's Mean Test ($p < 0.05$) or Two-sample T-test ($p < 0.05$) depending on the number of treatment groups.

RESULTS: Details of planting, application, and harvest are outlined in Table 1. Results of efficacy trials are indicated in Tables 2, 3 and 4.

CONCLUSIONS: For Precious Gem sweet corn (maturity = 78 days), application of SUCCESS, FURADAN and MATADOR significantly reduced the number of ECB tunnels on husks and ears at harvest compared to the untreated control (Table 2). While there were no significant differences in yield among treatments, mean marketability ratings in all treated plots were significantly lower than the mean rating in untreated plots. Sweet corn from all plots, however, was of marketable quality (Table 2). For Seneca Dancer sweet corn (maturity = 89 days; more susceptible to 2nd generation ECB infestations), application of SUCCESS, FURADAN or MATADOR significantly reduced the number of ECB tunnels on husks and ears

at harvest compared to the untreated control (Table 3). While there were no significant differences in yield among treatments, mean marketability ratings in all treated plots were significantly lower than the mean rating in untreated plots. Sweet corn from all plots, however, was of marketable quality (Table 3). ECB-damage to husks and ears was significantly lower in ATTRIBUTE sweet corn than in conventional Seneca Dancer sweet corn (Table 4). Marketability of ATTRIBUTE sweet corn was significantly lower than marketability of conventional sweet corn. Conventional sweet corn did not meet marketability standards in this trial (Table 4).

Considering all results, either application of SUCCESS to conventional sweet corn or planting ATTRIBUTE sweet corn, modified to produce Bt-toxin, enables harvest of sweet corn of quality equal or superior to that harvested from plots treated with either FURADAN or MATADOR, the current industry standards.

Table 1. Management parameters for the sweet corn field trial, Delhi Research Farm, 2002.

Cultivar	Maturity (days)	Planting Date	Application Dates			Harvest Date
			First	Second	Third	
Precious Gem	78	21 May	11 July	20 July	27 July*	9 August
Seneca Dancer	89	21 May	11 July	23 July	30 July*	15 August
Bt corn, BC0801	73	19 June	---	---	---	6 September

* Third application for SUCCESS and MATADOR only.

Table 2. Relative efficacy of SUCCESS, FURADAN, and MATADOR for control of European corn borer on sweet corn cv. Precious Gem grown on sandy soil at the Delhi Research Farm, 2002.

Treatments	Rate (g a.i./ha)	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (1-9 scale)**
Untreated	--	0.38a*	0.15a	4.78a	2.23a
SUCCESS	70	0.00b	0.00b	4.99a	1.0b
FURADAN	530	0.03b	0.00b	4.77a	1.10b
MATADOR	10	0.02b	0.01b	4.85a	1.08b

*Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Tukey's HSD).

**Ratings of ≤ 3 indicate acceptable market quality.

Table 3. Relative efficacy of SUCCESS, FURADAN, and MATADOR for control of European corn borer on sweet corn cv. Seneca Dancer grown on sandy soil at the Delhi Research Farm, 2002.

Treatments	Rate (g a.i./ha)	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (1-9 scale)**
Untreated	--	0.56a*	0.19a	4.98a	2.14a
SUCCESS	70	0.01b	0.00b	5.10a	1.03b
FURADAN	530	0.12b	0.03b	5.26a	1.25b
MATADOR	10	0.00b	0.01b	5.11a	1.17b

* Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Tukey's HSD).

** Ratings of ≤ 3 indicate acceptable market quality.

Table 4. Relative efficacy of ATTRIBUTE for control of European corn borer on sweet corn grown on sandy soil at the Delhi Research Farm, 2002.

Treatments	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (1-9 scale)**
Untreated	1.41a*	0.78a	5.11a	5.31a
ATTRIBUTE	0.00b	0.00b	6.66b	1.00b

* Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Two-sample T-test).

** Ratings of ≤ 3 indicate acceptable market quality.

References

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2002 PMR REPORT # 45

SECTION: VEGETABLES and SPECIAL CROPS – INSECT PESTS
ICAR: 440204

CROP: Sweet corn (*Zea mays* L.), cvs., Precious Gem, Seneca Dancer, Bt corn cv., BC 0801 ATTRIBUTE™

PEST: European corn borer (ECB), *Ostrinia nubilalis* (Hübner)

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TITLE: **RELATIVE EFFICACY OF SUCCESS® 480SC AND ATTRIBUTE™ COMPARED TO FURADAN® 4F AND MATADOR® 120EC FOR THE CONTROL OF EUROPEAN CORN BORER, *Ostrinia nubilalis* (Hübner), ON SWEET CORN GROWN ON SANDY LOAM SOIL (Cambridge Research Farm), 2002**

MATERIALS: SUCCESS® 480SC (spinosad, 480 g a.i./L), FURADAN® 4F (carbofuran, 480 g a.i./L), MATADOR® 120EC (8-cyhalothrin, 120 g a.i./L), Bt corn cv., BC 0801 ATTRIBUTE™

METHODS: Sweet corn (cvs. Precious Gem, Seneca Dancer) was seeded at the Cambridge Research Farm in 4 row blocks, 15.0 m long. Rows were 0.75 m apart with 20.0-22.0 cm plant spacing. For both cultivars four treatments were replicated four times in a randomized complete block design (RCBD). A separate field of Bt sweet corn (ATTRIBUTE) was seeded using the same planting parameters as the other two sweet corn varieties. Bt sweet corn and untreated control plots (cv. Seneca Dancer) were planted in 4 row blocks, with 4 buffer rows separating each block. The Bt sweet corn was isolated from the conventional corn by 100 m to comply with government regulation (CFIA, 2001). Peak ECB flights were monitored using pheromone traps (univoltine Iowa strain lures). Foliar insecticides were applied to all four rows of each block, using a tractor-mounted boom sprayer that delivered 944 L/ha at 450 kPa (Teejet # 8003VS). The first application took place when the corn reached late whorl. Efficacy of treatments for ECB-control was determined at harvest by examining 25 ears from the centre two rows of each plot for tunnelling on the husk and the ear, yield, and assessing marketability of each ear. Marketability was determined using a standard processor's 1-9 scale (Warnock and Davis, 1998), where ratings of ≤ 3 were considered marketable. Results were analyzed using either analysis of variance (ANOVA) and Tukey's Mean Test ($p < 0.05$) or Two-sample T-test ($p < 0.05$) depending on the number of treatment groups.

RESULTS: Details of planting, application, and harvest are outlined in Table 1. Results of efficacy trials are indicated in Tables 2, 3 and 4.

CONCLUSIONS: For Precious Gem (maturity = 78 days), application of SUCCESS, FURADAN or MATADOR significantly reduced the number of ECB tunnels on husks and ears at harvest compared to the untreated control (Table 2). While there were no significant differences in yield among treatments, mean marketability ratings of SUCCESS, FURADAN or MATADOR treated plots were significantly better than the mean rating of untreated plots. Only sweet corn from SUCCESS, MATADOR or FURADAN treated plots was of marketable quality (Table 2). For Seneca Dancer (maturity = 89 days), application of SUCCESS,

MATADOR or FURADAN significantly reduced ECB-damage to husks compared to the untreated control (Table 3). There was no significant difference, however, between the number of ECB tunnels on ears harvested from treated plots compared to the untreated plots. Mean marketability rating of SUCCESS treated plots was significantly better than mean ratings of plots treated with MATADOR, FURADAN or untreated plots. Sweet corn from all plots, however, was of marketable quality (Table 3). ECB-damage to husk and ears was significantly lower in ATTRIBUTE sweet corn than in conventional Seneca Dancer sweet corn (Table 4). Marketability of ATTRIBUTE sweet corn was significantly better than marketability of conventional sweet corn. Conventional sweet corn did not meet marketability standards in this trial (Table 4). Considering all results, either application of SUCCESS to conventional sweet corn, or planting ATTRIBUTE sweet corn, modified to produce Bt-toxin, enables harvest of sweet corn of quality equal or superior to that harvested from plots treated with either FURADAN or MATADOR, the current industry standards.

Table 1. Management parameters for the sweet corn field trial, Cambridge Research Farm, 2002.

Cultivar	Maturity (days)	Planting Date	Application Dates			Harvest Date
			First	Second	Third	
Precious Gem	78	16 May	11 July	20 July	30 July*	12 August
Seneca Dancer	89	16 May	11 July	23 July	6 August*	18 August
Bt corn, BC 0801	73	18 June	---	---	---	10 September

* Third application for SUCCESS and MATADOR only.

Table 2. Relative efficacy of SUCCESS 480SC, FURADAN 4F, and MATADOR 120EC for control of European corn borer on sweet corn cv. Precious Gem grown on sandy loam soil at the Cambridge Research Farm, 2002.

Treatments	Rate (g a.i./ha)	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (0-9 scale)**
Untreated	--	1.90a*	0.30a	5.38a	3.88a
SUCCESS	70	0.02b	0.03b	5.65a	1.23b
FURADAN	530	0.33b	0.05b	5.55a	1.89b
MATADOR	10	0.29b	0.01b	5.72a	1.47b

* Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Tukey's HSD).

** Ratings of ≤ 3 indicate acceptable market quality.

Table 3. Relative efficacy of SUCCESS 480SC, FURADAN 4F, and MATADOR 120EC for control of European corn borer on sweet corn cv. Seneca Dancer grown on sandy loam soil at the Cambridge Research Farm, 2002.

Treatments	Rate (g a.i./ha)	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (1-9 scale)**
Untreated	--	0.96a*	0.15a	5.05a	2.34a
SUCCESS	70	0.10b	0.03a	4.92a	1.32b
FURADAN	530	0.29b	0.13a	5.09a	2.13a
MATADOR	10	0.28b	0.11a	5.16a	1.85ab

*Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Tukey's HSD).

**Ratings of $\leq$ 3 indicate acceptable market quality.

Table 4. Relative efficacy of ATTRIBUTE for control of European corn borer on sweet corn grown on sandy loam soil at the Cambridge Research Farm, 2002.

Treatments	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (1-9 scale)**
Untreated	0.43a*	0.31a	4.48a	3.07a
ATTRIBUTE	0.00b	0.00b	6.62b	1.00b

* Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Two-sample T-test).

** Ratings of $\leq$ 3 indicate acceptable market quality.

References

Warnock, D.F. and D.W. Davis 1998. Comparison of two visual scales for estimating European corn borer ear damage in maize. HortScience 33:1048-1049.

Canadian Food Inspection Agency 2001. Regulatory Directive 2000-07: Guidelines for the environmental release of plants with novel traits within confined field trials in Canada. http://www.inspection.gc.ca/english/plaveg/pbo/dir/dir0007appe.shtml

2002 PMR REPORT # 46 **SECTION B: VEGETABLES and SPECIAL CROPS – Insect Pests**
ICAR: 440204

CROP: Sweet corn (*Zea mays* L.), cvs., Precious Gem, Seneca Dancer, Bt corn cv., BC 0801 ATTRIBUTE™
PEST: European corn borer (ECB), *Ostrinia nubilalis* (Hübner)

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TITLE: **RELATIVE EFFICACY OF SUCCESS® 480SC AND ATTRIBUTE™ COMPARED TO FURADAN® 4F AND MATADOR® 120EC FOR THE CONTROL OF EUROPEAN CORN BORER, *Ostrinia nubilalis* (Hübner), ON SWEET CORN GROWN ON SANDY LOAM SOIL (Cambridge Research Farm), 2002**

MATERIALS: SUCCESS® 480SC (spinosad, 480 g a.i./L), FURADAN® 4F (carbofuran, 480 g a.i./L), MATADOR® 120EC (8-cyhalothrin, 120 g a.i./L), Bt corn cv., BC 0801 ATTRIBUTE™

METHODS: Sweet corn (cvs. Precious Gem, Seneca Dancer) was seeded at the Cambridge Research Farm in 4 row blocks, 15.0 m long. Rows were 0.75 m apart with 20.0-22.0 cm plant spacing. For both cultivars four treatments were replicated four times in a randomized complete block design (RCBD). A separate field of Bt sweet corn (ATTRIBUTE) was seeded using the same planting parameters as the other two sweet corn varieties. Bt sweet corn and untreated control plots (cv. Seneca Dancer) were planted in 4 row blocks, with 4 buffer rows separating each block. The Bt sweet corn was isolated from the conventional corn by 100 m to comply with government regulation (CFIA, 2001). Peak ECB flights were monitored using pheromone traps (univoltine Iowa strain lures). Foliar insecticides were applied to all four rows of each block, using a tractor-mounted boom sprayer that delivered 944 L/ha at 450 kPa (Teejet # 8003VS). The first application took place when the corn reached late whorl. Efficacy of treatments for ECB-control was determined at harvest by examining 25 ears from the centre two rows of each plot for tunnelling on the husk and the ear, yield, and assessing marketability of each ear. Marketability was determined using a standard processor's 1-9 scale (Warnock and Davis, 1998), where ratings of ≤ 3 were considered marketable. Results were analyzed using either analysis of variance (ANOVA) and Tukey's Mean Test ($p < 0.05$) or Two-sample T-test ($p < 0.05$) depending on the number of treatment groups.

RESULTS: Details of planting, application, and harvest are outlined in Table 1. Results of efficacy trials are indicated in Tables 2, 3 and 4.

CONCLUSIONS: For Precious Gem (maturity = 78 days), application of SUCCESS, FURADAN or MATADOR significantly reduced the number of ECB tunnels on husks and ears at harvest compared to the untreated control (Table 2). While there were no significant differences in yield among treatments, mean marketability ratings of SUCCESS, FURADAN or MATADOR treated plots were significantly better than the mean rating of untreated plots. Only sweet corn from SUCCESS, MATADOR or FURADAN treated plots was of marketable quality (Table 2). For Seneca Dancer (maturity = 89 days), application of SUCCESS,

MATADOR or FURADAN significantly reduced ECB-damage to husks compared to the untreated control (Table 3). There was no significant difference, however, between the number of ECB tunnels on ears harvested from treated plots compared to the untreated plots. Mean marketability rating of SUCCESS treated plots was significantly better than mean ratings of plots treated with MATADOR, FURADAN or untreated plots. Sweet corn from all plots, however, was of marketable quality (Table 3). ECB-damage to husk and ears was significantly lower in ATTRIBUTE sweet corn than in conventional Seneca Dancer sweet corn (Table 4). Marketability of ATTRIBUTE sweet corn was significantly better than marketability of conventional sweet corn. Conventional sweet corn did not meet marketability standards in this trial (Table 4). Considering all results, either application of SUCCESS to conventional sweet corn, or planting ATTRIBUTE sweet corn, modified to produce Bt-toxin, enables harvest of sweet corn of quality equal or superior to that harvested from plots treated with either FURADAN or MATADOR, the current industry standards.

Table 1. Management parameters for the sweet corn field trial, Cambridge Research Farm, 2002.

	Cultivar	Planting Date	Application Dates			Harvest Date
			First	Second	Third	
Precious Gem	78	16 May	11 July	23 July	July* 30	August 12
Seneca Dancer	89	16 May	11 July	30 July	August* 6	August 18
Bt corn, BC 0801	73	18 June	—	---	---	September 10

* Third application for SUCCESS and MATADOR only.

Table 2. Relative efficacy of SUCCESS 480SC, FURADAN 4F, and MATADOR 120EC for control of European corn borer on sweet corn cv. Precious Gem grown on sandy loam soil at the Cambridge Research Farm, 2002.

Treatments	Rate (g a.i./ha)	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (0-9 scale)**
Untreated	--	1.90a*	0.30a	5.38a	3.88a
SUCCESS	70	0.02b	0.03b	5.65a	1.23b
FURADAN	530	0.33b	0.05b	5.55a	1.89b
MATADOR	10	0.29b	0.01b	5.72a	1.47b

*Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Tukey's HSD).
**Ratings of ≤ 3 indicate acceptable market quality.

Table 3. Relative efficacy of SUCCESS 480SC, FURADAN 4F, and MATADOR 120EC for control of European corn borer on sweet corn cv. Seneca Dancer grown on sandy loam soil at the Cambridge Research Farm, 2002.

Treatments	Rate (g a.i./ha)	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (1-9 scale)**
Untreated	--	0.96a*	0.15a	5.05a	2.34a
SUCCESS	70	0.10b	0.03a	4.92a	1.32b
FURADAN	530	0.29b	0.13a	5.09a	2.13a
MATADOR	10	0.28b	0.11a	5.16a	1.85ab

*Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Tukey's HSD).
**Ratings of $\leq$ 3 indicate acceptable market quality.

Table 4. Relative efficacy of ATTRIBUTE for control of European corn borer on sweet corn grown on sandy loam soil at the Cambridge Research Farm, 2002.

Treatments	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (1-9 scale)**
Untreated	0.43a*	0.31a	4.48a	3.07a
ATTRIBUTE	0.00b	0.00b	6.62b	1.00b

*Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Two-sample T-test).
** Ratings of $\leq$ 3 indicate acceptable market quality.

REFERENCES

Warnock, D.F. and D.W. Davis 1998. Comparison of two visual scales for estimating European corn borer ear damage in maize. HortScience 33:1048-1049.

Canadian Food Inspection Agency 2001. Regulatory Directive 2000-07: Guidelines for the environmental release of plants with novel traits within confined field trials in Canada. http://www.inspection.gc.ca/english/plaveg/pbo/dir/dir0007appe.shtml .

2002 PMR REPORT # 47 **SECTION B: VEGETABLES and SPECIAL CROPS – Insect Pests**
ICAR : 440204

CROP: Sweet corn (*Zea mays* L.), cvs., Precious Gem, Seneca Dancer, Bt corn cv., BC 0801 ATTRIBUTE™
PEST: European corn borer (ECB), *Ostrinia nubilalis* (Hübner)

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TITLE: **RELATIVE EFFICACY OF SUCCESS® 480SC AND ATTRIBUTE™ COMPARED TO FURADAN® 4F AND MATADOR® 120EC FOR THE CONTROL OF EUROPEAN CORN BORER, *Ostrinia nubilalis* (Hübner), ON SWEET CORN GROWN ON SANDY LOAM SOIL (Cambridge Research Farm), 2002**

MATERIALS: SUCCESS® 480SC (spinosad, 480 g a.i./L), FURADAN® 4F (carbofuran, 480 g a.i./L), MATADOR® 120EC (8-cyhalothrin, 120 g a.i./L), Bt corn cv., BC 0801 ATTRIBUTE™

METHODS: Sweet corn (cvs. Precious Gem, Seneca Dancer) was seeded at the Cambridge Research Farm in 4 row blocks, 15.0 m long. Rows were 0.75 m apart with 20.0-22.0 cm plant spacing. For both cultivars four treatments were replicated four times in a randomized complete block design (RCBD). A separate field of Bt sweet corn (ATTRIBUTE) was seeded using the same planting parameters as the other two sweet corn varieties. Bt sweet corn and untreated control plots (cv. Seneca Dancer) were planted in 4 row blocks, with 4 buffer rows separating each block. The Bt sweet corn was isolated from the conventional corn by 100 m to comply with government regulation (CFIA, 2001). Peak ECB flights were monitored using pheromone traps (univoltine Iowa strain lures). Foliar insecticides were applied to all four rows of each block, using a tractor-mounted boom sprayer that delivered 944 L/ha at 450 kPa (Teejet # 8003VS). The first application took place when the corn reached late whorl. Efficacy of treatments for ECB-control was determined at harvest by examining 25 ears from the centre two rows of each plot for tunnelling on the husk and the ear, yield, and assessing marketability of each ear. Marketability was determined using a standard processor's 1-9 scale (Warnock and Davis, 1998), where ratings of ≤ 3 were considered marketable. Results were analyzed using either analysis of variance (ANOVA) and Tukey's Mean Test ($p < 0.05$) or Two-sample T-test ($p < 0.05$) depending on the number of treatment groups.

RESULTS: Details of planting, application, and harvest are outlined in Table 1. Results of efficacy trials are indicated in Tables 2, 3 and 4.

CONCLUSIONS: For Precious Gem (maturity = 78 days), application of SUCCESS, FURADAN or MATADOR significantly reduced the number of ECB tunnels on husks and ears at harvest compared to the untreated control (Table 2). While there were no significant differences in yield among treatments, mean marketability ratings of SUCCESS, FURADAN or MATADOR treated plots were significantly better than the mean rating of untreated plots. Only sweet corn from SUCCESS, MATADOR or FURADAN treated plots was of marketable quality (Table 2). For Seneca Dancer (maturity = 89 days), application of SUCCESS, MATADOR or FURADAN significantly reduced ECB-damage to husks compared to the untreated control (Table 3). There was no significant difference, however, between the number of ECB tunnels on ears harvested from treated plots compared to the untreated plots. Mean marketability rating of SUCCESS treated

plots was significantly better than mean ratings of plots treated with MATADOR, FURADAN or untreated plots. Sweet corn from all plots, however, was of marketable quality (Table 3). ECB-damage to husk and ears was significantly lower in ATTRIBUTE sweet corn than in conventional Seneca Dancer sweet corn (Table 4). Marketability of ATTRIBUTE sweet corn was significantly better than marketability of conventional sweet corn. Conventional sweet corn did not meet marketability standards in this trial (Table 4). Considering all results, either application of SUCCESS to conventional sweet corn, or planting ATTRIBUTE sweet corn, modified to produce Bt-toxin, enables harvest of sweet corn of quality equal or superior to that harvested from plots treated with either FURADAN or MATADOR, the current industry standards.

Table 1. Management parameters for the sweet corn field trial, Cambridge Research Farm, 2002.

Cultivar	Maturity (days)	Planting Date	Application Dates			Harvest Date
			First	Second	Third	
Precious Gem	78	16 May	11 July	23 July	30 July*	12 August
Seneca Dancer	89	16 May	11 July	30 July	6 August*	18 August
Bt corn, BC 0801	73	18 June	---	---	---	10 September

* Third application for SUCCESS and MATADOR only.

Table 2. Relative efficacy of SUCCESS 480SC, FURADAN 4F, and MATADOR 120EC for control of European corn borer on sweet corn cv. Precious Gem grown on sandy loam soil at the Cambridge Research Farm, 2002.

Treatments	Rate (g a.i./ha)	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (0-9 scale)**
Untreated	--	1.90a*	0.30a	5.38a	3.88a
SUCCESS	70	0.02b	0.03b	5.65a	1.23b
FURADAN	530	0.33b	0.05b	5.55a	1.89b
MATADOR	10	0.29b	0.01b	5.72a	1.47b

*Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Tukey's HSD).
**Ratings of ≤ 3 indicate acceptable market quality.

Table 3. Relative efficacy of SUCCESS 480SC, FURADAN 4F, and MATADOR 120EC for control of European corn borer on sweet corn cv. Seneca Dancer grown on sandy loam soil at the Cambridge Research Farm, 2002.

Treatments	Rate (g a.i./ha)	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (1-9 scale)**
Untreated	--	0.96a*	0.15a	5.05a	2.34a
SUCCESS	70	0.10b	0.03a	4.92a	1.32b
FURADAN	530	0.29b	0.13a	5.09a	2.13a
MATADOR	10	0.28b	0.11a	5.16a	1.85ab

*Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Tukey's HSD).
** Ratings of ≤ 3 indicate acceptable market quality.

Table 4. Relative efficacy of ATTRIBUTE for control of European corn borer on sweet corn grown on sandy loam soil at the Cambridge Research Farm, 2002.

Treatments	Tunnels per Husk	Tunnels per Ear	Yield (kg)	Marketability (1-9 scale)**
Untreated	0.43a*	0.31a	4.48a	3.07a
ATTRIBUTE	0.00b	0.00b	6.62b	1.00b

*Treatment means in a column followed by the same letter are not significantly different ($p<0.05$, Two-sample T-test).
** Ratings of ≤ 3 indicate acceptable market quality.

References

Warnock, D.F. and D.W. Davis 1998. Comparison of two visual scales for estimating European corn borer ear damage in maize. HortScience 33:1048-1049.

Canadian Food Inspection Agency 2001. Regulatory Directive 2000-07: Guidelines for the environmental release of plants with novel traits within confined field trials in Canada. http://www.inspection.gc.ca/english/plaveg/pbo/dir/dir0007appe.shtml.

2002 PMR REPORT # 48 SECTION B : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

CROP: Dry yellow seed cooking onion, cv. Barrage
PEST: Onion thrips (OT), *Thrips tabaci* Lindeman

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TITLE: EVALUATION OF ENVIRONMENTALLY FRIENDLY, LOW IMPACT FOLIAR TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL, 2002

MATERIALS: NOVALURON 0.83 EC (novaluron 100 g/L), FOLICUR 432 F (tebuconazole 432 g/L), SURROUND (kaolin 95%), KNACK 0.86 EC (pyriproxifen), FULFILL 50 WG (pymetrozine 50%), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), SYLGARD 309 (siloxylated polyether 76% + surfactant mixture 24%)

METHODS: Onion seeds were planted (135 seeds/row) on 01-02 May on the SCPFRC-London Research Farm in 3-row microplots (2.25 m long x 0.9 m wide) filled with insecticide-residue-free organic soil. All treatments were replicated 4 times in a randomized complete block design. On 5 July, prior to the first foliar application, 3 shallot plants infested with OT from an untreated onion block were transplanted into each microplot to ensure buildup of OT-populations. On 17 and 25 July all treatments were applied in 900 L/ha, at 200 kPa, using a hand-held, CO_2-pressurized R&D field-plot sprayer fitted with a 0.6 m boom equipped with three disc-core (D5-25) hollow cone spray tips. On 2 August all treatments were again applied at the same volume and pressure with 1 central XR11002VS and 2 XR8002VS flat fan spray tips. On 19, 24 July (4 plants/plot), 30 July, 2, 6 and 12 August (5 plants/plot), OT were counted by destructive sampling; only the numbers of OT on the inner 3 leaves were counted on the last 2 sampling dates. Raw data were transformed using square root (Y + 0.5) and significance of observed differences among treatment means was determined using ANOVA and Fisher's Protected Least Significant Difference test. Untransformed data are presented in the table.

RESULTS: Experimental results are outlined in Table 1. OT populations on untreated onions exceeded the OMAF-recommended threshold of 3.0 OT/leaf for dry yellow seed cooking onions on all dates. In this trial, greatest reduction in OT-population always followed foliar application of MATADOR; OT-numbers were always at least 85% lower than in CONTROL plots for as long as 10 days after application. Application of the high rate of NOVALURON also significantly reduced OT-numbers by 65% seven days after initial application. Performance by NOVALURON improved after the second and third application, OT-numbers being reduced by as much as 80%. While the difference in activity was not statistically significant, OT-populations were consistently lower following application of the higher rate of NOVALURON. Multiple application of KNACK also significantly reduced OT-populations by as much as 80%. Application of FOLICUR, SURROUND and FULFILL had no significant, consistent impact on OT-populations under the conditions of this trial.

CONCLUSIONS: The pyrethroid MATADOR quickly and consistently reduced OT-populations. While slower to affect OT-numbers, both KNACK and NOVALURON significantly reduced populations after the second application. Further investigation of the potential of both insect growth regulators for effective OT-management is warranted.

Table 1. Impact of environmentally friendly, low impact foliar treatments on populations of onion thrips on dry yellow seed cooking onion on organic soil, London, ON, 2002.

Tmt No.	Treatment Applied	Rate/ha	Mean Number of OT/Plant on Indicated Date					
			19 Jul	24 Jul	30 Jul	2 Aug	6 Aug	12 Aug
1	NOVALURON	750 ml	16.6 ab[1]	37.3 ab	55.5 ab	73.4 bc	38.3 bcd	38.4 b
2	NOVALURON	1500 ml	15.1 b	33.1 b	32.5 b	39.9 cd	32.7 cde	23.1 bc
3	FOLICUR	1.0 L	13.4 b	39.8 a	79.8a	126.0 ab	82.9 ab	78.4 a
4	SURROUND	11.0 kg	27.5 ab	79.3 ab	55.5 ab	120.4 abc	77.5 ab	105.6 a
5	KNACK	750 ml	28.1 b	53.8 b	31.2 b	56.6 bcd	13.1 de	18.9 bc
6	FULFILL	250 g	14.0 b	62.8 a	67.2 a	95.1 bc	84.3 a	99.2 a
7	MATADOR	188 ml	3.5 c	11.2 c	1.9 c	14.5 d	6.7 e	6.2 c
8	CONTROL	---[2]	27.6 a	94.9 a	71.2 a	244.7 a	62.2 abc	94.8 a
Mean No. Leaves/Plant			5	6	6	7	inner 3	inner 3
Mean No. OT/Leaf[3]			5.5	15.8	11.9	34.9	20.7	31.6

[1] Means within a column followed by the same letter are not significantly different (P#0.05) as determined by ANOVA and Fisher's Protected Least Significant Difference Test.
[2] No insecticide applied.
[3] Calculated by dividing the mean number OT/plant in untreated CONTROL plots for each date by the mean number of leaves/plant on that date.

2002 PMR REPORT # 49 SECTION B : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

CROP: Dry yellow seed cooking onion, cv. Prince
PEST: Onion thrips (OT), *Thrips tabaci* Lindeman

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TITLE: EVALUATION OF FOLIAR INSECTICIDES FOR CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL; 2002

MATERIALS: ADMIRE 240 F (imidacloprid 240 g/L), SUCCESS 480 SC (spinosad 480 g/L), ORTHENE 75 SP (acephate 75%), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), SYLGARD 309 (siloxylated polyether 76% + surfactant mixture 24%)

METHODS: Onion seeds were planted 29-30 April in a commercial onion field in the Thedford Marsh (Lot 21, B Concession, Bosanquet Township, Lambton County). Experimental plots consisted of 1 bed of onions (4 x 2 rows) x 5 m, separated by 1 m walkways. To ensure reasonably uniform OT populations, untreated beds of onions extended down each side of treatment plots. All treatments were replicated 5 times in a randomized complete block design. Treatments were applied in 600 L/ha at 225 kPa using a hand-held, CO_2-pressurized R&D field-plot sprayer fitted with a 1.1 m boom equipped with four disc-core (D5-25) hollow cone spray tips (16, 26 July) or four XR11002VS flat spray tips (30 July). On 18, 23, 29 July, 01 and 07 August, OT were counted by destructive sampling of 5 plants per plot; only the numbers of OT on the inner 3 leaves were counted on the last sampling date. Raw data were transformed using square root (Y + 0.5) and significance of observed differences among treatment means was determined using ANOVA and Fisher's Protected Least Significant Difference test. Untransformed data are presented in the table.

RESULTS: Experimental results are outlined in Table 1. OT populations on untreated onions approached the OMAF-recommended threshold of 3.0 OT/leaf for dry yellow seed cooking onions on all dates. Foliar application of MATADOR was the least effective treatment at this site. On all dates OT-populations in plots treated with MATADOR were not significantly different from populations in the CONTROL plots. Bioassay of insecticide resistance in OT populations collected at this site subsequently revealed resistance to pyrethroid insecticides. When insecticides were applied with disc-core hollow cone spray tips, only SUCCESS on 18 July significantly reduced OT-populations by just over 60%. When insecticides were applied with flat spray tips on 30 July, OT-numbers were significantly reduced in plots treated with either ORTHENE or SUCCESS for at least 8 days. Application of ADMIRE had no significant effect on OT-populations in this trial.

CONCLUSIONS: Foliar application of both SUCCESS and ORTHENE had sufficient impact on subsequent OT populations to warrant further investigation. Flat spray tips appeared more effective for application of foliar insecticides for OT-management than disc-core hollow cone spray tips. OT in this commercial field had developed tolerance to pyrethroid insecticides.

Table 1. Impact of foliar treatments on populations of onion thrips on dry yellow seed cooking onion on organic soil, 2002.

Tmt. No.	Treatment Applied	Rate/ha	Mean Number of OT/Plant on Indicated Date				
			18 Jul	23 Jul	29 Jul	1 Aug	7 Aug
1	ADMIRE	150 ml	6.3 bc[1]	12.6 ab	31.6 a	13.8 ab	14.6 a
2	ADMIRE	200 ml	8.3 abc	13.3 ab	30.2 a	12.2 ab	9.3 ab
3	SUCCESS	300 ml	6.9 bc	12.6 ab	11.7 b	6.9 bc	3.6 b
4	SUCCESS	350 ml	5.6 c	14.1 ab	18.8 ab	7.9 bc	5.8 b
5	ORTHENE	700 g	10.3 abc	9.2 b	20.6 ab	10.3 ab	3.9 b
6	ORTHENE	1000 g	7.8 bc	16.5 ab	20.4 ab	2.4 c	3.6 b
7	MATADOR	188 ml	20.0 a	22.5 a	36.8 a	21.1 a	15.1 a
8	CONTROL	---[2]	14.3 ab	23.4 a	30.1 ab	23.8 a	19.3 a
Mean No. Leaves/Plant			5	6	7	8	inner 3
Mean No. OT/Leaf[3]			2.9	3.9	4.3	2.9	6.4

[1] Means within a column followed by the same letter are not significantly different (P#0.05) as determined by ANOVA and Fisher's Least Significant Difference Test.
[2] No insecticide applied.
[3] Calculated by dividing the mean number OT/plant in untreated CONTROL plots for each date by the mean number of leaves/plant on that date.

2002 PMR REPORT # 50 SECTION B : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

CROP: Dry yellow seed cooking onion, cv. Prince
PEST: Onion thrips (OT), *Thrips tabaci* Lindeman

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TITLE: EVALUATION OF INSECTICIDE - SURFACTANT COMBINATIONS FOR FOLIAR CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL; 2002

MATERIALS: SUCCESS 480 SC (spinosad 480 g/L), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), SYLGARD 309 (siloxylated polyether 76% + surfactant mixture 24%), COMPANION Agricultural Adjuvant (octylphenoxypolyethoxy- (9) -ethanol 70%), LI-700 (mixture phoshatidylcholine + methylacetic acid + alkyl polyoxyethylene ether 80%)

METHODS: Onion seeds were planted 29-30 April in a commercial onion field in the Thedford Marsh (Lot 21, B Concession, Bosanquet Township, Lambton County). Experimental plots consisted of 1 bed of onions (4 x 2 rows) x 5 m, separated by 1 m walkways. All treatments were replicated 4 times in a randomized complete block design. All treatments were applied in 600 L/ha at 225 kPa using a hand-held, CO_2-pressurized R&D field-plot sprayer fitted with a 1.1 m boom equipped with four disc-core (D5-25) hollow cone spray tips (16, 26 July) or with four XR11002VS flat spray tips (30 July). On all dates OT were counted by destructive sampling of 5 plants per plot. Raw data were transformed using square root (Y + 0.5) and significance of observed differences among treatment means was determined using ANOVA and Fisher's Protected Least Significant Difference test. Untransformed data are presented in the table.

OBSERVATIONS: Leaves of onions in plots treated with SYLGARD were noticeably darker and appeared "wetter", than the foliage in plots treated with insecticide alone or insecticide + COMPANION or LI-700.

RESULTS: Experimental results are outlined in Table 1. OT-populations on untreated onions exceeded the OMAF-recommended threshold of 3.0 OT/leaf for dry yellow seed cooking onions by 18 July. On 18 July, 2 days after initial application, OT numbers were significantly lower in all plots treated with SUCCESS than in untreated CONTROL plots. While no surfactant significantly improved performance of SUCCESS on that date, OT-numbers were lowest in plots treated with SUCCESS + SYLGARD. On 18 July OT-populations were also significantly reduced in plots treated with MATADOR alone or MATADOR + LI-700. By 23 July, 7 days after application, no treatment had a significant residual effect on OT-populations. No treatment had a significant impact on OT-numbers on 30 July, 4 days after the second application. On 01 August, one day after application using flat spray tips, OT-numbers were significantly lower in plots treated with SUCCESS + any surfactant. No treatment that included MATADOR had a significant impact on OT-numbers on that date.

CONCLUSIONS: Foliar application of SUCCESS provided more reliable control of OT than did similar application of MATADOR, especially following application with flat spray tips. The addition of surfactant did not significantly improve performance of SUCCESS applied with flat spray tips. Addition of a surfactant

to SUCCESS was, however, necessary to significantly lower OT-numbers relative to CONTROL plots. Finally, while there were no significant differences among surfactants in this experiment, further work is warranted to clarify relative performance.

Table 1. Impact of foliar application of insecticide-surfactant combinations on populations of onion thrips on dry yellow seed cooking onion on organic soil, 2002.

Tmt. No.	Treatment Applied	Rate/ha	Surfactant (conc'n)	Mean No. OT/Plant on Indicated Date			
				18 Jul	23 Jul	30 Jul	01 Aug
1	SUCCESS	350 ml	---[1]	7.3 bc[2]	13.7 a	23.1 a	8.7 abcd
2	SUCCESS	350 ml	COMPANION (0.2%)	5.8 bc	9.2 a	21.5 a	3.4 d
3	SUCCESS	350 ml	SYLGARD (0.375%)	3.4 c	7.8 a	15.0 a	6.7 bcd
4	SUCCESS	350 ml	LI-700 (0.5%)	4.6 c	11.1 a	21.9 a	5.2 cd
5	MATADOR	188 ml	---	5.9 bc	14.8 a	29.8 a	15.2 abc
6	MATADOR	188 ml	COMPANION (0.2%)	15.0 ab	14.1 a	19.9 a	16.9 ab
7	MATADOR	188 ml	SYLGARD (0.375%)	9.1 abc	9.9 a	22.7 a	20.2 a
8	MATADOR	188 ml	LI-700 (0.5%)	8.6 bc	7.8 a	30.3 a	17.9 ab
9	CONTROL	xxx[3]	----	20.2 a	13.9 a	33.7 a	22.9 a
Mean No. Leaves/Plant				5	6	6	7
Mean No. OT/Leaf[4]				4	2.3	5.6	3.3

[1] No surfactant applied.
[2] Means within a column followed by the same letter are not significantly different (P#0.05) as determined by ANOVA and Fisher's Protected Least Significant Difference test.
[3] No insecticide applied.
[4] Calculated by dividing the mean number OT/plant in CONTROL plots on each date by the mean number leaves/plant on that date.

2002 PMR REPORT # 51 SECTION B : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

CROP: Dry yellow seed cooking onion, cv. Barrage
PEST: Onion thrips (OT), *Thrips tabaci* Lindeman

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TITLE: EVALUATION OF GAUCHO® 480F AS A SEED TREATMENT FOR CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL, 2002

MATERIALS: GAUCHO 480 F (imidacloprid 480 g/L), PRO-GRO 80 WP (carbathiin 30% + thiram 80%), PYRIFOS 15 G (chlorpyrifos 15%)

METHODS: On 30 April, onion seed was treated in the laboratory at SCPRFRC-London by tumbling for 2 minutes with GAUCHO seed treatment in an air-filled plastic bag. To control onion smut, *Urocystis magica*, in all treatments, PRO GRO (25.0 g/kg seed) was then added to the treated seed, which was further tumbled for an additional 1 minute. On 3 May, seed was planted using a V-belt seeder in two commercial fields in the Thedford Marsh (Site 1 - Lot 21, B Concession and Site 2 - Lot 7, C Concession, Bosanquet Township, Lambton County). Experimental plots consisted of 4 grower-planted double rows in which the 2 inner rows were replaced by single rows of treated seed (160 seeds/4 m row). PYRIFOS G was applied in-furrow at planting to control onion maggot, *Delia antiqua,* in experimental rows. All treatments were replicated 5 times in a randomized complete block design. On 25 June and 2 July (3 plants/plot), 8 July (4 plants/plot), 15, 29 July and 13 August (5 plants/plot), OT were counted by destructive sampling. Raw data were transformed using square root (Y + 0.5) and significance of observed differences among treatment means was determined using ANOVA and Fisher's Protected Least Significant Difference test. Untransformed data are presented in the table.

OBSERVATIONS: No significant delayed germination or phytotoxicity was observed for any treatment at either site.

RESULTS: Experimental results are outlined in Table 1. OT-populations on untreated onions did not exceed the OMAF-recommended threshold of 3.0 OT/leaf for dry yellow seed cooking onions until 8 July (Site 2) and 23 July (Site 1). At Site 2, on 25 June, 8 weeks post-planting, significantly fewer OT were recorded in plots planted with GAUCHO-treated seed than in CONTROL plots; OT-populations remained significantly lower in treated plots at this site until 11 weeks after planting. At Site 1, while OT-numbers were lower in treated plots as early as 2 July, the difference was not significant until 15 July, 11 weeks post planting. At Site 1 treatment of seed had no significant impact on OT-numbers after 12 weeks. Buildup of OT-populations above the recommended threshold was delayed for 1 (Site 1) or 2 weeks (Site 2) in plots planted with onion seed coated with GAUCHO.

CONCLUSIONS: Application of GAUCHO to the seed of dry yellow seed cooking onion delayed development of OT-populations on treated plants in organic soil. Further research is warranted to verify plant safety and quantify potential economic benefits of seed treatment.

Table 1. Impact of GAUCHO 480 F seed treatments on populations of onion thrips on dry yellow seed cooking onions in organic soil, 2002.

Tmt. No.	Treatment Applied	Rate/Unit[1] Seed	Mean Number of OT /Plant on Indicated Date					
			25 Jun	2 Jul	8 Jul	15 Jul	23 Jul	31 Jul
Site 1:								
1	GAUCHO	55.0 ml	0.0 a[2]	0.7 a	0.1 a	0.9 b	8.0 b	31.1 a
2	GAUCHO	80.0 ml	0.0 a	0.7 a	0.1 a	1.1 b	10.7 b	17.4 a
3	CONTROL	---[3]	0.0 a	1.2 a	5.1 a	6.8 a	18.9 a	38.9 a
Mean No. Leaves/Plant			3	4	4	5	5	5
Mean No. OT/Leaf			0	0.3	1.3	1.4	3.8	7.8
Site 2:								
1	GAUCHO	55.0 ml	0.3 b	0.5 b	3.1 b	12.4 b	40.0 a	49.2 a
2	GAUCHO	80.0 ml	0.5 b	0.3 b	1.6 b	9.6 b	45.0 a	63.7 a
3	CONTROL	---	2.9 a	3.5 a	25.2 a	41.7 a	43.7 a	81.0 a
Mean No. Leaves/Plant			2	3	4	5	5	6
Mean No. OT/Leaf			1.4	1.2	6.3	8.3	8.7	13.5

[1] 1 unit contains 250,000 seeds.

[2] For each site, means within a column followed by the same letter are not significantly different (P#0.05) as determined by ANOVA and Fisher's Protected Least Significant Differences Test.

[3] No seed treatment applied.

[4] Calculated by dividing the mean number OT/plant in CONTROL plots on each date by the mean number leaves/plant on that date.

2002 PMR REPORT # 52 SECTION B : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

CROP: Spanish onion cvs. Vision, Yula
PEST: Onion thrips (OT), *Thrips tabaci* Lindeman

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TITLE: EVALUATION OF TRAY-DRENCH TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING SPANISH ONION; 2002

MATERIALS: ADMIRE 240F (imidacloprid 240 g/L)

METHODS: Commercially produced Spanish onion seedlings were grown singly in plastic propagation-plug trays each containing 14 rows of 29 plugs (cv. Vision) or 12 rows of 24 plugs (cv. Yula). On 8 (cv. Vision) or 15 May (cv. Yula) drench treatments were applied in 1.0 ml/plug at 200 kPa using a hand-held CO_2-pressurized, single nozzled, R&D field-plot sprayer fitted with a 4006E flat spray tip. Immediately after application the treatment was washed from foliage by applying 0.5 ml/plug of clear water using the above sprayer. Experimental plots at Site 1 (SCPFRC-London Research Farm) consisted of 2 untreated rows (40 plants/4 m row) bordered on each side by an untreated spreader row of cv. Vision. On 16 May Site 2 was established in a commercial field of transplanted onions in the Thedford Marsh (Lot 20, B concession, Bosanquet Township, Lambton County). Experimental plots consisted of 4-row grower planted plots in which the 2 inner rows were replaced with treated transplants (40 plants/4 m row, cv. Yula). On 17 May Site 3 was established, as described for Site 1, on the University of Guelph - Plant Agriculture Simcoe Research Station. Due to the limited number of transplants, 2 reps of each ADMIRE treatment (Tmts. 1, 2) were planted with cv. Yula and the other 3 reps were planted with cv. Vision at Site 3. All treatments were replicated 5 times in a randomized complete block design at all sites. All plants at all sites received 60-80 ml clear water at transplanting. At Site 1, OT counts were made on 10, 17, 24 June (3 plants/plot), 2, 8, 16 and 22 July (5 plants/plot). At Site 2, OT counts made on 11, 18 (3 plants/plot) and 25 June (4 plants/plot), 2 and 8 July (5 plants/plot). At Site 3, counts were made on 19 (3 plants/plot) and 27 June (4 plants/plot), 4 (4 plants/plot) and 11 (5 plants/plot) July. All OT were counted by destructive sampling. Raw data were transformed using square root (Y + 0.5) and significance of observed differences among treatment means was determined using ANOVA and Fisher's Protected Least Significant Difference test. Since no significant differences were found between cultivars at Site 3, all reps at this site were combined for analysis. Untransformed data are presented in the table.

OBSERVATIONS: No phytotoxicity was observed in any treatment at any site.

RESULTS: Experimental results are outlined in Table 1. OT-populations on untreated onions exceeded the OMAF-recommended threshold of 1.0 OT/leaf for Spanish onion on 17 June (Site 1), 19 June (Site 3), and 25 June (Site 2). Both ADMIRE tray-drench treatments significantly reduced OT numbers for 10 weeks (Site 1), 6 weeks (Site 2) or for 5 weeks (Site 3). Buildup of OT-populations above the recommended threshold was delayed for 1 (Site 3) or 2 weeks (Sites 1, 2) in plots planted with onion seedlings drenched

with ADMIRE in the propagation tray prior to transplanting. In this trial OT appeared first and reached highest levels at Site 3.

CONCLUSIONS: Tray-drench application of ADMIRE, a systemic insecticide, to Spanish onion seedlings significantly delayed development of economically important OT-populations in this trial.

Table 1. Impact of ADMIRE 240 F applied as a tray-drench treatment on populations of onion thrips on Spanish onion, 2002.

Tmt. No.	Treatment Applied	Rate/1000 Plants	Mean Number of OT/Plant on Indicated Date						
			10 Jun	17 Jun	24 Jun	2 Jul	8 Jul	16 Jul	22 Jul
Site 1: (mineral soil)									
1	ADMIRE	4.0 ml	0.1 b	0.6 b	1.8 b	10.8 b	46.6 ab	129.7 b	570.5 a
2	ADMIRE	6.0 ml	0.1 b	0.1 b	2.2 b	10.6 b	30.9 b	129.6 b	604.4 a
3	CONTROL	---	1.5 a	5.1 a	29.3 a	26.7 a	66.8 a	219.2 a	640.3 a
Mean No. Leaves/Plant			3	4	5	6	7	8	8
Mean No. OT/Leaf			0.5	1.3	5.9	4.5	9.5	27.4	80
Site 2: (organic soil)			11 Jun	18 Jun	25 Jun	2 Jul	8 Jul		
1	ADMIRE	4.0 ml	0.3 b	0.4 a	1.9 b	3.5 a	10.4 a		
2	ADMIRE	6.0 ml	0.4 b	0.1 a	1.2 b	5.6 a	9.9 a		
3	CONTROL	---[2]	3.5 a	0.4 a	7.9 a	9.4 a	14.2 a		
Mean No. Leaves/Plant			4	5	5	7	8		
Mean No. OT/Leaf[3]			0.9	0.1	1.3	1.3	1.8		
Site 3: (mineral soil)			19 Jun	27 Jun	4 Jul	11 Jul			
1	ADMIRE	4.0 ml	0.9 b	14.6 b	62.4 a	135.0 a			
2	ADMIRE	6.0 ml	0.1 b	11.4 b	46.7 a	142.5 a			
3	CONTROL	---	26.1 a	36.6 a	93.6 a	157.5 a			
Mean No. Leaves/Plant			4	5	6	7			
Mean No. OT/Leaf			6.5	7.3	15.6	22.5			

[1] For each site, means within a column followed by the same letter are not significantly different (P#0.05) as determined by ANOVA and Fisher's Protected Least Significant Differences Test.
[2] No insecticide applied.
[3] Calculated by dividing the mean number OT/plant in untreated CONTROL plots for each date by the mean number of leaves/plant on that date.

2002 PMR REPORT # 53 **SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests**
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Millenium
PEST: Onion maggot (OM), *Delia antiqua* (Meigen)

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TITLE: FIELD EVALUATION OF SEEDED COMMERCIAL YELLOW COOKING ONION CULTIVARS AND BREEDING LINES FOR RESISTANCE TO THE ONION MAGGOT, *DELIA ANTIQUA* (MEIGEN); 2002

MATERIALS: Onion breeding lines obtained from Seminis Vegetable Seeds and the University of Wisconsin and 10 commercial cultivars

METHODS: Seeded yellow cooking onions were evaluated for their resistance to the OM in an outdoor plot of naturally infested organic soil (pH 6.4, organic matter 60%) at the Muck Crops Research Station. Ten onion cultivars and 6 breeding lines obtained from Seminis Vegetable Seeds and the University of Wisconsin were hand-seeded at 25 seeds/m on 10 May. Each cultivar was replicated four times in a randomized complete block design. Each replicate consisted of two rows (40 cm apart), 3 m in length. Recommended control procedures were followed for other insect, pathogen and weed pressures. To determine initial stand count, emergence counts were taken on 3, 6, 11 and 14 June. Plants were counted and visually examined weekly throughout June and July and bulbs containing OM, or damage caused by other pests were rogued out and the cause recorded. Cumulative OM damage at the end of the first generation (5 Jul) and at harvest (13 Sep) are presented in the table. For yield assessment, bulb weight was recorded after harvest (13 Sep). The air temperatures in 2002 were above the long term (10 year) average for July (21.7^{O}C) and September (17.5^{O}C), below average for May (9.9^{O}C), and average for June (18.2^{O}C) and August (19.6^{O}C). Monthly rainfall was above the long term (10 year) average for May (113 mm) and June (106 mm), below average for August (18 mm) and September (40 mm) and average for July (76 mm). Data were analyzed using the General Analysis of variance function of the Linear Models section of Statistics 7. Separation of means was obtained using Fisher=s Protected LSD test at P=0.05 level of significance.

RESULTS: As presented in table 1.

CONCLUSIONS: No significant difference in the incidence of OM damage was found among the onion cultivars and breeding lines at first generation assessment (p=0.7638) and harvest (p = 0.8912). Unfavourable weather conditions early in the season may have been responsible for the low and extremely variable germination of all onion lines and cultivars (16.28% - 55.92%). Stand density had a small but significant effect on damage levels (p = 0.03, r^2 = 0.06). A significant difference was observed in yield. The commercial cultivars MARS and Stanley had the greatest yields at 20.95 T/ha and 19.76 T/ha, respectively, while the breeding lines 1598 B, 1415 C and 1220 B had the lowest yields at 3.33 T/ha, 3.95 T/ha and 4.05 T/ha, respectively.

Table 1. Percent germination, onion maggot damage and yield of seeded onions, 2002.

Cultivar/Line	Source	% Germ	% OM Damage		Yield (T/ha)
			1st Gen (5 Jul)	Harvest (13 Sep)	
FRONTIER	American Takii	55.92 ns*	7.91 ns	23.43 ns	14.76 ab**
CORTLAND	Bejo	55.92	9.41	22.41	19.05 ab
15056	Seminis	45.23	4.10	13.77	16.90 ab
1598 B (W461)	U of Wis	44.90	11.94	19.18	3.33 c
Stanley	Solar	42.60	2.76	11.83	19.76 a
MARS	Stokes	37.12	2.19	13.99	20.95 a
15055	Seminis	36.02	6.05	16.88	7.57 ab
NORSTAR	American Takii	35.20	7.92	14.98	15.48 ab
MILLENIUM	Sunseeds	30.43	6.84	11.10	16.67 ab
HOOPLA	Seedworks	25.33	5.61	19.89	17.38 ab
HAMLET	Seminis	25.33	4.46	27.72	12.38 a-c
RICOCHET	Seminis	24.34	8.75	14.84	15.95 ab
15073	Seminis	23.68	8.96	16.21	12.38 a-c
1415 C	Seminis	20.72	2.48	7.21	3.95 c
FORTRESS	Seminis	19.08	9.08	22.79	9.52 bc
1220 B	Seminis	16.28	5.95	13.08	4.05 c

[1] No significant treatment effects were observed.
[2] Numbers in a column followed by a different letter are significantly different at P = 0.05, Fisher=s Protected LSD test.

2002 PMR REPORT # 54 **SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests**
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Millenium
PEST: Onion maggot (OM), *Delia antiqua* (Meigen)

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TITLE: **FIELD EVALUATION OF SEEDED COMMERCIAL YELLOW COOKING ONION CULTIVARS AND BREEDING LINES FOR RESISTANCE TO THE ONION MAGGOT, *DELIA ANTIQUA* (MEIGEN); 2002**

MATERIALS: Onion breeding lines obtained from Seminis Vegetable Seeds and the University of Wisconsin and 10 commercial cultivars

METHODS: Seeded yellow cooking onions were evaluated for their resistance to the OM in an outdoor plot of naturally infested organic soil (pH 6.4, organic matter 60%) at the Muck Crops Research Station. Ten onion cultivars and 6 breeding lines obtained from Seminis Vegetable Seeds and the University of Wisconsin were hand-seeded at 25 seeds/m on 10 May. Each cultivar was replicated four times in a randomized complete block design. Each replicate consisted of two rows (40 cm apart), 3 m in length. Recommended control procedures were followed for other insect, pathogen and weed pressures. To determine initial stand count, emergence counts were taken on 3, 6, 11 and 14 June. Plants were counted and visually examined weekly throughout June and July and bulbs containing OM, or damage caused by other pests were rogued out and the cause recorded. Cumulative OM damage at the end of the first generation (5 Jul) and at harvest (13 Sep) are presented in the table. For yield assessment, bulb weight was recorded after harvest (13 Sep). The air temperatures in 2002 were above the long term (10 year) average for July (21.7^{O}C) and September (17.5^{O}C), below average for May (9.9^{O}C), and average for June (18.2^{O}C) and August (19.6^{O}C). Monthly rainfall was above the long term (10 year) average for May (113 mm) and June (106 mm), below average for August (18 mm) and September (40 mm) and average for July (76 mm). Data were analyzed using the General Analysis of variance function of the Linear Models section of Statistics 7. Separation of means was obtained using Fisher=s Protected LSD test at P=0.05 level of significance.

RESULTS: As presented in table 1.

CONCLUSIONS: No significant difference in the incidence of OM damage was found among the onion cultivars and breeding lines at first generation assessment (p=0.7638) and harvest (p = 0.8912). Unfavourable weather conditions early in the season may have been responsible for the low and extremely variable germination of all onion lines and cultivars (16.28% - 55.92%). Stand density had a small but significant effect on damage levels (p = 0.03, r^2 = 0.06). A significant difference was observed in yield. The commercial cultivars MARS and Stanley had the greatest yields at 20.95 T/ha and 19.76 T/ha, respectively, while the breeding lines 1598 B, 1415 C and 1220 B had the lowest yields at 3.33 T/ha, 3.95 T/ha and 4.05 T/ha, respectively.

Table 1. Percent germination, onion maggot damage and yield of seeded onions, 2002.

Cultivar/Line	Source	% Germ	% OM Damage		Yield (T/ha)
			1st Gen (5 Jul)	Harvest (13 Sep)	
FRONTIER	American Takii	55.92 ns*	7.91 ns	23.43 ns	14.76 ab**
CORTLAND	Bejo	55.92	9.41	22.41	19.05 ab
15056	Seminis	45.23	4.10	13.77	16.90 ab
1598 B (W461)	U of Wis	44.90	11.94	19.18	3.33 c
Stanley	Solar	42.60	2.76	11.83	19.76 a
MARS	Stokes	37.12	2.19	13.99	20.95 a
15055	Seminis	36.02	6.05	16.88	7.57 ab
NORSTAR	American Takii	35.20	7.92	14.98	15.48 ab
MILLENIUM	Sunseeds	30.43	6.84	11.10	16.67 ab
HOOPLA	Seedworks	25.33	5.61	19.89	17.38 ab
HAMLET	Seminis	25.33	4.46	27.72	12.38 a-c
RICOCHET	Seminis	24.34	8.75	14.84	15.95 ab
15073	Seminis	23.68	8.96	16.21	12.38 a-c
1415 C	Seminis	20.72	2.48	7.21	3.95 c
FORTRESS	Seminis	19.08	9.08	22.79	9.52 bc
1220 B	Seminis	16.28	5.95	13.08	4.05 c

[1] No significant treatment effects were observed.
[2] Numbers in a column followed by a different letter are significantly different at P = 0.05, Fisher=s Protected LSD test.

2002 PMR REPORT # 55 **VEGETABLES AND SPECIAL CROPS - Insect Pests**

CROP: Potatoes, Solanum tuberosum L. cv. Shepody
PEST: Colorado Potato Beetle (CPB), Leptinotarsa decemlineata (Say)

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TITLE: **RELATIVE EFFICACY OF RIMON 10EC (NOVALURON) AND ADMIRE 240F FOR CONTROL OF COLORADO POTATO BEETLE, Leptinotarsa decemlineata (Say), ON POTATOES, ON SANDY SOIL, 2002**

MATERIALS: RIMON 10EC (novaluron, 100 g/L), ADMIRE 240F (imidacloprid, 240 g/L)

METHODS: Potato seed pieces were planted at the Cambridge Research Farm on 15 May in 4 row plots, 13.0 m in length, with a row spacing of 0.9 m. Five treatments were replicated four times in a randomized complete block design (RCBD). Plots were separated by 3.0 m spray lanes. The foliar treatments were applied using a tractor mounted, four- row boom sprayer delivering 844 L/ha at 450 kPa (Colorjet nozzles # 80-28). Daily monitoring for CPB egg masses (5 plants/plot)was initiated on 20 June. Egg hatch reached 20% on 26 June (Day -1). All treatments were firstapplied on 27 June (Day 0) and again 7 days later, on 4 July. Treatment efficacy was determined by recording the number of egg masses, 1st to 2nd instar larvae (small larvae), 3rd and 4th instar larvae (large larvae) and adult CPB per plant (5 plants/plot; n=100) on 26 (Day –1) and 30 (Day 3) June, 3 (Day 6/Day –1), 7 (Day 10/Day 3), 11 (Day 14/Day 7), and 17 (Day 20/Day 10) July. Percent defoliation per plant was also recorded on each evaluation day using a Defoliation Rating Index. Results were analysed using ANOVA and Tukey's HSD Test.

RESULTS: See Tables 1- 4.

CONCLUSIONS: The results indicate that throughout the entire study all the rates of RIMON 10EC and ADMIRE 240F had no significant effect on the number of CPB eggs (Table 1) and adults (Table 2) compared to the untreated control. Numbers of 1st & 2nd or 3rd & 4th instar CPB larvae were not affected by a single application any of the foliar treatments compared to the untreated control (Table 3). However, following a second application (4 July) there was a significant decrease in the number of 3rd & 4th instar CPB larvae for all foliar treatments compared to the untreated control (Table 4 – 7 and 11 July). Even the lowest rate of RIMON proved as effective as application of ADMIRE. Relatively little defoliation was observed in this trial (Table 4). No single application of insecticide significantly reduced feeding damage. By 3 days after the second application, significantly less defoliation was observed in all treated than in untreated plots. On 11 July, 7 days after the second application, significantly less defoliation was observed in plots treated with either ADMIRE or the highest rate of RIMON than in plots treated with the lower rates of the growth regulator which, in turn, suffered significantly less defoliation than untreated CONTROL plots. Based on these observations, it would appear that novaluron has sufficient activity against CPB to warrant further investigation.

Table 1. Relative impact of RIMON 10EC and ADMIRE 240F on Colorado potato beetle (CPB) egg masses on potatoes on sandy soil, 2002.

Treatment	Rate (g a.i/ha)	Mean No. CPB Egg Masses / Plant					
		June 26 (Day -1)	June 30 (Day 3)	July 3 (Day 6/ Day –1))	July 7 (Day 10/ Day 3)	July 11 (Day 14/ Day 7)	July 17 (Day 20/ Day 10)
CONTROL	Untreated	1.60 a*	0.75 a	0.35 ab	0.15 a	0.05 a	0.05 a
RIMON	12.5	1.35 a	0.75 a	0.60 ab	1.00 a	0.00 a	0.00 a
RIMON	25	0.85 a	1.15 a	0.90 a	0.45 a	0.10 a	0.10 a
RIMON	50	2.75 a	0.70 a	0.80 a	0.15 a	0.10 a	0.00 a
ADMIRE	50	1.00 a	0.45 a	0.05 b	0.05 a	0.00 a	0.00 a

* Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

Table 2. Treatment comparisons of RIMON 10EC and ADMIRE 240F for the control of adult Colorado potato beetle (CPB) on potatoes grown in sandy soil.

Treatment	Rate (g a.i./ha)	Mean No. of Adult CPB/ Plant					
		June 26 (Day -1)	June 30 (Day 3)	July 3 (Day 6/ Day -1)	July 7 (Day 10/ Day 3)	July 11 (Day 14/ Day 7)	July 17 (Day 20/ Day 10
CONTROL	Untreated	0.85 a*	0.85 a	0.25 a	0.25 a	0.10 a	0.20 a
RIMON	12.5	0.60 a	0.60 a	0.15 a	0.25 a	0.00 a	0.10 a
RIMON	25	0.95 a	0.70 a	0.30 a	0.25 a	0.00 a	0.15 a
RIMON	50	1.10 a	0.25 a	0.15 a	0.15 a	0.05 a	0.00 a
ADMIRE	50	0.90 a	0.25 a	0.15 a	0.00 a	0.00 a	0.00 a

Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

Table 3. See next page.

Table 4. Relative impact of RIMON 10EC and ADMIRE 240F on defoliation of potatoes by larval and adult Colorado potato beetle.

Treatment	Rate (g a.i./ha)	Defoliation Index* Mean/ Plant					
		June 26 (Day -1)	June 30 (Day 3)	July 3 (Day 6/ Day -1)	July 7 (Day 10/ Day 3)	July 11 (Day 14/ Day 7)	July 17 (Day 20/ Day 10)
CONTROL	Untreated	0.85 a**	1.05 a	1.00 a	1.70 a	1.50 a	1.40 a
RIMON	12.5	0.90 a	1.00 a	1.00 a	1.00 b	1.05 b	1.00 b
RIMON	25	0.90 a	1.00 a	1.10 a	1.00 b	1.05 b	1.00 b
RIMON	50	1.00 a	1.00 a	1.05 a	1.00 b	0.95 c	0.90 b
ADMIRE	50	1.00 a	1.00 a	0.80 a	1.00 b	0.65 c	0.90 b

* Defoliation Index Rating where 0 = no defoliation; 1 = up to 10% defoliation; 2 = 25% defoliation; 3 = up to 50%
defoliation; 4 = up to 75% defoliation; 5 = up to 100% defoliation
** Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

Table 3. Relative impact of RIMON 10EC and ADMIRE 240F on Colorado potato beetle (CPB) larvae on potatoes on sandy soil, 2002.

Treatments	Rate (g a.i/ha)	Mean No. CPB Larvae / Plant											
		June 26 (Day -1)		June 30 (Day 3)		July 3 (Day 6/ Day -1)		July 7 (Day 10/ Day 3)		July 11 (Day 14/ Day 7)		July 17 (Day 20/ Day 10)	
		1st&2nd Instar	3rd&4th Instar	1st&2nd Instar	3rd&4th Instar	1st&2nd Instar	3rd&4th Instar	1st&2nd Instar	3rd&4th Instar	1st&2nd Instar	3rd&4th Instar	1st&2nd Instar	3rd&4th Instar
CONTROL	Untreated	1.15 a*	0.00 a	1.45 a	0.00 a	6.60 a	1.25 a	0.00 a	3.50 a	0.70 a	2.40 a	0.00 a	0.10 a
RIMON	12.5	0.50 a	0.00 a	2.60 a	0.00 a	3.00 a	0.00 a	0.00 a	0.00 b	0.00 a	0.00 b	0.00 a	0.00 a
RIMON	25	0.35 a	0.00 a	2.05 a	0.00 a	3.75 a	0.35 a	1.25 a	0.00 b	0.60 a	0.05 b	0.00 a	0.00 a
RIMON	50	1.00 a	0.00 a	2.75 a	0.00 a	4.75 a	0.00 a	0.00 a	0.00 b	0.10 a	0.00 b	1.25 a	0.00 a
ADMIRE	50	0.00 a	0.80 a	0.50 s	0.00 a	0.05 a	0.00 a	1.25 a	0.00 b	0.00 a	0.00 b	0.00 a	0.00 a

* Treatment means followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

2002 PMR REPORT # 56 SECTION B : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

CROP: Summer turnip, cv. Purple Top White Globe
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: EVALUATION OF EXPERIMENTAL TREATMENTS FOR CONTROL OF CABBAGE MAGGOT ATTACKING SUMMER TURNIP IN MINERAL SOIL, 2002

MATERIALS: CANON 200 SC (fipronil 200 g/L), TI-435 600 F (clothianidin 600 g/L), NOVALURON 0.83 EC (novaluron 100 g/L), PYRINEX 480 EC (chlorpyrifos 480 g/L), BotaniGard ES (*Beauveria bassiana* 2.11 x 10^{13} spores/L), GARLIC BARRIER mixture (mixture containing 500 ml reverse osmosis water + 10.0 ml GARLIC BARRIER AG^{+} Insect Repellent [garlic juice] + 10.0 ml canola oil + 8.0 ml Palmolive® hand soap)

METHODS: Summer turnip seed was planted on the SCPFRC-London Research Farm on 15 May in 2-row microplots (2.25 m long x 0.9 m wide) filled with insecticide-residue-free mineral soil. All treatments (Table 1) were replicated 3 times in a randomized complete block design. In-furrow spray (IFS)-treatments were applied in the open seed-furrow in a 3-4 cm band on top of the seed at 135 kPa in 4 L/100 m row using a hand-held, CO_2-pressurized, R&D plot sprayer with a single 4003E flat spray tip. On 7 June when seedlings had 2-4 true leaves, the first drench (D)-treatments were applied at 240 kPa in 20 L/100 m row in a 5-7 cm band over the crown of developing plants, using the same sprayer with a single 4006E flat spray tip. Also on 7 June, the first foliar (F)-treatments were applied at 135 kPa in 4 L/100 m row in a 10-15 cm band covering the row, using the same sprayer fitted with a single 4003E flat spray tip. On 21 June when plants had reached a height of 25-30 cm and largest roots had reached a diameter of 15 mm, the second D-treatments and second F-treatments were applied as described above. On 5 July, the 15 largest turnips from the treated rows were carefully pulled, washed and placed inside appropriately labelled plastic bags. All samples were then stored at 4°C until rated for CM-feeding damage according to the rating scale developed by King and Forbes (1954) (See footnote 2, Table 1). An Infestation Index (I.I.) was then calculated for each plot by multiplying the appropriate factor by the % of roots in each category, adding products and dividing the sum by 4. Statistical significance of observed impact of drench application on CM-injury was determined by analysis of variance (ANOVA). Significance of differences among treatments means was determined using a Least Significant Difference (LSD) Range Test. Mean % Control of CM-damage by each treatment was calculated (See footnote 3, Table 1).

OBSERVATIONS: No significant phytotoxicity was observed following any treatment. It was very difficult to re-suspend CANON 200SC following precipitation in the spray solution.

RESULTS: Results are presented in Table 1. As the I.I. in untreated CONTROL plots was just below 40, CM-pressure was not high in this trial. D-application of PYRINEX was the only treatment that significantly reduced the I.I. by over 90%. While less CM-damage was observed following 2 D-applications of NOVALURON, the approximately 50% reduction was not statistically significant. A similar pattern was observed following 3 applications of the GARLIC BARRIER mixture; the approximate 35% decrease in the I.I. was not statistically significant. Neither CANON nor TI-435 by D-application had a significant impact

on CM-damage to summer turnip in this trial. Higher CM-damage was noted when BotaniGard was included in treatments; again the difference was not statistically significant.

CONCLUSIONS: Drench-application of the current commercial standard PYRINEX on summer turnip seedlings on 7 June effectively controlled CM-feeding until harvest. Multiple application of either the insect growth regulator, NOVALURON or the insect repellent, GARLIC BARRIER, had sufficient impact on CM-damage to warrant further investigation. Observed suspension-problems and reduced efficacy by CANON in this trial could be due to the age of the tested sample of CANON which was received in 2000. D-application of CANON effectively reduced CM-damage to summer turnip in trials undertaken in previous years.

Table 1. Experimental treatments for control of cabbage maggot, *Delia radicum*, attacking summer turnip in mineral soil in microplots, London, ON, 2002.

Tmt. No.	Treatment Applied	Rate Applied (pdct/100 m)	Timing[1]	Treatment-Impact	
				Infestation Index[2]	% Control[3]
1	CANON 200SC	10.0 ml	D	33.7 abcd[4]	12
2	TI-435 600F	6.0 ml	D	33.0 abcd	13.8
3	NOVALURON 0.83EC	10.0 ml	D x 2	18.3 de	52.2
4	NOVALURON 0.83EC	20.0 ml	D x 2	16.1 de	58
5	BotaniGard ES	100.0 ml	IFS + F x 2	49.2 a	xxx[5]
6	BotaniGard ES	100.0 ml	IFS	43.3 abc	xxx
7	GARLIC BARRIER[6]	1.0 L	IFS + F x 2	25.6 bcd	33.2
8	GARLIC BARRIER	1.5 L	IFS + F x 2	22.8 cde	40.5
9	BotaniGard ES + GARLIC BARRIER	100.0 ml + 1.0 L	IFS + F x 2	38.7 abcd	xxx
10	BotaniGard ES + GARLIC BARRIER	100.0 ml + 1.5 L	IFS + F x 2	47.8 ab	xxx
11	PYRINEX 480EC	21.0 ml	D	2.8 e	92.7
12	CONTROL	-----[7]	----	38.3 abcd	

[1] D - drench application at 2 leaf stage + 2nd application after 14 days, if specified; IFS - in-furrow spray on top of seed; F - foliar application at 2-leaf stage + 2nd foliar application after 14 days, if specified.

[2] Infestation Index (I.I.) developed by King and Forbes (1954, J. Econ. Entomol. 47: 607) where harvested roots rated for feeding damage according to the following scale: **clean** - factor of 0, no damage; **light** - factor of 1, slight, superficial early feeding but fully healed; **moderate** - factor of 2, marketable as Grade 2 after single trim just above tap root to remove single deep penetration, or moderate, healed surface injury affecting < 20% of surface that could be removed by peeling; **severe** - factor of 4, unmarketable for table use, injury not removable by practical trimming; any extensive unhealed surface injury; maggot in root. Infestation Index was then calculated for each group of turnips in each plot by multiplying appropriate factor by the % of roots in each category, adding products and dividing sum by 4.

[3] Mean % Control relative to Infestation Index (I.I.) for Untreated plots.

% Control = I.I.(Control) - I.I.(Tmt.)/I.I.(Control) x 100%

[4] Means within a column followed by the same letter are not significantly different (P#0.05) as determined by ANOVA and an LSD Range Test.

[5] Damage greater than in CONTROL plots with no insecticide treatment (Tmt. 12).

[6] Formulated Proportion - 500 ml reverse osmosis water : 10.0 ml GARLIC BARRIER AG+ Insect Repellent : 10.0 ml canola oil : 8.0 ml Palmolive® hand soap.

[7] No insecticide applied.

2002 RAPPORT PMR # 57 **SECTION C: INSECTES DES POMMES DE TERRE**
BASE DE DONNÉES DES ÉTUDES: 86000718

CULTURE: Pomme de terre, cv. Superior
RAVAGEUR: Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say)

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TITRE: EFFICACITÉ DU ACTARA APPLIQUÉ AU SOL ET SUR LE FEUILLAGE CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 2002

PRODUITS: ACTARA 25WG (thiamethoxam 25 %), ACTARA 240SC (thiamethoxam 240 g/L), ADMIRE 240F (imidacloprid 240 g/L).

MÉTHODES: L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 29 mai 2002 à 25 cm d'espacement. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,9 m. Les traitements étaient les suivants:

1. ACTARA 240SC en bandes au sol à la plantation (dose 250 ml/ha);
2. ACTARA 240SC en bandes au sol à la plantation (dose 380 ml/ha);
3. ACTARA 240SC en bandes au sol à la plantation (dose 485 ml/ha);
4. ACTARA 25WG en pulvérisations foliaires (dose 52 g/ha);
5. ACTARA 25WG en pulvérisations foliaires (dose 104 g/ha);
6. ADMIRE 240F en pulvérisations foliaires (dose 200 ml/ha);
7. ADMIRE 240F en bandes au sol à la plantation (dose 850 ml/ha);
8. ADMIRE 240F en bandes au sol à la plantation (dose 1,3 L/ha);
9. TÉMOIN (sans traitement).

Lors de la première intervention foliaire, la population larvaire était composée à 80 % de larves de stade 1 et 2. Pour les traitements prévoyant des pulvérisations foliaires, celles-ci ont été faites le 4 et le 11 juillet à l'aide d'un pulvérisateur monté sur tracteur (pression : 690 kPa, volume : 450 L/ha). Dans le cas de l'application au sol, nous avons utilisé le même pulvérisateur avec une rampe modifiée pour un traitement dans le sillon avant de refermer les rangs. Dans ce cas, la pression a été réglée à 200 kPa, et le volume à 35 L/ha). L'évaluation des densités du doryphore a été effectuée sur 10 plants pris au hasard dans les deux rangées du centre. Le dommage au feuillage a été évalué visuellement par une estimation en pourcentage de défoliation du plant. Les plants de pommes de terre ont été défanés une première fois le 30 août avec du RÉGLONE (diquat 2,5 L p.c./ha) et le 6 septembre avec le même produit (diquat 1,5 L p.c./ha). Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 16 septembre 2002. Le rendement vendable se compose des tubercules dont le diamètre varie de 47 mm à 76 mm pour le calibre Canada No 1 et de 77 mm à 114 mm pour le calibre No 1 grosse.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSION: À Deschambault, en 2002, la pression exercée par le doryphore de la pomme de terre sur les plants a été très forte. Dans le témoin non traité, nous avons compté jusqu'à 55,9 larves par plant. Cette situation a été partiellement contrebalancée par des conditions climatiques qui en juillet ont favorisé une bonne croissance des plants. Par contre, nous avons connu au mois d'août une sécheresse qui ne s'était

jamais vue. Dans ces conditions, c'est l'insecticide ACTARA appliqué au sol à la plus forte dose (485 ml/ha) qui a permis d'obtenir le meilleur rendement avec un contrôle quasi parfait des populations larvaires et une absence de dommage au feuillage. La plus faible dose du même insecticide ne nous a pas permis d'obtenir un contrôle satisfaisant des populations larvaires et le rendement en a souffert. L'efficacité des traitements à la dose intermédiaire du ACTARA 240SC (380 ml/ha) se compare au ADMIRE appliqué au sol à la dose de 1,3 L/ha en ce qui touche au rendement. Par contre, au niveau du contrôle des larves et du dommage au feuillage, le ACTARA lui a été supérieur. Les applications de ACTARA 25WG sur le feuillage ont permis un très bon contrôle des larves. Celui-ci a été supérieur à ce que nous avons obtenu avec le ADMIRE appliqué également sur le feuillage. Par contre, dans le cas des traitements foliaires, il est à remarquer que des dommages ont été faits aux plants par les adultes et les larves avant que ne débute et après la première intervention. Cette situation semble avoir eu un impact négatif sur les rendements. Pour les traitements foliaires avec le ACTARA, les deux doses utilisées (52 g et 104 g) se comparent.

Table 1. Nombre moyen de larves de doryphore/plant, dommage en % et rendement vendable, Deschambault, Québec, 2002.

Traitement Insecticide	Dose (p.c). /ha	Population larvaire					Dommage				Rende-ment vendable (t/ha)
		Juin	Juillet				Juillet				
		27	03	08	18	25	03	10	19	25	
ACTARA au sol	485 ml	0	0,2b	0	0,3c	0,1c	0,3c	0,0c	0,0d	0,3c	47,0a
ACTARA au sol	380 ml	0	0,8b	0	0,6c	0,1c	1,0bc	0,3c	1,0c	0,7bc	43,5ab
ACTARA au sol	250 ml	0	1,3b	3,8d	14,1b	11,2b	1,3ab	1,3b	3,3ab	6,3a	33,8c
ACTARA foliaire	104g	0,7	30,2a	12,2c	0,8c	0,3c	3,5a	1,5b	1,3bc	1,0bc	39,4abc
ACTARA foliaire	52 g	0,7	24,0a	12,4c	0,8c	0,2c	3,0ab	3,3a	1,0c	1,5bc	41,4abc
ADMIRE foliaire	200 ml	16	31,4a	28,7b	6,6b	4,8b	3,0ab	4,0a	2,8abc	1,8b	37,2bc
ADMIRE au sol	1,3 L	13	1,3b	3,2d	12,2b	6,1b	1,0bc	1,0b	2,5bc	2,0b	43,3ab
ADMIRE au sol	850 ml	0	0,8b	4,7d	16,4ab	20,9a	1,0bc	1,3b	5,0a	6,3a	37,0bc
TÉMOIN	---	17	33,6a	55,9a	31,8a	11,5ab	38	375	70,0	688	13,1d

Les résultats suivis d'une même lettre ne sont pas significativement différents, à un seuil de 0,05 (Waller-Duncan).

Les données de population larvaire ont été transformées selon la formule log (x +1) avant l'analyse de la variance. Les données pour le dommage ont été transformées selon la formule arsin ($\sqrt{x}$ /100). Dans ce cas, pour obtenir une variance homogène, les données du témoin n'ont pas été considérées. Ces données sont présentées non transformées dans le tableau.

2002 PMR REPORT # 58 **SECTION C: POTATOES - Insect Pests**
STUDY DATA BASE: 303-1251-9601

CROP: Potato, cv. Shepody
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say); potato flea beetle (PFB), *Epitrix cucumeris* (Harris); aphids, wireworms

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TITLE: EFFECT OF SEED-PIECE OR IN-FURROW INSECTICIDE TREATMENTS ON INSECT DAMAGE ON POTATOES PLANTED AT TWO SEEDING RATES, 2002

MATERIALS: SENATOR 10% (thiophanate-methyl), L1210-A1 1.25% (imidacloprid, thiophanate-methyl, and mancozeb), L1216-A1 * (imidacloprid, thiophanate-methyl, and mancozeb), and ADMIRE 240 F (imidacloprid)

METHODS: Cut seed-potato pieces were planted at Harrington, PEI, on May 21, 2002, in four-row plots with plant spacing of either 0.3 m (treatments 11 through 15) or 0.5 m (treatments 21 through 25) within rows, and 0.9 m between rows. Plots were arranged in a split-plot design, with the main effect being the seeding rate, and the presence/absence and rate of insecticide a sub-plots. There were four replications of each treatment. The plots measured 7.6 m in length and 3.7 m in width, and were separated from each other by two buffer rows of potatoes. All treatments consisted of either a pre-plant seed-piece application or an in-furrow application at planting, and were as follows: 11 and 21) Check - SENATOR 10% at 50.0 g AI/100 kg seed; 12 and 22) L1210-A1 at 6.3 g AI/100 kg seed; 13 and 23) L1216-A1 at * g AI/100 kg seed; 14 and 24) L1210-A1 at 9.4 g AI/100 kg seed; and 15 and 25) ADMIRE 240 F in-furrow at 1.8 g AI/100 m row at planting after SENATOR 10% at 50.0 g AI/100 kg seed. Beginning with the first appearance of Colorado potato beetle (CPB) adults in the plots, weekly counts of the numbers of CPB adults, egg masses, early-instars (L1-L2), and late-instars (L3-L4) on five whole plants per plot were done. On the same schedule, Potato flea beetle (PFB) population levels were determined by counting the number of holes in a fourth terminal leaf of each of the five plants, and aphids were counted on a top, middle, and bottom leaf of the same plant. Percent defoliation by the CPB in each plot was estimated weekly throughout the growing season. After planting, a pre-emergence application of metribuzin at 1.1 kg AI/ha was applied to plots for weed control. Throughout the summer, plots received recommended applications of chlorothalonil at 1.25 kg AI/ha for late blight control. On September 17th , the top desiccant Diquat was applied at the rate of 370 g AI/ha. Tubers from the centre two rows of each plot were harvested on September 27, and total and marketable (wt.>33 g) yields were recorded. Fifty tubers per plot from treatments 21 through 25 were examined for wireworm damage as determined by the number of wireworm holes per tuber. Analyses of variance (ANOVA) were performed on the data and Least Significant Differences (LSD, p=0.05) were calculated. Insect counts were transformed to Ln(x+1) before analysis. Percent defoliation was transformed to sqrt (arcsine(prop)) before analysis. Untransformed means are presented.

* concentration confidential

RESULTS: Regardless of seed spacing, L1210-A1 at 6.3 and 9.4 g AI/100 kg seed, L1216-A1 at 333 g product*/100 kg seed, and ADMIRE 240 F in-furrow at 1.8 g AI/100 m row, were equally effective at reducing numbers of CPB adults on August 14 and 27, September 3 and 10, and on a seasonally-averaged basis, compared to the SENATOR-treated Check (Table 1). On August 21, all treatments gave similar results

in comparison with the Check, but L1216-A1 outperformed L1210-A1 at 6.3 g AI for CPB adult control (Table 1). All treatments at both spacings equally controlled numbers of CPB egg masses from July 3 through July 31 (Table 2), L1-L2 larvae from July 10 through August 7 (Table 3), and L3-L4 larvae from July 24 through August 21 (Table 4), and when seasonally averaged. As indicated by the average number of PFB holes per fourth terminal leaf, all treatments gave significant control of the potato flea beetle in comparison with the non-treated Check from July 3 through July 24, on September 3, and on a seasonally-averaged basis (Table 5). On July 3, L1216-A1 gave superior control of PFB compared to Admire, but following that date no significant effect of treatment was observed. Although aphid populations were very low throughout the entire summer, all treatments at both spacings effectively controlled total number of aphids per plant (Table 6). All treatments were equally effective at reducing wireworm damage, as indicated by number of holes per tuber compared to the non-treated Check (Table 7). From July 12 through September 13, all treatments were effective at reducing defoliation by the Colorado potato beetle. Seasonally averaged, all treatments performed equally well at reducing defoliation compared to the Check (Table 7). As expected, in-row seed spacing significantly affected yield, with 12" spacing of plants giving higher yields than 18" spacing for all size classes except Canada #1 large. When data for both seed spacings were combined, there was a rate response for both total and marketable yields/ha; L1210-A1 at 6.3 g AI gave significantly greater yields than the same product at 9.4 g AI (Table 7). All treatments gave superior results in comparison with the not-treated Check (Table 7). Because seed spacing alone resulted in no major differences in insect populations or defoliation, data were pooled for all tables.

CONCLUSIONS: Seed spacing did not have any appreciable effect on insect populations or defoliation throughout the summer. All treatments were equally effective at reducing populations of the Colorado potato beetle and defoliation due to CPB feeding relative to the fungicide-treated Check. Aphid populations were equally reduced by all treatments. Control of potato flea beetle damage was achieved equally well by all treatments throughout the early summer and on a seasonally-averaged basis. As might be expected, total and marketable tuber yields in plots with seed pieces spaced at 0.5 m were lower than those from plots with seed pieces spaced at 0.3 m. Treatments L1210-A1 at two rates, L1216-A1, and ADMIRE were all effective at reducing yield loss due to insect damage, with the low rate of L1210-A1 giving the highest yields.

Table 1. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) adults on potatoes planted at two seeding rates, Harrington, PE, 2002. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB Adults/Plant					
		August 14	August 21	August 27	Sept. 03	Sept. 10	Seas. Avg.
SENATOR 10%	50	1.0a[1]	4.9a	3.6a	2.8a	1.3a	1.3a
L1210-A1 1.25%	6.3	0.1b	0.3b	0.3b	0.5b	0.1b	0.1b
L1216-A1[3]	unknown[3]	0.0b	0.1c	0.2b	0.5b	0.2b	0.1b
L1210-A1 1.25%	9.4	0.1b	0.2bc	0.5b	0.4b	0.3b	0.2b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.0b	0.2bc	0.3b	0.7b	0.3b	0.2b
ANOVA P# 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).
[2] g AI/100 m row
[3] concentration is a trade secret

Table 2. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) egg masses on potatoes planted at two seeding rates, Harrington, PE, 2002. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB Egg Masses/ Plant					
		July 03	July 10	July 17	July 24	July 31	Seas. Avg.
SENATOR 10%	50	1.1a[1]	0.8a	0.6a	0.3a	1.3a	0.4a
L1210-A1 1.25%	6.3	0.0b	0.0b	0.1b	0.0b	0.1b	0.0b
L1216-A1[3]	unknown[3]	0.0b	0.0b	0.0b	0.0b	0.0b	0.1b
L1210-A1 1.25%	9.4	0.0b	0.0b	0.0b	0.0b	0.0b	0.0b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.0b	0.1b	0.0b	0.0b	0.0b	0.0b
ANOVA P# 0.05		s	s	s	s	s	s

1 Numbers in a column followed by the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).
[2] g AI/100 m row
[3] concentration confidential

Table 3. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) L1-L2 instars on potatoes planted at two seeding rates, Harrington, PE, 2002. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB L1-L2 Instars/ Plant					
		July 10	July 17	July 24	July 31	August 07	Seas. Avg.
SENATOR 10%	50	3.1a[1]	3.0a	6.5a	6.1a	6.5a	2.7a
L1210-A1 1.25%	6.3	0.0b	0.0b	0.0b	0.0b	0.5b	0.1b
L1216-A1[3]	unknown[3]	0.2b	0.0b	0.0b	0.0b	0.0b	0.1b
L1210-A1 1.25%	9.4	0.0b	0.0b	0.0b	0.0b	0.0b	0.1b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.0b	0.0b	0.0b	0.0b	0.0b	0.0b
ANOVA P# 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).
[2] g AI/100 m row
[3] concentration is a trade secret

Table 4. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) L3-L4 instars on potatoes planted at two seeding rates, Harrington, PE, 2002. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB L3-L4 Instars/ Plant					
		July 24	July 31	August 07	37481	August 21	Seas. Avg.
SENATOR 10%	50	1.3a[1]	3.9a	1.9a	3.3a	0.8a	1.0a
L1210-A1 1.25%	6.3	0.0b	0.1b	0.0b	0.3b	0.1b	0.1b
L1216-A1[3]	unknown[3]	0.0b	0.0b	0.0b	0.0b	0.0b	0.0b
L1210-A1 1.25%	9.4	0.0b	0.0b	0.0b	0.0b	0.1b	0.0b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.0b	0.0b	0.0b	0.0b	0.0b	0.0b
ANOVA P# 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).
[2] g AI/100 m row
[3] concentration confidential

Table 5. Effect of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, on PFB damage on potatoes planted at two seeding rates, Harrington, PE, 2002. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. of PFB Holes/4th Terminal Leaf					
		July 03	July 10	July 17	July 24	Sept. 03	Seas. Avg.
SENATOR 10%	50	35.3a[1]	5.8a	9.0a	4.9a	51.5a	16.8a
L1210-A1 1.25%	6.3	1.2bc	0.1b	0.0b	0.9b	27.2b	8.7b
L1216-A1[3]	unknown [3]	0.7c	0.6b	1.0b	0.4b	24.6b	8.3b
L1210-A1 1.25%	9.4	1.1bc	0.1b	0.1b	0.4b	24.6b	7.8b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	2.6b	0.4b	0.3b	0.4b	30.7b	8.7b
ANOVA P# 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).
[2] g AI/100 m row
[3] concentration is a trade secret

Table 6. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against aphids on potatoes planted at two seeding rates, Harrington, PE, 2002. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. of Aphids/Plant					
		August 07	August 14	August 21	August 27	Sept. 03	Seas. Avg.
SENATOR 10%	50	0.4	3.7a[1]	3.2a	1.6a	0.8	0.9a
L1210-A1 1.25%	6.3	0	0.5b	0.1b	0.1b	0	0.1b
L1216-A1[3]	unknown [3]	0	0.8b	0.1b	0.0b	0	0.1b
L1210-A1 1.25%	9.4	0	0.4b	0.1b	0.0b	0	0.1b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0	0.4b	0.0b	0.0b	0	0.0b
ANOVA P# 0.05		ns	s	s	s	ns	s

[1] Numbers in a column followed by the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).
[2] g AI/100 m row
[3] concentration confidential

Table 7. Effect of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, on wireworm damage, CPB defoliation, and total and marketable tuber yield of potatoes planted at two seeding rates, Harrington, PE, 2002. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Wireworm Damage	% Defoliation	Tuber Yield t/ha	
		mean no. holes/ tuber	Seas. Avg.	Total	Market.
SENATOR 10%	50	0.5a[1]	21.6a	30.4c	30.3c
L1210-A1 1.25%	6.3	0.2b	1.2b	40.4a	40.3a
L1216-A1[3]	unknown[3]	0.1b	3.2b	38.4ab	38.3ab
L1210-A1 1.25%	9.4	0.1b	1.2b	36.3b	36.2b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.1b	1.1b	37.0ab	36.9ab
ANOVA P# 0.05		s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).
[2] g AI/100 m row
[3] concentration confidential

2002 PMR REPORT # 59 **SECTION C: POTATOES - Insect Pests**
STUDY DATA BASE: 303-1251-9601

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say); potato flea beetle (PFB), *Epitrix cucumeris* (Harris)

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TITLE: EFFICACY OF *GARLIC BARRIER* AS A FEEDING DETERRENT TO COLORADO POTATO BEETLE AND POTATO FLEA BEETLE ON POTATO

MATERIALS: GARLIC BARRIER, food-grade soybean oil

METHODS: Whole seed potatoes were planted at Harrington, PEI, on June 13, 2002, in four-row plots with plant spacing of about 0.3 m within rows and 0.9 m between rows. Plots were set up in a randomized complete block design with two treatments and four replications. The plots measured 6.1 m in length and 3.7 m in width, and were laid out in a linear fashion, with bare soil surrounding each plot. The initial foliar application of GARLIC BARRIER (1:20 v:v with H_2O) with soyabean oil added as a sticker (+1:100) was made on July 11, after removal of any life stages of the Colorado potato beetle already present in the plots, and further applications were made on a weekly basis until August 22. Treatments were applied using a CO_2-pressurized precision plot sprayer that delivered a final spray volume of 250 L H_2O/ha at 240 kPa. Early morning on July 12, 264 equidistantly-spaced CPB adults were released on the bare soil on the west side of the plots, five feet away from the first row of potatoes. Late that afternoon, and continuing on a one-day, four-day, and seven-day post-spray schedule throughout the summer, counts of the numbers of CPB egg masses, adults, early-instars (L1-L2),and late-instars (L3-L4) on four whole plants per plot were done. On the same schedule, determinations of potato flea beetle (PFB) population levels were made by counting the number of holes in a fourth terminal leaf of the same plants. Percent defoliation in each plot was estimated each week throughout the growing season. After planting, plots received a pre-emergence application of metribuzin at 1.1 kg AI/ha for weed control. Throughout the summer, plots received recommended applications of chlorothalonil at 1.25 kg AI/ha for late blight control. Diquat was applied at the rate of 370 g AI/ha on September 17 for top desiccation. Analyses of variance were performed on the data and Least Significant Differences (LSD) were calculated. Insect counts were transformed to Ln(x+1) before analysis. Percent defoliation was transformed to sqrt (arcsine(prop)) before analysis. Untransformed means are presented.

RESULTS: Although counts of CPB adults tended to be higher in the non-treated Check plots than in the GARLIC BARRIER-treated plots throughout the summer, the trend was inconsistent. There was significant control of adults demonstrated at the four-day post-spray count on August 26, but none on any other counting date or on a seasonally-averaged basis (Table 1). GARLIC BARRIER was effictive at reducing the number of CPB egg masses at the 4-day post-spray counts on July 15 and August 6 only (Table 2), and the number of L1L2 larvae on August 26 only (Table 3). At no time throughout the summer were numbers of L3-L4 larvae effectively reduced by GARLIC BARRIER, and on most counting dates there were more L3L4 larvae found in the treated plots than in the Check plots (Table 4). GARLIC BARRIER showed no efficacy at reducing defoliation by the Colorado potato beetle at any time (data not shown). Although it appeared that the initial GARLIC BARRIER application on July 11 reduced potato flea beetle damage in comparison with

the non-treated Check, the trend was short-lived, and only on July 29 and August 8 was significant control of PFB damage demonstrated (Table 5). On a seasonally-averaged basis, PFB damage was slightly greater in the GARLIC BARRIER-treated plots than in the Check plots (Table 5).

CONCLUSIONS: Weekly foliar applications of GARLIC BARRIER with a soybean oil sticker were ineffective at consistently reducing numbers of Colorado potato beetle adults, early-instar larvae, or late-instar larvae, and effectively reduced numbers of CPB egg masses on only two isolated dates. The degree of damage due to CPB feeding was not reduced by GARLIC BARRIER, nor was feeding by the potato flea beetle. It appears that GARLIC BARRIER at a rate of 1:20 v:v with H_2O is not an effective feeding deterrent to either the Colorado potato beetle or the potato flea beetle even when applied on a weekly basis.

Table 1. Efficacy of GARLIC BARRIER against Colorado potato beetle (CPB) adults at four-day post-spray counts, Harrington, PE, 2002.

Treatment	Rate (v:v of H_2O)	Mean No. CPB Adults/Plant*						
		July 22	July 29	Aug. 6	Aug. 12	Aug. 20	Aug. 26	Seas. Ave.
CHECK	-	0.2	0.2	0.3	0.3	1	2.3a	0.6
GARLIC BARRIER plus soybean oil	1:20 +1:100	0.1	0.1	0.2	0.9	0.9	0.8b	0.4
ANOVA P# 0.05		ns	ns	ns	ns	ns	s	ns

* Numbers in a column followed by no letter or the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).

Table 2. Efficacy of GARLIC BARRIER against Colorado potato beetle (CPB) egg masses at four-day post-spray counts, Harrington, PE, 2002.

Treatment	Rate (v:v of H_2O)	Mean No. CPB egg masses/ Plant*						
		July 15	July 22	July 29	Aug. 6	Aug. 12	Aug. 20	Seas. Ave.
CHECK	-	0.5a	0.2	1.3	0.7a	0.1	0.3	0.3
GARLIC BARRIER plus soybean oil	1:20 +1:100	0.1b	0.5	0.6	0.1b	0.1	0.1	0.3
ANOVA P# 0.05		s	ns	ns	s	ns	ns	ns

* Numbers in a column followed by no letter or the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).

Table 3. Efficacy of GARLIC BARRIER against Colorado potato beetle (CPB) early-instar larvae (L1-L2) at four-day post-spray counts, Harrington, PE, 2002.

Treatment	Rate (v:v of H_2O)	Mean No. CPB L1-L2/ Plant*						
		July 22	July 29	Aug. 6	Aug. 12	Aug. 20	Aug. 26	Seas. Ave.
CHECK	-	1.3	4.5	7.5	2.3	1.7	0.9a	3
GARLIC BARRIER plus soybean oil	1:20 +1:100	2.4	10.6	7.4	2.9	0.5	0.1b	4.1
ANOVA P# 0.05		ns	ns	ns	ns	ns	s	ns

* Numbers in a column followed by no letter or the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).

Table 4. Efficacy of GARLIC BARRIER against Colorado potato beetle (CPB) late-instar larvae (L3-L4) at four-day post-spray counts, Harrington, PE, 2002.

Treatment	Rate (v:v of H_2O)	Mean No. CPB L3-L4/ Plant*						
		July 22	July 29	Aug. 6	Aug. 12	Aug. 20	Aug. 26	Seas. Ave.
CHECK	-	1.7	0.8	2.5	1.3	0.9	0.5	1
GARLIC BARRIER plus soybean oil	1:20 +1:100	2.2	2	2.5	1.7	0.6	0.5	1.4
ANOVA P# 0.05		ns	ns	ns	ns	ns	ns	ns

* Numbers in a column followed by no letter or the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).

Table 5. Efficacy of GARLIC BARRIER against potato flea beetle (PFB) damage, Harrington, PE, 2002.

Treatment	Rate (v:v of H_2O)	Mean No. PFB Holes/4th Terminal Leaf*						
		July 22	July 29	Aug. 8	Aug. 12	Aug. 20	Aug. 26	Seas. Avg.
CHECK	-	11.9	6.3a	16.2a	8.3	8.9	26.3	14.2
GARLIC BARRIER plus soybean oil	1:20 +1:100	5	2.3b	6.4b	8.8	16.5	44	15.5
ANOVA P# 0.05		ns	s	s	ns	ns	ns	ns

* Numbers in a column followed by no letter or the same letter are not statistically different (P # 0.05, Protected Least Significant Differences Test).

2002 PMR REPORT # 60 **SECTION C : POTATOES - Insect Pests**
STUDY DATA BASE: 280-2126-9904

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: EVALUATION OF PLANTING TREATMENTS FOR CONTROL OF COLORADO POTATO BEETLE ATTACKING POTATO ON MINERAL SOIL, 2002

MATERIALS: ADMIRE 240 F (imidacloprid 240 g/L), TI-435 600 F (clothianidin 600 g/L), CALYPSO 480 SC (thiacloprid 480 g/L)

METHODS: Seed treatments (Tmts. 1, 2, 4, 5) were uniformly applied to freshly cut, chitted potato seed-pieces in 1.15 L/100 kg seed, using a hand-operated mist-applicator on 21 May. Treated seed-pieces were allowed to dry and stored in vented, plastic tubs until planting. All seed potatoes were planted on the SCPFRC-London Research Farm on 22 May in single-row (10 plants/row) microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated 3 times in a randomized complete block design. To supplement scanty rainfall, microplots received 10 mm water via sprinkler-irrigation on 21 June, 2, 16 July and 2 August. IFS-treatments (Tmts. 3, 6-8) were applied in a 10-12 cm band over the seed pieces in the bottom of the seed furrow at 175 kPa in 5 L/100 m row using a hand-held, CO_2-pressurized, R&D plot sprayer with a single 4004E flat spray tip. Once growing plants had developed at least 2 tri-foliate leaves, residual effectiveness of all treatments against both adult and larval insecticide-susceptible, laboratory-reared CPB was measured by bioassay. On each collection date (Tables 1-4) a total of 6 leaves was harvested from each plot of each treatment and returned to the laboratory. If CPB numbers were sufficient, a total of 9 adult-bioassays (3 bioassays/plot x 3 plots/tmt.), each containing 1 tri-foliate leaflet and 5 CPB adults, and 9 larval-bioassays (3 bioassays/plot x 3 plots/tmt.), each containing two, 2.1 cm^2 leaf discs and 5 first instar larvae, was then established for each treatment. Bioassays were held at 25°C, 55% RH, and 16:8 L:D photoperiod. For each set of bioassays, mortality and leaf damage were recorded after 72 hrs. Mortality was corrected using Abbott's factor and subjected to arcsin square root transformation prior to statistical analysis by analysis of variance (ANOVA). Fisher's Protected Least Significant Difference test was then used to estimate significance of differences among treatment means. Untransformed data are presented in the tables. Adult-feeding damage was rated on 0-10 scale where 0.0 represents no feeding damage, 5.0 represents 50% loss of leaf area, 10.0 represents 100% consumption of the leaf. Larval feeding damage was measured directly. Areas of leaf discs remaining after 72 hrs were read directly using a LI-COR® portable leaf-area meter; larval-leaf consumption was calculated by subtracting the disc-area at the end of each bioassay from the area of standard leaf discs collected at the beginning of each bioassay. Significance of observed differences in leaf consumption among treatments was determined by ANOVA as described above.

RESULTS: No phytotoxicity was noted following any treatment. Early in the season results of bioassays of ST-application were more variable than bioassays of IFS-application.
At the time of the first bioassay, 26 days after treatment (DAT), mortality of adult CPB exceeded 85% only in treatments containing TI-435 (Table 1). As late as 47 DAT adult mortality continued about 80% in both IFS-treatments with TI-435 (Tmts. 6, 7) and when higher rate of TI-435 was applied to the seed (Tmt. 5). By 69 DAT, no treatment caused more than 40% mortality of adult CPB in bioassay. Although not always

statistically significant, adult CPB mortality tended to be higher when either ADMIRE or TI-435 was applied in the seed furrow than when applied to the seed (Table 1). The higher rate of application to the seed of both ADMIRE and TI-435 was usually numerically if not statistically more toxic to adult CPB than the lower rate (Table 1). At no time did mortality of adult CPB exceed when exposed to foliage from potatoes treated with CALYPSO in the seed furrow (Tmt. 8)(Table 1). All treatments significantly reduced feeding damage by adult CPB as long as 69 DAT (Table 2). On all sampling dates IFS-application of CALYPSO (Tmt. 8) was less effective than similar application of tested rates of either ADMIRE (Tmt. 3) or TI-435 (Tmt. 6, 7); there were no significant differences between foliage protection by IFS-application of ADMIRE and TI-435 (Table 2). Until 34 DAT there was no significant difference between control of adult feeding by IFS- and the higher rate of ST-application of ADMIRE (Tmt. 2). After 34 DAT, significantly less CPB damage was observed following IFS-application of ADMIRE. Until 34 DAT the higher rate of ST-application of ADMIRE provided significantly more protection of potato foliage than the lower rate of ST-application(Tmt. 1) (Table 2). The higher rate of ST-application of TI-435 (Tmt. 5) provided numerically but not always significantly superior protection of potato foliage than the lower rate of ST-application (Tmt. 4)(Table 2). There was no significant difference between foliage protection provided by the 2 rates of IFS-application and the higher rate of ST-application of TI-435 (Table 2).

Due to lack of larvae, bioassay of efficacy of planting treatments against first instar larvae did not begin until 47 DAT. At that time mortality of larvae exceeded 50% in bioassay only following IFS-application of both rates of TI-435 (Table 3). At 69 DAT, only IFS-application of the higher rate of TI-435 (Tmt. 8) resulted in significantly increased larval mortality; mortality, however, only reached 21.5% for that application (Table 3). In this trial, even though high larval mortality was not often seen in bioassay, feeding damage by surviving larvae was significantly reduced. As long as 69 DAT significantly less leaf area was consumed in bioassay of the efficacy of all treatments (Table 4). On that date, most effective treatments were IFS-application of ADMIRE (Tmt. 3) or either rate of TI-435 (Tmt. 6, 7)(Table 4). Feeding damage was reduced by at least 80% for all of these treatments. Damage reductions for all ST-applications and IFS-application of CALYPSO ranged from 50% - 64%.

CONCLUSIONS: Under the conditions of this trial sufficient systemic residues of all planting treatments remained in potato foliage to significantly reduce feeding by both adult and larval CPB several weeks beyond the period that those residues caused significant mortality of introduced insects. IFS-application of both ADMIRE and TI-435 provided excellent protection of potato foliage until the final sampling period, nearly 10 weeks after treatment; by this time vines had begun to senesce. IFS-application of CALYPSO was less effective than similar application of either ADMIRE or TI-435. While ST-application of ADMIRE or TI-435 in this trial appeared less effective than IFS-application, it is felt that uneven application of seed treatment to the small experimental batch of seed potatoes may have decreased their overall effectiveness.

Table 1. Effect of treated potato foliage on mortality of Colorado potato beetle (CPB) adults after feeding for 72 hours in bioassay, planting treatments, London, ON, 2002.

Tmt. No.	Treatment Applied	Formulation Applied	Appl. Time[1]	Rate Applied (product)	Average % Corrected CPB Mortality on Indicated DAT[3]				
					26	34	47	62	69
1	imidacloprid	ADMIRE 240 F	ST	25.0 ml/100 kg seed	47.0 c[2]	27.8 d	44.8 c	10.3 bc	5.6 d
2	imidacloprid	ADMIRE 240 F	ST	50.0 ml/100 kg seed	74.0 b	57.1 c	57.1 bc	6.5 c	4.8 d
3	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	36.4 cd	66.7 bc	70.1 ab	63.4 a	15.1 bcd
4	clothianidin	TI-435 600F	ST	10.0 ml/100kg seed	88.4 ab	66.7 bc	54.0 bc	33.6 b	3.2 d
5	clothianidin	TI-435 600F	ST	20.0 ml/100 kg seed	97.7 a	69.0 bc	81.0 a	35.2 b	35.7 abc
6	clothianidin	TI-435 600F	IFS	3.0 ml/100 m row	95.3 ab	95.2 a	81.6 a	68.3 a	27.8 ab
7	clothianidin	TI-435 600F	IFS	4.8 ml/100 m row	100.0 a	86.5 ab	90.8 a	78.0 a	38.1 a
8	thiacloprid	CALYPSO 480SC	IFS	4.0 ml/100m row	20.7 d	11.1 d	49.4 bc	2.7 c	11.1 cd

[1] ST - seed treatment; IFS - in furrow spray

[2] Means within a column followed by the same letter are not significantly different (P#0.05) as determined using ANOVA and Fisher's Protected Least Significant Difference test.

[3] Days after Treatment.

Table 2. Effect of treated potato foliage on feeding damage by Colorado potato beetle (CPB) adults after 72 hours in bioassay, planting treatments, London, ON, 2002.

Tmt. No.	Treatment Applied	Formulation Applied	Appl. Time[1]	Rate Applied (product)	Average Feeding Damage Rating[4] on Indicated DAT[5]				
					26	34	47	62	69
1	imidacloprid	ADMIRE 240 F	ST	25.0 ml/100 kg seed	3.6 c[3]	5.2 ab	3.7 b	4.1 bc	3.9 bc
2	imidacloprid	ADMIRE 240 F	ST	50.0 ml/100 kg seed	0.7 d	3.0 cd	3.7 b	3.3 cd	3.8 bc
3	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	0.8 d	0.9 de	0.8 c	0.9 e	1.6 d
4	clothianidin	TI-435 600F	ST	10.0 ml/100kg seed	1.1 d	4.2 bc	3.7 b	3.2 cd	4.6 b
5	clothianidin	TI-435 600F	ST	20.0 ml/100 kg seed	0.9 d	2.6 cde	1.9 c	2.8 cd	2.6 cd
6	clothianidin	TI-435 600F	IFS	3.0 ml/100 m row	1.1 d	1.2 de	0.8 c	1.1 e	2.4 cd
7	clothianidin	TI-435 600F	IFS	4.8 ml/100 m row	0.9 d	0.5 e	0.9 c	2.1 de	1.8 d
8	thiacloprid	CALYPSO 480 SC	IFS	4.0 ml/100 m row	5.4 b	7.1 a	3.6 b	5.1 b	4.6 b
9	CONTROL	No Insecticide	-----[2]	-----	8.8 a	7.1 a	4.7 a	9.4 a	9.5 a

[1] ST - seed treatment; IFS - in furrow spray.
[2] No insecticide applied.
[3] Means within a column followed by the same letter are not significantly different (P#0.05) as determined using ANOVA and Fisher's Protected Least Significant Difference test.
[4] Actual 72-hour leaf damage rating (0-10 scale where 0.0 represents no feeding damage, 5.0 represents 50% loss of leaf area, 10.0 represents 100% consumption of the leaf).
[5] Days after Treatment.

Table 3. Effect of treated potato foliage on mortality of first instar Colorado potato beetle (CPB) larvae after feeding for 72 hours in bioassay, planting treatments, London, ON, 2002.

Tmt. No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Average % Corrected CPB Mortality on Indicated DAT[3]		
					47	62	69
1	imidacloprid	ADMIRE 24 0F	ST	25.0 ml/100 kg seed	6.7 bc[2]	0.0 b	2.0 b
2	imidacloprid	ADMIRE 240 F	ST	50.0 ml/100 kg seed	8.9 bc	0.0 b	2.0 b
3	imidacloprid	ADMIRE 24 0F	IFS	12.0 ml/100 m row	22.2 b	0.0 b	4.3 b
4	clothianidin	TI-435 600 F	ST	10.0 ml/100kg seed	22.2 b	0.0 b	0.0 b
5	clothianidin	TI-435 600 F	ST	20.0 ml/100 kg seed	24.7 b	0.0 b	8.3 b
6	clothianidin	TI-435 600 F	IFS	3.0 ml/100 m row	55.6 a	0.0 b	8.3 b
7	clothianidin	TI-435 600 F	IFS	4.8 ml/100 m row	66.2 a	35.1 a	21.5 a
8	thiacloprid	CALYPSO 480 SC	IFS	4.0 ml/100 r row	0.0 c	0.0 b	0.0 a

[1] ST - seed treatment; IFS - in furrow spray

[2] Means within a column followed by the same letter are not significantly different (P#0.05) as determined using ANOVA and Fisher's Protected Least Significant Difference test.

[3] Days after Treatment.

Table 4. Effect of treated potato foliage on feeding damage by first instar Colorado potato beetle (CPB) larvae after 72 hours in bioassay, planting treatments, London, ON, 2002.

Tmt No.	Treatment Applied	Formulation Applied	Appl. Timing[1]	Rate Applied (product)	Average Leaf Area Consumed[4] (cm^2) on Indicated DAT[5]		
					47	62	69
1	imidacloprid	ADMIRE 240 F	ST	25.0 ml/100 kg seed	1.7 a[3]	0.9 bc	0.9 bc
2	imidacloprid	ADMIRE 240 F	ST	50.0 ml/100 kg seed	0.7 c	0.9 bc	0.8 c
3	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	0.5 cd	0.4 de	0.3 d
4	clothianidin	TI-435 600 F	ST	10.0 ml/100kg seed	0.5 cd	0.8 c	1.1 b
5	clothianidin	TI-435 600 F	ST	20.0 ml/100 kg seed	0.3 de	0.6 cd	1.0 bc
6	clothianidin	TI-435 600 F	IFS	3.0 ml/100 m row	0.1 e	0.3 de	0.4 d
7	clothianidin	TI-435 600 F	IFS	4.8 ml/100 m row	0.1 e	0.2 e	0.1 d
8	thiacloprid	CALYPSO 480 SC	IFS	4.0 ml/100 r row	1.2 b	1.2 b	1.0 bc
9	CONTROL	No Insecticide	----[2]	-----	0.6 cd	2.0 a	2.2 a

[1] ST - seed treatment; IFS - in furrow spray.
[2] No insecticide applied.
[3] Means within a column followed by the same letter are not significantly different (P#0.05) as determined using ANOVA and Fisher's Protected Least Significant Difference test.
[4] Actual area (cm^2) of leaf-disc consumed during 72 hour feeding period.
[5] Days after Treatment.

2002 PMR REPORT # 61 **SECTION C : POTATOES - Insect Pests**
STUDY DATA BASE: 280-2126-9904

CROP: Potato, cv. Superior
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: RELATIVE PERSISTENCE OF NEONICOTINOID INSECTICIDES APPLIED TO POTATO FOLIAGE FOR CONTROL OF COLORADO POTATO BEETLE ON MINERAL SOIL, 2002

MATERIALS: ADMIRE 240 F (imidacloprid 240 g/L), TI-435 600 F (clothianidin 600 g/L), CALYPSO 480 SC (thiacloprid 480 g/L)

METHODS: Chitted seed potatoes were planted on the SCPFRC-London Research Farm on 22 May in single-row (10 plants/row) microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated 3 times in a randomized complete block design. To supplement scanty rainfall, microplots received 10 mm water via sprinkler-irrigation on 21 June, 2, 16 July and 2 August. On 8 July when plants were in full flower, 55 fully expanded compound leaves were tagged in each plot. Later on 8 July, all treatments were applied at 250 kPa in 900 L/ha using a hand-held, CO_2-pressurized, R&D plot sprayer with a single disc-core (D4-25) hollow cone spray tip. Residual effectiveness of foliar deposits against both adult and larval insecticide-susceptible, laboratory-reared CPB was measured by bioassay. As soon as spray deposits had dried on the foliage, a total of 6 compound leaves were harvested from each plot of each treatment and returned to the laboratory. Tagged compound leaves were thereafter collected at regular intervals for further bioassay (Tables 1-4). If CPB numbers were sufficient, on each collection date a total of 9 adult-bioassays (3 bioassays/plot x 3 plots/tmt.), each containing 1 tri-foliate leaflet and 5 CPB adults, and 9 larval-bioassays (3 bioassays/plot x 3 plots/tmt.), each containing two, 2.1 cm^2 leaf discs and 5 first instar larvae, was established for each treatment. Bioassays were held at 25°C, 55% RH, and 16:8 L:D photoperiod. For each set of bioassays, mortality and leaf damage were recorded after 72 hrs. Mortality was corrected using Abbott's factor and subjected to arcsin square root transformation prior to statistical analysis by analysis of variance (ANOVA). Fisher's Protected Least Significant Difference test was then used to estimate significance of differences among treatment means. Untransformed data are presented in the tables. Adult-feeding damage was rated on 0-10 scale where 0.0 represents no feeding damage, 5.0 represents 50% loss of leaf area, 10.0 represents 100% consumption of the leaf. Larval feeding damage was measured directly. Areas of leaf discs remaining after 72 hrs were read directly using a LI-COR® portable leaf-area meter; larval-leaf consumption was calculated by subtracting the disc-area at the end of each bioassay from the area of standard leaf discs collected at the beginning of each bioassay. Significance of observed differences in leaf consumption among treatments was determined by ANOVA as described above.

RESULTS: After application on 8 July, no rain fell during the 24 hrs after treatment. A total of 4.4 mm of rainfall subsequently accumulated by 5 days after treatment (DAT) and reached 17.4 mm by 14 DAT. Temperature reached 31.4°C on Day 0 (8 July); the average daily maximum temperature over the first 5 DAT was 26.8°C. No phytotoxicity was noted following any treatment.
In bioassay, foliar application of all tested neonicotinoid insecticides killed at least 80% of exposed adult CPB for 1 DAT (Table 1). Thereafter until 10 DAT, foliar application of TI-435 proved significantly more toxic

to exposed adult CPB than did similar application of either ADMIRE or CALYPSO; mortality of exposed adult CPB, however, did not exceed 80% for any tested neonicotinoid beyond 1 DAT (Table 1). In this trial, foliar application of all neonicotinoids significantly reduced feeding damage by adult CPB in bioassay for at least 21 DAT (Table 2). Feeding damage was reduced by at least 75% for 7 DAT for all tested insecticides. While feeding by adult CPB before 4 DAT and after 14 DAT was the same in bioassays of all treatments, foliar application of TI-435 had a significantly greater impact 7 and 10 DAT (Table 2). While foliar residues of tested neonicotinoids did not remain highly toxic to first instar CPB larvae beyond 1 DAT (Table 3), those deposits did significantly reduce larval feeding for at least 21 DAT (Table 4). Residues of TI-435 were significantly more toxic to first instar larvae than either ADMIRE or CALYPSO 1 DAT and remained numerically more toxic until 7 DAT (Table 3). On 2 and 4 DAT, significantly more feeding by first instar larvae was recorded in bioassays of foliage treated with CALYPSO than in foliage treated with either ADMIRE or TI-435 (Table 4).

CONCLUSIONS: Based on the overall results of this experiment, foliar residues of the tested rates of ADMIRE, TI-435 and CALYPSO remained acutely toxic for only 1 DAT. However, feeding by both adult and first instar larval CPB was significantly reduced for at least 21 days. Although the trend was not always significant, insecticidal residues of T1-435 following foliar application appeared to be more persistent than either ADMIRE or CALYPSO.

Table 1. Effect of treated potato foliage on mortality of Colorado potato beetle (CPB) adults after feeding for 72 hours in bioassay, foliar treatments, London, ON, 2002.

Tmt. No.	Treatment Applied	Formulation Applied	Rate Applied (g a.i../ha)	Average % Corrected CPB Mortality on Indicated Day After Treatment						
				0	1	4	7	10	14	21
1	imidacloprid	ADMIRE 240 F	48.0 g	97.7 a[1]	86.1 a	43.6 b	23.8 b	7.4 b	11.4 a	0.0 a
2	clothianidin	TI-435 600 F	24.0 g	97.7 a	88.9 a	79.5 a	71.4 a	46.9 a	13.8 a	11.1 a
3	thiacloprid	CALYPSO 480S C	24.0 g	100.0 a	83.3 a	40.2 b	41.3 b	8.6 b	6.8 a	7.9 a

[1] Means within a column followed by the same letter are not significantly different (P#0.05) as determined using ANOVA and Fisher's Protected Least Significant Difference test.

Table 2. Effect of treated potato foliage on feeding damage by Colorado potato beetle (CPB) adults after 72 hours in bioassay, foliar treatments, London, ON, 2002.

Tmt. No.	Treatment Applied	Formulation Applied	Rate Applied (pdct./ha)	Average Feeding Damage Rating[1] on Indicated Day After Treatment						
				0	1	4	7	10	14	21
1	imidacloprid	ADMIRE 240 F	48.0 g	0.2 b[2]	0.8 b	0.9 b	1.6 bc	6.1 b	4.5 b	4.7 b
2	clothianidin	TI-435 600 F	24.0 g	0.1 b	0.7 b	0.9 b	0.8 c	2.2 d	3.9 b	4.8 b
3	thiacloprid	CALYPSO 480 SC	24.0 g	0.2 b	0.6 b	2.0 b	2.0 b	4.1 c	4.3 b	4.1 b
4	CONTROL	no insecticide	----[3]	4.7 a	5.5 a	5.7 a	8.0 a	8.2 a	9.5 a	9.5 a

[1] Actual 72-hour leaf damage rating (0-10 scale where 0.0 represents no feeding damage, 5.0 represents 50% loss of leaf area, 10.0 represents 100% consumption of the leaf).
[2] Means within a column followed by the same letter are not significantly different (P#0.05) as determined using ANOVA and Fisher's Protected Least Significant Difference test.
[3] No insecticide applied.

Table 3. Effect of treated potato foliage on mortality of first instar Colorado potato beetle (CPB) larvae after feeding for 72 hours in bioassay, foliar treatments, London, ON, 2002.

Tmt. No.	Treatment Applied	Formulation Applied	Rate Appl. (g a.i./ha)	Average % Corrected CPB Mortality on Indicated Day After Treatment							
				0	1	2	4	7	10	14	21
1	imidacloprid	ADMIRE 240 F	48.0 g	100.0 a[1]	49.8 b	28.9 a	17.8 a	11.1 a	0.0 a	0.0 a	0.0 a
2	clothianidin	TI-435 600F	24.0 g	100.0 a	100.0 a	62.2 a	25.7 a	15.6 a	0.0 a	0.0 a	0.0 a
3	thiacloprid	CALYPSO 480 SC	24.0 g	100.0 a	47.5 b	33.3 a	0.0 b	8.9 a	2.2 a	2.2 a	0.0 a

[1] Means within a column followed by the same letter are not significantly different (P#0.05) as determined using ANOVA and Fisher's Protected Least Significant Difference test.

Table 4. Effect of treated potato foliage on feeding damage by first instar Colorado potato beetle (CPB) larvae after 72 hours in bioassay, foliar treatments, London, ON, 2002.

Tmt. No.	Treatment Applied	Formulation Applied	Rate Applied (pdct./ ha)	Average Leaf Area Consumed[2] (cm^2) on Indicated Day After Treatment							
				0	1	2	4	7	10	14	21
1	imidacloprid	ADMIRE 240 F	48.0 g	0.0 b[1]	0.1 b	0.1 c	0.8 c	0.7 b	1.3 b	1.4 b	0.3 c
2	clothianidin	TI-435 600 F	24.0 g	0.0 b	0.0 b	0.1 c	0.8 c	0.5 b	1.3 b	1.4 b	0.5 bc
3	thiacloprid	CALYPSO 480 SC	24.0 g	0.0 b	0.1 b	0.5 b	1.7 b	0.8 b	1.3 b	1.2 c	0.6 b
4	CONTROL	no insecticide	---[3]	0.6 a	1.3 a	1.9 a	2.4 a	2.4 a	2.4 a	2.7 a	2.2 a

[1] Means within a column followed by the same letter are not significantly different (P#0.05) as determined using ANOVA and Fisher's Protected Least Significant Difference test.
[2] Actual area (cm^2) of leaf-disc consumed during 72 hour feeding period.
[3] No insecticide applied.

2002 PMR REPORT # 62 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR : 61006537

CROP: Barley (*Hordeum vulgare* L.), cv. Sunderland
PEST: Wireworm, (Elateridae, spp)

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TITLE: CONTROL OF WIREWORM IN BARLEY WITH SEED TREATMENTS

MATERIALS: RAXIL 250 FL (tebuconazole, 250 g ai/L); G2106-04 (carbathiin + lindane, 180 g ai/L + 165 g/L); GAUCHO 480FL (imidacloprid, 480 g ai/L); G2051-16 (carbathiin + thiram, 169.6 g ai/L + 150.6 g ai/L); G7009-01 (clothianidin, 600 g ai/L); L0112-A1 (imidacloprid, 600 g ai/L); G2789-05 (carbathiin 233 g ai/L).

METHODS: Barley seed was treated in 1 kg lots in individual plastic bags by applying a slurry of material via a syringe to each bag (all treatments diluted in water to the same volume of 3 ml per kg). The seed was then mixed in the inflated bag for 1 min to ensure thorough seed coverage. The barley was planted on 10 May, 2002 at Ridgetown using a two-row cone-seeder mounted on a John Deere Max Emerge planter Plots were single rows spaced 0.76 m apart and 6 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was determined on 29 May and 6 June, 2002 and vigor assessment, using a scale of 0 -100, (100= most advanced plant and 0 = dead plants dead in the trial) was recorded on the same dates. The total number of plants per meter and the number of damaged plants was estimated on 18 June, 2002. Wireworm populations were estimated on 18 June, 2002 by digging up 1 m of row in a trench 15.2 cm deep and 10.16 cm wide in the check plots, sifting the soil and separating out the wireworms. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Table 1.

CONCLUSIONS: The wireworm population in this trial was high. Direct effects on wireworm activity were not evident with any treatment. However, plant stand and vigor were significantly improved when an insecticide was combined with a fungicide, compared with a fungicide alone, suggesting that the treatments provide protection against the effects of feeding, rather than control the insect. Clothianidin and imidacloprid provided equivalent protection against the effects of the wireworm similar to the treatment containing lindane.

Table 1. Plant stand, vigor, plant damage and insect assessments of barley at Ridgetown, Ontario. 2002

Treatment	Rate	Emerge	Plant Stand	Vigor		Plants	DamPlt	Insects	InsDam
	g ai/100 kg.	number plants/plot		0-100%		number per m			%Dam pl
		29 May	6 June	29 May	6 June	18 June	18 June	18 June	4 leaf
Untreated Check		257 c *	81 c *	57.5 b	37.5 b	11 c	9.8 b	7	90
RAXIL 250 FL	1.5	253 c	141 b	52.5 b	50.0 b	20 bc	16.3 ab	7.8	85
G2106-04	104	348 ab	292 a	90.0 a	92.5 a	44 a	24.8 ab	9.5	59
GAUCHO 480	10	301 bc	259 a	90.0 a	82.5 a	33 ab	28.3 ab	16.3	86
GAUCHO 480	20	332 ab	297 a	85.0 a	95.0 a	31 ab	22.5 ab	16	72
+RAXIL 250 FL	1.5								
G2051-16	106	316 b	263 a	77.5 a	85.0 a	28 abc	20.5 ab	13.8	76
+GAUCHO 480	10								
G7009-01	20	392 a	278 a	85.0 a	90.0 a	40 ab	31.0 a	15.3	78
+RAXIL 250 FL	1.5								
G7009-01	10	320 b	250 a	85.0 a	77.5 a	27 abc	22.0 ab	12.8	82
+RAXIL 250 FL	1.5								
GAUCHO 480	1.5	316 b	253 a	75.0 a	75.0 a	33 ab	26.8 ab	13.5	77
+L0112-A1	10								
G2789-05	58	334 ab	263 a	87.5 a	90.0 a	39 ab	31.8 a	14	83
+L0112-A1	10								
RAXIL 250 FL	1.5	295 bc	219 a	72.5 a	72.5 a	28 abc	19.5 ab	9.5	74
+L0112-A1	5.1								
G7009-01	5.1	321 b	185 ab	87.5 a	75.0 a	31 ab	24.5 ab	10.5	80
+RAXIL 250 FL	1.5								
LSD		1.2	2.4	13.5	16.6	12.9	11.6	NS	NS
CV		4.7	11.0	11.9	15.0	29.7	34.7	50.3	17.6

* Means followed by same letter do not significantly differ (P= 0.05, LSD)

2002 PMR REPORT # 63 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: White Beans (*Phaseolus vulgaris* L.), cv. Stinger
PEST: Seedcorn maggot *Delia platura* (Meigen)
Potato leafhopper *Empoasca fabae* (Harris)

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TITLE: **CONTROL OF SEED CORN MAGGOT AND POTATO LEAFHOPPERS IN WHITE BEANS WITH SEED TREATMENT**

MATERIALS: APRON MAXX RTA 19.05 FS (fludioxonil + metalaxyl-m, 7.69 + 11.54 g ai/L); CRUISER 350 FS (thiamethoxam, 350 g ai/L); DCT (diazinon + captan + thiophanate-methyl, 18% + 6% 14%); FORCE ST 200 ME (tefluthrin, 200 g ai/L).

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying the treatment or slurry via a syringe to each bag (all treatments diluted to the same volume of 3.0 ml/kg seed using water). The seed was then mixed in the inflated bag for 1 min to ensure thorough seed coverage. Cattle manure was broadcast on the plots 2 weeks before planting and the soil was disked shortly after the manure application. The crop was planted at Ridgetown on 11 May, 2002 and at Highgate, ON on 21 May, 2002 using a 2-row cone seeder. Plots were 2 rows spaced 0.76 m apart and 6 m in length placed in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Total plot emergence was evaluated at Ridgetown on 11, 16 and 25 June, and 4 July, 2002 and at Highgate on 3,12 and 26 June, and 3 July, 2002 respectively. Vigor was assessed using a scale of 0-100% (100 = furthest developed plant in the trial and 0 = plant dead) on 11 June, 2002 at Ridgetown and 3 June, 2002 at Highgate respectively. Seed corn maggot populations were estimated in the check plots on 12 June at both locations by digging up all the plants and seed remains from 1 m of row. Seed corn maggot damage was assessed on the same day. Plants/seeds showing maggot feeding damage were counted and percent control was calculated as 100-(100*damaged/total plants and seeds). Leafhopper nymphs (ten trifoliates examined per plot) and hopper burn (visual assessment of 1-5 scale where 1 = no damage and 5 = plants severely stunted, leaves curled and scorched) were counted/assessed on 9 July at the Ridgetown and Highgate locations. Plant fresh weights of above ground whole plants from 6 m of row were measured on 21 Aug, 2002 at both locations. Remaining plots were harvested on 12 Sept, 2002 at both locations and yields converted to 14.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-6. Mean seedcorn maggot populations in the check plots averaged 0.75 and 0.25/plant at Ridgetown and Highgate respectively.

CONCLUSIONS: At the Ridgetown site, CRUISER did not improve emergence but final plant stand in CRUISER-treated plots was significantly higher than in the fungicide check, but not as high as in DCT-treated plots. The high rate of CRUISER was needed to significantly improve seedcorn maggot control, but the control at the Ridgetown site was not as good as that achieved using DCT. We cannot explain why hopperburn and leafhopper populations were low in the fungicide checks, but both parameters were significantly lower in CRUISER-treated plots than in the plots treated with either DCT or FORCE ST.

At the Highgate location seedcorn maggot control, plant stand and vigor increased with increasing rates of CRUISER. The highest rate of CRUISER was the most effective by far. DCT and FORCE ST seed treatments were similar in effectiveness to 30 or 50 g ai/L of CRUISER. Yield was extremely variable and severely hampered by the drought.

Table 1. Plant stand, vigor and seedcorn maggot control in white beans at Ridgetown. 2002.

Treatment	Rate	Emergence	SCM	Vigor	Plant Stand		
	g ai/100	#/plot	%	0-100	number plants per plot		
	kg.	11 June	control	11 June	16 June	25 June	4 July
FUNGICIDE CHECK	6.25	3.3 b *	0 c	12.5 b	1.8 b	0.8 b	0.4 c
- APRON MAXX RTA 19.05 FS							
APRON MAXX RTA 19.05 FS	6.25	8.3 ab	25 bc	42.5 ab	6.8 ab	5.8 b	4.9 b
+CRUISER 350 FS	15						
APRON MAXX RTA 19.05 FS	6.25	9.0 ab	31 bc	32.5 ab	8.0 ab	6.5 b	4.2 b
+ CRUISER 350 FS	30						
APRON MAXX RTA 19.05 FS	6.25	8.0 ab	26 bc	40.0 ab	7.0 ab	5.8 b	5.3 b
+CRUISER 350 FS	50						
APRON MAXX RTA 19.05 FS	6.25	10.3 ab	44 ab	47.5 ab	10.5 ab	8.8 b	5.2 b
+CRUISER 350 FS	100						
DCT	197.6	19.5 a	78 a	80.0 a	17.8 a	17.5 a	17.4 a
APRON MAXX RTA 19.05 FS	6.25	13.8 ab	48 ab	85.0 a	11.3 ab	11.0 ab	9.4 b
+ FORCE Seed Treatment 200 ME	40						
LSD		8	37.1	44.2	8.1	7	1
CV		52.2	56.8	61.3	60.8	58.6	26.4

*Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Leafhopper assessments in white beans at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Nymphs /trifoliate 9 July	Hopperburn 1-5 9 July	Hopperburn 1-5 23 July
FUNGICIDE CHECK - APRON MAXX RTA 19.05 FS	6.25	1.6 b *	0.50 c *	0.63 b *
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 15	1.5 b	0.50 c	0.88 b
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	0.2 b	0.13 c	0.50 b
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	0.4 b	0.13 c	0.63 b
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 100	0.6 b	0.25 c	0.50 b
DCT	197.6	7.1 a	2.25 a	2.50 a
APRON MAXX RTA 19.05 FS + FORCE Seed Treatment 200 ME	6.25 40	7.6 a	1.38 b	2.13 a
LSD		2.5	0.4	0.6
CV		61.8	37	38.6

*Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 3. Fresh weight and yield assessments in white beans at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Fresh Wt kg/6m 21 Aug	Yield T/ha 12 Sept
FUNGICIDE CHECK - APRON MAXX RTA 19.05 FS	6.25	0.2	0
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 15	0.29	0.01
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	0.34	0.08
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	0.58	0.09
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 100	0.67	0.15
DCT	197.6	1.04	0.41
APRON MAXX RTA 19.05 FS + FORCE Seed Treatment 200 ME	6.25 40	0.8	0.07
LSD		NS	NS
CV		87.6	81.4

*Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 4. Plant stand, vigor and seedcorn maggot damage assessments for white beans at Highgate, Ontario. 2002

Treatment	Rate g ai/100 kg.	Emerg #/plot 3 June	Vigor 0-100 12 June	SCM % control 12 June	Plant Stand number plants per plot 12 June	26 June	3 July
FUNGICIDE CHECK - APRON MAXX RTA 19.05 FS	6.25	2.3 e	15.0 c	0 b	0.2 d *	0.0 c	0.0 c
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 15	11.8 de	12.5 c	6 b	3.9 cd	4.8 bc	4.8 bc
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	28.3 c	35.0 c	11 b	8.9 bc	10.3 bc	10.3 bc
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	40.8 b	72.5 b	24 b	21.0 b	23.5 b	23.5 b
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 100	78.8 a	100.0 a	67 a	65.0 a	69.0 a	69.0 a
DCT	197.6	27.5 c	41.3 c	23 b	16.9 b	22.3 bc	22.3 bc
APRON MAXX RTA 19.05 FS + FORCE Seed Treatment 200 ME	6.25 40	17.0 cd	13.8 c	6 b	4.1 cd	6.5 bc	6.5 bc
LSD		10.9	26.1	17.1	1.3	15.5	15.5
CV		24.9	42.5	58.5	24.6	53.5	53.5

*Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 5. Leafhopper assessments in white beans at Highgate, Ontario. 2002

Treatment	Rate g ai/100 kg.	Nymphs #/Trif 9 July	Hopperburn 1 - 5 9 July	Hopperburn 1 - 5 9 July
FUNGICIDE CHECK - APRON MAXX RTA 19.05 FS	6.25	0	0	0.5
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 15	1.3	0.5	1
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	2.3	0.88	1.4
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	2	1	1.1
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 100	4	1.6	2.3
DCT	197.6	2.8	1.5	2.3
APRON MAXX RTA 19.05 FS + FORCE Seed Treatment 200 ME	6.25 40	2.8	1	1.9
LSD		NS	NS	NS
CV		100.9	98.8	63.3

*Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 6. Fresh weight and yield assessements in white beans at Highgate, Ontario. 2002

Treatment	Rate g ai/100 kg.	Fresh Weight kg/6m 21 Aug	Yield T/ha
FUNGICIDE CHECK - APRON MAXX RTA 19.05 FS	6.25	0	0
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 15	0.45	0.05
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	0.29	0.03
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	1.66	0.21
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 100	0.61	0.1
DCT	197.6	0.68	0.13
APRON MAXX RTA 19.05 FS + FORCE Seed Treatment 200 ME	6.25 40	0.42	0.04
LSD		NS	NS
CV		173.7	111.8

*Means followed by same letter do not significantly differ, (P= 0.05, LSD)

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SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests
ICAR:

CROP: Corn (Zea mays L.)
PESTS: Wireworm (Elateridae spp.)
Corn rootworm (Diabrotica virgifera virgifera)
Black cutworm (Agrotis ipsilon, Hufnagel)
European chafer (Rhizotrogus majalis, Razoumowsky)

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TITLE: **THE EFFECTS OF CLOTHIANIDIN TI435 SEED TREATMENT ON CORN ESTABLISHMENT AND EARLY CORN GROWTH IN FARM FIELDS INFESTED WITH EITHER WIREWORM, BLACK CUTWORM, CORN ROOTWORM, OR EUROPEAN CHAFER.**

MATERIALS: CLOTHIANIDIN (E)-1-(2-chloro-1,3-thiazol-5-ylmethyl)-3-methyl-2-nitroguanidine

METHODS: Forty farm fields were selected across southern Ontario before corn planting in the spring of 2002 with anticipated or known infestations of either wireworm, black cutworm, corn rootworm or European chafer At approximately two weeks before planting, seeds were either treated on-farm using a gasoline-powered portable cement mixer and $C0_2$-powered spray atomizer, or treated off-farm using a commercial treater through Pioneer Hi-Bred Limited. The hybrid of seed corn that for the insecticide treatment was depended on the grower; seeds that were treated on-farm were those purchased and planned by the corn grower. All seeds used in the study were pre-treated commercially with a fungicide. Three insecticide treatment-rate strips were planted across the entire length of each field by each corn grower/co-operator using their own planting equipment at target plant populations. The treatments included an untreated check (i..e., not treated with clothianidin), a low rate of clothianidin (0.25 mg a.i. kernel^{-1}, and a high rate (1.25 mg a.i. kernel^{-1}). Thirty-five of the 40 fields were planted in 76-cm-wide rows, while the other five fields were planted in 90-cm-wide rows. Target seeding rates varied from field-to-field (65,000 to 80,000 seeds per ha^{-1}), but the seeding rate was the same among the treatments in the same field. It was also planned that all treatments were to be replicated at least twice in a randomized complete block design; however, the number of actual replications varied from one to five depending on the field. All sites were monitored by Ridgetown College after planting to assess seed treatment performance on insect populations (counts) and/or insect damage on the plant stand, vigour and yield, as appropriate throughout the season. Dates and growth stages were recorded for all assessments. If differences between the treatments and the untreated control treatments are not apparent early in the season for wireworm, chafer, cutworm, and mid-season for corn rootworm, then the trial will be abandoned and yields will not be taken. Harvest date, grain yield, grain test weight, grain moisture will be recorded on sites with visible differences among treatments. Treatments were assessed along three transects that were established across treatment strips. If there was evidence that natural populations of the target pest may be higher in specific areas of each strip, then the transects crossed those areas. A visual assessment was made on most fields at corn emergence; however, most of the measurements in the crop were conducted between the third and sixth leaf stage of corn development. Measurements included plant populations of both healthy and plants lacking vigour, average leaf developmental stage per treatment strip, number of missing plants per 2, 5 m row segments, and plant height about 3 wk before tasseling. Populations of target pests were

assessed in each of the three untreated checks. Plants damaged by black cutworm were rated using the Guthrie Scale. The effects of corn rootworm were assessed about 2 wk before tasseling by excavating and washing roots from 12 plants per treatment per field (only in fields with visual damage). The roots were rated using the the Iowa 1-6 scale (Hills and Peters, 1971). The proportion of broken stalks (i.e., stalks broken below the ear) and root-lodged plants (i.e., stalks lodging more than 45 degrees from horizontal at the soil surface) were determined in each plot before harvest. Corn yields and harvest grain moisture were determined by harvesting the entire plot using the harvesting equipment of each farm co-operator. Grain corn was weighed in most fields using a weigh wagon. Harvest data were not obtained from several fields because either grain yields were not expected to be influenced by the insecticide treatments (i.e., low or non-existent insect infestations), or if high field variability was expected from factors not related to the treatments (e.g., planter problems, extreme drought, etc.).

RESULTS: Wireworm and corn rootworm were the major pests to induce significant damage in corn among the 40 fields used in the study. Damage caused by black cutworm was only evident in two fields of the fields. Populations of European chafer grubs in fields before corn planting were not active during early growth of corn; therefore, the activity of clothianidin on controlling the chafer grub could not be determined. Differences in corn growth and stand establishment were most apparent in fields where populations of wireworm were high (Tables 1 and 2). Of the 40 fields, five fields had the highest populations of wireworm. Wireworm populations varied from one to 15 wireworm per metre of corn row, depending on the field and the areas selected (i.e., along transects) within each field. Seeds treated with Clothianidin increased early plant populations at the 4- to 6-leaf stage, increased the proportion of emerged plants with high vigour and increased early development compared to seeds that were not treated with clothianidin (Table 1). In fields infested with wireworm, seeds treated with clothianidin produced taller plants with a lower coefficient of variation of plant heights within the stand (Table 2). In general, the high use rate of clothianidin did not improve corn establishment for wireworm control over the low use rate. The effect of clothianidin on reducing damage from corn rootworm was measured on only four fields, where visual damage was apparent in the untreated checks. Overall, scores of root damage averaged across plants were between 2.37 and 3.11 in the untreated checks (Table 3); scores higher than 2.0 indicates that roots from some plants have been completely pruned from the plant within 4 cm of the base (Hills and Peters, 1971). In contrast, plants treated with clothianidin scored below 1.92 for the low use rate of clothianidin and below 1.50 for the high use rate; scarring may be present but no roots eaten within 4 cm of the base of the plant with ratings less than 2.0. The high use rate treatment of clothianidin showed reduced root damage compared to the low use rate ($P = 0.05$), but only when the data was combined across field locations (Table 2). In general, the effect of clothianidin on grain corn yields depended on the level of damage caused by either wireworm or corn rootworm. In fields with low to moderate levels of wireworm or rootworm damage, clothianidin increased grain yields by up to 1.08 t ha^{-1} compared to the untreated check (see Broad, Table 4). In the McCallum field with a moderate level of damage caused by corn rootworm, the low use rate of clothianidin did not increase the yield of grain corn compared to untreated controls; however, grain yields were increased by 0.43 t ha^{-1} with the high use rate of clothianidin compared to the untreated check treatment ($P = 0.03$; see McCallum, Table 4). In the Broad field with similar rootworm damage, the low use rate increased grain yield by 0.89 t ha^{-1} compared to the yield in the untreated checks; yields were not different between the low use rate and the high use rate in this field. The response of grain yields to levels of pest infestation or visible damage was not as predictable in the fields arranged by Pioneer Hi-Bred (Table 5). The low rate of clothianidin increased grain yields by 0.35 t ha^{-1} (5.0%) compared to the untreated check when averaged across all of those fields (Table 5). Average differences between the low and high rate were less than 0.04 t ha^{-1}. In fields with visible damaged caused by either wireworm or corn rootworm, grain yields in the low use rate treatment averaged 0.27 t ha^{-1} (4%) higher compared to the check treatments. Even in fields with no visible damage caused by either corn rootworm or wireworm, grain yields averaged 0.45 t ha^{-1} higher (6.6%) across plots treated with the low use rate compared to the use of no insecticidal treatment (Table 5). There were no differences in either grain moisture at harvest or standability among the treatments.

CONCLUSIONS: Corn establishment, early corn growth, and grain yields were improved with the low use rate of clothianidin (0.25 mg a.i. kernel^{-1}) in most fields with wireworm infestations. The high use rate of clothianidin was more consistent than the low use rate in maintaining high yields and reducing root damage caused by infestations of corn rootworm.

Table 1. The effect of clothianidin seed treatments on corn plant population and early growth in fields infested with wireworm across southern Ontario, 2002.

Co-operator (Field Location)	Treatment/Contrast	Overall Population plants ha^{-1}	"High Vigor" Population plants ha^{-1}	"Low Vigor" Population plants ha^{-1}	Number Leaf Tips	Overall Vigor Rating[1] 1-10
Prieksaitis	Untreated	64.5	52.2	12.3	4.3	8.2
(Rodney)	Low Rate	74.4	67.8	6.6	4.5	9.2
	High Rate	70.8	62.7	8	4.5	9.6
			---------- p-values ----------			
	Untreated vs	0.01	0.01	0.07	0.05	0.01
	Low vs High Rate	ns	ns	ns	ns	ns
Littlejohn	Untreated	63.8	52.5	11.4	5.3	6.5
(Wallacetown)	Low Rate	69.7	68.4	1.3	5.8	8.6
	High Rate	70.5	70.5	0	6.1	9.6
			---------- p-values ----------			
	Untreated vs	0.15	0.015	0.0002	0.0017	0.007
	Low vs High Rate	ns	ns	ns	ns	ns
VanderPloeg	Untreated	65.5	61.5	3.9	8.5	7.5
(Dutton)	Low Rate	72.4	71.3	1	8.5	9
	High Rate	73	70.7	2.3	8.5	9
			---------- p-values ----------			
	Untreated vs	0.07	ns	ns	ns	ns
	Low vs High Rate	ns	ns	ns	ns	ns
McCallum Bros.	Untreated	61	57.1	3.9	7	7.3
(Iona)	Low Rate	65.6	65.1	0.5	7.3	8.4
	High Rate	62.7	61.4	1.3	7.3	8.3
			---------- p-values ----------			
	Untreated vs	0.08	0.02	0.003	0.06	0.03
	Low vs High Rate	ns	ns	ns	ns	ns
Roodzant	Untreated	59.9	53.7	6.3	6.5	6.5
(Rodney)	Low Rate	57.9	54.6	3.3	6.6	7.5
	High Rate	62.5	61.9	0.7	6.8	8
			---------- p-values ----------			
	Untreated vs	0.81	0.07	0.09	ns	0.07
	Low vs High Rate	ns	ns	ns	ns	ns

[1] Average vigor ratings per plot; 10 = tallest, 9 = 10% shorter, etc.

Table 2. The effect of clothianidin seed treatments on the height of corn plants in early July in 2002.

Co-operator (Field Location)	Treatment/Contrast	Average Plant Height cm	Plant Height CV
Prieksaitis	Untreated	151	15.3
(Rodney)	Low Rate	157	9.2
	High Rate	166	8.5
		---------- p-values ----------	
	ANOVA	0.05	0.02
	Untreated vs	0.05	0.009
	Low vs High rate	0.11	ns
Littlejohn	Untreated	121	15.7
(Wallacetown)	Low Rate	128	9.3
	High Rate	133	8.3
		---------- p-values ----------	
	ANOVA	0.001	<0.0001
	Untreated vs	0.0007	<0.0001
	Low vs High Rate	0.09	ns
VanderPloeg	Untreated	149	13.5
(Dutton)	Low Rate	173	7.8
	High Rate	174	7.9
		---------- p-values ----------	
	ANOVA	0.12	0.01
	Untreated vs	0.04	0.003
	Low vs High Rate	ns	ns
Roodzant	Untreated	118	14.2
(Rodney)	Low Rate	116	15.6
	High Rate	123	12.2
		---------- p-values ----------	
	ANOVA	ns	0.2
	Untreated vs	ns	ns
	Low vs High Rate	ns	0.08

Table 3. The effect of clothianidin seed treatment on corn rootworm damage to roots and plant heights in selected fields across southern Ontario, 2002.

Co-operator	Treatment	Root Rating 1-6	Plant Height cm
Aerts (Komoka)	Untreated	2.57 (1.55)[1]	184 (26)
	Low Rate	1.79 (1.10)	191 (21)
	High Rate	1.49 (0.79)	195 (23)
		---------- p-values ----------	
	ANOVA	0.004	0.51
	Untreated vs Treated	0.001	0.29
	Low Rate vs High Rate	0.23	0.72
Hart (Woodstock)	Untreated	3.11 (1.50)	214 (29)
	Low Rate	1.92 (1.12)	220 (28)
	High Rate	1.26 (0.63)	224 (32)
		---------- p-values ----------	
	ANOVA	0.0003	0.33
	Untreated vs Treated	0.0001	0.17
	Low Rate vs High Rate	0.04	0.58
Hooker (Belmont)	Untreated	2.37 (1.39)	184 (33)
	Low Rate	1.69 (0.93)	187 (24)
	High Rate	1.50 (0.72)	197 (17)
		---------- p-values ----------	
	ANOVA	0.14	0.22
	Untreated vs Treated	0.06	0.25
	Low Rate vs High Rate	0.65	0.18
McCallum (Iona)	Untreated	2.14 (1.00)	183 (25)
	Low Rate	1.36 (0.56)	194 (19)
	High Rate	1.32 (0.62)	189 (23)
		---------- p-values ----------	
	ANOVA	0.0019	0.012
	Untreated vs Treated	0.0006	0.008
	Low Rate vs High Rate	0.82	0.1
Average	Untreated	2.56 (1.42)	0.95 (0.14)[2]
	Low Rate	1.69 (0.98)	0.99 (0.11)
	High Rate	1.39 (0.70)	1.00 (0.12)
		---------- p-values ----------	
	ANOVA	<0.0001	0.012
	Untreated vs Treated	<0.0001	0.004
	Low Rate vs High Rate	0.05	0.43

[1] Standard Error of the Mean (SEM) in parentheses
[2] Average plant heights were transformed relative to the mean of each replication in each fields before analysis.

Table 4. The effect of clothianidin seed treatment on corn grain yields in selected fields across southern Ontario, 2002.

Co-operator/Pest	Treatment	Broken Stalks %	Harvest Grain Moisture Content g g^{-1}	Grain Yield t ha^{-1}
Prieksaitis	Untreated	5.1	21.1	4.85
wireworm: high infest	Low Rate	5.7	20.1	5.57
	High Rate	6	20.4	5.89
		---------- p-values ----------		
	ANOVA	ns	0.14	0.0007
	Untreated vs	0.16	0.06	0.0003
	Low Rate vs High	ns	ns	0.09
Littlejohn	Untreated	4	21.7	7.43
wireworm: mod-high infest	Low Rate	3.3	21.3	8.19
	High Rate	4.7	22	7.65
		---------- p-values ----------		
	ANOVA	ns	ns	0.11
	Untreated vs	ns	ns	0.11
	Low Rate vs High	ns	ns	0.12
Broad	Untreated	1.6	22	8.68
rootworm: moderate	Low Rate	1.8	22	9.59
	High Rate	1.6	22	9.76
		---------- p-values ----------		
	ANOVA	ns	ns	<0.0001
	Untreated vs	ns	ns	<0.0001
	Low Rate vs High	ns	ns	0.13
Hooker	Untreated	6	18.2	6.09
rootworm: light	Low Rate	5.3	18	5.99
	High Rate	5.3	18.1	6.06
		---------- p-values ----------		
	ANOVA	ns	0.03	ns
	Untreated vs	ns	0.04	ns
	Low Rate vs High	ns	0.03	ns
McCallum	Untreated	8	22	5.63
rootworm/wireworm	Low Rate	9.6	22.2	5.68
moderate/light	High Rate	6.6	22.4	6.06
		---------- p-values ----------		
	ANOVA	0.09	0.14	0.04
	Untreated vs	ns	ns	0.09
	Low vs High Rate	0.03	0.06	0.03

Table 5. The effect of clothianidin seed treatment on corn grain yields in fields harvested by Pioneer Hi-Bred Limited in 2002.

Fields Grouped According to Pest Infestation Level [1]	Treatment	Harvest Grain Moisture Content $g\ g^{-1}$	Grain Yield $t\ ha^{-1}$
Low infestations (7 fields)	Untreated	25.7	6.54
	Low Rate	25.3	6.81
	High Rate	25.6	6.77
		---------- p-values ----------	
	ANOVA	ns	0.04
	Untreated vs	ns	0.01
	Low Rate vs High	ns	ns
No detectable infestations (9 fields)	Untreated	20.3	6.79
	Low Rate	19.5	7.24
	High Rate	21.1	7.34
		---------- p-values ----------	
	ANOVA	0.009	0.0001
	Untreated vs	ns	<0.0001
	Low Rate vs High	0.003	ns

2002 PMR REPORT #65 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: Corn (*Zea maize* L.), cv. D73
PEST: Western Corn Rootworm, *Diabrotica virgifera virgifera* LeConte

NAME AND AGENCY:
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TITLE: CONTROL OF CORN ROOTWORM IN CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FL (fludioxonil + metalaxyl-M, 229.59 g ai/L + 87.66 g/L); G7009-01 (clothianidin, 600 g ai/L); COUNTER 15 G (terbufos, 15%)

METHODS: Seed was treated on 8 May, 2002 in 1 kg lots in individual plastic bags by applying a slurry of the material via syringe to each bag (all treatments diluted to a total volume of 8.4 ml/kg using water). The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. Seed weight was 277 g/1000 seeds. Inoculations with corn rootworm eggs were made at all three sites prior to planting using a two-row cultivator modified to apply a 4 cm band of eggs, 5 cm deep and 9 cm on each side of the corn row. Eggs were suspended uniformly in a 0.15% agar solution at a concentration of 20 eggs/ml and delivered through tubes from a holding tank at a rate of 2600 eggs/m by a ground driven metering pump (Demco model MP-466). Corn was planted in 1 row plots on 21 May, 2002 at London, ON and on 28 May, 2002 in two locations at Ridgetown using a two-row cone-seeder at a seeding rate of 8 seeds/m. COUNTER 15 G was applied in-furrow at planting using a Noble® plot scale applicator. Plots were spaced 0.76 m apart and were 10 m long in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant emergence was assessed on 6 June, 2002. Vigor was recorded on 6 June using a scale of 0-100% (100= furthest developed plant and 0 = dead plants). Plant stand was assessed on 13 and 20 June 2002 respectively at the London site. The same assessments were made at both of the Ridgetown sites on 10, 17 and 24 June 2002 respectively. Plant lodging was assessed as % plants per plot. Root damage assessments at the London and Ridgetown sites were recorded on 18 and 19 July 2002 respectively. Five plants per plot were dug up, washed and rated for root worm damage using the Iowa 1-6 scale where 1= no damage and 6= 3 or more nodes severely pruned. Plots were harvested on 23 Oct, 2002 at both Ridgetown sites and on 1 Nov, 2002 at London and yields converted to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-6. There were no lodged plants at the London location.

CONCLUSIONS: Insecticide treatments either in-furrow or as seed treatments improved crop vigor significantly at one of the locations. G7009-01 provided a similar level of protection against rootworm damage as COUNTER 15 G applied in-furrow. Yield for insecticide-protected plots was more than double than yields measured in untreated controls at the second Ridgetown site.

Table 1. Plant stand and vigor assessments at London, Ontario. 2002

Treatment	Rate g ai/100 kg. or g ai/80,000 seeds	Emerge	Plant stand number plants per 2m		Vigor 0-100%
		6 June	13 June	20 June	6 June
Untreated Control		63	65	64	72.5
MAXIM XL 324 FL	3.46	62.8	65	65	82.5
G7009-01 g ai/80,000 seeds	100	64.8	67	66	92.5
+MAXIM XL 324 FL	3.46				
COUNTER - In-Furrow	11.25	64.8	67	67	87.5
+MAXIM XL 324 FL	3.46				
LSD		NS	NS	NS	NS
CV		3.2	0.69	2.5	14.2

***** Means followed by the same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Insect damage and yield assessments at London, Ontario. 2002

Treatment	Rate g ai/100 kg. or g ai/80,000 seeds	Avg Insect Damage Iowa 1-6 18 July	Yield T/ha 1 Nov
Untreated Control		4.5	5.7
MAXIM XL 324 FL	3.46	3.4	6.4
G7009-01 g ai/80,000 seeds	100	1.8	6.7
+MAXIM XL 324 FL	3.46		
COUNTER - In-Furrow	11.25	2.7	6
+MAXIM XL 324 FL	3.46		
LSD		NS	NS
CV		49.6	11.1

***** Means followed by the same letter do not significantly differ, (P= 0.05, LSD)

Table 3. Plant stand and vigor assessments at Location 1 at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg or g ai/ 80,000 seeds	Emerge number plants per 2m 10 June	Plant Stand number plants per 2m 17 June	Plant Stand number plants per 2m 20 June	Vigor 0-100% 10 June
Untreated Control		67	69	66	75.0 b *
MAXIM XL 324 FL	3.46	70	69	69	77.5 b
G7009-01 g ai/80,000 seeds	100	71	73	72	92.5 a
+MAXIM XL 324 FL	3.46				
COUNTER - In-Furrow	11.25	76	75	74	97.5 a
+MAXIM XL 324 FL	3.46				
LSD		NS	NS	NS	10.8
CV		10	6.6	6.1	7.9

*****Means followed by the same letter do not significantly differ, (P= 0.05, LSD)

Table 4. Insect damage, lodging and yield assessements at Location 1 at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg. or g ai/ 80,000 seeds	Avg Ins Damage Iowa 1-6 18 July	% Plants Lodged 18 July	Yield T/ha 23 Oct
Untreated Control		5.3 a	51 a	6.2
MAXIM XL 324 FL	3.46	4.7 ab	47 a	4.9
G7009-01 g ai/80,000 seeds	100	3.0 b	8 b	5.6
+MAXIM XL 324 FL	3.46			
COUNTER - In-Furrow	11.25	2.8 b	1 b	6.8
+MAXIM XL 324 FL	3.46			
LSD		2	2.1	NS
CV		31.5	49.3	37.9

***** Means followed by the same letter do not significantly differ, (P= 0.05, LSD)

Table 5. Plant stand and vigor assessments at Location 2 at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg or g ai/80,000 seeds	Emerge number plants per 2m 10 June	Plant Stand number plants per 2m 17 June	Plant Stand number plants per 2m 24 June	Vigor 0-100% 10 June
Untreated Control		63	65.1	64.3	72.5
MAXIM XL 324 FL	3.46	62.8	64.7	65	82.5
G7009-01 g ai/80,000 seeds	100	64.8	67	66.3	92.5
+MAXIM XL 324 FL	3.46				
COUNTER - In-Furrow	11.25	64.8	67.4	67	87.5
+MAXIM XL 324 FL	3.46				
LSD		NS	NS	NS	NS
CV		3.2	0.69	2.5	14.2

***** Means followed by the same letter do not significantly differ, (P= 0.05, LSD)

Table 6. Insect damage, lodging and yield assessments at Location 2 at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg. or g ai/80,000 seeds	Avg Insect Damage Iowa 1-6 18 July	% Plants Lodged	Yield T/ha 23 Oct
Untreated Control		4.6 a *	0.20833	1.2 b
MAXIM XL 324 FL	3.46	3.2 ab	0.16667	1.0 b
G7009-01 g ai/80,000 seeds	100	1.4 b	0.20833	3.0 a
+MAXIM XL 324 FL	3.46			
COUNTER - In-Furrow	11.25	2.0 ab	0.20833	2.7 a
+MAXIM XL 324 FL	3.46			
LSD		1.8	10.6	0.8
CV		29.7	62.5	23.5

***** Means followed by the same letter do not significantly differ, (P= 0.05, LSD) +

2002 PMR REPORT #66 **SECTION E: CEREAL, FORAGE CROPS, and OILSEEDS - Insects**
ICAR: 61006537

CROP: Corn (*Zea maize* L.), cv. D73
PEST: European chafer, *Rhizotrogus (Amphimallon) majalis*, Razoumowsky

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TITLE: **EUROPEAN CHAFER CONTROL IN CORN**

MATERIALS: G7009-01 (clothianidin, 600 g ai/L); G7014-03 (imidacloprid, 480 g ai/L); MAXIM XL 324FS (fludioxonil + metalaxyl-m, 229.59 g ai/L + 87.66 g ai/L); CRUISER 350 FS (thiamethoxam 350 g ai/L); GAUCHO 480 FL (imidacloprid, 480 g ai/L); FORCE 3G (tefluthrin, 3%); FORCE 200 ME (tefluthrin, 200 g ai/L); Titan 600 FL (clothianidin + fludioxonil + metalaxyl-m, 600 g ai/L + 229.59 g ai/L + 87.66 g ai/L)

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. Seed weight was 277 g/1000 seeds. In furrow granular insecticides were applied using a Noble® applicator. Corn was planted on 20 May, 2002 at Port Stanley and Dorchester, respectively, using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were two rows 6 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications at a seeding rate of 7 seeds/m. Plant emergence was taken at Port Stanley on 6, 13 and 20 June, 2002 and vigor rating was assessed on 6 and 13 June, 2002 using a scale of 0-100% (100 = most advance plant and 0 = dead plants). Plant emergence was taken at Dorchester on 7, 14 and 21 June, 2002 and vigor rating was assessed on 7 and 14 June, 2002 using the same scale. At the first emergence reading date, damaged plants and chafers were counted in the check plots by removing a 1 m trench of soil 15 cm wide and 10 cm deep and sifting out them out of the soil. Plots were harvested on 6 Nov, 2002 at Port Stanley and yields corrected to 15.5% moisture. No yield results were available from the Dorchester site. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-3. Mean damaged plants and chafer counts in the check plots at Dorchester were 0.3/m and 1.5/m, respectively, on 7 June, 2002. Mean damaged plants and chafer counts in the check plots at Port Stanley were 1.8/m and 2.8/m, respectively on 6 June and 2.3/m and 0.8/m, respectively on 13 June, 2002.

CONCLUSIONS: Yields from the Port Stanley site were too variable (CV 58%) to be used for meaningful comparisons. There were no significant differences amongst treatments. Yield variability was due to the severe drought. At the Dorchester location, only FORCE seed treatment significantly improved plant stand over the untreated checks. At the Port Stanley location, all the insecticide treatments improved plant stand compared to the untreated and fungicide only controls.

Table 1. Plant stand and vigor assessments of corn at Dorchester, Ontario. 2002

Treatment	Rate	Emerge	Plant Stand		Vigor	
	g ai/100 kg or g ai/ 80,000 seeds	number plants per plot			0-100%	
		7 June	14 June	21 June	7 June	14 June
Untreated Control		75 b *	72 c	73 b	62.5	67.5
MAXIM XL 324 FS	3.46	76 b	75 bc	76 ab	67.5	77.5
G7009-01 g ai/80,000 seeds	10	81 ab	81 abc	79 ab	62.5	72.5
+MAXIM XL 324 FS	3.46					
G7009-01 g ai/80,000 seeds	20	78 ab	78 abc	78 ab	72.5	85
+MAXIM XL 324 FS	3.46					
G7014-03 g ai/80,000 seeds	13	78 ab	79 abc	78 ab	67.5	75
+MAXIM XL 324 FS	3.46					
G7014-03 g ai/80,000 seeds	48	79 ab	80 abc	80 ab	60	67.5
+MAXIM XL 324 FS	3.46					
Fungicide Check-	3.5	77 ab	79 abc	79 ab	57.5	67.5
MAXIM XL 324 FS						
MAXIM XL 324 FS	3.5	80 ab	83 ab	81 ab	80	90
+CRUISER 350 FS	25					
MAXIM XL 324 FS	3.5	81 ab	81 abc	81 ab	82.5	82.5
+CRUISER 350 FS	50					
MAXIM XL 324 FS	3.5	79 ab	78 abc	77 ab	67.5	77.5
+CRUISER 350 FS	100					
MAXIM XL 324 FS	3.5	80 ab	80 ab	81 ab	60	72.5
+GAUCHO 480 FL	256					
MAXIM XL 324 FS - on seed	3.5	81 ab	81 ab	81 ab	72.5	75
+FORCE 3G In-Furrow (g ai/100 m row)	1.13					
MAXIM XL 324 FS - on seed	3.5	81 ab	82 ab	81 ab	77.5	80
+FORCE 3G - T band (g ai/100 m row)	1.13					
MAXIM XL 324 FS	3.5	84 a	85 a	83 a	72.5	80
+FORCE Seed Treatment 200 ME	40					
TITAN	23.46	79 ab	78 abc	78 ab	75	80
Untreated		75 b	75 bc	74 b	70	77.5
LSD		4.3	6.6	7.7	NS	NS
CV		3.8	4.3	4	21.3	17.9

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Plant stand and vigor assessments of corn at Port Stanley, Ontario. 2002

Treatment	Rate g ai/100 kg or g ai/ 80,000 seeds	Emerge number plants per plot	Plant Stand number plants per plot		Vigor 0-100%	
		6 June	13 June	20 June	6 June	13 June
Untreated Control		74 ab *	68 c	63 c	70	62.5
MAXIM XL 324 FS	3.46	71 b	72 bc	71 b	65	67.5
G7009-01 g ai/80,000 seeds	10	81 ab	81 a	81 a	77.5	67.5
+MAXIM XL 324 FS	3.46					
G7009-01 g ai/80,000 seeds	20	78 ab	79 ab	79 a	70	80
+MAXIM XL 324 FS	3.46					
G7014-03 g ai/80,000 seeds	13	82 a	82 a	81 a	70	77.5
+MAXIM XL 324 FS	3.46					
G7014-03 g ai/80,000 seeds	48	79 ab	80 ab	80 a	70	70
+MAXIM XL 324 FS	3.46					
Fungicide Check- MAXIM XL 324 FS	3.5	79 ab	79 ab	78 a	77.5	72.5
MAXIM XL 324 FS	3.5	80 ab	82 a	80 a	70	85
+CRUISER 350 FS	25					
MAXIM XL 324 FS	3.5	80 ab	82 a	81 a	75	77.5
+CRUISER 350 FS	50					
MAXIM XL 324 FS	3.5	77 ab	81 a	81 a	82.5	72.5
+CRUISER 350 FS	100					
MAXIM XL 324 FS	3.5	77 ab	82 a	82 a	77.5	75
+GAUCHO 480 FL	256					
MAXIM XL 324 FS - on seed	3.5	80 ab	80 ab	80 a	75	75
+FORCE 3G In-Furrow (g ai/100 m row)	1.13					
MAXIM XL 324 FS - on seed	3.5	81 ab	80 ab	81 a	87.5	87.5
+FORCE 3G - T band (g ai/100 m row)	1.13					
MAXIM XL 324 FS	3.5	81 a	81 ab	81 a	80	82.5
+Force Seed Treatment 200 ME	40					
TITAN	23.46	81 ab	80 ab	81 a	70	75
Untreated		77 ab	80 ab	78 a	70	75
LSD (P=.05)		5.7	5.6	5.4	NS	NS
CV		5.1	5	4.8	19.4	16.7

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 3. Yield assessments of corn at Port Stanley, Ontario. 2002

Treatment	Rate g ai/100 kg.	Yield T/ha 7 Nov
Untreated Control		3.7
L0281-A1	3.46	4.6
G7009-01	10	4.7
+L0281-A1	3.46	
G7009-01	20	3.3
+L0281-A1	3.46	
G7014-03	13	2.8
+L0281-A1	3.46	
G7014-03	48	5.1
+L0281-A1	3.46	
Fungicide Check- MAXIM XL 324 FS	3.5	3
MAXIM XL 324 FS	3.5	2.5
+CRUISER 350 FS	25	
MAXIM XL 324 FS	3.5	2.6
+CRUISER 350 FS	50	
MAXIM XL 324 FS	3.5	3.3
+CRUISER 350 FS	100	
MAXIM XL 324 FS	3.5	4.7
+GAUCHO 480 FL	256	
MAXIM XL 324 FS - on seed	3.5	3.4
+FORCE 3G In-Furrow (g ai/100 m row)	1.13	
MAXIM XL 324 FS - on seed	3.5	1.7
+FORCE 3G - T band (g ai/100 m row)	1.13	
MAXIM XL 324 FS	3.5	2.2
+FORCE Seed Treatment 200 ME	40	
TITAN	23.46	3.8
Untreated		2.4
LSD		NS
CV		58.2

***** Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #67 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect pests**
ICAR: 61006537

CROP: Corn (*Zea maize* L.), cv. D73
PEST: Corn flea beetle (*Chaetocnema pulicaria*, Melsheimer)

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TITLE: CONTROL OF CORN FLEA BEETLE IN SEED CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (fludioxonil + metalaxyl-m, 229.59 + 87.66 g ai/L); CRUISER 350 FS (thiamethoxam, 350 g ai/L); GAUCHO 480 FL (imidacloprid, 480 g ai/L); TI 435 (clothianidin, 600 g ai/L); FORCE ST 200 ME (tefluthrin, 200 g ai/L).

METHODS: Seed was treated on 7 May, 2002 in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each inflated bag. The seed was then mixed for 1 minute in an inflated bag to ensure thorough seed coverage. Seed weight was 277 g/1000 seeds. In furrow granular insecticides were applied using a Noble® applicator. Corn was planted at Ridgetown on 28 May, 2002 using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were four rows 4 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications at a seeding rate of 7 seeds/m. Plant emergence was assessed on 10,17 and 24 June, 2002, and vigor rating was assessed on 10 and 17 June, 2002 using a scale of 0-100% (100 = most advance plant and 0 = dead plants). On 11 June, 2002 flea beetles were counted by carefully counting adults in 20 plants early in the morning without disturbing them by moving through the plots slowly and into the direction of the sun. Plant damage was also assessed in the third leaf from the bottom of each of the 20 plants by using a scale of 0-4 to evaluate the flea beetle feeding scars where (0= no damage, 1= 1-25% , 2= 25-50%, 3= 50-75% , and 4= $\geq$ 75% feeding scars in leaf). Plots were harvested on 30 Oct, 2002 and corrected to 15.5 % moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Table 1, 2 and 3.

CONCLUSIONS: None of the seed treatments had any negative effect on emergence of vigor. CRUISER, GAUCHO and TI 435 all significantly reduced flea beetle damage, but did not affect the population within plots. We did note many dead flea beetles in the plots, but could not assess this parameter because the plots were relatively small and the flea beetles were very mobile. No differences in yield were noted.

Table 1. Plant stand and vigor assessments of corn at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Emergence number plants per plot	Plant Stand number plants per plot		Vigor 0-100%	
		10 June	17 June	24 June	10 June	17 June
Fungicide Check - Maxim XL 324 FS	3.5	103 ab *	100	105	81.3	82.5
Maxim XL 324 FS +Cruiser 350 FS	3.5 25	101 bc	100	105	81.3	86.3
Maxim XL 324 FS +Cruiser 350 FS	3.5 50	107 a	100	107	86.3	82.5
Maxim XL 324 FS +Cruiser 350 FS	3.5 100	108 a	100	107	90	83.8
Maxim XL 324 FS +Gaucho 480 FL	3.5 256	100 bc	100	107	80	83.8
Maxim XL 324 FS +TI 435 @ 0.25 mg ai/seed	3.5 148	106 ab	100	109	83.8	82.5
Maxim XL 324 FS +Force Seed Treatment 200 ME	3.5 40	102 bc	100	106	90	87.5
LSD		5.4	NS	NS	NS	NS
CV		5.2	4.1	3	11.3	14.1

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Plant stand and vigor assessments of corn at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Insects #/20 plants	No. Damaged plants/plot 0-4 Scale categorically arranged		
		11 June	0	1	2
Fungicide Check - Maxim XL 324 FS	3.5	1.5	14.0 b *	5.5 a	0.3
Maxim XL 324 FS +Cruiser 350 FS	3.5 25	1	19.9 a	0.1 b	0
Maxim XL 324 FS +Cruiser 350 FS	3.5 50	0.4	18.4 ab	1.6 b	0
Maxim XL 324 FS +Cruiser 350 FS	3.5 100	1	18.1 ab	1.9 b	0
Maxim XL 324 FS +Gaucho 480 FL	3.5 256	0.9	19.1 a	0.9 b	0
Maxim XL 324 FS +TI 435 @ 0.25 mg ai/seed	3.5 148	0.9	19.8 a	0.3 b	0
Maxim XL 324 FS +Force Seed Treatment 200 ME	3.5 40	1.4	17.3 b	2.5 b	0.2
LSD		NS	3.3	3.1	NS
CV		106.4	18.1	166	24.1

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 3. Yield assessments of corn at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Yield T/ha
Fungicide Check - Maxim XL 324 FS	3.5	3.1
Maxim XL 324 FS	3.5	3.4
+Cruiser 350 FS	25	
Maxim XL 324 FS	3.5	3.4
+Cruiser 350 FS	50	
Maxim XL 324 FS	3.5	3.2
+Cruiser 350 FS	100	
Maxim XL 324 FS	3.5	3.5
+Gaucho 480 FL	256	
Maxim XL 324 FS	3.5	3.7
+TI 435 @ 0.25 mg ai/seed	148	
Maxim XL 324 FS	3.5	3.4
+Force Seed Treatment 200 ME	40	
LSD		NS
CV		18.7

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #68 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: Corn (*Zea maize* L.), cv. D73
PEST: European chafer, *Rhizotrogus (Amphimallon) majalis*, Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL IN CORN

MATERIALS: MAXIM XL 324 FL (fludioxonil + metalaxyl-M, 229.59 g ai/L + 87.66 g ai/L); G7009-01 (clothianidin, 600 g ai/L); G7014-03 (imidacloprid, 480 g ai/L).

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 minute in the inflated bag to ensure thorough seed coverage. Seed weight was 277 g/1000 seeds. In furrow granular insecticides were applied using a Noble® applicator. Corn was planted on 20 May, 2002 at Woodstock, ON and 15 May, 2002 at Ridgetown using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were two rows 6 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications at a seeding rate of 7 seeds/m. Plant emergence was assessed at Woodstock on 7 and 14 June, 2002 and on 10 and 17 June, 2002 at Ridgetown. Vigor was recorded on the same dates using a scale of 0-100% (100 = most advance plant and 0 = dead plants). Chafer counts were assessed on 7 June, 2002 at Woodstock and on June 11, 2002 at Ridgetown, by removing a 1 m trench of soil 15 cm wide and 10 cm deep from each check plot and sifting out them out of the soil. Plots were harvested on 1 and 5 Nov, 2002 at Woodstock and Ridgetown, respectively and yields corrected to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1and 2. Mean number of damaged plants and chafers in the check plots were, 1.0/m and 0/m on 11 June, 2002 respectively, at Ridgetown. There were no damaged plants or chafers found in the check plots at the Woodstock location.

CONCLUSIONS: Most treatments improved final stand significantly compared with the untreated control. However, none improved stand compared with the fungicide-treated control alone.

Table 1. Plant stand, vigor and yield assessments of corn at Woodstock, Ontario. 2002

Treatment	Rate g ai/100 kg or g ai/ 80,000 seeds	Emerge number plants per plot 7 June	Pl stand per plot 14 June	Vigor 0-100% 7 June	Vigor 0-100% 14 June	Yield T/ha 1 Nov
Untreated Control		77	73 b *	55	60	9.3
MAXIM XL	3.46	77	78 ab	60	72.5	9.4
G7009-01 g ai/80,000 seeds	10	77	80 a	65	77.5	8.4
+MAXIM XL	3.46					
G7009-01 g ai/80,000 seeds	20	78	78 ab	80	75	9.7
+MAXIM XL	3.46					
G7014-03 g ai/80,000 seeds	13	77	79 ab	75	75	9.7
+MAXIM XL	3.46					
G7014-03 g ai/80,000 seeds	48	79	82 a	75	77.5	8.9
+MAXIM XL	3.46					
G7009-01 g ai/80,000 seeds	100	79	80 a	85	77.5	9
+MAXIM XL	3.46					
LSD		NS	4.8	NS	NS	NS
CV		4.3	4.1	23.6	21.9	11.9

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Plant stand, vigor and yield assessments of corn at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg or g ai/ 80,000 seeds	Emerge number plants per plot 10 June	Pl stand per plot 17 June	Vigor 0-100% 10 June	Yield T/ha 5 Nov
Untreated Control		77.5	71.8 b *	70	8.5
MAXIM XL	3.46	76.3	80.5 a	80	9.3
G7009-01 g ai/80,000 seeds	10	76.8	79.0 a	85	8.9
+MAXIM XL	3.46				
G7009-01 g ai/80,000 seeds	20	76	78.5 a	85	8.2
+MAXIM XL	3.46				
G7014-03 g ai/80,000 seeds	13	78.5	81.0 a	85	9.3
+MAXIM XL	3.46				
G7014-03 g ai/80,000 seeds	48	77	81.3 a	82.5	9.3
+MAXIM XL	3.46				
G7009-01 g ai/80,000 seeds	100	76.3	77.5 a	85	9.2
+MAXIM XL	3.46				
LSD		NS	4.4	NS	NS
CV		6.0	3.8	14.6	17.6

***** Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #69 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR : 61006537

CROP: Corn (*Zea maize* L.), cv. D73
PEST: Wireworm, Elateridae spp

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TITLE: CONTROL OF WIREWORM IN CORN WITH SEED TREATMENTS

MATERIALS: G7009-01 (clothianidin, 600 g ai/L); G7014-03 (imidacloprid, 480 g ai/L); MAXIM XL 324 FS (fludioxonil + metalaxyl-m, 229.59 g ai/L+ 87.66 g ai/L); CRUISER 350 FS (thiamethoxam, 350 g ai/L); GAUCHO 480 FL (imidacloprid, 600 g ai/L); ALLEGIANCE FL (metalaxyl, 320 g ai/L); Captan (400 g ai/L); GAUCHO 480 (imidacloprid, 480 g ai/L); Titan 600 FL (clothianidin + fludioxonil + metalaxyl-m, 600 g ai/L + 229.59 g ai/L + 78.66 g ai/L); FORCE 200 ME (tefluthrin, 200 g ai/L).

METHODS: Seed was treated on 3 May, 2002 in 1 kg lots in individual plastic bags by applying a slurry of material via a syringe to each bag (all treatments diluted to the same volume of 3 ml per kg). The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. Seed weight was 277 g/1000 seeds. The crop was planted on 10 May, 2002 at Rodney, ON using a two-row cone-seeder mounted on a John Deere Max Emerge planter at 48 seeds/row. Plots were two rows spaced at 0.76 m apart and 6 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was assessed on 4, 12 and 26 June, 2002. Vigor, using a scale of; 0-100 (100 = most advanced plant and 0 = plants dead), was recorded on 4 and 12 June, 2002. Wireworm populations were counted on 4 June, 2002 by digging up 1 m of row in a trench 15 cm deep and 10 cm wide in check plots, sifting the soil and separating the wireworms. Plots were harvested on 31 Oct, 2002 and corrected to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1 and 2. Mean damaged plants and wireworm counts were 3.3 and 6.8/m respectively on 4 June and 1.5 and 1.0/m respectively on 12 June, 2002.

CONCLUSIONS: All insecticide treatments significantly improved the stand of plants in the plots. However, only imidacloprid at the low rate, Titan and FORCE IF resulted in significantly higher plant vigor than the untreated controls. There were no differences in yield due to severe drought causing variable yield data.

Table 1. Plant stand and vigor assessments of corn at Rodney, Ontario. 2002

Treatment	Rate	Plant Stand			Vigor	
		Emergence				
	g ai/100 kg or g ai/ 80,000 seeds	number plants per plot			0-100%	
		4 June	12 June	26 June	4 June	12 June
Untreated Control		68 b *	70 b	73 b	65.0 b	60.0 c
MAXIM XL 324 FS	3.46	87 a	86 a	85 a	75.0 ab	70.0 bc
G7009-01 g ai/80,000 seeds	10	93 a	93 a	92 a	80.0 ab	70.0 ab
+MAXIM XL 324 FS	3.46					
G7009-01 g ai/80,0000 seeds	20	94 a	90 a	91 a	90.0 a	80.0 ab
+MAXIM XL 324 FS	3.46					
G7014-03 g ai/80,000 seeds	13	95 a	93 a	93 a	90.0 a	92.5 a
+MAXIM XL 324 FS	3.46					
G7014-03 g ai/80,000 seeds	48	91 a	91 a	91 a	80.0 ab	80.0 ab
+MAXIM XL 324 FS	3.46					
MAXIM XL 324 FS	3.5	92 a	93 a	89 a	85.0 a	77.5 ab
+ CRUISER 350 FS	25					
MAXIM XL 324 FS	3.5	93 a	92 a	92 a	82.5 ab	77.5 ab
+ CRUISER 350 FS	50					
MAXIM XL 324 FS	3.5	93 a	90 a	87 a	80.0 ab	75.0 ab
+ CRUISER 350 FS	100					
MAXIM XL 324 FS	3.5	93 a	90 a	89 a	80.0 ab	85.0 ab
+GAUCHO 480 FL	256					
ALLEGIANCE	2	92 a	93 a	92 a	77.5 ab	77.5 ab
+CAPTAN	35					
+GAUCHO 480 FL	256					
TITAN	3.71	94 a	95 a	93 a	85.0 a	92.5 a
MAXIM XL 324 FS	3.5	89 a	89 a	88 a	80.0 ab	85.0 ab
+ FORCE 200 ME	40					
MAXIM XL 324 FS	3.5	91 a	92 a	90 a	90.0 a	92.5 a
+FORCE In Furrow (g ai/100 m row)	1.13					
Fungicide Check-MAXIM XL 324 FS	3.5	92 a	92 a	93 a	82.5 ab	77.5 ab
LSD		7.7	9.6	9.7	11.7	10.8
CV		6	7.5	7.7	10	9.4

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Yield assessments of corn at Rodney, Ontario. 2002

Treatment	Rate g ai/100 kg or g ai/ 80,000 seeds	Yield T/ha 31 Oct
Untreated Control		3.2
MAXIM XL 324 FS	3.46	2.8
G7009-01 g ai/80,000 seeds	10	2.2
+MAXIM XL 324 FS	3.46	
G7009-01 g ai/80,000 seeds	20	2
+MAXIM XL 324 FS	3.46	
G7014-03 g ai/80,000 seeds	13	2.7
+MAXIM XL 324 FS	3.46	
G7014-03 g ai/80,000 seeds	48	2.5
+MAXIM XL 324 FS	3.46	
MAXIM XL 324 FS	3.5	4.1
+ CRUISER 350 FS	25	
MAXIM XL 324 FS	3.5	3.3
+ CRUISER 350 FS	50	
MAXIM XL 324 FS	3.5	3.9
+ CRUISER 350 FS	100	
MAXIM XL 324 FS	3.5	4
+GAUCHO 480 FL	256	
ALLEGIANCE	2	2
+CAPTAN	35	
+GAUCHO 480 FL	256	
TITAN	3.71	5.7
MAXIM XL 324 FS	3.5	5.8
+ FORCE 200 ME	40	
MAXIM XL 324 FS	3.5	5.8
+FORCE In Furrow (g ai/100 m row)	1.13	
Fungicide Check-MAXIM XL 324 FS	3.5	3.1
LSD		NS
CV		42.1

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #70 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR : 61006537

CROP: Corn (*Zea maize* L.), cv. D73
PEST: Wireworm, (Elateridae spp)

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TITLE: CONTROL OF WIREWORM IN CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (fludioxonil + metalaxyl-M, 229.59 g ai/L + 87.66 g ai/L); G7009-01 (clothianidin, 600 g ai/L); G7014-03 (imidacloprid, 480 g ai/L)

METHODS: Seed was treated on 8 May, 2002 in 1 kg lots in individual plastic bags by applying a slurry of material via a syringe to each bag (all treatments diluted to the same volume of 3 ml per kg). The seed was then mixed for 1 min in a inflated bag to ensure thorough seed coverage. The crop was planted on 28 May, 2002 at Rodney, ON using a two-row cone-seeder mounted on a John Deere Max Emerge planter at 8 seeds/m. Plots were two rows spaced at 0.76 m apart and 6 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was assessed on 12, 19 and 26 June, 2002. Vigor, using a scale of 0-100 (100 = most advanced plant and 0 = plants dead) was recorded on 12 and 19 June, 2002. Damaged plants and wireworm populations were counted in the check plots on 12 and 19 June, 2002, by digging up 1 m of row in a trench 15 cm deep and 10 cm wide, sifting the soil and separating the wireworms. Plots were harvested on 1 Nov, 2002 and yields corrected to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1 and 2. Replications 3 and 4 were moisture stressed. Mean plants and wireworm counts in the check plots were 2.3 and 4.5/m respectively on 12 June and 0.3 and 0.3/m respectively on 19 June, 2002.

CONCLUSIONS: G7009-01 and G7014-03 at all rates provided the same protection against plant loss due to wireworms. Drought resulted in extremely variable yield data. There was no evidence of phytotoxicity for any of the seed treatments nor for any of the rates tested.

Table 1. Plant stand and vigor assessments of corn at Rodney, Ontario. 2002

Treatment	Rate g ai/100 kg or g ai/80,000 seeds	Emergence number plants per plot 12 June	Plant Stand number plants per plot 19 June	Plant Stand number plants per plot 26 June	Vigor 0-100% 12 June	Vigor 0-100% 19 June
Untreated Control		79	71	65 b *	70.0 bc	67.5 b
MAXIM XL	3.46	74	74	72 ab	65.0 c	70.0 b
G7009-01 g ai/80,000 seeds	10	82	82	82 a	92.5 a	92.5 a
+MAXIM XL	3.46					
G7009-01 g ai/80,000 seeds	20	81	81	82 a	87.5 ab	82.5 ab
+MAXIM XL	3.46					
G7014-03 g ai/80,000 seeds	13	82	82	83 a	90.0 ab	87.5 ab
+MAXIM XL	3.46					
G7014-03 g ai/80,000 seeds	48	83	78	82 a	85.0 ab	87.5 ab
MAXIM XL	3.46					
LSD		NS	ND	9.3	15	15.4
CV		5	6	7.9	12.2	12.6

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Yield assessments of corn at Rodney, Ontario. 2002

Treatment	Rate g ai/100 kg or g ai/80,000 seeds	Yield T/ha 1 Nov
Untreated Control		10.8
MAXIM XL	3.46	13.9
G7009-01 g ai/80,000 seeds	10	18.5
+MAXIM XL	3.46	
G7009-01 g ai/80,000 seeds	30	14.1
+MAXIM XL	3.46	
G7014-03 g ai/80,000 seeds	13	14.5
+MAXIM XL	3.46	
G7014-03 g ai/80,000 seeds	48	13.4
MAXIM XL	3.46	
LSD		NS
CV		31.6

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #71 **SECTION E: CEREAL, FORAGE, AND OILSEED CROPS - Insects**
ICAR : 61006537

CROP: Forage Sorghum (*Sorghum bicolor* (L.) Moench), cv. FS 30
PEST: Wireworm (Elateridae spp)

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TITLE: **CONTROL OF WIREWORMS WITH SEED TREATMENTS IN FORAGE SORGHUM**

MATERIALS: ADAGE 5FS (thiamethoxam, 600 g ai/L).

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying a slurry of material via a syringe to each bag (all treatments diluted to the same volume of 3 ml per kg). The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. The crop was planted on 10 May, 2002 at Rodney and on 20 May, 2002 at Wallacetown using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were two rows spaced at 0.76 m apart and 6 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was assessed on 18, 26 June and 3, 11 July, 2002 at both locations. Wireworm populations were estimated in each check plot on 11 July, 2002 by digging up 1 m of row in a trench 15 cm deep and 10 cm wide, sifting the soil and separating the wireworms. Fresh weights were assessed on 12 September, 2002. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1 & 2. Wireworm populations in the check plots were estimated to be an average of 0.25/m and 0/m at Rodney and Wallacetown, respectively. Although the check plots did not show wireworms, there was a low population at the Wallacetown site.

CONCLUSIONS: Although other experiments at the same locations had higher populations, these particular trials had low wireworm counts. However, where there were wireworm, at the Rodney location an increase in plant stand was noted with increasing rates of ADAGE up to 100 g ai/kg seed. At 150 g ai/kg seed emergence was again similar to the control. All results in all the plots were quite variable due to the slow start in the spring and the severe drought. All the ADAGE treated plots had numerically higher yields than the controls.

Table 1. Plant stand and fresh weight assessments of forage sorghum at Rodney, Ontario. 2002

Treatment	Rate g ai/100 kg.	* Emergence	Plant Stand number plants per plot			Fresh Weight kg
		18 June	26 June	3 July	11 July	12 Sept
Untreated Check		26 c	28	31	27	6.1
Adage 5FS	25	29 bc	26	31	27	7.5
Adage 5FS	50	36 ab	29	34	27	8.6
Adage 5FS	100	41 a	32	37	28	7
Adage 5FS	150	30 bc	29	32	28	8.2
LSD (P=.05)		7.8	NS	NS	NS	NS
CV		15.7	17.0	14.8	20.5	34.1

* Means followed by same letter do not significantly differ (P= 0.05, LSD)

Table 2. Plant stand and fresh weight assessments of forage sorghum at Wallacetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Emergence	Plant stand number plants per plot			Fresh Weight kg
		18 June	26 June	3 July	11 July	13 Sept
Untreated Check		24	15	15	13	7.4
Adage 5FS	25	33	16	15	17	7.6
Adage 5FS	50	29	19	18	13	7.8
Adage 5FS	100	26	16	16	16	9.1
Adage 5FS	150	35	24	23	19	11.1
LSD (P=.05)		NS	NS	NS	NS	NS
CV		29.8	36.1	30.4	40.2	35.6

* Means followed by same letter do not significantly differ (P= 0.05, LSD)

2002 PMR REPORT # 72 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: Soybean (*Glycine max* (L.) Merrill), cv. West-Ag 97
PEST: Seedcorn maggot, *Delia platura* (Meigen)

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TITLE: CONTROL OF SEEDCORN MAGGOT WITH SEED TREATMENTS IN SOYBEANS

MATERIALS: APRON MAXX RTA 19.05 FS (metalaxyl-m + fludioxonil, 19.05 g ai/L); CRUISER 350 FS (thiamethoxam, 350 g ai/L); DCT (diazinon + captan + thiophanate-methyl, 18% +6% +14% w/w); FORCE ST 200 ME (tefluthrin, 200 g ai/L).

METHODS: Seed was treated on 7 May, 2002 in 1 kg lots in individual plastic bags by applying the treatment or slurry via a syringe to each bag (all treatments diluted to the same volume of 3.0 ml/kg seed using water). The seed was then mixed in the inflated bag for 1 min to ensure thorough seed coverage. Cattle manure was broadcast on the plots 2 weeks before planting and the soil was disked shortly after the manure application. The crop was planted on 11 May, 2002 at Ridgetown using a 2-row cone seeder. Plots were 2 rows spaced 0.76 m apart and 6 m in length placed in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Total plot emergence was evaluated on 3, 12 and 25 June, and 3 July, 2002 respectively. Vigor was assessed on 3 June, 2002 using a scale of 0-100% (100 = furthest developed plant in the trial and 0 = plant dead). Seed corn maggot damage and number of maggots were assessed in the check plots on 12 and 25 June, 2002 by exhuming all plants and seed remains from a 1 m length of row. Plant fresh weights in 6 m were assessed on 21 Aug, 2002. Plots were harvested on 8 Oct, 2002 and corrected to 14.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at the P= 0.05.

RESULTS: See Tables 1 and 2. Mean damaged plants found in the check plots was 3.8/m on 12 June and 3.3/m on 25 June. Mean number of seedcorn maggots recovered from the check plots was 0.8/m on 12 June and 0/m on 25 June**.**

CONCLUSIONS: There were no significant differences in vigor or plant stand between the insecticide seed treatments and the fungicide-treated controls, with the exception of DCT which had the highest emergence and vigor.

Table 1. Plant stand and vigor in soybeans at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Emerge #/plot 3 June	Vigor 0-100% 3 June	Plant Stand number per plot 12 June	25 June	3 July
Fungicide Check - APRON MAXX RTA 19.05 FS	6.25	41.3	27.5	31.8	29.8 b *	30.5 ab
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 15	32	17.5	30	28.0 b	27.8 b
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	37.5	40	29.5	32.5 ab	30.8 ab
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	43.8	37.5	42	40.8 ab	40.8 ab
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 100	40	42.5	39	41.5 ab	40.5 ab
DCT	198	59.3	70	58	66.0 a	66.0 a
APRON MAXX RTA 19.05 FS + FORCE 200 ME	6.25 40	53.8	55	49.5	48.0 ab	47.5 ab
LSD		NS	NS	NS	23.8	23.8
CV		34.9	82.7	47.2	39.1	39.5

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Fresh weight and yield assessments in soybeans at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Fresh Weight kg/6m 21 Aug	Yield T/ha 8 Oct
Fungicide Check - APRON MAXX RTA 19.05 FS	6.25	1.6 c *	0.8
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 15	2.1 bc	0.6
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	3.8 ab	1
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	4.0 ab	1
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 100	2.6 bc	0.9
DCT	198	4.5 a	1.3
APRON MAXX RTA 19.05 FS + FORCE 200 ME	6.25 40	4.3 ab	1.1
LSD		1.8	NS
CV		37.3	40.8

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #73 **SECTION E:CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: Soybean (*Glycine max* (L.) Merrill), cvr West-Ag 97
PEST: Soybean aphid (*Aphis glycine*, Matsumura)

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TITLE: CONTROL OF SOYBEAN APHIDS WITH SEED TREATMENT

MATERIALS: CRUISER 350 FS (thiamethoxam, 350 g ai/L); APRON MAXX RTA 19.05 FS (metalaxyl-m + fludioxonil, 11.54 g ai/L + 7.69 g ai/L); TI-435 600 FS (clothianidin 600 g ai/L); GAUCHO 480 FS (imidacloprid 480 g ai/L).

METHODS: Seed was treated in 1 kg lots in individual new plastic bags by applying the treatment or slurry via a syringe to each bag (all treatments diluted to the same volume of 3.0 ml/kg seed using water). The seed was then mixed in the inflated bags for 1 min to ensure thorough seed coverage. The crop was planted on 4 June, 2002 at Ridgetown and Highgate using a 2-row cone seeder. Plots were 2 rows spaced 0.76 m apart and 4 m in length placed in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Total plot emergence, vigour and phytotoxicity were evaluated on 19 and 24 June, 2002 at Ridgetown, and 19 June, 2002 at Highgate. Plots were harvested on 16 and 17 Oct, 2002 at Highgate and Ridgetown, respectively. Data were analysed using analysis of variance and means were separated using least significant difference (LSD) at P= 0.05.

RESULTS: See Tables 1-4. No aphids arrived in Ontario so aphid control assessments were not possible. There was no evidence of phytotoxicity with any of the treatments.

CONCLUSIONS: None of the seed treatments were phytotoxic.

Table 1. Plant stand and vigor assessments of soybeans at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg	Emergence # plants/plot	Plant Stand # plants/plot	Vigor 0-100%	
		19 June	24 June	19 June	24 June
Untreated Check		50	90 b *	67.5	65
Cruiser 350 FS	15	62	101 ab	80	80
+Apron Maxx RTA fungicide	6.25				
Cruiser 350 FS	30	79	107 a	92.5	87.5
+Apron Maxx RTA fungicide	6.25				
Cruiser 350 FS	50	66	109 a	87.5	87.5
+Apron Maxx RTA fungicide	6.25				
Cruiser 350 FS	100	50	104 a	77.5	72.5
+Apron Maxx RTA fungicide	6.25				
Fungicide Check - Apron Maxx RTA	6.25	51	99 ab	77.5	65
TI 435 600 FS	31.25	65	101 ab	75.0	67.5
TI 435 600 FS	62.5	68	101 ab	82.5	75
TI 435 600 FS	125	53	97 ab	72.5	67.5
Gaucho 480 FS	31.25	65	97 ab	85.0	75
Gaucho 480 FS	62.5	53	100 ab	72.5	75
Gaucho 480 FS	125	62	102 ab	82.5	82.5
LSD		NS	8.3	NS	NS
CV		20.9	5.7	13.8	14.5

* Means followed by same letter do not significantly differ (P=0.05, LSD)

Table 2. Yield assessments of soybeans at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg	Plot Weight grams	Moisture % 17 Oct	Yield T/ha
Untreated Check		1347.8	9.8	4.7
Cruiser 350 FS	15	1385.8	10.1	4.8
+Apron Maxx RTA fungicide	6.25			
Cruiser 350 FS	30	1487.8	10	5.2
+Apron Maxx RTA fungicide	6.25			
Cruiser 350 FS	50	1336	10	4.6
+Apron Maxx RTA fungicide	6.25			
Cruiser 350 FS	100	1506.6	10.3	5.2
+Apron Maxx RTA fungicide	6.25			
Fungicide Check - Apron Maxx RTA	6.25	1322.6	10.2	4.6
TI 435 600 FS	31.25	1455.1	10.6	5
TI 435 600 FS	62.5	1343.3	10.8	1.6
TI 435 600 FS	125	1379.8	10.2	1.8
Gaucho 480 FS	31.25	1436.9	10	5
Gaucho 480 FS	62.5	1382.5	10.5	4.8
Gaucho 480 FS	125	1347.6	10	4.7
LSD		NS	NS	NS
CV		8.7	5.4	8.7

* Means followed by same letter do not significantly differ, (P =0.05, LSD)

Table 3. Plant stand, and vigor assessments of soybeans at Highgate, Ontario. 2002

Treatment	Rate g ai/100 kg.	Emergence No plants/plot 19 June	Vigor 0-100% 19 June
Untreated Check		78.8 b	62.5
Cruiser 350 FS	15	93.8 ab	77.5
+Apron Maxx RTA fungicide	6.25		
Cruiser 350 FS	30	102.8 a	75.0
+Apron Maxx RTA fungicide	6.25		
Cruiser 350 FS	50	100.3 ab	80.0
+Apron Maxx RTA fungicide	6.25		
Cruiser 350 FS	100	99.8 ab	75.0
+Apron Maxx RTA fungicide	6.25		
Fungicide Check - Apron Maxx RTA	6.25	90.0 ab	72.5
TI 435 600 FS	31.25	91.0 ab	77.5
TI 435 600 FS	62.5	85.0 ab	72.5
TI 435 600 FS	125	91.5 ab	82.5
Gaucho 480 FS	31.25	94.0 ab	72.5
Gaucho 480 FS	62.5	97.5 ab	77.5
Gaucho 480 FS	125	98.5 ab	77.5
LSD		13.5	NS
CV		10.0	20.6

* Means followed by same letter do not significantly differ (P=0.05, LSD)

Table 4. Yield assessments of soybeans at Highgate, Ontario. 2002

Treatment	Rate g ai/100 kg.	Plot Weight grams	Moisture % 16 Oct	Yield T/ha
Untreated Check		611.2	10.3	2.1
Cruiser 350 FS	15	712.2	9.9	2.5
+Apron Maxx RTA fungicide	6.25			
Cruiser 350 FS	30	692.5	9.8	2.4
+Apron Maxx RTA fungicide	6.25			
Cruiser 350 FS	50	795.7	10.1	2.8
+Apron Maxx RTA fungicide	6.25			
Cruiser 350 FS	100	633.9	10.4	2.2
+Apron Maxx RTA fungicide	6.25			
Fungicide Check - Apron Maxx RTA	6.25	542.2	10.2	1.9
TI 435 600 FS	31.25	788.8	10.6	2.7
TI 435 600 FS	62.5	658.7	10.2	2.3
TI 435 600 FS	125	673.3	10.4	2.3
Gaucho 480 FS	31.25	856.2	11	2.9
Gaucho 480 FS	62.5	743.7	10.4	2.6
Gaucho 480 FS	125	845.9	10.1	2.9
LSD		NS	NS	NS
CV		25.9	8.4	25.6

* Means followed by same letter do not significantly differ (P=0.05, LSD)

2002 PMR REPORT #74 **SECTION E: CEREALS, FORAGE CROPS, and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: Winter Wheat (*Triticum* spp.L.) cvr VA 586
PEST: European chafer, *Rhizotrogus (Amphimallon) majalis*, Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL WITH SEED TREATMENTS IN WINTER WHEAT

MATERIALS: RAXIL 250 FL (tebuconazole, 250 g ai/L); GAUCHO 480 (imidacloprid, 480 g ai/L); G7009-00 (clothianidin, 600 g ai/L); CRUISER (thiamethoxam 350 g ai/L); VITAVAX Dual Purpose (carbathiin + lindane, 180 g ai/L + 165 g ai /L); RAXIL 250 FL (tebuconazole, 250 g ai/L)

METHODS: Seed was treated in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. Wheat was planted at London and Ridgetown on 23 Dec, 2001 using a twelve-row Wintersteiger cone seeding drill. Plots were 6 rows 4 m in length and spaced 15 cm apart and arranged in a RCBD with 4 replications. Galvinized steel sheet enclosures, 25 X 25 cm square and 15 cm high, were placed in the center of each plot around the 2 planted rows to a depth of 10 cm. The soil and previously planted seed inside each enclosure were dug out to check for presence of chafers and then replaced with clean soil and planted with 50 seeds in 2 rows, 15 cm apart with 25 seeds per row per enclosure. European chafers were released into enclosures on 23 Oct, at London and 24 Oct at Ridgetown. Plant emergence was taken on 10 Nov, 2001 and 15 Apr, 2002 at London and on 11 Apr, 2002 at Ridgetown. Chafer counts and plant fresh weights were assessed on 11 and 14 June, 2002 at Ridgetown and London, respectively. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1and 2.

CONCLUSIONS: At the Ridgetown site only plant stand was significantly affected by seed treatments. Only imidacloprid and clothianidin protected the stand from plant loss. At the London site the highest emergence was obtained with imidacloprid at the 30 g ai/L rate. This carried through to the highest plant fresh weight harvested in June.

Table 1. Plant emergence, fresh weight and chafer assessments at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	#ECH/ enclosure	Plant Stand 11 Apr-02	Plant Fresh Weight g 11 June-02	#ECH recovered/ enclosure 11 June-02
Untreated Check		4	29 b *	137.9	0.7
RAXIL FL	1.5	4	38 ab	170.6	1.7
RAXIL FL +GAUCHO	1.51	4	43 a	191.9	1
RAXIL FL +GAUCHO	1.52	4	45 a	216.9	0.7
RAXIL FL +GAUCHO	1.53	4	47 a	185.5	1
G7009-00 +RAXIL FL	101.5	4	45 a	205.3	1
G7009-00 +RAXIL FL	201.5	4	48 a	228.2	0.9
CRUISER	20	4	37 ab	195.7	1
CRUISER	35	4	37 ab	180.9	1.3
VITAVAX DUAL	3.6	4	45 a	220.8	1.7
RAXIL FL	1.5	4	38 ab	164.3	1
LSD			8	NS	NS
CV			11.4	26.3	87.7

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Plant emergence, fresh weight and chafer assessments at London, Ontario. 2002

Treatment	Rate g ai/100 kg.	#ECH/ enclosure	Emergence	Plant Stand	Plant Fresh Weight g	#ECH recovered /enclosure
			10 Nov-01	15 Apr-02	14 June-02	
Untreated Check		4	20 ab *	19	83.9 ab	0
RAXIL FL	1.5	4	19 ab	18	73.7 ab	1.1
RAXIL FL +GAUCH0	1.51	4	21 ab	20	99.6 a	1
RAXIL FL +GAUCHO	1.52	4	19 ab	19	96.0 a	0.7
RAXIL FL +GAUCHO	1.53	4	0.41666667	20	104.3 a	0.7
G7009-00 +RAXIL FL	101.5	4	19 ab	18	82.8 ab	0
G7009-00 +RAXIL FL	201.5	4	20 ab	19	99.0 a	0
CRUISER	20	4	19 ab	18	74.0 ab	0.7
CRUISER	35	4	19 ab	18	79.1 ab	0.3
VITAVAX DUAL	3.6	4	19 ab	18	74.3 ab	0
RAXIL FL	1.5	4	18 b	17	53.2 b	0.7
LSD			2	NS	26.2	NS
CV			6	6.8	18.4	142.8

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #75 **SECTION E: CEREALS, FORAGE CROPS, and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: Winter Wheat (*Triticum* spp. L.), cv. VA 586
PEST: European chafer, *Rhizotrogus (Amphimallon) majalis*, Razoumowsky

NAME AND AGENCY:
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TITLE: EUROPEAN CHAFER CONTROL WITH SEED TREATMENTS IN WINTER WHEAT

MATERIALS: L0110-A1 (imidacloprid, 480 g ai/L); G7009-00 (clothianidin, 600 g ai/L); CRUISER (thiamethoxam 350 g ai/L); VITAVAX Dual Purpose (carbathiin + lindane, 180 g ai/L + 165 g ai /L); RAXIL 250 FL (tebuconazole, 250 g ai/L)

METHODS: Seed was treated in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 minute in the inflated bag to ensure thorough seed coverage. Wheat was planted on 21 Nov, 2001 at Ridgetown in a greenhouse environment. Plots were planted in 2 rows with 25 seeds each, spaced at 17 cm apart, inside Galvanized steel sheet enclosures 25 X 25 cm square and 15 cm high in a RCBD with 4 replications. Plant emergence was taken on 7 Dec, 2001. Chafer counts and fresh plant weights were taken on 21 Dec, 2001. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05).

RESULTS: See Table 1.

CONCLUSIONS: Imidacloprid at the highest rate improved plant growth over the check, but did not significantly reduce the chafer populations. Lindane was the only active ingredient which significantly reduced the chafer populations.

Table 1. Plant emergence, fresh weight and chafer assessments in wheat in greenhouse trial at Ridgetown, Ontario. 2001

Treatment	Rate g ai/100 kg.	# ECH/ enclosure	Emergence 7 Dec 2001	Plant Fresh Weight 21 Dec 2001	#ECH recovered/ enclosure 21 Dec 2001
Untreated Check			44	24.0 bc *	3.7 a *
RAXIL 250 FL	1.5	4	46	21.5 bc	3.3 ab
RAXIL 250 FL +L0110-A1	1.51	4	50	30.0 b	2.0 ab
RAXIL 250 FL +L0110-A1	1.52	4	48	26.9 bc	2.3 ab
RAXIL 250 FL +L0110-A1	1.53	4	50	38.0 a	2.0 ab
G7009-00 +RAXIL FL 250	101.5	4	47	29.2 b	2.7 ab
G7009-00 +RAXIL FL 250	201.5	4	49	28.6 b	2.7 ab
CRUISER	20	4	48	27.8 b	3.0 ab
CRUISER	35	4	48	25.4 bc	2.0 ab
VITAVAX DUAL	3.6	4	49	26.1 bc	1.0 b
RAXIL FL	1.5	4	46	17.8 c	3.3 ab
LSD			NS	6	1.5
CV			5.3	13.2	34.3

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #76 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR : 61006537

CROP: Spring Wheat, (*Triticum aestivum* L.), cv. B89-11-13-1788
PEST: Wireworm, (Elateridae spp)

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TITLE: CONTROL OF WIREWORM IN SPRING WHEAT WITH SEED TREATMENTS

MATERIALS: RAXIL 250 FL (tebuconazole, 250 g ai/L); G2106-04 (carbathiin + lindane, 180 g ai/L + 165 g ai/L); GAUCHO 480 (imidacloprid, 480 g ai/L); G2051-16 (carbathiin + thiram, 169.6 g ai/L + 150.6 g ai/L); G7009-01 (clothianidin, 600 g ai/L); L0112-A1 (imidacloprid, 600 g ai/L); G2789-05 (carbathiin, 233 g ai/L).

METHODS: Spring wheat seed was treated in 1 kg lots in individual plastic bags by applying a slurry of material via a syringe to each bag (all treatments diluted in water to the same volume of 3 ml per kg). The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. The wheat was planted on 4 May, 2002 at Rodney using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were single rows spaced 0.76 m apart and 6 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was determined on 29 May and 6 June, 2002 and vigor assessments, using a scale of 0 -100, (100= most advanced plant in trial and 0= plants dead) were recorded on the same dates. Wireworm populations were estimated on 19 June, 2002, by digging up 1 m of row in a trench 15.2 cm deep and 10.16 cm wide in the plots, sifting the soil and separating out the wireworms. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1 & 2.

CONCLUSIONS: The wireworm populations in this trial were relatively low. Stand and vigor were improved with the combination of insecticide and fungicide. Imidacloprid seemed to provide the best protection against the effects of wireworm in this trial, equivalent to the formulation containing lindane. Direct effects on wireworm activity were not noted with any of the treatments. The effects seemed to be in the form of helping the plant survive the feeding damage.

Table 1. Plant stand and vigor assessments of wheat at Rodney, Ontario. 2002

Treatment	Rate g ai/100 kg.	Emergence #pl/pl 29 May	Vigor 0-100% 29 May	Plant Stand #pl/pl 6 June	Vigor 0-100% 6 June
Untreated Check		281 a *	80	195 b	65.0 bc
RAXIL 250 FL	1.5	293 a	77.5	225 ab	62.5 c
G2106-04	104	328 a	85	287 ab	90.0 a
GAUCHO	10	320 a	92.5	293 a	85.0 ab
GAUCHO	20	313 a	87.5	275 ab	90.0 a
+RAXIL 250 FL	1.5				
G2051-16	106	320 a	87.5	269 ab	82.5 abc
+GAUCHO 480	10				
G7009-01	20	334 a	75	287 ab	82.5 abc
+RAXIL 250 FL	1.5				
G7009-01	10	320 a	85	243 ab	82.5 abc
+RAXIL 250 FL	1.5				
RAXIL 250 FL	1.5	336 a	85	265.0 ab	87.5 a
+L0112-A1	10				
G2789-05	58	336 a	87.5	285.3 ab	80.0 abc
+L0112-A1	10				
RAXIL 250 FL	1.5	293 a	77.5	243.5 ab	70.0 abc
+L0112-A1	5.1				
G7009-01	5.1	324 a	82.5	242.8 ab	75.0 abc
+RAXIL 250 FL	1.5				
LSD		32.3	NS	56.6	13.8
CV		7.1	11	15.1	12

* Means followed by same letter do not significantly differ (P= 0.05, LSD)

Table 2: Wireworm damage and populations in wheat at Rodney, Ontario. 2002

Treatment	Rate g ai/100 kg.	Plants #/m 19 June	Damaged Plants # Plants/m 19 June	Wireworm #/m 19 June	Damage % Plants 19 June
Untreated Check		39	29	2	78
RAXIL 250 FL	1.5	41	35	2	85
G2106-04	104	60	36	1	61
GAUCHO	10	47	37	3	80
GAUCHO	20	55	46	4	85
+RAXIL 250 FL	1.5				
G2051-16	106	46	37	1	81
+GAUCHO 480	10				
G7009-01	20	53	45	2	88
+RAXIL 250 FL	1.5				
G7009-01	10	38	24	1	60
+RAXIL 250 FL	1.5				
RAXIL 250 FL	1.5	63	50	1	78
+L0112-A1	10				
G2789-05	58	56	43	1	76
+L0112-A1	10				
RAXIL 250 FL	1.5	57	44	2	76
+L0112-A1	5.1				
G7009-01	5.1	56	46	3	83
+RAXIL 250 FL	1.5				
LSD		NS	NS	NS	NS
CV		28.8	33.8	104.5	17.8

* Means followed by same letter do not significantly differ (P= 0.05, LSD)

2002 PMR REPORT # 77 **SECTION E: CEREALS, FORAGE CROPS, and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: Winter Wheat (*Triticum* spp. L.), cv. VA 586
PEST: European chafer, *Rhizotrogus (Amphimallon) majalis*, Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL WITH SEED TREATMENTS IN WINTER WHEAT

MATERIALS: L0110-A1 (imidacloprid, 480 g ai/L); G7009-00 (clothianidin, 600 g ai/L); CRUISER (thiamethoxam 350 g ai/L); VITAVAX Dual Purpose (carbathiin + lindane, 180 g ai/L + 165 g ai /L); RAXIL 250 FL (tebuconazole, 250 g ai/L)

METHODS: Seed was treated in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 minute in the inflated bag to ensure thorough seed coverage. Wheat was planted on 21 Nov, 2001 at Ridgetown in a greenhouse environment. Plots were planted in 2 rows with 25 seeds each, spaced at 17 cm apart, inside Galvanized steel sheet enclosures 25 X 25 cm square and 15 cm high in a RCBD with 4 replications. Plant emergence was taken on 7 Dec, 2001. Chafer counts and fresh plant weights were taken on 21 Dec, 2001. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05).

RESULTS: See Table 1.

CONCLUSIONS: Imidacloprid at the highest rate improved plant growth over the check, but did not significantly reduce the chafer populations. Lindane was the only active ingredient which significantly reduced the chafer populations.

Table 1. Plant emergence, fresh weight and chafer assessments in wheat in greenhouse trial at Ridgetown, Ontario. 2001

Treatment	Rate g ai/100 kg.	# ECH/ enclosure	Emergence 7 Dec 2001	Plant Fresh Weight 21 Dec 2001	#ECH recovered/ enclosure 21 Dec 2001
Untreated Check			44	24.0 bc *	3.7 a *
RAXIL 250 FL	1.5	4	46	21.5 bc	3.3 ab
RAXIL 250 FL +L0110-A1	1.51	4	50	30.0 b	2.0 ab
RAXIL 250 FL +L0110-A1	1.52	4	48	26.9 bc	2.3 ab
RAXIL 250 FL +L0110-A1	1.53	4	50	38.0 a	2.0 ab
G7009-00 +RAXIL FL 250	101.5	4	47	29.2 b	2.7 ab
G7009-00 +RAXIL FL 250	201.5	4	49	28.6 b	2.7 ab
CRUISER	20	4	48	27.8 b	3.0 ab
CRUISER	35	4	48	25.4 bc	2.0 ab
VITAVAX DUAL	3.6	4	49	26.1 bc	1.0 b
RAXIL FL	1.5	4	46	17.8 c	3.3 ab
LSD			NS	6	1.5
CV			5.3	13.2	34.3

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #78 **SECTION E: CEREALS, FORAGE CROPS and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: Winter Wheat (*Triticum* spp. L.), cv. VA 586
PEST: European chafer, *Rhizotrogus (Amphimallon) majalis*, Razoumowsky

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TITLE: **EUROPEAN CHAFER DAMAGE THRESHOLDS IN WINTER WHEAT**

MATERIALS: RAXIL 250 FL (tebuconazole, 250 g ai/L)

METHODS: Seed was treated with RAXIL 250 FL in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 3 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 minute in the inflated bag to ensure thorough seed coverage. Wheat was planted on 21 Nov. 2001 at Ridgetown in a greenhouse environment. Plots were planted in 2 rows with 25 seeds each, spaced 17 cm apart, inside Galvanized steel sheet enclosures 25 X 25 cm square and 15 cm deep in a RCBD with 4 replications. Plant emergence was taken on 7 Dec, 2001. Chafer counts and plant fresh weights were taken on 21 Dec, 2001. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Table 1.

CONCLUSIONS: Some density dependent mortality started showing up at above 8 larvae/tray. Significant plant biomass loss was measured between 4 and 8 larvae per enclosure (equates roughly to 4-8 larvae/ft^2.)

Table 1. Plant emergence, fresh weight and chafer assessments in wheat in greenhouse trial at Ridgetown, Ontario. 2001

Treatment	Rate g ai/100 kg.	#ECH/ enclosure	Emergence 7 Dec 2001	Plant Fresh Weight 21 Dec 2001	#ECH recovered/ enclosure 21 Dec 2001
RAXIL FL	1.5	0	50	33.1 a	0.0 c
RAXIL FL	1.5	1	49	26.5 ab	1.0 c
RAXIL FL	1.5	2	49	26.9 ab	1.7 c
RAXIL FL	1.5	4	46	17.5 ab	3.3 bc
RAXIL FL	1.5	8	47	12.3 b	6.0 ab
RAXIL FL	1.5	16	48	12.1 ab	8.0 a
LSD			NS	2	3.2
CV			6.1	12.5	52.8

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #79 **SECTION F: GREENHOUSE CROPS AND ORNAMENTALS**
STUDY DATA BASE: 344-1252-0015

CROP: Cucumber (*Cucumis sativcus* L.), cv. Bodega
Tomato (*Lycopersicon esculentum* Mill.), cv. Rapsodie
PEST: Western flower thrips, *Frankliniella occidentalis* (Pergande)

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TITLE: **EVALUATION OF THE EFFICACY OF SPINOSAD ON *FRANKLI NIELLA OCCIDENTALIS* ON GREENHOUSE CUCUMBER AND TOMATO**

MATERIAL: CONSERVE SC (spinosad, *Saccharopolyspora spinosa)*

METHODS: Greenhouse trials were conducted from December 17, 2001 to January 15, 2002 in a glass greenhouse (12.0 by 6.1 m) with the tomato cultivar 'Rapsodie' and from June 17 to August 14, 2002 in a plastic greenhouse (7.6 by 7.6 m) with the cucumber cultivar 'Bodega' at the Greenhouse and Processing Crops Research Centre, Harrow, Ontario. Both crops were grown in rockwool according to commercial production practices and were allowed to develop until full canopy before pesticide application. Solutions of Conserve SC were applied at the recommended rate of 0.53 ml/L, using a low pressure/high volume CO_2 sprayer (276 kPa), to both leaf surfaces until runoff. Tap water was sprayed for the control treatment. At the same time, Conserve SC was also applied to the inner surface of the petri dish leaf cages. The cages were 5 cm in diameter and 0.5 cm high, with a hole of 3 cm diameter on the top half, covered with nylon cloth for ventilation. The cages were attached to the leaf using the same size plastic covering and two metal clips. The sprayed cages were left exposed in the greenhouse until used in efficacy trials. Western flower thrips were exposed to the residual toxicity of treated cucumber and tomato foliage by confining thrips onto sprayed leaves 1 to 28 days post spray application for tomatoes and 1 to 57 days post application for cucumber. Twenty to 25 individuals were confined to the lower surface of the treated cucumber leaves and upper surface of tomato leaves using the treated leaf cages. Adult and immature stages were evaluated in the cucumber trials and only adults in the tomato trials. Six to eight observations were completed for all treatments for each residue time period and crop. After 48 h exposure, the thrips were observed and recorded as live or dead. For statistical analysis of the data, an ANOVA was performed on the arcsine transformed mortality data. When significant differences in mortality means among residue time periods were found, the means were separated using the SNK multiple range test. For the thrips mortality data on cucumber, a probit analysis was used to quantify the relationship between thrips mortalities and residue time.

RESULTS: *Tomato* - All the thrips died after exposure to 1-day residues of Conserve SC (Table 1). Three-day residues caused 98% adult mortality. Ten days after spray application, 90% control of the adult thrips was achieved under greenhouse production conditions. The residual toxicity of Conserve SC to western flower thrips decreased slowly over time. Sixty-four percent mortality was still recorded when adult thrips were exposed to 4-week foliage residues.

Cucumber - Residual toxicity of Conserve SC to adult and immature western flower thrips decreased more slowly over time on cucumber compared to tomato (Fig. 1 and Table 1). This difference may be due to the different coverings between the two greenhouse compartments used in these trials. Double polyethylene coverings reduce UV radiation more into the greenhouse compared to glass. Also, the canopy structure for

the two crops was different. The cucumber umbrella canopy provided more shading to the leaves than the single row V trained tomato canopy. In addition, thrips were confined to the lower surface of cucumber leaves and the upper surface of tomato leaves due to thrips feeding preferences for the two crops. However, the upper surfaces of leaves are exposed to more UV radiation compared to the lower surfaces of leaves. Field experiments with spinosad have found that UV radiation decreases the residual lifespan of spinosad on outdoor crops.

After 28 days, residual toxicity of Conserve SC was >95% to adult and immature thrips (Table 2). Five to 6 weeks after application, thrips mortality was still 80%. Fifty days after spraying, the mortality rate of larval and adult thrips, respectively, had decreased only to 57 and 31%.

Table 1. Mortality of adult thrips exposed to 1- to 28-day residues of Conserve SC and water sprayed tomato foliage for 24 h

Residue time (days)	Mortality (%)	
	Control	Treatment
1	2.60 ± 0.82	100.00 ± 0.00a
3	1.26 ± 0.80	98.12 ± 1.18a
10	3.70 ± 1.10	89.05 ± 4.39ab
16	1.59 ± 1.59	77.87 ± 5.92bc
23	1.67 ± 1.67	75.16 ± 8.25bc
28	1.89 ± 1.07	64.00 ± 10.05c

Within treated column, means followed by the same letter are not significantly different at $P > 0.05$ based on SNK multiple range test. Data were arcsine transformed before ANOVA. Untransformed data are presented in the table.

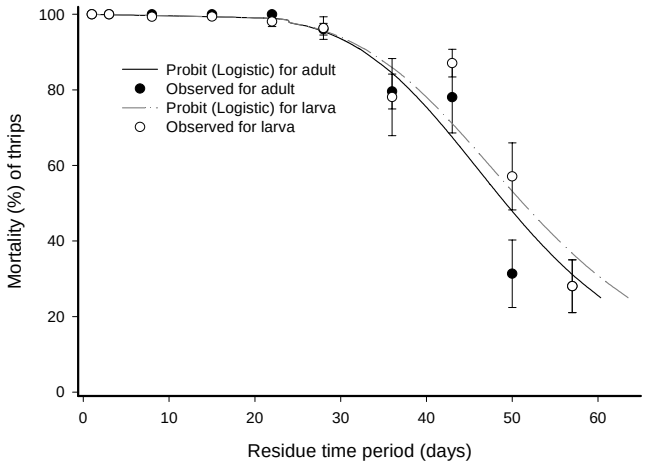

Fig 1. Mortalities of adult (solid line) and larva (dash-dot line) thrips exposed to 1- to 57-day foliage residues of Conserve SC on greenhouse cucumber under greenhouse production conditions. Control mortalities were < 5% for both adults and larvae. Vertical bars are standard errors.

Table 2. Mortality (% mean ± SE) of adult and larval thrips exposed to 1- to 57- day residues of Conserve SC and water on cucumber for 48 h under greenhouse production conditions

Residue time (days)	Larvae		Adults	
	Control	Treated	Control	Treated
1	1.7 ±1.7	100.0 ± 0.0a	3.3 ± 2.1	100.0 ± 0.0a
3	5.2 ± 1.4	100.0 ± 0.0a	3.3 ± 1.4	100.0 ± 0.0a
8	1.2 ± 0.8	99.4 ± 0.6a	1.9 ± 1.4	100.0 ± 0.0a
15	0.0 ± 0.0	99.4 ± 0.6a	2.6 ± 1.1	100.0 ± 0.0a
22	4.4 ± 2.0	98.1 ± 1.3a	0.6 ± 0.6	100.0 ± 0.0a
28	4.9 ± 1.4	96.4 ± 3.0a	4.4 ± 1.6	96.1 ± 1.5a
36	3.5 ± 1.5	78.1 ± 10.2b	3.3 ± 1.8	79.6 ± 4.6b
43	3.4 ± 1.1	87.1 ± 3.7b	4.3 ± 2.4	78.1 ± 9.4b
50	0.5 ± 0.5	57.1 ± 8.9c	1.7 ± 0.9	31.3 ± 8.9c
57	1.8 ± 0.9	28.0 ± 7.0d	2.2 ± 1.2	28.0 ± 7.0c

Within treated column, means followed by the same letter are not significantly different at $P > 0.05$ based on SNK multiple range test. Data were arcsine transformed before ANOVA. Untransformed data are presented in the table.

Conclusions: Based on the observations in this study, Conserve SC exhibits long residual control against both larva and adult stages of western flower thrips on greenhouse cucumber and tomato grown under greenhouse production conditions.

2002 PMR REPORT #80 **SECTION G: BASIC STUDIES - Entomology**
STUDY BASE NUMBER: 280-1252-9913

CR0P: Potato
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: SUSCEPTIBILITY TO IMIDACLOPRID IN BIOASSAY OF COLORADO POTATO BEETLE ADULTS FIELD-COLLECTED FROM ACROSS CANADA, 1997-2002

MATERIALS: Technical (>95% purity) imidacloprid

METHODS: Two replicates of ten adult CPB collected from field populations from seven provinces were sprayed directly with 5 ml of technical (>95% purity) insecticide in 19:1 acetone:olive oil, in a Potter spray tower. Bioassays were repeated to give 4 replicates. Four to five concentrations were selected to kill from 10 to 90% of the treated insects. Results were compared to the standard, insecticide-susceptible, lab-reared strain (Lab-S) to give the Standard Tolerance Ratio (LC_{50} subject population/LC_{50} standard Lab-S strain). The Field Tolerance Ratio (FTR) (LC_{50} subject population/LC_{50} most susceptible population that year) provided an index of the total variation in susceptibility to imidacloprid among all tested populations each year. The results were compared to those collected during the previous five years.

RESULTS: In direct contact bioassays in 2002, the ratio of the LC_{50} for imidacloprid of the most tolerant strain to that of the Lab-S strain was 2.9x at 1 Day After Treatment (DAT) and 3.6x at 8 DAT. The LC_{50} of imidacloprid to the Lab-S strain was 5.0 ppm at 1 DAT and increased to 22.0 ppm at 8 DAT, representing adult recovery from intoxication after exposure to the insecticide found in most field strains. At 8 DAT, 8 out of 27 field populations tested were more tolerant to imidacloprid than the Lab-S strain. Calculation of the FTR using the most susceptible population produced maximum ratios for imidacloprid of 14.5x at 1 DAT and 25.0x at 8 DAT. Table 1 shows trends in FTR after 1998. Prior to 1999, no FTR exceeded 5.4. In 1999 the FTR was greater than 10.4 in two populations. By 2002 the FTR was greater than 10.4 in 18.5% of collected populations.

CONCLUSIONS: Since the first survey for imidacloprid in 1996, there has been no significant increase in maximum FTR at 1 or 8 DAT. While some of the differences in susceptibility among field populations can be accounted for by natural variability among populations and difference in ages of collected adults, the number of populations exhibiting a higher FTR at 8 DAT suggests that changes are occurring in some of the populations that may lead to resistance and control problems.

Table 1. Annual summary of relative susceptibility of selected populations of adult Colorado potato beetle to imidacloprid by direct contact in bioassay,8 days after treatment, 1997-2002.

Year	n	Maximum STR[1]	Maximum FTR[2]	% (No.) Populations in indicated FTR Range	
				FTR<5.5	FTR>10.4
1997	14	6	23.1	100	0
1998	26	2.2	4.8	100	0
1999	30	4.6	13	50.0 (15)	6.7 (2)
2000	39	6.1	18.3	33.3 (13)	18.0 (7)
2001	38	3.9	17.9	78.9 (30)	13.1 (5)
2002	27	3.6	25	63.0 (17)	18.5 (5)

[1] Standard Tolerance Ratio (STR) - LC_{50} of subject CPB population/LC_{50} of the standard susceptible Lab-S strain.
[2] Field Tolerance Ratio (FTR) - LC_{50} of subject CPB population/LC_{50} of most susceptible CPB population.

2002 PMR REPORT #81

SECTION H - BIOLOGICAL CONTROL - Insects, Mites, Nematodes, Weeds
Study No.: 280-1252-9904

CROP: Alfalfa (*Medicago sativa* L.)
PEST: Tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois)
PARASITOID: *Peristenus digoneutis* Loan

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TITLE: SUCCESSFUL ESTABLISHMENT OF *PERISTENUS DIGONEUTIS* IN ONTARIO FOR THE CONTROL OF TARNISHED PLANT BUG, 2002

MATERIALS: Adult *Peristenus digoneutis* Loan (Hymenoptera: Braconidae) from a source population (bivoltine) in Hugelheim, Germany (collected in August 2000 by Dr. U. Kulhmann, CABI Biosciences, Delemont, Switzerland) were released within an alfalfa field at the SCPFRC Research Farm, London, Ontario ($43^0$01.77'N, $81^0$12.33'W) in 2001. Releases were timed to coincide with peak populations of first and second generation *Lygus* nymphs in late May/early June and July, respectively. The total *P. digoneutis* adults released were 6874 (3891 males and 2983 females) which was a ratio of 1.3 males per female.

METHODS: *P. digoneutis* cocoons from Europe were stored at 2^0C for 8 months and then adults emerged in the laboratory at 23^0C and 16hL photoperiod during May 2001. Each adult parasitoid that emerged was handled individually in a glass pipette under a dissecting microscope (10X) to confirm species identity (so only *P. digoneutis* would be released and without hyperparasites) and to identify sex. All females were placed in 4 litre glass mating cages with males in a ratio of 2 females per male before field release. The parasitoid population [87% successful emergence from cocoons] from Hugelheim alfalfa was 77.6% *P. digoneutis*, 0.6% *P. stygicus*, and 21.8% hyperparasites, mostly *Mesochorus* spp. Since *P. digoneutis* was previously released in the northeast USA and we found this species in southern Quebec in 1998, there was not a requirement to obtain a permit for release in Ontario. The mating cages, which contained honey and water supply, were taken after 1-3 days at 23^0C to the field for parasitoid release. The well- fed and mated parasitoids exited these cages which were placed beneath the weedy alfalfa canopy in the late afternoon when temperatures were between 18^0 and 29^0C. On July 12, 2001, 75 female wasps were also released in each of 3 fine-mesh release cages (1x1x2m) set over weedy alfalfa and each containing a honey + water vial on a platform at canopy level. Six hundred *Lygus* N2 and N3 nymphs from a lab culture were also released in each cage during the same week (July16-20, 2001) at temperatures around 23^0C. Over the winter months the release cage was removed and in April 2002 emergence cages were placed on the exact 3 sites where the release cages had been the previous summer. Emergence cages [1x1x1m with a collecting vial attached containing water, Kodak Photo-Flo 200 solution and salt] were checked twice per week for *Peristenus* emergence.

RESULTS: On July 30, 2001 *Lygus* nymphs (L4 and L5) were collected from all 3 cages and dissected to determine if these had been successfully parasitized. A mean of 83% [45 of 54 dissected] of *Lygus* nymphs were parasitized. On June 6, 2002 the first successful recovery of an over-wintered *P. digoneutis* adult was made from an emergence cage. Other *P. digoneutis* adults were collected in these cages on June 14 (2 females, 1 male), June 18 (3 males), and on June 21 (2 females). Mass-collected first generation *L. lineolaris* nymphs from the field release area during June 2002 were also found to contain *P. digoneutis* [1 female emerged on July 15, 2002, and 31 non emerged cocoons were chilled at 2^0C on July 30 and are expected to contain *P. digoneutis* when adult emergence occurs in March 2003 after 8 months cold storage].

CONCLUSIONS: The collection of 9 *P. digoneutis* individuals in June 2002 indicates that this species has successfully over-wintered and established in southern Ontario in the London area. Although only a few individuals were recovered in emergence cages, it was expected that the vial of water would capture only a small percentage of the emerging parasitoids. Releases of *P. digoneutis* continued in the summer of 2002 and post-release monitoring protocol will follow in southern Ontario to check the rate of expansion of this parasitoid's range.

2002 PMR REPORT #82 **SECTION H: BIOLOGICAL CONTROL- Insects, Mites, Nematodes**
STUDY DATA BASE: 344-1252-8901

CROP: Cucumber (*Cucumis sativcus* L.), cv. Bodega
PEST: Western flower thrips, *Frankliniella occidentalis* (Pergande)

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TITLE: **RESIDUAL TOXICITY OF CONSERVE SC AGAINST THREE COMMERCIALLY-PRODUCED BENEFICIAL SPECIES USED FOR BIOLOGICAL CONTROL OF GREENHOUSE PESTS**

MATERIALS: *Orius insidiosus* (Say) (Hemiptera: Anthocoridae); *Amblyseius cucumeris* (Oudermans) (Acari: Phytoseiidae); *Encarsia formosa* (Gahan) (Hymenoptera: Braconidae). CONSERVE SC (spinosad, *Saccharopolyspora spinosa*)

METHODS: The trials were conducted from June 17 to August 14, 2002 in a plastic greenhouse compartment (7.3 by 9.1 m) at the Greenhouse and Processing Crops Research Centre, Harrow, Ontario. The cucumber cultivar 'Bodega' was grown in rockwool slabs and sprayed June 17th after reaching a height of 3 m on a trellis. The beneficial insects and mites species used in the trials were *A. cucumeris*, *E. formosa* and *O. insidiosus.* Solutions of Conserve SC were prepared by dissolving the chemical in water at the recommended rate of 0.53ml/L. Solutions were applied, using a low pressure/high volume CO_2 sprayer (276 kPa), to both leaf surfaces until runoff. Water was sprayed as the control treatment. At the same time, Conserve SC was applied to the inner surface of the Petri dish leaf cages. The cages were 5 cm in diameter and 0.5 cm high, with a hole of 3 cm diameter on the bottom, covered with nylon cloth for ventilation. The cages were attached to the leaves using two metal clips. Test insects/mites were exposed to residues on the treated cucumber foliage by confining the insects/mites onto sprayed leaves 1 to 28 days after treatment application. Twenty to 25 individuals were confined to the lower surface of the treated leaves using the treated leaf cages. Six to 8 replicates were completed for all treatments for each residue time period and beneficial species. After 48 h exposure, the insects/mites were observed and recorded as live or dead (individuals that could not move from one point to another when probed were recorded as dead). For each replicate, treatment mortality was adjusted using Abbotts formula. ANOVA was performed on the arcsine transformed data. When significant differences in means among residue times were found by ANOVA, the means were separated using the SNK multiple range test.

RESULTS: See Table 1. According to IOBC guidelines (Hassan, S.A. 1989. Testing methodology and the concept of the IOBC/WPRS working group, pp. 1-18. *In* P.C. Jepson [ed.] Pesticides and Non-target Invertebrates. Incept, Wimborne Dorset), Conserve SC was harmful to *E. formosa* after 28 d. A mortality rate of 97% was still recorded for *E. formosa* after exposure to 28-d residues. For adult *O. insidiosus*, Conserve Sc was moderately harmful after 1 day residue. Thirty-five percent mortality was observed when the predators were exposed to1-d residues. Mortality of *Orius* was 17% (harmless) when exposed to 8-day residues. Conserve SC was only slightly harmful to the predatory mite, *A. cucumeris.*

Table 1. Mortality (mean " se) of three biological control agents exposed to residues of Conserve SC of different ages on cucumber foliage for 48 h under greenhouse conditions

Residue time (days)	*E. formosa*	*A. cucumeris*	*O. insidiosus*
1	100.0 " 0.0a	13.4 " 2.1a	35.0 " 7.7a
8	99.4 " 0.6a	4.4 " 1.7b	16.7 " 5.2b
13	100.0 " 0.0a	N/A	N/A
22	100.0 " 0.0a	N/A	N/A
28	97.4 " 1.8a	N/A	10.7 " 2.9b
F; df; *P*	1.8; 4,32; 0.15	13.4; 1,11; <0.01	5.7; 2,21; 0.01

Within treated column for each species, means followed by the same letter are not significantly different at $P > 0.05$ based on SNK multiple range test. Data were arcsine transformed before ANOVA. Untransformed data are presented in the table.

CONCLUSIONS: At the tested rate, Conserve SC is compatible with *A. cucumeris* 1 d after application and with *O. insidiosus* 8 d after application. However, Conserve SC was not compatible with adult *E. formosa* after 28 under greenhouse conditions.

2002 PMR REPORT #83 **SECTION H: BIOLOGICAL CONTROL-Insects, Mites and Nematodes**
STUDY DATA BASE #-419-2126-9717

CROP: Tomato, *Lycopersicon esculentum* Miller
PESTS: General greenhouse pests

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TITLE: ACUTE SENSITIVITY OF THE PREDATORY BUG, *Dicyphus hesperus* (HEMIPTERA: MIRIDAE), TO SOME CONTACT PESTICIDES USED IN IPM PROGRAMS IN COMMERCIAL VEGETABLE GREENHOUSES

MATERIALS: *Dicyphus hesperus* Knight (Hemiptera: Miridae), SAFER'S INSECTICIDAL SOAP, TRACER (spinosad), PIRIMOR 50WP (N-methyl carbamate), AVID 1.9% EC (abamectin), CONFIRM 2F (tebufenozide), ROVRAL WP , SANMITE (pyridaben), SULPHUR WP, THIODAN 4 EC (endosulfan), VENDEX 50 WP (fenbutatin-oxide), ENSTAR II (kinoprene).

METHODS: Pesticides were tested separately in the lab on individuals of freshly-emerged adult females and third- to fourth-instar nymphs of *D. hesperus* at 3 rates: one-half the recommended rate, recommended rate and twice the recommended rate. Agral® 90, a commercial wetting agent, was added at the rate of 1 drop per 100 ml of solution to each of the pesticide solutions and the control (water) prior to application. Replicates consisted of 3 to 5 groups of 10 to 20 adult females, 1 to 4 days old, or third to fourth instar nymphs, chosen at random from a lab-reared colony. Prior to application each replicate was placed in a freezer at -10°C for 3 minutes, then transferred to a Petri dish lined with filter paper which was placed on ice. Pesticides were applied with a pipettor to each individual to runoff. Each individual received approximately 50 microlitres of solution. Inoculated individuals were set aside for 30 minutes in the petri dishes to allow them to recover. Recovered individuals were transferred to 59 ml plastic cups (Solo® Cup Company, Urbana, Ill.) containing a fresh tomato (var. Rapsodie) leaflet and *Ephestia kuhniella* eggs on the sticky end of a Post-it® note strip. The cups were placed in trays of water. The stems of the tomato leaflets were inserted through small holes in the bottoms of the Solo cups and rested in the water. Lids with a 1 cm, screened hole for ventilation were placed on the cups. Cups were examined 48h post-treatment and mortality recorded. Several changes were made to this protocol with ENSTAR. The recommended rate only, was tested. Second instar nymphs were treated instead of older nymphs. Mortality was recorded 48h post treatment for adults and nymphs. Nymphs were subsequently observed through to adults and the numbers molting successfully to adults recorded.

RESULTS: Deaths immediately post-treatment was similar for controls and for treatments, and these numbers were not included in the mortality data. Data are shown in Table 1. ENSTAR II caused no mortality in nymphs or adults. When treated nymphs were allowed to develop to adults, 98% of Enstar-treated nymphs successfully completed development compared to 100% of controls. These results were not significant (t-test, $P< 0.05$).

CONCLUSIONS: CONFIRM, ENSTAR II, PIRIMOR, ROVRAL, SULPHUR, SANMITE and VENDEX inflicted no significant mortality on *D. hesperus*. TRACER killed significantly more nymphs than the control at the double rate after 48h. Although TRACER at all 3 rates inflicted considerable mortality on adults, compared to 0 percent in the control, the data were not significant. THIODAN had no significant effects on nymphs but killed significantly more adults at the full and double rates than the control and the half rate.

SAFER'S SOAP and AVID killed significant numbers of *D. hesperus* at all 3 rates. ENSTAR had no effect on successful completion of nymphal development to adult. Tests were not done under operational conditions and therefore only indicate pesticides where compatibility problems may or may not exist.

Table 1. Percent mortality of nymphs and adult females of *Dicyphus hesperus* 48h following treatment with some contact pesticides used in commercial vegetable greenhouses. Analysis of Variance was performed on proportionate data after transformation by Arcsine Square root. For a given pesticide and column, means followed by the same letter are not significantly different (Tukey test, alpha=0.05).

Treatment	Rate	n (Nymphs)	% Mortality Nymphs	n (Adults)	% Mortality Adults
Control	-	3	0.00 a	3	2.23 a
AVID	0.15 ml/L	3	8.90 b	3	35.57 b
AVID	0.30 ml/L	3	22.23 bc	3	48.87 bc
AVID	0.60 ml/L	3	46.67 c	3	80.00 c
P			<0.001		<0.001
$F_{df=3, 8}$			17.62		20.3
Control	-	3	0.00 a	3	0.00 a
CONFIRM	0.06 ml/L	3	2.23 a	3	0.00 a
CONFIRM	0.13 ml/L	3	0.00 a	3	0.00 a
CONFIRM	0.25 ml/L	3	0.00 a	3	0.00 a
P			0.44		1
$F_{df=3, 8}$			1		1
Control	-	3	0.00 a	3	2.23 a
PIRIMOR	0.25 g/L	3	0.00 a	3	0.00 a
PIRIMOR	0.50 g/L	3	0.00 a	3	2.23 a
PIRIMOR	1.00 g/L	3	0.00 a	3	0.00 a
P			1		0.596
$F_{df=3, 8}$			1		0.667
Control	-	3	4.47 a	3	0.00 a
ROVRAL	0.50 g/L	3	0.00 a	3	0.00 a
ROVRAL	1.00 g/l	3	2.23 a	3	2.23 a
ROVRAL	2.00 g/L	3	0.00 a	3	0.00 a
P			0.219		0.441
$F_{df=3, 8}$			1.83		1
Control	-	3	1.97 a	3	2.23 a
SAFER'S	10.00 ml/L	3	44.40 b	3	76.90 b
SAFER'S	20.00 ml/L	3	80.47 c	3	96.17 c
SAFER'S	40.00 ml/L	3	73.47 bc	3	100.00 c
ANOVA Pr>F			<0.001		<0.001
$F_{df=3}$			24.12		114.62

Control	-	3	0.00 a	3	4.47 a
SANMITE	0.08 g/L	3	0.00 a	3	11.10 a
SANMITE	0.15 g/L	3	0.00 a	3	4.47 a
SANMITE	0.30 g/L	3	6.67 a	3	11.13 a
P			0.06		0.27
$F_{df=3, 8}$			3.66		1.57

Control	-	3	0.00 a	3	0.00 a
TRACER	2.01 ml/L	3	0.00 a	3	23.67 a
TRACER	4.02 ml/L	3	7.33 ab	3	29.33 a
TRACER	8.04 ml/L	3	22.00 b	3	42.00 a
P			0.01		0.07
$F_{df=3, 8}$			9		3.49

Control	-	3	0.00 a	3	0.00 a
SULPHUR	5.00 g/L	3	2.23 a	3	4.33 a
SULPHUR	10.00 g/L	3	0.00 a	3	0.00 a
SULPHUR	20.00 g/L	3	-	3	-
P			0.42		0.42
$F_{df=3, 8}$			1		1

Control	-	5	12.00 a	5	2.00 a
THIODAN	0.75 ml/L	5	8.00 a	5	2.00 a
THIODAN	1.50 ml/L	5	10.00 a	5	54.00 b
THIODAN	3.00 ml/L	5	22.00 a	5	40.00 b
P			0.5		<0.001
$F_{df=3, 8}$			0.83		21.39

Control	-	3	0.00 a	3	0.00 a
VENDEX	0.33 g/L	3	0.00 a	3	0.00 a
VENDEX	0.67 g/L	3	2.33 a	3	0.00 a
VENDEX	1.33 g/L	3	0.00 a	3	0.00 a
P			0.44		1
$F_{df=3, 8}$			1		1

2002 PMR REPORT #84 **SECTION H: BIOLOGICAL CONTROL-Insects, Mites and Nematodes**
STUDY DATA BASE: 419-2126-9717

CROP: Tomato, *Lycopersicon esculentum* Miller
PESTS: General greenhouse pests

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TITLE: EFFECT OF CONSUMPTION OF DIPEL ON SURVIVAL OF THE OMNIVOROUS MIRID *Dicyphus hesperus* (HEMIPTERA: MIRIDAE)

MATERIALS: *Dicyphus hesperus* Knight (HEMIPTERA: MIRIDAE), DIPEL WP, *Bacillus thuringiensis kurstaki*

METHODS: The effect of consuming a water solution containing DIPEL on survival of one- to four- day-old adult females and third- to fourth- instar nymphs of *Dicyphus hesperus* was determined. Insects were isolated in cages without food and water 24h prior to testing. For the test, each individual was introduced into a 225 ml modified styrofoam cup. Each cup contained 30 ml of DIPEL solution or water on the bottom and a 59 ml tapered plastic cup (Solo® Cup Company, Urbana, Ill.) rested several mm above the solution and against the walls of the styrofoam cup so that individuals could not crawl between the walls of the 2 cups into the solution. A cotton dental roll was inserted into the solution through a hole drilled into the bottom of the solo cup so that 3 cm of the 5 cm length was in the solution. *D. hesperus* individuals were confined in the cups for 24h with the DIPEL-saturated wick, then transferred to new cups with a fresh tomato leaflet (var. Rapsodie) and *Ephestia kuhniella* eggs. A single set of 45 individuals in each treatment was tested. Mortality was recorded after 7 days.

RESULTS: The effects of DIPEL on *D. hesperus* are given in Table 1.

CONCLUSIONS: Adults and nymphs of *D. hesperus* might drink from droplets on leaves that contain DIPEL when the latter is applied to plants but this would have no significant effects on *D. hesperus* nymphs or adult females.

Table 1. Percent mortality of nymphs and adult females of *Dicyphus hesperus* 7 days following exposure to DIPEL. Numbers in each column followed by the same letter are not significantly different (Chi-square Test, alpha= 0.01).

Treatment	Rate	Percent Mortality	
Control	-	6.00 a	22.00 a
DIPEL	1.25 ml/L	2.00 a	28.00 a
Chi-square $_{d=1}$		0.26	0.213
P		0.61	0.644

2002 PMR REPORT #85 **SECTION H: BIOLOGICAL CONTROL-Insects, Mites and Nematodes**
STUDY DATA BASE: 419-2126-9717

CROP: Tomato, *Lycopersicon esculentum* Miller
PESTS: General greenhouse pests

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TITLE: SENSITIVITY OF THE PREDATORY BUG, *Dicyphus hesperus* (HEMIPTERA: MIRIDAE) TO PLANT-FUME AND SULPHUR

MATERIALS: Elemental sulphur, PLANT-FUME (Nicotine), *Dicyphus hesperus* Knight (HEMIPTERA: MIRIDAE)

METHODS: Fumigation experiments were conducted in 2 separate greenhouse compartments, 304.839 m^3 each. In each compartment, 5 reps of ten, one- to four- day old *D. hesperus* adult females, or ten, third- to fourth- instar nymphs were introduced on each of five, 30 cm tall tomato (var. Rapsodie) plants and placed on the floor in plastic trays. A mullein leaf sprinkled with *Ephestia kuhniella* eggs was placed in the bottom of each tub to attract and retain any *D. hesperus* individuals which left the tomato plants. In the nicotine fumigation, adult females or nymphs on 30 cm diameter mullein plants were also exposed to the fumigant. Two canisters (guaranteed 14.8g nicotine in smoke) were ignited at 1600h in the treatment house. The recommended rate is 1 cannister per 300 m^3. Compartment vents and doors were kept shut in both compartments overnight and mortality assessed the next morning after the compartments were vented. Data was analyzed by a two-way anova using treatment and plant as factors. In the Sulphur fumigation, approximately 30 ml of elemental sulphur was burned in an electric sulphur burner from 1600h until 0800h the next day. Mortality was assessed after the houses were vented. Data was analyzed by a one-way anova t-test.

RESULTS: Results for the sulphur fumigation are summarized in Table 1. The majority of nymphs were recovered and there were no significant differences in survival or recovery ($t_{df=8}$= 0.000, P= 1.000, and $t_{df=8}$= 0.831, P= 0.430, respectively). Most of the adults were recovered from plants in the sulphur treatment. A significant number of adults left the control plants ($t_{df=8}$= -3.262, P= 0.011) but there was no effect of sulphur on mortality ($t_{df=8}$= 0.000, P= 1.000). Results for the PLANT-FUME trial are shown in Table 2. Significantly fewer adults were recovered from plants in the PLANT-FUME treatment than from plants in the control treatment ($F_{df=1,16}$ = 24.585, P< 0.001) but there was no effect of PLANT-FUME on recovery of nymphs on either tomato or mullein ($F_{df=1,16}$= 1.682, P= 0.213). There were significant effects of treatment and plant type on mortality of nymphs ($F_{df=1,16}$= 113.108, P< 0.001, and $F_{df=1,16}$= 7.175, P= 0.016, respectively) and a significant interaction between treatment and plant ($F_{df=1,16}$= 7.175, P= 0.016). Significantly more nymphs died in the PLANT-FUME treatment on tomato and mullein than in the control treatment (q= 7.957, P< 0.05, and q= 13.314, P< 0.05, respectively). Also, significantly nymphs died on tomato than on mullein in the PLANT-FUME treatment (q= 5.357, P< 0.05). The effects of treatment and plant type were also significant on mortality of adults ($F_{df=1,16}$= 276.909, P< 0.001, and $F_{df=1,16}$= 7.275, P= 0.016, respectively). Significantly more adults died in the PLANT-FUME treatment on tomato and mullein than in the control treatment (q= 19.338, P< 0.05, and q= 13.338, P< 0.05, respectively). There was a significant interaction between treatment and plant type ($F_{df=1,16}$= 7.275, P= 0.016). Significantly more adults died from the PLANT-FUME treatment on tomato than on mullein (q=13.943, P< 0.05).

CONCLUSIONS: Sulphur vapour, created by burning sulphur on a hot plate does not cause mortality in *D. hesperus* adults or nymphs in one overnight treatment period. A single fumigation with PLANT-FUME causes significant mortality to adults and nymphs on tomato and mullein plants. However, significantly more adults survived on mullein plants. The rosette structure of mullein plants may prevent fumigants from penetrating to the inner areas of the plants where *D. hesperus* can crawl.

Table 1. Percent recovery and percent mortality of *Dicyphus hesperus* adult females and nymphs from tomato plants following a 16h fumigation with Sulphur. For each treatment and column, means followed by the same letter are not significantly different (t-test, alpha= 0.05).

Treatment	Plant	n		Percent Recovery		Percent Mortality	
		Nymphs	Adults	Nymphs	Adults	Nymphs	Adults
Control	Tomato	5	5	88 a	44 a	0	0
Sulphur	Tomato	5	5	76 a	76 b	0	0
$t_{df=8}$				0.831	-3.262	0	0
P				0.43	0.011	1	1

Table 2. Percent recovery and percent mortality of *Dicyphus hesperus* adult females and nymphs from tomato and mullein plants following treatment with PLANT-FUME (nicotine). Means in the same column followed by the same letter are not significantly different (two-way anova, Tukey test, alpha= 0.05)

Treatment	Plant	n		Percent Recovery		Percent Mortality	
		Nymphs	Adults	Nymphs	Adults	Nymphs	Adults
Control	Mullein	5	5	90 a	98 a	0	0
Nicotine	Mullein	5	5	84 a	62 b	41 b	74 b
Control	Tomato	5	5	90 a	96 a	0	0
Nicotine	Tomato	5	5	66 a	66 b	88 c	97 c

2002 PMR REPORT #86 **SECTION H: BIOLOGICAL CONTROL-Insects, Mites and Nematodes**
STUDY DATA BASE: 419-2126-9717

CROP: Tomato, *Lycopersicon esculentum* Miller
PESTS: General greenhouse pests

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TITLE: SENSITIVITY OF THE PREDATORY BUG, *Dicyphus hesperus* (HEMIPTERA: MIRIDAE) TO THE SYSTEMIC PESTICIDES NOVA AND ADMIRE

MATERIALS: *Dicyphus hesperus* Knight (HEMIPTERA: MIRIDAE) NOVA 40W (myclobutanil), ADMIRE 2F (imidacloprid)

METHODS: Adults and nymphs of *Dicyphus hesperus* were tested in separate experiments on 12 cm tall tomato (var. Rapsodie) plants in 4" pots. NOVA was mixed in water at 3.4g/L with Agral® 90 (0.3ml/L), a commercial wetting agent, and sprayed to runoff. ADMIRE was mixed at 0.04ml/L and applied as a drench to the pot. Each pot received about 180 ml of solution. Control plants were sprayed with water and Agral (Nova control) or drenched with water only (ADMIRE control). For each treatment, 5 plants in pots (5 replicates) were treated. Two days after application, *Ephestia kuhniella* eggs were sprinkled on the leaves and plants were transferred to cages. Each plant received either 10, one- to four- day-old adult females or 10, third- to fourth- instar nymphs of *D. hesperus*. Mortality was assessed after an additional 5 days.

RESULTS: Results are summarized in Table 1. Individuals treated with ADMIRE which still showed movement in 1 or 2 legs but could not walk or right themselves were considered dead.

CONCLUSIONS: NOVA has no effects on mortality of *D. hesperus* nymphs or adults ($t_{df=8}$= 0.00, P= 1.00, and $t_{df=8}$= 0.00, P= 1.00). ADMIRE killed all nymphs and adults of *D. hesperus*.

Table 1. Percent mortality of *Dicyphus hesperus* adult females and nymphs 5 days following introduction onto plants treated with NOVA or ADMIRE. For each treatment and column, means followed by the same letter are not significantly different (t-test, alpha= 0.05).

Treatment	n		Percent Mortality	
	Nymphs	Adults	Nymphs	Adults
Control	5	5	0	0
NOVA	5	5	0	0
t value			0	0
P			1	1
Control	5	5	0	6.00 a
ADMIRE	5	5	100 b	100 b
t value			$>1x10^{20}$	-17.48
P			<0.001	<0.001

2002 PMR REPORT #87 **SECTION H: BIOLOGICAL CONTROL-Insects, Mites and Nematodes**
STUDY DATA BASE: 419-2126-9717

CROP: Tomato, *Lycopersicon esculentum* Miller
PESTS: General greenhouse pests

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TITLE: **RESIDUAL ACTIVITY OF SEVERAL INSECTICIDES TO THE PREDATORY BUG, *Dicyphus hesperus* (HEMIPTERA: MIRIDAE)**

MATERIALS: *Dicyphus hesperus* Knight (Hemiptera: Miridae) , AVID 1.9% EC (abamectin), THIODAN 4 EC (endosulphan), ADMIRE 2F (imidacloprid).

METHODS: Pesticides were applied at the recommended rates for greenhouse vegetables to 40 cm tall tomato (var. Rapsodie) plants. Eight to ten plants were treated for each pesticide or control. AVID at the rate of 0.3ml/L and THIODAN at the rate of 1.5ml/L were sprayed to runoff on the leaves. ADMIRE, a systemic insecticide, was applied at the rate of 0.04ml/L as a drench. Each pot drenched with ADMIRE received 180ml of solution. Agral® 90, a commercial wetting agent, was added at the rate of 0.3ml/L to the AVID and THIODAN solutions. Control plants were sprayed with water and Agral for the AVID and THIODAN tests and drenched with water only for the ADMIRE test. Residual activity of AVID, and THIODAN was tested 24h, 3 days, 1 week, 2 weeks, 3 weeks and 4 weeks post treatment or until no significant mortality on treatment plants was recorded. Residual activity of ADMIRE was tested after 1 to 4 weeks post-treatment. For each bioassy, leaflets were removed from treated plants and placed in 59 ml plastic cups (Solo® Cup Company, Urbana, Ill.). Cups were placed on racks in trays of water. The leaf petioles extended into the water through small holes drilled in the bottoms of the Solo cups. A one- to four- day-old adult female or a third- to fourth- instar nymph of *D. hesperus* was introduced into each cup. *Ephestia kuhniella* on the sticky end of a Post-it® note strip was placed in each cup for food. Mortality was assessed after 24h and 48h for AVID, and THIODAN and after 5 days for ADMIRE. Each cup containing 1 insect represented a replicate. Control and treatment pairs were compared using Chi-square tests, alpha= 0.05.

RESULTS: Results are summarized in Tables 1 to 3.

CONCLUSIONS: THIODAN and AVID treated leaflets were harmful to *D. hesperus* after 3 days but had no significant effects on mortality after 1 week. ADMIRE caused significant mortality to *D. hesperus* nymphs and adults up to and including four weeks after application. ADMIRE would not be compatible with *D. hesperus* use in greenhouses.

Table 1. Percent mortality of *Dicyphus hesperus* nymphs and adults after 48h on tomato leaflets sprayed with AVID 1.9% EC at 0.3 ml/L, 24h, 3 days, and 1 week prior to bioassays. Chi-square values are shown for analysis conducted on each stage and time period (alpha= 0.05).

Treatment	Time Following Application	n (Nymphs)	% Mortality Nymphs	n (Adults)	% Mortality Adults
Control	24h	59	1.70 ***	63	4.76 ***
AVID	24h	68	74.24 ***	66	62.12 ***
Chi-square$_{df=1}$			65.326		44.668
Control	3 days	62	0.00 ***	55	7.27 *
AVID	3 days	63	23.81 ***	59	25.42 *
Chi-square$_{df=1}$			14.596		5.509
Control	1 week	59	1.7	63	4.76
AVID	1 week	63	7.94	67	4.48
Chi-square$_{df=1}$			1.379		0.116

* pairs of means within stage and time significant at P # 0.05
** pairs of means within stage and time significant at P # 0.01
*** pairs of means within stage and time significant at P # 0.001

Table 2. Percent mortality of *Dicyphus hesperus* nymphs and adults following 48h exposure on tomato leaflets sprayed with THIODAN 4 EC at 1.5 ml/L, 24h, 3 days, and 1 week prior to bioassays. Chi-square values are shown for analysis conducted on each stage and time period (alpha= 0.05).

Treatment	Time Following Application	n (Nymphs)	% Mortality Nymphs	n (Adults)	% Mortality Adults
Control	24h	59	1.70 ***	63	4.76 ***
THIODAN	24h	68	100.00 ***	61	100.00 ***
Chi-square$_{df=1}$			119.108		108.778
Control	3 days	54	0.00 ***	57	7.02
THIODAN	3 days	62	67.74 ***	52	17.31
Chi-square$_{df=1}$			54.447		1.849
Control	1 week	54	0	57	1.75
THIODAN	1 week	56	8.93	52	1.96
Chi-square$_{df=1}$			3.203		0.404

* pairs of means within stage and time significant at P # 0.05
** pairs of means within stage and time significant at P # 0.01
*** pairs of means within stage and time significant at P # 0.001

Table 3. Percent mortality of *Dicyphus hesperus* nymphs and adults after 5 days on tomato leaflets treated with ADMIRE 2F at 0.04 ml/L, 1 to 4 weeks prior to bioassays. Chi-square values are shown for analysis conducted on each stage and time period (alpha= 0.05).

Treatment	Time Following Application	n (Nymphs)	% Mortality Nymphs after 5 days	n (Adults)	% Mortality Adults after 5 days
Control	1 week	36	0.00 ***	40	0.00 ***
ADMIRE	1 week	33	100.00 ***	42	97.62 ***
Chi-square$_{df=1}$			65.051		74.239
Control	2 weeks	53	0.00 ***	53	0.00 ***
ADMIRE	2 weeks	53	100.00 ***	55	100.00 ***
Chi-square$_{df=1}$			102.038		104.036
Control	3 weeks	61	11.48 ***	57	12.00 ***
ADMIRE	3 weeks	63	98.41 ***	65	98.46 ***
Chi-square$_{df=1}$			91.416		85.106
Control	4 weeks	63	0.00 ***	52	5.46 ***
ADMIRE	4 weeks	43	100.00 ***	63	96.83 ***
Chi-square$_{df=1}$			101.893		95.123

* pairs of means within stage and time significant at P # 0.05
** pairs of means within stage and time significant at P # 0.01
*** pairs of means within stage and time significant at P # 0.001

2002 PMR REPORT #88 **SECTION H: BIOLOGICAL CONTROL- Insects, Mites, Nematodes**
STUDY DATA BASE: 344-1252-8901

CROP: Tomato (*Lycopersicon esculentum* Mill.), cv. Rapsodie
PEST: Two-spotted spider mite, *Tetranychus urticae* Koch

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TITLE: RESIDUAL TOXICITY OF FLORAMITE AGAINST THREE COMMERCIALLY-PRODUCED BENEFICIAL SPECIES USED FOR BIOLOGICAL CONTROL OF GREENHOUSE PESTS

MATERIALS: *Orius insidiosus* (Say) (Hemiptera: Anthocoridae); *Phytoseiulus persimilis* Athias-Henriot (Acari: Phytoseiidae) (Tomato strain); *Encarsia formosa* (Gahan) (Hymenoptera: Braconidae). FLORAMITE 50WP (bifenazate); DYNOMITE 75WP (pyridaben)

METHODS: Experiments were conducted from July to October 2001 in a glass greenhouse compartment (12.0 by 6.1 m) at the Greenhouse and Processing Crops Research Centre, Harrow, Ontario. The commercial tomato cultivar 'Rapsodie', grown in rockwool slabs to the 20 leaf age, were used as the host plants. The beneficials used in the trials were *O. insidiosus*, *P. persimilis* (Tomato strain) and *E. formosa*. Solutions of Floramite 50%WP were prepared by dissolving the pesticide in distilled water at 0.30 (recommended) or 0.60g/L. Both water and the registered acaricide, Dynomite 75WP at the rate of 0.284 g/L, were sprayed as control treatments. Solutions were applied, using a high pressure CO_2 sprayer (276 kPa), to both leaf surfaces until runoff. At the same time, the inner surfaces of 40 leaf cages were sprayed with each chemical and rate, and kept in the greenhouse until used. The Petri dish leaf cages were 5 cm diameter x 0.5 cm height, with a 3 cm diameter hole on one half of the cage, which was covered with nylon cloth for ventilation, and the same size plastic plate was used for the back of the cage. The cages were held in place on leaves using two metal clips. Test insects/mites were exposed to the residues on tomato foliage by confining them in the treated leaf cages on the upper surfaces of treated leaves for 24 h, 1 and 7 days after spray application. Twenty to 25 adult *O. insidiosus* and *P. persimilis* from commercial shipments, or 20 to 25 adult female *E. formosa* that emerged within 24 h from shipped parasitized whitefly pupae were placed in the cages. The *O. insidiosus* were provided with 100 *Ephestia* eggs as a food resource, *P. persimilis* with 40 two-spotted spider mites, and *E. formosa* with a cotton ball saturated with a 5% sucrose solution. Five to six replicates were completed for each combination of residual time period, treatment rate and beneficial species. After 48 h exposure, insects/mites were observed and recorded as live or dead (individuals that could not move from one point to another when probed were recorded as dead).

RESULTS: See Table 1. Mortalities caused by 7-day-old residues of Floramite at recommended rate of 0.3g/L were <5% for all three beneficial species. Dynomite at the recommended rate showed a significantly higher residual toxicity to the test beneficial insects/mites when compared to both rates of Floramite (Table 1).

Table 1. Mortality (mean " SE) of beneficial insect/mite exposed for 48 h to 1 to 7 d-old residues of Floramite, Dynomite and water sprayed foliage.

Residual time (days)	Treatment	Rate (g/L)	Mortality (%)[a]		
			O. insidiosus	*E. formosa*	*P. persimilis*
1	Dynomite	0.284	53.49 " 7.74a	99.15 " 1.03a	63.35 " 9.35a
	Floramite	0.3	3.02 " 1.97b	5.14 " 2.08b	13.89 " 3.48b
	Floramite	0.6	5.74 " 3.54b	2.7 " 1.53b	14.21 " 5.48b
F; df; *P*			26.1; 2,14; <0.01	615.8; 2,15; <0.01	18.7; 2,14; <0.01
7	Dynomite	0.284	88.44 " 3.97a	100.00 " 0.00a	67.60 " 8.94a
	Floramite	0.3	0.90 " 0.90b	4.68 " 2.14b	1.66 " 1.43b
	Floramite	0.6	8.53 " 5.59b	4.59 " 3.82b	8.02 " 1.95b
F; df; *P*			67.3; 2,14; <0.01	22.6; 2,15; <0.01	13.9; 2,14; <0.01

Within columns for each residual time, means followed by the same letter are not significantly different at $P > 0.05$ based on SNK multiple range test. Data were arcsine square root transformed before ANOVA. Untransformed data are presented in the table.

[a] Treatment mortalities were adjusted using Abbott's formula.

CONCLUSIONS: Floramite at the tested rates is harmless according to IOBC guidelines (Hassan, S.A. 1989. Testing methodology and the concept of the IOBC/WPRS working group, pp. 1-18. *In* P.C. Jepson [ed.] Pesticides and Non-target Invertebrates. Incept, Wimborne Dorset) against the three evaluated beneficial species. *Orius insidiosus, E. formosa* and *P. persimilis* exposed to residues of Floramite 1 day after application at the recommended rate will not exhibit significant mortality.

2002 PMR REPORT #89 **SECTION H: Biological Control**
STUDY DATA BASE: 280-2126-9904

CROP: Greenhouse tomato
PEST: *Trichoplusia ni* Cabbage looper

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TITLE: ***Copidosoma floridanum*** **B Preliminary Investigations for Control of Cabbage Loopers in Greenhouses**

MATERIALS: *Trichoplusia ni* Hubner (Lepidoptera:Noctuidae) cabbage looper (CL); *Copidosoma floridanum* Ashmead (Hymenoptera:Encyrtidae) (CF) polyembryonic wasp; Tomato cv. Bonny Best Improved Ontario Seed Company; Diet based on Chippendale GM and Beck, SD. 1965. A method for rearing the cabbage looper, *Trichoplusia ni* on a meridic diet. Journal of Economic Entomology 58: 377-378.

METHODS: Experiment 1: An individual tomato plant was placed into each of four cylindrical acetate cages, 41 cm X 36 cm diameter, over a brick sand base. Into each cage we placed 6-8 mated CL moths from our rearing culture. The culture had been maintained on artificial diet using paper towel as the oviposition substrate. That the moths could actually differentiate and oviposit on tomato was an interesting observation by itself. Test cages were maintained at 24/C with a 14h photophase and 60% RH. Plants were checked daily until a total number (estimated at 100) eggs were noticed on the leaves of each plant 48 hours later. No counts of egg numbers were attempted. Moths were then removed from the cages and 24 hour old CF wasps that had been checked for appropriate sex ratio (ie more than 95 % female population) were added at rates of either 50 (Low Density) or >250 (High Density) per cage. Cages were returned to the same conditions until hatch had commenced. Once larvae were observed on the leaves, diet was added to the floor of each cage to attract any wandering larvae. Larvae were placed individually into 30 ml creamer cups with a small piece of diet. All larvae were maintained at 26/C 16 h photophase and 80%RH. Subsequently, counts were made of pupae formed, number of dead larvae recovered from each treatment, and resulting parasitized mummies formed. Analysis of Expected vs Observed total mortality was compared using the Pearson P5 test. A sample of 5 dead larvae from the High Density Treatment were examined to determine cause of death.
Experiment 2: The experiment was repeated as above with no control cages but with two cages each of the Low Density and High Density treatments to better evaluate treatment differences.

RESULTS: As outlined in Tables 1 and 2.

CONCLUSIONS: CF is a polyembryonic parasitoid that lays its egg in the host CL egg. It does not kill the host until the last larval stage after passing through a proliferative stage during which it increases in number from one embryo to circa 2000 embryos. The larger the host larva the greater the number of CF that can survive for the next generation. The ability of CF wasps to locate and parasitize CL eggs on tomato leaves in controlled environments was noted. In Experiment 1 the High Density Treatment produced a significantly

higher number of dead and parasitized larvae than expected compared to the controls. Dissection of a sample (n=5) of dead larvae showed that all were heavily parasitized. No analysis was done with the Low Density treatment due to low numbers of larvae set. In Experiment 2 total mortality caused by mummies formed and larvae killed was significantly higher than expected for the High Density compared the Low Density Treatment. The increased level of larval mortality caused by parasitism could reduce the amount of CL feeding damage normally experienced and add value to this parasitoid that does not normally kill the host until the late larval instar. Reduction of the overall larval CL population from Low Density and High Density wasp populations was 2.7 and 74.1% respectively. This did not include the egg mortality which may or may not have been caused by CF parasitism. CF populations should be able to cycle in greenhouse situations if enough mummies and appropriate ratios of male to female wasps can be maintained.

Table 1. Comparison of 2 release rates of *Copidsoma floridanum* in reducing cabbage looper numbers on caged tomato plants - Experiment 1.

Treatment	#Larvae Set	#Pupae	#Mummies	#Dead Larvae	Total
High Density	98	0	17	81	981
Low Density	1	0	0	1	1
Control	100	82	0	18	181

[1] Pearson P5 = 139.0848; df = 2; Prob. = 0.0000 for parasitism + mortality rates.

Table 2. Comparison of 2 release rates of *Copidosoma floridanum* in reducing cabbage looper numbers on caged tomato plants - Experiment 2.

Treatment	#Larvae Set	#Pupae	#Mummies	#Dead Larvae	Total
High Density 1	100	36	24	40	64
High Density 2	62	6	40	16	56
Total	162	42	64	56	1201
Low Density 1	100	98	0	2	2
Low Density 2	83	80	2	1	3
Total	183	178	2	3	51

[1] Pearson P5 = 189.3486; df = 2; Prob. = 0.0000 for parasitism + mortality rates.

2002 PMR REPORT #90 **SECTION H: BIOLOGICAL CONTROL - Insects, Mites, Nematodes, Weeds; Insect Pheromones and Natural Products; Other Methods**
Study Database: 375-1122-9610

CROP: Wheat (*Triticum aestivum* L.)
PEST: Wheat midge *Sitodiplosis mosellana* (Géhin)
PARASITOID: *Platygaster tuberosul*a Kieffer

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TITLE: **POST-RELEASE MONITORING OF *PLATYGASTER TUBEROSULA* KIEFFER, AN INTRODUCED PARASITOID OF WHEAT MIDGE, *SITODIPLOSIS MOSELLANA* (GÉHIN)**

MATERIALS: Adult *Platygaster tuberosul*a Kieffer (Hymenoptera: Platygastéridae), from a source population around Délemont, Switzerland, were released within the canopy of spring wheat fields heavily infested with wheat midge in Saskatchewan in 1993 and 1994. The releases were timed to coincide with occurrence of midge oviposition (mid-July); 277 adults (154 females) were released in 1993, and 1094 adults (495 females) were released in 1994. Releases in both years were made at the same site near Langenburg, SK (Lat. 50º 54.25'; Long. 101º 40.30'; Elev. 517 m). The long term climate normals for Langenburg are 348 mm annual rainfall, 118 cm annual snowfall, 18.8 ºC average daily maximum temperature in summer, and -14.5 ºC average daily minimum temperature in winter.

METHODS: From 1996 - 2001, approximately 20,000 wheat heads were collected in August each year from spring wheat at the Langenburg release site. In addition, commercial spring wheat fields within a 5 km radius of the release site were sampled in a similar fashion from 1999-2001. In the laboratory, wheat heads were spread out in an even layer and left at room temperature (19-22 ºC) to dry for approximately two weeks. Dried heads were then threshed gently with a small sample de-awning machine. Midge larvae were separated from the seeds and the chaff with an air cleaner. Approximately 8,000-12,000 larvae were harvested in this manner each year. Harvested larvae were placed in a soil-less mixture of vermiculite and sphagnum, and stored at 2-4 ºC for a period of 5-6 months. After this time, the mixture containing larvae was placed in an incubator (22 ºC) and maintained until emergence of *S. mosellana* or its parasitoids was complete.

RESULTS: The number of adult *P. tuberosula* recovered from the original release site at Langenburg was 7, 21, 13, 12, and 3 in 1996 - 2000, respectively. No *P. tuberosula* were recovered from wheat midge larvae that were collected in fields surrounding the release site in 1999 and 2000. In 2001, the number of *P. tuberosula* recovered from wheat midge larvae collected from the release site increased to 89 specimens, a 5% rate of parasitism. Adult *P. tuberosula* (n= 44 and 99) were also recovered from two wheat fields adjacent to the release site, which represented parasitism of 2% and 4%, respectively. In addition, *P. tuberosula* were also recovered in very low numbers (n= 4 specimens) in two of three wheat fields within 2 km of the release site. No specimens were recovered in the wheat field at 5 km from the release site.

CONCLUSIONS: The data suggest that *P. tuberosula* has successfully established in Canada in the Langenburg area; adult specimens were recovered from midge-infested wheat fields at the original release site in each of six years (1996-2001), their numbers increased dramatically in 2001, and the population is beginning to migrate out of the release site into surrounding commercial fields.

2002 PMR RAPPORT #91 **SECTION I: ENQUÊTES PHYTOSANITAIRES ET INFESTATIONS**

CULTURE: Pommes

RAVAGEURS: Charançon de la prune, *Conotrachelus nenuphar* (Herbst), mouche de la pomme, *Rhagoletis pomonella* (Walsh), carpocapse de la pomme, *Cydia pomonella* (L.), tordeuse à bandes obliques, *Choristoneura rosaceana* (Harris), hoplocampe des pommes, *Hoplocampa testudinea* Klug, punaise terne, *Lygus lineolaris* P. de B., mineuse marbrée, *Phyllonorycter blancardella* (F.).

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TITRE: **LES RAVAGEURS DES VERGERS DE POMMIERS DU QUÉBEC EN 2002.**

MÉTHODES: Dans un verger non traité aux insecticides (Frelighsburg) et dix vergers de pommiers commerciaux dont un à régie biologique, une parcelle de 1-2 ha a été mise à la disposition du réseau d'avertissements phytosanitaires du Québec pour dépister les insectes et acariens nuisibles aux pommiers et évaluer leur importance. Dans chacun de ces vergers-pilotes, le dépistage des lépidoptères a été réalisé à l'aide de pièges à phéromone sexuelle Phérocon ou Multi-pher. Pour chaque lépidoptère, deux pièges ont été disposés de part et d'autres du centre de la parcelle. Pour dépister la punaise terne et l'hoplocampe des pommes, des cartons blancs englués (15 x 20 cm) ont été placés dans les pommiers, respectivement à 70 et 150 cm au-dessus du sol à raison de deux pièges à chacun des coins de la parcelle. La mouche de la pomme a été dépistée à l'aide de sphères rouges engluées et placées dans un pommier à chacun des coins de la parcelle. Les pièges ont été installés avant le début de la période d'activité des insectes concernés soit entre le 2 avril et le 10 juin 2002. La présence et le nombre d'insectes capturés ont été relevés à toutes les semaines jusqu'à la fin de la période d'activités des insectes, le dernier relevé ayant été effectué le 23 septembre 2002. Au besoin, les pièges collants ont été nettoyés ou remplacés et les diffuseurs à phéromone ont été remplacés à toutes les 4 ou 5 semaines. Les dommages à la récolte ont été évalués dans chacune des parcelles au début de septembre en échantillonnant 500 pommes récoltées aléatoirement dans 50 à 100 arbres. Ce bilan des insectes et acariens reflète la situation générale observée dans l'ensemble des régions pomicoles.

RÉSULTATS: Voir les tableaux ci-dessous.

CONCLUSIONS: Les chenilles, incluant la tordeuse à bandes obliques, ont occasionné des dommages importants et étaient responsables de plus du tiers des dommages attribués aux insectes en 2002. Les conditions chaudes du mois de septembre ont été favorables au développement de dégâts sur fruits. L'activité du charançon de la prune était importante et les dégâts de cette année ont atteint un niveau sans précédent depuis 1992. Les journées chaudes et humides de juin ont été particulièrement favorables à l'activité de cet insecte. Les dégâts du carpocapse de la pomme sont demeurés bas mais les captures augmentent d'année en année (une augmentation moyenne de 184% cette année comparativement à la normale dans les vergers commerciaux). L'hoplocampe des pommes a été peu actif sauf en Estrie où les populations étaient élevées. Les captures de mineuses marbrées ont été importantes dans quelques vergers pour les deuxième et troisième générations. Les dégâts de punaise terne et de mouche de la pomme ont été plus faibles que la normale dans la majorité des vergers. Les dégâts totaux d'insectes (7,11%) ont été plus importants qu'à l'habitude dans les vergers commerciaux (moyenne des 10 dernières années: 4,75%).

Tableau 1. Total des captures d'adultes par piège dans les vergers-pilotes du Québec en 2002.

	Ravageurs*							
Vergers	CARPO	HOP	MIN	MOU	NFV	PUN	SEC	TBO
Compton	87	45.5	5083	24.5	38	2.8	8	69
Dunham	51	46.5	24029	3.3	130	1.8	25	183
Ste-Famille (I.O.)	46	4.5	2809	0.0	53	0.3	5	194
Franklin	44	9.5	9530	6.3	271	0.8	37	285
Frelighsburg**	207	30.5	11000	145.8	131	0.8	5	245
Hemmingford	61	31.8	10854	9.8	98	9.8	30	406
Henryville***	156	29.0	2238	30.5	134	1.3	5	156
Oka	1	0.0	5956	1.8	302	3.0	51	90
Rougemont	143	2.5	67457	0.0	186	2.8	43	411
Saint-Joseph-du-lac	5	0.3	12816	0.3	221	4.5	82	57
St-Paul d'Abbotsford	47	1.8	45137	2.0	234	2.7	20	569
Période de dépistage	29 avril - 23 sep	22 avril- 25 juin	10 avril- 23 sep	10 juin- 23 sep	2 avril- 10 juin	2 avril- 17 juin	13 mai- 23 sep	13 mai- 23 sep
Type de piège****	MP-1	C B E	MP-2	S R E	MP-1	C B E	MP-3	PH-1C
Phéromone	Trécé		Trécé		Scentry		Scentry	Trécé

Tableau 2. Dommages à la récolte (%) dans les vergers-pilotes du Québec durant la saison 2002.

	Ravageurs*							
Année	CARPO	HOP	MOU	CHE	TBO	CHA	PUN	APP
					2e gen.			
VERGERS COMMERCIAUX (9 sites)								
1992	0.04	0.11	0.13	1.11	0.07	0.93	4.22	0.24
1993	0.00	0.04	0.07	1.18	0.00	0.07	1.64	0.27
1994	0.02	0.00	0.00	0.67	0.07	0.19	1.22	0.52
1995	0.00	0.60	0.04	1.14	0.04	0.33	2.04	0.60
1996	0.00	0.16	0.04	0.94	0.12	0.27	0.86	0.35
1997	0.00	0.18	0.00	1.22	0.13	0.04	0.77	0.11
1998	0.00	1.98	0.00	0.16	0.84	0.00	2.22	0.22
1999	0.04	1.51	0.00	1.00	0.53	0.18	0.93	0.27
2000	0.00	0.76	0.24	0.76	0.71	0.40	1.51	0.29
2001	0.04	0.98	0.07	1.39	1.47	0.16	3.16	0.51
2002	0.00	2.27	0.24	2.18	0.31	0.49	0.98	0.44
1992-2001	*0.01*	*0.63*	*0.06*	*0.96*	*0.40*	*0.26*	*1.86*	*0.34*
VERGER BIOLOGIQUE (1 site)								
2002	41.0	0.6	1.8	18.6	1.0	64.2	4.0	8.2
VERGER NON TRAITÉ AUX INSECTICIDES (collaboration: B.Rancourt. AAFC. Saint-Jean-sur-Richelieu)								
1992	16.6	1.0	28.2	32.6	5.6	36.2	12.6	61.8
1993	58.4	2.6	49.0	15.6	20.4	80.8	4.6	19.6
1994	43.2	1.2	55.8	23.4	4.4	86.0	3.4	20.0
1995	38.0	1.0	98.4	50.6	4.8	88.2	3.2	42.0
1996	10.2	1.4	90.0	46.8	0.6	39.4	3.6	21.8
1997	15.2	1.8	96.8	63.6	1.0	86.2	3.0	14.6
1998	16.8	7.2	94.6	30.4	1.0	48.0	6.2	5.8
1999	NA	NA	NA	NA	NA	NA	NA	NA
2000	27.2	7.8	86.8	57.2	4.8	88.8	11.2	19.2
2001	22.2	9.4	89.8	57.0	12.6	89.6	9.4	15.0
2002	39.0	4.8	93.2	46.6	9.4	82.2	4.8	13.6
1992-2001	*27.5*	*3.7*	*76.6*	*41.9*	*6.1*	*71.5*	*6.4*	*24.4*

*CARPO: Carpocapse de la pomme; HOP: Hoplocampe des pommes; MIN: Mineuse marbrée; MOU: Mouche de la pomme; NFV: Noctuelle du fruit vert; PUN: Punaise terne; SEC: Sésie du cornouiller; TBO: Tordeuse à bandes obliques; TBR: Tordeuse à bandes rouges; CHE: Chenilles; CHA: Charançon de la prune; APP : Autres punaises phytophages. ** Verger non traité aux insecticides; *** Verger à régie biologique. ****PH-1C= Phérocon 1C; C B E= Carton blanc englué; MP= Multi-pher (1, 2 ou 3); S R E= sphère rouge engluée.

2002 PMR REPORT #92 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE 402-1531-8605

CROP: Apples cv. Gala
PEST: Grey mold, *Botrytis cinerea* Pers., Blue mold, *Penicillium expansum* Link

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TITLE: **EVALUATION OF PREHARVEST FUNGICIDE TREATMENTS FOR CONTROL OF POSTHARVEST DECAY OF APPLES, 2001**

MATERIALS: VANGARD 75 WG (cyprodinil 75%), SCALA (pyrimethanil 400g/L).

METHODS: Fungicide treatments were applied to Gala apple trees arranged in a randomized complete block design with five replicate blocks. Each block consisted of four cv. Gala trees with guard cv. Spartan trees on either side. Treatments were an unsprayed check, two bloom sprays of BENLATE and MAESTRO (1.1 kg/ha and 3.25 kg/ha, respectively) May 3 and May 15, 2001 followed by a preharvest spray of either SCALA at 1.5L/ha, SCALA at 2 L/ha, or VANGARD at 370 g/ha. Spray applications were made using a hand operated gun sprayer (345 Kpa) to run off. Preharvest treatments were applied September 4, 2001. Apples were harvested September 18, 2001. Fruit were stored for three or six months in air storage at 1 ± 0.2 °C. Upon removal from storage, replicate fruit samples of 10 apples each were wounded in triplicate, inoculated with either 20 µl of sterile distilled water, a *Botrytis*, or a mixture of a thiabendazole sensitive and thiabendazole resistant *Penicillium* spore suspensions (10^5 conidia/ml), and incubated at 20 °C for five to seven days. Two diameters of developing rot lesions were measured and wound decay data was analysed using the General Linear Model of SAS. Means were separated using the LSD comparative test.

RESULTS: As shown in Tables 1 and 2

CONCLUSIONS: After three and six months storage, decay by *Botrytis* was significantly decreased by VANGARD and SCALA as preharvest treatments. SCALA significantly reduced *Penicillium* decay after three and six months for thiabendazole sensitive and resistant strains. VANGARD as a preharvest spray significantly reduced rot by *Penicillium* after six months.

Table 1. Effect of preharvest sprays on postharvest decay of wounded, *Botrytis* or *Penicillium* inoculated cv. Gala apples after three months air storage.

Treatment	Preharvest Spray Rate September 4, 2001	Mean[1] decay diameter[‡] mm, *Botrytis cinerea*[2]	Mean decay diameter[‡] mm, *Penicillium expansum*[3]
Check		21.0 a*	17.0 a*
SCALA[†]	1.5 L/ha	4.4 b	5.9 b
SCALA[†]	2.0 L/ha	4.1 b	4.3 b
VANGARD[†]	370.0 g/ha	4.5 b	13.4 a
LSD 0.05		3.2	2.4

[1] Mean of samples of 10 apples from each of five replicate blocks. Each apple was wounded in triplicate and decay diameters were measured in two directions for the purpose of calculating mean values.
[‡] Diameter of 4.0 mm indicates no decay
[2] inoculum concentration of 1 X 10^5 conidia/ml *B. cinerea*
[3] inoculum concentration of 8 X 10^5 conidia/ml *P. expansum*
[†]plus two applications of Benlate and Maestro during bloom at 50 g and 75 g/100 L respectively , May 3 and May 15 , 2001.
* numbers followed by the same letter are not statistically different at the p=.05 level.

Table 2. Effect of preharvest treatments on decay of wounded, *Botrytis* or *Penicillium* inoculated cv. Gala apples after six months air storage

Treatment	Preharvest Spray Rate September 4, 2001	Mean[1] decay diameter[‡] mm, *Botrytis cinerea*[2]	Mean decay diameter[‡] mm, *Penicillium expansum*[3]
Check		20.1 a*	13.6 a*
SCALA[†]	1.5 L/ha	4.9 b	5.1 b
SCALA[†]	2.0 L/ha	4.1 b	4.0 b
VANGARD[†]	370.0 g/ha	4.2 b	7.0 b
LSD 0.05		3.1	1.7

[1] Mean of samples of 10 apples from each of five replicate blocks. Each apple was wounded in triplicate and decay diameters were measured in two directions for the purpose of calculating mean values.
[‡] Diameter of 4.0 mm indicates no decay
[2] inoculum concentration of 3 X 10^5 conidia/ml *B. cinerea*
[3] inoculum concentration of 5 X 10^5 conidia/ml *P. expansum*
[†] plus two applications of Benlate and Maestro during bloom at 50 g and 75 g/100 L respectively , May 3 and May 15 , 2001.
* numbers followed by the same letter are not statistically different at the p=.05 level.

2002 PMR REPORT #93 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Apples cv. Gala
PEST: Grey mold, *Botrytis cinerea* Pers., Blue mold, *Penicillium expansum* Link

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TITLE: EVALUATION OF PREHARVEST AND POSTHARVEST FUNGICIDE TREATMENTS FOR CONTROL OF POSTHARVEST DECAY OF APPLES, 2000

MATERIALS: VANGARD 75 WG (cyprodinil 75%), SOVRAN (kresoxim-methyl 50%), SCALA (pyrimethanil 400g/L), SOVRAN (kresoxim-methyl 50%), BENLATE (benomyl 50%), ZIRAM (zinc dimethyldithiocarbamate 76%), MERTECT (thiabendazole 45%), acetic acid vapor fumigation (0.1 mg/L), *Pseudomonas syringae* strain 1100-6 .

METHODS: Fungicide treatments at two weeks preharvest were applied to Gala apple trees arranged in a randomized complete block design with five replicate blocks. Each block consisted of four cv. Gala trees with guard cv. Spartan trees on either side. Treatments were an unsprayed check, SOVRAN at 300 g/ha, VANGARD at 370 g/ha, BENLATE at 1.1 kg/ha, SCALA at 2 L/ha, and ZIRAM at 5.0 kg/ha . Spray applications were made with a CO_2 back pack sprayer (30 psi) to run off.. Preharvest treatments were applied September 5, 2000. Fruit harvest was September 25, 2000. Post harvest treatments applied October 3, 2000 as a three minute dip were an untreated check, MERTECT at 0.5 L/1000 L, and *Pseudomonas syringae* strain 1100-6 at 10^7 colony forming units. The acetic acid vapor fumigation was carried out on October 12 and 13, 2001. Treated fruit were stored for three or six months in air storage at 1 ± 0.2 °C. Upon removal from storage, replicate fruit samples were wounded in triplicate, inoculated with 20 µl of a *Botrytis* or *Penicillium* spore suspension (10^5 conidia/ml), and incubated at 20 °C for five to seven days. Two diameters of developing rot lesions were measured and wound decay data was analysed using the General Linear Model of SAS. Means were separated using the LSD comparative test.

RESULTS: As shown in Tables 1 and 2

CONCLUSIONS: After three and six months storage decay by *Penicillium* and *Botrytis* was significantly decreased by BENLATE and SCALA as preharvest treatments. After six months VANGARD as a preharvest spray significantly reduced rot by *Botrytis.* The most effective treatment for the control of *Botrytis* decay after three and six months storage was SCALA applied preharvest. The most effective treatment for the control of *Penicillium* decay after three and six months storage was BENLATE applied preharvest. Postharvest treatment with MERTECT significantly reduced *Botrytis* and *Penicillium* decay after three and six months storage.

Table 1. Effect of preharvest sprays on postharvest decay of wounded, *Botrytis* or *Penicillium* inoculated cv. Gala apples after three or six months air storage.

Treatment and Rate		Mean rot diameter , mm			
Preharvest	Rate	*Botrytis* 3 months	*Botrytis* 6 months	*Penicillium* 3 months	*Penicillium* 6 months
Check		19.8 a[1]	21.0 a	13.7 a	14.0 a
BENLATE	1.1 kg/ha	13.1 b	11.4 c	6.8 c	5.1 c
SOVRAN	300 g/ha	20.4 a	19.2 ab	13.1 ab	13.7 a
SCALA	2.0 L/ha	5.7 c	5.9 d	11.0 b	9.8 b
VANGARD	370 g/ha	16.9 ab	16.1 b	12.8 ab	12.8 ab
ZIRAM	5.0 kg/ha	20.2 a	20.2 a	13.2 ab	14.6 a

[1] numbers followed by the same letter are not statistically different at the p=.05 level

Table 2. Effect of postharvest treatments on decay of wounded, *Botrytis* or *Penicillium* inoculated cv. Gala apples after three or six months air storage

Treatment	Product rate	Mean rot diameter, mm			
		Botrytis 3 months	*Botrytis* 6 months	*Penicillium* 3 months	*Penicillium* 6 months
Check		15.7[1] ab	17.7 b	13.1 b	15.1 b
acetic acid	0.1 mg/L	17.4 b	17.4 b	14.6 b	12.8 b
MERTECT	0.5 L/1000 L	12.6 a	8.3 a	6.2 a	4.4 a
Pseudomonas syringae 1100-6	10^7 CFU/ml	18.3 b	19.0 b	13.1 b	14.6 b

[1] numbers followed by the same letter are not statistically different at the p=.05 level

2002 PMR REPORT #94 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE 402-1531-8605

CROP: Apples cv. Gala
PEST: Grey mold, *Botrytis cinerea* Pers., Blue mold, *Penicillium expansum* Link

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TITLE: **EVALUATION OF POSTHARVEST FUNGICIDE TREATMENTS FOR CONTROL OF POSTHARVEST DECAY OF APPLES, 2000 AND 2001**

MATERIALS: MERTECT (thiabendazole 45%), LAG 2001 264 (PH066 35%)

METHODS: Gala apples harvested from a commercial orchard were stored in air storage at 1± 0.2°C until December 17, 2001. Apples were removed from air storage, wounded in triplicate using an alcohol sterilized 3mm diameter nail embedded in cork so that wounds of uniform width and depth would be made in each apple. Wounded apples were dipped for two minutes in spore suspensions amended with 0.5% Tween 20: *Penicillium expansum* isolate 986-2W (thiabendazole sensitive) 4 X 10^5 conidia /ml, *Botrytis cinerea* isolate B-27 3 X 10^4 conidia/ml, or a sterile distilled water control. Wounded and dipped apples were allowed to dry. Five replicate samples of five apples each were placed in mesh bags for subsequent fungicide treatment. Treatments were applied twelve hours after wounding and dip inoculation. The various fungicide treatments were prepared in 10 L volumes in 20 L plastic tubs with lids. Apples were dipped for sixty seconds in the fungicide solutions, allowed to drain, and returned to cold air storage. On February 20, 2002 treated apples were removed from storage and existing wound rot diameters were measured. The measured wound rot diameters were analyzed statistically using the SAS General Linear Means LSD procedure.

RESULTS: As shown in Table 1.

CONCLUSIONS: LAG 2001 264 at every concentration tested eliminated *Botrytis* and *Penicillium* decay from wounded inoculated Gala apples. MERTECT was effective in controlling *Penicllium* decay. Some *Botrytis* decay occurred on MERTECT treated fruit but it was statistically as effective as LAG 2001 264.

Table 1. Mean Botrytis and Penicillium decay for wounded inoculated apple fruit treated with various fungicides after two months air storage.

		Mean[1] decay diameter[‡], mm		
Treatment	Rate	Botrytis[2]	Penicillium[3]	Uninoculated
Untreated		31.0 b*	15.2 b	4.2 a
MERTECT	0.5L/1000 L	6.1 a	4.0 a	4.0 a
LAG 2001 264	0.7 L/1000 L	4.0 a	4.0 a	4.0 a
LAG 2001 264	1.5 L/1000 L	4.0 a	4.0 a	4.0 a
LAG 2001 264	2.3 L/1000 L	4.0 a	4.0 a	4.0 a
LAG 2001 264	2.9 L/1000 L	4.0 a	4.0 a	4.0 a
standard error		±0.8	±0.3	±0.1

[1] Mean of samples of 5 apples from each of five replicates. Each apple was wounded in triplicate and decay diameters were measured in two directions for the purpose of calculating mean values.
[‡] Diameter of 4.0 mm indicates no decay
[2] inoculum concentration of 3X 10^4 conidia/ml *B. cinerea*
[3] inoculum concentration of 4 X 10^5 conidia/ml *P. expansum*
* numbers followed by the same letter are not statistically different at the p=.05 level.

2002 PMR Report #95 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 280-2127-9912

CROP: Apples (*Malus domestica* Borkh.) cv. Empire
PEST: Blue mold (*Penicillium expansum* Link)

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TITLE: **EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR , SWITCH AND BIOSAVE FOR CONTROL OF BLUE MOLD OF APPLES CV. EMPIRE, DURING STORAGE, 2001-2002.**

MATERIALS: SCHOLAR 50 WG (50% fludioxonil) SWITCH 62.5 WG (25% fludioxonil and 37.5 % cyprodinil), BioSave 10LP (*Pseudomonas syringae* ESC-10) and MERTECT 500 SC (thiabendazole 45%).

METHODS: SCHOLAR (fludioxonil), SWITCH (fludioxonil and cyprodinil), BioSave (*Pseudomonas syringae* ESC-10) were compared with MERTECT (TBZ) for efficacy against blue mold of apple caused by *Penicillium expansum*. Commercially ripe apple cv. Empire were obtained from a commercial cold storage facility. All fruits were stored under controlled atmosphere conditions (1.7 °C., 2.5% O_2 and 2.5% CO_2) until used in experimental treatments. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represented a treatment replication and three replicate trays were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were drenched for 20 seconds in fungicide and TBZ-resistant (a mixture of three isolates, PS-1R, PS-2R and P12-4AR) or TBZ-sensitive (a mixture of three isolates, P24-7AS, P28-8AS; P9-3AS) of *P. expansum* at a concentration of 1×10^4 conidia/ml. Untreated check had no fungicides. Treatments were applied on 7 March 2002 and 14 March, 2002, for Experiment 1 and 2, respectively. TBZ-resistant (TBZ-R) and TBZ-sensitive (TBZ-S) *P. expansum* were compared. The treatments were completely randomized. Treated apples were incubated at 4°C for 33 days. Apples in each of the experiments were evaluated for decay after the respective incubation periods. To determine the efficacy of fungicides on the shelflife of the fruit, after first fruit decay evaluations following incubation at 4°C, the fruits were moved to 20 °C, 85% RH and incubated for 6 days. The fruit was again evaluated for blue mold incidence (percent infected apples). Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means were separated by LSD comparative tests.

RESULTS: Percent reduction of blue mold in Experiments 1 and 2 are outlined in Tables 1 and 2, respectively.

CONCLUSIONS: Both SCHOLAR at 0.4, 0.6 and 0.9 g /L concentrations and SWITCH at 0.8, 1.2 and 1.8 g /L concentrations gave 100% control of blue mold caused by TBZ-sensitive (Tables 1 and 2) and TBZ-resistant (Tables 1 and 2) at 4°C for 33 days and in shelf life studies at 20 °C for 6 days. At recommended concentration (1.59 g/L) , BioSave gave moderate disease incidence (8 to 33 %) in cold storage but high blue mold incidence was observed at 20 °C. BioSave at higher concentrations gave good control but was not effective at 20 °C. In summary, SCHOLAR and SWITCH, which gave 0 % blue mold, was very effective

against TBZ-sensitive and -resistant *P. expansum* on apples, while high disease incidence was observed in MERTECT treatments in which TBZ-resistant inoculum was used (Table 2).

Table 1. Evaluation of postharvest treatment of SCHOLAR (fludioxonil), SWITCH (fludioxonil and cyprodinil) and Biosave (*Pseudomonas syringae* ESC-10) for control of blue mold of apple, 2001-2002, (Experiment 1).

Treatment g/L	Incidence of blue mold (%)			
	Following incubation at 4°C for 33 days		Shelflife at 20 °C for 6 days following incubation at 4°C for 33 days	
	TBZ-Sensitive	TBZ-Resistant	TBZ-Sensitive	TBZ-Resistant
Inoculum only	97.2 c[1]	98.6 d	98.6 b	98.6 b
SCHOLAR @ 0.40	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.60	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.90	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @ 1.15	0.0 a	50.0 d	0.0 a	97.2 b
SWITCH-1 @ 0.80	0.0 a	0.0 a	0.0 a	0.0 a
SWITCH-2 @ 1.20	0.0 a	0.0 a	0.0 a	0.0 a
SWITCH-3 @ 1.80	0.0 a	0.0 a	0.0 a	0.0 a
BioSave @ 1.06	NT[2]	11.1 b	NT	87.5 b
BioSave @ 1.59	20.8 b	8.3 b	98.6 b	100.0 b
BioSave @ 2.38	NT	0.0 b	NT	92.4 b
BioSave @ 3.57	NT	0.0 a	NT	93.9 b

[1] Means within the column followed by the same letter are not significantly different according to LSD test at (P = 0.05).
[2] Not tested

Table 2. Evaluation of postharvest treatment of SCHOLAR (fludioxonil), SWITCH (fludioxonil and cyprodinil) and and Biosave (*Pseudomonas syringae* ESC-10) for control of blue mold of apple, 2001-2002, (Experiment 2).

Treatment g/L	Incidence of blue mold (%)			
	Following incubation at 4°C 33 days		Shelflife at 20 °C for 6 days following incubation at 4°C for 33 days	
	TBZ-Sensitive	TBZ-Resistant	TBZ-Sensitive	TBZ-Resistant
Inoculum only	95.8 d[1]	98.6 e	95.8 c	97.2 b
SCHOLAR @ 0.40	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.60	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.90	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @ 1.15	2.8 b	80.6 d	2.8 b	95.8 b
SWITCH @ 0.80	0.0 a	0.0 a	0.0 a	0.0 a
SWITCH @ 1.20	0.0 a	0.0 a	0.0 a	0.0 a
SWITCH @ 1.80	0.0 a	0.0 a	0.0 a	0.0 a
BioSave @ 1.06	NT[2]	56.6 c	NT	87.5 b
BioSave @ 1.59	8.3 c	8.3 b	98.6 c	100.0 b
BioSave @ 2.38	NT	8.3 b	NT	92.4 b
BioSave @ 3.57	NT	0.0 a	NT	93.9 b

[1] Means within the column followed by the same letter are not significantly different according to LSD test at (P = 0.05).
[2] Not tested

2002 PMR Report #96 **SECTION K: FRUIT - Diseases.**
STUDY DATA BASE: 280-2127-9912

CROP: Apples (*Malus domestica* Borkh.) cv. Red Delicious
PEST: Blue mold (*Penicillium expansum* Link)

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TITLE: **EFFICACY OF POSTHARVEST FUNGICIDE SCHOLAR FOR CONTROL OF BLUE MOLD OF APPLES CV. RED DELICIOUS, DURING STORAGE, 2001-2002.**

MATERIALS: SCHOLAR 50 WG (50% fludioxonil) and MERTECT 500 SC (thiabendazole 45%).

METHODS: A low risk fungicide, SCHOLAR (fludioxonil) was compared with the MERTECT (TBZ) for efficacy against blue mold of apple caused by *Penicillium expansum*. Commercially ripe apple cv. Red Delicious were obtained from a research orchard at Jordan Station, Ontario. All fruits were stored under controlled atmosphere conditions until used in experimental treatments. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each treatment replicate had 12 apples and four replicate trays were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were drenched for 20 seconds in fungicide and TBZ-resistant (a mixture of three isolates, PS-1R, PS-2R and P12-4AR) or TBZ-sensitive (a mixture of three isolates, P24-7AS, P28-8AS; P9-3AS) of *P. expansum* at a concentration of 1×10^4 conidia/ml. Untreated check had no fungicides. Treatments were applied on 26 April. In this experiment, blue mold caused by TBZ-resistant (TBZ-R) and TBZ-sensitive (TBZ-S) *P. expansum* were compared. The treatments were completely randomized. Treated apples were incubated at 4°C for 62 days. Apples in each of the experiments were evaluated for decay after every two weeks. Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means were separated by LSD comparative tests.

RESULTS: Percent reduction of blue mold is outlined in Tables 1and 2.

CONCLUSIONS: SCHOLAR at 0.2 and 0.4 g/L concentrations gave 100% control of blue mold caused by TBZ-sensitive (Table 1) and TBZ-resistant (Table 2) *P. expansum* isolates at 4°C for 62 days. The lower concentration of SCHOLAR (0 .01 g/L) controlled blue mold only up to a month (Tables 1 and 2). The thiabendazole fungicide, MERTECT was effective against TBZ-sensitive isolates (Table 1) but was ineffective against TBZ-resistant *P. expansum* (Table 2). In summary, SCHOLAR was very effective against thiabendazole sensitive- and resistant- *P. expansum* on apples, while high disease incidence was observed in MERTECT treatments in which TBZ-resistant inoculum was used.

Table 1. Evaluation of postharvest treatment of SCHOLAR (fludioxonil), in drench inoculation with with TBZ-sensitive *Penicillium expansum* against blue mold of apple, 2001-2002.

Treatment g/L	Incidence of blue mold (%) at various intervals following treatment and incubation at 4°C			
	15 days	30 days	45 days	62 days
Inoculum only	29.2 b[1]	41.7 b	91.7c	100.0c
SCHOLAR @ 0.01	0.0 a	0.0 a	16.6b	70.8 b
SCHOLAR @ 0.20	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.40	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @1.15	0.0 a	0.0 a	0.0 a	0.0 a

[1] Means within the column followed by the same letter are not significantly different according to LSD test at (P = 0.05).

Table 2. Evaluation of postharvest treatment of SCHOLAR (fludioxonil), in drench inoculation with TBZ-resistant *Penicillum. expansum*, against blue mold of apple, 2001-2002.

Treatment	Incidence of blue mold (%) at various intervals following treatment and incubation at 4°C			
	15 days	30 days	45 days	62 days
Inoculum only	29.2 c[1]	54.2 c	91.7 d	100.0 c
SCHOLAR @ 0.01 g/L	0.0 a	0.0 a	8.3 b	58.3 b
SCHOLAR @ 0.20 g/L	0.0a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.40 g/L	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @ 1.15 g/L	20.8 b	29.2 b	75.0 c	100.0 c

[1] Means within the column followed by the same letter are not significantly different according to LSD test at (P = 0.05).

2002 PMR Report #97 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 280-2127-9912

CROP: Apples (*Malus domestica* Borkh.) cv. Empire
PEST: Blue mold (*Penicillium expansum* Link)

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TITLE: **STORAGE EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR AND DIPHENYLAMINE FOR CONTROL OF BLUE MOLD OF APPLES CV. EMPIRE, UNDER CONTROLLED ATMOSPHERE CONDITIONS, 2001-2002.**

MATERIALS: SCHOLAR 50 WG (50% fludioxonil), No Scald Diphenylamine EC 283, BioSave 10LP *(Pseudomonas syringae* ESC-10) and MERTECT 500 SC (thiabendazole 45%).

METHODS: A trial was conducted to determine the effect of diphenylamine (DPA), an antiscalding agent, on the effectiveness of SCHOLAR (fludioxonil) against blue mold of apple caused by *Penicillium expansum*. The treatments were compared with MERTECT (TBZ) for efficacy against blue mold. Commercially ripe apple cv. Empire were obtained from a AAFC research orchard in Jordan Station, ON. All fruits were stored in cold storage at 2 °C until used in experimental treatments. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 20 apples were placed on a plastic packing insert (20 fruit master) contained in a plastic box. Each box represented a treatment replication and three replicate trays were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were drenched for 20 seconds in fungicide, DPA and TBZ-resistant (a mixture of three isolates, PS-1R, PS-2R and P12-4AR) or TBZ-sensitive (a mixture of three isolates, P24-7AS, P28-8AS; P9-3AS) of *P. expansum* at a concentration of 1×10^4 conidia/ml. Untreated check had no fungicides or DPA. Treatments were applied on 28 January, 2002 and the treated apples were stored under controlled atmosphere (CA) conditions (1.7 °C., 2.5% O_2 and 2.5 % CO_2) for 105 days. Efficacy of fungicides and DPA against TBZ-resistant (TBZ-R) and TBZ-sensitive (TBZ-S) *P. expansum* were evaluated. The treatments were completely randomized. Apples in each of the experiments were evaluated for decay after the respective incubation period. To determine the efficacy of fungicides on the shelflife of the fruit, after first fruit decay evaluations following incubation in CA storage, the fruits were moved to 20 °C, 85% RH and incubated for 6 days. The fruit was again evaluated for blue mold incidence (percent infected apples). Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means were separated by LSD comparative tests.

RESULTS: Percent reduction of blue mold in Table 1.

CONCLUSIONS: The results demonstrate that DPA has not reduced the effectiveness of SCHOLAR at 0.6 g /L against blue mold caused by TBZ-sensitive or -resistant *P. expansum* under CA conditions for 105 days, and in shelf life studies at 20 °C for 6 days. Disease incidence in BioSave treated apples ranged between 20.8 to 100.0 %. In this trial, SCHOLAR, which gave 0 % blue mold, was very effective against TBZ-sensitive and -resistant *P. expansum* on apples, while high disease incidence was observed in MERTECT treatments, in which TBZ-resistant inoculum was used.

Table 1. Evaluation of postharvest treatment of SCHOLAR (fludioxonil), in drench inoculation with TBZ-sensitive or -resistant *Penicillium expansum* and DPA, against blue mold of apple under controlled atmosphere conditions (CA), 2001-2002.

Treatment	Incidence of blue mold (%)			
	Incubation under CA for 105 days		Shelflife at 20 °C for 6 days following incubation in CA storage for 105 days	
	TBZ-Sensitive	TBZ-Resistant	TBZ-Sensitive	TBZ-Resistant
Water only	0.0 a[1]	0.0 a	0.0 a	0.0 a
Inoculum only	69.4 c	66.6 d	91.7 b	91.7 b
SCHOLAR @ 0.40 g/L	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR@ 0.60 g/L	0.0 a	0.0 a	0.0 a	0.0 a
DPA @ 3.86 g/L + inoculum	86.1 d	77.8 e	94.4 b	94.4 a
DPA @ 3.86 g/L + SCHOLAR 0.60 g/L	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT 1.15 g/L	0.0 a	50.0 c	0.0 a	97.2 b
BioSave 1.59 g/L	20.8 b	33.3 b	98.6 b	100.0 b

[1] Means within the column followed by the same letter are not significantly different according to LSD test at (P = 0.05).

2002 PMR Report #98 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 280-2127-9912

CROP: Apples (*Malus domestica* Borkh.) cv. Empire
PEST: Blue mold (*Penicillium expansum* Link)

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TITLE: **CURATIVE AND PROTECTIVE EFFECT OF POSTHARVEST FUNGICIDE SCHOLAR ON BLUE MOLD OF APPLES CV. EMPIRE, DURING CONTROLLED ATMOSPHERE STORAGE, 2001-2002.**

MATERIALS: SCHOLAR 50 WG (50% fludioxonil) and MERTECT 500 SC (thiabendazole 45%).

METHODS: In this study, SCHOLAR (fludioxonil) was evaluated for its curative and protective properties against blue mold of apple caused by *Penicillium expansum*. Commercially ripe apple cv. Empire were obtained from a AAFC research orchard in Jordan Station, ON. All fruits were stored in cold storage at 2 °C until used in experimental treatments. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 2 apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represented a treatment replication and three replicate trays were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. To test for curative properties, apples were wounded and inoculated and then incubated for 24 hours and 48 hours prior to treatment with fungicides. To test for protective properties, apples were wounded and incubated for 24 hrs and 48 hrs prior to co-treatment with fungicides and inoculum and then moved to CA storage. Apples were drenched for 20 seconds in fungicide, and/or TBZ-resistant (a mixture of three isolates, PS-1R, PS-2R and P12-4AR) or TBZ-sensitive (a mixture of three isolates, P24-7AS, P28-8AS; P9-3AS) of *P. expansum* at a concentration of 1 x 10^4 conidia/ml. Untreated check had no fungicides. Treatments were applied on 14 January and 28 January, 2002, for experiments 1 ans 2, respectively. The treated apples were stored under controlled atmosphere (CA) conditions (1.7 °C., 2.5% O_2 and 2.5 CO_2) for 105 days. Efficacy of fungicides against TBZ-resistant (TBZ-R) and TBZ-sensitive (TBZ-S) *P. expansum* were evaluated. The treatments were completely randomized. Apples in each of the experiments were evaluated for decay after the respective incubation period. To determine the efficacy of fungicides on the shelflife of the fruit, after first fruit decay evaluations following incubation in CA storage, the fruits were moved to 20 °C, 85% RH and incubated for 6 days. The fruit was again evaluated for blue mold incidence (percent infected apples). Fruits were considered decayed when a lesion develops on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means were separated by LSD comparative tests.

RESULTS: Percent reduction of blue mold is outlined in Tables 1 and 2.

CONCLUSIONS: The fungicide SCHOLAR (a.i. fludioxonil) has exhibited both curative and protective properties at 0.4, 0.6 and 0.9 g /L concentrations by controlling blue mold caused by TBZ-sensitive and TBZ-resistant (Tables 1 and 2) isolates of *P. expansum*, after 1 day and 2 days. The fungicide gave 100% control of blue mold under CA storage and during shelf life studies at 20 °C for 6 days (Tables 1 and 2). SCHOLAR,

which gave 0 % blue mold, was very effective against TBZ-sensitive and -resistant *P. expansum* on apples, while high disease incidence was observed in MERTECT treatments in which TBZ-resistant inoculum was used (Tables 1 and 2).

Table 1. Evaluation of curative and protective properties of postharvest fungicide SCHOLAR (fludioxonil) for control of blue mold of apple, under controlled atmosphere conditions (CA) for 105 days, 2001-2002.

Treatment g/L	Incidence of blue mold (%)							
	Curative				Protective			
	Day 1		Day 2		Day 1		Day 2	
	TBZ-S [1]	TBZ-R	TBZ-S	TBZ-R	TBZ-S	TBZ-R	TBZ-S	TBZ-R
Inoculum only	100.0 b[2]	100.0 c	100.0b	100.0 b	77.7 b	88.8 c	72.2 b	77.7 c
SCHOLAR @ 0.26	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.40	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.60	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.90	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @ 1.15	0.0 a	13.8 b	0.0 a	100.0 b	0.0 a	47.2 b	0 .0 a	58.3 b

[1] TBZ-S, TBZ-sensitive and TBZ-R, TBZ-resistant

[2] Means within the column followed by the same letter are not significantly different according to LSD test at (P = 0.05).

Table 2. Evaluation of curative and protective properties of postharvest fungicide SCHOLAR (fludioxonil) for control of blue mold of apple following the incubation under controlled atmosphere conditions (CA) for 105 days and then after 6 days at 20 °C , 2001-2002.

Treatment g/L	Incidence of blue mold (%)							
	Curative				Protective			
	Day 1		Day 2		Day 1		Day 2	
	TBZ-S [1]	TBZ-R	TBZ-S	TBZ-R	TBZ-S	TBZ-R	TBZ-S	TBZ-R
Inoculum only	100.0 b[2]	100.0 b	100.0 b	100.0 b	88.8 b	94.4 b	83.3 b	91.6 b
SCHOLAR @ 0.26	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.40	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.60	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.90	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @ 1.15	0.0 a	94.4 b	0.0 a	100.0 b	0.0 a	94.4 b	0 .0 a	88.8 b

[1] TBZ-S, TBZ-sensitive and TBZ-R, TBZ-resistant

[2] Means within the column followed by the same letter are not significantly different according to LSD test at (P = 0.05).

2002 PMR Report #99 **SECTION K: FRUIT - Diseases.**
STUDY DATA BASE: 280-2127-9912

CROP: Apples (*Malus domestica* Borkh.) cv.Empire
PEST: Blue mold (*Penicillium expansum* Link)

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TITLE: **CONTROL OF BLUE MOLD OF APPLES WITH SCHOLAR AND SWITCH DURING STORAGE, 2001-2002.**

MATERIALS: SCHOLAR 50 WG (50% fludioxonil), SWITCH (25% fludioxonil and 37.5% cyprodinil) and MERTECT 500 SC (45% thiabendazole).

METHODS: *Penicillium expansum*. Commercially ripe apple cv. Empire were obtained from a research orchard at Jordan Station, Ontario. All fruits were stored under controlled atmosphere conditions until use in experimental treatments. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each treatment replicate had 12 apples and four replicate trays were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were drenched for 20 seconds in fungicide and TBZ-resistant (a mixture of three isolates, PS-1R, PS-2R and P12-4AR) or TBZ-sensitive (a mixture os three isolates, P24-7AS, P28-8AS; P9-3AS) of *P. expansum* at a concentration of 1×10^4 conidia/ml. Untreated check had no fungicides. Treatments were applied on 26 April. The treatments were completely randomized. Treated apples were incubated at 4°C for 62 days. Apples in each of the experiments were evaluated for decay after every two weeks. Fruits were considered decayed when a lesion develops on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means were separated by LSD comparative tests.

RESULTS: Percent reduction of blue mold is outlined in Table 1.

CONCLUSIONS: In this trial, SCHOLAR at 0.20, 0.40, 0.60 and 0.90 g/L concentrations and SWITCH at 0.60 and 0.90 g/L gave 100% control of blue mold caused by TBZ-sensitive and TBZ-resistant (Table 1) *P. expansum* isolates at 4°C for 62 days. The lower concentration of SCHOLAR (0.12 g/L) controlled blue mold only up to a month. The complete control of blue mold with SCHOLAR at 0.2 g/l and presence of disease with SWITCH at 0.4 g/L indicates a possibility of antagonism between fludioxonil and cyprodinil in the SWITCH. This aspect will be explored next year. The thiabendazole fungicide, MERTECT was effective against TBZ-sensitive isolates but was ineffective against TBZ-resistant *P. expansum*. In summary, SCHOLAR and SWITCH were very effective against thiabendazole sensitive- and resistant- *P. expansum* on apples, while high disease incidence was observed in MERTECT treatments in which TBZ-resistant inoculum was used.

Table 1. Evaluation of postharvest treatment of SCHOLAR (fludioxonil), in drench inoculation with TBZ-sensitive or -resistant *Penicillium expansum* against blue mold of apple, 2001-2002.

Treatment g/L	Incidence of blue mold (%) at various intervals following treatment and incubation at 4°C							
	TBZ-sensitive				TBZ-resistant			
	15 days	30 days	45 days	62 days	15 days	30 days	45 days	62 days
Inoculum only	100.0 g	100.0 g	100.0 f	100.0 f	96.9 f	96.9 h	96.9 g	96.9 g
SCHOLAR @ 0.006	34.4 d	65.6 e	93.8 e	100.0 f	94.0 f	37.5 d	87.5 g	100.0 g
SCHOLAR @ 0.011	31.3 d	56.3 d	90.6 e	100.0 f	25.0 b	28.2 c	62.5 f	87.5 f
SCHOLAR @ 0.036	0.0 a	0.0 a	0.0 a	43.6 c	0.0 a	6.3 b	9.4 c	40.6 c
SCHOLAR @ 0.12	0.0 a	0.0 a	3.1 b	15.6 b	0.0 a	3.1 b	3.1 b	14.7 b
SCHOLAR @ 0.20	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.40	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.60	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.90	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SWITCH @ 0.006	84.3 f	90.63	93.6 e	96.8 e	71.9 e	78.1 f	87.5 g	90.6 f
SWITCH @ 0.011	81.3 f	93.8	100.0 f	100.0 f	59.4 d	84.4 g	96.9 g	100.0 g
SWITCH @ 0.036	37.5 e	68.8	87.5	90.6 e	37.5 c	68.8 e	90.6 g	100.0 g
SWITCH @ 0.12	6.3 c	12.5	31.3 d	56.3 d	0.0 a	0.0 a	37.5 e	75.0 e
SWITCH @ 0. 20	3.1 b	3.1	25.0 c	46.8 c	0.0 a	0.0 a	15.6 d	59.4 d
SWITCH @ 0.40	0.0 a	3.1 b	3.1 b	25.0 b	0.0 a	0.0 a	12.5 d	37.5 c
SWITCH @ 0.60	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SWITCH @ 0.90	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @ 1.15	0.0 a	0.0 a	0.0 a	0.0 a	100.0 f	100	100	100.0 g

[1] Means within the column followed by the same letter are not significantly different according to LSD test at (P = 0.05).

2002 PMR REPORT #100 **SECTION K: DISEASES OF FRUIT**
ICAR: 88880030

CROP: Apple (*Malus domestica*) cv. Gala
PEST: Fire blight, *Erwinia amylovora* (Burrill) Winslow et al

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TITLE: SCREENING QRD FORMULATIONS FOR CONTROL OF FIRE BLIGHT, 2002

MATERIALS: QRD 137 (Bacillus subtilis WP), MYCO SHIELD (Oxytetracycline hydrochloride 21.6%), UAP STREPTOMYCIN 17 (Streptomycin sulfate 22.5%)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre in Summerland, BC on two year-old Royal Gala trees on B-9 rootstocks. The bare root trees were planted in 19 litre pots containing Premier Pro-Mix growing media *(Premier Horticulture ltee, Riviere-du-Loup, Quebec)* on 17 April. The roots were trimmed. Each tree was a single replicate and each treatment was replicated six times according to the randomized block design used in this trial. Trees were separated from one another by 1 meter on all sides and were arranged in 8 rows within the screen house. The trees were fertilized with 10-52-10 (5 g/L) and Nutricote 14-14-14 (40 g/tree) at planting, and 15-15-18 (3 g/L) weekly thereafter. They were irrigated twice a week for one hour, then three times a week starting in June. Streptomycin and Myco Shield were applied with a spray bottle (80 ml per tree) on 3 May (25% bloom). On 13 May (100% bloom), all treatments were applied. Blossoms were inoculated with a cell suspension of *Erwinia amylovora* (1.4×10^7 CFU/ml) 24 hours later on 14 May (late bloom). The suspension was a mixture of two different isolates of *E. amylovora* grown in nutrient broth for 24 hours. The isolates (#S1620 & #S1477-1) were known to be virulent to apple and sensitive to streptomycin. The suspension was sprayed with a backpack sprayer (150 ml per tree). On 15 May, the second application of QRD 137 was applied. Forty-eight hours after the blossoms were inoculated, the trees were wetted for 3 hours with the overhead irrigation system on 16 May. Clusters displaying symptoms of fire blight indicated by blackening of flowers were recorded on 24 May (10 days after inoculation) and 29 May. Shoots displaying symptoms of fire blight indicated by blackening and wilting were recorded on 12 June.

RESULTS and DISCUSSION: Almost half the control flower clusters on the Gala apple trees in the trial were blighted by *Erwinia amylovora* on May 24. Oxytetracyline hydrochloride was ineffective against these sensitive strains of *E. amylovora* that were used throughout the duration of this trial. QRD 137 used at 0.75% was very effective and reduced the number of blighted clusters by 30.2% when compared to the control after the first reading. The higher rate was not as effective and the reason for this is not clear but it possibly was a result of uneven opening of flower clusters leading to less than effective coverage. The final reading of wilted flower clusters on May 29 and the number of infected shoots on June 11 showed that only streptomycin was effective for the duration of the trial.

CONCLUSIONS: QRD 137 at the 0.75% rate is an effective material for control of the blossom blight phase of fire blight.

Table 1. Percent Gala apple flower clusters and shoots blighted by *Erwinia amylovora*

Treatment and Rate	% Fire blight incidence*		
	Flowers May 24	Flowers May 29	Shoots June 11
Control	47.9 A**	68.6 A	31.2 A
Myco Shield 130 ppm + 0.3% Regulaid	45.6 A	63.0 A	30.0 A
QRD 137 1.0%	31.8 AB	61.2 A	27.4 A
QRD 137 0.75%	17.2 B	52.3 AB	25.2 A
Streptomycin 135 ppm + 0.3% Regulaid	22.5 AB	40.4 B	11.7 B
ANOVA Pr>F	0.04	0.03	0.03

* These values are means of six replications of Gala potted apple trees.
** Numbers followed by the same letter are not significantly different at p#0.05 as decided by Waller-Duncan k-ratio (k = 100) test. Raw data were arcsin transformed before ANOVA and the detransformed values are reported here.

2002 PMR REPORT #101 **SECTION K: DISEASES OF FRUIT**
ICAR: 88880030

CROP: Apple (*Malus domestica*) cv. Gala
PEST: Fire blight, *Erwinia amylovora* (Burrill) Winslow et al

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TITLE: SCREENING SO208 FORMULATIONS FOR CONTROL OF FIRE BLIGHT, 2002

MATERIALS: SO208 20 WP (Oxolinic acid), MYCO SHIELD (Oxytetracycline hydrochloride 21.6%), UAP STREPTOMYCIN 17 (Streptomycin sulfate 22.5%)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre in Summerland, BC on two year-old Royal Gala trees on B-9 rootstocks. The bare root trees were planted in 19 litre pots containing Premier Pro-Mix growing media *(Premier Horticulture ltee, Riviere-du-Loup, Quebec)* on 17 April. The roots were trimmed. Each tree was a single replicate and each treatment was replicated six times according to the randomized block design used in this trial. Trees were separated from one another by 1 meter on all sides and were arranged in 8 rows within the screen house. The trees were fertilized with 10-52-10 (5 g/L) and Nutricote 14-14-14 (40 g/tree) at planting, and 15-15-18 (3 g/L) weekly thereafter. They were irrigated twice a week for one hour, then three times a week starting in June. All treatments were applied with a spray bottle (80 ml per tree) on 3 May (25% bloom) and 13 May (100% bloom). Blossoms were inoculated with a cell suspension of *Erwinia amylovora* (1.4×10^7 CFU/ml) 24 hours later on 14 May (late bloom). The suspension was a mixture of two different isolates of *E. amylovora* grown in nutrient broth for 24 hours. The isolates (#S1620 & #S1477-1) were known to be virulent to apple and sensitive to streptomycin. The suspension was sprayed with a backpack sprayer (150 ml per tree). Forty-eight hours after the blossoms were inoculated, the trees were wetted for 3 hours with the overhead irrigation system on 16 May. Clusters displaying symptoms of fire blight indicated by blackening of flowers were recorded on 24 May (10 days after inoculation) and 29 May. Shoots displaying symptoms of fire blight indicated by blackening and wilting were recorded on 12 June.

RESULTS and DISCUSSION: Almost half the control flower clusters on the Gala apple trees in the trial were blighted by *Erwinia amylovora* on May 24. Oxytetracyline hydrochloride was ineffective against these streptmycin-sensitive strains of *E. amylovora* that were used throughout the duration of this trial. SO208 at the 200 ppm rate was as effective as streptomycin in controlling blossom blight based on the first reading of wilted blossom clusters. It reduced the number of wilted clusters by 25.2% when compared to the control. The final reading of wilted flower clusters on May 29 and the number of infected shoots on June 11 showed that only streptomycin was effective for the duration of the trial.

CONCLUSIONS: SO208 at the 200 ppm rate is an effective material for control of the blossom blight phase of fire blight, although it is not as effective as streptomycin for longer durations and may need to be applied more often.

Table 1. Percent Gala apple flower clusters and shoots blighted by *Erwinia amylovora*

Treatment and Rate	% Fire blight incidence*		
	Flowers May 24	Flowers May 29	Shoots June 11
Control	47.9 A**	68.6 A	31.2 AB
Myco Shield 130 ppm + 0.3% Regulaid	45.4 AB	64.7 A	30.0 AB
SO208 100 ppm + 0.03% Regulaid	27.5 AB	63.0 A	27.4 AB
SO208 150 ppm + 0.03% Regulaid	32.5 AB	62.0 A	31.6 AB
SO208 200 ppm + 0.03% Regulaid	22.5 B	56.3 A	30.4 AB
Streptomycin 135 ppm + 0.3% Regulaid	17.6 B	40.4 B	11.7 B
ANOVA Pr>F	0.0582	0.0134	0.1284

* These values are means of six replications of Gala potted apple trees.

** Numbers followed by the same letter are not significantly different at p#0.05 as decided by Waller-Duncan k-ratio (k = 100) test. Raw data were arcsin transformed before ANOVA and the detransformed values are reported here.

2002 PMR REPORT #102 **SECTION K: DISEASES OF FRUIT**
ICAR: 88880030

CROP: Apple (*Malus domestica*) cv. Gala
PEST: Fire blight, *Erwinia amylovora* (Burrill) Winslow et al

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TITLE: SCREENING GWN-9200 FOR CONTROL OF FIRE BLIGHT CAUSED BY STREPTOMYCIN-RESISTANT BACTERIA IN 2002

MATERIALS: GWN-9200 (Gentamicin 10 WP), SO208 20 WP (Oxolinic acid), MYCO SHIELD (Oxytetracycline hydrochloride 21.6%), UAP STREPTOMYCIN 17 (Streptomycin sulfate 22.5%)

METHODS: Two trials were conducted at the Pacific Agri-Food Research Centre, Summerland, BC on two year-old Royal Gala tree on B-9 rootstocks. The bare root trees were planted in 5 gallon pots containing Premier Pro-Mix growing media *(Premier Horticulture ltee, Riviere-du-Loup, Quebec)*. The roots were trimmed. Thirty-two of these trees were put in a greenhouse on 17 April to be used in the first screening trial and the other 32 trees were kept in a 1° C cold room until needed. Each single tree was a single replicate and each treatment replicated five times according to a randomized block design. Trees were separated from one another by 1 meter on all sides and were arranged in 4 rows within the greenhouse. The trees were fertilized with 10-52-10 (5 g/L) and Nutricote 14-14-14 (40 g/tree) at planting, and 15-15-18 (3 g/L) weekly thereafter; and irrigated as needed. All treatments were applied with a spray bottle (80 ml per tree) on 25 April (25% bloom) and 27 April (100% bloom). Blossoms were inoculated with a cell suspension of *Erwinia amylovora* (4.6×10^6 CFU/ml) 48 hours later on 29 April (late bloom). The suspension was a mixture of two different isolates of *E. amylovora* grown in nutrient broth for 24 hours. The isolates (#R1280 & #R1623) were known to be virulent to apple and resistant to streptomycin. The suspension was sprayed with a backpack sprayer (200 ml per tree). Forty-eight hours after the blossoms were inoculated, the trees were wetted for 3 hours with a mist system. Trees for use in the second trial were placed in the greenhouse on 4 June. The statistical design and fertilizer program were the same as in the first trial. Treatments were applied 13 June (25-50% bloom) and 14 June (full bloom). Blossoms were inoculated with the same isolates (#R1280 & #R1623) in a cell suspension of *E. amylovora* (5.5×10^6 CFU/mL) 24 hours later on 15 June (late bloom). Forty-eight hours after the blossoms were inoculated, the trees were wetted for 3 hours. Clusters displaying symptoms of fire blight indicated by blackening of flowers were recorded on 7 May (9 days after inoculation) for the first trial and on 21 June (6 days after inoculation) for the second trial. Shoots displaying symptoms of fire blight indicated by blackening and wilting were recorded on 22 May and 4 June for the first trial and on 26 June and 4 July for the second trial.

RESULTS and DISCUSSION: Fire blight disease pressure was extremely high in the first trial blighting 96% of the clusters on 24 May (Table 1). MYCO SHIELD was the only effective material in reducing the proportion of wilted clusters in the first reading on 7 May, and none of the materials were effective in the second reading on 24 May or against shoot blight. As expected streptomycin was ineffective against these resistant isolates. In the second trial fire blight disease pressure was lower with 31.3% of the clusters blighted after the second reading on 4 July (Table 2). The high rate of GWN-9200 was significantly more effective than streptomycin and did not differ significantly from MYCO SHIELD. MYCO SHIELD and

SO208 reduced shoot blight compared to the control. GWN-9200 appeared to reduce shoot blight but did not differ significantly from the control.

CONCLUSIONS: GWN-9200 is an effective material for controlling fire blight caused by streptomycin-resistant *E. amylovora* if the disease pressure is not too high.

Table 1. Percent Gala apple flower clusters and shoots blighted by *Erwinia amylovora* in first trial

Treatment and Rate	% Fire blight incidence[x]		
	Flower clusters May 7	Flower clusters May 24	Shoots June 4
Control	73.6 AB[z]	95.6 A	23.4 A
Streptomycin 200 ppm a.i + 0.3% Regulaid	85.2 A	98.5 A	8.9 A
[y]GWN-9200 250 ppm + 0.3% Regulaid	54.3 AB	100.0 A	0.0 A
[y]GWN-9200 375 ppm + 0.3% Regulaid	71.4 AB	99.3 A	13.6 A
[y]Gwn-9200 500 ppm + 0.3% Regulaid	61.7 AB	96.9 A	5.3 A
Myco Shield 200 ppm + 0.3% Regulaid	38.5 B	90.7 A	3.6 A
ANOVA Pr>F	0.0743	0.9087	0.2389

[x] These values are means of five replications of Gala potted apple trees.
[y] These materials were combined with Regulaid surfactant and adjusted to pH 6 with phosphate buffer.
[z] Numbers followed by the same letter are not significantly different at p#0.05 as decided by Waller-Duncan k-ratio (k = 100) test. Raw data were arcsin transformed before ANOVA and the detransformed values are reported here.

Table 2. Percent Gala apple flower clusters and shoots blighted by *Erwinia amylovora* in second trial

Treatment and Rate	% Fire blight incidence[x]		
	Flower clusters June 21	Flower clusters June 26	Shoots July 4
Control	38.3 A[Z]	23.1 A	31.3 AB
Streptomycin 200 ppm ai + 0.3% Regulaid	13.8 AB	34.0 A	40.9 A
[y]SO208 200 ppm + 0.03% Regulaid	5.4 B	22.3 A	29.8 ABC
[y]GWN-9200 250 ppm + 0.03% Regulaid	9.2 AB	21.8 A	22.8 ABC
[y]GWN-9200 500 ppm + 0.03% Regulaid	12.3 AB	18.8 AB	21.7 BC
Myco Shield 200 ppm ai + 0.3% Regulaid	4.2 B	7.0 B	14.2 C
ANOVA Pr>F	0.0983	0.0137	0.0304

[x] These values are means of five replications of Gala potted apple trees.
[y] These materials were combined with Regulaid surfactant and adjusted to pH 6 with phosphate buffer.
[z] Numbers followed by the same letter are not significantly different at p#0.05 as decided by Waller-Duncan k-ratio (k = 100) test. Raw data were arcsin transformed before ANOVA and the detransformed values are reported here.

2002 PMR REPORT #103 **SECTION K: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Apple, cv. Jonagold
PEST: Powdery mildew, *Podosphaera leucotrica* (Ell. and Ev.) Salm.

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TITLE: EFFICACY OF SERENADE AGAINST POWDERY MILDEW ON APPLE, 2000

MATERIALS: KUMULUS 80 (sulphur), NOVA 40 WP (myclobutanil), SERENADE QRD 132 and 137 (Dried Bacillus spores)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 13-year-old Jonagold apple trees on M7a rootstocks spaced at 3.0 x 6.0 m. Average volume of water applied per tree was 4 litres for a total of 3000 litres per hectare. Treatment quantities for each 100 litres of water were based on these water volumes. Forty trees were separated into 5 blocks of 8 random single tree replicates per block. The treatments were applied until run-off with a handgun operated at 400 kPa. Treatments were applied on 13 April (Tight cluster), 27 April (10% bloom,), 4 May (Full bloom), 16 May (Petal fall), 26 May (First cover), 9 June (Second cover), 30 June (Third cover), 21 July (Fourth cover), 11 August (Fifth cover), 31 August (Sixth cover). Primary powdery mildew was assessed on 16 May by counting the total number of white tips on each single tree replicate. Secondary powdery mildew incidence and severity were evaluated on 13 June, 14 July, and 7 September by rating 10 leaves on 5 shoots per tree for percent area covered by powdery mildew. Fruit mildew was determined on 25 harvested apples from each single tree replicate and evaluating each fruit for net russetting and sunburn. These counts were converted to percent infected leaves per tree, mean severity per leaf, and percent russetted or sunburned fruit. Because the values were proportions they were arcsin-transformed and subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range test at p=0.05 was used for multiple comparison of means.

RESULTS and DISCUSSION: White tips which indicate primary infection were not significantly different between treatments and ranged from a mean number of 14.4 to 27.2 per tree (Table 1). Last year the average number was 2.1 in the same orchard block indicating that powdery mildew disease pressure would be extremely high this year. Of the Serenade treatments, QRD 132 was more effective than QRD 137 in controlling foliage powdery mildew at the first recording on 13 June. The low rate of QRD 132 reduced the incidence of powdery mildew by 29% and severity 27% when compared to the untreated control. However none of the QRD 132 treatment rates were significantly different from one another. QRD 132 was not as effective as the NOVA standard on 13 June, and only NOVA was effective after this date, although even it allowed 78 and 86% of leaves to be infected in July and September, respectively. Only the NOVA standard significantly reduced the incidence and severity of fruit russetted by powdery mildew (Table 2) although it appears that QRD 132 reduced the number of russetted fruit this was not found to be significantly different than the control. Fruit treated with KUMULUS showed signs of phytotoxicity in the summer probably due to sulphur burning. The medium rate of QRD 137 increased the number of fruit with sunburn from 5.6 to 17.8%. Although phytotoxicity was not recorded on any the foliage or fruit sprayed with QRD 132 or 137, QRD 137 and 132 at medium and high rates may predispose fruit to sunburn.

CONCLUSIONS: QRD 132 is more effective than QRD 137 and will suppress powdery mildew early in the growing season. However, QRD 132 is not as effective as the NOVA standard.

Table. 1. Powdery mildew of foliage of Jonagold trees treated with Serenade

Treatment and Rate per 100 L (kg/ha)	Whit. Tips	%Foliage Powdery Mildew					
		13 June		14 July		7 September	
		Incidence	Severity	Incidence	Severity	Incidence	Severity
NOVA 4 bloom sprays 11.3 g (.34 kg/ha) then KUMULUS 200 g (6.0 kg/ha) 6 cover sprays	14.4	13.2 d*	2.4 d	78.4 b	18.7 d	86.0 b	30.3 b
QRD 132 for 10 applications 150 g (4.5 kg/ha)	23.6	64.4 c	14.0 c	95.6 a	33.5 c	95.6 a	48.5 a
QRD 132 for 10 applications 225 g (6.75 kg/ha)	21.4	78.0 bc	21.0 bc	94.4 a	40.6 bc	97.2 a	56.1 a
QRD 132 for 10 applications 300 g (9.0 kg/ha)	25.4	76.4 bc	21.0 bc	97.2 a	37.5 bc	97.6 a	58.0 a
QRD 137 for 10 applications 150 g (4.5 kg/ha)	21.8	82.8 ba	22.4 bc	86.4 a	37.6 b	99.5 a	61.0 a
QRD 137 for 10 applications 225 g (6.75 kg/ha)	22.6	82.0 b	29.2 ab	95.6 a	42.9 ab	98.8 a	53.9 a
QRD 137 for 10 applications 300 g (9.0 kg/ha)	23	86.0 ab	30.2 ab	96.8 a	36.0 ab	96.8 a	59.1 a
Control	27.2	93.2 a	40.8 a	98.0 a	42.0 a	94.8 a	59.6 a
ANOVA Pr>F	0.16	<.0001	<.0001	0.004	<.0001	0	0

* These data were arcsin transformed prior to analysis of variance. The de-transformed means are presented here. Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Duncan's Multiple Range Test.

Table 2. Percent Jonagold apples russetted and sunburned at harvest

Treatment	Powdery mildew fruit russetting		Sunburn Incidence
	Incidence	Severity	
NOVA followed by KUMULUS	16.0 b	2.6 b	0.8 c
QRD 132 (4.5 kg/ha)	25.6 ab	2.4 ab	5.6 cb
QRD 132 (6.7 kg/ha)	23.2 ab	1.9 ab	7.2 abc
QRD 132 (9.0 kg/ha)	22.4 ab	2.3 ab	12.8 ab
QRD 137 (4.5 kg/ha)	50.0 a	10.4 a	9.0 ab
QRD 137 (6.7 kg/ha)	37.2 ab	5.4 ab	17.8 a
QRD 137 (9.0 kg/ha)	38.4 ab	4.0 ab	8.0 ab
Control	56.0 a	8.4 a	5.6 cb
ANOVA	0.0669	0.0813	0.0179

* Powdery mildew data were arcsin transformed prior to analysis of variance. The de-transformed means are presented here. Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Duncan's Multiple Range Test.

2002 PMR REPORT #104 **SECTION K: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Apple, cv. Jonagold
PEST: Powdery mildew, *Podosphaera leucotrica* (Ell. and Ev.) Salm.

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TITLE: EFFECT OF CLAY AND ORGANIC TREATMENTS ON APPLE POWDERY MILDEW AND COLOUR , 2001

MATERIALS: KUMULUS 80 (sulphur), NOVA 40 WP (myclobutanil), MINERALL CLAY (glacial marine mud)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 14-year-old Jonagold apple trees on M7a rootstocks spaced at 3.0 x 6.0 m. The four treatments were applied on single tree replicates in five blocks following the complete block statistical design. Average volume of water applied per tree was 4 litres for a total of 3000 litres per hectare. Treatment quantities for each 100 litres of water were based on these water volumes. The treatments were applied until run-off with a handgun operated at 400 kPa. Treatments were applied on 26 April (Tight cluster), 8 May (Late pink), 15 May (Petal fall), 29 May (First cover), 20 June (Second cover), 10 July (Third cover), 31 July (Fourth cover), 5 September (Fifth cover). Primary powdery mildew was assessed on 7 May by counting the total number of white tips on each single tree replicate. Secondary powdery mildew incidence and severity were evaluated on 29 June, 25 July, and 12 September by rating 10 leaves on 5 shoots per tree for percent area covered by powdery mildew. Foliage chlorophyll was recorded for the clay treatments, control and NOVA standard with a Minolta SPAD 502 leaf chlorophyll meter (Minolta Canada, Mississauga, ON) on 28 August. Thirty readings from two sides of 2 to 3 leaves on 5 to 8 shoots per single tree replicate were evaluated. The shoots used were one-year-old and were growing at a 45° angle. Fruit mildew was determined on 25 harvested apples or total number of apples on the tree when less than 25 were present, for each single tree replicate and each fruit was evaluated visually for net russetting and sunburn. For the clay treatments, NOVA standard, and control fruit colour was also assessed with a Minolta CR 200 chroma meter (Minolta Canada, Mississauga, ON) at both red and yellow green locations on the apples for L, a, and b colour parameters. Chroma, an index somewhat analogous to colour saturation or intensity was calculated as $(a^{*2} + b^{*2})^{½}$. Hue is calculated from the arctangent of b*/a*. Proportion of fruit surface with solid red colour was also determined and recorded. These counts were converted to percent infected leaves per tree, mean severity per leaf, and percent russetted or sunburned fruit. Values that were proportions were arcsin-transformed and all replicate values were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). Tukey's Studentized Range test at p=0.05 or the Waller-Duncan Kratio t test at K = 100 were used for multiple comparison of means.

RESULTS and DISCUSSION: White tips which indicate primary infection were not significantly different between treatments and control (Table 1). The first reading on 27 June showed that CLAY after NOVA bloom sprays were more effective than CLAY after KUMULUS, the organic treatment. The second reading on 25 July showed that sprays of CLAY with surfactant were as effective as consecutive sprays with NOVA. CLAY without surfactant allowed more leaf area to become infected with powdery mildew. The third and final reading on 12 September was similar to the second reading although powdery

mildew incidence and severity had increased in most cases. As in the previous reading consecutive NOVA sprays and CLAY cover sprays with surfactant were among the most effective spray schedules. Use of CLAY in this trial did not effect leaf chlorophyll (Table 2) although in the previous year it did increase the chlorophyll content. CLAY without surfactant was as effective as the SOVRAN fungicide treatment in preventing fruit russet (Table 3). None of the treatments evaluated for colour characteristics differed significantly from the control in this study (Table 4) although chroma differed significantly in the previous year.

CONCLUSIONS: Ironwood Minerall clay is an effective alternative to KUMULUS (sulphur) for apple cover sprays to prevent powdery mildew.

Table. 1. Primary (white tips) and secondary (foliage) powdery mildew of Jonagold trees treated with NOVA bloom sprays followed by CLAY cover sprays

Treatment and Rate per 100 L	White Tips	%Foliage Powdery Mildew					
		29 June		25 July		12 September	
		Incid.	Severity	Incid.	Severity	Incid.	Severity
Control	14.2 A[1]	80.1 A	11.3 A	76.5 A	16.6 A	88.0 A	16.4 A
HORSETAIL extract 2 L (60 L/ha)	14.2 A	50.6 ABC	4.8 ABC	50.0 ABC	6.0 BCD	38.5 BC	3.5 D
STYLET OIL 2 L (60 L/ha)	09.0 A	41.0 ABCD	4.0 ABC	34.7 BCD	3.8 CD	40.1 BC	4.6 BCD
SOVRAN 8.0 g (0.24 kg/ha)	10.2 A	31.1 BCD	3.3 BC	53.2 ABC	7.7 ABCD	55.5 AB	5.7 BCD
[2]Clay Program	06.8 A	30.3 BCD	3.3 BC	66.8 BC	9.9 ABC	68.2 AB	10.9 ABC
[3]Clay Surf. Program	08.8 A	17.6 CD	1.5 BC	22.3 DC	2.4 D	35.6 BC	3.9 CD
[4]Clay Organic Program	12.6 A	64.1 AB	5.9 AB	64.4 AB	14.1 AB	59.2 AB	10.2 ABC
NOVA 11.3 g (0.34 kg/ha)	06.8 A	04.8 D	0.8 C	13.7 D	2.3 D	17.3 C	1.8 D
ANOVA Pr>F	0.1184	<.0001	0	<.0001	<.0001	<.0001	<.0001

[1] These data were arcsin transformed prior to analysis of variance. The detransformed means are presented here. Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Tukey's Studentized Range Test.

[2] Clay Program: Three NOVA bloom sprays at 11.3 g per 100 L of water followed by five Clay sprays at 1.5 kg per 100 L water (45 kg/ha).

[3] Clay Surfactant Program: Three NOVA bloom sprays followed by five Clay sprays at 1.5 kg per 100 L water (45 kg/ha) with 250 ml Sylgard surfactant per 100 L water (7.5 L/ha).

[4] Clay Organic Program: Three KUMULUS bloom sprays at 200 g per 100 L of water (6 kg/ha) followed by 5 Clay sprays at 1.5 kg per 100 L of water (45 kg/ha).

Table 2. SPAD Model 502 chlorophyll meter readings of Jonagold apple leaves treated with MINERALL CLAY

Treatment and Rate per 100 L	SPAD Reading
Control	36.6 A
[2]Clay Program	36.2 A
[3]Clay Surfactant Program	37.9 A
[4]Clay Organic Program	36.6 A
NOVA 11.3 g (0.34 kg/ha)	36.0 A
ANOVA Pr>F	0.9141

1 Numbers followed by the same letter are not significantly different at Kratio = 100 as decided by the Waller-Duncan K-ratio t test.

[2] Clay Program: Three NOVA bloom sprays at 11.3 g per 100 L of water followed by five Clay sprays at 1.5 kg per 100 L water (45 kg/ha).

[3] Clay Surfactant Program: Three NOVA bloom sprays followed by five Clay sprays at 1.5 kg per 100 L water (45 kg/ha) with 250 ml Sylgard surfactant per 100 L water (7.5 L/ha).

[4] Clay Organic Program: Three KUMULUS bloom sprays at 200 g per 100 L of water (6 kg/ha) followed by 5 Clay sprays at 1.5 kg per 100 L of water (45 kg/ha).

Table 3. Percent Jonagold apples russetted and sunburned at harvest

Treatment and Rate	Powdery mildew fruit russetting		Sunburn Incidence
	Incidence	Severity	
Control	52.1 A[1]	7.8 A	10.7 A
HORSETAIL extract 2 L (60 L/ha)	43.1 AB	2.8 AB	4.2 A
STYLET OIL 2 L (60 L/ha)	14.9 AB	0.9 B	9.7 A
SOVRAN 8.0 g (0.24 kg/ha)	9.5 B	0.6 B	8.0 A
[2]Clay Program	6.8 B	0.6 B	9.8 A
[3]Clay Surfactant Program	11.6 AB	2.1 AB	12.1 A
[4]Clay Organic Program	40.2 AB	3.6 AB	11.5 A
NOVA 11.3 g (0.34 kg/ha)	21.6 AB	1.2 B	6.9 A
ANOVA Pr>F	0.0011	0.0027	0.9848

[1] These data were arcsin transformed prior to analysis of variance. The detransformed means are presented here. Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Tukey's Studentized Range Test.
[2] Clay Program: Three NOVA bloom sprays at 11.3 g per 100 L of water followed by five Clay sprays at 1.5 kg per 100 L water (45 kg/ha).
[3] Clay Surfactant Program: Three NOVA bloom sprays followed by five Clay sprays at 1.5 kg per 100 L water (45 kg/ha) with 250 ml Sylgard surfactant per 100 L water (7.5 L/ha).
[4] Clay Organic Program: Three KUMULUS bloom sprays at 200 g per 100 L of water (6 kg/ha) followed by 5 Clay sprays at 1.5 kg per 100 L of water (45 kg/ha).

Table 4. Analysis of apple skin colour at a red and green location of fruit treated with MINERAL CLAY

Treatment	Colour Characteristics					
	L*	a*	b*	Chroma	Hue	%Red
A. RED AREA READINGS						
Control	48.8 A[1]	32.2 A	20.9 A	39.0 A	33.9 A	64 A
[2]Clay Prg.	51.8 A	31.8 A	21.0 A	38.8 A	34.6 A	64 A
[3]Clay Surfact Prgram	49.0 A	31.7 A	20.6 A	38.3 A	33.6 A	67 A
[4]Clay Organic Prg.	51.2 A	27.5 A	21.8 A	37.2 A	40.6 A	66 A
NOVA	49.6 A	33.4 A	19.7 A	39.0 A	31.0 A	74 A
Pr>F	0.6923	0.5419	0.858	0.8151	0.5327	0.8561
B. GREEN AREA READINGS						
Control	73 A	-6.4 A	36.8 A	38.0 A	98.1 A	
[2]Clay Prg.	75 A	-5.8 A	36.2 A	38.0 A	97.6 A	
[3]Clay Surfact. Prg.	73 A	-6.6 A	37.2 A	38.8 A	96.8 A	
[4]Clay Organic Prg.	74 A	-4.9 A	35.2 A	36.6 A	95.5 A	
NOVA	72 A	-0.8 A	33.4 A	36.4 A	89.4 A	
Pr>F	0.7563	0.8483	0.7026	0.8649	0.9105	

[1] Numbers followed by the same letter are not significantly different at Kratio = 100 as decided by the Waller-Duncan K-ratio t test.

Means of 25 fruit per treatment using a Minolta CR-200 Chroma meter measuring in CIELAB. L*= lightness, a*= bluish-green/red-purple hue components, b*= yellow/blue hue component.

Chroma = $(a^{*2} + b^{*2})^{½}$ and hue is calculated from the arctangent of b*/a*. They measure colour intensity or saturation . %Red= proportion of apple visually estimated to be a red colour.

2002 PMR REPORT #105 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 390 1252 9201

CROP: Highbush Blueberry (*Vaccinium corymbosum*)
PEST: Anthracnose *(Colletotrichum gloeosporioides (Penz.)* Penz., and Sacc. and *C. acutatum* Simmonds.)

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TITLE: **EFFICACY OF FUNGICIDES ON THE CONTROL OF ANTHRACNOSE IN HIGHBUSH BLUEBERRIES IN 2001.**

MATERIALS: MAESTRO 75 DF (captan), ALIETTE 80 WP (fosetyl-al), QUADRIS 80 WG (azoxystrobin), BRAVO 500 (chlorothalonil), BAS 500 20F, BAS 510 70F, BAS 516 38F

METHODS: The trial was conducted in 2001 in a commercial blueberry planting at Abbotsford, B.C. in a field known to be infected with *Colletotrichum gloeosporioides* and *C.acutatum*. Plants were spaced 1.3 metres apart within the row. Each treatment was applied to 3.9 m x 3 m plots (3 bushes) replicated four times in a randomized complete block design. Only the middle bush within each plot was assessed. Two untreated bushes at either end of each plot were left as a buffer between each treatment. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 500L/ha of water at a pressure of 350 kPA. QUADRIS, BAS 500, BAS 510 and BAS 516 (two rates) were each applied three times on May 10 (60% blossom stage), May 22 (90% blossom stage) and June 6 (100% blossom stage and some fruit set). Combination treatments included (a) QUADRIS (May 10) followed by ALIETTE (May 22) followed by QUADRIS (June 6), (b) QUADRIS (May 10) followed by BRAVO (May 22) followed by QUADRIS (June 6) and QUADRIS (May 10) followed by two applications of MAESTRO (May 22 and June 6) followed by(c) QUADRIS (June 26, complete fruit set). Harvest began on July 23 and continued until August 21. At each picking, marketable, rot and cull weights were recorded. Size index based on the gram weight of 50 marketable berries was also recorded at each picking. Two postharvest fruit rot trials were set up. In one trial three hundred randomly picked berries from the marketable yield were placed on damp paper towels on styrofoam plates, covered with plastic wrap and left at ambient temperature. The rots were counted approximately 8 days later. In the other trial, fifty berries were placed on moist paper towels on styrofoam plates and covered and put in cold storage at 2°C for approximately two weeks and then stored at ambient temperature for approximately one week before rots were counted. The main postharvest rot that developed was caused by *C. gloeosporioides* and *C. acutatum* with some *Botrytis cinerea* and the odd *Alternaria sp.* and *Rhizopus sp*. Ten stem sections, each containing at least two fruit trusses, were collected between November 5 and 7, 2001 from each plot. The sections from each plot were incubated at room temperature in a plastic bag with a moist paper towel. The stems and trusses were sprayed with tap water after placement in the bag. Trusses were evaluated for sporulation of the Colletotrichum fungi on November 14. The table indicates the average percent of infected trusses for the treatment. Trusses appear to be the most common plant part for winter survival of the fungus in BC. Data were analysed with the general linear models procedure (SAS institute, Cary, NC) and means were separated using the Duncan's Multiple Range Test.

RESULTS: Data are presented in Tables 1, 2, 3, 4 and 5. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: Size index was not detrimentally affected by any treatment (Table 1). There was little field rot caused by *C. gloeosporioides* and *C. acutatum* this year, although the highest amount occurred in the untreated control. Most rot occured after harvest with the highest level over 60 % in the untreated plots. In the postharvest storage trials *C. gloeosporioides* and *C. acutatum* were the main rots with some *Botrytis cinerea, Alternaria sp.* and *Rhizopus sp*. In both postharvest trials, QUADRIS, QUADRIS alternated with ALIETTE, QUADRIS alternated with BRAVO, QUADRIS alternated with MAESTRO, BAS 500 and BAS 516 reduced *Collectotrichum* (Tables 2 and 3). There appeared to be no difference between the two rates of BAS 516. *Botrytis cinerea* was more common on the last date of harvest so only this data is presented (Table 4). BAS 516 and QUADRIS alternated with MAESTRO were the best treatments for reduction of *Botrytis cinerea*. Infection in the truss counts taken in the fall after treatment were reduced by QUADRIS alternated with either ALIETTE or BRAVO and the high rate of BAS 516 (Table 5). This reduction in the truss infection could reduce the disease inoculum load for the following season.

Table 1. Marketable weight, field rot weight and size index of blueberries.

Treatment	Rate (g ai/ha)	No of Appn [1]	Marketable Weight (grams/m^2)	Rot Weight (grams/m^2)	Size Index (grams/50 berries)
Check	-	-	1991 a [2]	4.5 a	69.4 a
QUADRIS	250	3	1905 a	1.2 a	69.4 a
QUADRIS fb ALIETTE [3] fb QUADRIS	250 5500 250	1 1 1	2103 a	0.0 a	65.5 a
QUADRIS fb BRAVO fb QUADRIS	250 3600 250	1 1 1	2172 a	0.0 a	68.8 a
QUADRIS fb MAESTRO fb MAESTRO fb QUADRIS	250 1800 1800 250	1 1 1 1	1784 a	1.3 a	67.8 a
BAS 500	200	3	2066 a	0.0 a	66.0 a
BAS 510	392	3	1808 a	1.0 a	69.5 a
BAS 516	492	3	1931 a	0.0 a	67.1 a
BAS 516	600	3	2035 a	0.0 a	68.6 a

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[3] fb = followed by

Table 2. Percentage of berries infected by *Colletotrichum gloeosporioides* after storage ambient temperature following harvest.

			% infection				
Treatment	Rate (g ai /ha)	No of Appn[1]	Jul 24 Jul 30 [2]	Jul 31 Aug 7	Aug 08 Aug 15	Aug 14 Aug 23	Aug 21 Aug 29
Check	-	-	46.0 a[3]	14.8 b	45.8 a	49.3 a	62.6 a
QUADRIS	250	3	19.5 ab	2.7 c	21.3 ab	22.9 cd	33.8 ab
QUADRIS fb ALIETTE [4] fb QUADRIS	250 5500 250	1 1 1	7.5 b	4.3 c	19.3 b	30.5 bc	48.4 ab
QUADRIS fb BRAVO fb QUADRIS	250 3600 250	1 1 1	7.0 b	2.8 c	14.0 b	21.1 cd	27.6 ab
QUADRIS fb MAESTRO fb MAESTRO fb QUADRIS	250 1800 1800 250	1 1 1 1	5.0 b	0.8 c	16.4 b	13.3 cd	34.0 ab
BAS 500	200	3	26.5 ab	3.4 c	15.8 b	7.6 d	23.7 ab
BAS 510	392	3	48.5 a	25.2 a	51.4 a	43.6 ab	46.3 ab
BAS 516	492	3	5.0 b	2.1 c	13.4 b	15.8 cd	20.7 b
BAS 516	600	3	8.5 b	1.8 c	9.9 b	16.0 cd	20.7 b

[1] No of Appn = number of applications

[2] First date: set up; second date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] fb = followed by

Table 3. Percentage of berries infected by *Colletotrichum gloeosporioides* after storage in cold storage then holding at ambient temperature following harvest.

			% infection				
Treatment	Rate (g ai /ha)	No of Appn[1]	Jul 24 Aug 08 Aug 15[2]	Jul 31 Aug 16 Aug 23	Aug 08 Aug 23 Aug 30	Aug 14 Aug 29 Sept 07	Aug 21 Sept 05 Sept 12
Check	-	-	27.0 ab[3]	53.5 a	45.5 ab	24.0 b	48.0 ab
QUADRIS	250	3	10.0 bc	19.5 b	25.0 b	5.5 c	56.5 a
QUADRIS fb ALIETTE [4] fb QUADRIS	250 5500 250	1 1 1	3.5 c	23.0 b	29.0 b	14.0 bc	43.5 ab
QUADRIS fb BRAVO fb QUADRIS	250 3600 250	1 1 1	16.5 bc	16.0 b	24.5 b	7.0 c	38.0 ab
QUADRIS fb MAESTRO fb MAESTRO fb QUADRIS	250 1800 1800 250	1 1 1 1	5.0 c	25.0 b	23.0 b	4.5 c	33.5 ab
BAS 500	200	3	8.0 bc	22.0 b	34.5 ab	2.5 c	24.5 b
BAS 510	392	3	43.5 a	43.5 a	60.0 a	38.5 a	55.0 a
BAS 516	492	3	3.0 c	15.0 b	40.0 ab	4.0 c	42.5 ab
BAS 516	600	3	3.5 c	14.0 b	21.5 b	4.0 c	23.5 b

[1] No of Appn = number of applications

[2] First date: set up, second date: berries taken out of storage, third date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] fb = followed by

Table 4. Percentage of berries harvested August 21 that were infected by *Botryis cinerea* after post harvest storage trials.

			% infection	
Treatment	Rate (g ai /ha)	No of Appn[1]	Aug 21 Aug 29 [2]	Aug 21 Sept 05 Sept 12 [3]
Check	-	-	6.9 a [4]	34.5 a
QUADRIS	250	3	4.6 ab	20.5 ab
QUADRIS	250	1	5.6 ab	12.5 ab
fb ALIETTE [5]	5500	1		
fb QUADRIS	250	1		
QUADRIS	250	1	3.1 bd	24.0 ab
fb BRAVO	3600	1		
fb QUADRIS	250	1		
QUADRIS	250	1	4.8 ab	10.5 b
fb MAESTRO	1800	1		
fb MAESTRO	1800	1		
fb QUADRIS	250	1		
BAS 500	200	3	4.3 abc	13.5 ab
BAS 510	392	3	4.3 abc	22.0 ab
BAS 516	492	3	2.8 bc	13.0 ab
BAS 516	600	3	1.1 c	16.5 ab

[1] No of Appn = number of applications

[2] First date: set up, second date: rots counted

[3] First date: set up, second date: berries taken out of storage, third date: rots counted.

[4] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[5] fb = followed by

Table 5. Percentage of fruit trusses infected by *Collectotrichum* after one week of incubation at ambient temperature.

Treatment	Rate (g ai /ha)	No of Appn [1]	Percent Infection %
Check	-	-	78 a [2]
QUADRIS	250	3	60 abc
QUADRIS	250	1	43 bc
fb ALIETTE [3]	5500	1	
fb QUADRIS	250	1	
QUADRIS	250	1	38 c
fb BRAVO	3600	1	
fb QUADRIS	250	1	
QUADRIS	250	1	68 ab
fb MAESTRO	1800	1	
fb MAESTRO	1800	1	
fb QUADRIS	250	1	
BAS 500	200	3	68 ab
BAS 510	392	3	80 a
BAS 516	492	3	68 ab
BAS 516	600	3	35 c

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[3] fb = followed by

2002 PMR REPORT #106 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 390 1252 9201

CROP: Highbush Blueberry (*Vaccinium corymbosum*)
PEST: Anthracnose *(Colletotrichum gloeosporioides (Penz.)* Penz., and Sacc. and *C. acutatum* Simmonds.), Botrytis (*Botrytis cinerea*)

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TITLE: EFFICACY OF FUNGICIDES FOR THE CONTROL OF ANTHRACNOSE AND BOTRYTIS IN HIGHBUSH BLUEBERRIES IN 2002.

MATERIALS: BAS 500 CABRIO 20 WG (pyraclostrobin), BAS 510 70 WG, BAS 516 38 WG, BAS 516 300 g/L SE, MAESTRO 80 DF (captan), SCALA 400 g/L F (pyrimethanil), ELEVATE 50 WDG (fenhexamid).

METHODS: The trial was conducted in 2002 in a blueberry planting near Abbotsford, B.C. in a field known to be infected with anthracnose and botrytis Plants were spaced 1.3 metres apart within the row. Each treatment was applied to 3.9 m x 3 m plots (3 bushes) replicated four times in a randomized complete block design. Only the middle bush within each plot was assessed. One untreated bush at either end of each plot was left as a buffer between each treatment. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 1000 L/ha of water at a pressure of 276 kPa , BAS 500, BAS 510, BAS 516 38 % WG (three rates), BAS 516 300 g/L SE, SCALA , MAESTRO, ELEVATE, and a mixture of ELEVATE plus MAESTRO were each applied four times on May 15 (5-10 % blossom stage), June 6 (95% blossom stage), June 20 (100% blossom stage) and July 12 (fruit set). Combination treatments included BAS 510 (May 15) followed by MAESTRO (June 6) followed by BAS 510 (June 20) followed by MAESTRO (July 12, complete fruit set). Harvest began on July 30 and continued until August 14. At each picking, marketable, rot and cull weights were recorded. Size index based on the gram weight of 50 marketable berries was also recorded at each picking. Two postharvest fruit rot trials were set up. In one trial two hundred randomly picked berries from the marketable yield were placed on damp paper towels on styrofoam plates, covered with plastic wrap and left at ambient temperature. The rots were counted approximately 8 days later. In the other trial, fifty berries were placed on moist paper towels on styrofoam plates and covered and put in cold storage at 3°C for approximately two weeks and then stored at ambient temperature for approximately one week before rots were counted. The main postharvest rots that developed were caused by *C. gloeosporioides*, *Botrytis cinerea* and *Rhizopus sp*. and the odd *Alternaria sp*. Data were analysed with the general linear models procedure (SAS institute, Cary, NC) and means were separated using the Duncan's Multiple Range Test.

RESULTS: Data are presented in Tables 1 - 5. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: Size index was not detrimentally affected by any treatment. The field rots were mainly mummy berries that appeared not to be affected by any of the treatments. In the postharvest storage trials *C. gloeosporioides* and *C. acutatum*, *Botrytis cinerea* and *Rhizopus sp.* were the main rots with some *Pennicillium sp.* Anthracnose and botrytis are the main postharvest rots that reduce shelf-life. In the ambient temperature trials *C. gloeosporioides* and *C. acutatum* were reduced by BAS 500, BAS 516, ELEVATE + MAESTRO and MAESTRO. *Botrytis cinerea* was reduced by BAS 500., BAS 516, BAS 510 fb MAESTRO, ELEVATE and ELEVATE + MAESTRO. The treatments were not consistent in

reducing *Rhizopus sp.* The incidence of *C. gloeosporioides* and *C. acutatum* was reduced by the cool storage treatment. In the cool storage followed by ambient temperature trials, *Botrytis cinerea* was reduced by BAS 516, BAS 510 fb MAESTRO, ELEVATE, and ELEVATE + MAESTRO.

Table 1. Marketable weight, field rot weight and size index of blueberries.

Treatment	Rate (g ai/ha)	No of Appn [1]	Marketable Weight (grams/m^2)	Rot Weight (grams/m^2)	Size Index (grams/50 berries)
Check	-	-	8982 a [2]	73.5 ab	95.6 ab
BAS 500	200	4	8213 a	99.2 a	93.7 ab
BAS 510	390	4	7687 a	48.8 ab	89.7 b
BAS 516 WG	490	4	8108 a	46.7 ab	93.3 ab
BAS 516	600	4	8678 a	32.8 b	92.4 ab
BAS 516	1200	4	10236 a	38.9 ab	93.3 ab
BAS 516 SE	490	4	10768 a	65.3 ab	95.1 ab
BAS 510 fb MAESTRO fb BAS 510 fb MAESTRO	390 1800 390 1800	1 1 1 1	9947 a	82.6 ab	87.9 b
SCALA	800	4	8042 a	76.7 ab	94.3 ab
ELEVATE	850	4	8582 a	90.5 ab	90.0 ab
ELEVATE + MAESTRO	550 1800	4	8671 a	57.1 ab	93.0 ab
MAESTRO	1800	4	8607 a	76.8 ab	98.8 a

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[3] fb = followed by

Table 2. Percentage of berries infected by *Colletotrichum gloeosporioides* after ambient temperature storage following harvest.

			% infection		
Treatment	Rate (g ai /ha)	No of Appn[1]	Jul 30 Aug 8[2]	Aug 6 Aug 14	Aug 12 Aug 20
Check	-	-	69.6 a [3]	53.5 ab	21.4 ab
BAS 500	200	4	4.8 c	3.4 d	1.4 d
BAS 510	390	4	72.3 a	68.5 a	28.5 a
BAS 516 WG	490	4	24.5 bc	22.3 bcd	2.3 cd
BAS 516	600	4	17.3 bc	29.3 bcd	1.5 d
BAS 516	1200	4	20.4 bc	19.8 cd	0.4 d
BAS 516 SE	490	4	8.8 c	16.3 cd	0.8 d
BAS 510 fb[4] MAESTRO fb BAS 510 fb MAESTRO	390 1800 390 1800	1 1 1 1	62.3 a	48.5 abc	15.8 abc
SCALA	800	4	62.4 a	46.4 abc	21.5 ab
ELEVATE	850	4	53.0 ab	49.1 abc	12.5 bcd
ELEVATE+ MAESTRO	550 1800	4	19.8 bc	21.8 bcd	2.1 cd
MAESTRO	1800	4	27.4 bc	18.0 cd	5.8 cd

[1] No of Appn = number of applications

[2] First date: set up; second date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] fb = followed by

Table 3. Percentage of berries infected by *Botrytis cinerea* after ambient temperature storage following harvest.

			% infection		
Treatment	Rate (g ai /ha)	No of Appn[1]	Jul 30 Aug 8[2]	Aug 6 Aug 14	Aug 12 Aug 20
Check	-	-	75.9 a [3]	46.9 a	34.0 a
BAS 500	200	4	44.5 cde	26.3 a-d	19.1 abc
BAS 510	390	4	54.3 bc	40.1 abc	28.5 ab
BAS 516 WG	490	4	40.5 c-f	19.8 bcd	12.8 bc
BAS 516	600	4	27.9 ef	20.8 bcd	6.5 c
BAS 516	1200	4	23.5 f	15.3 cd	4.6 c
BAS 516 SE	490	4	29.8 def	18.5 bcd	11.3 bc
BAS 510	390	1	55.8 bc	27.2 a-d	20.3 abc
fb[4] MAESTRO	1800	1			
fb BAS 510	390	1			
fb MAESTRO	1800	1			
SCALA	800	4	77.9 a	42.5 ab	30.8 a
ELEVATE	850	4	48.4 bcd	28.1 a-d	18.0 abc
ELEVATE+ MAESTRO	550 1800	4	33.9 def	11.3 d	13.0 bc
MAESTRO	1800	4	64.0 ab	19.8 bcd	18.2 abc

[1] No of Appn = number of applications

[2] First date: set up; second date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] fb = followed by

Table 4. Percentage of berries infected by *Rhizopus sp.* after ambient temperature storage following harvest.

			% infection		
Treatment	Rate (g ai /ha)	No of Appn[1]	Jul 30 Aug 8[2]	Aug 6 Aug 14	Aug 12 Aug 20
Check	-	-	33.9 a	57.6 a	25.9 a
BAS 500	200	4	35.9 a	17.6 b	28.0 a
BAS 510	390	4	47.1 a	23.0 b	20.0 a
BAS 516 WG	490	4	11.9 a	25.1 b	31.3 a
BAS 516	600	4	28.4 a	9.3 b	16.8 a
BAS 516	1200	4	17.9 a	30.0 b	17.3 a
BAS 516 SE	490	4	35.5 a	37.8 ab	44.8 a
BAS 510 fb[4] MAESTRO fb BAS 510 fb MAESTRO	390 1800 390 1800	1 1 1 1	20.6 a	28.3 b	18.5 a
SCALA	800	4	32.6 a	57.6 a	37.5 a
ELEVATE	850	4	32.4 a	29.3 b	23.4 a
ELEVATE+ MAESTRO	550 1800	4	17.4 a	16.8 b	31.0 a
MAESTRO	1800	4	27.3 a	25.8 b	31.5 a

[1] No of Appn = number of applications

[2] First date: set up; second date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] fb = followed by

Table 5. Percentage of berries infected by *Colletotrichum gloeosporioides* after cold temperature storage and ambient temperature storage following harvest.

			% infection	
Treatment	Rate (g ai /ha)	No of Appn[1]	Jul 30 Aug 15 Aug 19[2]	Aug 6 Aug 20 Aug 27
Check	-	-	1.1 a [3]	7.1 bc
BAS 500	200	4	2.0 a	1.8 c
BAS 510	390	4	5.6 a	15.6 a
BAS 516 WG	490	4	1.5 a	3.3 c
BAS 516	600	4	0.8 a	6.1 bc
BAS 516	1200	4	0.4 a	2.9 c
BAS 516 SE	490	4	0.5 a	2.8 c
BAS 510 fb[4] MAESTRO fb BAS 510 fb MAESTRO	390 1800 390 1800	1 1 1 1	3.9 a	8.0 abc
SCALA	800	4	3.9 a	7.3 bc
ELEVATE	850	4	6.0 a	12.1 ab
ELEVATE+ MAESTRO	550 1800	4	4.1 a	6.6 bc
MAESTRO	1800	4	1.8 a	4.9 bc

[1] No of Appn = number of applications

[2] First date: put in cool storage; second date: put in ambient storage; third date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] fb = followed by

Table 6. Percentage of berries infected by *Botrytis cinerea* after cold storage and ambient temperature storage following harvest.

			% infection	
Treatment	Rate (g ai /ha)	No of Appn[1]	Jul 30 Aug 15 Aug 19[2]	Aug 6 Aug 20 Aug 27
Check	-	-	17.0 ab[3]	21.5 a
BAS 500	200	4	13.8 abc	18.3 abc
BAS 510	390	4	15.6 ab	17.6 abc
BAS 516 WG	490	4	11.8 bcd	11.0 d
BAS 516	600	4	6.7 d	11.9 d
BAS 516	1200	4	5.4 d	6.0 e
BAS 516 SE	490	4	8.8 cd	11.7 d
BAS 510 fb[4] MAESTRO fb BAS 510 fb MAESTRO	390 1800 390 1800	1 1 1 1	13.5 abc	15.6 bcd
SCALA	800	4	19.4 a	19.9 ab
ELEVATE	850	4	13.4 abc	17.1 cd
ELEVATE+ MAESTRO	550 1800	4	10.4 bcd	13.3 cd
MAESTRO	1800	4	18.8 a	17.6 abc

[1] No of Appn = number of applications

[2] First date: put into cool storage; second date: put into ambient storage; third date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] fb = followed by

2002 PMR REPORT #107 **SECTION K: FRUIT- Diseases**
ICAR: na

CROP: Grape, *Vitis vinifera*, cv. Cabernet Franc
PEST: Powdery Mildew, *Uncinula necator*, (Schw.) Burr.

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TITLE: VINEYARD EVALUATION OF COMMERCIAL FUNGICIDES AND ALTERNATIVES FOR CONTROL OF GRAPEVINE POWDERY MILDEW

MATERIALS: BAS 516, FLINT (trifloxystrobin 50%), KUMULUS 80W (sulphur 80%), NOVA 40W (myclobutanil 40%), KASIL25 (potassium silicate), SOVRAN (kresoxim-methyl 50%), POTASSIUM BICARBONATE, HORSETAIL TEA (*Equisetum arvense*), AUXI-GRO (gamma amino butyric acid), UPTAKE PLUS (chelated P,K,N, Zn, Cu), QWEL (botanical extract), PRIMROSE OIL

METHODS: The experiment was conducted on five to six-vine plots replicated four times in a randomised complete block design in a mature research vineyard cv. Cabernet Franc with a history of severe powdery mildew infection. Due to extremely dry conditions, 5 cm of overhead irrigation was applied to the vineyard 16 July. Sprays were applied with a hydraulic tunnel sprayer at 1380 kPa at a rate of 500 L per ha through post-bloom and 1000 L per ha from fruit set onward. Treatments were applied 3 June (5-8 cm shoot length), 10 June (12-15 cm shoot length), 19 June (immediate pre-bloom), 29 June (immediate post-bloom), 12 July (fruit set), 30 July (berry touch), 20 August (early veraison), 6 September (late veraison) and September 19 (pre-harvest). BAS 516 (160 g ai/ha and 280 g ai/ha), KUMULUS (10.1, 5 and 2.5 g ai/ha), HORSETAIL TEA (75 g/ha), PRIMROSE OIL HIGH and QWEL HIGH (each at 5 L/ha pre-bloom and 10 L /ha post-bloom) PRIMROSE OIL MEDIUM and QWEL MEDIUM (each at 2.5 L/ha pre-bloom and 5 L/ha post-bloom) and PRIMROSE OIL LOW and QWEL LOW (each at 1.25 L/ha pre-bloom and 2.5 L/ha post-bloom), KASIL (2.4 L product/ha until post-bloom, 4.8 L product/ha after post-bloom) and FLINT were applied at all dates. The spray schedules for the remaining treatments included rotations of various compounds and a GROWER program as outlined in Table 1. Incidence and severity of powdery mildew was evaluated 23 October on 50 random leaves and 25 random clusters on the middle three vines per plot using the Barratt Horsfall scale for severity. Both incidence and severity values were arcsin square root transformed and analysed using ANOVA (SPSS).

RESULTS: As outlined in Table 2.

CONCLUSIONS: The growing season of 2002 was extremely dry with precipitation significantly less than the 10-year average. The application of irrigation at approximately fruit set provided ideal conditions for primary infections. All treatments provided control of foliar infections and, with the exception of full season KASIL and PRIMROSE OIL at 5 and 2.5 L/ha rates, of fruit infections significantly better than the untreated check at fruit set. Both rates of BAS 516, all rates of KUMULUS, the FLINT alternations, and the GROWER provided the best control of foliar and fruit infections at the pre-harvest evaluation. There was no significant difference in incidence or severity of powdery mildew on fruit or foliage among different rates of BAS 516 or KUMULUS. KASIL, alone or in alternation, POTASSIUM BICARBONATE, QWEL at all rates, AUXI-GRO and UPTAKE PLUS provided moderate control of powdery mildew on leaves. The PRIMROSE OIL treatments and the HORSETAIL TEA did not give good control of foliar infections, although levels were generally significantly less than the untreated check. All treatments provided commercially acceptable control of powdery mildew on fruit. PRIMROSE OIL

treatments changed the waxy bloom on fruit to a shiny oily texture. No other symptoms of phytotoxicity were observed in any treatments on fruit or foliage.

Table 1. Date of fungicide applications for treatments including more than 1 product

	Treatments						
Date of Application	Grower Program	Flint Early	Flint Mid-Season	KaSil/ Grower	Auxi-Gro	Potassium Bicarbonate	UpTake Plus
June 3	Kumulus	Flint	Kumulus	KaSil	Kumulus	Kumulus	Kumulus
June 10	Nova	Flint	Nova	Nova	Nova	Nova	Nova
June 19	Sovran	Flint	Flint	Sovran	Auxi-Gro	Potassium Bicarbonate	UpTake Plus
June 29	Nova	Flint	Flint	Nova	Nova	Potassium Bicarbonate	UpTake Plus
July 12	Sovran	Flint	Kumulus	Sovran	Auxi-Gro	Potassium Bicarbonate	UpTake Plus
July 30	Kumulus	Kumulus	Flint	KaSil	Kumulus	Potassium Bicarbonate	UpTake Plus
Aug. 20	Kumulus	Kumulus	Kumulus	KaSil	Auxi-Gro	Potassium Bicarbonate	UpTake Plus
Sept.6	Kumulus	Kumulus	Kumulus	KaSil	Auxi-Gro	Potassium Bicarbonate	UpTake Plus
Sept.19				KaSil			

Table 2. Evaluation of fungicides for control of grapevine powdery mildew

	Foliar infection				Fruit infection			
	Incidence		Severity		Incidence		Severity	
Treatment	(%)		(% area)		(%)		(% area)	
UNTREATED	100	h[1]	97	i	97	e	41	h
GROWER	20	ab	0	a	5	a	0	a
FLINT FULL SEASON	99	gh	42	d	77	bcde	2	c
BAS516 421 g ai/ha	33	abcd	1	a	9	a	0	a
BAS516 737 g ai/ha	26	abc	0	a	3	a	0	a
FLINT EARLY SEASON	11	a	0	a	5	a	0	a
FLINT MID-SEASON	13	a	0	a	4	a	0	a
HORSETAIL TEA	80	defgh	62	f	96	de	4	c
KASIL FULL SEASON	94	fgh	40	d	91	cde	8	fg
KASIL/GROWER	66	cdef	9	b	72	bcde	1	c
KUMULUS 10.1 kg	19	ab	1	a	3	a	0	a
KUMULUS 5 kg	16	ab	1	a	5	a	0	a
KUMULUS 2.5 kg	35	abcde	6	b	61	bcd	1	b
POTASSIUM BICARBONATE	74	cdef	52	e	74	bcde	2	c
QWEL HIGH	69	cde	43	d	85	bcde	2	cd
QWEL MEDIUM	71	cdef	43	d	76	bcde	2	c
QWEL LOW	59	bcdef	17	c	56	bc	1	b
PRIMROSE OIL HIGH	100	h	82	h	91	cde	7	f
PRIMROSE OIL MEDIUM	82	efgh	72	g	95	de	10	g
PRIMROSE OIL LOW	100	gh	60	f	66	bcde	3	d
AUXI-GRO	76	defg	18	c	45	b	0	b
UPTAKE PLUS	69	cdef	38	d	75	bcde	1	c

[1] Values in a column followed by the same letter are not significantly different according to the Student Newman Keuls multiple range test ("=0.05)

2002 PMR REPORT #108 **SECTION K: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Pinot noir; Chancellor
PEST: Powdery mildew, *Uncinula necator* Pers.:Fr.

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TITLE: EFFICACY OF FLINT AGAINST POWDERY MILDEW OF GRAPE, 2001

MATERIALS: NOVA 40W (Myclobutanil), ROVRAL 50W (Iprodione), FLINT 50 WDG (Trifloxystrobin)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 16 year old Pinot noir (5 replicates) and Chancellor (4 replicates) vines. Spacing was 1.4 x 3.6 m for a panel of five Pinot noir and three Chancellor grape vines. The cordon trained, spur pruned vines (ca. 20 nodes/m row) on vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block. Each replicate had the first and last vines (Pinot noir) or half vines (Chancellor) as guards for disease evaluation, thus treatments were separated by buffer vines. The treatments were applied until run-off with a handgun operated at approximately 500 kPa at a rate of 1000 L water/ha. The grower standard conventional treatment, the UC Davis powdery mildew model treatment, and the FLINT treatment were applied to Pinot noir grapes on 25 May (Pre-bloom), 6 June (Pre-bloom), 13 June (Pre-bloom), 27 June (Bloom), 18 July (Fruit set), 8 August (Berry touch), 5 September (Veraison), 14 September (Post Veraison, Grower standard only), 21 September (Post Veraison), 2 October (Grower standard only). The treatments were applied to Chancellor grapes on the same dates except only the UC Davis model treatment was applied on 13 June. See below for application times and fungicides that were used in each treatment. Percent incidence and severity of leaf and cluster powdery mildew were evaluated on 5 August, 1 September, and 15 October by examining ten leaves on each of five shoots per three middle vines; and 10 berry clusters per three middle vines. Fifty clusters were examined for powdery mildew and bunch rot at harvest on October 11, 2001. Clusters were considered to have bunch rot if gray mold was observed growing among the berries. At harvest weight and number of clusters per replicate panel were also recorded. Five Pinot noir grape clusters from each replicate were incubated at 13°C for 10 days to determine if they were infected by *Botrytis* spp., *Penicillium* spp., or *Alternaria* spp. Counts of cluster, and leaf powdery mildew incidence and severity and bunch rot incidence and severity were converted to the percent infected per replicate and arcsin-transformed. The transformed data for leaf and cluster mildew were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller-Duncan's Multiple Range Test was used to separate means (K = 100).

GROWER Program consisted of NOVA (20 g/100 L or 200 g/ha) on 25 May, 6 June, 13 June, and 27 June; ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 18 July, 8 August, 5 September, 14 September, 21 September, and 2 October (Pinot Noir only). Harvest on 11 October.

UC DAVIS MODEL Program consisted of NOVA (20 g/100 L or 200 g/ha) on 25 May, 6 June, 13 June, and 27 June; ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 18 July, 8 August, 5 September, and 21 September. Harvest on 11 October.

FLINT Program consisted of FLINT 50 WG (14 g/100 L or 0.14 kg/ha) on 25 May, 6 June, 27 June, 18 July, 8 August, 5 September, and 21 September.

RESULTS and DISCUSSION: Powdery mildew was first observed on grape foliage in late July. FLINT was very effective in controlling powdery mildew on both Pinot noir and Chancellor grape foliage throughout the growing season (Tables 1 and 2). As powdery mildew increased over the summer FLINT maintained its effectiveness compared to standard fungicides such as NOVA which became less effective. FLINT did not allow cluster powdery mildew to develop on Chancellor grapes and only allowed it to develop early in the season on Pinot noir grapes. Use of FLINT did not effect the weight or number of clusters of grapes that were harvested from each replicate panel (Table 3). Although FLINT is used primarily to control powdery mildew it reduced the incidence of bunch rot by 20% from the level found in the control on Pinot noir grapes (Table 4). The levels of bunch rot in Chancellor grape were relatively low and did not differ between treatments. Clusters of Pinot noir grapes that were incubated at 13°C were infected by *Botrytis, Penicillium,* and *Alternaria* spp. of fungi (Table 5). FLINT reduced the severity of *Penicillium* spp. but had no effect on *Botrytis* or *Alternaria* spp. on incubated clusters. Evaluation of Pinot noir grape berry weight and juice BRIX, pH, and TA did not differ significantly from the control (Table 6). Phytotoxicity was not observed on any vines treated with FLINT. Furthermore FLINT appeared to reduce damage by leafhoppers on Pinot noir vines. This observation came late in the season after a severe infestation of leafhoppers decimated control and grower standard vines near the FLINT treated vines. Further research is needed on the ability of FLINT to reduce leafhopper damage in grape.

CONCLUSIONS: FLINT is a very effective fungicide for the control of powdery mildew in grape and may also provide addition benefits such as the reduction of bunch rot incidence and severity.

Table 1. Percent powdery mildew incidence and severity of Pinot Noir grapes treated with Flint

Treatment (Evaluated)	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
FLINT (Aug. 5)	9 B*	1 B	0.125	0.041666667
Grower (Aug. 5)	13 B	2 B	0.125	0.041666667
Model (Aug. 5)	16 AB	2 AB	0.125	0
Control (Aug. 1)	42 A	0.20833333333	0.41666666667	0.083333333
Pr> F	0.0517	0.0319	0.2452	0.2332
FLINT (Sep. 1)	16 B	5 B	0	0
Grower (Sep.1)	42 AB	20 AB	0	0
Model (Sep. 1)	36 AB	14 B	0	0
Control (Sep.1)	80 A	51 A	0.33333333333	0.083333333
Pr> F	0.0335	0.0268	0.098	0.1025
FLINT (Oct. 15)	9 C	4 C	0 B	0 B
Grower (Oct. 15)	24 BC	15 BC	0 B	0 B
Model (Oct. 15)	53 B	32 B	0 B	0 B
Control (Oct. 15)	96 A	82 A	0.29166666667	0.2916666667
Pr > F	0.0025	0.001	0.0007	0.0003

*Numbers followed by the same letter are not significantly different as decided by the Waller-Duncan's K-ratio t Test (K=100). Treatments were analyzed with five replications.

Table 2. Percent powdery mildew incidence and severity of Chancellor grapes treated with Flint

Treatment (Evaluated)	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
FLINT (Aug. 5)	4 B*	1 B	0	0
Grower (Aug.5)	16 B	3 AB	0.0833333333	0
Model (Aug.5)	14 B	2 B	0.16666666667	0.041666667
Control (Aug. 5)	55 A	26 A	0.33333333333	0.041666667
Pr > F	0.0027	0.0518	0.3924	0.3491
FLINT (Sep. 1)	4 C	1 B	0 B	0 B
Grower (Sep.1)	43 B	13 B	0 B	0 B
Model (Sep. 1)	30 BC	10 B	2 B	1 AB
Control (Sep.1)	95 A	66 A	56 A	0.125
Pr > F	0.0033	0.0033	0.0535	0.0802
FLINT (Oct. 15)	C	1 B	0	0
Grower (Oct.15)	32 B	8 B	0	0
Model (Oct. 15)	37 B	11 B	0	0
Control (Oct. 15)	96 A	79 A	0.20833333333	0.083333333
Pr > F	<.0001	0.0013	0.0877	0.088

*Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Duncan's Multiple Range Test. Treatments were analyzed with four replications.

Table 3. Effect of FLINT on number of clusters and weight of Pinot noir and Chancellor grapes at harvest

Treatment	No. Clusters		Weight (kg)	
	Pinot noir; Chancellor		Pinot noir; Chancellor	
FLINT	177 A*	272 A	20.2 AB	29.6 A
Grower	205 A	232 A	22.3 A	26.8 A
Model	220 A	240 A	18.8 AB	30.2 A
Control	166 A	194 A	15.0 B	29.1 A
Pr> F	0.165	0.7743	0.1021	0.8910

*Numbers followed by the same letter are not significantly different as decided by the Waller- Duncan K-ratio t Test (K=100). Treatments were analyzed with four replications.

Table 4. Effect of FLINT on percent bunch rot of Pinot noir and Chancellor grapes in the vineyard at harvest

Treatment	Pinot Noir		Chancellor	
	Incidence	Severity	Incidence	Severity
FLINT	16 B*	6 B	0.16666666667	0.0416666667
Grower	28 AB	6 B	0.125	0.0833333333
Model	23 AB	7 B	0.375	0.125
Control	36 A	0.25	0.45833333333	0.125
Pr> F	0.0941	0.0009	0.31	0.6116

*Numbers followed by the same letter are not significantly different as decided by the Waller- Duncan K-ratio t Test (K=100).

Table 5. Effect of FLINT on development of *Botrytis, Penicillium,* and *Alternaria* species on incubated (13°C) Pinot noir grape clusters

Treatment	*Botrytis*		*Penicillium*		*Alternaria*	
	Incidence	Severity	Incidence	Severity	Incidence	Severity
FLINT	64 A*	0.333333	24 AB	2 B	98 A	0.333333333
Grower	95 A	0.33333	12 B	1 B	5 B	1 B
Control	93 A	0.16667	76 A	0.25	95 A	0.41666667
Pr> F	0.189	0.2139	0.046	0.0273	<.0001	0.0015

*Numbers followed by the same letter are not significantly different as decided by the Waller- Duncan K-ratio t Test (K=100). Treatments were analyzed with five replications.

Table 6. Effect of FLINT on berry weight, pH, soluble solids (BRIX), and titratable acidity (TA) of Pinot noir grapes

Treatment	Berry wt. (g)	pH	BRIX	TA
FLINT	143 A	3.44 AB	22.9 A	11.3 A
Grower	117 A	3.58 A	22.3 A	11.1 A
Control	137 A	3.34 B	21.4 A	12.0 A
Pr> F	0.1513	0.0228	0.3407	0.2181

*Numbers followed by the same letter are not significantly different as decided by the Waller- Duncan K-ratio t Test (K=100). Treatments were analyzed with five replications.

2002 PMR REPORT #109 **SECTION K: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Chancellor
PEST: Powdery mildew, *Uncinula necator* Pers.:Fr.

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TITLE: EFFICACY OF MINERALL CLAY AGAINST POWDERY MILDEW OF CHANCELLOR GRAPE, 2001

MATERIALS: NOVA 40W (Myclobutanil), ROVRAL 50W (Iprodione), KUMULUS (Sulphur), DITHANE 75 DF (Mancozeb), MAESTRO 75 DF (Captan), MINERALL CLAY (Glacial marine mud)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 17 year old Chancellor vines. Spacing was 2.5 x 3.6 m for a panel of 3 grape vines. The cordon trained, spur pruned vines (ca. 20 nodes/m row) on vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block with four replicates. Each 3-vine replicate had half vines of 1 and 3 as guards for disease evaluation, thus treatments were separated by two half vines. The treatments were applied until run-off with a handgun operated at approximately 500 kPa at a rate of 1000 L water/ha. The treatments were applied on 25 May (3-8 cm shoot), 7 June (13-18 cm shoot), 28 June (Postbloom), 18 July (Fruit set), 8 August (Berry touch), 6 September (Veraison), and 21 September (Post Veraison). See below for application times and fungicides that were used in each treatment. Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 5 August, 1 September, and 15 October by examining ten leaves on each of five shoots on the middle vine, and on 5 berry clusters from the center of the panel on 1 August and 15 September. Foliage chlorophyll was recorded with a Minolta SPAD 502 leaf chlorophyll meter (Minolta Canada, Mississauga, ON) on 22 August. Readings were taken from both left and right sides of the main vien of the leaf on 30 leaves located opposite to fruit clusters on 13 to 15 shoots. Fifty clusters were examined for bunch rot and powdery mildew at harvest on October 6, 2000. Clusters were considered to have bunch rot if gray mold was observed growing among the berries and powdery mildew if shrivelled and covered with white growth. Yield and number of clusters per replicate were recorded at harvest. Counts of cluster, and leaf powdery mildew incidence and severity and bunch rot incidence and severity were converted to the percent infected per replicate and arcsin-transformed. The transformed data for leaf and cluster mildew were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller-Duncan K-ratio t Test was used to separate means (K=100).

GROWER Program consisted of NOVA 40W (20 g/100 L or 200 g/ha) on 25 May, 7 June, and 28 June, and ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 18 July, 8 August, 6 September, and 21 September. Harvest on 11 October.

KUMULUS Program consisted of KUMULUS S (300 g/ 100 L or 3.0 kg/ha) on 25 May, 7 June, 28 June, 18 July, 8 August, 6 September, and 21 September. Harvest on 11 October.

MINERALL CLAY COMBINED NOVA Surfactant Program consisted of NOVA (20 g/100 L or 200 g/ha) on 25 May, and 7 June and MINERALL CLAY (2.0 kg/100 L or 20.0 kg/ha) with AGRAL 90 (200 ml/ 100 L) on 28 June,18 July, 8 August, 6 September, and 21 September. Harvest on 11 October.

MINERALL CLAY STRAIGHT AGRAL 90 Surfactant Program consisted of MINERALL CLAY (2.0 kg/100 L or 20.0 kg/ha) with AGRAL 90 (200 ml/ 100 L) on 25 May, 7 June, 28 June,18 July, 8 August, 6 September, and 21 September. Harvest on 11 October.

MINERALL CLAY STRAIGHT Program consisted of MINERALL CLAY (2.0 kg/100 L or 20.0 kg/ha) on 25 May, 7 June, 28 June,18 July, 8 August, 6 September, and 21 September. Harvest on 11 October.

RESULTS and DISCUSSION: Incidence of powdery mildew on foliage appeared to be reduced by CLAY-NOVA and the straight CLAY treatments after the first reading in August (Table 1). Very little cluster infection was present at this time because powdery mildew was late in developing. The Agral 90 surfactant was very effective in spreading clay over the leaf surface and prevented the formation of droplets that were observed on the treatment where surfactant was not used. The CLAY treatments were ineffective in controlling powdery mildew under high disease incidence as noted during the second reading in early September (Table 2). Poor control of foliage powdery mildew continued into October as noted in the final reading (Table 3). More importantly however, was that the CLAY treatments prevented cluster infection at harvest and were as effective as KUMULUS or NOVA. The CLAY treatment did not reduce leafhopper damage as it had in the past but did maintain higher chlorophyll levels than the control as previously reported (Table 4). The CLAY treatments had no significant effect on number of clusters or weight per replicate of grapes harvested on October 11 (Table 5). Incidence of Bunch rot and severity on grape clusters at harvest was relatively low and it was not possible to identify any differences between treatments (Table 6).

CONCLUSIONS: In general the CLAY treatments were not as effective as they had been in the past but did prevent cluster infection at harvest. Possibly a higher rate or more frequent applications would have improved effectiveness.

Table 1. Percent powdery mildew incidence and severity of Chancellor grapes treated with MINERALL CLAY on 5 August

Treatment	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
CLAY	47 AB*	10 AB	0	0
CLAY AGRAL	71 A	16 AB	0.0833333333	0.0416666667
CLAY NOVA	48 AB	10 AB	0.16666666667	0.0416666667
KUMULUS	23 B	4 B	0.20833333333	0.0416666667
GROWER Prog.	16 B	3 B	0.0833333333	0.0416666667
CONTROL	74 A	26 A	0.33333333333	0.0416666667
Pr> F	0.0229	0.1196	0.4516	0.3656

* Numbers followed by the same letter are not significantly different as decided by the Waller-Duncan K-ratio t Test (K=100). Treatments were analyzed with four replications.

Table 2. CLAY on 1 September

Treatment	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
CLAY	91 A*	62 A	16 AB	3 AB
CLAY AGRAL	99 A	84 A	9 AB	1 AB
CLAY NOVA	95 A	67 A	8 AB	2 AB
KUMULUS	23 B	6 B	0 B	0 B
GROWER Prog.	43 B	13 B	0 B	0 B
CONTROL	95 A	84 A	31 A	3 B
Pr> F	<.0001	<.0001	0.0503	0.0871

* Numbers followed by the same letter are not significantly different as decided by the Waller-Duncan K-ratio t Test (K=100). Treatments were analyzed with four replications.

Table 3. Percent powdery mildew incidence and severity of Chancellor grapes treated with MINERALL CLAY on 15 October

Treatment	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
CLAY	99 A*	90 A	0 B	0 B
CLAY AGRAL	100 A	96 A	0 B	0 B
CLAY NOVA	97 A	85 A	0 B	0 B
KUMULUS	33 B	12 B	0 B	0 B
GROWER Prog.	32 B	8 B	0 B	0 B
CONTROL	96 A	79 A	0.20833333333	0.0833333333
Pr > F	<.0001	<.0001	0.045	0.0452

* Numbers followed by the same letter are not significantly different as decided by the Waller-Duncan K-ratio t Test (K=100). Treatments were analyzed with four replications.

Table 4. Effect of MINERALL CLAY on leafhopper damage and chlorophyll count

Treatment	Leafhopper damage to foliage 23 July		Chlorophyll 22 Aug
	%Incidence	%damaged	SPAD counts
CLAY	78 A*	28 A	36.3 A
CLAY AGRAL	------	------	36.1 A
CLAY NOVA	------	------	35.6 A
KUMULUS	------	------	35.1 AB
GROWER Prog.	89 A	30 A	34.8 AB
CONTROL	72 A	0.29166666667	33.6 B
Pr> F	0.4102	0.5578	0.0345

*Numbers followed by the same letter are not significantly different as decided by the Waller-Duncan K-ratio t Test (K=100). Treatments were analyzed with four replications.

Table 5. Effect of MINERALL CLAY on number of clusters, and weight of Chancellor grapesat harvest

Treatment	No. Clusters	Weight (kg)
CLAY	242 A*	24.9 A
CLAY AGRAL	205 A	26.9 A
CLAY NOVA	180 A	15.9 A
KUMULUS	205 A	23.9 A
GROWER Prog.	232 A	26.8 A
CONTROL	194 A	29.1 A
Pr> F	0.9343	0.8226

* Numbers followed by the same letter are not significantly different as decided by the Waller-Duncan K-ratio t Test (K=100). Treatments were analyzed with two to four replications depending on the amount of bird damage.

Table 6. Effect of MINERALL CLAY on bunch rot of Chancellor grapes at harvest

Treatment	%Incidence	%Severity
CLAY	6 A*	0.0833333333
CLAY AGRAL	0.125	0.0833333333
CLAY NOVA	0.25	0.0833333333
KUMULUS	0.375	0.16666666667
GROWER Prog.	0.125	0.0833333333
CONTROL	0.45833333333	0.125
Pr> F	0.4924	0.64

* Numbers followed by the same letter are not significantly different as decided by the Waller-Duncan K-ratio t Test (K=100). Treatments were analyzed with two to four replications depending on the amount of bird damage.

2002 PMR REPORT #110 **SECTION K: DISEASES OF FRUIT**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Pinot noir
PEST: Powdery mildew, *Uncinula necator* (Schwein.) Burrill
Bunch rot, *Botrytis cinerea* Pers.:Fr.

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TITLE: **EFFICACY OF QRD FORMULATIONS AGAINST POWDERY MILDEW OF GRAPE, 2001**

MATERIALS: NOVA 40W (Myclobutanil), ROVRAL 50W, QRD 131 (Liquid Formulation of *Bacillus subtilis*), 132, and 137 (Dried Formulation of *Bacillus subtilis*).

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 16 year-old vines. Spacing was 1.4 x 3.6 m for a panel of 5 grape vines. The cordon trained, spur pruned vines (ca. 20 nodes/m row) on vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block with five replicates. Each 5-vine replicate had vines 1 and 5 as guards for disease evaluation, thus treatments were separated by 2 buffer vines. The treatments were applied until run-off with a handgun operated at approximately 500 kPa at a rate of 1000 L water/ha. The grower standard treatment was applied on 25 May (3-8 cm shoot), 6 June (Pre-bloom), 13 June (Pre-bloom), 27 June (Post bloom),18 July (7 d after Pre-closure), 8 August (21 d after Pre-closure), 5 September (Veraison), 14 September (Post Veraison), 21 September (Post Veraison), 2 October (9 d Preharvest). QRD 131, 132, and 137 treatments were applied on 6 June (Prebloom), 27 June (Postbloom), 5 September (Veraison), and 2 October (9 days Preharvest). See below for application times and fungicides that were used in each treatment. Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 5 August, 1 September, 15 October by examining ten leaves on each of five shoots per three middle vines, and on 10 berry clusters per three middle vines on 1 August and 12 September. Fifty clusters were examined for powdery mildew at harvest on October 11, 2001. At harvest yield, number of clusters and number of clusters with bunch rot were also recorded. Clusters were considered to have bunch rot if gray mold was observed growing among the berries. Five clusters from each replicate were incubated at 13EC to determine if they were infected with *Botrytis cinerea*. Counts of cluster, and leaf powdery mildew incidence and severity and bunch rot incidence and severity were converted to the percent infected per replicate and arcsin-transformed. The transformed data for leaf and cluster mildew were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Tukey's Studentized Range Test was used to separate means (P = 0.05).

GROWER Program consisted of NOVA 40 W (20 g/100 L or 0.2 kg/ha) applied on 25 May, 6 June, 13 June, and 27 June, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA 40W (20 g/100 L or 200 g/ha) on 18 July, 8 August, NOVA 40 W (20 g/100 L or 0.2 kg/ha) on 5 September, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA 40W (20 g/100 L or 200 g/ha) on 14 September, 21 September, and 2 October. Harvest was on 11 October.

QRD Program consisted of QRD 131 (930 mL/100 L or 9.3 L/ha = Low rate, and 1870 mL /100 L or 18.7 L/ha = High rate); QRD 132 (670 g/100 L or 6.7 kg/ha), and QRD 137 (450 g/100 L or 4.5 kg/ha = Low rate, and 670 g/100 L or 6.7 kg/ha = High rate), applied on 6 June, 27 June, 5 September and 2 October. Cover sprays of the QRD treated plants consisted of NOVA 40 W (20 g/100 L or 0.2 kg/ha)

applied on 25 May, 13 June, 18 July, 8 August, and ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA 40W (20 g/100 L or 200 g/ha) applied on 14 September, and 21 September. Harvest was on 11 October.

RESULTS and DISCUSSION: Powdery mildew was first observed on grape foliage in late July. Incidence of foliage powdery mildew was controlled by QRD 131 and the high rate of QRD 137 early in the season after the first reading in August (Table 1). The grower standard was the only treatment that provided effective control on foliage late in the season. All the QRD products provided effective control of powdery mildew on grape clusters at harvest essentially preventing any infection from occurring. There were no significant differences between QRD treatments and the grower standard treatment in the number and weight of clusters (Table 2). Bunch rot was evaluated in the field and on bunches that were incubated at 13°C for 10 days. Contrary to the previous year bunch rot incidence was relatively high in 2001 and QRD 137 was found to reduce the field severity of bunch rot by 13% (Table 3). Phytotoxicity was not observed on QRD treated vines although white residue was sometimes present on the foliage. A leafhopper outbreak occurred in these grapes and a preliminary evaluation of leafhopper eggs showed that QRD products had no effect on their viability.

CONCLUSIONS: QRD treatments alternated with NOVA-ROVRAL are effective early season treatments for the control of foliage powdery mildew and powdery mildew of grape clusters. QRD 137 is also effective for reduction of bunch rot severity.

Table 1. Percent powdery mildew incidence and severity of Pinot Noir grapes treated with QRD (Q) 131, 132, 137

Treatment	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
Q131L (Aug.5)	8 B*	1 B	0.16666666667	1 A
Q131H (Aug. 5)	6 B	1 B	0.16666666667	1 A
Q132 (Aug.5)	30 AB	3 AB	10 A	1 A
Q137L (Aug.5)	20 AB	2 AB	11 A	1 A
Q137H (Aug.5)	7 B	1 B	0.25	1 A
Grower (Aug. 5)	13 AB	2 AB	0.125	1 A
Control (Aug. 5)	42 A	0.20833333333	22 A	2 A
Pr> F	0.0093	0.0054	0.4919	0.4527
Q131L (Sept.15)	56 A	31 A	0 A	0 A
Q131H (Sept.15)	37 A	15 A	0 A	0 A
Q132 (Sept. 15)	44 A	20 A	0 A	0 A
Q137L (Sept.15)	53 A	23 A	0 A	0 A
Q137H (Sept.15)	56 A	25 A	4 A	1 A
Grower (Sep.15)	42 A	20 A	0 A	0 A
Control (Sep. 15)	90 A	51 A	8 A	2 A
Pr> F	0.1456	0.0816	0.0621	0.0598
Q131L (Oct. 10)	58 AB	42 AB	1 B	1 B
Q131H (Oct. 10)	56 AB	44 AB	1 B	0 B
Q132 (Oct. 10)	58 AB	35 AB	1 B	1 B
Q137L (Oct. 10)	51 AB	32 AB	1 B	0 B
Q137H (Oct. 10)	76 AB	64 AB	0 B	1 B
Grower (Oct. 10)	24 B	15 B	0 B	0 B
Control (Oct. 10)	92 A	82 A	7 A	7 A
Pr > F	0.0349	0.0086	0.0015	<.0001

* Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Tukey's Studentized Range Test. Treatments were analyzed with five replications.

Table 2. Effect of SERENADE (QRD) low rate (L) and high rate (H) on number of clusters, and weight of harvested Pinot noir grapes

Treatment	No. Clusters	Weight (kg)
QRD131L	169 A*	13.0 A
QRD131H	166 A	12.6 A
QRD132	177 A	16.8 A
QRD137L	183 A	16.2 A
QRD137H	166 A	16.4 A
Grower	182 A	19.4 A
Control	166 A	15.0 A
Pr> F	0.9664	0.6092

* Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Tukey's Studentized Range Test. Treatments were analyzed with five replications.

Table 3. Effect of SERENADE (QRD) low rate (L) and high rate (H) on bunch rot of harvested and incubated Pinot noir grapes

Treatment	Field Samples		Incubated Samples	
	%Bunch rot Incidence	%Bunch rot severity	%Bunch rot incidence	%Bunch rot severity
QRD131L	26 A*	9 AB	80 A	9 A
QRD131H	42 A	14 AB	86 A	14 A
QRD132	39 A	10 AB	82 A	11 A
QRD137L	19 A	5 B	88 A	19 A
QRD137H	30 A	10 AB	61 A	14 A
Grower	28 A	6 AB	95 A	20 A
Control	42 A	18 A	93 A	16 A
Pr> F	0.3021	0.0606	0.3192	0.3021

* Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Tukey's Studentized Range Test. Treatments were analyzed with five replications.

2002 PMR REPORT #111 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 390 1252 9201

CROP: Raspberry cv. Willamette
PEST: Fruit rots, *Botrytis cinerea*, *Rhizopus* sp.

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TITLE: EFFICACY OF FUNGICIDES FOR THE CONTROL OF FRUIT ROT IN RASPBERRIES IN 2002.

MATERIALS: ELEVATE 50 WDG (fenhexamid), BAS 510 70 % WG, BAS 516 38 % WG, SCALA (pyrimethanil)

METHODS: The trial was conducted in 2002 in a raspberry planting at Agassiz, B.C. Each treatment was applied to 4.25 m x 3 m plots replicated four times in a randomized complete block. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 1000L/ha of water at a pressure of 415 kPa. Each treatment was applied four times: May 31 (10 % bloom stage), June 10 (100% bloom stage and some set berries), July 2 (fruit set) and July 17 (fruit set - during harvest period). Harvest began on July 3 and continued until July 29. At each picking, marketable, rot and cull weights were recorded. Size index, based on the gram weight of 50 marketable berries, was also recorded at each picking. Two postharvest fruit rot trials were set up. In both, fifteen randomly picked berries from the marketable yield were placed on styrofoam plates covered with damp paper towels. The plates were then covered with plastic wrap. In one trial the prepared plates were left at ambient temperature and rots counted approximately 3 days later. The other set was put in cold storage at 2°C for 6 days and then stored at ambient temperature for approximately 3 days before rots were counted. The main postharvest rots that developed were *Botrytis cinerea* and *Rhizopus* sp. Data were analysed with the general linear models procedure (SAS institute, Cary, NC) and means were separated using the Duncan's Multiple Range Test.

RESULTS: Data are presented in Tables 1- 5. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: Even though field rots were low due to the warm, dry weather all treatments had fewer rotten berries than the control. Size index was not detrimentally affected by any treatment. In both the ambient temperature postharvest trials and the cool storage followed by ambient temperature postharvest trials , *Botrytis cinerea* was reduced by all treatments. On some dates BAS 516 was significantly better than the other treatments. Though not consistent on all dates there appeared to be some reduction in *Rhizopus* sp. with BAS 516.

Table 1. Marketable weight, rot weight, size index and percentage field rot of raspberries.

Treatment	Rate (g ai/ha)	Marketable Weight (g/m^2)	Rot Weight (g/m^2)	Size Index (g/25 berries)	% Rot
CHECK	-	13810 a[1]	87.8 a	131.1 a	0.5 a
ELEVATE	850	12962 a	34.4 b	140.5 a	0.1 b
BAS 510	390	14935 a	10.9 b	130.3 a	0.2 b
BAS 516	600	12323 a	7.1 b	136.4 a	0.1 b
SCALA	800	8578 a	5.1 b	124.2 a	0.1 b

[1] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. Percentage of berries infected by *Botrytis cinerea* after being stored at ambient temperature following harvest.

		% Rot					
Treatment	Rate (g ai /ha)	Jul 08[1] Jul 10	Jul 11 Jul 14	Jul 15 Jul 18	Jul 18 Jul 21	Jul 25 Jul 28	Jul 29 Jul 31
CHECK	-	88.3 a[2]	71.1 a	66.7 a	86.7 a	73.3 a	63.3 a
ELEVATE	850	25.0 b	35.0 b	61.7 ab	55.0 b	20.0 bc	56.7 ab
BAS 510	390	18.3 b	28.3 bc	46.7 bc	28.3 bc	16.7 bc	28.3 bc
BAS 516	600	21.7 b	8.3 c	30.0 c	18.3 c	8.3 c	10.0 c
SCALA	800	23.3 b	40.0 b	60.0 ab	38.3 bc	36.7 b	56.7 ab

[1] First date: set up, second date: rots counted.
[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 3. Percentage of berries infected by *Rhizopus sp*. after being stored at ambient temperature following harvest.

		% Rot					
Treatment	Rate (g ai /ha)	Jul 08[1] Jul 10	Jul 11 Jul 14	Jul 15 Jul 18	Jul 18 Jul 21	Jul 25 Jul 28	Jul 29 Jul 31
CHECK	-	68.3ab[2]	13.3 a	38.3 a	76.7 a	90.0 ab	21.7 a
ELEVATE	850	71.7ab	31.7 a	13.3 b	56.7 a	100.0 a	8.3 ab
BAS 510	390	71.7ab	26.7 a	26.7 ab	70.0 a	95.0 ab	3.3 b
BAS 516	600	41.7 b	16.7 a	11.7 b	48.3 a	85.0 b	1.7 b
SCALA	800	75.0 a	23.3 a	20.0 ab	70.0 a	100.0 a	6.7 ab

[1] First date: set up, second date: rots counted.
[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P<0.05).

Table 4. Percentage of berries infected by *Botrytis cinerea* after being stored at a cool temperature and then ambient temperature following harvest.

Treatment	Rate (g ai /ha)	Jul 08[1] Jul 15 July 16	Jul 11 Jul 18 July 20	Jul 15 Jul 22 Jul 24	Jul 18 Jul 25 Jul 27	Jul 22 Jul 29 Jul 31	Jul 29 Aug 6 Aug 8
CHECK	-	91.7 a[2]	98.3 a	80.0 a	95.0 a	76.7 a	78.3 a
ELEVATE	850	83.3 a	73.3 b	63.3a-c	30.0 b	38.3 b	70.0 ab
BAS 510	390	33.3 b	61.7 b	50.0 bc	45.0 b	31.7 bc	50.0 b
BAS 516	600	16.7 b	18.3 c	43.3 c	8.3 c	15.0 c	18.3 c
SCALA	800	73.3 a	81.7 ab	76.7 ab	36.7 b	31.6 bc	60.0 ab

[1] First date: put into cool storage, second date: put into ambient storage, third date: rots counted.
[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P<0.05).

Table 5. Percentage of berries infected by *Rhizopus sp*. after being stored at a cool temperature and then ambient temperature following harvest.

		% Rot					
Treatment	Rate (g ai /ha)	Jul 08[1] Jul 15 Jul 16	Jul 11 Jul 18 Jul 20	Jul 15 Jul 22 Jul 24	Jul 18 Jul 25 Jul 27	Jul 22 Jul 29 Jul 31	Jul 29 Aug 6 Aug 8
CHECK	-	25.0 a[2]	56.7 a	25.0 a	53.3 a	20.0 ab	50.0 a
ELEVATE	850	21.7 a	36.7 a	28.3 a	50.0 a	11.7 ab	51.7 a
BAS 510	390	38.3 a	48.3 a	41.7 a	51.7 a	26.7 a	30.0 ab
BAS 516	600	25.0 a	51.7 a	31.7 a	16.7 a	5.0 b	11.7 b
SCALA	800	43.3 a	61.7 a	35.0 a	38.3 a	28.3 a	50.0 a

[1] First date: set up, second date: rots counted.
[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 6. Raspberry cane height, diameter, weight, and number of canes per treatment taken in a 4.5 metre plot on August 19 and 27.

Treatment	Rate (g ai /ha)	Number of Canes	Cane Ht (metres) per Cane	Cane Diameter (cm) per Cane	Cane Wt (grams) per Cane
CHECK	-	39.3 a	1.48 abc	1.05 a	118.0 a
ELEVATE	850	35.3 a	1.50 a	1.00 ab	127.6 a
BAS 510	390	42.3 a	1.49 ab	1.03 ab	119.3 a
BAS 516	600	33.8 a	1.43 bc	1.02 ab	148.4 a
SCALA	800	23.3 a	1.42 c	0.99 b	125.0 a

[1] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

2002 PMR REPORT #112 **SECTION K: FRUIT DISEASES**
STUDY DATA BASE: 390 1252 9201

CROP: Strawberry, cv. Totem
PEST: Fruit Rots, *Botrytis cinerea*, *Rhizopus* sp., *Cladosporium* sp.

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TITLE: **FUNGICIDE TREATMENTS FOR THE CONTROL OF FIELD AND POSTHARVEST FRUIT ROT IN STRAWBERRIES IN 2001.**

MATERIALS: MAESTRO 75 DF (captan), BAS 500 20F, BAS 510 70F, BAS 516 38F, ELEVATE 50WG (fenhexamid), SWITCH 62.5 WG (cyprodinil + fludioxonil)

METHODS: The trial was conducted in Agassiz, B.C. in 2001 in a field known to have fruit rot. Each plot consisted of one 5-m row of strawberries, cv. Totem. There were four replicates and treatments were arranged in a randomized complete block design. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 500L/ha of water at a pressure of 350 kPA. There were four applications of each treatment: May 2 (5% bloom stage), May 17 (50% bloom stage), May 31 (100% bloom stage) and June 26, 2001 (ripe berry stage). Three of the applications were made prior to harvest initiation and the final application was made after the first three harvests. The weather in the spring of 2001 was cool and moist. Harvest began on June 14 and continued until July 4. At each picking, marketable, rot and cull weights were recorded. Size index based on the gram weight of 25 marketable berries was also recorded at each picking. Two postharvest fruit rot trials were set up. In one trial, ten randomly picked berries from the marketable yield were placed on damp paper towels on styrofoam plates, covered with plastic wrap and left at ambient temperature. The rots were counted 3 days later. In the other trial, ten berries were placed on moist paper towels on styrofoam plates and covered and put in cold storage at 2°C for approximately 6 days and left at ambient temperature. Rots were counted 2 days later. Four postharvst rots developed: *Botrytis cinerea* was the main rot, with some *Rhizopus* sp., *Cladosporium* sp. and *Penicillium* sp. Data were analysed with the general linear models procedure (SAS institute, Cary, NC) and means were separated using the Duncan's Multiple Range Test.

RESULTS: Data are presented in Tables 1- 5. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: Size index was not detrimentally affected by any treatment. Field rot was reduced by all treatments. Postharvest *Botrytis cinerea* was reduced by all treatments. BAS 510 and 516 were more effective at reducing *Botrytis cinerea* than BAS 500. There appeared to be some reduction in *Rhizopus sp*. with BAS 500 and BAS 516 (a mixture of BAS 500 and BAS 510). The fourth fungicide application during the harvest reduced the postharvest rots in the next picking. Thus, it would appear that fungicide applications during the harvest period are beneficial.

Table 1. Marketable weight, field rot weight and size index of strawberries.

Treatment	Rate (g ai/ha)	No of Appn [1]	Marketable Weight (grams/m^2)	Rot Weight (grams/m^2)	Size Index (grams/25 berries)	% Rot
Check	-	-	1591 b [2]	319 a	286 a	15.3 a
ELEVATE	550	4	1944 b	149 b	296 a	5.9 bc
ELEVATE	850	4	1627 b	84 b	263 a	3.9 cd
ELEVATE + MAESTRO	550 2750	4	1833 b	93 b	275 a	3.8 cd
MAESTRO	2750	4	2086 b	163 b	300 a	6.0 bc
SWITCH	625	4	1586 b	81 b	264 a	3.8 cd
BAS 500	220	4	1897 b	163 b	290 a	6.9 b
BAS 510	390	4	2542 ab	138 b	321 a	4.6 bcd
BAS 516	490	4	2376 ab	138 b	306 a	4.7 bcd
BAS 516	600	4	3260 a	98 b	326 a	2.7 d

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 2. Postharvest *Botrytis cinerea* fruit rot counts of strawberries treated with ELEVATE, MAESTRO, SWITCH, BAS 500, BAS 510 and BAS 516 at Agassiz, B.C. The percentage of rotten berries is reported after 3 days at ambient temperature.

			% Rot				
Treatment	Rate (g ai /ha)	No of Appn[1]	June 14 June 17 [2]	June 19 June 22	June 25 June 28	June 28 July 1	July 4 July 7
Check	-	-	85.0 a [3]	90.0 a	92.5 a	92.5 a	87.5 a
ELEVATE	550	4	15.0 c	57.5 b	62.5 ab	30.0 bc	62.5 bc
ELEVATE	850	4	32.5 bc	35.0 bc	55.0 b	22.5 c	40.0 cd
ELEVATE + MAESTRO	550 2750	4	30.0 bc	22.5 c	52.5 b	30.0 bc	27.5 de
MAESTRO	2750	4	66.7 ab	47.5 bc	37.5 b	50.0 bc	42.5 cd
SWITCH	625	4	30.0 bc	25.0 c	62.5 ab	25.0 bc	52.5 bc
BAS 500	220	4	65.0 ab	60.0 b	65.0 ab	65.0 ab	70.0 ab
BAS 510	390	4	30.0 bc	40.0 bc	60.0 b	17.5 c	15.0 e
BAS 516	490	4	40.0 bc	40.0 bc	55.0 b	35.0 bc	20.0 de
BAS 516	600	4	37.5 bc	52.5 bc	60.0 b	35.0 bc	22.5 de

[1] No of Appn = number of applications
[2] First date: set up, second date: rots counted.
[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 3. Postharvest *Botrytis cinerea* fruit rot counts of strawberrries treated with ELEVATE, SWITCH, MAESTRO, BAS 500, BAS 510 and BAS 516 at Agassiz, B.C. The percent of rot after approximately 6 days in cold storage at 2 C and 2 days at ambient temperature is reported.

			% Rot				
Treatment	Rate (grams ai /ha)	No of Appn[1]	June 14 June 19 June 21[2]	June 19 June 25 June 27	June 25 July 2 July 4	June 28 July 5 July 7	July 4 July 10 July 13
Check	-	-	97.5 a [3]	95.0 a	97.5 a	100.0 a	87.5 a
ELEVATE	550	4	52.5 bc	42.5 bc	80.0 abc	30.0 cd	55.0 bc
ELEVATE	850	4	40.0 c	35.0 c	62.5 bc	10.0 d	37.5 cd
ELEVATE + MAESTRO	550 2750	4	50.0 bc	32.5 c	65.0 bc	25.0 cd	37.5 cd
MAESTRO	2750	4	70.0 abc	55.0 bc	77.5 abc	42.5 c	12.5 d
SWITCH	625	4	37.5 c	60.0 bc	90.0 ab	22.5 cd	42.5 cd
BAS 500	220	4	80.0 ab	72.5 ab	77.5 abc	70.0 b	70.0 ab
BAS 510	390	4	45.0 bc	40.0 bc	55.0 c	7.5 d	12.5 d
BAS 516	490	4	42.5 c	35.0 c	65.0 bc	40.0 c	42.5 bcd
BAS 516	600	4	57.5 bc	40.0 bc	72.5 abc	32.5 cd	17.5 d

[1] No of Appn = number of applications
[2] First date: set up, second date: berries taken out of storage, third date: rots counted.
[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 4. *Rhizopus* postharvest fruit rot counts of strawberries treated with ELEVATE, MAESTRO, SWITCH, BAS 500, BAS 510 and BAS 516 at Agassiz, B.C. The percent of rot after 3 days at ambient temperature is reported.

			% Rot				
Treatment	Rate (grams ai /ha)	No of Appn[1]	June 14 June 17 [2]	June 19 June 22	June 25 June 28	June 28 July 1	July 4 July 7
Check	-	-	45.0 a [3]	62.5 ab	75.0 a	95.0 a	55.0 abc
ELEVATE	550	4	60.0 a	77.5 a	72.5 a	82.5 a	60.0 ab
ELEVATE	850	4	42.5 a	70.0 ab	75.0 a	80.0 a	75.0 a
ELEVATE + MAESTRO	550 2750	4	33.3 a	60.0 ab	72.5 a	75.0 ab	82.5 a
MAESTRO	2750	4	66.7 a	65.0 ab	67.5 ab	77.5 a	80.0 a
SWITCH	625	4	35.0 a	52.5 ab	70.0 a	67.5 abc	60.0 ab
BAS 500	220	4	37.5 a	40.0 b	67.5 ab	50.0 bcd	25.0 c
BAS 510	390	4	45.0 a	55.0 ab	60.0 ab	80.0 a	60.0 ab
BAS 516	490	4	32.5 a	55.0 ab	35.0 b	42.5 cd	27.5 bc
BAS 516	600	4	35.0 a	50.0 ab	52.5 ab	40.0 d	25.0 c

[1] No of Appn = number of applications
[2] First date: set up, second date: rots counted.
[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

Table 5. *Rhizopus* postharvest fruit rot counts of strawberrries treated with ELEVATE, SWITCH, MAESTRO, BAS 500, BAS 510 and BAS 516 at Agassiz, B.C. The percent of rot after approximately 6 days in cold storage at 2 C and 2 days at ambient temperature is reported.

			% Rot				
Treatment	Rate (grams ai /ha)	No of Appn[1]	June 14 June 19 June 21[2]	June 19 June 25 June 27	June 25 July 2 July 4	June 28 July 5 July 7	July 4 July 10 July 13
CHECK	-	-	60.0 ab [3]	40.0 b	87.5 a	92.5 a	77.5 ab
ELEVATE	550	4	72.5 a	40.0 b	72.5 abc	92.5 a	72.5 ab
ELEVATE	850	4	55.0 abc	20.0 b	65.0 abc	95.0 a	87.5 a
ELEVATE + MAESTRO	550 2750	4	26.7 bc	27.5 b	87.5 a	95.0 a	80.0 ab
MAESTRO	2750	4	56.7 abc	47.5 ab	77.5 abc	90.0 a	87.5 a
SWITCH	625	4	52.5 abc	77.5 a	55.0 bc	80.0 a	87.5 a
BAS 500	220	4	32.5 bc	35.0 b	52.5 c	55.0 b	65.0 ab
BAS 510	390	4	57.5 abc	20.0 b	75.0 abc	90.0 a	82.5 ab
BAS 516	490	4	20.0 c	52.5 ab	50.0 c	72.5 ab	87.5 a
BAS 516	600	4	25.0 bc	30.0 b	85.0 ab	75.0 ab	55.0 b

[1] No of Appn = number of applications
[2] First date: set up, second date: berries taken out of storage, third date: rots counted.
[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

2002 PMR REPORT #113 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 390 1252 9201

CROP: Strawberry, cv. Totem
PEST: Fruit Rots, *Botrytis cinerea, Rhizopus* sp., *Cladosporium* sp.

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TITLE: **FUNGICIDE TREATMENTS FOR THE CONTROL OF FIELD AND POSTHARVEST FRUIT ROT IN STRAWBERRIES IN 2002.**

MATERIALS: MAESTRO 75 DF (captan), BAS 500 20WG , BAS 510 70WG, BAS 516 38F, BAS 516 300SE, ELEVATE 50WG (fenhexamid), SCALA 400F (pyrimethanil)

METHODS: The trial was conducted in Agassiz, B.C. in 2002 in a field known to have fruit rot. Each plot consisted of one 5-m row of strawberries, cv. Totem. There were four replicates and treatments were arranged in a randomized complete block design. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 500L/ha of water at a pressure of 350 kPA. There were four applications of each treatment, applied on May 13 (5-10 % bloom), May 23 (50 - 60 % bloom), June 3 (5 % blossom left), and June 20 (ripe berry stage). All applications were made prior to harvest. The weather in the spring was cool and moist. Blossom development was delayed this year and the first pick did not occur until June 21, two weeks later than normal. At each picking, marketable, rot and cull weights were recorded. Size index based on the gram weight of 25 marketable berries was also recorded at each picking. Two postharvest fruit rot trials were set up. In one trial, ten randomly picked berries from the marketable yield were placed on damp paper towels on styrofoam plates, covered with plastic wrap and left at ambient temperature. The rots were counted 3 days later. In the other trial, ten berries were placed on moist paper towels on styrofoam plates and covered and put in cold storage at 2°C for approximately 6 days and removed and left at ambient temperature. Rots were counted 2 days later. Four postharvest rots developed: *Botrytis cinerea* and *Rhizopus* sp. were the main rots, with some *Cladosporium* sp. and *Penicillium* sp. Data were analysed with the general linear models procedure (SAS institute, Cary, NC) and means were separated using the Duncan's Multiple Range Test.

RESULTS: Data are presented in Tables 1- 5. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: Size index was not detrimentally affected by any treatment. Field rot was very high with 28.8% in the control plot. The yield in the control plot was also low which indicates many blossoms were lost prior to berry development. All treatments had lower field rot than the untreated control. *Botrytis cinerea* in the ambient temperature post harvest trials was reduced by all treatments at least on one date. BAS 500 was not as effective as the other treatments, especially in the cool storage followed by ambient temperature trials. The results for the two formulations of BAS 516 were similar. The size of the rot is not included in the counts, as soon as any rot is seen on a berry it is counted. However, BAS 516 berries stood out as better looking berries in the postharvest storage trials as the rots were small in area. BAS 500 and BAS 516 reduced *Rhizopus* sp. on some dates.

Table 1. Marketable weight, field rot weight and size index of strawberries.

Treatment	Rate (g ai/ha)	No of Appn [1]	Total Marketable Weight (g/m^2)	Total Rot Weight (g/m^2)	Size Index (grams/25 berries)	% Rot
Check	0	0	2005.0c[2]	1138.3a	207.3	28.8a
BAS 500	220	4	3513.5bc	557.1bcd	265.5a	11.4b
BAS 510	390	4	6081.5a	447.8bcd	237.8a-e	6.0bcd
BAS 510	390	4	5897.1a	265.7cd	248.8abc	3.9d
BAS 516 (38% WG)	490	4	6283.8a	187.3d	245.8a-d	2.4d
BAS 516 (38% WG)	600	4	5153.4ab	119.6d	237.8a-e	1.7d
BAS 516 (38% WG)	1200	4	5655.0ab	158.4d	255.3ab	2.2d
BAS 516 (300g/L SE)	600	4	6044.5a	365.2bcd	237.7a-e	5.0cd
BAS 516 (300g/L SE) Fb[3] MAESTRO Fb BAS 516 (300g/SE) Fb MAESTRO	600 2200 600 2200	1 1 1 1	4259.2ab	205.1d	237.2a-e	3.9d
MAESTRO Fb BAS 510 Fb MAESTRO Fb BAS 500	2200 390 2200 220	1 1 1 1	5429.8ab	460.1bcd	245.9a-d	6.5bcd
MAESTRO	2200	4	4109.7ab	785.3ab	213.0de	12.1b
SCALA	800	4	4403.4ab	683.8bc	220.3cde	10.6bc
ELEVATE	550	4	4264.2ab	455.3bcd	238.6a-e	6.9bcd
ELEVATE	850	4	4766.8ab	642.5bc	260.8ab	10.9bc
ELEVATE + MAESTRO	550 2200	4	5527.1ab	312.6cd	229.5b-e	4.3d

[1] No of Appn = number of applications

[2] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[3]Fb = Followed by

Table 2. Postharvest *Botrytis cinerea* fruit rot counts of strawberries treated with ELEVATE, SCALA, MAESTRO, BAS 500, BAS 510 and BAS 516 at Agassiz, B.C. The percentage of rotten berries is reported after 3 days at ambient temperature.

Treatment	Rate (g ai /ha)	No of Appn[1]	% Rot June 21 June 24 [2]	June 25 June 28	July 2 July 4
Check	0	0	87.5a[3]	85.0a	82.5a
BAS 500	220	4	85.0a	72.5a	35.0b
BAS 510	390	4	25.0c	7.5d	10.0b
Bas 510	390	4	32.5c	17.5bcd	5.0b
Bas 516 (38% WG)	490	4	35.0bc	27.5bcd	27.5b
Bas 516 (38% WG)	600	4	27.5c	15.0cd	10.0b
Bas 516 (38% WG)	1200	4	25.0c	17.5bcd	7.5b
BAS 516 (300g/L SE)	600	4	30.0c	22.5bcd	7.5b
BAS 516 (300g/L SE) Fb [4] MAESTRO Fb BAS 516 (300g/L SE) Fb MAESTRO	600 2200 600 2200	1 1 1 1	37.5bc	25.0bcd	22.5b
MAESTRO Fb BAS 510 Fb MAESTRO Fb BAS 500	2200 390 2200 220	1 1 1 1	55.0bc	45.0b	25.0b
MAESTRO	2200	4	52.5bc	37.5bc	22.5b
SCALA	800	4	62.5ab	27.5bcd	37.5b
ELEVATE	550	4	35.0bc	15.0cd	15.0b
ELEVATE	850	4	45.0bc	25.0bcd	20.0b
ELEVATE + MAESTRO	550 2200	4	42.5bc	17.5bcd	22.5b

[1] No of Appn = number of applications

[2] First date: set up, second date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] Fb = Followed by

Table 3. Postharvest *Botrytis cinerea* fruit rot counts of strawberries treated with ELEVATE, SCALA, MAESTRO, BAS 500, BAS 510 and BAS 516 at Agassiz, B.C. The percent of rot after approximately 6 days in cold storage at 2°C and 2 days at ambient temperature is reported.

			% Rot		
Treatment	Rate (grams ai /ha)	No of Appn[1]	June 21 June 26 June 29[2]	June 25 July 5 July 8	July 2 July 11 July 12
Check	0	0	55.0a[3]	87.5ab	82.5ab
BAS 500	220	4	52.5a	100.0a	100.0a
BAS 510	390	4	7.5cd	42.5def	10.0fg
BAS 510	390	4	10.0cd	47.5c-f	5.0g
BAS 516 (38% WG)	490	4	5.0cd	37.5ef	30.0def
BAS 516 (38% WG)	600	4	12.5bcd	42.5def	15.0d-g
BAS 516 (38% WG)	1200	4	0.0d	42.5def	12.5efg
BAS 516 (300g/L SE)	600	4	12.5bcd	92.5ab	25.0d-g
BAS 516 (300g/L SE) Fb [4] MAESTRO Fb BAS 516 (300g/L SE) Fb MAESTRO	600 2200 600 2200	1 1 1 1	17.5bcd	47.5c-f	35.0d
MAESTRO Fb BAS 510 Fb MAESTRO Fb BAS 500	2200 390 2200 220	1 1 1 1	17.5bcd	82.5ab	55.0c
MAESTRO	2200	4	40.0ab	75.0abc	70.0bc
SCALA	800	4	30.0abc	37.5ef	32.5de
ELEVATE	550	4	10.0cd	30.0f	10.0fg
ELEVATE	850	4	23.3bcd	65.0b-e	15.0d-g
ELEVATE + MAESTRO	550 2200	4	12.5bcd	67.5bcd	22.5d-g

[1] No of Appn = number of applications

[2] First date: set up, second date: berries taken out of storage, third date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] Fb = Followed by

Table 4. Postharvest *Rhizopus* sp. fruit rot counts of strawberries treated with ELEVATE, SCALA, MAESTRO, BAS 500, BAS 510 and BAS 516 at Agassiz, B.C. The percent of rot after 3 days at ambient temperature is reported.

Treatment	Rate (grams ai /ha)	No of Appn[1]	% Rot June 21 June 24 [2]	June 25 June 28	July 2 July 4
Check	0	0	62.5a-d[3]	55.0bcd	57.5ab
BAS 500	220	4	12.5f	45.0cde	7.5b
BAS 510	390	4	55.0a-d	75.0ab	87.5a
BAS 510	390	4	65.0abc	87.5a	87.5a
BAS 516 (38% WG)	490	4	15.0f	30.0def	35.0ab
BAS 516 (38% WG)	600	4	25.0def	32.5def	15.0b
BAS 516 (38%WG)	1200	4	7.5f	22.5ef	45.0ab
BAS 516 (300g/L SE)	600	4	27.5c-f	15.0f	20.0b
BAS 516 (300g/L SE) Fb [4] MAESTRO	600 2200	1 1	52.5a-e	67.5abc	32.5ab
Fb BAS 516 (300g/L SE) Fb MAESTRO	600 2200	1 1			
MAESTRO Fb BAS 510	2200 390	1 1	57.5a-d	82.5ab	25.0ab
Fb MAESTRO Fb BAS 500	2200 220	1 1			
MAESTRO	2200	4	42.5a-f	60.0abc	55.0ab
SCALA	800	4	67.5ab	75.0ab	72.5ab
ELEVATE	550	4	77.5a	72.5ab	90.0a
ELEVATE	850	4	35.0b-f	80.0ab	67.5ab
ELEVATE + MAESTRO	550 2200	4	62.5a-d	67.5abc	52.5ab

[1] No of Appn = number of applications

[2] First date: set up, second date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] Fb = Followed by

Table 5. Postharvest *Rhizopus* sp. fruit rot counts of strawberries treated with ELEVATE, SCALA, MAESTRO, BAS 500, BAS 510 and BAS 516 at Agassiz, B.C. The percent of rot after approximately 6 days in cold storage at 2 C and 2 days at ambient temperature is reported.

% Rot

Treatment	Rate (grams ai /ha)	No of Appn[1]	June 21 June 26 June 29[2]	June 25 July 5 July 8	July 2 July 11 July 12
Check	0	0	12.5ab[3]	80.0ab	70.0 ab
BAS 500	220	4	5.0b	90.0ab	50.0 b
BAS 510	390	4	32.5ab	100.0a	100.0a
BAS 510	390	4	15.0ab	87.5ab	95.0a
BAS 516 (38% WG)	490	4	10.0b	87.5ab	77.5ab
BAS 516 (38%WG)	600	4	15.0ab	90.0ab	52.5b
BAS 516 (38%WG)	1200	4	10.0b	87.5ab	57.5b
BAS 516 (300g/L SE)	600	4	12.5ab	77.5b	87.5a
BAS 516 (300g/L SE) Fb [4] MAESTRO Fb BAS 516 (300 g/L SE) Fb MAESTRO	600 2200 600 2200	1 1 1 1	25.0ab	92.5ab	90.0a
MAESTRO Fb BAS 510 Fb MAESTRO Fb BAS 500	2200 390 2200 220	1 1 1 1	12.5ab	97.5ab	92.5a
MAESTRO	2200	4	10.0b	87.5ab	95.0a
SCALA	800	4	40.0a	97.5ab	95.0a
ELEVATE	550	4	32.5ab	97.5ab	75.0ab
ELEVATE	850	4	13.3ab	92.5ab	97.5a
ELEVATE + MAESTRO	550 2200	4	17.5ab	90.0ab	97.5a

[1] No of Appn = number of applications

[2] First date: set up, second date: berries taken out of storage, third date: rots counted.

[3] These values are the means of four replications. Numbers within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[4] Fb = Followed by

2002 PMR REPORT #114 SECTION L: VEGETABLE and SPECIAL CROPS - Diseases
ICAR: 206003

CROP: Carrot (*Daucus carota* subsp. *sativus* (Hoffm.) Arkang.), cv. Cellobunch
PEST: Sclerotinia rot (*Sclerotinia sclerotiorum* (Lib.) De Bary)
Alternaria leaf blight (*Alternaria dauci* (Kuhn))
Cercospora leaf blight (*Cercospora carotae* (Pass.) Solh.)

NAME AND AGENCY:
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TITLE: EVALUATION OF FOLIAR TRIMMING TREATMENTS IN COMBINATION WITH COMMERCIAL FUNGICIDES FOR CULTURAL CONTROL OF SCLEROTINIA ROT OF CARROT, 2002.

MATERIALS: Gas operated hand-held hedge trimmer (STIHL, Model # HS45, 27cc engine with a 60 cm double edge cutting blade), BAS 510 (experimental)

METHODS: The trial was conducted on naturally infested organic soil at the Muck Crop Research Station, Holland Marsh, Ontario. Carrots (cv. Cellobunch) were direct seeded with a precision seeder (80-90 seeds/m) on 3 June on raised beds 86 cm apart. A randomized complete block arrangement with four blocks per treatment was used. Each treatment plot consisted of four, 5 m long rows of carrots. The 6 treatments were: 1) untrimmed, 2) trimmed once and 3) trimmed twice, each trimming treatment had a fungicide treatment of BAS 510 at 320 g/ha applied and one treatment without. Fungicide treatments were applied using a pull type plot sprayer with TeeJet D-2 hollow cone nozzles at 100 psi (boom) in 500 L/ha of water. Application dates were 23 August, 9, 19, 23 September and 4, 10 October. The vertical trimming of the carrot canopy was performed using a gas operated hand-held hedge trimmer after full canopy closure and apothecial development. The trimmer was held vertically touching the base of the hill and moved along the carrot row to cut off overlapping leaves above the furrow and lodged senescing leaves on both sides of the row. The trimmed plant debris was left in the furrow. The treatments trimmed twice were cut on 20 August and 18 September. The treatments trimmed once were cut on 11 September. As result of the trimming an average of 3 out of 10 leaves per carrot in the side lines were trimmed and the average length of the trimmed petioles was 26.4 cm. One furrow in each treatment was evaluated weekly for the presence of apothecia and percentage of canopy closure was also determined weekly starting at the end of August and continuing until harvest. If rainfall was insufficient to keep soil moisture above 35%, then irrigation was applied. Leaf blight assessments were conducted on 24 September and 1 October. At harvest a 2.32 m yield sample was taken and the carrots and foliage were weighed. Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.7. Means separation was obtained using Fisher's Protected LSD test at P=0.05 level of significance.

RESULTS: Please see Tables 1 and 2.

CONCLUSIONS: The untrimmed treatments had significantly higher numbers of apothecia compared to the trimmed treatments (Table 1). Even though there were high numbers of apothecia found in the field, no disease developed. The untrimmed and trimmed twice fungicide treatments significantly had the lowest average leaf blight ratings (Table 1). The untrimmed fungicide treatment had significantly higher foliar weight then all other treatments (Table 2). No differences were found in foliar weight among the non-fungicide treatments, regardless of trimming. There were no significant differences in yield or percent of marketable carrots among any of the treatments. No significant differences were found in marketable sizes

of the carrots among all treatments. The results suggest that if trimming is done at the proper time it will reduce apothecia numbers and will have little effect on carrot yield.

Table 1. Effect of foliar trimming of carrot canopy on the development apothecia of *S. sclerotiorum* and leaf blight in the experimental plot at Muck Crops Research Station, 2002.

	Apothecia count				Leaf Blight[3]
Trimming treatment	August	September	October	Total	
Untrimmed - No Fungicide	3.3 ns[1]	4.3 a[2]	11.8 ns	19.3 b	3.1 b
Untrimmed - Fungicide	8.5	10.5 b	6	25.0 b	2.4 a
Trimmed once - No Fungicide	1	2.5 a	0.3	3.8 a	3.4 b
Trimmed once - Fungicide	0	0.3 a	0.5	0.8 a	3.0 b
Trimmed twice - No Fungicide	0	2.0 a	0	2.0 a	3.3 b
Trimmed twice - Fungicide	0	0.0 a	0	0.0 a	2.5 a
Total rainfall/irrigation (mm)	57.7	50.3	16.5	124.5	

[1] ns indicates that no significant differences were found among the treatments
[2] Numbers in a column followed by the same letter are not significantly different at P =0.05, Fisher's Protected LSD Test. [3] mean of season, rated from 0-5: 0 = no disease; 1 = <25% leaves diseased; 2 = 26-50% diseased; 3 = 51-75% diseased; 4 = 75-99% diseased; 5 = 100% diseased

Table 2. Effect of vertical foliar trimming of carrot canopy on fresh shoot and root yield of carrot crop grown at the Muck Crops Research Station, 2002.

		% Of Carrots			
Trimming treatment	**Fresh foliar weight kg/m row**	**2.0 - 4.4 cm**	**> 4.4 cm**	**Yield T/ha**	**% Marketable**
Untrimmed - No Fungicide	1.53 cd[1]	35.5 ns[2]	56.1 ns	97.8 ns	91.6 ns
Untrimmed - Fungicide	2.31 a	36.6	54.5	99.6	91.1
Trimmed once - No Fungicide	1.55 cd	41.8	50.6	100.2	92.5
Trimmed once - Fungicide	2.06 b	39.8	51.4	102.5	91.1
Trimmed twice - No Fungicide	1.42 d	39.9	51.6	102.1	91.5
Trimmed twice - Fungicide	1.70 c	40.6	51.8	97.8	92.4

[1] Numbers in a column followed by the same letter are not significantly different at P =0.05, Fisher's Protected LSD Test. [2] ns indicates that no significant differences were found among the treatments

2002 PMR REPORT#115 **SECTION L: VEGETABLE and SPECIAL CROPS - Diseases**
ICAR: 206003

CROP: Carrot (*Daucua carota* subsp. *sativus* (Hoffm.) Arkang.), cv. Cellobunch
PEST: Alternaria leaf blight (*Alternaria dauci* (Kühn) Groves & Skolko)
Cercospora leaf blight (*Cercospora carotae* (Pass.) Solheim)

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TITLE: **EFFICACY OF NEW CHEMISTRY FUNGICIDES FOR THE CONTROL OF CARROT LEAF BLIGHT, 2002.**

MATERIALS: CABRIO (pyraclostrobin 20%), BAS 510 (experimental), BAS 516 (experimental), BRAVO 500 (chlorothalonil 50%)

METHODS: The trial was conducted in naturally infested organic soil at the Muck Crops Research Station, Holland Marsh, Ontario. Carrots were direct seeded (70-80 seeds/m) on raised beds using a Stan Hay Precision seeder on 23 May. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of 4 rows (86 cm apart), 5 m in length. Treatments were applied on 8, 20 August, 7, 17 September and 4 October using a pull type plot sprayer with TeeJet D-2 hollow cone nozzles at 100 psi (boom) in 500 L/ha of water. Treatments were: CABRIO at 0.8 kg/ha, BAS 510 at 0.32 kg/ha, BAS 516 at 0.59 kg/ha, BAS 516 at 0.737 kg/ha, BAS 516 at 0.933 L/ha, CABRIO at 0.8 kg/ha or BAS 510 at 0.32 kg/ha, BRAVO 500 at 3.2 L/ha or BAS 516 at 0.737 kg/ha, BRAVO 500 at 3.2 L/ha. An untreated check was also included. A yield sample of 2.33 m was taken from each treatment on 23 October. A sample of the foliage of 10 carrots from each treatment was also taken. Carrots were weighed for total yield and graded for size and marketable yield. The tops were assessed for disease severity based upon a 6 class scale: 0 = no disease; 1= < 10% petioles diseased; 2 = 10-25% petioles diseased; 3 = 25-50% petioles diseased; 4 = 50-75% petioles diseased; 5 = >75% petioles dead/diseased. The Disease Severity Index (DSI) was determined by the following equation:

$$DSI = \frac{\sum (\text{class no.}) \quad [(\text{class no.}) \times (\text{no. of plants in each class})]}{(\text{total no. plants}) \times (\text{no. classes}-1)} \times 100$$

The air temperatures in 2002 were above the long term (10 year) average for July (21.7^{O}C) and September (17.5^{O}C), below average for May (9.9^{O}C) and October (7.2), and average for June (18.2^{O}C) and August (19.6^{O}C). Monthly rainfall was above the long term (10 year) average for May (113 mm) and June (106 mm), below average for August (18 mm), September (40 mm) and October (49mm), and average for July (76 mm). Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.7. Means separation was obtained using Fisher's Protected LSD test at P = 0.05 level of significance.

RESULTS: As presented in Tables 1 and 2.

CONCLUSIONS: All the treatments had significantly lower disease incidence compared to the CHECK. The BAS 510 treatment also had significantly higher disease than all the other spray treatments except

BAS 516 at 0.59 kg/ha. All treatments had a significantly lower DSI then the CHECK, but were not significantly different from each other. The CABRIO/BAS 510 treatment had the lowest DSI of any treatment. The CHECK also had the lowest number of leaves of any treatment. No significant differences were found among the treatments with regards to marketable yield or marketable size distribution. The CHECK had the lowest yield of any of the treatments.

Table 1. Total number of leaves, % disease and DSI of carrot foliage treated with new chemistry fungicides, grown at the Muck Crops Research Station, 2002.

Treatment	Rate	Total # Leaves	% Disease	DSI
CHECK	----	63.0 ns[1]	76.7 c[2]	43.5 b
CABRIO	0.8 kg/ha	81.3	34.7 a	15.8 a
BAS 510	0.32 kg/ha	87.3	53.2 b	19.8 a
BAS 516	0.59 kg/ha	79	39.9 ab	15.8 a
BAS 516	0.737 kg/ha	87.3	36.8 a	15.7 a
BAS 516	0.933 kg/ha	83.8	33.4 a	14.2 a
CABRIO or BAS 510	0.8 kg/ha or 0.32 kg/ha	88.3	33.6 a	13.0 a
BRAVO 500 or BAS 516	3.2 L/ha or 0.737 kg/ha	75.5	38.8 a	14.4 a
BRAVO 500	3.2 L/ha	85	38.6 a	14.1 a

[1] ns indicates that no significant differences were found among the treatments
[2] numbers in a column followed by the same letter are not significantly different at P=0.05, Fishers Protected LSD test

Table 2. Marketable weight and size distribution within yield samples of carrots treated with new chemistry fungicides, grown at the Muck Crops Research Station, 2002.

Treatment	Rate	t/ha	% of Carrots 2.0 - 4.4 cm	% of Carrots > 4.4 cm
CHECK	----	89.8 ns[1]	67.0 ns	26.1 ns
CABRIO	0.8 kg/ha	101.2	55.5	38.5
BAS 510	0.32 kg/ha	101.6	62.7	25.7
BAS 516	0.59 kg/ha	99.9	66.1	26
BAS 516	0.737 kg/ha	98.6	58.2	33.8
BAS 516	0.933 kg/ha	95.6	51.2	38.3
CABRIO or BAS 510	0.8 kg/ha or 0.32 kg/ha	91.7	48.7	40.9
BRAVO 500 or BAS 516	3.2 L/ha or 0.737 kg/ha	102.3	56.6	34.9
BRAVO 500	3.2 L/ha	97	57.5	27.7

[1] ns indicates that no significant differences were found among the treatments

2002 PMR REPORT #116 **SECTION L: VEGETABLES and SPECIAL CROPS - Diseases**
ICAR: 206003

CROP: Carrot (*Daucus carota* subsp. *sativus* (Hoffm.) Arkang.) cvs. Fontana and Idaho
PEST: Alternaria (*Alternaria dauci* (Kühn) Groves & Skolko) leaf blight, Cercospora (*Cercospora carotae* (Pass.) Solheim) leaf blight

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TITLE: **EFFECT OF NITROGEN RATE ON YIELD AND LEAF BLIGHT SEVERITY IN CARROTS GROWN ON MUCK AND MINERAL SOIL, 2002**

MATERIALS: AMMONIUM NITRATE (nitrogen 34%)

METHODS: Carrots were seeded into muck soil (pH 6.0, organic matter 75%) at the Muck Crops Research Station, Holland Marsh, Ontario, and into mineral soil (pH 8.1, organic matter 2.6%) at an off-station site adjacent to the Holland Marsh. Cultivars Fontana and Idaho were seeded on 24 May into muck soil and 3 Jun into mineral soil. Each experimental unit in the muck soil plot consisted of 8 hills (4 hills/cultivar), 5 m in length, 20 cm high, spaced 86 cm apart, and with a seeding rate of 80 seeds/m. Each experimental unit in the mineral soil plot consisted of 16 hills (8 hills/cultivar), 10 m in length , 20 cm high, spaced 86 cm apart, and with a seeding rate of 100 seeds/m. Mineral soil plots were re-hilled twice during the season. Nitrogen (N) was applied at 0%, 50%, 100%, 150%, and 200% of the rates recommended by the Ontario Ministry of Agriculture and Food (OMAF) using ammonium nitrate for all applications. Once leaf blight symptoms developed, all treatments and cultivars were visually rated bi-weekly for the damage caused by *Alternaria* and *Cercospora* separately. The treatments were rated on a scale of 0 to 10 (0 - no symptoms, 2 - some lesions mainly on leaves, 4 - many lesions on leaves and some on petioles, 6 - numerous lesions on leaves and petioles, 8 - half of leaves destroyed, and 10 - all leaves destroyed). A final leaf blight assessment was conducted at harvest by counting the number of leaves destroyed by leaf blight on 10 carrots per treatment and cultivar. Carrots were harvested from two 2.32 m sections of the middle rows of each cultivar and treatment on 18 Oct (muck) and 24 Oct (mineral), and assessed for total and marketable yield. The air temperatures in 2002 were above the long-term (10 year) average for July (21.7ºC) and September (17.5ºC), below average for May (9.9 ºC) and October (7.2ºC), and average for June (18.2ºC) and August (19.6ºC). Monthly rainfall was above the long-term (10 year) average for May (113 mm) and June (106 mm), below average for August (18 mm), September (40 mm), and October (49 mm), and average for July (76 mm). The experiments were arranged as a split-plot design (N rate x cultivar) with four replications. Data were analyzed using the GLM and Univariate procedures of SAS version 8.0 (SAS Institute, Cary NC).
RESULTS: Representative leaf blight data from mid-season and late-season assessments are presented in Table 1. The leaf assessment data at harvest are presented in Table 2. Yield data are presented in Table 3.

CONCLUSIONS: On muck soil, increasing the N rate reduced mid-season *Alternaria* damage on both cultivars, and reduced mid-season *Cercospora* damage on Idaho carrots up to the recommended rate. Previous research has shown an effect of N rate on *Alternaria* or the leaf blight complex, but this is the first study to show a potential connection between N rate and *Cercospora* damage. The lack of effect of N rate on leaf blight severity on muck soil late in the season can be attributed to high levels of disease damage in all treatments near harvest and difficulty distinguishing the damage from each pathogen. On mineral soil, the lack of effect of N rate is probably due to large patches of wilted carrots due to drought,

which increased leaf blight severity and leaf death in those areas and increased variability in the plot. The number of live leaves at harvest for both cultivars combined on muck soil increased with increasing N rate, which shows the effect of leaf blight over the season on the carrot foliage health at harvest. Poor foliage health can cause yield losses due to the leaves breaking off when pulled by the mechanical harvester and many roots remaining unharvested as a result. Total and marketable yield for both cultivars were unaffected by N rate. This data suggests that soil N levels were adequate in all plots. However, higher levels of N appear necessary in some cases to minimize both *Alternaria* and *Cercospora* damage. Nitrogen fertilization practices should be taken into consideration in the integrated pest management program for carrot leaf blight.

Table 1. Effect of nitrogen (N) application rate on *Alternaria* and *Cercospora* leaf blight damage on selected dates of carrots grown on muck and mineral soil.

N Application Rate (% of Recommended)		Leaf Blight Damage Rating[1]							
		Mid-Season (3 Sep muck; 5 Sep mineral)				Late-Season (7 Oct)			
		Idaho		Fontana		Idaho		Fontana	
		Alt.	Cerc.	Alt.	Cerc.	Alt.	Cerc.	Alt.	Cerc.
Muck	0	5.82	7.03	7.04	7.85	5.85	7.55	5.35	9.55
	50	5.8	6.5	7	7.5	4.8	7	5	9
	100	4.5	5.5	6	7.3	5	7	5.3	9
	150	4.3	5.8	6	7.5	6	7	5	9
	200	4.8	5.8	6	7.3	5.3	7	5.5	9
Mineral	0	3.05	2.35	3.05	3.05	7.05	5.85	8.05	7.55
	50	3	2.8	3.3	4	7.3	6.3	8	7.5
	100	2.8	3	3.5	3.3	6.5	6	7.5	7.5
	150	2.3	2	2.3	3.3	5.3	5	7	6.5
	200	1.8	2.5	2.3	3	7	6.8	7.8	8.5

[1] Rating system: 0 = no lesions; 5 = numerous lesions on leaves and many on petioles; 10 = tops completely destroyed.
[2] Regression: P=0.0007, R^2=0.50, Equation: blight rating=5.81 - 0.0070Nrate (one outlier removed).
[3] Regression: P=0.0002, R^2=0.65, Equation: blight rating=7.03 - 0.0136Nrate + 0.000035Nrate ^{2} (one outlier removed).
[4] Regression: P=0.0003, R^2=0.53, Equation: blight rating=7.00 - 0.0060Nrate.
[5] Linear and quadratic regression analysis not significant.

Table 2. Effect of nitrogen (N) application rate on leaf survival at harvest of carrots grown on muck and mineral soil.

N Application Rate (% of Recommended)	Number of Live Leaves per 10 Plants					
	Muck			Mineral		
	Idaho	Fontana	Combined	Idaho	Fontana	Combined
0	35.81	27.51	31.62	29.81	25.01	27.41
50	42.3	38.3	40.3	30.5	18.3	24.4
100	39.8	35	37.4	32.8	27	29.9
150	43	38.8	40.9	38	40.5	39.3
200	47.3	31.3	39.3	34.3	24.8	29.5

[1] Linear and quadratic regression analysis not significant.
[2] Regression: P=0.0019, R^2=0.23, Equation: live leaves=33.83 + 0.0491Nrate (one outlier removed).

Table 3. Effect of nitrogen (N) application rate on total and marketable yield of carrots grown on muck and mineral soil.

N Application Rate (% of Recommended)	Total Yield (t/ha)				Marketable Yield (t/ha)			
	Muck		Mineral		Muck		Mineral	
	Idaho	Font.	Idaho	Font.	Idaho	Font.	Idaho	Font.
0	92.81	98.41	48.21	47.21	88.91	95.01	43.41	45.41
50	94.1	100	44.9	46	89.8	96.9	41.8	44.3
100	93.9	96.8	51.9	52.7	88.6	94.4	48.4	49.1
150	91	97.8	41.6	38.5	86.3	93.1	37.7	34.5
200	87.5	96.9	43.2	43.5	82.4	93.7	36.8	40.5

[1] Linear and quadratic regression analysis not significant.

2002 PMR REPORT #117 **SECTION L: VEGETABLES and SPECIAL CROPS - Diseases**
STUDY DATA BASE: 280-2124-9915

CROP: Ginseng (*Panax quinquefolius* L.)
PEST: Damping-off, *Rhizoctonia solani* (Kühn)

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TITLE : **EFFICACY OF PROPICONAZOLE FOR MANAGEMENT OF RHIZOCTONIA DAMPING-OFF IN GINSENG, 1997-2001**

MATERIALS: NUTRI-Q 0-0-5 (quintozene 5%), TOPAS (propiconazole 250 g/L)

METHODS: The trial was established on a brunisolic grey-brown luvisol (Fox loamy sand; Delhi research farm) in Oct 1997. Plots (2.5 m. long x 1.5 m wide), with 0.5-m buffers between, were laid out in a conventional cambered ginseng bed under plastic shade cloth using a randomized complete block design with four replications. Each plot was subdivided into two 1-m^2 subplots, designed to receive pathogen inoculum either in the fall (12 Nov 1997), or the following spring (11 May 1998). Inoculum consisted of pieces of *R. solani*-colonized ginseng roots, prepared by slicing fresh roots into 5 mm thick sections then double-autoclaving in erlenmeyer flasks. Root pieces were inoculated with an agar culture of *R. solani* then incubated under ambient light in the laboratory for 4 wk. Five g (fresh wt) of colonized root, held in a cheesecloth bag, were placed in a shallow (2 cm) depression in the centre of each fall-infested subplot. Additional inoculum, prepared simultaneously, was stored at 8 C until 11 May 1998, when it was added to spring-infested subplots. Fall fungicide application of NUTRI-Q 0-0-5 was made 23 Oct 1997 prior to placement of an oat straw mulch over the seeded beds. Applications of TOPAS were made the same day but after placement of the mulch. Spring fungicide applications (TOPAS only) were made on 12 May 1998 and 15 May 1998 over the existing straw mulch. TOPAS applications were made once in the fall and twice in the spring, using a CO_2 - powered backpack sprayer (4000 L water / ha). NUTRI-Q 0-0-5 (quintozene) was applied (fall only) with a spice shaker. Control treatments consisted of water only (4000 L water / ha). Efficacy was evaluated during 1998-2001 growing seasons but no further treatment applications were made after 26 May 1998. Ginseng stand counts for each 1.0 m^2 area subplot were recorded twice (spring and late summer) in each growing season. Radial extension of disease (cm) from the central inoculum point in each subplot was determined on the same dates. In each subplot, the extent of disease spread was measured in the south and west directions; means of the two radii were used in analysis. Data were analysed using GLM (SAS) and Tukey's studentized range test (P = 0.05).

RESULTS: As outlined in Table 1. Due to poor disease development in spring-infested subplots, data from fall-infested subplots only are shown. Data pertaining to stand counts and disease radii observations were collected in spring and late summer of each year, but as data for the two time periods were similar, only spring data (May/June) are shown for the fall-infested subplots.

CONCLUSIONS: Disease in all plots spread in a roughly circular pattern from the site of inoculum addition. In the seedling year, disease development in control plots was adequate in fall-infested subplots; the mean radius of area of damped-off plants in control plots was 26 cm compared to 11 cm in spring-infested control subplots. In fall-infested subplots, application with the high rate of TOPAS tended to increase stand and decrease disease radius when compared to the control. However, differences were significant for stand only in the third year (2000) and for disease radius only in the fourth year (2001). The

high rate of TOPAS was not significantly different from NUTRI-Q with respect to stand or disease radius. Disease development in spring-infested subplots was erratic but overall trends in treatment effects were similar (data not shown). Delayed emergence resulted in higher stand counts in 1999 than in 1998. The high rate of TOPAS used here may provide some suppression of damping-off caused by *R. solani*.

Table 1. Effect of fungicides on plant stand and radius of damped-off area in *Rhizoctonia*-infested plots, 1997-2001.

Treatment and rate a.i./ ha	Fall-infested subplots							
	1998		1999		2000		2001	
	Pl[5]	Rad[5]	Pl[5]	Rad[5]	Pl[5]	Rad[5]	Pl[5]	Rad[5]
Topas @ 125 g[1] + 125 g[2] + 125 g[3]	47	17	63	22	66 ab	21	32	40 ab
Topas @ 250 g[1] + 250 g[2] + 250 g[3]	63	18	81	18	81 a	21	43	23 b
Nutri-Q 0-0-5 @ 6.8 kg [4]	50	18	70	25	67 ab	20	36	36 ab
Control	46	26	63	21	34 b	35	16	42 a
P > F	0.050	0.078	0.138	0.566	0.010	0.082	0.306	0.032

1 Application of treatment was made 23 Oct 97. No applications were made during 1999-2001.
2 Application of treatment was made 12 May 98. No applications were made during 1999-2001.
3 Application of treatment was made 26 May 98. No applications were made during 1999-2001.
4 Nutri-Q 0-0-5 was applied 23 Oct 97 only.
5 Pl: Mean number of plants per square metre. Rad: radius of damped-off area in cm.

2002 PMR REPORT #118

SECTION L: VEGETABLES and SPECIAL CROPS - Diseases
STUDY DATA BASE: 280-2124-9915

CROP: Ginseng (*Panax quinquefolius* L.)
PEST: Disappearing root rot, rusted root, *Cylindrocarpon destructans* f. sp. *panacis* Matuo & Miyazawa

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TITLE: **EFFICACY OF PROPICONAZOLE FOR CONTROL OF CYLINDROCARPON ROOT ROT IN GINSENG, 1997-2001**

MATERIALS: TOPAS (propiconazole 250 g/L)

METHODS: The trial was established on a brunisolic grey-brown luvisol (Fox loamy sand; Delhi research farm) on 29 Oct 1997. Plots (2.5 m. long x 1.5 m wide), with 0.5-m buffers between, were laid out in a conventional cambered ginseng bed under plastic shade cloth using a randomized complete block design with four replications. After seeding, all plots were infested with *C. destructans* by spraying a suspension of conidia (2×10^7 conidia per m^2 of plot surface) over the soil surface. An oat straw mulch was then applied to the plots (30 Oct 1997). TOPAS applications were made over the straw mulch with a CO_2-powered backpack sprayer using 4000 L water /ha on 15 June and 14 Aug 1998. Control treatments consisted of water only (4000 L water / ha). Efficacy was evaluated during 1998-2001 growing seasons but no further treatment applications were made after 14 Aug 1998. Ginseng stand counts were made in centrally-located 1.0 m^2 area subplots within each plot and were recorded twice (spring and late summer) in each growing season. A rating (scale 1 to 5; 1 = symptomless root, 5 = severe symptoms) for severity of rusted root disease, caused by *C. destructans*, was done on roots harvested from each plot after 4 yr of growth. Data were analysed using linear regression (SAS).

RESULTS: As outlined in Table 1. As spring and summer data sets were similar, only spring data (May/June) are shown.

CONCLUSIONS: Delayed emergence resulted in higher stand counts in 1999 and 2000 than in 1998. There was no response to increasing rate of TOPAS for stand or disease severity. It was concluded that the incidence of disappearing root rot (leading to stand decline) was low and not affected by treatment. Rusted root, however, was common and was moderate to severe in most plots. The trial did not provide evidence that TOPAS, at the rates and application frequency used here, will be useful for control of diseases caused by *C. destructans*.

Table 1. Effect of TOPAS on plant stand and disease index in *Cylindrocarpon*-infested plots, 1997-2001.

Treatment a.i./ ha	1998		1999		2000		2001			
	Pl[4]	SE[4]	Pl	SE	Pl	SE	Pl	SE	DI[5]	SE
Topas @ 500 g[1] + 500 g[2]	65	9.6	69	9.9	72	12	59	13	4	0.27
Topas @ 1000 g[1] + 1000 g[2]	77	3.3	82	5.6	92	5.2	76	7.5	4	0.2
Topas @ 1500 g[1] + 1500 g[2]	64	6.1	66	1.8	83	5.3	65	3.8	4	0.1
Control	62	8.1	66	6.2	71	6.7	45	14	5	0.66
P > F[3]	0.781		0.318		0.277		0.308		0.081	

[1] Application of TOPAS was made 15 June 1998.
[2] Application of TOPAS was made 14 August 1998.
[3] P value for linear regression (treatment parameter).
[4] Pl: Mean number of plants per square metre in May/June of each year. SE: standard error.
[5] DI: Disease index: Mean rusted root disease index of approx 20 roots (4 yr-old) on a 1-5 scale.

2002 PMR REPORT #119 SECTION L: VEGETABLE and SPECIAL CROPS - Diseases
ICAR :

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Hamlet
PEST: Botrytis Leaf Blight, *Botrytis squamosa* (Walker)
Purple Blotch, *Alternaria porri* (Ellis)

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TITLE: EFFICACY OF NEW CHEMISTRY FUNGICIDES FOR THE CONTROL OF BOTRYTIS LEAF BLIGHT, 2002

MATERIALS: CABRIO (20% pyraclostrobin), BAS 510 (experimental), BAS 516 (experimental), BRAVO 500 (chlorothalonil 50%)

METHODS: Onions were direct seeded (34 seeds/m) using a Stan Hay Precision seeder into organic soil (organic matter 60%, pH 6.4) at the Muck Crops Research Station on 4 May. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of 8 rows (42 cm apart), 5 m in length. Treatments were applied on 10, 20, 31 Jul and 8, 15 Aug using a pull type plot sprayer with TeeJet D-2 hollow cone nozzles at 100 psi (boom) in 500 L/ha of water. Treatments were: CABRIO at 0.8 kg/ha, BAS 510 at 0.471 kg/ha, BAS 516 at 1.026 kg/ha, BAS 516 at 1.316 kg/ha, BAS 516 at 1.3 L/ha, BRAVO 500 at 3.2 L/ha or CABRIO at 0.8 kg/ha, BRAVO 500 at 3.2 L/ha or BAS 516 at 1.026 kg/ha, BRAVO 500 at 3.2 L/ha. An untreated check was also included. Twenty plants per replicate were harvested on 21 Aug when the plants were near maturity. The four oldest green leaves per plant with 80% or more of non-necrotic tissue were evaluated for Botrytis Leaf Blight. The percentage of green tissue area was rated using The Manual of Assessment Keys for Plant Diseases by Clive James, Key No. 1.6.1. The total number of green and dead leaves were also recorded. Purple blotch was assessed by looking at all leaves, dead and green, and counting the number of lesions. A 4.66 m yield sample was taken from each replicate on 18 September, and the onions were graded for size. The air temperatures in 2002 were above the long term (10 year) average for July (21.7^{O}C) and September (17.5^{O}C), below average for May (9.9^{O}C), and average for June (18.2^{O}C) and August (19.6^{O}C). Monthly rainfall was above the long term (10 year) average for May (113 mm) and June (106 mm), below average for August (18 mm) and September (40 mm) and average for July (76 mm). Data were analyzed using the General Analysis of Variance function of the Linear Models section of Statistix V.7. Means separation was obtained by using Fisher's Protected LSD test at P= 0.05 level of significance.

RESULTS: As presented in Tables 1 and 2.

CONCLUSIONS: The CHECK had a significantly higher percentage of leaves in the 2-5% infection category than all spray treatments. BAS 516 at 1.316 kg/ha and rotation of BRAVO 500 + BAS 516 had significantly higher percentages of disease-free leaves then the CHECK and BAS 516 at 1.026 kg/ha. All treatments had significantly lower numbers of purple blotch lesions then the CHECK. The three BAS 516 treatments had the significantly highest yields. There were no significant differences in size distribution among the treatments . However, numerically BAS 516 at 0.471 kg/ha produced the highest percent of jumbo size onions, and the CHECK and BRAVO 500 produced the lowest.

Table 1. Evaluation of fungicides for the control of Botrytis leaf blight and purple blotch on onions grown in the Holland Marsh, Ontario, 2002.

Treatment	Rate	# Green leaves/ plant	# Dead leaves/ plant	% Botrytis Leaf Blight			# Purple blotch lesions
				0	1 - 2	2 - 5	
CHECK	----	6.2 c[1]	4.0 d	43.8 c	44.4 ns[2]	11.9 c	12.3 b
CABRIO	0.8 kg/ha	7.3 ab	3.0 bc	62.9 abc	33.8	3.5 b	5.3 a
BAS 510	0.471 kg/ha	6.8 bc	3.0 bc	66.8 ab	32.2	1.1 ab	4.0 a
BAS 516	1.026 kg/ha	7.2 ab	2.8 abc	57.9 bc	41.6	0.6 a	6.3 a
BAS 516	1.316 kg/ha	7.4 ab	2.4 a	80.0 a	17.2	2.8 ab	3.0 a
BAS 516	1.3 L/ha	7.6 a	2.7 abc	64.0 abc	34.1	1.9 ab	4.3 a
BRAVO or **CABRIO**	3.2 L/ha or 0.8 kg/ha	6.7 bc	3.1 c	74.4 ab	25	0.6 a	3.8 a
BRAVO or **BAS 516**	3.2 L/ha or 1.026 kg/ha	7.3 ab	2.5 ab	82.0 a	17.7	0.3 a	4.3 a
BRAVO	3.2 L/ha	7.0 ab	3.0 bc	77.9 ab	21.9	0.3 a	7.5 a

[1] numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD test

[2] ns indicates that there were no significant differences found among the treatments

Table 2. Yield and size distribution of onions treated with various fungicides grown at the Muck Crops Research Station, 2002.

Treatment	Rate	t/ha	% Small 32 - 44 mm	% Large 45 - 76 mm	% Jumbo > 76 mm
CHECK	----	66.9 c[1]	9.3 ns[2]	88.4 ns	2.3 ns
CABRIO	0.8 kg/ha	67.0 c	7.3	87.8	4.9
BAS 510	0.471 kg/ha	70.4 bc	7.4	85.7	6.8
BAS 516	1.026 kg/ha	75.9 ab	7.5	87.9	4.7
BAS 516	1.316 kg/ha	78.9 a	9.5	86.4	4.1
BAS 516	1.3 L/ha	73.5 abc	10.1	84.2	5.6
BRAVO or **CABRIO**	3.2 L/ha or 0.8 kg/ha	68.3 c	9.5	86.4	4.2
BRAVO or **BAS 516**	3.2 L/ha or 1.026 kg/ha	69.8 bc	8	88.4	3.6
BRAVO	3.2 L/ha	69.4 bc	8.6	88.6	2.7

[1] numbers in a column followed by the same letter are not significantly different at P=0.05, Fisher's Protected LSD test

[2] ns indicates that there were no significant differences found among the treatments

2002 PMR REPORT #120 SECTION L: VEGETABLE and SPECIAL CROPS - Diseases
ICAR: 206003

CROP: Yellow cooking onions (*Allium cepa* L.), cv. Millenium
PEST: Onion smut, *Urocystis cepulae* Frost

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TITLE: EVALUATION OF SEED TREATMENT AND FURROW FUNGICIDE TREATMENTS FOR CONTROL OF ONION SMUT, 2002

MATERIALS: ALLEGIANCE (metalayl 28.4%), APRON XL (mefenoxam 28.4%), DITHANE DG (mancozeb 75%), VORTEX (60%), MAXIM (fludioxinil 40.3%), PRO GRO (carbathiin 30%, thiram 50%), RAXIL (tebuconazole 28.4%), REGENT (fipronil 80%)

METHODS: Selected new fungicide seed treatments were evaluated in an outdoor field trial at the Muck Crops Research Station to determine optimum rates and combinations to effectively control onion smut. Yellow cooking onions (cv. Millenium) were seeded 40 seeds/m in naturally infested organic muck soil (pH 6.4, organic matter 60%) on 7 May. Treatments included PRO GRO at 2000 mg ai, APRON XL at 15 mg ai + VORTEX at 5 mg ai + RAXIL at 200 mg ai, APRON XL at 15 mg ai + VORTEX at 10 mg ai + RAXIL at 100 mg ai, APRON XL at 15 mg ai + VORTEX at 10 mg ai + RAXIL at 200 mg ai, APRON XL at 15 mg ai + MAXIM at 5 mg ai + RAXIL at 200 mg ai, ALLEGIANCE at 30 mg ai + VORTEX at 5 mg ai + RAXIL at 200 mg ai, ALLEGIANCE at 30 mg ai + VORTEX at 10 mg ai + RAXIL at 100 mg ai, ALLEGIANCE at 30 mg ai + VORTEX at 10 mg ai + RAXIL at 200 mg ai, ALLEGIANCE at 30 mg ai + MAXIM at 5 mg ai + RAXIL at 200 mg ai. Two standard treatments of DITHANE DG at 8.8 kg/ha, and PRO GRO at 2000 mg ai + DITHANE DG at 8.8 kg/ha were included. An untreated check was also included. All seeds were treated with REGENT at 2500 mg ai to control onion maggot. All seed treatments expressed as mg ai/ 100 g seed. Treatments were replicated four times in a randomized complete block design. Each replicate consisted of four rows (42 cm apart), 5 m in length. All seed treatments were seeded using a push cone seeder. DITHANE DG treatments were applied using a V-belt seeder, with product and seed on the belt. Three random 2 m sections were marked off, and germination counts were recorded weekly prior to first assessment to determine initial stands. At one (12 Jun) and three (3 July) true leaves, one of the 2m sections was harvested and evaluated by looking at bulbs and leaves for smut. The remaining 2 m section was evaluated in the same manner at harvest on 20 Sep. A final 2.33 m section was also harvested to assess yield on 20 Sep. The air temperatures in 2002 were above the long term (10 year) average for July (21.7^{O}C) and September (17.5^{O}C), below average for May (9.9^{O}C), and average for June (18.2^{O}C) and August (19.6^{O}C). Monthly rainfall was above the long term (10 year) average for May (113 mm) and June (106 mm), below average for August (18 mm) and September (40 mm) and average for July (76 mm). Data were analyzed using the General Analysis of variance function of the Linear Models section of Statistics 7. Separation of means was obtained using Fisher's Protected LSD test at P=0.05.

RESULTS: As outlined in Table 1.

CONCLUSIONS: Significant differences in the incidence of onion smut were found among treatments. In the first assessment, the treatment of ALLEGIANCE at 30 mg ai + VORTEX at 10 mg ai + RAXIL at 200 mg

ai had the lowest incidence of onion smut at 2.3%. The lowest incidence of onion smut in the second and third assessments were treatments of ALLEGIANCE at 30 mg ai + MAXIM 5 mg ai + RAXIL 200 mg ai at 10.4 % and PRO GRO + DITHANE DG at 3.6 %. The untreated check had significantly higher disease incidence in the first and second assessments than all other treatments. In the third assessment, the standard PRO GRO treatment was the only fungicide treatment that did not have a significantly lower incidence of smut than the check. Significant differences were also found in yield among the treatments. The highest yield was obtained by the standard treatment of PRO GRO + DITHANE DG at 102.2 T/ha. The check had significantly lower yields than all fungicide treatments. The ALLEGIANCE at 30 mg ai + VORTEX at 10 mg ai + RAXIL at 200 mg ai had the highest yield of the experimental fungicide treatments at 100.1 T/ha.

Table 1. Evaluation of seed treatment and furrow fungicide treatments for the control of onion smut, 2002

Treatments	Rate Product	Incidence of Smut %			Yield
	(mg ai/100 g seed)	12 Jun	3 Jul	20 Sep	(T/ha)
Check	-----	98.3 f [2]	72.1 e	53.3 c	42.0 e
PG [1]	2000	31.8 de	50.3 d	44.6 c	59.7 d
A + V+ R	15 + 5 + 200	9.0 a-c	29.1 bc	13.6 ab	92.0 ab
A + V + R	15 + 10 +100	12.0 bc	27.7 b	15.0 ab	86.3 a-c
A + V + R	15 + 10 + 200	4.8 ab	15.2 a	6.6 a	87.3 a-c
A + M+ R	15 + 5 + 200	6.6 a-c	19.0 ab	10.4 a	85.9 a-c
AL + V + R	30 + 5 + 200	3.5 a	27.6 b	10.3 a	85.6 bc
AL + V + R	30 + 10 + 100	25.1 d	40.0 cd	24.2 b	73.8 cd
AL + V + R	30 + 10 + 200	2.3 a	21.4 ab	8.7 a	100.1 ab
AL + M + R	30 + 5 + 200	3.0 a	10.4 a	11.6 a	91.3 ab
D	8.8 kg/ha	33.1 e	20.1 ab	6.3 a	96.5 ab
PG + D	2000 + 8.8 kg/ha	13.8 c	15.1 a	3.6 a	102.2 a

[1] **PG = PRO GRO A = APRON XL V = VORTEX R = RAXIL M = MAXIM AL = ALLEGIANCE D = DITHANE DG**

[2] Numbers in a column followed by a different letter are significantly different at P = 0.05, Fisher's Protected LSD test.

Funding for this project was made available by the Agricultural Adaptation Council through the support of the Ontario Fruit and Vegetable Association and by the Ontario Ministry of Agriculture and Food's New Directions in Agricultural Research Fund

2002 PMR REPORT #121 SECTION M: FIELD LEGUMES - (Beans, Peas) - Diseases
STUDY DATA BASE: 390 1252 9201

CROP: Snap Beans, *Phaseolus vulgaris* L.
PEST: White Mould *(Sclerotinia sclerotiorum*) and Grey Mould (*Botrytis cinerea*)

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TITLE: COMPARISON OF SEVERAL FUNGICIDES FOR THE CONTROL OF ROTS IN SNAP BEANS IN 2001

MATERIALS: RONILAN 50 EG (vinclozolin), FOLICUR 3.6 F (tebuconazole), BAS 510 70 WG, BAS 516 38 WG, ALTIMA 500 F (fluazinam), SWITCH 62.5 WG (cyprodinil + fludioxonil), PROSTAR 70 WP (flutolanil), SERENADE 137 WP (Bacillus subtilis), ROVRAL 50 WP (iprodione)

METHODS: The snap bean trial was seeded on May 24, 2001 in Delta, B.C. on a silt loam soil. Each plot consisted of 2 rows of beans 6 metres long with one bean row left between each treatment as a buffer. Each plot was 1.2 m x 6 m with rows spaced 60 cm apart and plants spaced 3-5 cm. There were five replicates and treatments were arranged in a randomized complete block design. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 500 L/ha of water at 275 kPa. BAS 516 and SWITCH were applied once at 10% bloom, RONILAN, FOLICUR, BAS 510, ALTIMA, PROSTAR, and ROVRAL were applied twice at 10 % and 50 % bloom and SERENADE was applied 3 times at 10, 50, and 100 % bloom. Spray dates were July 9, July 13, and July 17, 2001. The weather conditions were dry and warm during bloom period. Irrigation was started earlier in the season than usual. Rain and cooler temperatures began 2-3 days before harvest. Beans were harvested on August 2 -3, 2001. Those harvested August 2 were rated in the field and those harvested August 3 were stored in plastic bags at ambient temperature and rated in the lab on August 4, 2001. In each plot, one row was harvested for yield and the other was harvested for disease severity. Twenty plants were pulled at random from a 2 metre section from one of the 2 treated rows of each plot and rated for disease on a scale of 0 - 5, where 0 = no disease, 1 = leaf spot mould only, 2 = stem rot lesions, 3 = stem and pod rot, 4 = severe stem and pod rot , and 5 = whole plant necrotic. Data were analysed with the general linear model procedure (SAS institute, Cary, NC.) and means were separated using the Duncan's Multiple Range Test at $P < 0.05$.

RESULTS: Data are presented in Table 1and 2. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: There were no significant differences in yield whether marketable or total weight or in rot weight (g/m or %) among the treatments (Table 1). RONILAN and ALTIMA - treated plants had the lowest weight of field rotted pods. BAS 510 and ROVRAL were the best treatments for reducing the leaf spot and stem and pod rot. RONILAN, ALTIMA, and PROSTAR also appeared to have a beneficial effect (Table 2). Further work is needed to verify results.

Table 1. Marketable weight, total weight, rot weight, and percentage of field rot in snap beans following various fungicide treatments in Delta, B.C., 2001.

Treatments	Rate (g ai/ha)	Time of application (% bloom)	Market. Weight (g/m)	Total Weight (g/m)	Rot Weight (g/m)	Rot Weight (%)
CHECK	-	-	991.2 a*	1006.3 a	15.1 a	0.8 a
RONILAN	500	10	978.7 a	982.8 a	4.1 a	0.2 a
FOLICUR	250	10, 50	1013.6 a	1033.5 a	19.9 a	1.0 a
BAS 510	500	10, 50	1024.3 a	1036.1 a	11.8 a	0.6 a
BAS 516	450	10	1018.8 a	1040.5 a	21.7 a	1.1 a
ALTIMA	500	10, 50	1008.9 a	1013.3 a	4.4 a	0.2 a
SWITCH	670	10	913.5 a	924.7 a	11.2 a	0.6 a
PROSTAR	2240	10, 50	892.0 a	903.0 a	11.0 a	0.7 a
SERENADE	**	10, 50, 100	995.7 a	1033.6 a	37.9 a	1.8 a
ROVRAL	1500	10, 50	943.3 a	951.4 a	8.1 a	0.4 a

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).
** 9.0 kg prod/ha

Table 2. Percentage field rot of leaf spot mould, stem and pod rot in snapbeans following treatment with various fungicides in Delta B.C., 2001.

Treatments	Rate (g ai/ha)	Time of application (% bloom)	Leaf Spot Mould (%)	Stem & Pod Rot (%)	Leaf Spot, Mould, Stem, and Pod Rot (%)
CHECK	-	-	26.0 ab*	14.0 ab	40.0 a
RONILAN	500	10	17.0 ab	10.0 bc	27.0 ab
FOLICUR	[1]	10, 50	15.0 ab	23.0 a	38.0 a
BAS 510	500	10, 50	14.0 b	1.0 c	15.0 b
BAS 516	450	10	21.3 ab	13.8 ab	35.0 a
ALTIMA	500	10, 50	21.0 ab	6.0 bc	27.0 ab
SWITCH	670	10	18.0 ab	13.0 abc	31.0 ab
PROSTAR	2240	10, 50	27.0 a	2.0 bc	29.0 ab
SERENADE	[2]	10, 50, 100	20.0 ab	11.0 bc	31.0 ab
ROVRAL	1500	10, 50	14.0 b	1.0 c	15.0 b

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test ($P<0.05$).

[1] 580 ml prod/ha

[2] 9.0 kg prod/ha

2002 PMR REPORT #122 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry bean (*Phaseolus vulgaris* L.), cv. US 1140
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF DRY BEAN IN ALBERTA IN 2002

MATERIALS: CROWN (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl, 320 g/l FL), L1030 (HEC 5725, 100 g/l SU), FLINT (trifloxystrobin, 500 g/l WP), L1050 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), STILETTO (carbathiin, 100 g/l + thiram, 100 g/l + metalaxyl, 16.2 g/l SU).

METHODS: Seed of dry bean cv. US1140 was treated in a Hege II small batch seed treater with L1050 at 3.25 ml/kg seed, STILETTO at 4.4 ml/kg seed, CROWN at 2.6 ml/kg seed, or with ALLEGIANCE at 0.128 ml/kg seed, either alone or in combination with CROWN at 2.6 ml/kg seed, L1030 at 0.5 ml/kg seed or FLINT at 0.05 or 0.1 g/kg seed. An experimental plot was established on 11 May, 2002 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Non-treated seeds were planted as inoculated and non-inoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 40 ml/row. Emerged seedlings were counted on 5 June. At maturity (11 September), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly ($P \# 0.05$) higher for all seed treatments in the trial than for the inoculated control (Table 1). Yield was similar among all seed treatments, but was significantly greater ($P \# 0.05$) than the inoculated control for L1050. Emergence and yield for the fungicide treatments were generally below that for the noninoculated control.

CONCLUSIONS: All seed treatments in the trial improved emergence over the inoculated control; L1050 improved seed yield over the inoculated control.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of dry bean cv. US 1140 grown in soil inoculated with *Rhizoctonia solani* at Brooks, Alberta in 2002.

Treatment	Rate (ml/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Noninoculated Control		39.7 a [1]	6.44 ab
Inoculated Control [2]		24.8 c	5.05 b
ALLEGIANCE	0.128	30.7 b	5.88 ab
STILETTO	4.4	35.0 ab	5.88 ab
L1050	3.25	38.1 a	7.01 a
CROWN	2.6	37.0 ab	5.47 ab
ALLEGIANCE + L1030	0.128 + 0.5	37.4 a	5.86 ab
ALLEGIANCE + CROWN	0.128 + 2.6	35.9 ab	5.47 ab
ALLEGIANCE + FLINT	0.128 + 0.05 g	36.9 ab	5.77 ab
ALLEGIANCE + FLINT	0.128 + 0.1 g	39.4 a	5.74 ab

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).

[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2002 PMR REPORT #123 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry Bean (*Phaseolus vulgaris* L.), cv. Envoy
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA ROOT ROT OF DRY BEAN IN ALBERTA IN 2002

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), CROWN (carbathiin, 92 g/l + thiabendazole, 58 g/l SU), APRON (metalaxyl, 320 g/l FL)

METHODS: Seed of dry bean cv. Envoy was treated with APRON at 12.8 g/100 kg seed + CROWN at 88 g ai/100 kg seed or APRON MAXX at 6.25 or 12.5 g ai/100 kg seed in a Hege II small batch seed treater. Experimental plots were established on 13 May, 2002 at Brooks, Alberta, in brown chernozemic clay loam soil. The plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 40 ml/row, along with a clay-based *Rhizobium* inoculant at 30 ml/row. Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted on 5 June. At maturity (12 September), plants were harvested by hand, then dried and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence and seed yield were significantly greater ($P \# 0.05$) than the inoculated control for all seed treatments in the trial (Table 1). Emergence and yield for the treated plots were comparable to the uninoculated control.

CONCLUSIONS: Emergence and seed yield were improved over the inoculated control by all seed treatments used in the trial.

Table 1. Effect of seed treatments on plant stand and seed yield of dry bean cv. Envoy grown in soil inoculated with *Rhizoctonia solani* at Brooks, Alberta in 2002.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Noninoculated Control	--	66.2 a[1]	5.48 a
Inoculated Control [2]	--	17.2 b	3.16 b
APRON MAXX	6.25	62.3 a	5.45 a
APRON MAXX	12.5	65.4 a	5.77 a
CROWN + APRON	88 + 12.8	57.3 a	5.12 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2002 PMR REPORT #124 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry Bean (*Phaseolus vulgaris* L.), cv. Envoy
PEST: Root rot, *Fusarium avenaceum* (Fr.:Fr.) Saccardo

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF FUSARIUM ROOT ROT OF DRY BEAN IN ALBERTA IN 2002

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), CROWN (carbathiin, 92 g/l + thiabendazole, 58 g/l SU), APRON (metalaxyl, 320 g/l FL)

METHODS: Seed of dry bean cv. Envoy was treated with APRON at 12.8 g/100 kg seed + CROWN at 88 g ai/100 kg seed or APRON MAXX at 6.25 or 12.5 g ai/100 kg seed in a Hege II small batch seed treater. An experimental plot was established on 13 May, 2002 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. *Fusarium avenaceum* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 ml/row. Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted on 5 June. At maturity (12 September), plants were harvested by hand, then dried and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence and seed yield were significantly greater ($P \# 0.05$) than the inoculated control for all seed treatments in this trial (Table 1).

CONCLUSIONS: Emergence and seed yield were improved over the inoculated control by all seed treatments used in this trial.

Table 1. Effect of seed treatments on plant stand and seed yield of dry bean cv. Envoy grown in soil inoculated with *Fusarium avenaceum* at Brooks, Alberta in 2002.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Noninoculated Control	--	64.4 a[1]	4.74 a
Inoculated Control[2]	--	7.8 b	1.28 b
APRON MAXX	6.25	66.3 a	4.90 a
APRON MAXX	12.5	53.6 a	4.77 a
CROWN + APRON	88 + 12.8	56.0 a	4.58 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).

[2] This and all subsequent treatments were inoculated with *Fusarium avenaceum* at the time of seeding.

2002 PMR REPORT #125 **SECTION M: FIELD LEGUMES - Diseases**
ICAR:61009653

CROP: Dry Bean (*Phaseolus vulgaris* L.), cv. US 1140
PEST: Anthracnose, *Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib.

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TITLE: EVALUATION OF FOLIAR FUNGICIDE TREATMENTS TO CONTROL ANTHRACNOSE OF DRY BEAN IN ALBERTA IN 2002

MATERIALS: QUADRIS 250 SC (azoxystrobin, 250 g/l SC), BRAVO 500F (chlorothalonil, 500 g/l SU), HEADLINE (pyraclostrobin, 250 g/l EC), DITHANE DG (mancozeb 75% WDG)

METHODS: Seed of dry bean cv. US 1140 was sown in pots and grown in a greenhouse at CDC South, Brooks, Alberta. Seeds were planted 5 cm deep at a rate of five seeds per pot. Ten replicate pots were seeded per treatment and plants were grown to the two-cotyledon stage. Pre-inoculated treatments were sprayed with a conidial suspension of *C. lindemuthianum* (10^6 spores/ml). Two days later, foliar fungicide treatments were applied to all pots, except for the inoculated and noninoculated control treatments, in a randomized complete block design. Post-inoculated treatments were sprayed with the conidial suspension two days after treatment with foliar fungicides. Fungicide treatments consisted of QUADRIS (125 g ai/ha), BRAVO (1000 g ai/ha), HEADLINE (100 g ai/ha), or DITHANE (1688 g ai/ha) as either a single treatment, or as a double treatment with the second application 14 days later. Treatments were applied using a hand-held sprayer. Treatments comprising BRAVO in the first application and QUADRIS in the second, and vice versa, were also applied. Pots were rated for incidence and severity of anthracnose on 40 leaves/pot, 3 wk after the final fungicide applications. Disease was rated on a 0-10 scale, based on percentage of leaf area infected, where 1=1-10% infection, 2=10-20% infection, etc. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Disease incidence and severity were significantly greater ($P \# 0.05$) than the inoculated control for all seed treatments in the pre-inoculated trial (Table 1). Among the treatments in this trial, disease incidence was greatest ($P \# 0.05$) for BRAVO, DITHANE, the double BRAVO and DITHANE treatments, and the BRAVO/QUADRIS treatment. Disease incidence was lowest for the single and double applications of QUADRIS and HEADLINE, and the treatment using QUADRIS then BRAVO. Disease severity was significantly reduced ($P \# 0.05$) by every foliar spray treatment in this trial, compared to the inoculated control. Among the treatments in the post-inoculated trial, the double and single applications of BRAVO showed the highest disease incidence, followed by the BRAVO/QUADRIS treatment, the single and double applications of DITHANE DG, and the double application of QUADRIS. The single and double applications of HEADLINE and the single application of QUADRIS ranked among the lowest disease incidence. Disease severity was significantly higher ($P \# 0.05$) for the BRAVO treatments (either single or double application) compared to the other foliar spray treatments.

CONCLUSIONS: QUADRIS and HEADLINE reduced disease incidence more than BRAVO and DITHANE DG. All treatments reduced disease severity in the pre-inoculated trial. Disease severity in the BRAVO treatments was greater compared to the other foliar spray treatments in the post-inoculated trial.

Table 1. Effect of foliar spray treatments on incidence and severity of anthracnose on dry bean cv. US 1140 at Brooks, Alberta in 2002.

Treatment	Rate	Pre-inoculated		Post-inoculated	
	(g ai/ha)	Incidence (%)	Severity (0-10)	Incidence (%)	Severity (0-10)
Noninoculated Control	--	0.0 d[1]	0.00 b	0.0 f	0.00 d
Inoculated Control[2]	--	62.2 a	2.60 a	22.6 b	1.08 a
QUADRIS	125	0.0 d	0.00 b	4.2 ef	0.04 d
BRAVO	1000	6.5 c	0.07 b	27.4 ab	0.87 ab
HEADLINE	100	0.3 d	0.00 b	2.0 f	0.02 d
DITHANE	1688	7.8 bc	0.09 b	14.1 c	0.29 cd
QUADRIS	125/125[3]	0.0 d	0.00 b	12.5 cd	0.39 c
BRAVO	1000/1000	6.8 c	0.07 b	31.9 a	0.76 b
HEADLINE	100/100	0.0 d	0.00 b	4.3 ef	0.07 d
DITHANE	1688/1688	7.0 c	0.08 b	10.3 cd	0.11d
QUADRIS/BRAVO	125/1000	1.3 d	0.01 b	8.1 de	0.12 cd
BRAVO/QUADRIS	1000/125	12.8 b	0.14 b	14.3 c	0.21 cd

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[2] This and all subsequent treatments were inoculated with *Colletotrichum lindemuthianum.*
[3] This and all subsequent fungicide treatments applied both at the two-cotyledon stage and 14 days later.

2002 PMR REPORT #126 **SECTION M:FIELD LEGUMES - Diseases**
ICAR: 61006537

CROP: White Beans (*Phaseolus vulgaris* L.), cv Stinger
PEST: Naturally occurring root rots and seedling blights

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TITLE: WHITE BEAN SEED TREATMENTS FOR SEEDLING DISEASES

MATERIALS: G2051-16 (carbathiin + thiram, 169.6 g ai/L + 150.6 g ai/L); L0020-A1 (metalaxyl, 320 g ai/L); L1115-A1(trifloxystrobin, 500 g ai/kg); L1050-A1 (fludioxonil + metalaxyl-M, 7.69 g ai/L + 11.54 g ai/L); L1030-A1 (HEC5725, 100 g ai/L); L0202-A1 (carbathiin + metalaxyl + thiram, 100 g ai/L + 16.2 g ai/L + 100 g ai/L).

METHODS: Seed was treated on 13 May, 2002 in 1 kg lots in individual plastic bags by applying the treatment or slurry via a syringe to each bag (all treatments diluted to the same volume of 3.0 ml/kg seed using water). The seed was mixed for 1 min in the inflated bag to ensure thorough seed coverage. Seed weight was 161g/1000 seeds. The crop was planted on 10 June, 2002 at Ridgetown on a sandy clay loam site with pH 7.1 and 5.4% organic matter that had 2 previous years of corn, using a 2-row cone seeder. Plots were 2 rows spaced 0.76 m apart and 4 m in length placed in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Total plot emergence was evaluated on 24 June, 2 and 9 July respectively. Vigor was assessed using a scale of 0-100% (100 = most developed plant in the trial and 0 = plant dead) on 24 June and 2 July, 2002 respectively. Plots were harvested on 16 Sept, 2002 and yields corrected to 14.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at $P \leq 0.05$.

RESULTS: See Table 1.

CONCLUSIONS: There were no significant differences from the untreated check for any of the treatments for any of the parameters assessed. There was no sign of phytotoxicity for any of the treatments.

Table 1. Plant stand, vigor and yield assessments of white beans (*Phaseolus vulgaris)* at Ridgetown, Ontario, 2002.

Treatment	Rate g ai/100 kg.	Emerge	Plant Stand plants/2m		Vigor 0-100%		Yield T/ha
		24 June	2 July	9 July	24 June	2 July	16 Sept
Untreated Control		87.3	83.3 a *	87.0 ab	72.5	75.0	3.5
G2051-16	83	86.5	81.5 a	84.5 ab	72.5	77.5	3.6
L0020-A1	4.2	92.3	90.3 a	90.8 ab	87.5	90.0	3.5
+L1115-A1	5						
L0020-A1	4.2	91.8	90.5 a	90.8 ab	72.5	72.5	3.3
+L1115-A1	2.5						
G2051-16	83	86.3	77.0 a	80.3 b	60	62.5	3.7
+L0020-A1	4.2						
L0020-A1	4.2	93.3	92.3 a	97.8 a	75	75.0	3.2
L1050-A1	6.3	92.0	91.5 a	89.0 ab	80	80.0	3.4
L0020-A1	4.2	96.3	97.0 a	99.5 a	92.5	90.0	3.3
+L1030-A1	5						
L0202-A1	95.1	85.5	81.3 a	76.5 b	65.0	70.0	3.7
LSD		NS	12.5	10.4	NS	NS	NS
CV		8.3	9.8	8.1	19.2	18.2	7.4

* Means followed by same letter do not significantly differ, (P= 0.05, LSD)

2002 PMR REPORT #127 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. B-90
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF CHICKPEA IN ALBERTA IN 2002

MATERIALS: CROWN (carbathiin, 90 g/l + thiabendazole, 58 g/l FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl, 320 g/l FL), FLINT (trifloxystrobin, 500 g/kg WP), L1050 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), STILETTO (carbathiin, 100 g/l + thiram, 100 g/l + metalaxyl, 16.2 g/l SU).

METHODS: Seed of chickpea cv. B-90 was treated in a Hege II small batch seed treater with L1050 at 3.25 ml/kg seed, STILETTO at 4.4 ml/kg seed, or with ALLEGIANCE at 0.16 ml/kg seed either alone or in combination with CROWN at 3.0 or 4.5 ml/kg seed, VITAFLO 280 at 3.3 ml/kg seed, or FLINT at 0.1, 0.2 or 0.4 g/kg seed. Experimental plots were established on 13 May, 2002 at Brooks, Alberta in brown chernozemic clay loam soil. The plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Nontreated seeds were planted as inoculated and noninoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum at the time of seeding at the rate of 30 ml/row. Emerged seedlings were counted for each plot on 5 June. At maturity (25 September), plants were harvested by small-plot combine. Seeds were weighed to determine yi elds. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly higher ($P \# 0.05$) than the inoculated control for all seed treatments in the trial except for ALLEGIANCE alone, L1050, and ALLEGIANCE + FLINT at the lowest and highest rates (Table 1). These treatments produced significantly lower emergence compared to STILETTO and ALLEGIANCE + CROWN at both rates. Yield was significantly higher ($P \# 0.05$) for all seed treatments, except for ALLEGIANCE alone, compared to the inoculated control.

CONCLUSIONS: STILETTO, ALLEGIANCE + CROWN and ALLEGIANCE + VITAFLO 280 improved emergence over the inoculated control while L1050 and ALLEGIANCE alone did not. ALLEGIANCE + FLINT produced emergence that was not significantly higher than the inoculated control, except at the middle rate of FLINT. However, all of the treatments except for ALLEGIANCE alone produced higher yield than the inoculated control.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of chickpea cv. B-90 grown in soil inoculated with *Rhizoctonia solani* at Brooks, Alberta in 2002.

Treatment	Rate (product/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Noninoculated Control		44.9 a[1]	3.58 a
Inoculated Control [2]		11.2 ef	0.56 b
ALLEGIANCE		2.3 f	0.38 b
STILETTO	3.25 ml	45.9 a	4.14 a
L1050	0.16 ml	22.3 cde	3.44 a
ALLEGIANCE + CROWN	0.16 ml + 3.0 ml	40.4 ab	3.56 a
ALLEGIANCE + CROWN	0.16 ml + 4.5 ml	45.2 a	3.73 a
ALLEGIANCE + VITAFLO 280	0.16 ml + 3.3 ml	34.1 abc	3.94 a
ALLEGIANCE + FLINT	0.16 ml + 0.1 g	15.1 def	2.63 a
ALLEGIANCE + FLINT	0.16 ml + 0.2 g	28.8 bcd	3.23 a
ALLEGIANCE + FLINT	0.16 ml + 0.4 g	20.3 cde	2.85 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2002 PMR REPORT #128 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Chico
PEST: Seedling blight, *Ascochyta rabiei* (Pass.) Lab.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL ASCOCHYTA SEEDLING BLIGHT OF CHICKPEA IN ALBERTA IN 2002

MATERIALS: ALLEGIANCE (metalaxyl, 320 g/l FL), FLINT (trifloxystrobin, 500 g/kg WP), CROWN (carbathiin, 90 g/l + thiabendazole, 58 g/l FS), L1030 (HEC 5725, 100 g/l SU), L1050 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC).

METHODS: Ascochyta-infested seed (35%) of chickpea cv. Chico was treated in a Hege II small batch seed treater with L1050 at 3.25 ml/kg seed, ALLEGIANCE at 0.16 ml/kg seed, alone, as a control, or in combination with CROWN at 3.0 ml/kg seed, L1030 at 2.0 ml/kg seed or FLINT at 0.1, 0.2 or 0.4 g/kg seed. Experimental plots were established on 12 May at Brooks, Alberta in brown chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 30 cm apart. Two rows of spring triticale were seeded as a barrier between each plot to reduce interplot spread of spore inoculum. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Emerged seedlings were counted for each subplot on 8 July. At maturity (26 September), plots were harvested by small-plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence and seed yield were similar for all treatments.

CONCLUSIONS: No single treatment improved emergence or seed yield compared to the others.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of chickpea cv. Chico grown from seed infested with *Ascochyta rabiei* at Brooks, Alberta in 2002.

Treatment	Rate (product/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
ALLEGIANCE + CROWN	0.16 ml + 3.0 ml	46.8 a[1]	3.33 a
ALLEGIANCE + L1030	0.16 ml + 2.0 ml	56.5 a	2.64 a
L1050	3.25 ml	54.6 a	2.61 a
ALLEGIANCE (CONTROL)	0.16 ml	49.6 a	2.85 a
ALLEGIANCE + FLINT	0.16 ml + 0.1 g	51.7 a	2.52 a
ALLEGIANCE + FLINT	0.16 ml + 0.2 g	54.2 a	2.21 a
ALLEGIANCE + FLINT	0.16 ml + 0.4 g	47.3 a	2.38 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).

2002 PMR REPORT #129 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. B-90
PEST: Seedling blight, *Botrytis cinerea* Pers.:Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF BOTRYTIS SEEDLING BLIGHT IN INFESTED CHICKPEA SEED IN ALBERTA IN 2002

MATERIALS: CROWN (carbathiin, 90 g/l + thiabendazole, 58 g/l FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl, 320 g/l FL), FLINT (trifloxystrobin, 500 g/kg WP), L1050 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), STILETTO (carbathiin, 100 g/l + thiram, 100 g/l + metalaxyl, 16.2 g/l SU).

METHODS: Seed of naturally *Botrytis*-infested chickpea cv. B-90 was treated in a Hege II small batch seed treater with L1050 at 3.25 ml/kg seed, STILETTO at 4.4 ml/kg seed, or with ALLEGIANCE at 0.16 ml/kg seed either alone or in combination with CROWN at 3.0 or 4.5 ml/kg seed, VITAFLO 280 at 3.3 ml/kg seed, or FLINT at 0.1, 0.2 or 0.4 g/kg seed. Experimental plots were established on 13 May, 2002 at Brooks, Alberta, in brown chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Nontreated seeds were planted as a control. Emerged seedlings were counted for each plot on 6 June. At maturity (26 September), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly ($P \# 0.05$) higher for all seed treatments in the trial compared to the inoculated control (Table 1). Seed yield was significantly ($P \# 0.05$) higher for all seed treatments, except ALLEGIANCE + STILETTO, ALLEGIANCE + CROWN at the higher rate, and ALLEGIANCE + FLINT at 0.2 ml/kg seed, than for the inoculated control.

CONCLUSIONS: All seed treatments in the trial improved emergence over the untreated control. L1050 and ALLEGIANCE, alone or combined with VITAFLO 280, the lowest and highest rates of ALLEGIANCE + FLINT, or the lower rate of ALLEGIANCE + CROWN, improved yield over the untreated control.

Table 1. Effect of seed treatments on plant stand and seed yield of chickpea cv. B-90 grown from seed infested with *Botrytis cinerea* at Brooks, Alberta in 2002.

Treatment	Rate (product/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Untreated Control		25.1 b[1]	3.13 b
ALLEGIANCE	0.16 ml	50.9 a	6.27 a
STILETTO	4.40 ml	54.4 a	5.39 ab
L1050	3.25 ml	52.5 a	6.63 a
ALLEGIANCE + CROWN	0.16 ml + 3.0 ml	52.1 a	6.70 a
ALLEGIANCE + CROWN	0.16 ml + 4.5 ml	53.3 a	5.48 ab
ALLEGIANCE + VITAFLO 280	0.16 ml + 3.3 ml	53.0 a	6.46 a
ALLEGIANCE + FLINT	0.16 ml + 0.1 g	51.0 a	7.27 a
ALLEGIANCE + FLINT	0.16 ml + 0.2 g	50.3 a	5.51 ab
ALLEGIANCE + FLINT	0.16 ml + 0.4 g	54.3 a	6.29 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).

2002 PMR REPORT #130 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. B-90
PEST: Seedling blight, *Botrytis cinerea* Pers.:Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF BOTRYTIS SEEDLING BLIGHT OF CHICKPEA IN ALBERTA IN 2002

MATERIALS: CROWN (carbathiin, 90 g/l + thiabendazole, 58 g/l FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl, 320 g/l FL), FLINT (trifloxystrobin, 500 g/kg WP), L1050 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), STILETTO (carbathiin, 100 g/l + thiram, 100 g/l + metalaxyl, 16.2 g/l SU).

METHODS: Seed of chickpea cv. B-90 was treated in a Hege II small batch seed treater with L1050 at 3.25 ml/kg seed, STILETTO at 4.4 ml/kg seed, or with ALLEGIANCE at 0.16 ml/kg seed either alone or in combination with CROWN at 3.0 or 4.5 ml/kg seed, VITAFLO 280 at 3.3 ml/kg seed, or FLINT at 0.1, 0.2 or 0.4 g/kg seed. Experimental plots were established on 13 May, 2002 at Brooks, Alberta, in brown chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Nontreated seeds were planted as inoculated and noninoculated controls. *Botrytis cinerea* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 40 ml/row. Emerged seedlings were counted on 5 June. At maturity (25 September), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly (*P*#0.05) higher for all seed treatments, except for ALLEGIANCE alone and combined with FLINT at the two highest rates, compared to the inoculated control (Table 1). Emergence was significantly (*P*#0.05) higher for L1050 and for ALLEGIANCE + CROWN at the lower rate compared to any of the other seed treatments. Yield was significantly higher for all seed treatments, except for ALLEGIANCE alone and with FLINT at 0.2 mL/kg seed, compared to the inoculated control. Yield was significantly greater for the ALLEGIANCE + CROWN, ALLEGIANCE + VITAFLO 280 and L1050 treatments compared to any of the ALLEGIANCE + FLINT treatments.

CONCLUSIONS: Most seed treatments in the trial, except for ALLEGIANCE alone, improved emergence and seed yield over the inoculated control. Treatment with ALLEGIANCE + FLINT usually resulted in slight improvement, while ALLEGIANCE + VITAFLO 280 resulted in greater improvement in yield, but not in emergence, treatment with STILETTO resulted in greater improvement in emergence, but not in yield, compared to the ALLEGIANCE + FLINT treatments. Treatment with L1050 or ALLEGIANCE + CROWN resulted in substantial improvement in both emergence and yield compared to the ALLEGIANCE + FLINT treatments.

Table 1. Effect of seed treatments on plant stand and seed yield of chickpea cv. B-90 grown in soil inoculated with *Botrytis cinerea* at Brooks, Alberta in 2002.

Treatment	Rate (product/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Noninoculated Control		47.7 a[1]	5.89 a
Inoculated Control [2]		5.3 e	1.26 e
ALLEGIANCE	0.16 ml	4.4 e	1.61 de
STILETTO	4.4 ml	29.8 b	3.59 bc
L1050	3.25 ml	48.5 a	5.62 a
ALLEGIANCE + CROWN	0.16 ml + 3.0 ml	43.3 a	5.03 ab
ALLEGIANCE + CROWN	0.16 ml + 4.5 ml	32.9 b	5.01 ab
ALLEGIANCE + VITAFLO 280	0.16 ml + 3.3 ml	27.4 bc	4.81 ab
ALLEGIANCE + FLINT	0.16 ml + 0.1 g	18.6 cd	2.97 cd
ALLEGIANCE + FLINT	0.16 ml + 0.2 g	9.0 de	2.71 cde
ALLEGIANCE + FLINT	0.16 ml + 0.4 g	12.2 de	2.87 cd

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[2] This and all subsequent treatments were inoculated with *Botrytis cinerea* at the time of seeding.

2002 PMR REPORT #131 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Sanford
PEST: Ascochyta blight, *Ascochyta rabiei* (Pass.) Lab.

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TITLE: EVALUATION OF FOLIAR SPRAY TREATMENTS FOR THE CONTROL OF ASCOCHYTA BLIGHT OF CHICKPEA IN ALBERTA IN 2002

MATERIALS: BRAVO 500F (chlorothalonil, 500 g/l SU), DITHANE DG (mancozeb 75% WDG), HEADLINE (pyraclostrobin, 250 g/l EC), QUADRIS (azoxystrobin, 250 g/l EC)

METHODS: Experimental plots were established on 14 May, 2002 near Brooks, Alberta, in a brown chernozemic sandy clay soil. Chickpea cv. Sanford was seeded in subplots consisting of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Foliar fungicide treatments of BRAVO 500F at 1.0 or 1.5 kg/ha, DITHANE DG at 1.68 or 2.44 kg ai/ha, HEADLINE at 0.1 kg/ha or QUADRIS at 0.125 kg/ha were applied in a randomized complete block design of eight different spray schedules with four replications. Each treatment was applied to one plot in each replicate using a knapsack sprayer with an 8002 tee-jet nozzle at 250 kpa on July 19, July 26, August 2 and August 19, corresponding to early budding, early bloom, mid-flowering, and/or mid-podding, respectively, using 360 l/ha water volume. All treatments and one control were inoculated with conidial sunspensions of *A. rabiei* on July 26, August 1 and August 4. Ascochyta blight severity was rated on August 9, August 19, August 27 and September 3 at five sites per plot based on percent foliar infection on a 0-9 scale. Disease incidence (percentage of plants infected) was also evaluated at the same time. The area under the disease progress curve (AUDPC) value was calculated for disease incidence and severity according to the procedure used by Shaner and Finney (1977) and normalized according to Fry (1978). The final disease incidence and severity ratings and AUDPC values are presented. At maturity, on October 9, plants from each plot were harvested using a small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Disease incidence and severity were significantly lower ($P \# 0.05$) than the inoculated control for all treatment schedules in the trial. Most treatment schedules, except for those using DITHANE DG alone, also reduced disease incidence and severity compared to the noninoculated control, which became infected by secondary airborne inoculum. Insertion of a HEADLINE treatment into the DITHANE DG schedule resulted in significantly lower ($P \# 0.05$) disease incidence compared to the use of DITHANE DG alone. None of the treatments significantly improved ($P \# 0.05$) yield over the controls.

CONCLUSIONS: All treatment schedules in the trial reduced disease incidence and severity compared to the inoculated control. Inclusion of HEADLINE in the spray schedule at the mid-flowering stage in place of DITHANE DG improved disease control compared to a schedule where DITHANE DG was applied throughout the spray season. None of the treatments improved yield over the controls.

Table 1. Effect of foliar spray treatments on the severity of ascochyta blight and seed yield of chickpea near Brooks, Alberta in 2002.

Treatment	Disease incidence (%)[1]	AUDPC[2]	Disease severity (0-9)	AUDPC	Yield (T/ha)
X X X X[3] (Control)	100 a[4]	67 ab	4.9 a	2.5 b	1.85 a
X X X X[5]	98 a	83 a	6.4 a	4.1 a	1.77 a
D D D D	68 b	50 bc	2.6 b	1.4 bc	1.68 a
$D^+D^+D^+D^+$	65 b	45 bcd	1.9 bc	1.2 c	1.58 a
D D^+ H D^+	23 e	12 e	0.5 c	0.2 c	1.88 a
X D^+H D^+	50 bc	35 cde	1.3 bc	0.7 c	2.15 a
X H H X	43 cd	23 de	0.8 c	0.4 c	1.90 a
X B^+ B B	53 bc	34 cde	1.1 bc	0.7 c	1.72 a
D H H D^+	43 cd	29 cde	1.0 c	0.7 c	1.58 a
B Q Q B	30 de	27 cde	0.7 c	0.5 c	2.13 a

[1] Disease incidence and severity were rated on August 9, August 19, August 27 and September 3 for AUDPC. Final ratings are presented.
[2] Area under the disease progress curve (AUDPC) was calculated according to Shaner and Finney (1977) and normalized according to Fry (1978).
[3] Treatments were applied at early budding (July 19), early flowering (July 26), mid-flowing (August 2) and at the mid-podding stage (August 19), respectively, corresponding to the four letters in the treatment code:
B = BRAVO 500 applied at 1.0 kg/ha
B^+ = BRAVO 500 applied at 1.5 kg/ha
D = DITHANE DF applied at 1.68 kg/ha
D^+ = DITHANE DG applied at 2.44 kg/ha
H = HEADLINE applied at 0.1 kg/ha
Q = QUADRIS applied at 0.125 kg/ha
X = No fungicide treatment applied
[4] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[5] This and subsequent treatments were inoculated with spores of *A. rabiei* prior to the first fungicide application.

References

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Fry, W.E. 1978. Quantification of general resistance of potato cultivars and fungicide effects for integrated control of potato late blight. Phytopathology 68: 1650-1655.

2002 PMR REPORT #132 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Sanford
PEST: Ascochyta blight, *Ascochyta rabiei* (Pass.) Lab.

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TITLE: EVALUATION OF FOLIAR SPRAY TREATMENT SCHEDULES TO CONTROL ASCOCHYTA BLIGHT OF CHICKPEA IN ALBERTA IN 2002

MATERIALS: BRAVO 500F (chlorothalonil, 500 g/l SU), HEADLINE (pyraclostrobin, 250 g/l EC), QUADRIS (azoxystrobin, 250 g/l EC)

METHODS: Experimental plots were established on 14 May, 2002 near Brooks, Alberta, in a brown chernozemic sandy clay soil. Chickpea cv. Sanford was seeded in subplots consisting of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Foliar fungicide treatments of BRAVO 500F at 1.0 or 1.5 kg/ha, DITHANE DG at 1.68 or 2.44 kg ai/ha, HEADLINE at 0.1 kg/ha or QUADRIS at 0.125 kg/ha were applied in a randomized complete block design of eight different spray schedules with four replications. Each treatment was applied to one plot in each replicate using a knapsack sprayer with an 8002 tee-jet nozzle at 250 kpa on July 19, July 26, August 2 and August 19, corresponding to early budding, early bloom, mid-flowering, and/or mid-podding, respectively, using 360 l/ha water volume. All treatments and one control were inoculated with conidial sunspensions of *A. rabiei* on July 26, August 1 and August 4. Ascochyta blight severity was rated on August 9, August 19, August 27 and September 3 at five sites per plot based on percent foliar infection on a 0-9 scale. Disease incidence (percentage of plants infected) was also evaluated at the same time. The area under the disease progress curve (AUDPC) value was calculated for disease incidence and severity according to the procedure used by Shaner and Finney (1977) and normalized according to Fry (1978). The final disease incidence and severity ratings and AUDPC values are presented. At maturity, on October 10, plants from each plot were harvested using a small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Disease incidence and severity and AUDPC values, were significantly lower ($P \# 0.05$), than the inoculated control for all treatment schedules in the trial. Yield was similar for all treatments.

CONCLUSIONS: All treatment schedules in the trial reduced disease incidence and severity compared to the inoculated control, but none of the treatments significantly improved yield over the controls.

Table 1. Effect of foliar spray treatments on the severity of ascochyta blight and seed yield of chickpea near Brooks, Alberta in 2002.

Treatment	Disease incidence (%)[1]	AUDPC[2]	Disease severity (0-9)	AUDPC	Yield (T/ha)
X X X X[3] (Control)	98 a[4]	73 a	6.1 a	3.5 a	0.42 a
Q Q X X[5]	35 b	18 b	1.2 b	0.6 b	0.74 a
Q H X X	33 b	21 b	0.7 b	0.4 b	0.88 a
Q Q B X	8 bc	8 b	0.4 b	0.2 b	0.70 a
B^+ Q Q X	35 b	28 b	1.0 b	0.7 b	0.99 a
B^+ H H X	18 bc	18 b	0.6 b	0.4 b	0.64 a
B^+ Q Q B	38 b	29 b	1.4 b	1.0 b	0.75 a
B^+ H H B	3 c	2 b	0.0 b	0.0 b	0.56 a

[1] Disease incidence and severity were rated on August 9, August 19, August 27 and September 3 for AUDPC. Final rating is presented.
[2] Area under the disease progress curve (AUDPC) was calculated according to Shaner and Finney (1977) and normalized according to Fry (1978).
[3] Treatments were applied at early budding (July 19), early flowering (July 26), mid-flowing (August 2) and at the mid-podding stage (August 19), respectively, corresponding to the four letters in the treatment code:
B = BRAVO 500 applied at 1.0 kg/ha
B^+ = BRAVO 500 applied at 1.5 kg/ha
H = HEADLINE applied at 0.1 kg/ha
Q = QUADRIS applied at 0.125 kg/ha
X = No fungicide treatment applied
[4] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[5] This and subsequent treatments were inoculated with spores of *A. rabiei* prior to the first fungicide application.

References

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2002 PMR REPORT #133 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Chico
PEST: Seedling blight, *Botrytis cinerea* Pers. Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF BOTRYTIS ROOT ROT OF CHICKPEA IN ALBERTA IN 2002

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), CROWN (carbathiin, 92 g/l + thiabendazole, 58 g/l SU).

METHODS: Seed of chickpea cv. Chico was treated with CROWN at 90 g ai/100 kg seed or APRON MAXX at 6.25 or 12.5 g ai/100 kg seed in a Hege II small batch seed treater. An experimental plot was established on 17 May, 2002 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. *Botrytis cinerea* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 ml/row. Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted on 5 June. At maturity (20 September), plants were harvested by small-plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence and seed yield were significantly greater ($P \# 0.05$) for all seed treatments than for the inoculated control (Table 1). Seed yield was significantly greater ($P \# 0.05$) for APRON MAXX at the higher rate than for CROWN or APRON MAXX at the lower rate. Emergence and yield values for the chemical treatments generally exceeded those of the non-inoculated control.

CONCLUSIONS: Seedling emergence and seed yield were improved over the inoculated control by both the CROWN and APRON MAXX treatments. Treatment with the higher rate of APRON MAXX resulted in higher yield than the same treatment at the lower rate or treatment with CROWN.

Table 1. Effect of seed treatments on plant stand and seed yield of chickpea cv. Chico grown in soil inoculated with *Botrytis cinerea* at Brooks, Alberta in 2002.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Noninoculated Control	--	41.7 a[1]	0.34 b
Inoculated Control [2]	--	1.4 b	0.09 c
APRON MAXX	6.25	38.2 a	0.53 b
APRON MAXX	12.5	45.3 a	0.94 a
CROWN	90	46.6 a	0.39 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[2] This and all subsequent treatments were inoculated with *Botrytis cinerea* at the time of seeding.

2002 PMR REPORT #134 **SECTION M: DISEASES OF FIELD LEGUMES**
STUDY DATA BASE: 375-1231-9614

CROP: Lentil (*Lens culinaris* Medik.) cv. Laird.
PEST: Ascochyta blight, *Ascochyta lentis* Vassil.; botrytis leaf and pod blight, *Botrytis cinerea* Pers.:Fr.; sclerotinia stem rot, *Sclerotinia sclerotiorum* (Lib.) de Bary; anthracnose, *Colletotrichum truncatum* (Schwein.) Andrus & W.D. Moore.

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TITLE: EFFECT OF FUNGICIDE APPLICATION ON FOLIAR DISEASE SEVERITY AND YIELD OF LENTIL IN SASKATCHEWAN IN 1998 - 1999

MATERIALS: BRAVO 500 (chlorothalonil 50% FL), BRAVO ULTREX (chlorothalonil 82.5% WG), BRAVO 1B10353, QUADRIS (azoxystrobin 25% FL), ABOUND 250 (azoxystrobin 80% WG), and HEADLINE (pyraclostrobin 25% EC).

METHODS: Trials were conducted at the AAFC research farm at Saskatoon SK in 1998 and 1999 to evaluate the effect of timing and rates of application of several fungicides on foliar disease severity, and yield of the lentil cv. Laird. A randomized complete block design with four replications was used, and each plot was 6 x 2.4 m. Fungicides were applied in 200 L ha^{-1} spray volume using a hand-held sprayer with Tee-Jet 8003 VS nozzles at 275 kPa. Residue from a lentil crop that was heavily infested with ascochyta blight was distributed in the plots before the first fungicide application was made, to provide a source of inoculum. Overhead irrigation was applied several times to stimulate disease development. Disease severity was rated 2-3 weeks after the second fungicide application using the Horsfall-Barratt scale (0-11) and converted to % leaf area affected. Analysis of variance (General Linear Model Procedure, SAS) was used in the initial statistical analyses, and Duncan's Multiple Range Test at $P \# 0.05$ was used for means comparisons.
In 1998, the following treatments were assessed: 1) untreated check; 2) fungicides applied at early flowering only: ABOUND 250 at 0.25 kg a.i. ha^{-1}; QUADRIS at 125 g a.i. ha^{-1}; BRAVO 500 at 1.0 kg a.i. ha^{-1}; BRAVO ULTREX at 1.0 kg a.i. ha^{-1}: BRAVO 1B10353 at 1.0 kg a.i. ha^{-1}; HEADLINE at 0.1, 0.15, and 0.2 kg a.i. ha^{-1}; HEADLINE (an early version of the formulation) at 0.15 kg a.i. ha^{-1}; and 3) fungicides applied at mid flower and again at late flower; BRAVO ULTREX at 1.0 kg a.i. ha^{-1} per application, and HEADLINE plus adjuvant at 0.15 kg a.i. ha^{-1} per application. The first spray application was made on July 23 and the second on August 04. Preliminary seed analyses demonstrated that ascochyta incidence was #4% in the control plots, so further assessment were not pursued.
In 1999, the treatments were: 1) untreated check; 2) fungicides applied at early flowering only: ABOUND 250 at 0.25 kg a.i. ha^{-1}; BRAVO ULTREX at 1.0 kg a.i. ha^{-1}; HEADLINE at 0.15 kg a.i. ha^{-1}; HEADLINE plus adjuvant at 0.1, 0.15, and 0.3 kg a.i. ha^{-1}; HEADLINE plus adjuvant at 0.15 kg a.i. ha^{-1} applied in a reduced water volume (25 L); and 3) fungicides applied at mid flower and again at late flower; BRAVO ULTREX at 1.0 kg a.i. ha^{-1} per application, and HEADLINE plus adjuvant at 0.1 and 0.15 kg a.i. ha^{-1} per application. The first application was made on July 28 and the second on August 04.

RESULTS AND CONCLUSIONS: In 1998, ascochyta blight was the only foliar disease observed in the trial, and severity was very low due to hot dry conditions during the growing season. Yields in most of the fungicide treatments were numerically higher than the control, but only one treatment provided a significant increase. Multiple applications of fungicide did not increase seed yield.
In 1999, ascochyta blight was the only disease observed in the trial at the first application date, with a mean severity of 2% leaf area affected. Ascochyta blight severity levels in the controls increased to 5% by the second application date (data not shown). A period of rainy weather followed the second application, and foliar

severity in the controls increased rapidly to 85% by the mid-pod stage (Table 1). *Sclerotinia sclerotiorum* and *Botrytis cinerea* were the dominant pathogens at this time, although ascochyta blight and anthracnose were also present. Fungicide application reduced foliar disease severity compared with the controls, but there were no differences among the fungicides. However, fungicide had no impact on seed yield, likely because the disease(s) did not increase until late in the season.

Table 1. Effect of foliar fungicide application on foliar disease severity and seed yield of lentil cv. Laird at Saskatoon, SK in 1998 and 1999.

Fungicide	Rate (a.i. ha^{-1})	# applications	Leaf area affected (%)	Yield (kg ha^{-1})
		---1998---		
BRAVO 500	1.0 kg	1	0.0833333	1110 abc
BRAVO	1.0 kg	1	0.0833333	990 bc
ULTREX		2	0.0833333	1080 abc
BRAVO 1B10353	1.0 kg	1	0.0833333	1140 abc
ABOUND 250	0.25 kg	1	0.0833333	970 c
QUADRIS	125 g	1	0.0833333	1130 abc
HEADLINE	0.1 kg	1	0.0833333	1030 abc
	0.15 kg	1	0.0833333	1160 abc
		2	0.0833333	1040 abc
	0.2 kg	1	0.0833333	1210 ab
HEADLINE‡	0.15 kg	1	0.0833333	1220 a
Control	--	--	0.0833333	990 bc
		---1999---		
BRAVO ULTREX	1.0 kg	1	34 b	1000 a
		2	23 b	1160 a
ABOUND 250	0.25 kg	1	21 b	1140 a
HEADLINE	0.15 kg	1	38 b	1210 a
HEADLINE‡	0.1 kg	1	19 b	1130 a
		2	34 b	1050 a
	0.15 kg	1	25 b	1140 a
		2	34 b	960 a
	0.15 kg†	1	26 b	1100 a
	0.3 kg	1	31 b	1150 a
Control	--	--	84 a	990 a

Fungicides applied at: 1 = early flowering, 2 = early +mid-late flowering.
(*a-c*) Means in columns and years with the same letters are not significantly different at $P \# 0.05$.
† Applied in 25 L ha^{-1} of water; ‡ plus adjuvant.

2002 PMR REPORT #135 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* L.), cv. Laird
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF LENTIL IN ALBERTA IN 2002

MATERIALS: CROWN (carbathiin, 90 g/l + thiabendazole, 58 g/l FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl, 320 g/l FL), FLINT (trifloxystrobin, 500 g/l WP), L1050 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC).

METHODS: Seed of lentil cv. Laird was treated in a Hege II small batch seed treater with L1050 at 3.25 ml/kg seed,VITAFLO 280 at 3.3 ml/kg seed, CROWN at 3.0 or 6.0 ml/kg seed, or with ALLEGIANCE at 0.128 ml/kg seed either alone or in combination with FLINT at 0.1, 0.2 or 0.4 g/kg seed. An experimental plot was established on 16 May, 2002 at Vegreville, Alberta, in black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 4 cm deep at a rate of 10 g of seed per row. Nontreated seeds were planted as inoculated and noninoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 40 ml/row. Emerged seedlings were counted on 5 July. At maturity (18 September) plants were harvested by hand, then dried and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence for ALLEGIANCE was significantly ($P \# 0.05$) lower than all other seed treatments in the trial, except for CROWN at 3.0 ml/kg and the inoculated control (Table 1). Seed yield was similar for all seed treatments and both controls.

CONCLUSIONS: All seed treatments in the trial, except ALLEGIANCE, improved emergence over the inoculated control.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of lentil cv. Laird grown in soil inoculated with *Rhizoctonia solani* at Vegreville, Alberta in 2002.

Treatment	Rate (ml/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Noninoculated Control		33.7 a[1]	0.19 a
Inoculated Control[2]		5.4 d	0.07 a
ALLEGIANCE	0.128	7.2 cd	0.09 a
L1050	3.25	15.3 b	0.14 a
CROWN	3	12.0 bc	0.14 a
CROWN	6	17.1 b	0.13 a
VITAFLO 280	3.3	13.8 b	0.12 a
ALLEGIANCE + FLINT	0.128 + 0.1 g	12.7 b	0.10 a
ALLEGIANCE + FLINT	0.128 + 0.2 g	12.7 b	0.16 a
ALLEGIANCE + FLINT	0.128 + 0.4 g	13.6 b	0.11 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).

[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2002 PMR REPORT #136 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* L.), cv. Laird
PEST: Root rot, *Botrytis cinerea* Pers.:Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF BOTRYTIS SEEDLING BLIGHT IN INFECTED LENTIL SEED IN ALBERTA IN 2002

MATERIALS: CROWN (carbathiin, 90 g/l + thiabendazole, 58 g/l FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl, 320 g/l FL), FLINT (trifloxystrobin, 500 g/l WP), L1050 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC).

METHODS: Seed of naturally *Botrytis*-infested lentil cv. Laird was treated in a Hege II small batch seed treater with L1050 at 3.25 ml/kg seed, VITAFLO 280 at 3.3 ml/kg seed, CROWN at 3.0 or 6.0 ml/kg seed or with ALLEGIANCE at 0.128 ml/kg seed in combination with FLINT at 0.1 g/kg seed. An experimental plot was established on 15 May, 2002 at Vegreville, Alberta, in black chernozemic sandy loam soil. Dry conditions delayed emergence until late June, so a second plot was seeded on 26 June, 2002 at Brooks, Alberta, into brown chernozemic clay loam soil. The plots were seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Nontreated seeds were planted as a control. Emerged seedlings were counted on 7 July at Brooks and on 5 July at Vegreville. At maturity (18 September), plants at Vegreville were harvested by hand, then dried and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence and seed yields were similar for all treatments at Vegreville (Table 1). Emergence at Brooks was significantly ($P \# 0.05$) higher than the inoculated control for L1050, CROWN at the lower rate, and for ALLEGIANCE + FLINT.

CONCLUSIONS: Where adequate moisture was present, L1050, CROWN at the lower rate, and ALLEGIANCE + FLINT improved emergence over untreated seed.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of lentil cv. Laird grown from seed infested with *Botrytis cinerea* at Vegreville and Brooks, Alberta in 2002.

Treatment	Rate	Stand (plants/6m)		Seed yield (T/ha)
	(ml/kg seed)	Vegreville	Brooks	Vegreville
Untreated Control		48.5 a[1]	99.6 b	0.25 a
L1050	3.25	57.2 a	130.3 a	0.26 a
CROWN	3	60.0 a	129.4 a	0.31 a
CROWN	6	55.0 a	122.8 ab	0.26 a
VITAFLO 280	3.3	59.4 a	125.1 ab	0.36 a
ALLEGIANCE + FLINT	0.128 + 0.1 g	60.5 a	148.0 a	0.24 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).

2002 PMR REPORT #137 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* L.), cv. Laird
PEST: Root rot, *Botrytis cinerea* Pers.:Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF BOTRYTIS SEEDLING BLIGHT OF LENTIL IN ALBERTA IN 2002

MATERIALS: CROWN (carbathiin, 90 g/l + thiabendazole, 58 g/l FS), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl, 320 g/l FL), FLINT (trifloxystrobin, 500 g/l WP), L1050 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC).

METHODS: Seed of lentil cv. Laird was treated in a Hege II small batch seed treater with L1050 at 3.25 ml/kg seed,VITAFLO 280 at 3.3 ml/kg seed, CROWN at 3.0 or 6.0 ml/kg seed, or with ALLEGIANCE at 0.128 ml/kg seed either alone or in combination with FLINT at 0.1, 0.2 or 0.4 g/kg seed. An experimental plot was established on 15 May, 2002 at Vegreville, Alberta, in black chernozemic sandy loam soil. Dry conditions delayed emergence until late June, so a second plot was seeded on 27 June, 2002 at Brooks, Alberta, into brown chernozemic clay loam soil. The treatments with ALLEGIANCE alone and with FLINT at 0.2 or 0.4 g/kg seed were omitted at Vegreville. The plots were seeded in a randomized complete block design with four replications. At Vegreville, each plot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 4 cm deep at a rate of 10 g of seed per row. Plots at Brooks consisted of two rows, but were otherwise the same as at Vegreville. Non-treated seeds were planted as inoculated and non-inoculated controls. *Botrytis cinerea* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 ml/row (3×10^2 cfu/ml). Emerged seedlings were counted on 5 July Vegreville and 9 July at Brooks. At maturity (18 September), plants at Vegreville were harvested by hand, then dried and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: At Vegreville, emergence was significantly ($P \# 0.05$) greater for all seed treatments in the trial than for the inoculated control (Table 1). Emergence for plots treated with CROWN at the higher rate was significantly ($P \# 0.05$) greater than for those treated with the lower rate of CROWN or with L1050. Seed yield was greater for both CROWN treatments compared to treatment with ALLEGIANCE + FLINT and both controls. At Brooks, emergence was significantly ($P \# 0.05$) greater for seed treated with CROWN at the lower rate or L1050 compared to the inoculated control and to ALLEGIANCE, either alone or combined with FLINT.

CONCLUSIONS: CROWN improved seed yield over ALLEGIANCE + FLINT and the inoculated control. Response to seed treatment varied with site, but CROWN and L1050 generally produced greater emergence than the inoculated control, while ALLEGIANCE, whether alone or combined with FLINT, generally did not.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of lentil cv. Laird grown in soil inoculated with *Botrytis cinerea* at Vegreville and Brooks, Alberta in 2002.

Treatment	Rate	Stand (plants/6m)		Seed yield (T/ha)
	(ml/kg seed)	Vegreville	Brooks	Vegreville
Noninoculated Control		7.6 cd[1]	45.4 a	0.03 b
Inoculated Control[2]		5.2 d	15.8 cd	0.05 b
ALLEGIANCE	0.128		4.9 e	
L1050	3.25	24.5 b	27.5 b	0.13 ab
CROWN	3	14.9 bc	26.4 b	0.27 a
CROWN	6	25.1 a	23.8 bc	0.28 a
VITAFLO 280	3.3	18.5 ab	20.9 bc	0.14 ab
ALLEGIANCE + FLINT	0.128 + 0.1 g	19.4 ab	13.9 cde	0.10 b
ALLEGIANCE + FLINT	0.128 + 0.2 g		15.8 cd	
ALLEGIANCE + FLINT	0.128 + 0.4 g		9.3 de	

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[2] This, and all subsequent treatments inoculated with *Botrytis cinerea* at the time of seeding.

2002 PMR REPORT #138 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* L.), cv. Laird
PEST: Root rot, *Botrytis cinerea* Pers.:Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF BOTRYTIS ROOT ROT OF LENTIL IN ALBERTA IN 2002

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), CROWN (carbathiin, 92 g/l + thiabendazole, 58 g/l SU).

METHODS: Seed of lentil cv. Laird was treated with CROWN at 90 g ai/100 kg seed or APRON MAXX at 6.25 or 12.5 g ai/100 kg seed in a Hege II small batch seed treater. An experimental plot was established on 16 May, 2002 at Vegreville, Alberta, in black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 4 cm deep at a rate of 10 g of seed per row. *Botrytis cinerea* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 ml/row (3×10^2 cfu/ml). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted on 5 July. At maturity (11 October), plants were harvested by hand and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence was similar among all fungicidal seed treatments (Table 1). Emergence was significantly greater ($P \# 0.05$) than the inoculated control for the APRON MAXX treatment at the higher rate and the CROWN treatment. Seed yield was intermediate between the inoculated and noninoculated controls for all fungicidal seed treatments.

CONCLUSIONS: Seedling emergence was improved over the inoculated control by CROWN and by APRON MAXX at the higher rate.

Table 1. Effect of seed treatments on plant stand and seed yield of lentil cv. Laird grown in soil inoculated with *Botrytis cinerea* at Vegreville, Alberta in 2002.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Non-inoculated Control		50.8 a[1]	0.10 a
Inoculated Control [2]		21.0 c	0.02 b
CROWN	90	38.5 ab	0.06 ab
APRON MAXX	6.25	33.7 bc	0.06 ab
APRON MAXX	12.5	36.5 ab	0.06 ab

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).

[2] This and all subsequent treatments were inoculated with *Botrytis cinerea* at the time of seeding.

2002 PMR REPORT #139 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Soybean (*Glycine max* L.), cv. Gaillard
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF SOYBEAN IN ALBERTA IN 2002

MATERIALS: VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl, 320 g/L FL), L1030 (HEC 5725, 100 g/L SU), FLINT (trifloxystrobin, 500 g/L WP), L1050 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), STILETTO (carbathiin, 100 g/L + thiram, 100 g/L + metalaxyl, 16.2 g/L SU).

METHODS: Seed of soybean cv. Gaillard was treated in a Hege small batch seed treater with L1050 at 3.25 ml/kg seed, STILETTO at 4.4 ml/kg seed, VITAFLO 280 at 2.6 ml/kg seed, or with ALLEGIANCE at 0.128 ml/kg seed either alone or in combination with VITAFLO 280 at 2.6 ml/kg seed, L1030 at 0.5 ml/kg seed or FLINT at 0.05 or 0.1 g/kg seed. An experimental plot was established on 10 May, 2002 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Nontreated seeds were planted as inoculated and noninoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 40 ml/row. Emerged seedlings were counted on 5 June. At maturity (16 October), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly ($P \# 0.05$) higher for all seed treatments in the trial, except for ALLEGIANCE alone and VITAFLO 280 alone than for the inoculated control (Table 1). Emergence was significantly higher ($P \# 0.05$) for STILETTO, ALLEGIANCE + L1030, and ALLEGIANCE + VITAFLO 280 than for either ALLEGIANCE or VITAFLO 280 alone. Yield was similar among all seed treatments and both controls.

CONCLUSIONS: All seed treatments in the trial, except ALLEGIANCE and VITAFLO 280 alone, improved emergence over the inoculated control. None of the treatments improved seed yield.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of soybean cv. Gaillard grown in soil inoculated with *Rhizoctonia solani* at Brooks, Alberta in 2002.

Treatment	Rate (ml/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Non-inoculated Control		41.6 bcd [1]	5.02 a
Inoculated Control [2]		30.1 d	3.96 a
ALLEGIANCE	0.128	33.2 d	4.27 a
STILETTO	4.4	54.1 a	4.76 a
L1050	3.25	44.7 abc	4.66 a
VITAFLO 280	2.6	39.6 cd	4.61 a
ALLEGIANCE + L1030	0.128 + 0.5	51.8 ab	5.03 a
ALLEGIANCE + VITAFLO 280	0.128 + 2.6	53.1 ab	4.74 a
ALLEGIANCE + FLINT	0.128 + 0.05 g	47.4 abc	4.93 a
ALLEGIANCE + FLINT	0.128 + 0.1 g	47.3 abc	4.43 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[2] This and all subsequent treatments were inoculated with *Botrytis cinerea* at the time of seeding.

2002 PMR REPORT # 140 **SECTION N: POTATOES - Diseases**
ICAR: 61009653

CROP: Potato (*Solanum tuberosum* L.), cv. Yukon Gold
PEST: Fusarium seed piece decay of potato (*Fusarium sambucinum* Fuckel)

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TITLE: EVALUATION OF SEED PIECE TREATMENTS FOR THE CONTROL OF FUSARIUM SEED PIECE DECAY OF POTATO IN ALBERTA IN 2002

MATERIALS: GENESIS (imidacloprid, 240 g/L), GENESIS MZ (imidacloprid and mancozeb,1.25 and 6.0% wt./wt.), GENESIS XT (imidacloprid, thiophanate-methyl and mancozeb,1.25, 2.5 and 6.0% wt./wt.), SENATOR (thiophanate-methyl, 10% wt./wt.), and MAXIM (fludioxonil, 0.5% wt./wt.)

METHODS: Efficacy of seed piece treatments in controlling fusarium seed piece decay of potato was evaluated in black chernozemic sandy loam soil at Vegreville, Alberta in 2002. Cut seed-potato pieces were planted on May 23, 2002, in four-row plots with a plant spacing of 0.3 m within rows and 1.0 m between rows. Plots were arranged in a randomized complete block design and replicated four times. The plots measured 6.0 m in length and 4.0 m in width, and were separated by a 2.0 m buffer zone between replicates. Seed pieces for all inoculated treatments were sprayed with a spore suspension of *Fusarium sambucinum* at a rate of 500 mL/100 kg seeds. The spore suspension was prepared by flooding the surface of 3-week-old agar cultures with sterile distilled water, gently scraping the colony with a glass rod, and filtering the suspension through two layers of cheesecloth. The concentration of spores was determined with a hemacytometer and adjusted to 7.4 x 10^6 spores/mL. The experiment included six seed piece treatments: (1) GENESIS XT, 750 g/100 kg seed; (2) GENESIS XT, 500 g/100 kg seed; (3) GENESIS 26 mL/100 kg seed and SENATOR 500 g/100 kg seed; (4) GENESIS 26 mL/100 kg seed and MAXIM 500 g/100 kg seed; (5) GENESIS MZ, 500 g/100 kg seed; and (6) GENESIS MZ, 750 g/100 kg seed. To dry the seed pieces after treatment, talc was applied to treatments (3) and (4) at a rate of 500 g/100 kg seeds. The seed pieces for inoculated and noninoculated controls did not receive any fungicides. Plant stand count was taken on July 2, and stem count and plant height were made on July 24. Plant root samples were taken on July 28 and single root weights were recorded. Potatoes were harvested on September 19 and yields were recorded from two central rows of each treatment plot. Data were subjected to analysis of variance using a Mixed Models Procedure from the Statistical Analysis System (SAS 8.1) and Tukey's honest significant difference test was performed for mean comparison.

RESULTS: GENESIS XT, GENESIS MZ and GENESIS + MAXIM significantly ($P \# 0.001$) improved plant stands compered to the *Fusarium*-inoculated control (Table 1). Treatment with GENESIS + SENATOR did not improve stand establishment. There were no statistical differences ($P \# 0.05$) among treatments with regard to stem counts or root weights (*data not shown*). GENESIS XT, GENESIS + SENATOR and GENESIS + MAXIM significantly increased plant height ($P \# 0.02$), but GENESIS MZ did not. GENESIS XT at two rates and GENESIS MZ at the higher rate improved tuber yield ($P \# 0.01$), while GENESIS + SENATOR, GENESIS + MAXIM and GENESIS MZ at the lower rate did not. GENESIS XT at 750 g/100 kg seed exhibited the highest plant stand, plant height and tuber yield.

CONCLUSIONS: GENESIS XT, GENESIS MZ seed piece treatments protected potatoes from *Fusarium* infection at establishment. However, only GENESIS MZ at the higher rate and GENESIS XT improved tuber yield.

Table 1. Efficacy of seed piece treatments on fusarium seed piece decay of potato (*Fusarium sambucinum*) in field experiment at Vegreville, Alberta in 2002

Treatment	Rate (100 kg seed)	Final stand (60 seeds)	Plant height (cm)	Tuber yield (t/ha)
GENESIS XT + F	750 g	49.0 a	39.2 a	11.5 a
GENESIS XT + F	500 g	47.5 a	38.9 a	10.9 a
GENESIS + SENATOR + F	26 mL + 500 g	37.5 bc	38.8 a	9.9 ab
GENESIS + MAXIM + F	26 mL + 500 g	44.5 ab	38.7 a	9.8 ab
GENESIS MZ + F	500 g	45.8 ab	35.7 ab	9.9 ab
GENESIS MZ + F	750 g	48.3 a	35.0 ab	10.4 a
Inoculated control (F)		29.3 c	30.8 b	7.5 b
Non-inoculated control		42.8 ab	35.2 ab	10.1 ab

Data were analysed in a mixed model procedure using SAS 8.1. Values are means of four replications in each treatment. Means in a column within each category followed by the same letter under same category are not significantly different according to Tukey's honest significant difference (TUKEY) at $P \# 0.05$. F = *fusarium* inoculation.

2002 PMR REPORT # 141 **SECTION N: POTATOES - Diseases**
ICAR: 61009653

CROP: Potato (*Solanum tuberosum* L.), cv. Yukon Gold
PEST: Fusarium blight of potato (*Fusarium sambucinum* Fuckel)

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TITLE: ***IN VITRO* EVALUATION OF FUNGICIDES FOR THE INHIBITION OF *FUSARIUM SAMBUCINUM* CAUSING FUSARIUM SEED PIECE DECAY OF POTATO**

MATERIALS: GENESIS MZ (imidacloprid and mancozeb,1.25 and 6.0% wt./wt.), GENESIS XT (imidacloprid, thiophanate-methyl and mancozeb,1.25, 2.5 and 6.0% wt./wt.), SENATOR (thiophanate-methyl, 10% wt./wt.), and MAXIM (fludioxonil, 0.5% wt./wt.)

METHODS: *In vitro* bioassays to assess the effects of fungicides were conducted by spreading spores of *Fusarium sambucinum* on potato-dextrose agar (PDA) plates amended with GENESIS MZ, GENESIS XT, SENATOR, or MAXIM. The final concentration of fungicides in the plate was adjusted to 0.1, 0.5, 1, 5, 10, 50 and 100 ppm (by active ingredient). However, MAXIM was not assayed at the highest concentration level (100 ppm). Non-amended PDA plates served as controls. Nine *F. sambucinum* isolates were included in the bioassay (isolate 001 obtained from R. McLeod of Gustafson® in Calgary, AB; isolates 002-009 obtained from infected table potatoes in the supermarket). The spore suspension was prepared by flooding the surface of 3-week-old agar cultures with sterile distilled water, gently scraping the colony with a glass rod, and filtering the suspension through two layers of cheesecloth. After 24 hr incubation at room temperature, spore germination was counted by checking 100 spores in each of four replications; and growth of the germ tube was recorded by measuring the length of ten germ tubes in each of four replications. Data are presented as percentage of inhibition by comparing with non-amended controls. To assess the efficacy of fungicides and variations among different *Fusarium* isolates, data were subjected to analysis of variance using a Mixed Models Procedure from the Statistical Analysis System (SAS 8.1) with fungicide concentration as a random factor, and Tukey's honest significant difference test was performed for mean comparisons.

RESULTS: Both GENESIS XT and GENESIS MZ significantly ($P \# 0.001$) inhibited spore germination, while SENATOR and MAXIM had little effect on it (Table 1). However, MAXIM achieved the highest inhibitory effect on the growth of germ tubes, while the effect of SENATOR had the least. There were no significant differences ($P \# 0.05$) in spore germination found among nine *Fusarium* isolates in the assay, although the growth of germ tube was statistically ($P \# 0.001$) different among several of isolates. The dose-response of two fusarium isolates (isolates 001 and 006) to four fungicides is presented in Fig. 1. MAXIM and SENATOR had no inhibitory effect on spore germination at any concentration level for either isolate, while GENESIS XT and GENESIS MZ achieved high inhibition when the concentration was higher than 5 to 10 ppm. GENESIS XT and GENESIS MZ had a greater inhibitory effect on spore germination in isolate 001 than isolate 006, while germ tube development was more inhibited in isolate 006. Lower concentrations of SENATOR stimulated the growth of germ tubes in isolate 001.

CONCLUSIONS: Both GENESIS XT and GENESIS MZ restricted spore germination and germ tube growth in *F. sambucinum*. MAXIM was effective to inhibit germ tube growth, and SENATOR had no effect on either spore germination or germ tube growth of *F. sambucinum*.

Table 1. The effect of fungicides on spore germination, growth of germination tubes of *Fusarium sambucinum* and the response of *Fusarium* isolates to fungicide treatment in an agar plate bioassay

	Inhibition (%) relative to non-amended control	
	Spore germination	Length of germ tube
Fungicide: GENESIS XT	48.0 a	70.3 b
GENESIS MZ	42.0 b	59.7 c
SENATOR®	-0.1 c	14.5 d
MAXIM	5.6 c	97.0 a
Probability (*P*)	**– 0.001**	**– 0.001**
***Fusarium* isolate:** *F. sambucinum* 001	31	66.1 ab
F. sambucinum 002	20.3	55.2 d
F. sambucinum 003	21.3	55.4 d
F. sambucinum 004	22.9	54.2 d
F. sambucinum 005	22.1	57.3 cd
F. sambucinum 006	25.4	67.5 a
F. sambucinum 007	25.5	58.3 bcd
F. sambucinum 008	22.2	64.9 abc
F. sambucinum 009	24.3	64.3 abc
Probability (*P*)	**0.096**	**– 0.001**

Data were analysed in a mixed model procedure using SAS 8.1, where fungicide concentrations were arranged as a random factor. Means in a column within each category followed by the same letter under same category are not significantly different according to Tukey's honest significant difference at $P \# 0.05$.

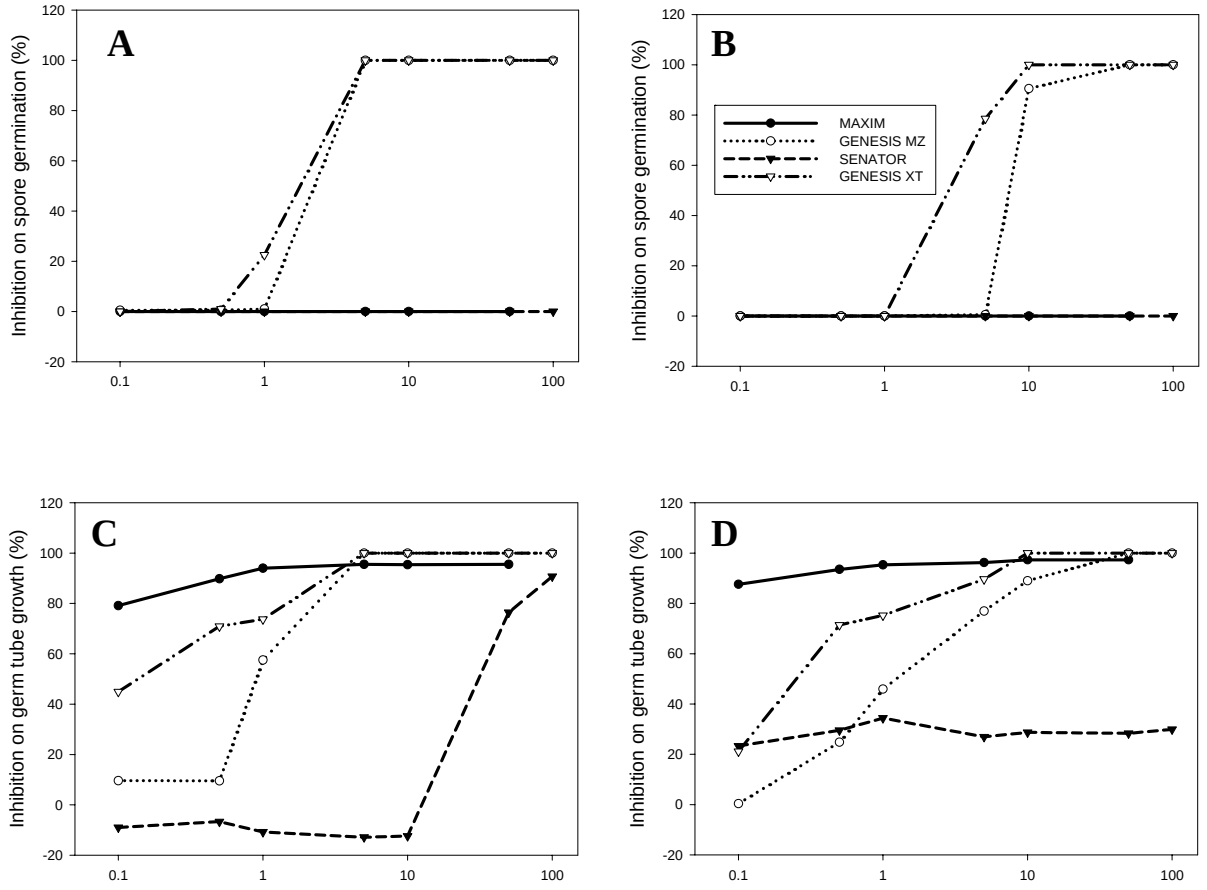

Fig. 1. Dose-response of *Fusarium sambucinum* isolates 001 (A and C) and 006 (B and D) to four fungicides for spore germination (A and B) and growth of germination tubes (C and D) in an agar plate bioassay

2002 PMR REPORT #142 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
ICAR: 61009653

CROP: Alfalfa (*Medicago sativa* L.), cv. Algonquin
PEST: Alfalfa foliar disease complex (*Phoma medicaginis* Malbr.& Roum. in Roum., *Leptosphaerulina Briosiana* (Pollacci) J. H. Graham & Luttrel, *Pseudopeziza medicaginis* (Lib.) Sacc., etc.)

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TITLE: EVALUATION OF FOLIAR SPRAY TREATMENT FOR THE CONTROL OF ALFALFA FOLIAR DISEASE COMPLEX IN ALBERTA IN 2002

MATERIALS: BENLATE (benomyl, 50 WP) and TILT 250 EC (propiconazole, 250 g/l)

METHODS: Experimental plots were seeded with the alfalfa cultivar Algonquin at Camrose and Vegreville in 1998. Plots were 5 m long and consisted of four rows with a 20 cm row spacing. A 40-cm buffer zone was established between plots. Selected foliar pathogens were applied as artificial inocula in field plots. Plots were sprayed with a single application of BENLATE (1500 g/ha) one week before inoculation, TILT (500 g/ha) one week before inoculation, or TILT (500 g/ha) one week after inoculation. The fungicides were applied with 360 l/ha water in a randomized complete block design on early July 2002 using a 2.5 L Spray-Doc Sprayer (Gilmour Manufactory Co., Somerset, PA). Treatments were replicated four times. Leaf spot assessments were made from 20 upper and 20 lower leaves for each replication 15 days after fungicide application according to the rating scales described by James (1971). Disease development was recorded at 15-day intervals for 2 months to observe symptom development. Area under the disease progress curve (AUDPC) was calculated according to Shaner and Finney (1977). Values for AUDPC were normalized by dividing the AUDPC by the total area of the graph, and the normalized AUDPC is referred to as relative AUDPC (Fry 1978). Data were subjected to analysis of variance using a Mixed Models Procedure (SAS) with plant parts (upper and lower leaves) as a random factor and, where appropriate, Tukey's honest significant difference test was performed for mean comparison.

RESULTS: In both sites, foliar disease symptoms were visually observed 30 days after inoculation. Leaf spots spread rapidly in Camrose, while disease development progressed slowly until two month after inoculation in Vegreville (Fig. 1). Although the efficacy of fungicide treatments in Vegreville site was lower than in Camrose, all three treatments significantly ($P \# 0.05$) reduced both disease incidence and severity compared to the non-treated plots. The AUDPC for the three spray treatments for both disease incidence and severity at both field sites was significantly lower than the non-treated control (Fig. 2). There were no statistical differences observed among the fungicide spray treatments.

CONCLUSIONS: A single application of BENLATE (pre-inoculation) or TILT (either pre- or post-inoculation) reduced alfalfa foliar disease incidence and severity levels at two sites in central Alberta.

REFERENCE:

Fry, W.E. 1978. Quantification of general resistance of potato cultivars and fungicide effects for integrated control of potato late blight. Phytopathology 68: 1650–1655.

James, W.C. 1971. An illustrated series of assessment keys for plant diseases, their preparation and usage. Can. Plant Dis. Surv. 51: 39 - 65.

Shaner, G. and Finney, R.E. 1977. The effect of nitrogen fertilization on the expression of slow-mildewing resistance in Knox wheat. Phytopathology 67: 1051–1056.

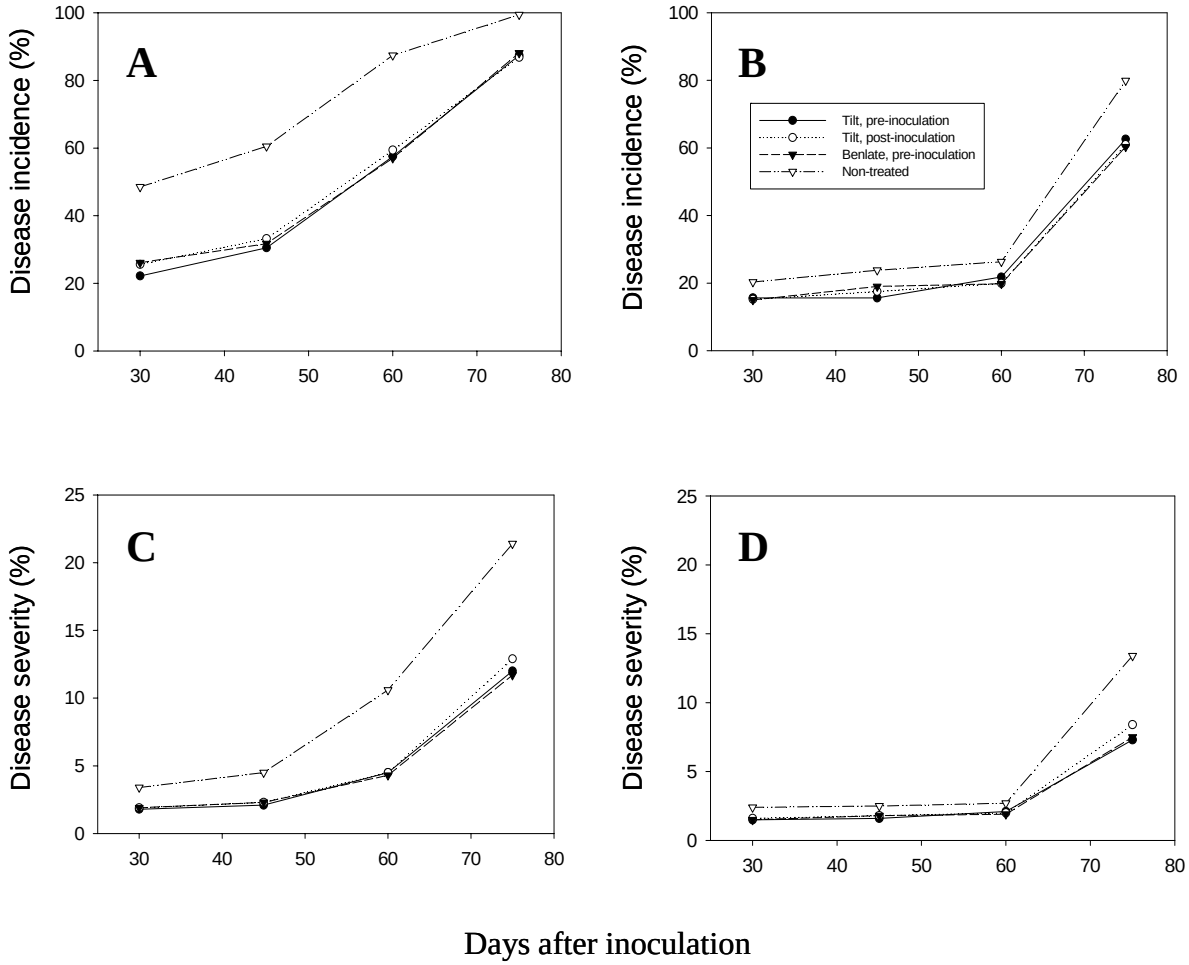

Fig. 1. Disease progress curves for foliar diseases (A and B. incidence, and C and D. severity) in two field locations (A and C. Camrose, and B and D. Vegreville) in 2002.

Table 1. Area under the disease progress curve (AUDPC) for foliar disease incidence and severity in Camrose and Vegreville field plots in 2002 growing season.

Fungicide treatment	AUDPC			
	Disease incidence		Disease severity	
	Camrose	Vegreville	Camrose	Vegreville
TILT, pre-inoculation	47.6 b	20.2 b	4.5 b	2.2 b
TILT, post-inoculation	49.6 b	19.3 b	4.7 b	2.3 b
BENLATE, pre-inoculation	48.6 b	19.1 b	4.5 b	2.1 b
Non-treated control	73.9 a	26.0 a	9.2 a	3.5 a

Data were analysed in a mixed model procedure using SAS 8.1. Values are means of four replications in Camrose and three replications in Vegreville. Means in a column followed by the same letter are not significantly different according to Tukey's honest significant difference (TUKEY) at $P \# 0.05$. Values of AUDPC were normalized.

2002 PMR REPORT #143 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
ICAR: 61009653

CROP: Alfalfa (*Medicago sativa* L.), cvs. Absolute and Beaver
PEST: Spring black stem (*Phoma medicaginis* Malbr.& Roum. in Roum.)

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TITLE: GREENHOUSE EVALUATION OF FOLIAR SPRAY TREATMENT FOR THE CONTROL OF ALFALFA SPRING BLACK STEM IN 2002

MATERIALS: BENLATE (benomyl, 50 WP) and TILT 250 EC (propiconazole, 250 g/l)

METHODS: The fungicides BENLATE and TILT were evaluated on alfalfa cultivars Absolute and Beaver infected by *P. medicaginis* in greenhouse experiments in 2002. Alfalfa plants were seeded in foam cups (5 plants/cup) and grown for three weeks under greenhouse conditions. The experiment included four treatments: (1) TILT, pre-inoculation spraying, 0.625 g a.i./l and 1.25 ml/cup; (2) TILT, post-inoculation spraying, 0.625 g a.i./l and 1.25 ml/cup; (3) BENLATE, pre-inoculation spraying, 8.75 g a.i./l and 1.25 ml/cup and (4) non-treated control sprayed with same amount of water. To inoculate the alfalfa cups, a spore suspension of *P. medicaginis* (10^6 spores/ml) was diluted with 0.5 % Tween 80 (EM Science, Gibbstwon, NJ) and 1.25 ml was sprayed onto each cup with an H-set airbrush (Paasche Airbrush Company, Harwood Hights, IL) at pressure 100 kpa. Inoculated cups were kept in a moist chamber inside the greenhouse. Pre-inoculation treatments were sprayed one week before inoculation. The post-inoculation treatment was conducted one week after inoculation. The treatments were replicated five times. Leaf spot assessments were made on 20 upper and 20 lower leaves for each replication, 15 days after fungicide application according to the rating scales described by James (1971). Disease development was recorded at 15-day intervals for 2 months to observe symptom development. The area under the disease progress curve (AUDPC) was calculated according to Shaner and Finney (1977). Values for the AUDPC were normalized by dividing the AUDPC by the total area of the graph. The normalized AUDPC is referred to as relative AUDPC (Fry 1978). Data were subjected to analysis of variance using a Mixed Models Procedure (SAS) with plant parts (upper and lower leaves) as a random factor and, where appropriate, Tukey's honest significant difference test was performed for mean comparison.

RESULTS: The symptoms of leaf spot established and spread rapidly on the treated plants after inoculation in the greenhouse (Fig.1). The initial disease incidence for the non-treated controls was 50% for Absolute and 42% for Beaver, but was 17 – 21% for all fungicide treatments. Disease incidence escalated slowly as the incubation period increased for all treatments. There was no significant difference in disease incidence ($P \# 0.05$) among three fungicide treatments or between the two cultivars. Disease severity on Beaver was significantly higher than on Absolute ($P \# 0.001$) at the last disease evaluation. There was no significant difference in relative AUDPC for disease incidence or severity between the two cultivars (Table 1). The AUDPC for both incidence and severity was lower for all three treatments was significantly lower ($P \# 0.05$) than the non-treated control.

CONCLUSIONS: A single application of BENLATE (pre-inoculation) or TILT (either pre- or post-inoculation) reduced alfalfa foliar disease incidence and severity levels in greenhouse experiments.

REFERENCE:

Fry, W.E. 1978. Quantification of general resistance of potato cultivars and fungicide effects for integrated control of potato late blight. Phytopathology 68: 1650–1655.

James, W.C. 1971. An illustrated series of assessment keys for plant diseases, their preparation and usage. Can. Plant Dis. Surv. 51: 39 - 65.

Shaner, G. and Finney, R.E. 1977. The effect of nitrogen fertilization on the expression of slow-mildewing resistance in Knox wheat. Phytopathology 67: 1051–1056.

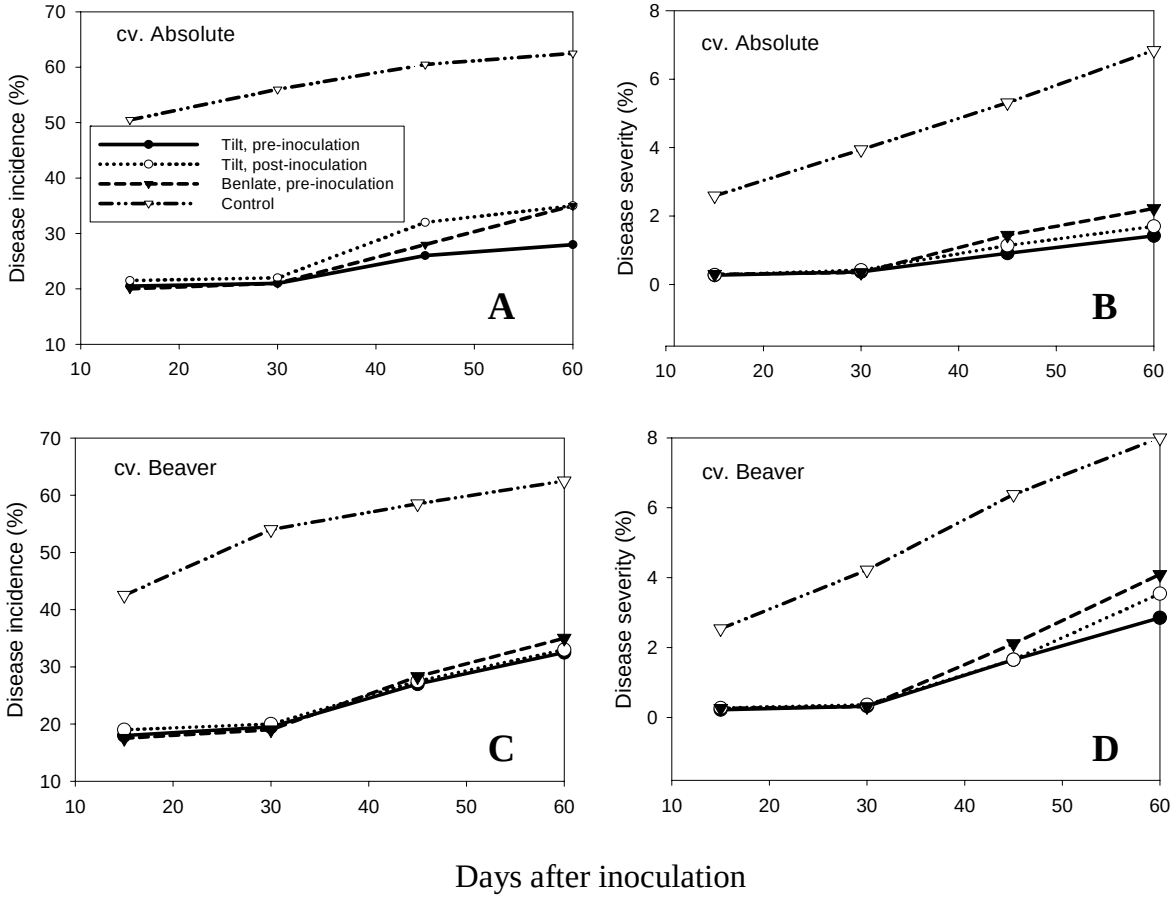

Fig. 1. Progress curves for disease incidence (A and C) and severity (B and D) in alfalfa cultivar Absolute (A and B) and Beaver (C and D) infected by *Phoma medicaginis*.

Table 1. Area under the disease progress curve (AUDPC) for alfalfa cultivars Absolute and Beaver infected by *Phoma medicaginis* in a greenhouse study in 2002

Fungicide treatment	AUDPC			
	Disease incidence		Disease severity	
	Absolute	Beaver	Absolute	Beaver
TILT, pre-inoculation	23.9 b	23.9 b	0.7 b	1.0 b
TILT, post-inoculation	27.4 b	24.5 b	0.8 b	1.3 b
BENLATE, pre-inoculation	25.5 b	24.5 b	1.0 b	1.5 b
Non-treated control	57.7 a	57.3 a	4.7 a	5.3 a

Data were analysed in a mixed model procedure using SAS 8.1. Values are means of five replications in each cultivar. Means in a column followed by the same letter are not significantly different according to Tukey's honest significant difference (TUKEY) at $P \# 0.05$. Values of AUDPC were normalized.

2002 PMR REPORT # 144 **SECTION O: DISEASES OF CEREALS, FORAGE CROPS and OILSEEDS**
STUDY DATA BASE: 375-1231-9614

CROP: Alfalfa (*Medicago sativa)*
PEST: Blossom blight (*Botrytis cinerea* Pers.:Fr., *Sclerotinia sclerotiorum* (Lib.) de Bary)

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TITLE: EFFECT OF FUNGICIDE APPLICATION ON BLOSSOM BLIGHT INCIDENCE AND SEED YIELD OF ALFALFA, 2001 - 2002.

MATERIALS: BENLATE (benomyl, 50% WP), DITHANE (mancozeb, 75% DG), QUADRIS (azoxystrobin 25% F), and BRAVO 500 (chlorothalonil, 50% F)

METHODS: The efficacy of fungicides in reducing alfalfa blossom blight infection caused by *Botrytis cinerea* and *Sclerotinia sclerotiorum* was evaluated in commercial seed fields in 2001 and 2002. Three fungicides, BENLATE (0.93 kg a.i. ha^{-1}), QUADRIS (125 g a.i. ha^{-1}), and DITHANE (1.6 kg a.i. ha^{-1}) were applied to the crop at early bloom (mid July) at MacDowall, Hague, and Valparaiso SK. in 2001, and at mid- to late-bloom stage (July 19-23) at Hague, Atwater, and Valparaiso, SK in 2002. In addition, BRAVO (1.5 kg a..i. ha^{-1}) was included in the tests in 2002. Each fungicide was applied in 200 L ha^{-1} spray volume using a truck-mounted sprayer with Tee-Jet 8002 nozzles at 275 kPa. Fungicide treatments were compared with an untreated control. A randomized complete block design with four replications was used at each site, and each plot was 6 x 12 m. Mature florets (20 per plot) were collected from the controls prior to the first spray application, and from each plot at approx.10 days after each spray application. The flowers were plated onto a semi-selective medium without surface sterilization and incubated at room temperature on a laboratory bench. The number of florets infected with *S. sclerotiorum* and *B. cinerea* were assessed after 6 d of incubation and expressed as percentage. Seed harvest (30 m^2) was taken at all sites in late September to early October. Statistical analysis used analysis of variance (General Linear Model Procedure, SAS), with Duncan's Multiple Range Test for comparison of means.

Also, the impact of BENLATE at early bloom was evaluated across a slope gradient at all three sites in 2001. The fungicide was applied in two strips, which ran from top to bottom of the slope, and compared with two untreated control strips at five points along the slope gradient. Sampling, harvest, and analyses were as described previously.

RESULTS: *Sclerotinia sclerotiorum* was the dominant pathogen each year. In 2001, pathogen incidence prior to fungicide application was quite low: 5% for *S. sclerotiorum* and 0% *B. cinerea* at MacDowall, 0% for both pathogens at Hague, and 15% *S. sclerotiorum* and 0% *B. cinerea* at Valparaiso. Incidence remained low throughout the sampling period, except at Valparaiso, where *Sclerotinia* increased to about 20% near the end of July (Table 1). Fungicide application did not affect pathogen incidence at any site, but application increased seed yield over the control at 2 of 3 sites. In the slope trial, the same pattern was observed; fungicide had no impact on pathogen incidence (data not shown); mean yield was increased slightly at 2 of 3 sites (Table 2), but there were no consistent differences in yield along the slope gradient (data not shown).
As in 2001, conditions during early flowering in 2002 were extremely dry and pathogen incidence prior to fungicide application was low: 5% *S. sclerotiorum* and 3% *B. cinerea* at Atwater, 5% *S. sclerotiorum* and 0% *B. cinerea* at Hague, and 0% *S. sclerotiorum* and 5% *B. cinerea* at Valparaiso. After application, the incidence of *S. sclerotiorum* in the controls increased substantially at both Valparaiso and Atwater (Table 3). However,

conditions remained dry at Hague and pathogen incidence declined at this site. Fungicide application did not affect pathogen incidence, but increased seed yield at 1 of 3 sites (Table 3).

CONCLUSIONS: In both years, pathogen incidence was roughly correlated with the amount of precipitation received at each site. Disease levels were low during early flowering, and fungicide application did not reduce pathogen incidence at any site. However, fungicide increased yield in three of six trials. BENLATE and QUADRIS provided the most consistent impact on yield. This supports the conclusions of a previous report on the impact of these fungicides (Gossen et al. 1999).

REFERENCE: Gossen, B.D., Bassendowski, K.A., and Wong, B. 1999. Effect of fungicide application on blossom blight and seed yield of alfalfa in Saskatchewan in 1999. Pg. 314-317, Report #117 In 1999 Pestic. Manage. Res. Rep., AAFC, Ottawa, ON.

Table 1. Impact of fungicide application on incidence (%) of *Botrytis cinerea* (*Bc*) and *Sclerotinia sclerotiorum* (*Ss*) and seed yield (kg ha^{-1}) in three alfalfa seed production fields in Saskatchewan, 2001.

Fungicide	Rate (a.i. ha^{-1})	Hague		MacDowall		Valparaiso	
				Incidence (%)			
		Bc	*Ss*	*Bc*	*Ss*	*Bc*	*Ss*
QUADRIS	125 g	0.16667	0.08333	0.0417	0.0417	0.125	0.0417
BENLATE	0.9 kg	0.20833	0.125	0.0833	0	0.16667	0.375
DITHANE	1.6 kg	0.29167	0.04167	0.125	0.0417	6 a	26 a
Control	--	0.29167	0.04167	0.0833	0.0833	0.0833	0.0833
				Seed yield (kg ha^{-1})			
QUADRIS	125 g	629 a		1090 a		415 a	
BENLATE	0.9 kg	610 ab		1080 a		396 ab	
DITHANE	1.6 kg	628 a		1160 a		360 bc	
Control	--	576 b		970 a		339 c	

(*a-c*) Means in a column followed by the same letter did not differ at *P* # 0.05.

Table 2. Impact of a single fungicide application at early bloom on alfalfa seed yield (kg/ha) along a slope gradient at three sites (mean of 5 points on each slope gradient) in Saskatchewan in 2001 (n = 10).

Fungicide	Rate (a.i. ha^{-1})	Hague	MacDowall	Valparaiso
BENLATE	0.9 kg	568 a	1760 a	767 a
Control	--	522 b	1670 a	601 b

(*a-b*) Means in a column followed by the same letter did not differ at *P* # 0.05.

Table 3. Impact of fungicide application on incidence of *Botrytis cinerea* (*Bc*) and *Sclerotinia sclerotiorum* (*Ss*) and seed yield in three alfalfa seed production fields in Saskatchewan, 2002.

Fungicide	Rate (a.i. ha^{-1})	Hague		Atwater		Valparaiso	
				Incidence (%)			
		Bc	*Ss*	*Bc*	*Ss*	*Bc*	*Ss*
QUADRIS	125 g	0	0	0	0.25	0.0417	0.20833
BENLATE	0.9 kg	0	0	0	0.33333	0	0.375
DITHANE	1.6 kg	0	0	0	0.375	0 a	0.33333
BRAVO	1.5 kg	0	0	0	29 a	0	0.0417
Control	--	0	0.04167	0	29 a	0	0.16667
				Seed yield (kg ha^{-1})			
QUADRIS	125 g	197 a		294 a		336 ab	
BENLATE	0.9 kg	189 a		302 a		315 ab	
DITHANE	1.6 kg	171 a		240 a		280 bc	
BRAVO	1.5 kg	174 a		234 a		315 ab	
Control	--	174 a		179 a		235 c	

(*a-c*) Means in a column followed by the same letter did not differ at *P* # 0.05.

ACKNOWLEDGEMENT: Thanks to the Canada-Saskatchewan AgriFood Innovation Fund for financial assistance, and to Syngenta Crop Protection Canada Inc. for fungicides.

2002 PMR REPORT #145 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Volla
PEST: Net blotch, *Pyrenophora teres*
Fusarium head blight, *Fusarium graminearum*

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TITLE: CONTROL OF NET BLOTCH AND FUSARIUM HEAD BLIGHT ON BARLEY WITH LATE SEASON FUNGICIDE APPLICATIONS.

MATERIALS: TILT (propiconazole, 125 g ai/L), HEADLINE (BAS 500 00F, 250g ai/L), BAS 5000 01F (250 g ai/L), BAS 505 03F (500 g ai/kg), FOLICUR EC (tebuconazole, 250 g ai/L).

METHODS: Barley plots, cv. Volla, were established on June 2, 2000, at a seeding rate of 300 viable seeds per m^2. Each plot was 20 rows wide, five metres long and 17.8 cm between rows. Plots received a herbicide application of MCPA (1.1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 32. Treatments were applied at Zadok's Growth Stages 62 (July 25, 2000), at the rates indicated in the table below. Treatments were applied to the plots using a tractor mounted small plot sprayer, at 30 psi and with a delivery volume of 250 L/ha. Treatments were replicated four times in a randomized complete block design. Inoculum of *Fusarium graminearum* was produced in a liquid media by soaking 100g/L of diced ripe tomatoes for 2 hours before straining and adding 15g/L NaCl. After autoclaving and inoculating with *Fusarium graminearum*, the flasks were bubbled vigorously until suitable numbers of spores were produced. This inoculum was then applied to the plots three times, on a weekly basis, starting shortly after heading, at a rate of 50-60,000 spores per ml in 250 L per ha. Net blotch was rated on August 3, at ZGS 82 on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine on August 30, 2000. Harvested seed was evaluated for fusarium damaged kernels, samples ground and DON (deoxynivalenol) levels determined via an ELISA test.

RESULTS: Results are presented in Table 1. There were no visual symptoms of *Fusarium* infection of the heads in the field or of *Fusarium* damaged kernels in the harvested seed samples. While fungicide applications were made relatively late in the season there were still significant reductions from some treatments relative to net blotch severity (Table 1). Yield was significantly increased with treatments containing HEADLINE and BAS 500 01F. All treatments significantly increased kernel weights.

CONCLUSIONS: Some of the increase in yield may have been due to the reduction in net blotch, while some may have been due to reductions in fusarium head blight severity. While symptoms of fusarium head blight severity were not pronounced in the trial, adjacent wheat trials had fusarium damaged kernel levels in the 6 - 10% range, indicating a high infection level. Barley often does not demonstrate symptoms as clearly as those associated with wheat. Yield was only increased significantly with treatments containing HEADLINE and BAS 500 01F, but every treatment resulted in a significant increase in thousand kernel weight. The increase in thousand kernel weight could have been an indication of control of fusarium head blight. However, levels of DON indicated that this was not the case, and that there was no control of fusarium head blight from the treatments applied. There were no significant decreases in DON, and one treatment, BAS 500 01F, actually resulted in an increased DON level, at 3.93 ppm.

Table 1. Efficacy of fungicide foliar sprays in barley, Charlottetown, PEI, 2000.

Treatment	Rate*	Net Blotch		Yield	1000 Kwt	DON
		Flag -1	Flag -2			
	(g ai/ha)	(%)	(%)	(kg/ha)	(g)	(ppm)
Untreated Control	0	77.9	95.3	2115	27.58	2.1
HEADLINE	150	31.2	72.2	2512	33.7	3.25
HEADLINE	200	42.7	85.6	2846	34.4	3.33
HEADLINE +	100					
FOLICUR	125	34.3	76.8	2720	32.2	2.45
BAS 500 01F	200	30.7	63.3	2887	35.25	3.93
BAS 505 03F	200	33.4	79.7	2528	32	2.30
BAS 505 03F	250	62.0	89.7	2569	31.9	1.55
FOLICUR	125	62.9	88.5	2413	32.05	1.7
FOLICUR	190	40.2	74.5	2226	30.90	1.75
TILT	125	49.8	80.2	2177	31.50	1.9
SEM**		6.36	4.61	151.7	1.074	0.438
LSD (0.05)		18.45	13.37	440.9	3.122	1.271

* Fungicide applications made at Zadoks Growth Stage 62
** SEM = standard error of mean

2002 PMR REPORT #146 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. AC Sterling
PEST: Net blotch, *Pyrenophora teres*

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TITLE: EFFICACY OF FUNGICIDE SEED TREATMENTS ON CONTROL OF NET BLOTCH AND ON YIELD OF BARLEY.

MATERIALS: VITAFLO 280 (carbathiin 14.9%, thiram 13.2%), BAYTAN 30 (triadimenol, 30%), RAXIL FL (tebuconazole 6 gai/L), DIVIDEND XL (difenoconazole 16.5%), RAXIL MD (tebuconazole 4.96 gai/L, metalaxyl 6.62 gai/L), RAXIL THIRAM (tebuconazole 6.6 gai/L, thiram 220 gai/L), Z0008 (triadimenol 3 g/kg, nitrogen 113.4 g/kg, phosphate 481 g/kg), Z0011 (triadimenol 3 g/kg, nitrogen 120 g/kg, phosphate 510 g/kg), CHARTER (triticonazole, 25 g/L).

METHODS: Barley seed, cv. AC Sterling, was treated using a small batch seed treater with the materials and at the rates listed in the table below. Plots were established on May 23, 2000, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide, five metres long and 17.8 cm between rows. Treatments with Z0008 and Z0011 were applied by spreading the material on the plot after planting and gently raked in. Between each treatment plot was an equal sized wheat guard plot. Plots received a herbicide application of MCPA (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 32. Treatments were replicated four times in a randomized complete block design. Emergence was taken on 2 x 1m of row prior to tillering. Seedling blight was rated on subcrown internode of one metre of row per plot (0-10, where 0 = no disease and 10 = sever disease). Net blotch severity was rated on July 25, ZGS 75, and again on August 4, 2000, ZGS 84, on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine on August 28, 2000

RESULTS: Results are contained in Table 1.

CONCLUSIONS: Only VITAFLO 280 demonstrated any positive and significant effect on emergence. There was very little seedling blight in the trial and this factor was not evaluated. There were no significant effects of seed treatments on net blotch at either the early or late rating. The lack of any significant yield response may have been due to the relatively low severity levels of net blotch in the trial, and the lack of disease control.

Table 1. Efficacy of fungicide seed treatments in barley, Charlottetown, PEI, 2000.

Treatment	Rate * (ml)	Emer-gence (#/m)	Net blotch (%) ZGS 75 Flag-3	ZGS 75 Flag-4	ZGS 84 Flag-2	ZGS 75 Flag-3	Yield (kg/ha)	1000 Kwt (g)
Untreated Control	---	38.4	5.7	20.4	24.5	61.6	3774	43.2
VITAFLO 280	3.3	51.6	5.3	16.1	24.8	53.4	4052	43.65
BAYTAN 30	2.5	44.9	5.2	14.8	21.9	53.8	4036	43.9
BAYTAN 30	5.0	47.1	5.2	15.7	23.5	39.3	4144	44.5
RAXIL FL	2.5	39.5	5.3	16.3	17.8	51.0	3806	43.05
RAXIL THIRAM	2.2	47.1	5.8	17.6	21.2	56.2	3858	43.4
RAXIL MD	3.25	39.1	5.4	17.9	25.9	58.9	3844	42.55
RAXIL MD + Z0008	3.25 5 kg/ha	45.9	4.7	14.3	26.8	58.2	3906	43.90
RAXIL MD + Z0008	3.25 10kg/ha	36.9	4.8	15.2	16.2	47.2	3906	44.05
RAXIL MD + Z0008	3.25 20kg/ha	39	3.9	10.9	21.1	55.6	4003	44.65
RAXIL MD + Z0011	3.25 20kg/ha	35.9	5.5	16.9	24.0	55.8	3843	42.70
DIVIDEND XL	3.25	32.9	5.4	15.4	19.4	48.6	3741	43.9
CHARTER	2	37.4	6.3	21.1	27.4	63.4	3953	41.15
LSD (0.05)		10.43	(ns)	(ns)	(ns)	(ns)	(ns)	(ns)
SEM		3.64	0.607	2.165	4.36	5.22	91	0.74

* product per kg/seed, unless otherwise indicated
ZGS - Zadoks Growth Stage
(ns) - no significant difference, p=0.05

2002 PMR REPORT #147 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. AC Sterling
PEST: Net blotch, *Pyrenophora teres*

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TITLE: EFFICACY OF FUNGICIDE SEED TREATMENTS ON CONTROL OF NET BLOTCH AND ON YIELD OF BARLEY.

MATERIALS: VITAFLO 280 (carbathiin 14.9%, thiram 13.2%), BAYTAN 30 (triadimenol, 30%), RAXIL FL (tebuconazole 6 gai/L), DIVIDEND XL (difenoconazole 16.5%), RAXIL MD (tebuconazole 4.96 gai/L, metalaxyl 6.62 gai/L), RAXIL THIRAM (tebuconazole 6.6 gai/L, thiram 220 gai/L), Z0008 (triadimenol 3 g/kg, nitrogen 113.4 g/kg, phosphate 481 g/kg), Z0011 (triadimenol 3 g/kg, nitrogen 120 g/kg, phosphate 510 g/kg), CHARTER (triticonazole, 25 g/L).

METHODS: Barley seed, cv. AC Sterling, was treated using a small batch seed treater with the materials and at the rates listed in the table below. Plots were established on May 23, 2000, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide, five metres long and 17.8 cm between rows. Treatments with Z0008 and Z0011 were applied by spreading the material on the plot after planting and gently raked in. Between each treatment plot was an equal sized wheat guard plot. Plots received a herbicide application of MCPA (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 32. Treatments were replicated four times in a randomized complete block design. Emergence was taken on 2 x 1m of row prior to tillering. Seedling blight was rated on subcrown internode of one metre of row per plot (0-10, where 0 = no disease and 10 = sever disease). Net blotch severity was rated on July 25, ZGS 75, and again on August 4, 2000, ZGS 84, on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine on August 28, 2000

RESULTS: Results are contained in Table 1.

CONCLUSIONS: Only VITAFLO 280 demonstrated any positive and significant effect on emergence. There was very little seedling blight in the trial and this factor was not evaluated. There were no significant effects of seed treatments on net blotch at either the early or late rating. The lack of any significant yield response may have been due to the relatively low severity levels of net blotch in the trial, and the lack of disease control.

Table 1. Efficacy of fungicide seed treatments in barley, Charlottetown, PEI, 2000.

Treatment	Rate * (ml)	Emer-gence (#/m)	Net blotch (%) ZGS 75 Flag-3	ZGS 75 Flag-4	ZGS 84 Flag-2	ZGS 75 Flag-3	Yield (kg/ha)	1000 Kwt (g)
Untreated Control	---	38.4	5.7	20.4	24.5	61.6	3774	43.2
VITAFLO 280	3.3	51.6	5.3	16.1	24.8	53.4	4052	43.65
BAYTAN 30	2.5	44.9	5.2	14.8	21.9	53.8	4036	43.9
BAYTAN 30	5.0	47.1	5.2	15.7	23.5	39.3	4144	44.5
RAXIL FL	2.5	39.5	5.3	16.3	17.8	51.0	3806	43.05
RAXIL THIRAM	2.2	47.1	5.8	17.6	21.2	56.2	3858	43.4
RAXIL MD	3.25	39.1	5.4	17.9	25.9	58.9	3844	42.55
RAXIL MD + Z0008	3.25 5 kg/ha	45.9	4.7	14.3	26.8	58.2	3906	43.90
RAXIL MD + Z0008	3.25 10kg/ha	36.9	4.8	15.2	16.2	47.2	3906	44.05
RAXIL MD + Z0008	3.25 20kg/ha	39	3.9	10.9	21.1	55.6	4003	44.65
RAXIL MD + Z0011	3.25 20kg/ha	35.9	5.5	16.9	24.0	55.8	3843	42.70
DIVIDEND XL	3.25	32.9	5.4	15.4	19.4	48.6	3741	43.9
CHARTER	2	37.4	6.3	21.1	27.4	63.4	3953	41.15
LSD (0.05)		10.43	(ns)	(ns)	(ns)	(ns)	(ns)	(ns)
SEM		3.64	0.607	2.165	4.36	5.22	91	0.74

* product per kg/seed, unless otherwise indicated
ZGS - Zadoks Growth Stage
(ns) - no significant difference, p=0.05

2002 PMR REPORT #148 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. AC Sterling
PEST: Net blotch, *Pyrenophora teres*

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TITLE: CONTROL OF NET BLOTCH ON BARLEY WITH HEADLINE.

MATERIALS: HEADLINE (BAS 500 00F , 250 g ai/L), BAS 5000 01F (250 g ai/L), FLINT (trifloxystrobin, 50WG), QUADRIS (azoxystrobin, 250FL), TILT (propiconazole, 125 g ai/L), MERGE L

METHODS: Barley plots, cv. AC Sterling, were established on May 23, 2000, at a seeding rate of 300 viable seeds per m^2. Each plot was ten rows wide, five metres long and 17.8 cm between rows. Each plot was separated by an equal sized wheat plot. Plots received a herbicide application of MCPA (1 L/ha) plus Refine Extra (20 g/ha) at Zadok's Growth Stage (ZGS) 32. Treatments were applied at the growth stages and rates indicated in the table below. Treatments were applied to the plots using a tractor mounted small plot sprayer, at 30 psi and with a delivery volume of 250 L/ha. Treatments were replicated four times in a randomized complete block design. ZGS 30 applications were made on June 29, and ZGS 49 applications on July 13. Net blotch was rated on July 25, 2000, ZGS 62, on ten randomly selected tillers per plot using the Horsfall & Barratt Rating system. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine on August 29, 2000.

RESULTS: Results are presented in the table below.

CONCLUSIONS: With the exception of the low rate of HEADLINE, all treatments had a significant effect on net blotch severity on the flag-1 leaf. While not significant at a 0.05 level there was some indication that some treatments could have potential in influencing yield. Disease pressure in the trial was not severe, which may have resulted in lower yield responses from the treatments.

Table 1. Efficacy of fungicide foliar sprays in barley, Charlottetown, PEI, 2000.

Treatment	Rate	ZGS*	Net Blotch (%)		Yield	1000
			Flag -1	Flag -2		Kwt
	(gai/ha)		(%)	(%)	(kg/ha)	(g)
Untreated Control	0	.	5.7	18.1	3960	43.30
HEADLINE	75	49	4.7	14.2	4207	44.30
HEADLINE	100	49	3.0	7.8	4300	44.65
HEADLINE	150	49	4.0	12.2	4374	46.30
HEADLINE +	150					
MERGE L	1%	49	2.6	5.3	4142	44.80
HEADLINE +	75	30				
HEADLINE	75	49	3.2	7.3	3975	45.55
HEADLINE***	150	30	3.5	9.9	4219	45.5
BAS 500 01F	100	49	3.2	7.5	3985	44.35
BAS 500 01F +	100					
MERGE L	1%	49	3.4	6.7	4454	45.7
BAS 500 01F	150	49	3.1	7.1	4173	43.8
TILT +	125	49				
FLINT	125	49	2.8	6.0	4418	45.8
TILT	125	49	3.6	10.5	4161	45.65
QUADRIS	200	49	3.3	8.1	4216	45.8
LSD (0.05)	.	.	1.65	6.58	ns	ns
SEM**	.	.	0.58	2.29	123.3	0.864

* Fungicide applications made at Zadoks Growth Stage 62
** SEM = standard error of mean
*** at 40 l/ha
ns - no significant difference (F=0.05)

2002 PMR REPORT #149 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. AC Sterling
PEST: Net blotch, *Pyrenophora teres*

NAME and AGENCY:
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TITLE: CONTROL OF NET BLOTCH OF AC STERLING BARLEY WITH FOLIAR FUNGICIDE APPLICATIONS

MATERIALS: NOVARTIS-TR1 125EC(trifloxystrobin, 125 g/l), NOVARTIS-TR2 250EC (propiconazole 125 g/L, trifloxystrobin 125 g/L), NOVARTIS-TR3 250EC (asoxystrobin, 250 g/l), TILT (propiconazole 125 g ai/L).

METHODS: Barley plots, cv. AC Sterling, were established on May 17, 2000, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide, five metres long and 17.8 cm between rows. Each barley plot was separated by an equal size wheat plot. Plots received a herbicide application of MCPA (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 28. Treatments were applied at the rates and timings indicated in the tables below. Treatments were applied at ZGS 30 (June 27) and or ZGS 56 (July 13) using a tractor mounted small plot sprayer, at 30 psi and with a delivery volume of 250 L/ha. Treatments were replicated four times in a randomized complete block design. Net Blotch was rated approximately every seven days starting at ZGS 30 on June 27. Individual leaves were rated on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine on August 28, 2000.

RESULTS: Results are presented in Table 1 and Table 2.

CONCLUSIONS: While not fully reflective of its disease control potential, NOVARTIS-TR1 was effective in increasing yield by 19%, from a single early application. This was significantly better than the untreated control. A similar application rate and timing of TILT was not significantly different from the check. In general, early applications were not effective on disease control or yield, when compared to responses from late applications, in relation to the check. Higher rates of trifloxystrobin require testing, for early and late applications. The 'strobin' materials warrant further evaluation, as they demonstrated potential in this trial equal to or better than TILT.

Table 1. Disease control in barley following application of foliar fungicides, 2000

Treatment	Rate	Time*	Net blotch (%)					
			37447	37454		37460		37469
			ZGS49	ZGS68		ZGS71		ZGS82
	(g ai/ha)	(ZGS)	L3**	L2	L3	L2	L3	L3
Untreated Control			3.5	3.4	8.7	3.3	8.6	27.8
NOVARTIS-TR1	62.5	30	2.8	3.6	7.7	4.9	16.9	32
NOVARTIS-TR2	125	30	1.8	1.4	2.8	2.6	5.0	21.9
NOVARTIS-TR2	125	56	4.3	3.3	8.8	3.5	10.0	17.2
NOVARTIS-TR2 +	125+	30						
NOVARTIS-TR2	125	56	1.5	1.5	2.3	2.4	4.1	5.5
NOVARTIS-TR3	250	56	5.6	4.1	10.9	4.8	15.0	12.9
Tilt	62.5	30	3.0	2.3	4.7	4.3	13.6	29.3
Tilt	125	30	2.8	2.0	2.9	2.8	6.4	24.9
Tilt	125	56	3.3	3.3	4.5	3.6	11.6	9.5
Tilt +	125 +	30						
Tilt	125	56	1.8	1.8	2.6	2.4	4.5	6.8
LSD (0.05)			1.94	1.45	4.17	1.23	6.855	11.01
SEM			0.667	0.501	1.437	0.424	2.360	3.8

* Zadok's Growth Stage (ZGS) at time of application
** Leaf position, from the head

Table 2. Yield response in barley following application of foliar fungicides, 2000

Treatment	Rate (g ai/ha)	Time* (ZGS)	Yield (kg/ha)	1000 kwt (g)
Untreated Control			3431	42
NOVARTIS-TR1	62.5	30	3771	45.35
NOVARTIS-TR2	125	30	4082	45.3
NOVARTIS-TR2	125	56	3944	47.55
NOVARTIS-TR2 +	125+	30		
NOVARTIS-TR2	125	56	3825	48.95
NOVARTIS-TR3	250	56	3910	47.95
Tilt	62.5	30	3716	45.45
Tilt	125	30	3727	45.55
Tilt	125	56	3962	46.75
Tilt +	125 +	30		
Tilt	125	56	4161	48.35
LSD (0.05)			375.2	3.135
SEM			129.1	1.08

* Zadok's Growth Stage (ZGS) at time of application

2002 PMR REPORT #150 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv AC Sterling
PEST: Root Rot, various pathogens
Scald, *Rhynchosporium secalis*
Net blotch, *Pyrenophora teres*

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TITLE: EFFICACY OF FUNGICIDE SEED TREATMENTS ON CONTROL OF ROOT ROT AND FOLIAR DISEASES AND ON YIELD OF BARLEY, 2001

MATERIALS: VITAFLO 280 (carbathiin 14.9%, thiram 13.2%), RAXIL MD (tebuconazole 4.61 g ai/L, metalaxyl 0.68 g ai/L), RAXIL-Thiram (tebuconazole 6.67 g ai/L thiram 222.2 g ai/L), RAXIL FL (tebuconazole 6 g ai/L), CHARTER (triticonazole, 25 g ai/L), DIVIDEND XL (difenoconazole 36.9 g ai/L, metalaxyl-m 3.11 g ai/L), G7009 (clothianidin 600 g ai/L)

METHODS: Barley seed, cv. AC Sterling, was treated using a small batch seed treater with the materials and at the rates listed in the table below. Plots were established on May 16, 2001, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide, five metres long and 17.8 cm between rows. Between each treatment plot was an equal sized wheat guard plot. Plots received a herbicide application of MCPA600 (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 24. Treatments were replicated four times in a randomized complete block design. Due to a major aphid infestation CYGON 4-E (425 ml/ha) was also applied at ZGS 69. Emergence was taken on 2 x 1m of row prior to tillering. Root rot/seedling blight severity was rated on July 13, ZGS 45, on one metre of plot, on a 0 to 10 scale, where 0 = no disease and 10 = very severe. Scald severity was rated on July 26, at ZGS 64, on a whole plot basis, using the same scale. Net blotch severity was also rated on July 26, on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Yield and thousand kernel weight were determined from the harvest of nine rows on September 27, using a small plot combine.

RESULTS: Results are contained in Table 1. There was no significant effect on emergence. It should be noted that the 2001 growing season was well below normal for moisture, 54 and 10 mm recorded in July and August, respectively, compared to a mean of 100 and 75 mm in the previous 6 years.

CONCLUSIONS: All treatments resulted in a significant reduction in the severity of root rot at ZGS 45, when compared to the untreated control. There were no differences in root rot severity between seed treatments. While there was no significant effect of treatment on foliar scald or net blotch symptoms, there was a tendency towards reduced severity following treatment, particularly on the flag-2 leave rating for net blotch, where maximum reduction was obtained with RAXIL MD at 65%. A similar yield response was noted in a companion wheat seed treatment trial, where azole containing seed treatments appeared to adversely affect yield, though not significantly. Similarly clothianidin (Z7009) appeared to increase yields relative to where the fungicide component was applied alone.

Table 1. Efficacy of fungicide seed treatments in spring wheat, Charlottetown, PEI, 2001.

Treatment	Rate*	Emerg-ence	Root rot	Scald	Net blotch		Yield	1000 Kwt
					Flag-1	Flag-2		
		(#/m)	(0-10)	(0-10)	(%)	(%)	(kg/ha)	(g)
Untreated Control	0.00	52.9	5.8	3.0	4.3	11.5	3975	46.95
VITAFLO 280	3.3	55.6	4.3	2.8	3.9	6.8	3946	46.95
RAXIL MD	3.25	53.6	3.5	2.3	2.6	4.0	3510	46.50
RAXIL-THIRAM	2.20	56.9	3.8	4.0	3.9	8.1	3437	45.75
RAXIL FL	2.5	51.9	4.3	3.3	3.6	7.6	3527	46.80
DIVIDEND XL	3.25	51.2	3.3	2.3	3.6	7.5	3580	46.45
Z0099	1	49.7	4.5	2.8	3.5	6.4	3255	46.25
G7009 +RAXIL MD	0.83 +2.50	53.1	3.8	2.3	3.5	7.3	4442	47.45
VITAFLO 280 +G7009	3.3 +0.83	58.7	3.3	2.0	3	4.9	4118	46.60
SEM		3.45	0.34	0.427	0.39	1.725	253.1	0.756
LSD (0.05)		(ns)	1.00	(ns)	(ns)	(ns)	738.8	2.206

* ml product/kg seed)
(ns) - no significant difference, p=0.05

2002 PMR REPORT #151 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. AC Sterling
PEST: Seedling blight/root rot, various pathogens
Scald, *Rhynchosporium secalis*
Net blotch, *Pyrenophora teres*

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TITLE: EFFICACY OF FUNGICIDE SEED TREATMENTS ON CONTROL OF BARLEY DISEASES AND ON YIELD, 2002

MATERIALS: RAXIL MD (tebuconazole 4.96 g/L, metalaxyl 6.62 g/L), RAXIL-THIRAM (tebuconazole 6.6 g/L, thiram 220 g/L), RAXIL FL (tebuconazole, 6 g/L), DIVIDEND XL RTA (difenoconazole 36.9 g/L, metalaxyl-M 3.11 g/L), CHARTER (triticonazole 25 g/L), GAUCHO 480 (imidacloprid 480 g/L), VITAFLO 280 (carbathiin 169.6 g/L, thiram 150.6 g/L)

METHODS: Barley seed, cv. AC Sterling, was treated by Gustafson, with the materials and at the rates listed in the table below. Plots were established on May 9, 2002, at a seeding rate of 300 viable seeds per m^2. Each plot was 5 rows wide and 5 metres long, with 17.8 cm between rows. An equal size plot of wheat, cv. Belvedere, was placed between each barley plot. Plots received a herbicide application of MCPA500 (1 L/ha) plus REFINE EXTRA (20 g/ha) on June 12, Zadok's Growth Stage (ZGS) 28. Treatments were replicated four times in a randomized complete block design. Seedling blight/root rot was rated on a 0-10 scale (zero = no symptoms, 10 = severe symptoms on the subcrown internode region) on July 4. Scald was rated on a whole plot basis at the same time on a scale of 0-10. Net blotch and scald severity were rated separately on July 26, at ZGS 82, on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. After heading each plot was evaluated for loose smut. Yield and thousand kernel weight were determined from the harvest of the entire plot, using a small plot combine on August 21.

RESULTS: Results are contained in Table 1 for emergence and early disease, and Table 2 for late foliar diseases and yield components.

CONCLUSIONS: There was no significant amount of loose smut in any plot. Disease pressure in the plots was very low in 2002, as is evident from both the seedling blight ratings and the late season net blotch and scald ratings. As a result, there was no benefit evident from any of the seed treatments, on disease control or on yield. However, it should be noted that there was no evidence of phytotoxicity from any of the treatments.

Table 1. Efficacy of fungicide seed treatments on disease in barley, Charlottetown, PEI, 2001.

Treatment	Rate (ml product per kg seed)	Emergence (#/m)	Seedling Blight* (0-10)	Scald* (0-10)	Scald** 2nd leaf (%)	Net Blotch** 2nd leaf (%)
Untreated		34.5	2.0	1.3	1.0	3.3
RAXIL MD	3.25	34.8	2.5	2.0	1.3	6.8
RAXIL THIRAM	2.25	36.5	2.3	2.0	1.0	5.3
RAXIL FL	2.5	40.0	2.5	1.3	0.9	3.9
VITAFLO 280	2.3	31.5	2.5	2.5	1.3	4.1
VITAFLO 280	3.3	34.0	2.8	2.5	0.8	4.1
DIVIDEND XL	3.25	35.8	2.3	2.3	1.1	3.9
CHARTER	1	30.0	2.8	1.5	0.6	4.5
GAUCHO +	0.21 +					
RAXIL FL	2.5	36.3	2.5	2.0	1.0	3.2
LSD (0.05)		7.70(ns)	0.96(ns)	1.1(ns)	1.17(ns)	2.21(ns)
SEM		2.64	0.328	0.392	0.402	0.76

(ns) No significant difference, p=0.05
* ZGS 30
** ZGS 82

Table 2. Efficacy of fungicide seed treatments on yield in barley, Charlottetown, PEI, 2001.

Treatment	Rate (ml product per kg seed)	Yield (kg/ha)	1000 Kwt (g)
Untreated		4007	48.1
RAXIL MD	3.25	3931	48.45
RAXIL THIRAM	2.25	4067	49.05
RAXIL FL	2.5	4099	49.13
VITAFLO 280	2.3	3732	48.78
VITAFLO 280	3.3	3831	48.07
DIVIDEND XL	3.25	4082	47.92
CHARTER	1	3808	47.72
GAUCHO +	0.21 +		
RAXIL FL	2.5	3837	48.85
LSD (0.05)		654(ns)	1.511(ns)
SEM		225	0.521

(ns) No significant difference, p=0.05

2002 PMR REPORT #152 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cvs. Springfield, Hyola 401, Cyclone, OAC Summit
Yellow mustard (*Sinapis alba* L.) cv. Viscount
PEST: Damping-off (*Pythium paroecandrum*)

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TITLE: GROWTH ROOM AND FIELD EVALUATION OF SEED TREATMENTS TO CONTROL PYTHIUM DAMPING-OFF OF CANOLA AND MUSTARD

MATERIALS: HELIX 1997 (fludioxonil 1.25 g ai/L, metalaxyl-M 3.75 g ai/L, difenoconazole 12.0 g ai/L, thiomethoxam 266.6 g ai/L), HELIX 289 FS (fludioxonil 1.7 g ai/L, metalaxyl-M 5.0 g ai/L, difenoconazole 16.0 g ai/L, thiomethoxam 266.6 g ai/L), VITAVAX RS (carbathiin 45 g ai/L, thiram 90 g ai/L, lindane 680 g ai/L), PREMIERE PLUS (thiabendazole 1.6%, thiram 4.8%, lindane 40%).

METHODS: Test products applied to canola seed, cvs. Cyclone, Hyola 401, Springfield, and OAC Summit, and mustard seed, cv. Viscount, were HELIX 1997 at 20 mL/kg seed, HELIX 289 FS at 15 or 7.5 mL/kg seed, VITAVAX RS at 22.5 mL/kg seed, and PREMIERE PLUS at 28.2 mL/kg seed. To treat seed, the required amount of product + 6% was added to the seed and shaken in an Erlenmeyer flask for 5 minutes to ensure thorough coating of the seed. Flasks were primed by treating a quantity of seed and discarding this seed before treating seed for experimental use. Check treatments consisted of untreated seed sown in infested or uninfested potting mix or soil. *Pythium paroecandrum* (isolate s from soil) was grown on V8 agar in 9-cm petri plates until the colonies reached the edge of the plates. A commercial potting mix (Promix BX, Plant Products, Brampton, ON) was infested wth the fungus by incorporating the contents of two culture plates per L of mix. The infested mix was amended with water (0.5 L/L mix) and D-glucose (0.3 g/L mix) and incubated in the dark at room temperature (22-22°C) overnight. Two plates of uninfested V8 agar, 0.5 L water and 0.3 g D-glucose were added per L of mix in uninfested checks. Treatment effects on canola cvs. Cyclone, Hyola 401, and Springfield, and mustard cv. Viscount were examined in a growth room study. Nine seeds per 5 x 7.5 cm pot were sown 2.5 cm deep. Pots were placed on 7.5 cm aluminum pans and covered with plastic bags to maintain high humidity and facilitate germination. Bags were removed and plants were watered daily once emergence occurred, and plants were watered with a fertilizer solution (28-14-14; 31 g/25 L distilled water) once the first true leaves were observed. Plants were grown at 25/18°C under a 16/8 hour light/dark regime. There were three replicate pots per treatment and treatments were arranged in a completely randomized design. Treatment effects on canola cv. OAC Summit were determined in a field study conducted at the Arkell Research Station, ON. Treatments were arranged in a completely randomized block design with five replications. Each block contained seven plots, and each plot consisted of a 2-m treatment row of canola seed separated from adjacent rows and blocks by 1 m of unplanted soil. The outer treatment rows were flanked by unbroken guard rows of canola. A 2-m trench was pulled with a hoe and seeds were sown with a dibbler (Lee Valley Garden Supplies Canada) at a rate of 20 seeds per m of row. The seeds were covered with infested Promix BX, prepared as described above, to a depth of 1 cm and then covered with 1 cm of soil. Untreated seed sown with infested or uninfested potting mix were used as the two check treatments. In both the growth room and field study, treatment effects on plant stand 28 days after seeding were determined by ANOVA and treatment means were compared by LSD at $P = 0.05$.

RESULTS: The results are presented in Table 1.

CONCLUSIONS: Infestation of the potting mix or soil with *P. paroecandrum* significantly reduced stand by 34-96% in the growth room and by 26% in the field. All treatments significantly increased stand of all cultivars. Complete efficacy (restoration of stand to levels equivalent to, or greater than, that in the untreated uninfested check) was shown by HELIX 97, HELIX 289 FS (full rate), and VITAVAX RS on all cultivars tested in the growth room and field, by HELIX 289 FS (half rate) on all cultivars except Springfield, and by PREMIERE PLUS on all cultivars except Springfield and Cyclone. In the growth room, stand from untreated seed in uninfested potting mix was 81-97% of the seed sown, and no treatment increased stand above that seen in the uninfested check. In contrast, in the field, stand in the untreated uninfested check was 57% of the number of seed sown and three treatments, HELIX 97, VITAVAX RS, and PREMIERE PLUS, significantly increased stand to 71-77% of seed sown, suggesting efficacy of these treatments against one or more resident pathogens in the soil..

Table 1. Effect of seed treatment on stand (day 28) of canola[1] and mustard[1] seedlings from 9 seeds (growth room) or 40 seeds (field) sown in potting mix (growth room) or soil (field) infested with *Pythium paroecandrum*.

		Growth room				Field
Treatment	Product rate (mL/kg seed)	Springfield	Hyola 401	Cyclone	Viscount	OAC Summit
Untreated, uninfested		7.3a[2]	8.0a	8.7a	8.7a	22.8c
Untreated, infested		0.3c	0.3b	2.3c	5.7b	16.8d
HELIX 97, infested	20	5.0ab	8.0a	8.0ab	8.7a	30.8a
HELIX 289 FS, infested	15	5.3ab	8.0a	7.7ab	8.3a	23.2c
HELIX 289 FS, infested	7.5	4.3b	7.3a	8.3a	8.7a	26.6bc
VITAVAX RS, infested	22.5	6.0ab	7.7a	7.7ab	8.0a	28.4ab
PREMIERE PLUS, infested	28.2	4.0b	7.7a	7.0b	9.0a	28.8ab

[1]Canola cultivars were Cyclone, Hyola 401, Springfield, and OAC Summit; mustard cultivar was Viscount.
[2]Within a column, means followed by the same letter are not significantly different at P = 0.05 (LSD).

2002 PMR REPORT #153 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases#**
ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cvs. Springfield, Hyola 401, Cyclone, OAC Summit
Yellow mustard (*Sinapis alba* L.) cv. Viscount
PEST: Damping-off (*Rhizoctonia solani*)

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TITLE: GROWTH ROOM AND FIELD EVALUATION OF SEED TREATMENTS TO CONTROL RHIZOCTONIA DAMPING-OFF OF CANOLA AND MUSTARD

MATERIALS: HELIX 1997 (fludioxonil 1.25 g ai/L, metalaxyl-M 3.75 g ai/L, difenoconazole 12.0 g ai/L, thiomethoxam 266.6 g ai/L), HELIX 289 FS (fludioxonil 1.7 g ai/L, metalaxyl-M 5.0 g ai/L, difenoconazole 16.0 g ai/L, thiomethoxam 266.6 g ai/L), VITAVAX RS (carbathiin 45 g ai/L, thiram 90 g ai/L, lindane 680 g ai/L), PREMIERE PLUS (thiabendazole 1.6%, thiram 4.8%, lindane 40%).

METHODS: Test products applied to canola seed, cvs. Cyclone, Hyola 401, Springfield, and OAC Summit, and mustard seed, cv. Viscount, were HELIX 1997 at 20 mL/kg seed, HELIX 289 FS at 15 or 7.5 mL/kg seed, VITAVAX RS at 22.5 mL/kg seed, and PREMIERE PLUS at 28.2 mL/kg seed. To treat seed, the required amount of product + 6% was added to the seed and shaken in an Erlenmeyer flask for 5 minutes to ensure thorough coating of the seed. Flasks were primed by treating a quantity of seed and discarding this seed before treating seed for experimental use. Check treatments consisted of untreated seed sown in infested or uninfested vermiculite or soil. To produce inoculum, moist rye kernels were autoclaved for 1 h, cooled, and inoculated with agar plugs cut from the growing margin of colonies of *Rhizoctonia solani* on potato dextrose agar. The inoculated rye kernels were incubated at room temperature (20-22°C) for 2 weeks, dried for 2 days, ground in a blender, and sieved to collect particles 0.5-1.2 mm in diameter. The ground infested rye was added to extra fine vermiculite at rates of 0.5, 0.1, 0.05, 0.01, and 0.005 g infested rye/L vermiculite. Treatment effects on canola cvs. Cyclone, Hyola 401, and Springfield, and mustard cv. Viscount were examined in the growth room. All levels of infested vermiculite were used. The infested vermiculite was placed in 5 x 7.5 cm pots and 9 seeds were sown 2.5 cm deep per pot. Pots were placed on 7.5 cm aluminum pans and covered with plastic bags to maintain high humidity and facilitate germination. Bags were removed and plants were watered daily once emergence occurred, and plants were watered with a fertilizer solution (28-14-14; 31 g/25 L distilled water) once the first true leaves were observed. Plants were grown at 25/18°C under a 16/8 hour light/dark regime. There were three replicate pots per treatment and treatments were arranged in a completely randomized design. Treatment effects on canola cv. OAC Summit were determined in a field study conducted at the Arkell Research Station, ON. Treatments were arranged in a completely randomized block design with five replications. Each block contained seven plots, and each plot consisted of a 2-m treatment row of canola seed separated from adjacent rows and blocks by 1 m of unplanted soil. The outer treatment rows were flanked by unbroken guard rows of canola. A 2-m trench was pulled with a hoe and seeds were sown with a dibbler (Lee Valley Garden Supplies Canada) at a rate of 20 seeds per m of row. The seeds were covered with vermiculite infested at rates of 0.05 and 0.01 g/L, prepared as described above, to a depth of 1 cm and then covered with 1 cm of soil. Untreated seed sown with infested or uninfested vermiculite were used as the two check treatments. In both the growth room and field study, treatment effects on plant stand 28 days after seeding were determined by ANOVA and treatment means were compared by LSD at P = 0.05. Each combination of cultivar and inoculum concentration was considered a test. There were 20 tests (4 cultivars x 5 inoculum concentrations) in the growth room and 2 tests (1 cultivar x 2 inoculum concentrations) in the field.

RESULTS: Stand from untreated seed in infested vermiculite was significantly reduced in 19 of 20 tests in the growth room and in 1 of 2 tests in the field. Tests in which infestation did not reduce stand were cv. OAC Summit at 0.01 g/L infestation in the field and cv. Hyola 401 at 0.0005 g/L infestation in the growthroom. In the 20 tests (19 in the growth room and 1 in the field) that were available for assessing the treatments, stand reduction (SR) in the untreated infested check compared to the untreated uninfested check was 34% in the field and ranged from 23% to 100% in the growth room.

At a given level of infestation, efficacy depended on the treatment, the cultivar, and the location of the test. At 0.05 g of infested rye/L vermiculite (the only level of infestation to reduce stand in the field), SR was 66-88% in the growth room and 34% in the field (Table 1). At this level of infestation, all treatments except PREMIERE PLUS significantly increased stand in the field compared to the untreated infested check. The only treatments to significantly increase stand in the growth room were HELIX 289 FS (full rate) on all cultivars except Viscount, and HELIX 97 on cultivars Hyola 401 and Cyclone. Complete efficacy (restoration of stand to levels equivalent to, or greater than, that in the untreated uninfested check) was shown in the field (SR 34%) by all products, and in the growth room by HELIX 97 on cv. Hyola 401 (SR 67%), and HELIX 289 FS (full rate) on cvs. Springfield and Hyola 401 (SR 66-67%).

Table 1. Effect of seed treatment on stand (day 28) of canola[1] and mustard[1] seedlings from 9 seeds (growth room) or 40 seeds (field) sown in vermiculite (growth room) or soil (field) infested with *Rhizoctonia solani* at a rate of 0.05 g infested rye/L vermiculite.

		Growth room				Field
Treatment[3]	Product rate (mL/kg seed)	Springfield	Hyola 401	Cyclone	Viscount	OAC Summit
Untreated, uninfested		8.0a[4]	8.3a	8.3a	8.0a	19.2ab
Untreated, infested		2.7bc	2.7cd	1.3cd	1.0bc	12.6c
HELIX 97	20	3.7bc	7.3a	5.7b	0.7bc	21.1ab
HELIX 289 FS	15	7.3a	7.0ab	6.7b	0.7bc	23.0a
HELIX 289 FS	7.5	4.3b	4.7bc	2.0c	3.3b	22.0ab
VITAVAX RS	22.5	2.0c	2.7cd	2.7c	0.0c	22.6ab
PREMIERE PLUS	28.2	2.0c	0.7d	0.0d	0.0c	17.4bc

[1] Canola cultivars were Cyclone, Hyola 401, Springfield, and OAC Summit; mustard cultivar was Viscount.
[3] Treated seed was exposed to infested vermiculite.
[4] Within a column, means followed by the same letter are not significantly different at P = 0.05 (LSD).

Results across all cultivars and infestation levels tested in the growth room are summarized by reporting the number of tests in which products were effective or completely effective (Table 2). The incidence of efficacy in the growth room depended on the product and SR. Stand was increased significantly by HELIX 97 in 10 tests (SR 23-100%), by HELIX 289 FS (full rate) in 14 tests (SR 23-100%), by HELIX 289 FS (half rate) in 10 tests (SR 23-100%), by VITAVAX RS in 6 tests (SR 23-100%) and by PREMIERE PLUS in 2 tests (SR 23-55%). Complete efficacy (restoration of stand to levels equivalent to, or greater than, that in the untreated uninfested check) was shown by HELIX 97 in 4 tests (SR 23-81%), by HELIX 289 FS in 8 tests (SR 23-95%), by HELIX 289 FS at half rate in 6 tests (SR 23-81%), by VITAVAX RS in 3 tests (SR 23-62%), and by PREMIERE PLUS in 2 tests (SR 23-55%).

Table 2. Relation of stand reduction (SR[1]) in infested check to number of growth room tests[2] in which product was effective[3] or completely effective[4] in protecting canola[5] and mustard[5] seedlings from *Rhizoctonia solani*.

		Effective		Completely effective	
Treatment[6]	Product rate (mL/kg seed)	Tests	SR (%)	Tests	SR (%)
HELIX 97	20	10	23-100	4	23-81
HELIX 289 FS	15	14	23-100	8	23-95
HELIX 289 FS	7.5	10	23-100	6	23-81
VITAVAX RS	22.5	6	23-100	3	23-62
PREMIERE PLUS	28.2	2	23-55	2	23-55

[1] Reduction (%) of stand in untreated infested check compared to untreated uninfested check.
[2] Efficacy determined in 19 tests conducted in the growth room.
[3] Stand in treated infested treatment significantly greater than stand in untreated infested check. The count includes tests in which the product was completely effective.
[4] Stand in treated infested treatment equivalent to, or greater than, stand in untreated uninfested check.
[5] Canola cultivars were Cyclone, Hyola 401, Springfield, and OAC Summit; mustard cultivar was Viscount.
[6] Treated seed was exposed to infested vermiculite.

CONCLUSIONS: All treatments were completely effective at the lowest level of disease tested (SR 23%, growth room test). HELIX 289 FS (full rate) was the most effective treatment when judged by the incidence of efficacy (15/20 tests) or complete efficacy (9/20 tests), or by the range of disease pressures (SR) over which it was effective (23-100%) or completely effective (23-95%). According to these criteria, the descending order of efficacy of the remaining treatments was HELIX 289 FS (half rate), HELIX 97, VITAVAX RS and PREMIERE PLUS.

2002 PMR REPORT #154 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cvs. Springfield, Hyola 401, Cyclone, OAC Summit
Yellow mustard (*Sinapis alba* L.) cv. Viscount
PEST: Damping-off (*Fusarium avenaceum*)

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TITLE: **GROWTH ROOM AND FIELD EVALUATION OF SEED TREATMENTS TO CONTROL FUSARIUM DAMPING-OFF OF CANOLA AND MUSTARD**

MATERIALS: HELIX 1997 (fludioxonil 1.25 g ai/L, metalaxyl-M 3.75 g ai/L, difenoconazole 12.0 g ai/L, thiomethoxam 266.6 g ai/L), HELIX 289 FS (fludioxonil 1.7 g ai/L, metalaxyl-M 5.0 g ai/L, difenoconazole 16.0 g ai/L, thiomethoxam 266.6 g ai/L), VITAVAX RS (carbathiin 45 g ai/L, thiram 90 g ai/L, lindane 680 g ai/L), PREMIERE PLUS (thiabendazole 1.6%, thiram 4.8%, lindane 40%).

METHODS: Test products applied to canola seed, cvs. Cyclone, Hyola 401, Springfield, and OAC Summit, and mustard seed, cv. Viscount, were HELIX 1997 at 20 mL/kg seed, HELIX 289 FS at 15 or 7.5 mL/kg seed, VITAVAX RS at 22.5 mL/kg seed, and PREMIERE PLUS at 28.2 mL/kg seed. To treat seed, the required amount of product + 6% was added to the seed and shaken in an Erlenmeyer flask for 5 minutes to ensure thorough coating of the seed. Flasks were primed by treating a quantity of seed and discarding this seed before treating seed for experimental use. Check treatments consisted of untreated seed sown in infested or uninfested vermiculite or soil. To produce inoculum, moist rye kernels were autoclaved for 1 h, cooled, and inoculated with agar plugs cut from the growing margin of colonies of *Fusarium avenaceum* on potato dextrose agar. The inoculated rye kernels were incubated at room temperature (20-22°C) for 2 weeks, dried for 2 days, ground in a blender, and sieved to collect particles 0.5-1.2 mm in diameter. The ground infested rye was added to extra fine vermiculite at a rate of 2.5 g infested rye/L vermiculite. Treatment effects on canola cvs. Cyclone, Hyola 401, and Springfield, and mustard cv. Viscount were examined in a growth room study. Nine seeds per 5 x 7.5 cm pot were sown 2.5 cm deep. Pots were placed on 7.5 cm aluminum pans and covered with plastic bags to maintain high humidity and facilitate germination. Bags were removed and plants were watered daily once emergence occurred, and plants were watered with a fertilizer solution (28-14-14; 31 g/25 L distilled water) once the first true leaves were observed. Plants were grown at 25/18°C under a 16/8 hour light/dark regime. There were three replicate pots per treatment and treatments were arranged in a completely randomized design. Treatment effects on canola cv. OAC Summit were determined in a field study conducted at the Arkell Research Station, ON. Treatments were arranged in a completely randomized block design with five replications. Each block contained seven plots, and each plot consisted of a 2-m treatment row of canola seed separated from adjacent rows and blocks by 1 m of unplanted soil. The outer treatment rows were flanked by unbroken guard rows of canola. A 2-m trench was pulled with a hoe and seeds were sown with a dibbler (Lee Valley Garden Supplies Canada) at a rate of 20 seeds per m of row. The seeds were covered with infested vermiculite, prepared as described above, to a depth of 1 cm and then covered with 1 cm of soil. Untreated seed sown with infested or uninfested potting mix were used as the two check treatments. In both the growth room and field study, treatment effects on plant stand 28 days after seeding were determined by ANOVA and treatment means were compared by LSD at $P = 0.05$.

RESULTS: The results are presented in Table 1.

CONCLUSIONS: Infestation of the vermiculite or soil with *F. avenaceum* significantly reduced stand by 36-70% in the growth room and by 42% in the field. All products protected the seedlings of at least 1 cultivar. Both efficacy (stand from treated seed significantly greater than stand from untreated seed exposed to infested vermiculite) and complete efficacy (restoration of stand to levels equivalent to, or greater than, that in the untreated uninfested check) were shown by HELIX 289 FS (full rate) on all 5 cultivars, by HELIX 97 on all cultivars except Viscount, by HELIX 289 FS (half rate) and PREMIERE PLUS on 2 cultivars (Hyola 401 and Cyclone), and by VITAVAX RS on 1 cultivar (OAC Summit). In addition, efficacy was shown by HELIX 289 FS (half rate) on cv. OAC Summit, and by VITAVAX RS and PREMIERE PLUS on cv. Springfield. Efficacy was inversely related to disease pressure. For example, the number of completely effective treatments was 4, 4, 3, 2, and 1 when stand reduction in the infested check was 36%, 39%, 42%, 48%, and 70%, respectively. The rank of treatments by number of cultivars protected was, in descending order, HELIX 289 FS at full rate (5), HELIX 97 (4), HELIX 289 FS at half rate (3), PREMIERE PLUS (3), and VITAVAX RS (2). The treatments ranked in the same order by number of cultivars completely protected; viz. 5, 4, 2, 2, and 1, respectively.

Table 1. Effect of seed treatment on stand (day 28) of canola[1] and mustard[1] seedlings from 9 seeds (growth room) or 40 seeds (field) sown in vermiculite (growth room) or soil (field) infested with *Fusarium avenaceum*.

		Growth room				Field
Treatment	Product rate (mL/kg seed)	Springfield	Hyola 401	Cyclone	Viscount	OAC Summit
Untreated, uninfested		9.0a[2]	8.3a	8.7a	5.7a	19.4bc
Untreated, infested		4.7	5.3c	5.3c	1.7bc	11.2
HELIX 97, infested	20	7.7abc	8.7a	8.3a	2.3b	22.0a
HELIX 289 FS, infested	15	8.7ab	8.7a	8.7a	4.3a	21.4ab
HELIX 289 FS, infested	7.5	6.0de	7.3ab	8.7a	2.3b	15.8d
VITAVAX RS, infested	22.5	7.0cd	6.7bc	6.3bc	0.0c	18.2cd
PREMIERE PLUS, infested	28.2	7.3bcd	7.7ab	7.7ab	0.3c	10.4

[1] Canola cultivars were Cyclone, Hyola 401, Springfield, and OAC Summit; mustard cultivar was Viscount.
[2] Within a column, means followed by the same letter are not significantly different at P = 0.05 (LSD).

2002 PMR REPORT #155 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cvs. Springfield, Hyola 401, Cyclone, OAC Summit
Yellow mustard (*Sinapis alba* L.) cv. Viscount
PEST: Blackleg (*Leptosphaeria maculans*)

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TITLE: **GROWTH ROOM AND FIELD EVALUATION OF SEED TREATMENTS TO CONTROL BLACKLEG OF CANOLA AND MUSTARD**

MATERIALS: HELIX 1997 (fludioxonil 1.25 g ai/L, metalaxyl-M 3.75 g ai/L, difenoconazole 12.0 g ai/L, thiomethoxam 266.6 g ai/L), HELIX 289 FS (fludioxonil 1.7 g ai/L, metalaxyl-M 5.0 g ai/L, difenoconazole 16.0 g ai/L, thiomethoxam 266.6 g ai/L), VITAVAX RS (carbathiin 45 g ai/L, thiram 90 g ai/L, lindane 680 g ai/L), PREMIERE PLUS (thiabendazole 1.6%, thiram 4.8%, lindane 40%).

METHODS: Seed of canola cultivars Cyclone, Hyola 401, Springfield, and OAC Summit, and of mustard cultivar Viscount, were surface sterilized with 0.6% sodium hypochlorite for 3 minutes and rinsed 3 times with sterile distilled water. Surface sterilized seed was infested with *Leptosphaeria maculans* at a rate of 4 g seed/10 mL of an aqueous suspension containing 10^7 conidia/mL. Seed was soaked in the spore suspension for 18 h then dried in a fumehood for 24 hours. The uninfested check used seed that was surface sterilized and soaked for 18 hours in sterile distilled water at the rate of 4 g seed/10 mL water. Soaked and dried seed was treated with HELIX 1997 at 20 mL/kg seed, HELIX 289 FS at 15 or 7.5 mL/kg seed, VITAVAX RS at 22.5 mL/kg seed, and PREMIERE PLUS at 28.2 mL/kg seed. To treat seed, the required amount of product + 6% was added to the seed and shaken in an Erlenmeyer flask for 5 minutes to ensure thorough coating of the seed. Flasks were primed by treating a quantity of seed and discarding this seed before treating seed for experimental use. Treatment effects on canola cvs. Cyclone, Hyola 401, and Springfield, and mustard cv. Viscount were examined in a growth room study. Ten seeds per 10-cm-diameter pot were sown 2.5 cm deep in fine vermiculite. Pots were placed on aluminum pans and covered with plastic bags to maintain high humidity and facilitate germination. Bags were removed and plants were watered daily once emergence occurred, and plants were watered with a fertilizer solution (28-14-14; 31 g/25 L distilled water) once the first true leaves were observed. Plants were grown at 25/18°C under a 16/8 hour light/dark regime. There were three replicate pots per treatment and treatments were arranged in a completely randomized design. Treatment effects on canola cv. OAC Summit were determined in a field study conducted at the Arkell Research Station, ON. Treatments were arranged in a completely randomized block design with five replications. Each block contained seven plots. Plots were 5 m long and 1 m apart. Blocks were separated by a single row of wheat sown 0.5 m from the treatment row. Plots within blocks were separated by a 1-m wide bare strip of land. A 5-m long trench was pulled with a hoe and seeds were sown 2 cm deep with a dibbler (Lee Valley Garden Supplies Canada) at a rate of 20 seeds per m of row. Untreated infested seed and untreated uninfested seed were used as the two check treatments. In both the growth room and field study, treatment effects on plant stand 35 days after seeding were determined by ANOVA and treatment means were compared by LSD at P = 0.05.

RESULTS: The results are presented in Table 1.

CONCLUSIONS: Infestation of the seed with *L. maculans* significantly reduced stand by 67-100% in the growth room and by 21% in the field. HELIX 289 FS (full rate) and VITAVAX RS were completely effective (restored stand to levels equivalent to, or greater than, that in the untreated uninfested check) on all cultivars.

The efficacy of VITAVAX RS on the mustard cultivar Viscount was equivocal since stand from this treatment was not significantly different from that of either the uninfested check or the infested check. The other three treatments were ineffective on cultivar Viscount but were completely effective on all four canola cultivars. In the field, stand in the untreated uninfested check was 48% of the number of seed sown. The full and half rates of HELIX 289 FS significantly increased stand to 64.4% and 61.6% of seed sown, respectively, suggesting efficacy against one or more soil-borne pathogens.

Table 1. Effect of seed treatment on stand (day 35) of canola[1] and mustard[1] seedlings from 10 seeds (growth room) or 100 seeds (field) infested with *Leptosphaeria maculans*.

		Growth room				Field
Treatment	Product rate (mL/kg seed)	Springfield	Hyola 401	Cyclone	Viscount	OAC Summit
Untreated, uninfested		7.3ab[2]	10.0a	9.7a	8.3a	48.0b
Untreated, infested		0.0c	1.3b	0.7b	2.7c	37.8c
HELIX 97, infested	20	7.7a	9.7a	9.0a	4.0bc	56.2ab
HELIX 289 FS, infested	15	7.3ab	9.0a	10.0a	6.3ab	64.4a
HELIX 289 FS, infested	7.5	7.3ab	9.7a	9.3a	3.7bc	61.6a
VITAVAX RS, infested	22.5	7.7a	8.0a	9.3a	5.3abc	58.6ab
PREMIERE PLUS, infested	28.2	5.3b	8.7a	9.3a	4.3bc	58.2ab

[1] Canola cultivars were Cyclone, Hyola 401, Springfield, and OAC Summit; mustard cultivar was Viscount.
[2] Within a column, means followed by the same letter are not significantly different at P = 0.05 (LSD).

2002 PMR REPORT #156

SECTION O: CEREALS, FORAGE CROPS AND OILSEEDS - Diseases
ICAR: 61009653

CROP: Canola (*Brassica napus* L.), cv. 45A51
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF CANOLA IN ALBERTA IN 2002

MATERIALS: G7047 (carbathiin, 56 g/L + thiram, 120 g/L + metalaxyl, 4 g/L + clothianidin, 120 g/L FL), G7030 (carbathiin 56 g/L + thiram 120 g/L + metalaxyl, 4 g/L + clothianidin, 160 g/L FL), G7057 (trifloxystrobin, 8 g/L + metalaxyl 8 g/L + clothianidin, 120 g/L FL), G7059 (trifloxystrobin, 4 g/L + metalaxyl 8 g/L + clothianidin, 160 g/L FL), G7060 (trifloxystrobin, 6 g/L + metalaxyl 8 g/L + clothianidin, 160 g/L FL), G7061 (trifloxystrobin, 8 g/L + metalaxyl 8 g/L + clothianidin, 160 g/L FL), G7062 (carbathiin, 40 g/L + trifloxystrobin, 4 g/L + metalaxyl 8 g/L + clothianidin, 160 g/L FL), L1100 (EXP1, 16 g/L + EXP2, 1.67 g/L + EXP3, 5g/L + EXP4, 133.3 g/L FL).

METHODS: Seed of canola cv. 45A51 was treated in a Hege small batch seed treater with G7047, G7057, G7059, G7060, G7061 and G 7062 at 1.25 ml/kg seed, G7030 at 1.4 ml/kg seed, or with L1100 at 1.5 ml/kg seed. An experimental plot was established on 16 May, 2002 at Vegreville, Alberta, in black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 1.5 cm deep at a rate of 1.0 g of seed per row. Non-treated seeds were planted as inoculated and noninoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 ml/row. Emerged seedlings were counted on 5 July. Due to late germination, plants did not mature before the first killing frost, so were not harvested. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly ($P \# 0.05$) higher for all seed treatments in the trial than for the inoculated control (Table 1). Emergence for treatment L1100 was significantly greater ($P \# 0.05$) than for several of the other treatments, including G7030, G7057, G7059 and G7061.

CONCLUSIONS: All seed treatments in the trial improved emergence over the inoculated control. L1100 produced the greatest improvement in seedling emergence among the treatments tested. None of the treatments improved emergence to the level of the non-inoculated control.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of canola cv. 45A51 grown in soil inoculated with *Rhizoctonia solani* at Vegreville, Alberta in 2002.

Treatment	Rate (ml/kg seed)	Stand (plants/6m)
Noninoculated Control		122.5 a[1]
Inoculated Control[2]		45.5 d
G7030	1.4	74.1 c
G7047	1.25	89.8 bc
G7057	1.25	73.9 c
G7059	1.25	70.2 c
G7060	1.25	76.8 bc
G7061	1.25	72.7 c
G7062	1.25	90.2 bc
L1100	1.5	97.3 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test (*P*#0.05).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2002 PRM REPORT #157 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
ICAR:

CROP: Winter wheat (*Triticum aestivum* L.), cv. (various)
PESTS: Fusarium Head Blight (*Fusarium graminearum* Schawbe)
Septoria spp.

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TITLE: **THE EFFECT OF FUNGICIDES ON FUSARIUM HEAD BLIGHT, LEAF DISEASE, CONCENTRATIONS OF DON AND GRAIN YIELD IN WINTER WHEAT.**

MATERIALS: FOLICUR 432F (432 g L^{-1} tebuconazole); AGRAL 90 (surfactant); BRAVO 500 (chlorothalonil 500 g L^{-1}); TILT 250EC (250 g L^{-1} propiconazole); AMS21619

METHODS: Fungicides were applied in ten winter wheat fields on private farms across southern Ontario and in one wheat field at Ridgetown College in 2002. The experiments were conducted under natural infections of Fusarium Head Blight. Therefore, an attempt was made to select fields in areas with potentially high concentrations of DON, as predicted from the DON-weather model. Unfortunately, high DON concentrations were not predicted for any of the fields in southern Ontario during the time of heading. Because of windy conditions, spraying was delayed a few days on two fields near Chatham; both fields were sprayed approximately five days after 75% of the heads in the canopy cleared the flag leaf or "heading" (Zadoks 59). All other fields were sprayed approximately one to three days after heading. On four of the ten fields in the study, seven spray treatments were arranged in a randomized complete block design (RCBD) with 4 replications. The spray treatments included FOLICUR at 125 and 188 g a.i.ha^{-1} with 0.02% (v/v) Agral 90, AMS21619 at 150 and 200 g a.i.ha^{-1} with 0.02% (v/v) Agral 90, TILT at the use rate of 125 g a.i. ha^{-1}, BRAVO at the use rate of 1000 g ha^{-1}, and an untreated check where no fungicide was applied; the fungicides were sprayed on one variety of wheat in the same field. In the remaining seven fields, three spray treatments were arranged in a RCBD with four replications, which consisted of an untreated check plus FOLICUR at125 and 188 g a.i.ha^{-1} with 0.02% (v/v) Agral 90. Differential responses of FOLICUR among wheat varieties were investigated on four of the fields with three spray treatments. Spray treatments were applied across existing strips of wheat varieties that were planted along the length of the field for the purpose of yield comparisons. On the remaining three fields, the three spray treatments were applied on one wheat variety within each field. All fungicides were applied using a custom-designed self-propelled sprayer. The 1.5-m tread width of the sprayer marked the width of each plot or strip in the wheat canopy. The sprayer was equipped with a 1.5-m-wide boom fitted with three paired nozzles on nylon double swivel nozzle holders spaced 50-cm apart at each mount on the boom. A shield was positioned at the ends of the boom to prevent the drift of spray on adjacent wheat strips. Each nozzle consisted of Turbo TeeJet® 110015-VP spray tips (Spraying Systems Co.); one nozzle in each pair was adjusted on the swivel to spray forward in the direction of travel, and the other to spray backward so that each spray patterns tilted about 10 degrees downward. The height of the boom was hydraulically adjusted to maintain a clearance of approximately 10- to 15-cm above the wheat heads during spraying for maximum coverage of the wheat heads. The sprayer was calibrated to deliver 95 L of spray solution ha^{-1} at 340 kPa using $C0_2$-pressurized canisters at a forward speed of 8.0 kph. Approximately three weeks after heading, approximately 30 wheat heads were gathered in each of four areas within each plot for disease assessment. The total number of heads infected with Fusarium head blight was counted and the average number of spikelets infected in each wheat head was estimated according to the scoring system developed by Stack and McMullen. Variability among sub-samples was assessed in the statistical analysis.

Fusarium head blight index was calculated from the product of the average percent heads infected and average percent spikelets infected divided by 100. Visible diseases on the flag leaves were identified and each rated as % coverage of flag leaves within each sub-sample of 30 wheat plants. In most fields, wheat grain yield and moisture content was determined by harvesting a 5-m long segment in each 1.5-m-wide strip. A sample of the harvested grain was analyzed for of deoxynivalenol (DON) concentration using a quantitative ELISA test (Beacon Analytic Systems, Inc., Scarborough, ME). Fields with no symptoms of head blight or disease on the flag leaf were not harvested for yield determinations or for DON concentrations in the grain. PROC UNIVARIATE (SAS) was used to test the plausibility of assumptions for ANOVA. Both incidence and FHBI data were transformed using square root (x + 0.5), and leaf disease data were transformed using ln(x +0.1) to satisfy assumptions of normality; means were detransformed for presentation purposes. The transformed data were analyzed using the SAS procedure PROC MIXED, with the effects of replication treated as a random variable. Single degree of freedom contrasts were used to determine differences among treatments.

RESULTS: Low levels of Fusarium head blight disease were present in all the fields of the study. Septoria was the main disease showing visual symptoms of the flag leaf in most plots; average levels of Septoria did not exceed 4% of the total area of the flag leaves in the plots. FHBI was less than nine in the plots of all the fields in study, and concentrations of DON were below the level of detection (<0.2 : g g^{-1}) in the majority of plots (Tables 1 to 5). Compared to the untreated check, the application of either FOLICUR or AMS21619 lowered FHB indices from 7.5 to an average of 1.3 in only the Belmont field of the four fields that various fungicides were assessed (Tables 1 and 2), and lowered the area infected by Septoria on the flag leaf from 2.7 to 0.7% in the Belmont field and from 1.4 to 0.7% at Ridgetown (Table 2; $P = 0.01$ and $P = 0.06$, respectively). Concentrations of DON were lower than the detectable limit at Belmont (<0.2 : g g^{-1}; Table 2). The application of BRAVO reduced the FHBI compared to the untreated check at Belmont, but was higher than the average FHBI of FOLICUR or AMS21619 (Table 2; $P = 0.07$). Few differences were detected between FOLICUR and AMS21619, although the average FHBI of AMS21619-treated plots was marginally lower than the average of FOLICUR-treated plots at Ridgetown (Table 2; $P = 0.04$) and at Belmont (Table 2; $P = 0.19$). There were few differences between the low and high use rates of either FOLICUR or AMS21619. TILT was not efficacious against Fusarium or disease coverage on the flag leaves in any of the fields compared to the untreated check. Grain yields were not affected by the spray treatments in any of the four fields used to assess various fungicides (Tables 1 and 2). Two rates of FOLICUR were compared with an untreated check across wheat variety trials in fields near Bothwell, Petrolia, and Melbourne, and on single varieties in three fields near Belmont. At Bothwell, the average FHBI in the plots treated with FOLICUR was significantly less than the untreated plots across seven wheat varieties (Table 3; $P < 0.0001$). FOLICUR reduced the FHBI in all wheat varieties at Bothwell with the exception of Pioneer 25R42 and Stealth (Table 3); these varieties also had the lowest FHBI in the untreated checks compared to other varieties. The application of FOLICUR marginally reduced the average FHBI across two varieties in Field Two at Petrolia (Table 4; $P = 0.10$). There were no differences among the varieties in the Melbourne field (data not shown). FOLICUR reduced both FHBI and DON in two of three fields near Belmont ($P < 0.01$; Table 5). Concentrations of DON were below the detectable limit in most of the plots. FOLICUR was effective in reducing flag leaf disease across all varieties at both the Bothwell, Petrolia, and at two field locations at Belmont (Tables 3 and 5). At the Melbourne field location, no significant disease was observed on the flag leaves at approximately three weeks after heading. Only two of the seven wheat varieties at Bothwell responded to FOLICUR; no trend was observed between yield and levels of flag leaf disease or Fusarium head blight (Table 3). Averaged across all varieties, grain yields were 5% higher in FOLICUR-treated plots compared to plots that were not treated with any fungicide at Bothwell ($P = 0.07$; Table 4). In two fields near Belmont, FOLICUR increased grain yields by an average of 11% or 0.52 t ha^{-1}. The wheat was not harvested for yield at Petrolia because of a communication problem with the co-operator.

CONCLUSIONS: Both FOLICUR and AMS21619 were effective in reducing the FHBI if levels of the disease were high enough to provide some degree of measureable control. Because of low levels of disease in many of the field plots, grain yields in general were not significantly higher where FOLICUR or AMS21619 was applied. However, where moderately low levels of disease were present, an application of FOLICUR

increased grain yields by up to 11%. There was little data to suggest any difference between the low and high use rates of either fungicide on Fusarium head blight, leaf diseases, or grain yields. There was little data to support fungicide efficacy on reducing DON in harvested grain because concentrations of DON were below the level of detection in most of the plots. On wheat varieties with better disease resistance, the application of FOLICUR was less effective for reducing Fusarium head blight or leaf disease compared to other varieties more susceptible to disease. These experiments need to be repeated in conditions that promote higher levels of Fusarium head blight and leaf diseases than those conditions encountered in 2002.

Table 1. Effects of fungicides on Fusarium, Flag Leaf Disease, grain yield, and deoxynivalenol in machine-harvested grain in two winter wheat fields (cv. Pioneer 25R26) near Chatham, ON in 2002.

Treatment	Rate g a.i. ha^{-1}	Fusarium			Flag Leaf Disease[1,2]	Grain Yield	DON
		Incidence	Severity	Index[1]			
		%	%		% coverage coverage	t ha^{-1}	: g g^{-1}
Larry Litschko Field #1, Chatham							
Untreated Check		4.4	33.7	1.8	2.6	6.36	0.10
FOLICUR	125	5.8	26.8	26.8 2.2	2.3	6.07	0.03
FOLICUR	188	7.9	33.0	33.0 2.6	1.8	6.29	0.01
AMS21619	150	2.9	29.2	29.2 1.5	1.3	6.14	0.06
AMS21619	200	5.3	25.8	25.8 1.3	3.0	5.46	0.17
BRAVO	1000	3.7	22.2	22.2 1.6	1.2	6.10	0.04
TILT	125	10.5	46.7	46.7 5.0	2.9	6.27	0.08
		---------- *p*-values ----------					
FOLICUR vs Untreated		ns	ns	ns	ns	ns	ns
AMS21619 vs Untreated		ns	ns	ns	ns	ns	ns
FOLICUR vs AMS21619		0.060	ns	ns	ns	-	0.15
FOLICUR Application Rate		ns	ns	ns	ns	ns	ns
AMS21619 Application Rate		0.180	ns	ns	0.150	0.11	-
TILT vs FOLICUR/AMS21619		0.010	ns	0.009	ns	ns	ns
BRAVO vs FOLICUR/AMS21619		ns	ns	ns	ns	ns	ns
Larry Litschko Field #2, Chatham							
Untreated Check		9.2	46.0	4.6	2.5	6.87	0.15
FOLICUR	125	5.7	38.4	2.6 2.6	2.2	6.44	0.03
FOLICUR	188	6.2	37.8	3.2 3.2	1.9	5.92	0.08
AMS21619	150	7.1	31.7	2.8 2.8	2.0	6.00	0.08
AMS21619	200	5.3	40.3	2.3 2.3	2.0	6.89	0.03
BRAVO	1000	7.9	23.5	4.3 4.3	2.2	7.06	0.13
TILT	125	10.1	34.1	4.6 4.6	3.8	6.63	0.08
Contrasts		---------- *p*-values ----------					
FOLICUR vs Untreated		ns	ns	0.130	ns	0.03	ns
AMS21619 vs Untreated		ns	ns	ns	ns	ns	ns
FOLICUR vs AMS21619		ns	0.110	ns	ns	ns	0.15
FOLICUR Application Rate		ns	ns	ns	ns	0.14	ns
AMS21619 Application Rate		ns	ns	ns	ns	0.02	ns
TILT vs FOLICUR/AMS21619		0.100	ns	0.190	0.130	ns	ns
BRAVO vs FOLICUR/AMS21619		ns	ns	ns	ns	0.01	ns

[1] Before analyses, both incidence and index data were transformed using square root (x + 0.5), and flag leaf disease data were transformed using ln(x +0.1) to satisfy assumptions of normality; the data were detransformed for presentation purposes. No transformations were necessary for either severity, grain yield, or DON.

[2] Flag leaf disease was predominately Septoria leaf spots

Table 2. Effects of fungicides on Fusarium, Flag Leaf Disease, grain yield, and deoxynivalenol in machine-harvested grain in two winter wheat fields at Ridgetown College and near Belmont, ON in 2002.

Location/ Contrasts	Treatment	Rate	Fusarium			Flag Leaf Disease[1,2]	Grain Yield	DON
			Incidence	Severity	Index [1]			
		ha^{-1}	%	%		%	$t\ ha^{-1}$	$:g\ g^{-1}$
Ridgetown College, Ridgetown						coverage		
	Untreated		6.0	30.6	3.0	1.4	NH [3]	NH
	FOLICUR	125	11.3	39.5	5.5	1.0	NH	NH
	FOLICUR	188	6.6	31.9	3.0	0.8	NH	NH
	AMS21619	150	4.9	26.6	1.9	0.8	NH	NH
	AMS21619	200	6.9	27.9	3.3	0.4	NH	NH
	BRAVO	1000	7.2	33.4	3.1	0.7	NH	NH
	TILT	125	5.5	29.6	2.4	0.4	NH	NH
Contrasts			---------- *p*-values ----------					
FOLICUR vs Untreated			0.18	ns	ns	0.19	-	-
AMS21619 vs Untreated			ns	ns	ns	0.02	-	-
FOLICUR vs AMS21619			0.08	0.11	0.04	0.17	-	-
FOLICUR Application Rate			0.08	ns	0.05	ns	-	-
AMS21619 Application Rate			ns	ns	0.16	0.07	-	-
TILT vs FOLICUR/AMS21619			ns	ns	ns	0.10	-	-
BRAVO vs FOLICUR/AMS21619			ns	ns	ns	ns	-	-
Dave Hooker, Belmont								
	Untreated		13.9	55.5	7.5	2.7	5.92	0.06
	FOLICUR	125	3.7	32.8	2.1	0.8	5.86	0.03
	FOLICUR	188	2.4	24.1	1.2	1.1	6.07	0.06
	AMS21619	150	2.3	25.0	1.1	0.4	5.71	0.04
	AMS21619	200	1.4	22.2	0.9	0.5	5.99	0.04
	BRAVO	1000	5.9	34.0	2.5	0.9	5.93	0.06
	TILT	125	11.1	59.5	6.4	1.9	5.84	0.14
Contrasts			---------- *p*-values ----------					
FOLICUR vs Untreated			0.00	0.00	0.00	0.00	0.11	ns
AMS21619 vs Untreated			0.00	0.00	0.00	0.00	ns	ns
FOLICUR vs AMS21619			ns	ns	0.19	0.02	ns	ns
FOLICUR Application Rate			ns	ns	ns	ns	ns	ns
AMS21619 Application Rate			ns	ns	ns	ns	0.13	ns
TILT vs FOLICUR/AMS21619			0.00	0.00	0.00	0.00	ns	<0.0001
BRAVO vs FOLICUR/AMS21619			0.02	ns	0.07	ns	ns	ns

[1] Before analyses, both incidence and index data were transformed using square root (x + 0.5), and leaf disease data were transformed using ln(x +0.1) to satisfy assumptions of normality; means were detransformed for presentation purposes. No transformations were necessary for either severity, grain yield, or DON.
[2] Flag leaf disease was predominately Septoria leaf spots
[3] NH = no data; not harvested

Table 3. The effects of FOLICUR and winter wheat variety on Fusarium, Flag Leaf Disease, grain yield, and deoxynivalenol in machine-harvested grain on Rob Annett's farm near Bothwell, ON in 2002.

Wheat Variety	Treatment	Rate	Fusarium			Flag Leaf Disease[1,2]	Grain Yield	DON
			Incidence	Severity	Index [1]			
		g a.i. ha^{-1}	%	%		% coverage	t ha^{-1}	: g g^{-1}
25R23	Untreated		17.5	50.4	8.7	1.7	5.66	0.20
	FOLICUR	125	3.7	40.1	2.2	0.4	6.15	0.07
	FOLICUR	188	3.9	39.1	2.2	0.1	6.56	0.05
25R26	Untreated		5.4	42.3	2.8	5.6	5.50	0.08
	FOLICUR	125	2.4	23.4	1.1	1.8	5.58	0.02
	FOLICUR	188	2.0	31.8	1.3	2.4	5.58	0.02
25R42	Untreated		0.5	12.5	0.4	1.8	4.87	0.01
	FOLICUR	125	0.2	2.1	0.2	0.7	5.15	0.00
	FOLICUR	188	0.3	7.8	0.1	0.4	5.07	0.00
25R49	Untreated		6.4	48.7	4.2	10.5	5.26	0.06
	FOLICUR	125	0.9	10.8	0.5	1.7	5.26	0.07
	FOLICUR	188	1.7	29.3	1.4	1.7	5.64	0.05
GENESIS	Untreated		3.2	30.3	1.9	4.6	5.12	0.12
	FOLICUR	125	1.0	12.2	0.6	1.1	5.29	0.08
	FOLICUR	188	0.8	11.1	0.4	1.1	5.21	0.04
STEALTH	Untreated		1.3	12.1	1.3	1.8	4.99	0.12
	FOLICUR	125	0.0	0.0	0.0	0.3	5.11	0.03
	FOLICUR	188	0.0	0.0	0.0	0.4	5.27	0.02
WITNEY	Untreated		7.9	50.9	4.5	9.1	5.61	0.08
	FOLICUR	125	4.8	28.7	2.0	1.5	5.90	0.14
	FOLICUR	188	3.3	26.3	1.5	1.7	6.10	0.04
Average	Untreated		5.0	35.3	2.9	3.9	5.29	0.10
	FOLICUR	125	1.5	16.8	0.8	0.9	5.49	0.06
	FOLICUR	188	1.5	20.8	0.9	0.8	5.63	0.03
Contrasts			---------- *p*-values ----------					
25R23	Treated vs Untreated		0.00	ns	0.00	0.01	0.03	0.01
25R26	Treated vs Untreated		0.04	ns	0.05	0.00	ns	0.12
25R42	Treated vs Untreated		ns	ns	ns	0.02	ns	0.09
25R49	Treated vs Untreated		0.01	ns	0.04	0.00	ns	ns
GENESIS	Treated vs Untreated		0.06	ns	0.04	0.00	ns	0.16
STEALTH	Treated vs Untreated		ns	ns	ns	0.01	0.18	0.14
WITNEY	Treated vs Untreated		0.06	ns	0.01	0.00	0.04	ns
Average	Treated vs Untreated		0.00	0.01	0.00	0.00	0.07	0.03

[1] Before analyses, both incidence and index data were transformed using square root (x + 0.5), and Flag Leaf Disease data were transformed using ln(x +0.1) to satisfy assumptions of normality; means were detransformed for presentation purposes. No transformations were necessary for either severity, grain yield, or DON.

[2] Flag leaf disease was predominately Septoria leaf spots

Table 4. The effects of FOLICUR and winter wheat variety on Fusarium, Flag Leaf Disease, grain yield, and deoxynivalenol in machine-harvested grain on Dave and Gabrielle Ferguson's farm near Petrolia, ON in 2002.

Wheat Variety	Treatment	Rate	Fusarium			Flag Leaf Disease [1,2]	Grain Yield	DON
			Incidence	Severity	Index [1]			
		g a.i. ha^{-1}	%	%		% coverage	t ha^{-1}	: g g^{-1}
Field One								
25R26	Untreated		1.5	18.6	0.8	3.4	NH [3]	NH
	FOLICUR	125	0.9	16.7	0.6	1.1	NH	NH
	FOLICUR	188	1.1	15.6	0.5	1.1	NH	NH
25R39	Untreated		1.6	19.3	0.9	4.4	NH	NH
	FOLICUR	125	0.6	11.9	0.4	1.6	NH	NH
	FOLICUR	188	1.1	14.3	0.6	1.2	NH	NH
Average	Untreated		1.6	18.9	0.9	3.9	NH	NH
	FOLICUR	125	0.8	14.3	0.5	1.3	NH	NH
	FOLICUR	188	1.1	14.9	0.6	1.2	NH	NH
Field Two								
25R39	Untreated		2.5	27.3	1.4	5.2	NH	NH
	FOLICUR	125	1.2	16.8	0.8	1.2	NH	NH
	FOLICUR	188	0.8	12.1	0.5	1.4	NH	NH
2540	Untreated		6.9	48.2	4.1	2.6	NH	NH
	FOLICUR	125	5.1	44.4	3.1	1.1	NH	NH
	FOLICUR	188	3.6	38.2	2.1	1.0	NH	NH
Average	Untreated		4.5	37.8	2.6	3.7	NH	NH
	FOLICUR	125	2.9	30.6	1.8	1.3	NH	NH
	FOLICUR	188	2.0	25.1	1.2	1.1	NH	NH
Field One Contrasts			---------- *p*-values ----------					
25R26	Treated vs Untreated		ns	ns	ns	0.00	-	-
25R39	Treated vs Untreated		ns	ns	ns	0.00	-	-
Average	Treated vs Untreated		0.14	ns	0.19	0.00	-	-
Field Two Contrasts								
25R39	Treated vs Untreated		0.10	ns	0.20	0.00	-	-
2540	Treated vs Untreated		0.10	ns	0.14	0.00	-	-
Average	Treated vs Untreated		0.04	0.19	0.10	0.00	-	-

[1] Before analyses, both incidence and index data were transformed using square root (x + 0.5), and Flag Leaf Disease data were transformed using ln(x +0.1) to satisfy assumptions of normality; means were detransformed for presentation purposes. No transformations were necessary for either severity, grain yield, or DON.
[2] Flag leaf disease was predominately Septoria leaf spots
[3] NH = no data; not harvested

Table 5. The effects of FOLICUR on Fusarium, Flag Leaf Disease, grain yield, and deoxynivalenol in machine-harvested grain in three fields near Belmont, ON in 2002.

Wheat Variety	Treatment	Rate a.i.	Fusarium			Flag Leaf Disease [1,2]	Grain Yield	DON
			Incidence	Severity	Index [1]			
		g a.i. ha^{-1}	%	%		% coverage	t ha^{-1}	: g g^{-1}
Field One	Untreated		14.0	45.2	6.2	2.4	4.45	0.17
Maxine	FOLICUR	125	0.9	12.7	0.5	0.4	5.22	0.04
	FOLICUR	188	1.0	8.9	0.4	0.4	5.11	0.04
Field Two	Untreated		9.6	35.0	3.7	7.1	4.78	0.15
25R26	FOLICUR	125	3.1	24.4	1.2	1.4	5.20	0.08
	FOLICUR	188	1.8	21.1	0.9	1.0	4.99	0.06
Field Three	Untreated		3.8	25.7	1.8	2.5	NH [3]	NH
Maxine	FOLICUR	125	2.7	20.2	1.1	1.9	NH	NH
	FOLICUR	188	1.7	20.0	1.0	2.0	NH	NH
Contrast			---------- *p*-values ----------					
Field One: Treated vs Untreated			0.00	0.00	0.00	0.01	0.04	0.00
Field Two: Treated vs Untreated			0.00	0.17	0.01	0.00	0.04	0.01
Field Three: Treated vs Untreated			ns	ns	ns	ns	-	-

[1] Before analyses, both incidence and index data were transformed using square root (x + 0.5), and Flag Leaf Disease data were transformed using ln(x +0.1) to satisfy assumptions of normality; means were detransformed for presentation purposes. No transformations were necessary for either severity, grain yield, or DON.
[2] Flag leaf disease was predominately Septoria leaf spots
[3] NH = no data; not harvested

2002 PMR REPORT #158 **SECTION O: CEREAL, FORAGE, AND OILSEED CROPS -Diseases**
ICAR: 61006537

CROP: Soybean (*Glycine max* (L.) Merrill*)*, cv Hyland RR Renown
PEST: Naturally occurring rot roots

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TITLE: SOYBEAN SEED TREATMENTS FOR SEEDLING DISEASE

MATERIALS: G2051-16 (carbathiin + thiram, 169.6 g ai/L + 150.6 g ai/L); L0020-A1 (metalaxyl, 320 g ai/L); L1115-A1(trifloxystrobin, 500 g ai/kg); L1050-A1 (fludioxonil + metalaxyl-M, 7.69 g ai/L + 11.54 g ai/L); L1030-A1 (HEC5725 100 g ai/L); L0202-A1 (carbathiin + metalaxyl + thiram, 100 g ai/L + 16.2 g ai/L + 100 g ai/L).

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying the treatment or slurry via a syringe to each bag (all treatments diluted to the same volume of 3.0 ml/kg seed using water). The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. Seed weight was 161 g/1000 seeds. The crop was planted on 10 June, 2002 at Ridgetown ,on a sandy clay loam site with pH 7.1 and 5.4% organic matter that had 2 previous years of corn, using a 2-row cone seeder. Plots were 2 rows spaced 0.76 m apart and 4 m in length placed in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Total plot emergence was evaluated on 24 June, 2 and 9 July respectively. Vigor was assessed using a scale of 0-100% (100 = furthest developed plant in the trial and 0 = plant dead) on 24 June and 2 July, 2002 respectively. Plots were harvested on 10 Oct, 2002 and corrected to 14.5% moisture. Data were analysed using analysis of variance and means separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Table 1.

CONCLUSIONS: Emergence was significantly improved when G2051-16, both L0020-A1 + L115-A1 treatments, G2051-16 + L0020-A1 and L022-A1 are each significantly different from the untreated control when used as seed treatments. There was no sign of phytotoxicity for any of the treatments.

Table 1. Plant stand, vigor and yield assessments of soybeans at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Emergence number plants/2m	Plant Stand number plants/2m		Vigor 0-100%		Yield T/ha
		24 June	2 July	9 July	24 June	2 July	10 Oct
Untreated Control		93.8 c *	98	98.5	77.5	82.5	4.7
G2051-16	83	104.3 ab	105.3	102.3	85	85	4.5
L0020-A1	4.2	104.0 ab	106.5	105	82.5	90	4.2
+L1115-A1	5						
L0020-A1	4.2	104.3 ab	105.3	104.5	87.5	85	4.2
+L1115-A1	2.5						
G2051-16	83	102.5 ab	102	101.8	75	75	4.5
+L0020-A1	4.2						
L0020-A1	4.2	100.0 bc	102.8	100.8	87.5	87.5	4.7
L1050-A1	6.3	97.0 bc	101.3	97.8	77.5	80	4.7
L0020-A1	4.2	99.8 bc	103.8	102	72.5	72.5	4.7
+L1030-A1	5						
L0202-A1	95.1	107.8 a	109.5	106.3	82.5	85	4.9
LSD		7.6	NS	NS	NS	NS	NS
CV		5.1	6.0	5.3	13.6	13.1	4.8

***** Means followed by same letter do not significantly differ, (P=0.05, LSD)

2002 PMR REPORT #159 **SECTION O: CEREAL, FORAGE, AND OILSEED CROPS - Diseases**
ICAR: 61006537

CROP: Soybean (*Glycine max* (L.) Merrill), cv First Line
PEST: Phomopsis (*Phomopsis* spp)

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TITLE: CONTROL OF SEED BORNE PHOMOPSIS IN SOYBEANS WITH SEED TREATMENTS

MATERIALS: APRON MAXX RTA 19.05 FS (metalaxyl-m + fludioxonil, 11.54 g ai/L + 7.69 g ai/L); ICIA 5504 100 FS (100 g ai/L); VITAFLO 280 (thiram + carbathiin,130 g ai/L + 150 g ai/L); G2051-16 (carbathiin + thiram, 169.60 + 150.60 g ai/L); L0020-A1 (carbathiin + metalaxyl + thiram, 100 + 16.20 + 100 g ai/L); L1115-A1 (trifloxystrobin 500 g ai/L); G2789-07 (carbathiin, 233 g ai/L); L0029-A1 (metalaxyl,233 g ai/L); L0148-A1(carbathiin,320 g ai/L); L0021-A1(triazolinthion,100 g ai/L)

METHODS: Seed that was infected with Phomopsis at 25% incidence was treated in 1 kg lots in individual plastic bags by applying the treatment or slurry via a syringe to each bag (all treatments diluted to the same volume of 3.0 ml/kg seed using water). The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. The crop was planted on 23 May, 2002 at Huron Research Station and on 10 June, 2002 at Ridgetown using a 2-row cone seeder. Plots were 2 rows spaced 0.76 m apart and 4 m in length placed in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Total plot emergence and vigor was evaluated on 31 May and 7, 14 June at Huron Station and on 24 June, 2, 9 July and 8 Aug, 2002 at Ridgetown. Plant vigor was assessed on 14 and 24 June, 2002, respectively at Huron Station using a scale of 0-100 % where 0 = most advanced plant and 100 = plant dead. Plots were harvested on 10 Oct, 2002 at Ridgetown and on 8 Oct, 2002 at Huron Station and corrected to 14.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-4.

CONCLUSIONS: At the Ridgetown location all but Apron Maxx RTA alone improved plant stand significantly. This was also reflected in early plant vigor, but not carried through to yield. At the Huron location, neither Apron Maxx RTA or ICIA 5504 seed treatments improved plant stand while the rest of the seed treatments did. Plant vigor was similar amongst all treatments. No phytotoxicity due to seed treatment was noted. The higher yields were obtained with treatments containing APRON MAXX RTA + ICIA 5504, L0029-A1 + L0148-A1, L0020-A1 + L1115-A1, and G2789-07 + L0020-A1.

Table 1. Plant stand assessments of soybeans at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Emerge	Plant stand plants per plot		
		24 June	2 July	9 July	8 Aug
Infected/Untreated Check		65	63	65	63
Infected/Treated Check	6.25	77	80	80	80
+Apron Maxx RTA 19.05 FS					
Apron Maxx RTA 19.05 FS	6.25	71	73	73	72
Apron Maxx RTA 19.05 FS	6.25	79	79	78	80
+ICIA 5504 100 FS	2.5				
ICIA 5504 100 FS	2.5	78	80	80	79
ICIA 5504 100 FS	5	77	80	79	76
ICIA 5504 100 FS	10	80	84	82	84
Vitaflo 280	73	73	73	74	75
G2051-16	83	96	99	96	91
L0029-A1	3.6	81	87	85	85
+L0148-A1	2.2				
G2051-16	83	95	95	99	91
+L0020-A1	4.2				
L0020-A1	4.2	86	86	87	85
+L1115-A1	2.5				
L0020-A1	4.2	85	89	87	85
+L1115-A1	5				
G2789-07	43	94	92	86	89
+L0020-A1	4.2				
LSD		9.5	10.4	9.0	12.1
CV		8.22	8.8	7.7	10.5

Table 2. Vigor and yield assessments of soybeans at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Vigor 0-100 %				Yield T/ha
		24 June	2 July	9 July	8 Aug	10 Oct
Infected/Untreated Check		52.5	60	67.5	70.5	4.1
Infected/Treated Check		67.5	70	72.5	60.1	4
-Apron Maxx RTA 19.05 FS	6.25					
Apron Maxx RTA 19.05 FS	6.25	60	67.5	70	70.6	4.4
Apron Maxx RTA 19.05 FS	6.25	65	70	75	77.6	4.5
+ICIA 5504 100 FS	2.5					
ICIA 5504 100 FS	2.5	65	75	77.5	88.8	4.8
ICIA 5504 100 FS	5	65	75	77.5	78.4	4.7
ICIA 5504 100 FS	10	70	72.5	72.5	67.8	4.7
Vitaflo 280	73	62.5	67.5	72.5	72.4	4
G2051-16	83	95	95	92.5	92.5	4.9
L0029-A1	3.6	75	85	85	80.5	4.7
+L0148-A1	2.2					
G2051-16	83	85	90	90	93.8	4.8
+L0020-A1	4.2					
L0020-A1	4.2	77.5	77.5	75	73.7	4.5
+L1115-A1	2.5					
L0020-A1	4.2	75	77.5	85	75.4	4.7
+L1115-A1	5					
G2789-07	43	90	82.5	80	68.2	4.3
+L0020-A1	4.2					
LSD		14.2	15.0	NS	NS	NS
CV		13.8	13.8	14.8	20	11.1

Table 3. Plant stand assessments of soybeans at Huron Research Station, Ontario. 2002

Treatment	Rate g ai/100 kg.	Emerge	Plant stand number per plot	
		31 May	7 June	31 May
Infected/Untreated Check		0.8	54	64
Infected/Treated Check	6.25	5	51	65
+Apron Maxx RTA 19.05 FS				
Apron Maxx RTA 19.05 FS	6.25	2	49	62
Apron Maxx RTA 19.05 FS	6.25	1	52	65
+ICIA 5504 100 FS	2.5			
ICIA 5504 100 FS	2.5	0.5	50	62
ICIA 5504 100 FS	5	1	46	60
ICIA 5504 100 FS	10	2	50	62
Vitaflo 280	73	2	54	65
G2051-16	83	3	63	74
L0029-A1	3.6	1	69	75
+L0148-A1	2.2			
G2051-16	83	5	64	75
+L0020-A1	4.2			
L0020-A1	4.2	7	66	77
+L1115-A1	2.5			
L0020-A1	4.2	6	67	74
+L1115-A1	5			
G2789-07	43	2	60	76
+L0020-A1	4.2			
LSD		3	7.6	5.8
CV		77.2	9.4	10.7

Table 4. Vigor and yield assessments of soybeans at Huron Research Station, Ontario. 2002

Treatment	Rate g ai/100 kg.	Plant Vigor 0-100		Yield T/ha
		7 June	14 June	8 Oct
Infected/Untreated Check		68.8	65	3.8
Infected/Treated Check	6.25	70	66.3	4.3
+Apron Maxx RTA 19.05 FS				
Apron Maxx RTA 19.05 FS	6.25	68.8	65	4.1
Apron Maxx RTA 19.05 FS	6.25	67.5	62.5	6.3
+ICIA 5504 100 FS	2.5			
ICIA 5504 100 FS	2.5	67.5	62.5	4.7
ICIA 5504 100 FS	5	66.3	65	4.5
ICIA 5504 100 FS	10	68.8	65	4.3
Vitaflo 280	73	72.5	66.3	4.9
G2051-16	83	72.5	68.8	5.3
L0029-A1	3.6	71.3	67.5	5.4
+L0148-A1	2.2			
G2051-16	83	73.8	70	5.1
+L0020-A1	4.2			
L0020-A1	4.2	73.8	72.5	5.6
+L1115-A1	2.5			
L0020-A1	4.2	75	68.8	3.8
+L1115-A1	5			
G2789-07	43	70	67.5	5.2
+L0020-A1	4.2			
LSD		4.6	5.3	1.5
CV		4.5	5.6	21.5

2002 PMR REPORT #160 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Wheat, cv. AC Barrie
PEST: Septoria leaf blotch, *Septoria nodorum*
Powdery mildew, *Erysiphe graminis*

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TITLE: EFFICACY OF FUNGICIDE SEED TREATMENTS ON CONTROL OF FOLIAR DISEASE AND ON YIELD OF SPRING WHEAT

MATERIALS: VITAFLO 280 (carbathiin 14.9%, thiram 13.2%), BAYTAN 30 (triadimenol, 30%), RAXIL FL (tebuconazole 6 gai/L), DIVIDEND XL (difenoconazole 16.5%), RAXIL MD (tebuconazole 4.96 gai/L, metalaxyl 6.62 gai/L), RAXIL THIRAM (tebuconazole 6.6 gai/L, thiram 220 gai/L), Z0008 (triadimenol 3 g/kg, nitrogen 113.4 g/kg, phosphate 481 g/kg), Z0011 (triadimenol 3 g/kg, nitrogen 120 g/kg, phosphate 510 g/kg), CHARTER (triticonazole, 25 g/L).

METHODS: Wheat seed, cv. AC Barrie, a mildew susceptible cultivar, was treated using a small batch seed treater with the materials and at the rates listed in the table below. Plots were established on May 23, 2000, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide, five metres long with 17.8 cm between rows. Treatments with Z0008 and Z0011 were applied by spreading the material on the plot after planting and gently raked in. Between each treatment plot was an equal sized wheat guard plot. Plots received a herbicide application of MCPA (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 32. Treatments were replicated four times in a randomized complete block design. Emergence was taken on 2 x 1m of row prior to tillering. Septoria leaf blotch severity was rated on August 4, ZGS 76, on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Powdery mildew was rated on a whole plot basis on a 0 to 9 scale where 0 = no disease and 9 = very severe. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine on August 30, 2000.

RESULTS: Results are contained in Table 1.

CONCLUSIONS: Seed treatment had no significant effect on emergence or on symptoms of septoria leaf blotch. There was a significant response from some seed treatments to powdery mildew severity. BAYTAN 30 was effective in controlling powdery mildew when applied to the seed. The active ingredient in BAYTAN, triadimenol, was not however effective when applied as part of a granular fertilizer. What was not expected was that VITAFLO 280 demonstrated activity against powdery mildew. VITAFLO 280 is not usually associated with powdery mildew control. Several treatments increased yield with the higher rate of BAYTAN being the most effective, providing a 471 kg/ha, 22.3%, increase.

Table 1. Efficacy of fungicide seed treatments in spring wheat, Charlottetown, PEI, 2000.

Treatment	Rate (ml product/ kg seed)	Emer-gence (#/m)	Septoria Flag-3 (%)	Flag-4 (%)	Powdery mildew (0-9)	Yield (kg/ha)	1000 Kwt (g)
Untreated Control		39.5	6.3	25.5	6.25	2112	28.33
VITAFLO 280	3.3	38.5	7.0	26.1	4.75	2214	29.82
BAYTAN 30	2.5	42.3	5.5	17.4	4.25	2415	3110
BAYTAN 30	5.0	43.1	6.2	22.3	4.00	2583	30.25
RAXIL FL	2.5	33.6	6.9	21.6	6.00	2137	29.55
RAXIL THIRAM	2.2	39.6	6.9	26.8	5.00	2136	29.06
RAXIL MD	3.25	36.6	12.5	21.6	4.50	2277	29.46
RAXIL MD	3.25						
+ Z0008	5kg/ha	37.1	7.6	27.7	6.00	2399	30.15
RAXIL MD	3.25						
+ Z0008	10kg/ha	36.1	6.7	24.0	5.25	2296	30.35
RAXIL MD	3.25						
+ Z0008	20kg/ha	38.0	9.7	19.5	5.50	2426	30.75
RAXIL MD	3.25						
+ Z0011	20kg/ha	40.5	7.0	25.9	5.25	2273	29.75
DIVIDEND XL	3.25	38.9	7.9	26.2	4.75	2179	30.25
CHARTER	2	39.4	8.1	30.6	5.00	2411	30.4
LSD (0.05)		(ns)	(ns)	(ns)	1.387	195.1	(ns)
SEM		2.735	1.88	3.96	0.483	67.7	0.53

ZGS - Zadoks Growth Stage
(ns) - no significant difference, p=0.05

2002 PMR REPORT #161 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Wheat cv. Belvedere
PEST: Septoria leaf blotch, *Septoria nodorum*

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TITLE: **CONTROL OF SEPTORIA LEAF BLOTCH OF SPRING WHEAT WITH FOLIAR FUNGICIDE APPLICATIONS.**

MATERIALS: NOVARTIS-TR1 125EC(trifloxystrobin, 125 g/l), NOVARTIS-TR2 250EC (propiconazole 125 g/L, trifloxystrobin 125 g/L), NOVARTIS-TR3 250EC (asoxystrobin, 250 g/l), TILT (propiconazole 125 g ai/L).

METHODS: Wheat plots, cv. Belvedere, were established on May 17, 2000, at a seeding rate of 350 viable seeds per m^2. Each plot was 10 rows wide, five metres long and 17.8 cm between rows. Each wheat plot was separated by an equal size barley plot. Plots received a herbicide application of MCPA (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 28. Treatments were applied at the rates and timings indicated in the tables below. Treatments were applied at ZGS 30 (June 27) and or ZGS 56(July 13) using a tractor mounted small plot sprayer, at 30 psi and with a delivery volume of 250 L/ha. Treatments were replicated four times in a randomized complete block design. Septoria leaf blotch was rated approximately every seven days starting at ZGS 30 on June 27. Individual leaves were rated on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine on August 30, 2000.

RESULTS: Results are presented in Table 1 and Table 2. Disease levels at the first rating, ZGS 30, were similar to the ZGS 37 rating and are not reported.

CONCLUSIONS: Double applications of both NOVARTIS-TR2 and TILT were effective in the control of septoria leaf blotch and in yield response. NOVARTIS-TR3 (asoxystrobin) was also effective at disease control and provided a yield increase of 12.7%, which was significantly different from the untreated control. NOVARTIS-TR2 showed some potential in early season disease control but this was not maintained at later growth stages. While NOVARTIS-TR2 did result in a significant increase in yield from an early application more research is required to determine if this type of response would be consistent over years. Higher application rates of trifloxystrobin may be beneficial in wheat production. Fusarium head blight in this trial was a serious disease problem, which may have had a negative effect on the yield potential from treatment applications.

Table 1. Disease control in spring wheat following application of foliar fungicides, 2000

Treatment	Rate (g ai/ha)	Time* (ZGS)	Septoria leaf blotch(%)					
			37440 ZGS37 L3**	37454 ZGS66 L3	37460 ZGS70 L2	L3	37470 ZGS78 L2	L3
Untreated Control			0	1.9	2.8	5.7	18.8	37.7
NOVARTIS-TR1	62.5	30	0.9	1.0	2.2	4.9	14.5	33.7
NOVARTIS-TR2	125	30	0.0	0.9	1.4	2.8	19.3	29.3
NOVARTIS-TR2	125	56	0.0	0.9	1.5	2.9	11.0	29.7
NOVARTIS-TR2 +	125	30						
NOVARTIS-TR2	125	56	0.0	0.2	1.4	2.2	3.6	7.4
NOVARTIS-TR3	250	56	0.0	2.5	2.3	4.6	6.8	21.3
Tilt	62.5	30	0.0	1.3	2.2	3.2	15.5	35
Tilt	125	30	0.0	0.5	1.3	2.6	15.6	38.7
Tilt	125	56	1.2	1.5	1.5	2.9	4.7	13.4
Tilt +	125	30						
Tilt	125	56	0	1.2	1.8	2.4	3.7	7
LSD (0.05)			0.22	1.89	0.92	1.915	8.68	12.27
SEM			0.08	0.651	0.316	0.66	2.993	4.23

* Zadok's Growth Stage (ZGS) at time of application
** Leaf position, from the head

Table 2. Yield response in wheat following application of foliar fungicides, 2000

Treatment	Rate (g ai/ha)	Time* (ZGS)	Yield (kg/ha	1000 kwt (g)
Untreated Control			3311	33.45
NOVARTIS-TR1	62.5	30	3457	34.1
NOVARTIS-TR2	125	30	3775	34.1
NOVARTIS-TR2	125	56	3600	34.35
NOVARTIS-TR2 +	125+	30		
NOVARTIS-TR2	125	56	3773	35.95
NOVARTIS-TR3	250	56	3733	36.9
Tilt	62.5	30	3492	34.9
Tilt	125	30	3575	34.25
Tilt	125	56	3573	34.85
Tilt +	125 +	30		
Tilt	125	56	3765	37.75
LSD (0.05)			316.5	2.057
SEM			109.1	0.709

* Zadok's Growth Stage (ZGS) at time of application

2002 PMR REPORT #162 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Wheat cv. Belvedere
PEST: Septoria leaf blotch, *Septoria nodorum*

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TITLE: **EFFICACY OF FUNGICIDE SEED TREATMENTS ON CONTROL OF FOLIAR DISEASE AND ON YIELD OF SPRING WHEAT**

MATERIALS: VITAFLO 280 (carbathiin 14.9%, thiram 13.2%), BAYTAN 30 (triadimenol, 30%), RAXIL FL (tebuconazole 6 gai/L), RAXIL MD (tebuconazole 4.96 gai/L, metalaxyl 6.62 gai/L), RAXIL THIRAM (tebuconazole 6.6 gai/L, thiram 220 gai/L), Z0008 (triadimenol 3 g/kg, nitrogen 113.4 g/kg, phosphate 481 g/kg), Z0011 (triadimenol 3 g/kg, nitrogen 120 g/kg, phosphate 510 g/kg).

METHODS: Wheat seed, cv. Belvedere, a powdery mildew tolerant spring wheat cultivar, was treated using a small batch seed treater with the materials and at the rates listed in the table below. Plots were established on May 23, 2000, at a seeding rate of 350 viable seeds per m^2. Each plot was 10 rows wide and five metres long, 17.8 cm between rows. Treatments with Z0008 and Z0011 were applied by spreading the material on the plot after planting and gently raked in. Between each treatment plot was an equal sized wheat guard plot. Plots received a herbicide application of MCPA (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 32. Treatments were replicated four times in a randomized complete block design. Septoria leaf blotch severity was rated on August 12, at ZGS 85, on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine on August 30, 2000.

RESULTS: Results are contained in Table 1.

CONCLUSIONS: There were no significant effects of seed treatments on foliar disease severity or yield. Foliar disease was not severe in 2000 and fusarium head blight was a major problem. Both of these factors may have combined to limit any potential yield benefit from the seed treatments.

Table 1. Efficacy of fungicide seed treatments in spring wheat, Charlottetown, PEI, 2000.

Treatment	Rate (ml product/ kg seed)	Septoria leaf blotch Flag-2 (%)	Septoria leaf blotch Flag-3 (%)	Yield (kg/ha)	1000 Kwt (g)
Untreated Control		37.8	59.6	2950	30.40
RAXIL MD	3.25	20.3	38.9	2955	29.55
VITAFLO 280	3.3	45.9	70.0	2896	31.25
BAYTAN 30	2.5	10.9	29.5	3079	30.05
BAYTAN 30	5.0	20.4	44.5	3045	30.40
RAXIL FL	2.5	20.4	45.7	2881	30.30
RAXIL THIRAM	2.2	28.0	51.6	2902	30.45
RAXIL MD + Z0008	3.25 + 10kg/ha	30.5	57.7	2978	30.55
RAXIL MD + Z0011	3.25 + 20kg/ha	37.7	61.7	2941	29.20
SEM		7.84	8.50	64.5	0.695
LSD (0.05)		(ns)	(ns)	(ns)	(ns)

ZGS - Zadoks Growth Stage
(ns) - no significant difference, p=0.05

2002 PMR REPORT #163 **SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases**
STUDY DATA BASE: 303-1212-8907

CROP: Wheat, cv. Belvedere
PEST: Root Rot, various pathogens
Powdery mildew, *Erysiphe graminis*

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TITLE: EFFICACY OF FUNGICIDE SEED TREATMENTS ON CONTROL OF ROOT ROT AND FOLIAR DISEASES AND ON YIELD OF SPRING WHEAT, 2001

MATERIALS: VITAFLO 280 (carbathiin 14.9%, thiram 13.2%), RAXIL MD (tebuconazole 4.61 g ai/L, metalaxyl 0.68 g ai/L), RAXIL-Thiram (tebuconazole 6.67 g ai/L thiram 222.2 g ai/L), RAXIL FL (tebuconazole 6 g ai/L), CHARTER (triticonazole, 25 g ai/L), DIVIDEND XL (difenoconazole 36.9 g ai/L, metalaxyl-m 3.11 g ai/L), G7009 (clothianidin 600 g ai/L)

METHODS: Wheat seed, cv. Belvedere was treated using a small batch seed treater with the materials and at the rates listed in the table below. Plots were established on May 16, 2001, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide, five metres long and 17.8 cm between rows. Between each treatment plot was an equal sized barley guard plot. Plots received a herbicide application of MCPA600 (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 25. Treatments were replicated four times in a randomized complete block design. Due to a major aphid infestation CYGON 4-E (425 ml/ha) was also applied at ZGS 69. Emergence was taken on 2 x 1m of row prior to tillering. Root rot/seedling blight severity was rated on July 13, ZGS 45, on one metre of plot, on a 0 to 10 scale where 0 = no disease and 10 = very severe. Powdery mildew was also rated on July 13, on a whole plot basis, using the same scale. Yield and thousand kernel weight were determined from the harvest of nine rows, using a small plot combine on September 30, 2001.

RESULTS: Results are contained in Table 1. There was no significant effect on emergence. It should be noted that the 2001 growing season was well below normal for moisture, 54 and 10 mm recorded in July and August, respectively, compared to a mean of 100 and 75 mm in the previous 6 years.

CONCLUSIONS: With the exception of the VITAFLO 280+G7009 treatment, all treatments resulted in a significant reduction of up to 45% in root rot symptoms. Powdery mildew was suppressed by all treatments with those containing tebuconazole were the most effective, compared to the untreated control, with reductions of up to 48%. VITAFLO 280 resulted in a reduction in powdery mildew, though this seed treatment is not usually associated with control of powdery mildew. The effect of VITAFLO 280 may have been a direct effect on the pathogen or as an indirect effect on plant growth. There was some evidence that the fungicide seed treatments may have had a negative effect on yield. This could have been in part related to or enhanced by the dry conditions. There was some indication that the insecticide treatment (clothianidin, G7009) may have potential effects on growth response. Further evaluation is warranted to determine both potential adverse effects from the azole fungicides and the potential benefits of insecticide additions to a fungicide seed treatment.

Table 1. Efficacy of fungicide seed treatments in spring wheat, Charlottetown, PEI, 2001.

Treatment	Rate*	Emergence	Root rot	Powdery mildew	Yield	1000 Kwt
		(#/m)	(0-10)	(0-10)	(kg/ha)	(g)
Untreated Control	0	41.0	5.5	4.5	3507	32.56
VITAFLO 280	3.3	41.6	3.5	3.0	3390	32.70
RAXIL MD	3.25	47.0	3.8	2.3	3091	32.80
RAXIL-THIRAM	2.20	42.2	3.8	2.3	2755	32.25
RAXIL FL	2.5	38.4	3.8	3.3	3102	33.20
DIVIDEND XL	3.25	46.9	3.0	2.8	3187	32.70
Z0099	1	44.6	3.8	2.5	2922	32.55
G7009 +RAXIL MD	0.83+2.50	40.2	3.2	2.3	3986	35.25
VITAFLO 280 +G7009	3.3+0.83	46.4	4.3	3.0	3683	33.85
SEM		4.43	0.424	0.434	193.8	0.674
LSD (0.05)		(ns)	1.24	1.27	567	1.972

* mls product/ kg seed
(ns) - no significant difference, p=0.05

2002 PMR REPORT #164 **SECTION O: CEREAL, FORAGE, AND OILSEED CROPS - Diseases**
ICAR: 61006537

CROP: Spring Wheat, (*Triticum aestivum* L.), cv B89-11-13-1788
PEST: Bunt, Common, *T. foetida* (Wallr.) Liro

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TITLE: **CONTROL OF COMMON BUNT IN SPRING WHEAT WITH SEED TREATMENTS**

MATERIALS: G2789-05 (carbathiin 233 g ai/L); RAXIL 250 FL (tebuconazole, 250 g ai/L); L1043-A1 (EXP); L1194-A1 (EXP); L0121-A1 (triazolinthion, 100 g ai/L); G2051-16 (carbathiin + thiram, 169.6 + 150.6 g ai/L); L1115-A1 (trifloxystrobin, 500 g ai/kg; L0180-01 (tebuconazole + thiram, 6.6 g ai/L + 220 g ai/L); L1007-A1 (metalaxyl +tebuconazole, 6.62 g ai/L + 4.96 g ai/L).

METHODS: Bunt infected spring wheat seed was treated in 1 kg lots in individual plastic bags by applying a slurry of material via a syringe to each bag (all treatments diluted in water to the same volume of 3 ml per kg). The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. The wheat was planted on 25 April, 2002 at Ridgetown and 26 April, 2002 at Huron using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were single rows spaced 0.22 m apart and 4 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was determined on 21 May, 2002 at Ridgetown and 15 May, 2002 at Huron respectively. Vigor assessment, using a scale of 0-100(100 = most advanced plant and 0 = plants dead) was determined on the same dates. Plots were hand-harvested on 29 and 31 July, 2002 at Ridgetown and Huron Station, respectively. Two replications were hand threshed, weighed and put through a clean out procedure. A column blower/separator was obtained from Agriculture Canada to clean the samples. The plot sample was placed into the column separator and an equal air force was applied to each sample. The air volume removed the bunted kernels and remaining chaff from the sound grain. The clean out portion was then sorted by hand and the bunted kernels removed from the chaff. The number and weight of bunt kernels in the clean out samples were assessed. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1and 2. Due to labor requirements data were analysed from only two replications and the remaining two were discarded.

CONCLUSIONS: All treatments significantly reduced the presence of the bunt in the seed sample, measured at harvest at both locations. Although, L1194-A1, G2051-16 and L115-A1 still had commercially detectable levels of bunt. There was a significant reduction in emergence for L1043-A1 at the Huron location. There were no significant differences in yield.

Table 1. Plant stand, vigor, yield and bunt assessments of spring wheat at Ridgetown, Ontario. 2002

Treatment	Rate g ai/100 kg.	Pl stand #/plot 21 May	Vigor 0-100% 21 May	Yield T/ha 19 Sept	Clean Out g	Clean Out #Bunt kernels	Clean Out g Bunt kernels
Untreated Check		217	67.5	3	32.9	957.4 a *	7.6 a *
G2789-05	56	221.8	75	3.2	24.3	0 b	0 b
G7040-06	1.5	213	75	2.6	24.2	3.4 b	0 b
L1043-A1	13	227.8	82.5	2.9	24	0 b	0 b
L1194-A1	2.5	226.3	80	3.5	21.7	2.8 b	0 b
L0121-A1	5	216	75	2.1	15.7	0 b	0 b
G2789-05	70	227.3	82.5	2.8	27.7	51.5 b	0.5 b
G2051-16	74	222	72.5	2.9	27.1	5.8 b	0 b
G2051-16	106	205.5	75	3.5	25.2	14.1 b	0.4 b
L1115-A1	2.5	221.5	80	3.1	16.9	12.8 b	0.1 b
L0121-A1	7.5	221	70	2.7	22.5	0.4 b	0 b
L0180-01	51.5	213	80	3.9	22	0.8 b	0 b
L1007-A1	3.8	219	87.5	3.4	23.5	0 b	0 b
L1007-A1	3.8	236.8	80	3.2	20.8	1.2 b	0 b
+L1115-A1	2.5						
L1115-A1	2.5	211.5	75	3.4	17.6	1.2 b	0 b
+L1194-A1	2.5						
Non Inoculated Check		228.3	95	3.5	16.7	18.6 b	0.1 b
LSD		NS	NS	NS	NS	13.2	1.18
CV		7.1	17.2	15.4	27.6	43.6	70.7

***** Means followed by same letter do not significantly differ, (P= 0.05, LSD)

Table 2. Plant stand, vigor, yield and bunt assessments of spring wheat at Huron Research Station, Ontario. 2002.

Treatment	Rate g ai/100 kg.	Pl stand #/plot 15 May	Vigor 0-100% 15 May	Yield T/ha 19 Sept	Clean Out g	Clean Out # Bunt kernels	Clean Out g Bunt kernels
Untreated Check		234.3 a *	80	3.3	35	1243.5 a *	10.4 a *
G2789-05	56	219.0 ab	77.5	5	23.9	0.4 b	0 b
G7040-06	1.5	229.5 a	72.5	4.2	17.5	0 b	0 b
L1043-A1	13	203.5 b	70	5	18.8	0 b	0 b
L1194-A1	2.5	223.8 a	75	4.7	34.5	6.3 b	0.2 b
L0121-A1	5	230.0 a	75	5	23.6	0 b	0 b
G2789-05	70	212.8 ab	77.5	5.1	24.6	0 b	0 b
G2051-16	74	222.5 a	77.5	5.4	14.9	0.4 b	0 b
G2051-16	106	228.5 a	85	4.4	22.1	1.5 b	0 b
L1115-A1	2.5	215.5 ab	72.5	4.6	19.2	4.2 b	0.1 b
L0121-A1	7.5	216.8 ab	70	4.9	16.1	0 b	0 b
L0180-01	51.5	226.5 a	82.5	4.4	17.9	0.4b	0 b
L1007-A1	3.8	225.0 a	80	4.5	22.6	1.0 b	0.1 b
L1007-A1	3.8	232.0 a	80	4.8	29.3	0.4 b	0 b
+L115-A1	2.5						
L1115-A1	2.5	228.3 a	77.5	5.1	20.2	0 b	0 b
+L1194-A1	2.5						
Non Inoculated Check		226.0 a	80	4.5	23.2	22.9 b	0.2 b
LSD		12.3	NS	NS	NS	9.4	1.3
CV		3.8	17.8	13.7	30.9	99.6	57.2

***** Means followed by same letter do not significantly differ, (P= 0.05, LSD)