Agriculture and Agri Food Canada | Agriculture et Agroalimentaire Canada

2001 Pest Management Research Report (PMRR)
2001 Growing Season

2001 Rapport de recherches sur la lutte dirigée (RRLD)
pour le saison 2001

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

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

February, 2002 / Février, 2002

Canada

English

2001 PEST MANAGEMENT RESEARCH REPORT

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

Chairperson: **Michel Letendre**

Prepared by: **Research Branch, Agriculture and Agri-Food Canada**
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[1] This is the second 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 144 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 Stephanie Hilton for editorial and computer compilation services.
Suggestions for improving this publication are always welcome.

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Procedures for the 2002 Annual PMR Report will be sent in September, 2002. They will also be published on our web site, or contact PMRR EDITOR, Stephanie Hilton.

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 2001 has been assigned a Volume number for the second 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 40.

An individual report will be cited as follows:
Author(s). 2002. Title. 2001 Pest Management Research Report - 2001 Growing Season. Expert Committee on Integrated Pest Management. February, 2002. Report No. x. Vol. 40: pp-pp.

Français

Rapport de recherches sur la lutte dirigée - 2001

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
2001 Rapport de recherches sur la lutte dirigée - pour le saison 2001. Compilé par le Comité d'experts sur la lutte intégrée, par Agriculture et Agroalimentaire Canada, London (Ontario) Canada N5V 4T3. Février, 2002. 387p. Publié sur disquette et l'Internet à http://www.agr.gc.ca/science/london/pmrc/english/report/repmenu.html

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 144 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 Stephanie Hilton 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.

L'an dernier, 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 2001 correspond au volume 40.

Modèle de référence :
[Nom de l'auteur ou des auteurs. Année de parution 2002. Titre (*2001 Rapport de recherche sur la lutte antiparasitaire*). Comité d'experts de la lutte antiparasitaire intégrée. Fev. 2002. Rapport n^{o} x. 40:pp-pp.]

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TITLE: 2001 PEST MANAGEMENT RESEARCH REPORT - VOLUME 40

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37 reports

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2001 PMR REPORT # 1 **SECTION A: FRUIT - Insect/mite Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), Two-spotted spider mite (TSSM) *Tetranychus urticae* (Koch)
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: EFFICACY OF A NOVEL SUMMER MITICIDE AGAINST TWO SPOTTED SPIDER MITES AND EUROPEAN RED MITES ON APPLE IN 2001

MATERIALS: ENVIDOR 240 SC (spirodiclofen), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was done in an 11 yr-old orchard of McIntosh apple trees planted at a spacing of 7 x 5.5 m and a density of 260 trees/ ha at an experimental orchard in Sheffield Mills, Nova Scotia. The control and the 4 treatments were arranged in a randomized complete block design with each treatment replicated 4 times. The eastern 2 rows of the orchard were split into northern and southern halves giving a total of 4 blocks. Pesticides were diluted to a rate comparable to 600 litres/ha. and were applied by a backpack mounted mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany). Each tree received 2L of spray solution delivered at 60% throttle with the flow control valve set at 2, except for the control trees which received 2L of water. Samples of 50 leaves per tree, totalling 200 leaves per treatment, were taken on the dates shown below and passed through a mite-brushing machine. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the glass collecting plate. The precount of 9 August was taken the same day the treatments were applied. Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves.

RESULTS: Data are shown in Table 1.

CONCLUSIONS: . Pretreatment counts 9 August indicated damaging numbers of TSSM and ERM in all plots. Counts of motile ERM stayed relatively high throughout the trial in the control until the final sampling date of 19 September. On sampling dates after the precount, ERM numbers were significantly lower than the control for most treatments with the exception of samples from ENVIDOR (180g/ha) on 13 August and the two lower rates of ENVIDOR on 20 August. Although TSSM counts were lower in the treatments than in the control, tree-to-tree variation nearly always obscured statistically significant differences. With few exceptions, counts of *T. pyri* motiles and eggs, for the four treatment groups and the control, were not significantly different until the 28 August sample. After this date, egg counts and later counts of motile *T. pyri* decreased in all treated plots compared with the control. This decrease was likely due to the lower numbers of prey available as well as to possible delayed toxic effects.

Table 1. Densities of eggs and motile stages of European red mite (ERM), two-spotted spider mite (TSSM) and *Typhlodromus pyri* (TP). 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 square root transformation of the data ($P = 0.05$).

Treatment	Rate g a.i./ha	ERME	ERM	TSSME	TSSM	TPE	TPM
		9 Aug.	Pre-treatment				
Control		34.60 a	9.00 a	4.20 b	2.00 a	0.00 a	0.41 a
ENVIDOR	120.0	29.20 a	21.00 a	10.60 ab	10.80 a	0.41 a	0.82 a
ENVIDOR	180.0	35.20 a	14.40 a	7.80 ab	5.20 a	0.06 a	1.24 a
ENVIDOR	240.0	22.06 a	18.59 a	13.08 a	7.82 a	0.12 a	0.73 a
PYRAMITE	112.5	19.80 a	31.00 a	4.00 b	8.40 a	0.64 a	1.03 a
		13 Aug.	4 days				
Control		28.66 a	33.41 a	11.83 a	5.93 a	1.05 a	2.59 a
ENVIDOR	120.0	7.74 b	10.25 b	4.58 a	3.79 a	0.18 a	0.82 a
ENVIDOR	180.0	9.53 b	16.55 ab	6.25 a	6.09 a	0.70 a	1.36 a
ENVIDOR	240.0	5.40 b	12.40 b	3.40 a	4.00 a	0.24 a	1.08 a
PYRAMITE	112.5	4.00 b	7.20 b	3.20 a	5.40 a	1.10 a	0.72 a
		20 Aug.	11 days				
Control		10.60 a	18.60 a	15.60 a	18.20 a	1.28 a	2.11 a
ENVIDOR	120.0	20.40 a	9.80 ab	4.40 a	3.40 ab	0.64 a	1.03 ab
ENVIDOR	180.0	10.00 a	8.80 ab	4.00 a	4.20 ab	0.70 a	1.18 ab
ENVIDOR	240.0	10.60 a	4.20 b	4.00 a	3.20 ab	0.77 a	0.46 b
PYRAMITE	112.5	29.22 a	4.97 b	4.52 a	0.20 b	0.30 a	0.96 ab
		28 Aug.	19 days				
Control		15.00 a	16.20 a	8.40 a	20.80 a	3.01 a	4.69 a
ENVIDOR	120.0	1.20 bc	0.20 b	0.00 a	0.60 a	0.18 b	0.41 b
ENVIDOR	180.0	1.80 bc	0.20 b	0.20 a	0.80 a	0.12 b	0.67 b
ENVIDOR	240.0	0.20 c	0.00 b	0.00 a	0.20 a	0.35 b	0.98 b
PYRAMITE	112.5	10.20 ab	3.20 b	3.20 a	1.60 a	0.06 b	0.51 b
		6 Sept.	28 days				
Control		6.93 a	14.40 a	9.87 a	13.87 a	4.09 a	2.33 a
ENVIDOR	120.0	0.80 b	0.20 b	0.60 a	0.20 a	0.24 b	1.34 a
ENVIDOR	180.0	0.60 b	0.80 b	0.20 a	0.00 a	0.06 b	0.41 a
ENVIDOR	240.0	2.20 ab	0.00 b	0.40 a	0.20 a	0.12 b	0.77 a
PYRAMITE	112.5	3.20 ab	0.40 b	3.00 a	1.20 a	0.29 b	0.88 a
		19 Sept.	41 days				
Control		0.81 a	1.32 a	0.10 a	2.14 a	0.24 a	3.97 a
ENVIDOR	120.0	0.59 a	0.10 a	0.00 a	0.00 a	0.00 b	0.18 b
ENVIDOR	180.0	0.41 a	0.21 a	0.00 a	0.00 a	0.03 b	0.26 b
ENVIDOR	240.0	0.60 a	0.20 a	0.00 a	0.00 a	0.00 b	0.18 b
PYRAMITE	112.5	2.19 a	0.00 a	0.20 a	0.10 a	0.03 b	0.73 b

2001 PMR REPORT # 2 **SECTION A: FRUIT - Insect/mite Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. Nova Spy
PESTS: Apple Rust mite (ARM) *Aculus schlechtendali* (Nalepa), European red mite (ERM), *Panonychus ulmi* (Koch), two-spotted spider mite (TSSM) *Tetranychus urticae* (Koch)
PREDATOR: *Typhlodromus pyri* Scheuten, *Zetzellia mali* (ZM) (Ewing)

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TITLE: EFFECTS OF APOLLO AND A NOVEL EARLY SEASON MITICIDE ON PHYTOPHAGOUS AND PREDACIOUS MITES ON APPLE

MATERIALS: APOLLO 500 SC (clofentezine), AGRI-MEK 1.9 EC (abamectin), MANA 300 6.4 SC, CYGON 480 EC (dimethoate)

METHODS: Pre-bloom APOLLO was applied 31 May whereas post-bloom miticides were applied 6 June 2001 to 2 yr old, 1.5-2.0 m tall potted Nova Spy apple trees housed in a 31 x 6 m tunnel house covered by 60% shade cloth. Because the 29 May precount indicated low densities of adult *T. pyri* on many of the potted trees, and because it was feared they would strongly suppress phytophagous mites, on 1 June 2001 we treated all trees except one set of 6 with the equivalent of 480 g/ha of CYGON to suppress *T. pyri*. Six trees treated with CYGON and no miticide served as a control, whereas the six trees that had neither CYGON nor miticide treatments served as dimethoate controls. On the day of treatment, six trees randomly assigned to each treatment were removed from the tunnel house and were sprayed with 500 ml of solution (per tree) with a backpack, gasoline-powered mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany) with dilutions equivalent to 600L/ha. Trees were arranged in the tunnel house in a randomized complete block design with six single-tree plots per treatment. The trees were placed 80 cm apart so that there was no direct contact between foliage of adjacent trees. A pre-treatment count of mites was made immediately before treatments were applied. Counts of mites were also taken 0, 7, 13, 20, 28, 35 and 41 days after the 5th June treatment. On each sampling date, 5 leaves were removed from each tree and upper and lower leaf surfaces were directly examined for mites and their eggs under a microscope at 12x or higher magnification.

RESULTS: Data for phytophagous mites are shown in Table 1 and data for predacious mites are in Table 2. There was no indication of phytotoxicity in any of the treated trees.

CONCLUSIONS: Motile stages of ERM and ARM in the control trees increased to maximum densities of 5.4 and 160 per leaf, respectively, by 10 July (Table 1). Although the peak density of motile TSSM (also on 10 July) was only 0.67 per leaf there were also significant treatment effects with this species. Initially ERM, TSSM and ARM numbers were quite low in all treatments. However starting 18 June densities of motile ERM and ARM in all miticide treated trees, including those treated with MANA 300, were usually significantly lower than densities in the control. By early July densities of motile ERM and TSSM in the dimethoate control were also less than in the control, likely because of predation by *T. pyri* on those trees that were not treated with dimethoate.

Significant treatment effects on predators first appeared 18 June, 13 days after the post-bloom applications of miticides (Table 2). Typically, densities of motile *Zetzellia mali* were highest on the control trees (dimethoate-treated), with intermediate densities on the dimethoate controls, and lowest values on all trees treated with miticides. Suppression of *Z. mali* on the dimethoate controls was likely due to predation by *T. pyri* whose adults will kill immature stages of *Z. mali.* Low densities of *Z. mali* on miticide-treated trees were likely more due to miticide toxicity to this predator and less due to scarcity of prey because *Z. mali* is known to survive well on pollen found on apple leaves and has low feeding requirements. Starting 18 June and thereafter, motile stages of *T. pyri* were most abundant on the dimethoate control trees. By 16 July, mean densities on the dimethoate control were > 4 motile stages and 1.9 *T. pyri* eggs per leaf. In July, motile *T. pyri* gradually reappeared in all trees except those treated with AGRIMEK. This predator was effective in suppressing both ERM and TSSM on the dimethoate control trees.

Table 1. Densities per leaf of eggs and motile stages of European red mite (ERM) and two-spotted spider mite (TSSM) as well as apple rust mite motiles (ARM). For each column and each date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P = 0.05$).

Treatment	Rate ai/ha	ERME	ERM	TSSME	TSSM	ARM
				29 May Precount		
Control		0.00 a	0.40 a	0.00 a	0.00 a	0.00 b
APOLLO[a]	150.0	0.01 a	0.70 a	0.00 a	0.00 a	0.00 b
APOLLO	150.0	0.00 a	0.87 a	0.00 a	0.00 a	0.09 a
APOLLO	193.5	0.01 a	0.20 a	0.00 a	0.00 a	0.00 b
APOLLO	236.5	0.00 a	0.67 a	0.00 a	0.00 a	0.00 b
MANA	192.0	0.00 a	0.60 a	0.00 a	0.00 a	0.00 b
AGRIMEK[b]	14.2	0.01 a	0.50 a	0.00 a	0.00 a	0.00 b
				5 June		
Control		0.06 a	0.20 ab	0.00 a	0.00 a	0.27 b
APOLLO[a]	150.0	0.15 a	0.37 ab	0.00 a	0.00 a	0.03 b
APOLLO	150.0	0.00 a	0.07 b	0.00 a	0.00 a	0.10 b
APOLLO	193.5	0.09 a	0.43 ab	0.00 a	0.00 a	0.09 b
APOLLO	236.5	0.12 a	0.58 a	0.00 a	0.00 a	2.47 a
MANA	192.0	0.13 a	0.53 a	0.00 a	0.00 a	0.10 b
AGRIMEK[b]	14.2	0.05 a	0.37 ab	0.00 a	0.00 a	0.28 b
				12 June		
Control		0.33 ab	0.03 a	0.00 a	0.00 a	0.01 a
APOLLO[a]	150.0	0.02 c	0.03 a	0.00 a	0.00 a	0.00 a
APOLLO	150.0	0.13 bc	0.00 a	0.00 a	0.00 a	0.00 a
APOLLO	193.5	0.13 ab	0.17 a	0.00 a	0.00 a	0.01 a
APOLLO	236.5	0.54 a	0.07 a	0.00 a	0.00 a	0.03 a
MANA	192.0	0.01 c	0.00 a	0.00 a	0.00 a	0.00 a
AGRIMEK[b]	14.2	0.00 c	0.00 a	0.00 a	0.00 a	0.00 a
				18 June		
Dim. control[c]		0.00 c	0.00 b	0.00 a	0.00 a	4.09 a
Control		0.49 ab	0.70 a	0.00 a	0.00 a	3.49 a

APOLLO[a]	150.0	0.23 b	0.00 b	0.00 a	0.00 a	0.25 b
APOLLO	193.5	0.71 a	0.10 b	0.10 a	0.00 a	0.22 b
APOLLO	236.5	0.94 a	0.10 b	0.00 a	0.00 a	0.10 b
MANA	192.0	0.02 c	0.00 b	0.00 a	0.00 a	0.00 b
AGRIMEK[b]	14.2	0.00 c	0.00 b	0.00 a	0.00 a	0.00 b
				25 June		
Dim. control[c]		0.00 e	0.00 c	0.00 a	0.00 a	2.45 ab
Control		0.71 a	1.87 a	0.00 a	0.00 a	3.06 a
APOLLO[a]	150.0	0.03 e	0.00 c	0.93 a	0.03 a	0.09 c
APOLLO	150.0	0.19 bc	0.03 c	0.00 a	0.00 a	0.24 bc
APOLLO	193.5	0.20 bc	0.00 c	0.00 a	0.03 a	0.08 c
APOLLO	236.5	0.37 ab	0.33 b	0.47 a	0.00 a	0.21 c
MANA	192.0	0.03 de	0.00 c	0.00 a	0.00 a	0.09 c
AGRIMEK[b]	14.2	0.05 cd	0.00 c	0.00 a	0.00 a	0.01 c
				3 July		
Dim. control[c]		0.10 ef	0.00 c	0.20 b	0.03 b	103.70 a
Control		1.59 a	1.87 a	0.87 a	0.17 a	79.11 a
APOLLO[a]	150.0	0.31 de	0.00 c	0.03 b	0.00 b	0.07 b
APOLLO	150.0	0.55 cd	0.13 bc	0.03 b	0.03 b	0.21 b
APOLLO	193.5	1.21 ab	0.50 b	0.27 ab	0.07 ab	0.72 b
APOLLO	236.5	0.87 bc	0.13 bc	0.00 b	0.00 b	0.36 b
MANA	192.0	0.33 cd	0.07 c	0.03 b	0.03 b	0.09 b
AGRIMEK[b]	14.2	0.01 f	0.03 c	0.00 b	0.00 b	0.00 b
				10 July		
Dim. control[c]		0.03 c	0.27 bc	0.00 a	0.00 b	40.00 b
Control		1.79 ab	5.37 a	0.33 a	0.30 ab	160.00 a
APOLLO[a]	150.0	2.76 a	0.37 bc	0.27 a	0.67 a	4.65 c
APOLLO	150.0	1.27 b	1.10 bc	0.00 a	0.00 b	6.91 c
APOLLO	193.5	1.83 ab	1.47 b	0.27 a	0.27 b	7.79 c
APOLLO	236.5	1.16 b	0.67 bc	0.00 a	0.00 b	0.29 c
MANA	192.0	0.89 b	0.10 c	0.00 a	0.00 b	0.33 c
AGRIMEK[b]	14.2	0.00 c	0.00 c	0.00 a	0.00 b	0.03 c
				16 July		
Dim. control[c]		0.08 d	0.17 b	0.13 a	0.00 b	33.72 a
Control		0.47 c	2.27 a	0.07 a	0.43 a	33.93 a
APOLLO[a]	150.0	1.36 ab	0.80 ab	0.00 a	0.00 b	20.62 ab
APOLLO	150.0	1.88 a	0.33 ab	0.00 a	0.10 ab	13.55 bc
APOLLO	193.5	0.97 bc	0.30 ab	0.63 a	0.00 b	0.57 cd
APOLLO	236.5	0.63 c	1.53 a	0.00 a	0.20 ab	7.51 bc
MANA	192.0	0.69 c	0.27 ab	0.43 a	0.00 b	0.41 cd
AGRIMEK[b]	14.2	0.00 d	0.07 b	0.00 a	0.00 b	0.00 d

a This was the only miticide application 29 May. All others were 5 June 2001.

b Mixed with SUPERIOR OIL 70 sec equivalent to 10 L/ha..

c These were the only trees not treated with dimethoate 1 June 2001.

Table 2. Densities per leaf of eggs and motile stages of *Zetzellia mali* (ZM) and *Typhlodromus pyri* (TP), the two predator mites. For each column and each date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P = 0.05$).

Treatment	Rate g ai/ha	ZME	ZMM	TPE	TPM
			29 May		
Control		0.06 a	0.05 a	0.00 a	0.00 a
APOLLO[a]	150.0	0.00 a	0.02 a	0.00 a	0.07 a
APOLLO	150.0	0.02 a	0.03 a	0.00 a	0.07 a
APOLLO	193.5	0.03 a	0.02 a	0.07 a	0.00 a
APOLLO	236.5	0.01 a	0.01 a	0.00 a	0.00 a
MANA	192.0	0.01 a	0.02 a	0.03 a	0.10 a
AGRIMEK	14.2	0.00 a	0.03 a	0.00 a	0.00 a
			5 June		
Control		0.03 a	0.02 a	0.00 a	0.00 a
APOLLO[a]	150.0	0.03 a	0.01 a	0.00 a	0.03 a
APOLLO	150.0	0.03 a	0.04 a	0.00 a	0.00 a
APOLLO	193.5	0.08 a	0.06 a	0.00 a	0.00 a
APOLLO	236.5	0.11 a	0.03 a	0.08 a	0.08 a
MANA	192.0	0.13 a	0.07 a	0.00 a	0.03 a
AGRIMEK	14.2	0.10 a	0.03 a	0.00 a	0.00 a
			12 June		
Control		0.01 a	0.03 a	0.00 a	0.00 a
APOLLO[a]	150.0	0.01 a	0.02 a	0.00 a	0.00 a
APOLLO	150.0	0.01 a	0.01 a	0.00 a	0.00 a
APOLLO	193.5	0.07 a	0.03 a	0.03 a	0.00 a
APOLLO	236.5	0.05 a	0.00 a	0.00 a	0.00 a
MANA	192.0	0.00 a	0.01 a	0.00 a	0.00 a
AGRIMEK	14.2	0.03 a	0.00 a	0.00 a	0.00 a
			18 June		
Dim. control[b]		0.20 a	0.04 b	0.00 a	0.28 a
Control		0.05 ab	0.13 a	0.00 a	0.00 b
APOLLO	150.0	0.05 ab	0.03 b	0.03 a	0.00 b
APOLLO	193.5	0.17 a	0.04 b	0.00 a	0.00 b
APOLLO	236.5	0.03 ab	0.01 b	0.00 a	0.00 b
MANA	192.0	0.08 ab	0.01 b	0.00 a	0.03 b
AGRIMEK	14.2	0.00 b	0.00 b	0.00 a	0.00 b
			25 June		
Dim. control[b]		0.02 b	0.07 ab	0.00 a	0.55 a
Control		0.03 b	0.11 a	0.03 a	0.00 b
APOLLO[a]	150.0	0.14 a	0.00 b	0.00 a	0.00 b
APOLLO	150.0	0.02 b	0.00 b	0.07 a	0.00 b
APOLLO	193.5	0.04 ab	0.00 b	0.00 a	0.00 b
APOLLO	236.5	0.01 b	0.00 b	0.00 a	0.00 b
MANA	192.0	0.05 ab	0.02 ab	0.00 a	0.03 b
AGRIMEK	14.2	0.00 b	0.00 b	0.00 a	0.00 b

			3 July		
Dim. control[b]		0.40 b	0.11 b	0.00 a	1.43 a
Control		4.12 a	0.85 a	0.00 a	0.10 b
APOLLO[a]	150.0	0.01 c	0.00 c	0.00 a	0.00 b
APOLLO	150.0	0.08 bc	0.02 c	0.00 a	0.07 b
APOLLO	193.5	0.10 bc	0.01 c	0.00 a	0.03 b
APOLLO	236.5	0.00 c	0.01 c	0.00 a	0.00 b
MANA	192.0	0.01 c	0.01 c	0.00 a	0.00 b
AGRIMEK	14.2	0.00 c	0.00 c	0.00 a	0.00 b
			10 July		
Dim. control[b]		0.98 b	0.47 b	2.03 a	2.73 a
Control		3.62 a	1.96 a	0.00 b	0.00 b
APOLLO[a]	150.0	0.13 c	0.04 c	0.00 b	0.00 b
APOLLO	150.0	0.03 c	0.01 c	0.00 b	0.13 b
APOLLO	193.5	0.05 c	0.03 c	0.00 b	0.03 b
APOLLO	236.5	0.00 c	0.01 c	0.00 b	0.00 b
MANA	192.0	0.00 c	0.00 c	0.00 b	0.00 b
AGRIMEK	14.2	0.00 c	0.00 c	0.00 b	0.00 b
			16 July		
Dim. control[b]		0.75 b	0.48 b	1.87 a	4.27 a
Control		2.12 a	2.83 a	0.10 c	0.07 b
APOLLO[a]	150.0	0.15 cd	0.01 c	0.03 c	0.03 b
APOLLO	150.0	0.01 cd	0.01 c	0.57 b	0.43 b
APOLLO	193.5	0.01 cd	0.02 c	0.07 c	0.07 b
APOLLO	236.5	0.33 c	0.26 c	0.03 c	0.13 b
MANA	192.0	0.06 cd	0.01 c	0.27 bc	0.33 b
AGRIMEK	14.2	0.00 d	0.01 c	0.00 c	0.00 b

a This was the only miticide application 29 May. All others were 5 June 2001.

b These were the only trees not treated with dimethoate 1 June 2001.

2001 PMRR REPORT # 3 **SECTION A: FRUIT- Insect/mite Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), Two-spotted spider mite (TSSM) *Tetranychus urticae* (Koch)
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: EFFICACY OF A NOVEL SUMMER MITICIDE AGAINST TWO-SPOTTED SPIDER MITES AND EUROPEAN RED MITES ON APPLE IN 2001

MATERIALS: ACRAMITE 50WP (bifenazate), PYRAMITE 75WP (pyridaben)

METHODS: The trial was done in an 11 yr-old orchard of McIntosh apple trees planted at a spacing of 7 x 5.5 m and a density of 260 trees/ ha at an experimental orchard at Sheffield Mills, Nova Scotia. The control and the 4 treatments were arranged in a randomized complete block design with each treatment replicated 4 times. The eastern 2 rows of the orchard were split into northern and southern halves giving a total of 4 blocks. Pesticides were diluted to a rate comparable to 600 litres/ha. and were applied by a backpack mounted mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany). Each 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. Samples of 50 leaves per tree, totalling 200 leaves per treatment, were taken on the dates shown below and passed through a mite-brushing machine. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the glass collecting plate. The pre-count of 9 August was taken a few hours before the treatments were applied. Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves.

RESULTS: Data are shown in Table 1. There was no sign of phytotoxicity.

CONCLUSIONS: Pretreatment counts 9 August indicated damaging numbers of TSSM and ERM in all plots (Table 1). Densities of motile stages of ERM in the control plots peaked at 33 mites per leaf 13 August and remained ≥ 14 per leaf until the final sampling date of 19 September. The lower numbers on this date were likely due to predation by *T. pyri* combined with large proportion of ERM females producing winter eggs. Densities of eggs and motile stages of ERM in all treated plots were significantly lower than in the controls for all dates from 13 August to 6 September. In the control plots motile TSSM increased from 2 per leaf on 9 August to 18 per leaf by 20 August remaining > 10 per leaf until 6 September. Densities of TSSM in all treated plots were less than those in the control from 13 August- 19 September, although contrasts were not significant due to large tree-to-tree variations within a treatment. Survival of the predator *T. pyri* was good in all of the treated plots indicating that both rates of ACRAMITE and the relatively low rate of PYRAMITE were effective in controlling ERM and TSSM while conserving a valuable biocontrol agent..

Table 1. Densities of eggs (ERME, TSSME and TPE) for European red mite, two-spotted spider mite and *Typhlodromus pyri*, respectively, as well as motile stages (ERM),(TSSM) and TPM of the same species. 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 square root transformation of the data (*P* = 0.05).

Treatment	Rate g a.i/ha	ERME	ERM	TSSME	TSSM	TPE	TPM
				9 August pretreatment			
Control		34.60 a	9.00 a	4.20 b	2.00 a	0.00 a	0.41 a
ACRAMITE	280.0	17.80 a	19.00 a	18.40 a	9.20 a	0.53 a	0.51 a
ACRAMITE	420.0	34.00 a	11.00 a	5.00 b	3.00 a	0.06 a	0.36 a
PYRAMITE	112.5	19.80 a	31.00 a	4.00 b	8.40 a	0.64 a	1.03 a
				13 August 4 days			
Control		28.66 a	33.41 a	11.83 a	5.93 a	1.05 a	2.59 a
ACRAMITE	280.0	6.20 b	3.40 b	3.60 a	1.00 a	0.06 a	0.21 b
ACRAMITE	420.0	9.05 b	5.70 b	1.60 a	0.20 a	0.55 a	0.71 ab
PYRAMITE	112.5	4.00 b	7.20 b	3.20 a	5.40 a	1.10 a	0.72 ab
				20 August 11 days			
Control		10.60 a	18.60 a	15.60 a	18.20 a	1.28 a	2.11 a
ACRAMITE	280.0	2.04 b	5.63 b	1.83 a	5.22 ab	0.88 ab	1.79 a
ACRAMITE	420.0	1.20 b	3.40 b	0.20 a	1.60 ab	0.29 b	0.77 a
PYRAMITE	112.5	29.22 a	4.97 b	4.52 a	0.20 b	0.30 b	0.96 a
				28 August 19 days			
Control		15.00 a	16.20 a	8.40 a	20.80 a	3.01 a	4.69 a
ACRAMITE	280.0	2.00 a	2.80 b	0.00 a	0.40 a	0.06 b	1.65 ab
ACRAMITE	420.0	1.20 b	0.40 b	0.00 a	0.20 a	0.18 b	0.93 ab
PYRAMITE	112.5	10.20 a	3.20 b	4.20 a	1.60 a	0.06b	0.51b
				6 September 28 days			
Control		6.93 a	14.40 a	9.87 a	13.87 a	4.09 a	2.33 a
ACRAMITE	280.0	1.00 b	0.20 b	0.40 a	0.00 a	0.18 b	1.18 a
ACRAMITE	420.0	0.81 b	0.00 b	0.00 a	0.00 a	0.07 b	1.56 a
PYRAMITE	112.5	3.20 a	0.40 b	3.00 a	1.20 a	0.29 b	0.88 a
				19 September 41 days			
Control		0.81 a	1.32 a	0.10 a	2.14 a	0.24 a	3.97 a
ACRAMITE	280.0	0.00 a	0.20 a	0.00 a	0.00 a	0.00 b	0.21 b
ACRAMITE	420.0	0.50 a	0.10 a	0.00 a	0.00 a	0.06 ab	1.16 b
PYRAMITE	112.5	2.19 a	0.00 a	0.20 a	0.10 a	0.03 ab	0.73 b

2001 PMR REPORT # 4 **SECTION A: FRUIT- Insect Pests**
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 (thiocloprid), 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 at an experimental orchard near Kentville, Nova Scotia. Treatments were arranged in randomized complete block design with four blocks of sixteen trees, spanning 2 rows of the orchard. Each block of sixteen trees included guard trees that were next to each of the 8 treated or control trees to minimize the effects of spray drift. Pesticides were diluted to a rate comparable to 600 L/ha and were applied by a backpack mounted, gasoline powered, mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany). Each 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. All treatments were applied on 26 July 2001, except for an additional application of SUCCESS 480 SC made for for the SUCCESS X 2 treatment on 6 August. On 18 September, 100 fruit were collected from each tree and assessed for AM injury.

RESULTS: Data are shown in Table 1. There were no signs of phytotoxicity in the treated plots.

CONCLUSIONS: Trees treated with ADMIRE, CALYPSO and GUTHION had significantly fewer maggot-infested apples than the control trees (Table 1). The lowest rate of infestation was associated with the highest rate of CALYPSO.

Table 1. Percent fruit damaged by apple maggot larvae (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	Percent damage
Control		4.30 ab
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

2001 PMR REPORT # 5 **SECTION A: FRUIT- Insect Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: Codling Moth (CM), *Cydia pomonella* (Linnaeus)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST CODLING MOTH ON APPLE IN 2001

MATERIALS: CONFIRM 240 F (tebufenozide), GUTHION 50 WP (azinphos-methyl), RIMON 7.5 WDG (novaluron)

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 randomized complete block design with four blocks of sixteen trees, spanning 8 rows of the orchard. There were four single-tree plots per treatment. The sixteen-tree blocks included guard trees that surrounded each of the six treated or control 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 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. The biofix was the first capture of male *C. pomonella* in pheromone traps. The first application of RIMON was made on 20 June (150 DD after biofix) followed by a second application on 2 July. CONFIRM was applied on 20 June (150 DD after biofix) and GUTHION was applied on 28 June (250 DD after biofix). On 17 September, fruit injury was assessed when 100 fruit collected from each tree as well as all dropped fruit were examined for CM deep larval entries or superficial injury.

RESULTS: Data are shown in Tables 1 and 2.

CONCLUSIONS: All treatments had fewer apples on the tree with deep entries or superficial wounds than were found on the control trees, but tree-to-tree variations within a treatment prevented nearly all of these contrasts from being significant (Table 1). Only the 225 g of the chitin-synthesis inhibitor RIMON had fewer apples with deep larval entries than the control. When deep entries and superficial wounds were combined ("total wounds"), both the trees treated with 150 and 225 g RIMON and those treated with GUTHION had a significantly lower percentage of damaged apples than did the control. The mean number of dropped fruit per tree varied from 19 with GUTHION to 57 with the control (Table 2). Dropped apples had much higher levels of damage than did those on the tree. Although percentages of injured apples were usually lower for treated trees, there were no significant differences between the control and any of the treatments because of large tree-to-tree variations within a treatment.

Table 1. Percent fruit damage for apples remaining on the tree (100 apples 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	Deep entries	Superficial wounds	Total wounds
Control	-	3.75 a	2.50 a	6.25 a
RIMON 7.5 WDG	150	1.25 ab	1.25 a	2.50 bcd
RIMON 7.5 WDG	225	0.25 b	0.25 a	0.50 d
RIMON 7.5 WDG	300	1.75 ab	2.75 a	4.50 abc
CONFIRM 240 F	240	2.00 ab	2.75 a	4.75 ab
GUTHION 50 WP	1000	1.25 ab	0.50 a	1.75 cd

Table 2. Total number of dropped fruit and percent CM damage for that fruit. 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	Dropped fruit	Deep entries	Superficial wounds	Total wounds
Control	-	57.25a	46.69 a	3.71 a	50.40 a
RIMON 7.5 WDG	150	52.25a	17.46 a	1.20 a	18.66 a
RIMON 7.5 WDG	225	35.50a	16.81 a	0.00 a	16.81 a
RIMON 7.5 WDG	300	43.50a	15.59 a	1.47 a	17.06 a
CONFIRM 240 F	240	36.75a	26.80 a	1.32 a	28.12 a
GUTHION 50 WP	1000	19.00a	33.04 a	2.78 a	35.81 a

2001 PMR REPORT # 6 **SECTION A: FRUIT- Insect/mite Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), two spotted spider mite (TSSM) *Tetranychus urticae* (Koch)
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: EFFICACY OF MITICIDES AGAINST THE EUROPEAN RED MITE ON APPLE IN 1998

MATERIALS: PYRAMITE 75 WP (pyridaben), ENVIDOR 30 WG (spirodiclofen)

METHODS: The trial was conducted in a commercial apple orchard block located in Upper Canard, Nova Scotia on 2 yr-old McIntosh apple trees planted at a spacing of 4.3 x 1.5 m on M9 rootstock. The three miticide treatments were applied 6 August 1998 to the appropriate set of 5 single-tree plots (Table 1). Five single-tree plots at the southern end of the block served as an untreated control. All other treated zones were further north. Application of miticides was by a backpack gasoline-powered mist blower at an output setting of 3.36L/min. Pesticides were diluted to a rate comparable to 600 litres/ha. Samples of 20 leaves from each of five trees per treatment were taken on the dates shown below and passed through a mite-brushing machine. Treatments were separated within the row by two unsprayed guard trees. A precount sample was taken on 6 August 1998 immediately prior to treatment. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 10 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *P. ulmi* were from 1/16th of the plate.

RESULTS: Data are shown in Table 1. No phytotoxic effects were seen in any plots.

CONCLUSIONS: Mite counts were similar in all plots before treatment. Densities of ERM motiles were < 1 per leaf in all plots 7 days after treatment. Densities of motile ERM in treated plots were less than the control for samples taken 14, 22, and 28 days after treatment. Densities of ERM eggs were less than the control from day 7 onwards for the trees sprayed with the higher rate of ENVIDOR. With other treatments significant reductions first appeared 22 days after treatment and remained for the rest of the season. TSSM counts were low (< 0.5 per leaf) throughout the season in all treated plots. In the control counts were likewise low except for the 13th August when motile stages reached 4 per leaf. *T.pyri* counts which were initially quite high in the pre-count, were significantly affected by the treatments seven days after application and for the remainder of the season. There was no significant difference with the ERM, TSSM or TP counts between the high and low rate of ENVIDOR with the low rate providing the same high degree of control.

Table 1. Densities of eggs and active stages of European red mite (ERM), of two spotted spider mite (TSSM), and *T. pyri* (TP). 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 square root transformation of the data ($P = 0.05$).

Treatment	Rate g [AI]/ha	ERME	ERM	TSSME	TSSM	TPE	TP
			6 Aug.	Pretreatment			
Control		5.00a	4.00a	0.20a	0.00a	0.64ab	1.49a
ENVIDOR	240	7.13a	2.65a	0.00a	0.42a	0.41ab	1.19a
ENVIDOR	180	13.00a	4.40a	0.00a	0.00a	0.23b	1.03a
PYRAMITE	225	13.00a	5.00a	0.00a	0.00a	0.75a	1.54a
			13 Aug.	7 days			
Control		9.60ab	0.40a	3.00a	4.00a	0.41a	0.72a
ENVIDOR	240	1.36b	0.00a	0.00b	0.00a	0.05ab	0.22ab
ENVIDOR	180	11.40a	0.60a	0.00b	0.00a	0.06ab	0.15b
PYRAMITE	225	2.60ab	0.60a	0.00b	0.00a	0.00b	0.05b
			20 Aug.	14 days			
Control		9.79a	6.23a	0.20a	0.20a	0.66a	1.78a
ENVIDOR	240	1.00b	0.00b	0.00a	0.00a	0.06b	0.21b
ENVIDOR	180	1.43ab	0.20b	0.00a	0.00a	0.00b	0.21b
PYRAMITE	225	2.82ab	0.00b	0.21a	0.21a	0.00b	0.00b
			28 Aug.	22 days			
Control		8.40a	2.20a	0.00b	0.00a	0.41a	1.08a
ENVIDOR	240	0.20b	0.00b	0.00b	0.40a	0.00b	0.05b
ENVIDOR	180	0.40b	0.40b	0.20ab	0.00a	0.00b	0.15b
PYRAMITE	225	2.40b	0.00b	0.60a	0.00a	0.00b	0.00b
			3 Sept.	28 days			
Control		4.61a	2.60a	0.40a	0.00a	0.29a	1.24a
ENVIDOR	240	0.00b	0.00b	0.00a	0.00a	0.00b	0.00b
ENVIDOR	180	0.00b	0.00b	0.42a	0.41a	0.00b	0.00b
PYRAMITE	225	0.80b	0.00b	0.20a	0.00a	0.06b	0.05b
			8 Sept.	33 days			
Control		5.63a	0.63a	0.00a	0.00a	0.06a	1.44a
ENVIDOR	240	0.20b	0.00a	0.40a	0.00a	0.00a	0.00b
ENVIDOR	180	0.00b	0.00a	0.00a	0.00a	0.00a	0.15b
PYRAMITE	225	0.00b	0.00a	0.39a	0.20	0.00a	0.05b
			14 Sept.	39 days			
Control		2.00a	1.20a	0.00a	0.00a	0.12a	1.08a
ENVIDOR	240	0.00b	0.00a	0.00a	0.00a	0.00a	0.05b
ENVIDOR	180	0.20b	0.00a	0.00a	0.00a	0.00a	0.05b
PYRAMITE	225	0.40b	0.00a	0.20a	0.00a	0.00a	0.00b

2001 PMR REPORT # 7 **SECTION A: FRUIT- Insect/mite Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), two spotted spider mite (TSSM) *Tetranychus urticae* (Koch)
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: EFFICACY OF MITICIDES AGAINST THE TWO SPOTTED SPIDER MITE ON APPLE IN 1998

MATERIALS: APOLLO 500 SC (clofentezine), PYRAMITE 75 WP (pyridaben), ENVIDOR 30 WG (spirodiclofen)

METHODS: The trial was conducted in a commercial apple orchard located in Upper Canard, Nova Scotia. on a nursery block of apple trees planted in 1996 at a spacing of 4.3 x 1.5 m. Each of the four miticide treatments were applied by a backpack portable gasoline-powered mist blower set for an output rate of 3.36 L/min on 19 August, 1998. Treatments were applied to sets of 5 single-tree plots per treatment in a single a row running north-south (Table 1). Two guard trees separated trees given a particular treatment from trees given another treatment. Five trees at the southern end of the plot served as an untreated control. All other treated zones were further north. Pesticides were diluted to a rate comparable to 600 litres/ha. Samples of 20 leaves from each of the five trees in each treated plot were taken on the dates shown below and passed through a mite-brushing machine. The count of 17 August, 1998 was taken 2 days before treatments were applied. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 10 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the plate. Older trees adjacent to the treated row had been inoculated with pyrethroid/organophosphate resistant *T. pyri* (the New Zealand strain) in the late summer of 1996.

RESULTS: Data are shown in Table 1. No phytotoxic effects were seen in any plots.

CONCLUSIONS: Pretreatment counts 19 August indicated damaging numbers of two-spotted spider mites, TSSM, (38- 54 motiles per leaf) and the presence of *T. pyri*, (up tp 0.41 motiles per leaf) along with a low density of European red mites in the control plot but damaging densities (> 5 motiles per leaf) in all other plots. After treatment, there were significantly fewer TSSM motiles in the treated plots than in the control. For all treatments it took over 7 days for densities of motile TSSM to decrease to < 5 per leaf. Thereafter all treatments gave excellent control for the full 26 day duration of the trial. *T. pyri* counts showed no significant variations among the different treatments and remained low (< 0.3 per leaf) throughout the trial.

Table 1. Densities of eggs of European red mite (ERM), two spotted spider mite (TSSM) and *T. pyri* (TP). 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 square root transformation of the data ($P > 0.05$).

Treatment	Rate g (AI)/ha	ERME	ERM	TSSME	TSSM	TPE	TP
			17 Aug.	precount			
Control		3.20c	1.40b	60.20ab	40.20a	0.06a	0.00a
APOLLO	150	14.20b	6.80ab	57.00b	37.60a	0.06a	0.10a
ENVIDOR	240	31.6a	19.60a	97.40a	50.60a	0.52a	0.05a
ENVIDOR	180	14.28b	11.67a	65.08ab	49.80a	0.06a	0.10a
PYRAMITE	225	18.73ab	9.00ab	87.60ab	53.87a	0.23a	0.41a
			26 Aug.	7 days			
Control		3.00b	4.80a	180.60a	126.40a	0.00a	0.00a
APOLLO	150	3.60b	3.40ab	72.40b	19.80b	0.00a	0.10a
ENVIDOR	240	8.29ab	1.21ab	32.52b	15.46b	0.00a	0.00a
ENVIDOR	180	5.07b	0.60b	36.73b	13.78b	0.00a	0.00a
PYRAMITE	225	12.80a	0.80b	41.80b	8.40b	0.00a	0.15a
			3 Sept.	15 days			
Control		2.48b	0.78a	30.72a	60.37a	0.22a	0.10a
APOLLO	150	3.98b	0.38a	29.51a	1.76b	0.05a	0.05a
ENVIDOR	240	2.89b	0.00a	2.49b	1.65b	0.00a	0.00a
ENVIDOR	180	1.78b	0.57a	2.79b	2.15b	0.00a	0.00a
PYRAMITE	225	9.11a	0.00a	7.04b	1.00b	0.00a	0.00a
			9 Sept.	21 days			
Control		2.40b	1.20a	25.80a	45.80a	0.00a	0.20a
APOLLO	150	3.60b	0.00b	22.20a	1.20b	0.06a	0.16a
ENVIDOR	240	0.86b	0.20ab	1.28b	0.00b	0.00a	0.00a
ENVIDOR	180	3.40b	0.00b	0.60b	0.60b	0.00a	0.00a
PYRAMITE	225	10.00a	0.00b	5.20b	0.60b	0.00a	0.00a
			14 Sept.	26 days			
Control		1.02b	0.00a	6.05a	43.39a	0.00a	0.10a
APOLLO	150	2.40ab	0.00a	7.80a	0.40b	0.00a	0.10a
ENVIDOR	240	1.40b	0.00a	0.80b	0.60b	0.00a	0.00a
ENVIDOR	180	1.80ab	0.00a	0.20b	0.00b	0.00a	0.00a
PYRAMITE	225	4.40a	0.00a	5.40a	2.40b	0.00a	0.00a

2001 PMR REPORT # 8 **SECTION A: FRUIT- Insect/mite Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), two-spotted spider mite (TSSM) *Tetranychus urticae* (Koch), apple rust mite *Aculus schlechtendali* (Nalepa)

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TITLE: EFFICACY OF A NOVEL MITICIDE AGAINST TWO SPOTTED SPIDER MITE, EUROPEAN RED MITE AND APPLE RUST MITE ON APPLE IN 1999

MATERIALS: CARZOL 92 SP (formetanate), KELTHANE 35 WP (dicofol), PYRAMITE 75 WP (pyridaben), ENVIDOR 240 SC (spirodiclofen)

METHODS: The trial was conducted in a 2.06 ha, 13 yr-old commercial apple orchard located near Kingston, Nova Scotia. Trees were planted at a spacing of 3.7 x 5.5 m. Each treatment and the control comprised 6 single-tree plots, where 3 of the trees were located in the eastern three rows and 3 located in the western three rows of the 18 row orchard. Pesticides were diluted to a rate comparable to 3000 litres/ha. and were applied to runoff by a truck-mounted sprayer set at 2800 kPa pressure through a 2.5 mm orifice nozzle. Samples of 20 leaves per tree, totalling 120 leaves per treatment, were taken on the dates shown below and passed through a mite-brushing machine. Counts for *A. schlechtendali T. urticae* and *P. ulmi* were from 1/16th of the glass collecting plate. The precount was taken just before treatments were applied on 28 July, 1999.

RESULTS: Data are shown in Table 1. No phytotoxic effects were seen in any plots.

CONCLUSIONS: The economic thresholds for two-spotted spider mites and European red mite are 5 motile stages per leaf whereas the threshold for apple rust mite is 300 per leaf. Pretreatment counts 28 July indicated damaging numbers of TSSM and ERM but densities of apple rust mite were well below threshold. There were no significant variations among the different plots before miticide treatments. Six days after treatment, ERM counts were found to be significantly lower than the control in all treated plots except for the high rate of ENVIDOR. TSSM numbers were highest in the control with only the high rate of ENVIDOR showing no significant difference from the control. By the fifteenth day after treatment, both ERM and TSSM numbers differed significantly from the control with lowest ERM numbers found for the low rate of ENVIDOR and the lowest TSSM numbers for CARZOL. In subsequent dates densities of ERM and TSSM on control trees also decreased probably because crowding and damage to the leaves (which were bronzed by this time) tended to increase mortality and reduce reproductive rates of the mites. This decline blurred contrasts between treated and untreated trees. Also heavy rainfall (8.4 cm) 14-15 August likely washed off mites and possibly reduced miticide residues. On the final date, 30 August, there was a minor resurgence of apple rust mite on the control trees but not on those treated with ENVIDOR suggesting this miticide was also toxic to rust mites.

Table 1. Densities of eggs and active stages of European red mite (ERM), two spotted spider mite (TSSM) and apple rust mite(ARM). 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 square root transformation of the data ($P = 0.05$).

Treatment	Rate g [a.i.]/ha	ERME	ERM	TSSME	TSSM	ARM
			28 July	Precount		
Control		51.65a	4.68a	69.70b	22.26a	8.24a
CARZOL	1012	67.45a	7.49a	100.83ab	36.14a	0.00a
ENVIDOR	240	56.33a	12.45a	61.00b	24.89a	3.78a
KELTHANE	1575	60.62a	4.49a	143.32ab	38.61a	3.16a
ENVIDOR	180	35.44a	5.22a	151.22a	47.33a	1.00a
PYRAMITE	225	44.00a	6.00a	87.67ab	24.00a	0.67a
			3 August	6 Days		
Control		32.67a	19.00a	81.00a	56.33a	8.50a
CARZOL	1012	17.37ab	3.30b	24.07c	5.21d	0.70b
ENVIDOR	240	15.33ab	12.50a	62.33ab	46.50ab	0.67b
KELTHANE	1575	9.76b	1.86b	35.54bc	22.37c	1.67b
ENVIDOR	180	8.09b	1.33b	52.28abc	13.94cd	3.50b
PYRAMITE	225	8.50b	1.33b	59.17ab	30.67bc	2.17b
			12 August	15 Days		
Control		24.30a	11.99a	41.54a	64.47a	5.00a
CARZOL	1012	6.72b	4.68b	2.51c	1.84d	2.83a
ENVIDOR	240	5.84bc	4.86b	19.26b	15.73bc	1.50a
KELTHANE	1575	6.71b	2.52bc	15.45b	8.82c	3.22a
ENVIDOR	180	1.33c	0.50c	18.33b	12.33c	1.00a
PYRAMITE	225	2.36bc	1.00c	34.55ab	28.26b	1.73a
			17 August	20 Days		
Control		10.00ab	6.67a	17.50ab	17.50a	1.17a
CARZOL	1012	16.47a	3.02b	5.90c	6.08ab	0.17a
ENVIDOR	240	1.67	2.00bc	5.96c	7.23ab	0.52a
KELTHANE	1575	7.00b	1.33cd	9.17bc	5.67b	0.50a
ENVIDOR	180	0.67d	0.50de	9.67bc	9.67ab	0.83
PYRAMITE	225	4.33bc	0.00e	26.00a	13.00ab	0.50a
			30 August	33 Days		
Control		4.34a	2.00b	4.46b	7.52a	10.87a
CARZOL	1012	3.35a	3.54a	7.49ab	2.89a	1.00b
ENVIDOR	240	1.03b	0.00c	4.04b	6.27a	0.17b
KELTHANE	1575	3.67a	2.67ab	5.17b	3.50a	0.33b
ENVIDOR	180	0.00b	0.00c	3.17b	3.00a	0.17b
PYRAMITE	225	0.67b	0.33c	14.49a	6.00a	0.48b

2001 PMR REPORT # 9 **SECTION A: FRUIT- Insect/mite Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. Red Delicious
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch)
PREDATOR: *Typhlodromus pyri* Scheuten

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TITLE: COMPATIBILITY OF ENVIDOR WITH BIOLOGICAL CONTROL OF EUROPEAN RED MITE ON APPLE IN 2000

MATERIALS: KELTHANE 35 WP (dicofol), PYRAMITE 75 WP (pyridaben), ENVIDOR 240 SC (spirodiclofen)

METHODS: The trial was conducted in a 0.6 ha orchard block located in Sheffield Mills, Nova Scotia on 38 yr old cv. "Red Delicious" apple trees planted at a spacing of 4.6 x 7.9 m, which had been cut 3 years previously to a height of 1.5 m. By the time of this trial the trees were covered with a dense growth of water sprouts and some trees reached a height of 3.5 m. Each of the five miticide treatments and a water-sprayed control were applied to runoff by truck-mounted sprayer set at 2000 kPa pressure through a 2.5 mm orifice nozzle on 28 July 2000. There were 4 single-tree plots per treatment plus 5 control trees. There were also guard trees between trees given different treatments. Pesticides were diluted to a rate comparable to 3000 litres/ha. Samples of 20 leaves per single-tree plot were taken on the dates shown below and passed through a mite-brushing machine. The count of 28 July was taken just before treatments were applied. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 10 leaves). Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Counts for *P. ulmi* were from 1/16th of the plate.

RESULTS: Data are shown in Table 1. No phytotoxic effects were seen in any plots.

CONCLUSIONS: Pretreatment counts 28 July indicated mite densities did not vary significantly among the different plots. Throughout the trial period, European red mites in all plots were strongly suppressed by the predator mite, *T. pyri*. On 8 August, 11 days after treatment, there were no *T. pyri* detected on leaves taken from the KELTHANE plots, but all of the rest of the plots had detectable *T. pyri*. On the next sampling date, 17 days after treatment, predator densities were similar in all treated plots and the control. However, on the 22nd of August, 25 days after treatment, predator densities were lower than the control in all treated plots. By the final two dates, 31 and 41 days after treatment, *T. pyri* densities in treated plots were no longer less than those in the control. Because trees were widely spaced within rows--foliage of adjacent trees was separated by ~4 metres-- and because *T. pyri* is known to be a slow disperser, we conclude that predator recovery after treatment was more due to population growth of survivors on the treated trees than due to immigration from untreated trees. All miticides tested caused some predator suppression but all allowed sufficient *T. pyri* survival to permit continued biological control of European red mites.

Table 1. Densities of eggs and active stages of European red mite (ERM) and of *Typhlodromus pyri* (TP). For each column on a given date, means followed by the same letter are not significantly different according to the Waller Duncan *k* ratio *t* test after square root transformation of the data ($P > 0.05$).

Treatment	Rate g a.i./ha	ERME	ERM	TPE	TP	ERME	ERM	TPE	TP
		28 July		0 days		8 Aug.		11 days	
Control		0.20a	0.00a	0.29a	0.67a	1.80a	0.20a	0.00a	0.21ab
KELTHANE	1575	0.25a	0.00a	0.15a	0.38a	0.00a	0.00a	0.00a	0.00b
PYRAMITE	225	0.00a	0.00a	0.58a	0.64a	0.00a	0.00a	0.22a	0.20ab
ENVIDOR	120	0.00a	0.00a	0.44a	1.10a	0.00a	0.00a	0.00a	0.32ab
ENVIDOR	180	0.25a	0.00a	0.21a	0.44a	0.00a	0.00a	0.00a	0.26ab
ENVIDOR	240	0.25a	0.00a	0.37a	0.85a	0.25a	0.25a	0.00a	0.64a
		14 Aug.		17 days		22 Aug.		25 days	
Control		1.60a	0.80a	0.17a	0.26a	0.80a	0.60a	0.52a	0.93a
KELTHANE	1575	0.00a	0.00a	0.00a	0.13a	0.00a	0.00a	0.00a	0.00b
PYRAMITE	225	0.00a	0.00a	0.22a	0.52a	0.00a	0.00a	0.07a	0.13b
ENVIDOR	120	0.00a	0.25a	0.00a	0.39a	0.00a	0.00a	0.07a	0.19b
ENVIDOR	180	0.00a	0.00a	0.15a	0.26a	0.00a	0.00a	0.07a	0.07b
ENVIDOR	240	0.25a	0.00a	0.07a	0.32a	2.75a	3.50a	0.00a	0.00b
		28 Aug.		31 days		7 Sept.		41 days	
Control		1.40a	1.80a	0.00a	0.41a	1.00a	3.40a	0.12a	1.42a
KELTHANE	1575	0.00a	0.00a	0.00a	0.07a	0.00a	0.00a	0.00a	0.38a
PYRAMITE	225	0.00a	0.00a	0.07a	0.64a	0.00a	0.00a	0.23a	1.13a
ENVIDOR	120	0.00a	0.00a	0.00a	0.65a	0.00a	0.00a	0.29a	0.26a
ENVIDOR	180	0.00a	0.00a	0.07a	0.19a	0.00a	0.00a	0.29a	0.51a
ENVIDOR	240	0.00a	0.00a	0.00a	0.19a	0.00a	0.00a	0.07a	0.71a

2001 PMR REPORT # 10 **SECTION A: FRUIT- Insect/mite Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Apple, cv. McIntosh
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), two-spotted spider mite (TSSM) *Tetranychus urticae* (Koch)
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: EFFICACY OF A NOVEL SUMMER MITICIDE AGAINST TWO SPOTTED SPIDER MITES AND EUROPEAN RED MITES ON APPLE IN 2000

MATERIALS: CARZOL 92 SP (formetanate), KELTHANE 35 WP (dicofol), PYRAMITE 75 WP (pyridaben), ENVIDOR 240 SC (spirodiclofen)

METHODS: The trial was conducted in a 2.06 ha, 13 yr-old commercial apple orchard located near Kingston, Nova Scotia. Trees were planted at a spacing of 3.7 x 5.5 m. Each treatment and the water-sprayed control comprised 6 single tree plots located in the eastern three rows (numbers 16, 17 and 18) of the 18 row orchard. Pesticides were diluted to a rate comparable to 3000 litres/ha and were applied to runoff by a truck-mounted sprayer set at 2200 kPa pressure through a 2.5 mm orifice nozzle. Samples of 20 leaves per tree, totalling 120 leaves per treatment, were taken on the dates shown below and passed through a mite-brushing machine. Counts for *T. urticae* and *P. ulmi* were from 1/16th of the glass collecting plate. The precount of 31 July was taken 2 days before all treatments except PYRAMITE. Most treatments were applied on 2 August, 2000 but the PYRAMITE application was 9 August 2000 due to temporary breakdown of spray equipment. Plate counts of *T. pyri* motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves. Five trees in each of rows 5, 6 and 7 were each inoculated with at least 20 pyrethroid/organophosphate resistant *T. pyri* (the New Zealand strain) on 21 July 2000. To monitor immigration of two-spotted spider mites into trees we placed masking tape covered with Tangletrap on 6 trees in the orchard. Bands were removed and replaced and mites on bands were counted in the lab every 2 weeks from 3 August to 29 August.

RESULTS: Precount data are shown in Table 1. Least squares treatment means for the post spray period are shown in Table 2.

CONCLUSIONS: The economic thresholds for two-spotted spider mites and European red mite are a combined totals (both species) of 5 motile stages per leaf. Pretreatment counts 31 July indicated combined counts of active stages of TSSM, and ERM were close to or above threshold in most plots (Table 1). Because treatment means varied significantly in the precount, we used analysis of covariance with treatment as a factor and precount as a covariate to analyze all data from 8 August to 5 September. Hence Table 2 shows least squares treatment means where each mean has been adjusted to even out any effects of precount density. Mean counts of motile ERM in all plots, including the control, were < 3 per leaf for the full 34 day period after treatment. It is likely that severe competition from TSSM helped suppress ERM. Within 6 days after treatment, counts of motile TSSM were significantly less than the

control in the CARZOL plots. By 14 August, 3 days after the PYRAMITE application and 12 days after the other sprays, there were also statistically significant TSSM reductions in two of the three ENVIDOR treatments and in the PYRAMITE plots. Thereafter all treated plots had significantly fewer motile TSSM than the water treated control until the trial ended 5 September, 34 days after treatment. Counts of the predator mite *T. pyri* were < 0.1 per leaf and occurrences were sporadic until 5 September when mean densities ranged from 0.04 per leaf in the CARZOL plots and one set of the ENVIDOR plots to a high of 0.26 per leaf in the control plots and another set of the ENVIDOR plots. These populations, however, were too low through most of the trial to suppress TSSM. Mean counts of TSSM on sticky bands affixed to tree trunks were 3602 and 542 for the intervals from 3-16 August and 17-29 August respectively, indicating over 4000 TSSM climbed up each tree in the month of August. Thus miticides applied to the trees not only had to control all mites on the foliage but also several thousand immigrants climbing up each tree. This trial was thus a rigorous test of residual control of TSSM.

Table 1. Precount of European red mite eggs (ERME) and active stages (ERM) and corresponding stages (TSSME, TSSM) of two-spotted spider mites taken 31 July 2000. Means within a column followed by the same letter were not different at $P = 0.05$ according to the Waller-Duncan k ratio t test after square root transformation of the data.

Treatment	Rate g a.i./ha	ERME	ERM	TSSME	TSSM
			31 July	precount	
Control		3.29b	0.50b	7.48a	2.54b
KELTHANE	1575	1.62b	1.39b	5.56a	6.41a
CARZOL	1012	13.60a	7.96a	3.65a	2.48b
ENVIDOR	120	3.17b	1.80b	6.47a	3.67a
ENVIDOR	180	2.63b	2.44b	14.71a	8.95a
ENVIDOR	240	11.57a	9.24a	12.07a	4.21a
PYRAMITE	225	16.74a	7.64a	17.09a	10.29a

Table 2. Least squares means for mite densities where treatment means are corrected for the precount taken 31 July 2000. Means are eggs and active stages of European red mite(ERM) and two spotted spider mite (TSSM). For a given column and a given date, least squares means followed by the same letter are not significantly different according to *t* tests after square root transformation of the data ($P = 0.05$). PYRAMITE was applied 9 August, 7 days after the other treatments.

Treatment	Rate g a.i./ha	ERME	ERM	TSSME	TSSM	ERME	ERM	TSSME	TSSM
			8 Aug.	6 days			14 Aug.	12 days	
Control		8.53ab	0.94ab	12.94a	4.94a	8.72a	2.40ab	27.46a	11.33a
KELTHANE	1575	2.96bc	0.45b	10.78a	1.91ab	2.35b	0.74ab	9.42bc	2.18b
CARZOL	1012	11.15a	0.17b	2.68b	0.74b	8.06ab	2.28a	2.95c	2.37b
ENVIDOR	120	0.53c	0.43b	13.19a	2.77ab	3.66ab	0.39ab	16.96b	2.99b
ENVIDOR	180	2.21c	0.09b	13.92a	4.62a	1.48b	0.39ab	10.58bc	8.47a
ENVIDOR	240	2.31c	0.86ab	4.38ab	2.60ab	7.01ab	0.62ab	9.28bc	2.84b
PYRAMITE	225	10.32a	3.04ab	12.58a	5.06a	4.93ab	0.10b	12.17bc	1.35b
			22 Aug.	20 days			28 Aug.	26 days	
Control		1.79ab	2.85a	28.38a	23.31a	4.61a	2.75a	23.81a	24.17a
KELTHANE	1575	0.65bc	0.34bc	6.68c	1.81d	1.51b	1.53ab	9.86bc	3.21bc
CARZOL	1012	1.84abc	2.61a	3.02c	3.32cd	6.87a	0.42ab	5.50c	2.10c
ENVIDOR	120	0.58c	0.37bc	16.74ab	7.10bc	0.04b	1.04ab	8.16b	6.28b
ENVIDOR	180	0.40c	0.00c	8.61bc	5.02cd	0.05b	0.84ab	15.11ab	5.30bc
ENVIDOR	240	1.24bc	1.19abc	7.94c	4.66cd	0.85b	0.00b	5.12c	1.62c
PYRAMITE	225	2.95a	1.63ab	13.21b	9.67b	1.54b	1.23ab	10.91bc	4.35bc
			5 Sept.	34 days					
Control		4.95a	2.27a	51.49a	55.78a				
KELTHANE	1575	1.74b	0.72b	12.84b	3.38b				
CARZOL	1012	7.76a	2.28a	12.87b	5.50b				
ENVIDOR	120	0.00c	0.38b	9.84b	9.31b				
ENVIDOR	180	0.00c	0.22b	9.66b	5.26b				
ENVIDOR	240	0.62c	0.00b	4.06b	3.99b				
PYRAMITE	225	0.90bc	0.00b	13.44b	8.28b				

2001 PMR REPORT # 11 **SECTION A: FRUIT - Insects/mite Pests**

CROP: Apples cv. Red Delicious
PEST: European red mite, *Panonychus ulmi* (Koch)

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TITLE: MANAGEMENT OF EUROPEAN RED MITE ON APPLE WITH ACARICIDES, 2001

MATERIALS: APOLLO SC (clofentezine), MANA-300, CARZOL (formetanate hydrochloride)

METHODS: The trial was conducted in a mature apple (cv. Red Delicious) orchard in Jordan Station, Ontario. Trees were spaced 2.7 m by 4.6 m and were on M26 rootstock. Three rates of Apollo (150, 193 and 237 g ai/ha) were compared to MANA-300, a CARZOL (1012 g ai./ha) standard and an unsprayed control. Treatments were assigned to one-tree plots, replicated four times in a randomized complete block design. Approximately 10 days after petal fall (5 June), acaricides were applied at 3000L/ha and sprayed to run-off with a hydraulic sprayer equipped with a handgun at 1400 kPa. 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 from the first sampling date through the seventh post-treatment sampling date. At this time mite populations had stabilized and the number of leaves collected per plot was reduced to ten. Leaves were examined under a stereomicroscope and the numbers of living European Red Mite (ERM) eggs and motiles (nymphs and adults) were recorded. Data were analyzed using analyses of variance and Tukey's 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 and no single event measured more than 10 mm from 1 Jun to 5 August. This lead to reduced shoot development with leaves that possessed heavy cuticular wax. Daily maximum temperatures exceeded 30ºC in the latter parts of July and early August with a high of 36.5º C recorded on 8 August. Treatments were applied when the majority of mites were in the egg stage, as recommended just after the calyx stage of crop development. 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 did not improve control, measured as number of mites or duration of control. Mana-300 provided control equivalent to the low rate of Apollo. Carzol initially provided good control of both eggs and motiles; however, by 10 weeks after application, motile numbers exceeded acceptable thresholds.

Table 1. Mean number of ERM eggs per leaf.

Treatment	g ai./ha	Weeks after Treatment						
		2	3	6	7	9	10	12
		18 June	26 June	18 July	26 July	7 August	17 August	27 August
APOLLO SC	150	0.2a	1.8a	1.6a	5.5abc	31.5a	25.7ab	23.3ab
APOLLO SC	193	0.6a	1.1a	2.4ab	2.9ab	26.5a	22.7a	26.3 b
APOLLO SC	237	0.5a	3.1a	2.4ab	5.7abc	42.9 bc	26.9ab	21.7ab
MANA-300	3000	0.5a	1.1a	1.2a	4.1ab	36.1abc	32.1 bc	19.3ab
CARZOL	1012	0.1a	0.9a	5.3 b	6.6bc	39.0 bc	37.4 c	20.0ab
Untreated		0.7a	6.0 b	4.1ab	8.9 c	48.1 c	24.2ab	16.7a

Table 2. Mean number of ERM actives (nymphs & adults) per leaf.

Treatment	Rate g ai./ha	Weeks after Treatment						
		2	3	6	7	9	10	12
		18 June	26 June	18 July	26 July	7 August	17 August	27 August
APOLLO	150	0.1a	0.1a	0.2a	5.1ab	2.1ab	7.5a	6.0 b
APOLLO	193	0.2a	0.2a	0.7a	2.3a	1.7a	8.6ab	6.7 b
APOLLO	237	0.2a	0.2a	0.3a	6.3 b	3.9 bc	10.8 bc	4.6ab
MANA-300	3000	0.1a	0.1a	0.5a	3.1a	3.1abc	7.8ab	6.9 b
CARZOL	1012	0a	0.1a	0.6a	7.3b	3.5abc	14.7 c	6.6 b
Untreated		1.2 b	0.4 b	1.8 b	11.3 c	4.9 c	6.6a	2.2a

Means in the same column followed by the same letter are not significantly different at P=0.05, Tukey multiple range test.

2001 PMR REPORT # 12 **SECTION A: TREE FRUIT - Insect/mite Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apples cv. Empire
PESTS: Spotted Tentiform Leafminer, *Phyllonorycter blancardella* (F.)
Mullein Leaf Bug, *Campylomma verbasci* (Meyer)
European Red Mite, *Panonychus ulmi* (Koch)
PARASITOIDS: *Pholetesor ornigis*, *Sympiesis spp.* (*Hymenoptera: Chalcidoidea*)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF FIRST GENERATION SPOTTED TENTIFORM LEAFMINER AND MULLEIN LEAF BUG ON APPLE WITH VARIOUS INSECTICIDES, 2001

MATERIALS: EXP 61486A 70 WP (acetamiprid), 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. Three rates of EXP 61486A were applied at petal fall (22 May), timed for egg hatch of the first generation of Spotted Tentiform Leafminer (STLM). To test efficacy versus STLM larvae in the mines, one treatment of EXP 61486A was applied after egg hatch was complete, 9 days after the first application (31 May). All treatments were compared with a MATADOR standard, applied at petal fall (22 May). 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 18 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. The percentage of mines containing the parasitoids *Pholetesor ornigis* and *Sympiesis* spp. (Hymenoptera: Chalcidoidea) was also recorded. On 12 June, plots were examined for Mullein leaf bug (MB) by tapping each tree at three equally spaced locations (six taps per plot), and counting MB nymphs on tapping trays. Numbers of MB per six taps were recorded for each plot. Effects on populations of European Red Mite (ERM) were also examined; four weeks (28 June) after 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 mites 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, 2, 3, and 4. Prespray samples 7 May and 22 May showed similar numbers of STLM eggs (approximately 1.0 eggs/cluster) in all plots. STLM were in the egg stage in the 7 May sample, and less than 5% egg hatch had occurred (first sap feeding mines) at the time of petal fall applications (22 May). A sample taken from untreated trees 31 May showed that all STLM eggs had hatched, and the first tissue feeding mines were observed at the time of application of the late EXP 61486A treatment. No phytotoxic effects were observed in any of the treated plots. STLM infestations

were considered heavy.

CONCLUSIONS: In the sample taken 18 June to assess the effects of treatments on STLM, all but the MATADOR treated plots had significantly fewer mines per cluster than the control (Table 1). The late (31 May) treatment of EXP61486A contained more mines per cluster than the petal fall applications of EXP 61486A. Similar results were observed when percent mined clusters were compared. Percentages of mines parasitised by *P. ornigis* or *Sympiesis spp* were the same in all treatments (Table 2). In the 12 June sample for MB, all treated plots showed significantly lower numbers of MB than the control (Table 3), and none of the EXP 61486A treatments were significantly different from each other. However, numbers of MB in the MATADOR treatment were significantly lower than in the 28 g ai/ha EXP 614876A treatment. No differences in numbers of predator mites were observed in any plots (Table 4), but the plots treated with MATADOR had significantly more European red mites than the control.

Table 1. Effects on spotted tentiform leafminer.

Treatment	Rate (a.i./ha)	STLM mines/cluster 18 June	% Mined Clusters 18 June
EXP 61486A 70 WP[1]	112 g	0.07 c[3]	6.8 c
EXP 61486A 70 WP[1]	56 g	0.15 c	13.6 c
EXP 61486A 70 WP[1]	28 g	0.15 c	17.5 c
EXP 61486A 70 WP[2]	56 g	0.76 b	51.6 b
MATADOR 120 EC[1]	10 g	2.19 a	76.4 a
CONTROL	-	2.53 a	93.3 a

[1] Applied at egg hatch, 22 May (petal fall).
[2] Applied after egg hatch, 31 May.
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on parasitoids.

Treatment	Rate (a.i./ha)	% Parasitised Mines 18 June	% of Mines Containing *Pholetesor* 18 June	% of Mines Containing *Chalcid* 18 June
EXP 61486A 70 WP[1]	112 g	60.0 a[3]	47.5 a	12.5 a
EXP 61486A 70 WP[1]	56 g	40.8 a	32.5 a	8.3 a
EXP 61486A 70 WP[1]	28 g	43.8 a	21.9 a	21.9 a
EXP 61486A 70 WP[2]	56 g	66.0 a	50.9 a	15.2 a
MATADOR 120 EC[1]	10 g	57.9 a	40.4 a	17.5 a
CONTROL	-	57.9 a	39.9 a	18.0 a

[1] Applied at egg hatch, 22 May (petal fall).
[2] Applied after egg hatch, 31 May.
[3] 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.

Treatment	Rate (a.i./ha)	MB/6 taps per plot 12 June
MATADOR 120 EC[1]	10 g	2.25 c[3]
EXP 61486A 70 WP[1]	112 g	6.00 bc
EXP 61486A 70 WP[1]	56 g	6.75 bc
EXP 61486A 70 WP[2]	56 g	7.00 bc
EXP 61486A 70 WP[1]	28 g	11.00 b
CONTROL	-	25.50 a

[1] Applied at egg hatch, 22 May (petal fall).
[2] Applied after egg hatch, 31 May.
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 4. Effects of insecticides on numbers of phytophagous and predatory mites.

Treatment	Rate (a.i./ha)	European Red Mite/leaf 28 June	*A. fallacis*/leaf 28 June
MATADOR 120 EC[1]	10 g	2.86 b[3]	0.10 a
EXP 61486A 70 WP[1]	56 g	1.50 ab	0.27 a
EXP 61486A 70 WP[1]	112 g	1.05 a	0.28 a
EXP 61486A 70 WP[1]	28 g	0.82 a	0.26 a
EXP 61486A 70 WP[2]	56 g	0.66 a	0.27 a
CONTROL	-	1.04 a	0.24 a

[1] Applied at egg hatch, 22 May (petal fall).
[2] Applied after egg hatch, 31 May.
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 13 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apples cv. Idared
PESTS: Spotted Tentiform Leafminer, *Phyllonorycter blancardella* (F.),
Mullein Leaf Bug, *Campylomma verbasci* (Meyer)
Rosy Apple Aphid, *Dysaphis plantaginea* (Passerini)
PARASITOIDS: *Pholetesor ornigis*, *Sympiesis spp.* (*Hymenoptera: Chalcidoidea*)

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TITLE: CONTROL OF FIRST GENERATION SPOTTED TENTIFORM LEAFMINER, MULLEIN LEAF BUG, AND ROSY APPLE APHID ON APPLE, 2001

MATERIALS: EXP 61486A 70 WP (acetamiprid), CYMBUSH 250 EC (cypermethrin)

METHODS: The trial was conducted in an eleven-year-old orchard in the Simcoe, Ontario area; trees cv. Idared were spaced 4.8 m by 7.2 m, and were on MM106 rootstock. Treatments were replicated four times, assigned to one-tree plots, and arranged according to a randomised complete block design. Three rates of EXP 61486A were applied at petal fall (23 May), timed for 50% egg hatch of the first generation of spotted tentiform leafminer (STLM). To test efficacy versus STLM larvae in the mines, one treatment of EXP 61486A was applied after egg hatch was complete, 12 days after the first application (4 June). All treatments were compared with a CYMBUSH standard applied at 50% egg hatch (23 May). 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 21 June, a sample of 30 leaf clusters per plot was collected from the lower 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. The percentage of mines containing the parasitoids *Pholetesor ornigis* and *Sympiesis* spp. (Hymenoptera: Chalcidoidea) was also recorded. On 4 June and 13 June, plots were examined for mullein leaf bug (MB) and rosy apple aphid (RAA) by tapping each tree at three equally-spaced locations and counting MB and RAA nymphs on tapping trays; numbers of MB and RAA per three 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 Tables 1, 2, 3 and 4. Prespray samples 23 May showed similar numbers of STLM larvae (approximately 0.5 larvae/cluster) and approximately 50% egg hatch in all plots. A prespray sample 4 June showed that the late (4 June) application was applied when the first tissue-feeding mines were present. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the sample taken 21 June to assess the effects of treatments on STLM, all treated plots had significantly fewer mines per cluster than the control, but were not different from each other (Table 1). Similarly, all treatments showed lower % mined clusters than the control, but plots treated with the late application of EXP 61486A contained higher % mined clusters than the 23 May EXP 61486A treatments. In addition, the plots treated with the 112 g ai/ha rate of EXP 61486A showed lower

% mined clusters than the plots treated with the CYMBUSH standard. Percentages of mines parasitised by *P. ornigis* or *Sympiesis spp* were the same in all treatments (Table 2); no STLM mines were found in the plots treated with 112 g ai/ha EXP 61486A, so no parasitoid data was available. In both the 4 June and 13 June samples for MB, all treated plots showed significantly lower numbers of MB than the control (Table 3), but none were different from each other. Numbers of RAA were not significantly lower than the control in all treated plots in the 4 June sample (Table 4); however, no RAA were found in any treated plots in the 13 June sample. It should be noted that the late treatment of EXP 61486A had not been applied before the 4 June sample, so numbers of MB and RAA in those plots were not different from the control until the 13 June sample.

Table 1. Effects on spotted tentiform leafminer.

Treatment	Rate (a.i./ha)	STLM mines/cluster 21 June	% Mined Clusters 21 June
EXP 61486A 70 WP[1]	112 g	0.00 b[3]	0.0 d
EXP 61486A 70 WP[1]	56 g	0.17 b	10.0 cd
EXP 61486A 70 WP[1]	28 g	0.12 b	10.8 cd
CYMBUSH 250 EC[1]	100 g	0.37 b	29.5 bc
EXP 61486A 70 WP[2]	56 g	0.41 b	42.5 b
CONTROL	-	2.44 a	89.3 a

[1] Applied at 50% egg hatch, 23 May.
[2] Applied after egg hatch, 4 June (first tissue-feeding mines observed).
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on parasitoids.

Treatment	Rate (a.i./ha)	% Parasitised Mines 21 June	% of Mines Containing *Pholetesor* 21 June	% of Mines Containing *Chalcid* 21 June
EXP 61486A 70 WP[1]	112 g	N/A	N/A	N/A
EXP 61486A 70 WP[1]	56 g	32.0 a[3]	18.0 a	14.0 a
EXP 61486A 70 WP[1]	28 g	28.9 a	21.1 a	7.8 a
CYMBUSH 250 EC[1]	100 g	30.5 a	14.7 a	15.8 a
EXP 61486A 70 WP[2]	56 g	48.5 a	32.9 a	15.6 a
CONTROL	-	41.1 a	29.5 a	11.6 a

[1] Applied at 50% egg hatch, 23 May.
[2] Applied after egg hatch, 4 June (first tissue-feeding mines observed).
[3] 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.

Treatment	Rate (a.i./ha)	MB/3 taps per plot 4 June	MB/3 taps per plot 13 June
EXP 61486A 70 WP[1]	112 g	0.25 b[3]	0.25 b
EXP 61486A 70 WP[1]	56 g	1.00 b	0.00 b
CYMBUSH 250 EC[1]	100 g	1.25 b	0.50 b
EXP 61486A 70 WP[1]	28 g	1.75 b	1.00 b
EXP 61486A 70 WP[2]	56 g	6.00 a[4]	0.50 b
CONTROL	-	6.25 a	4.25 a

[1] Applied at 50% egg hatch, 23 May.
[2] Applied after egg hatch, 4 June (first tissue-feeding mines observed).
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.
[4] Untreated at the time of sampling.

Table 4. Effects of insecticides on numbers of rosy apple aphid.

Treatment	Rate (a.i./ha)	RAA/3 taps per plot 4 June	RAA/3 taps per plot 13 June
EXP 61486A 70 WP[1]	112 g	0.25 a[3]	0.00 b
EXP 61486A 70 WP[1]	56 g	0.00 a	0.00 b
CYMBUSH 250 EC[1]	100 g	0.25 a	0.00 b
EXP 61486A 70 WP[1]	28 g	0.75 a	0.00 b
EXP 61486A 70 WP[2]	56 g	1.75 a[4]	0.00 b
CONTROL	-	1.25 a	6.50 a

[1] Applied at 50% egg hatch, 23 May.
[2] Applied after egg hatch, 4 June (first tissue-feeding mines observed).
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.
[4] Untreated at the time of sampling.

2001 PMR REPORT # 14 **SECTION A: TREE FRUIT - Insect/mite Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apple cv. McIntosh
PEST: Two Spotted Spider Mite, *Tetranychus urticae* Koch

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TITLE: CONTROL OF TWO SPOTTED SPIDER MITE ON APPLE WITH VARIOUS ACARICIDES, 2001

MATERIALS: ENVIDOR 240 SC (spirodiclofen), FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a ten-year-old orchard in the Bowmanville, Ontario, area; trees cv. McIntosh were spaced 3.4 m by 4.2 m and were on M9 rootstock. Treatments were replicated four times and assigned to one-tree plots, and arranged according to a randomised complete block design. Three rates of ENVIDOR (120, 180, and 240 g a.i./ha) and two rates of FLORAMITE (280 and 560 g a.i./ha) were compared to a PYRAMITE standard and an unsprayed control. On 26 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 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled pre-treatment 20 July, and three times post-treatment, 2 August, 9 August, and 16 August (7, 14, and 21 days after treatment). Efficacy ratings consisted of counts of motiles of Two Spotted Spider Mite (TSSM) on 20 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. 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 Table 1 below. Prespray samples 20 July showed similar numbers of TSSM motiles (approximately 13 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 7-day sample, all treated plots had fewer TSSM than the control (Table 1); the plots treated with FLORAMITE had fewer TSSM motiles than the plots treated with PYRAMITE or the two lower rates (120 and 180 g a.i./ha) of ENVIDOR; there was no difference between rates of ENVIDOR. In the 14-day sample, all treated plots had significantly fewer TSSM than the control; all plots treated with FLORAMITE and ENVIDOR had fewer TSSM than those treated with PYRAMITE, while the 560 g a.i./ha rate of FLORAMITE was different from the 240 g a.i./ha rate of ENVIDOR. By 16 August, numbers of TSSM were low in all plots except for those treated with PYRAMITE.

Table 1. Numbers of TSSM motiles per leaf.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		7 days 2 August	14 days 9 August	21 days 16 August
FLORAMITE 50 W	560 g	1.0 d[2]	0.1 d	0.0 b
FLORAMITE 50 W	280 g	0.7 d	0.2 cd	0.0 b
ENVIDOR 240 SC	240 g	3.1 cd	2.2 c	0.1 b
ENVIDOR 240 SC	180 g	7.7 bc	0.4 cd	0.1 b
ENVIDOR 240 SC	120 g	9.0 bc	0.4 cd	0.2 b
PYRAMITE 75 WP	450 g	13.7 b	9.6 b	6.5 a
CONTROL	-	52.6 a	25.4 a	0.2 b

[1] Applied 26 July.
[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2001 PMR REPORT # 15 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apples cv. McIntosh
PEST: Codling Moth, *Cydia pomonella* (L.)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST CODLING MOTH ON APPLE, 2001

MATERIALS: CONFIRM 240F (tebufenozide), GUTHION 50 WP (azinphos-methyl), RIMON 7.5 WDG (novaluron), VIROSOFT^{CP4} (*Cydia pomonella* granulovirus)

METHODS: The trial was conducted in a six-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 three rates of RIMON to CONFIRM, VIROSOFT^{CP4}, 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, 100 DD (base 10C) after first male CM catch, and reapplied 28 June, 310 DD (base 10C) 21 days after first application. All other treatments were applied for the first generation 31 May (75 DD_{10}) and 14 June (161 DD_{10}), 14 days after the first application. Timing for the second generation was based on peak catches of male CM in pheromone traps; GUTHION was applied 2 August (690 DD_{10}) and reapplied 23 August (975 DD_{10}), 21 days after the third application. All other treatments were applied 30 July (663 DD_{10}) and reapplied 13 August (855 DD_{10}), 14 days after the third 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 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. A sample was taken to assess first generation codling moth (CM) damage on 11 July, when 100 apples per plot were examined on the tree. Second generation CM damage was assessed on 30 August when 100 apples per plot were examined on the tree. On 17 September; a total of 100 apples per plot were harvested from the canopy and the ground, and examined for CM damage. 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 Table 1. It should be noted that CONFIRM was applied earlier than recommended; CONFIRM should be applied for codling moth control at 100 DD_{10} using the standard CM degree day model. No phytotoxic effects were observed in any of the plots.

CONCLUSIONS: In the 11 July sample for first-generation CM damage, all treated plots showed significantly lower damage than the control (Table 1); the plots treated with GUTHION and RIMON had less damage than those treated with CONFIRM. All treatments significantly reduced CM damage in the second-generation sample taken 30 August; the plots treated with GUTHION and RIMON had less damage than those treated with VIROSOFT^{CP4} or CONFIRM. The 17 September harvest sample showed

similar results, all treated plots showed lower CM damage than the control, but damage levels in the GUTHION, RIMON, and CONFIRM treated plots were lower than in the VIROSOFT^{CP4} plots.

Table 1. Percent fruit damaged by codling moth.

Treatment	Rate (a.i./ha)	Gen. 1 11 July	Gen. 2 30 August	Harvest 17 September
GUTHION 50 W [1]	1.05 kg	2.0 c[3]	2.0 d	2.5 d
RIMON 7.5 WDG [2]	300 g	0.5 c	3.75 cd	4.5 d
RIMON 7.5 WDG [2]	225 g	1.0 c	4.0 cd	6.5 d
RIMON 7.5 WDG [2]	150 g	2.0 c	10.0 c	8.0 cd
CONFIRM 240 F [2]	240 g	18.5 b	26.0 b	20.5 c
VIROSOFT^{CP4} [2]	10^{13} OB/ha	9.0 bc	31.5 b	35.0 b
CONTROL	-	29.0 a	41.0 a	58.5 a

[1] Applied 7 June, reapplied 28 June, 2 August, 23 August
[2] Applied 31 May, reapplied 14 June, 30 July, 13 August
[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2001 PMR REPORT # 16 **SECTION A: TREE FRUIT - Insect/mite Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apples 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, 2001

MATERIALS: AGRI-MEK 1.9 EC (abamectin), FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. Red Delicious were spaced 3.4 m by 4.2 m, and were on M9 rootstock. Two rates of FLORAMITE (280 g a.i./ha and 560 g a.i./ha), were compared to AGRI-MEK, 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 18 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. SUPERIOR 70 oil was added to the AGRI-MEK treatment at 0.1% of the total spray volume. 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, 15, and 28 days after treatment. Samples consisted of counts made on 25 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 beneficial mites 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 Tables 1 and 2. Pre-treatment samples 12 July showed similar numbers of ERM motiles (approximately 35 motiles per leaf) in all plots. Phytotoxic effects were observed in the plots treated with AGRI-MEK/OIL; leaves appeared burned after all plots were sprayed with the fungicide CAPTAN 22 July. Mite numbers were observed to decrease naturally in August.

CONCLUSIONS: In the 7-day sample, only the plots treated with AGRI-MEK and the 560 g a.i./ha rate of FLORAMITE did not have significantly fewer ERM motiles than the control (Table 1). While all treated plots were significantly different from the control in the 15-day sample, the plots treated with PYRAMITE had fewer ERM motiles than those treated with AGRI-MEK. Only the PYRAMITE treatment was different from the control in the 28-day sample, but was not different from the FLORAMITE treatments. All treated plots had fewer beneficial mites than the control in the 7-day sample (Table 2), while numbers in the plots treated with PYRAMITE and FLORAMITE were significantly different from the control in the 15-day sample. Whether these differences were due to toxic effects or a lack of prey was not determined. No differences in beneficial mite numbers were observed in any of the plots in the 28-day sample.

Table 1. Number of ERM motiles per leaf.

Treatment[1]	Rate a.i./ha	Days After Treatment		
		7 days (25 July)	15 days (2 August)	28 days (15 August)
PYRAMITE 75 WP	225 g	8.0 b[2]	0.2 c	0.1 b
FLORAMITE 50 W	560 g	19.8 ab	0.5 bc	0.1 ab
FLORAMITE 50 W	280 g	10.2 b	0.8 bc	0.2 ab
AGRI-MEK 1.9 EC[3]	10.6 g	13.1 ab	1.1 b	0.4 a
CONTROL	-	28.2 a	4.9 a	0.4 a

[1] Applied 18 July
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.
[3] SUPERIOR 70 oil was added at 0.1% of the total spray volume.

Table 2. Number of beneficial mites per leaf.

Treatment[1]	Rate a.i./ha	Days After Treatment		
		7 days (25 July)	15 days (2 August)	28 days (15 August)
PYRAMITE 75 WP	225 g	0.008 b[2]	0.000 b	0.000 a
FLORAMITE 50 W	560 g	0.240 b	0.050 b	0.008 a
FLORAMITE 50 W	280 g	0.195 b	0.075 b	0.033 a
AGRI-MEK 1.9 EC[3]	10.6 g	0.207 b	0.225 a	0.025 a
CONTROL	-	0.600 a	0.373 a	0.083 a

[1] Applied 18 July.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.
[3] SUPERIOR 70 oil was added at 0.1% of the total spray volume.

2001 PMR REPORT # 17 **SECTION A: TREE FRUIT - Insect/mite Pests**
STUDY DATA BASE #: 280-1261-9341

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

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TITLE: EARLY-SEASON CONTROL OF EUROPEAN RED MITE ON APPLE WITH ACARICIDES, 2001

MATERIALS: AGRI-MEK 1.9 EC (abamectin), APOLLO SC (clofentezine), MANA 300 6.4 SC

METHODS: The trial was conducted in a seven-year-old orchard in the Jordan Station, Ontario area; trees cv. Red Delicious were spaced 3.4 m by 4.2 m, and were on M9 rootstock. Three rates of APOLLO (150 g a.i./ha, 193.5 g a.i./ha, and 236.5 g a.i./ha), were compared to MANA 300, an AGRI-MEK standard, and an unsprayed control. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application was timed to target the egg stage of the first summer generation of European Red Mite (ERM), within 14 days of petal fall. On 30 May, 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. SUPERIOR 70 oil was added to the AGRI-MEK treatment at 0.3% of the total spray volume. 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, 28, 42, and 71 days after treatment. Samples consisted of counts made on 30 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 ERM eggs and motiles (nymphs and adults) recorded. Total numbers of beneficial mites 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 Tables 1, 2, and 3. Pre-treatment samples 29 May showed similar numbers of ERM motiles (approximately 4 motiles per leaf) in all plots. Phytotoxic effects were observed in the plots treated with AGRI-MEK/OIL; leaves appeared burned after all plots were sprayed with the fungicide CAPTAN 8 June. Mite numbers were observed to decrease naturally in August.

CONCLUSIONS: In the 7-day and 71-day samples, none of the plots showed differences in numbers of ERM motiles or eggs due to overall low mite numbers (Tables 1 and 2). All treated plots had fewer ERM motiles than the control in the 14, 28, and 42-day samples. Similar results were observed for ERM eggs, except that the number of ERM eggs in plots treated with MANA 300 were not different from the control in the 14-day sample. Beneficial mite numbers were too few to analyse in the 7, 14, and 28-day samples; however, no differences in beneficial mite numbers were observed in any of the plots in the 42 or 71-day samples.

Table 1. Number of ERM motiles per leaf.

Treatment[1]	Rate a.i./ha	Days After Treatment				
		7 days (6 June)	14 days (13 June)	28 days (27 June)	42 days (11 July)	71 days (9 August)
APOLLO SC	236.5 g	0.19 a[2]	0.16 b	0.28 b	2.74 b	0.57 a
APOLLO SC	193.5 g	0.15 a	0.09 b	0.17 b	2.99 b	0.82 a
APOLLO SC	150.0 g	0.10 a	0.09 b	0.24 b	3.94 b	0.80 a
MANA 300 6.4 SC	193.5 g	0.17 a	0.08 b	0.21 b	2.77 b	1.05 a
AGRI-MEK 1.9 EC[3]	10.6 g	0.08 a	0.08 b	0.40 b	2.01 b	1.10 a
CONTROL	-	0.40 a	1.45 a	5.61 a	22.47 a	1.40 a

[1] Applied 30 May.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.
[3] SUPERIOR 70 oil was added at 0.3% of the total spray volume.

Table 2. Number of ERM eggs per leaf.

Treatment[1]	Rate a.i./ha	Days After Treatment				
		7 days (6 June)	14 days (13 June)	28 days (27 June)	42 days (11 July)	71 days (9 August)
APOLLO SC	236.5 g	1.06 a[2]	1.58 b	2.11 b	13.04 b	8.57 a
APOLLO SC	193.5 g	1.42 a	1.73 b	2.90 b	17.02 b	7.85 a
APOLLO SC	150 g	1.87 a	1.45 b	2.45 b	18.78 b	6.25 a
MANA 300 6.4 SC	193.5 g	1.92 a	1.95 ab	2.36 b	16.24 b	8.45 a
AGRI-MEK 1.9 EC[3]	10.6 g	0.94 a	0.28 b	2.46 b	7.50 b	5.70 a
CONTROL	-	3.86 a	4.21 a	22.13 a	64.45 a	3.85 a

[1] Applied 30 May.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.
[3] SUPERIOR 70 oil was added at 0.3% of the total spray volume.

Table 3. Number of beneficial mites per leaf.

Treatment[1]	Rate a.i./ha	Days After Treatment	
		42 days (11 July)	71 days (9 August)
APOLLO SC	236.5 g	0.09 a[2]	0.25 a
APOLLO SC	193.5 g	0.21 a	0.18 a
APOLLO SC	150 g	0.08 a	0.13 a
MANA 300 6.4 SC	193.5 g	0.10 a	0.18 a
AGRI-MEK 1.9 EC[3]	10.6 g	0.05 a	0.23 a
CONTROL	-	0.30 a	0.18 a

[1] Applied 30 May.
[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.
[3] SUPERIOR 70 oil was added at 0.3% of the total spray volume.

2001 PMR REPORT # 18 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apples cv. Red Delicious
PEST: Oblique-Banded Leaf Roller, *Choristoneura rosaceana* (Harris)

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TITLE: CONTROL OF OVERWINTERED OBLIQUE-BANDED LEAF ROLLER ON APPLE, 2001

MATERIALS: CONFIRM 240F (tebufenozide), RH 2485 240F (methoxyfenozide)

METHODS: The trial was conducted in a 10-year-old orchard in the Jordan Station, Ontario area; trees cv. Red Delicious 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. Treatments were applied at petal fall (18 May), targeting overwintered (second to fourth instar) oblique-banded leaf roller (OBLR) larvae; three rates of RH 2485 were compared with CONFIRM and 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 10-12 L of spray mix were used per plot; pressure was set at 2000 kPa. Treatments were inspected on 31 May, before OBLR larvae had pupated; 50 terminals were examined per plot, and the number of terminals containing live 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. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: Infestations were lower in all treated plots than in the control (Table 1); the 1.0 L/ha (240 g a.i./ha) rate of RH 2485 gave better control than the same rate of CONFIRM or the 0.375 L/ha (90 g a.i./ha) RH 2485 treatment.

Table 1. Percent terminals infested per plot.

Treatment[1]	Rate (a.i./ha)	Percent Infested Terminals (31 May)
RH 2485 240 SC	240.0 g	1.5 c[2]
RH 2485 240 SC	180.0 g	4.0 bc
CONFIRM 240 F	240.0 g	8.0 b
RH 2485 240 SC	90.0 g	8.5 b
CONTROL	-	28.5 a

[1] Applied 18 May.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 19 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apples cv. Red Delicious
PEST: Oblique-Banded Leaf Roller, *Choristoneura rosaceana* (Harris)

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TITLE: CONTROL OF OBLIQUE-BANDED LEAF ROLLER ON APPLE, 2001

MATERIALS: DECIS 5EC (deltamethrin), GUTHION 50W (azinphos-methyl), ORTHENE 75SP (acephate), VIROSOFT^{OB4} (*Choristoneura rosaceana* granulovirus)

METHODS: The trial was conducted in a 10-year-old orchard in the Jordan Station, Ontario area; trees cv. Red Delicious 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 three rates of ORTHENE with DECIS, GUTHION, VIROSOFT^{OB4}, and an unsprayed check for control of oblique-banded leaf roller (OBLR). The VIROSOFT^{OB4} treatment was timed for application before egg hatch of the first generation, and was applied 21 June, 155.5 DD (base 6.1C) after first male moth catch, and reapplied 5 July (366 $DD_{6.1}$), 14 days after first application. All other treatments were applied 25 June, 202.4 $DD_{6.1}$ after first male moth catch, and repeated 9 July (411 $DD_{6.1}$), 14 days after 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 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. On 2 August, 50 terminals were examined per plot, and the number of terminals containing live 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. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 2 August sample of terminals, only the plots treated with VIROSOFT^{OB4} did not show significantly lower infestations than the control (Table 1); however, damage in these plots was not different from the ORTHENE or GUTHION treatments. None of the insecticide treatments were significantly different from the others.

Table 1. Percent terminals infested per plot.

Treatment	Rate (a.i./ha)	% Infested Terminals 2 August
DECIS 5 EC [1]	10 g	0.5 c[3]
GUTHION 50 W [1]	1.05 kg	4.0 bc
ORTHENE 75 SP [1]	750 g	3.0 bc
ORTHENE 75 SP [1]	562.5 g	3.0 bc
ORTHENE 75 SP [1]	450 g	3.0 bc
VIROSOFT^{OB4} [2]	10^{12} OB/ha	7.0 ab
CONTROL	-	12.5 a

[1] Applied 25 June (202.4 DD from first male moth catch), reapplied 9 July (411 DD).
[2] Applied 21 June (155.5 DD from first male moth catch), reapplied 5 July (366 DD).
[3] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2001 PMR REPORT # 20 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apples cv. McIntosh
PEST: Oblique-Banded Leaf Roller, *Choristoneura rosaceana* (Harris)

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TITLE: ASSESSMENT OF INSECTICIDES FOR CONTROL OF OBLIQUE-BANDED LEAF ROLLER ON APPLE, 2001

MATERIALS: BIOPROTEC CAF (*Bacillus thuringiensis*, subsp. *kurstaki*), DECIS 5EC (deltamethrin), DIPEL 2X (*Bacillus thuringiensis*, subsp. *kurstaki*), SUCCESS 480F (spinosad)

METHODS: The trial was conducted in a 10-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 each of BIOPROTEC and SUCCESS to DIPEL 2X and DECIS standards and an unsprayed check. Treatments were applied at dusk 25 June, 202.4 $DD_{6.1}$ after first male moth catch, and repeated 9 July (411 $DD_{6.1}$), 14 days after 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 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. On 2 August, 50 terminals were examined per plot, and the number of terminals containing live 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. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 2 August sample of terminals, only the plots treated with the 2.8 L/ha rate of BIOPROTEC CAF did not show significantly lower infestations than the control (Table 1); however, damage in these plots was not different from the other insecticide treatments.

Table 1. Percent terminals infested per plot.

Treatment[1]	Rate (a.i./ha)	% Infested Terminals 2 August
DECIS 5 EC	10 g	0.5 b[2]
SUCCESS 480F	125 g	0.0 b
SUCCESS 480F	87.5 g	1.0 b
DIPEL 2X	1.125 kg	1.0 b
BIOPROTEC CAF	4.0 L	1.5 b
BIOPROTEC CAF	2.8 L	3.0 ab
CONTROL	-	5.0 a

[1] Applied 25 June (202.4 DD from first male moth catch), reapplied 9 July (411 DD).
[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2001 PMR REPORT # 21 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

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

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TITLE: LATE SEASON CONTROL OF ORIENTAL FRUIT MOTH ON APPLE WITH INSECTICIDES, 2001

MATERIALS: DECIS 5 EC (deltamethrin), GUTHION 50 W (azinphos-methyl), RH 2485 240 F (methoxyfenozide)

METHODS: The trial was conducted in a 10-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 and 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. Treatments were applied 30 August, 1398 DD (base 7.2 C) after first male moth catch (May 3); 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 post-treatment 13 September; 50 apples per plot were harvested from the canopy and the ground, and examined for damage. Damaged apples were cut open and all live larvae found were identified as either Oriental fruit moth (OFM) or codling moth. Efficacy was expressed as percent fruit infested by OFM. 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 of the treated plots.

CONCLUSIONS: In the 13 September sample, all treated plots had fewer OFM larvae than the control (Table 1), but there were no differences in numbers of OFM among insecticide-treated plots.

Table 1. OFM damage per plot.

Treatment[1]	Rate (a.i./ha)	% Infested Fruit (13 September)
DECIS 5 EC	10.0 g	2.0 b[2]
GUTHION 50 W	1.05 kg	4.0 b
RH 2485 240 F	360.0 g	3.0 b
CONTROL	-	12.0 a

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

2001 PMR REPORT # 22 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apples cv. McIntosh
PESTS: Plum Curculio, *Conotrachelus nenuphar* (Herbst)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST PLUM CURCULIO ON APPLE, 2001

MATERIALS: ACTARA 30 WG (thiamethoxam), GUTHION 50 WP (azinphos-methyl), MATADOR 120 EC (lambda cyhalothrin)

METHODS: The trial was conducted in a 3-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 were applied at petal fall (24 May); a second application of both ACTARA treatments was made 12 days later (5 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 4 June and 18 June (13 and 25 days after application, respectively); 100 apples per plot were examined on the tree for PC damage, and results expressed as percent fruit damage. 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 the table below; PC-damaged fruit in the 4 June sample were too few to analyse. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 18 June sample for PC damage, all treated plots showed significantly lower damage than the control.

Table 1. Percent fruit damaged by plum curculio.

Treatment	Rate (a.i./ha)	18 June (25 days after first application)
MATADOR 120 EC[1]	12.7 g	0.50 b[3]
ACTARA 30 WG[2]	96 g	1.00 b
GUTHION 50 WP[1]	1.05 kg	1.75 b
ACTARA 30 WG[2]	79 g	2.75 b
CONTROL	-	16.25 a

[1] Applied 24 May.
[2] Applied 24 May, reapplied 5 June.
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 23 **SECTION A: TREE FRUIT - Insect/mite Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Apples cv. Empire
PESTS: Spotted Tentiform Leafminer, *Phyllonorycter blancardella* (F.)
Mullein Leaf Bug, *Campylomma verbasci* (Meyer)
European Red Mite, *Panonychus ulmi* (Koch)
PARASITOIDS: *Pholetesor ornigis*, *Sympiesis spp.* (*Hymenoptera: Chalcidoidea*)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF FIRST GENERATION SPOTTED TENTIFORM LEAFMINER AND MULLEIN LEAF BUG ON APPLE, 2001

MATERIALS: ACTARA 25 WG (thiamethoxam), ADMIRE 240 F (imidacloprid), 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. Two rates at two different application timings were tested for ACTARA, one applied at pink (7 May); the second at petal fall (22 May), timed for egg hatch of the first generation of Spotted Tentiform Leafminer (STLM). All treatments were compared with ADMIRE and a MATADOR standard, applied at petal fall (22 May). 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 18 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. The percentage of mines containing the parasitoids *Pholetesor ornigis* and *Sympiesis* spp. (Hymenoptera: Chalcidoidea) was also recorded. On 12 June, plots were examined for Mullein leaf bug (MB) by tapping each tree at three equally spaced locations (six taps per plot), and counting MB nymphs on tapping trays; numbers of MB per six taps were recorded for each plot. Effects on populations of European Red Mite (ERM) were also examined; six weeks (3 July) 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 mites 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, 2, 3, and 4. Prespray samples 7 May and 22 May showed similar numbers of STLM eggs (approximately 1.0 eggs/cluster) in all plots. STLM were in the egg stage in the 7 May sample, and less than 5% egg hatch (first sap feeding mines) at the time of petal fall applications (22 May). No phytotoxic effects were observed in any of the treated plots. STLM infestations were considered heavy.

CONCLUSIONS: In the sample taken 18 June to assess the effects of treatments on STLM, all treated plots had significantly fewer mines per cluster than the control (Table 1), but the MATADOR treatment and treatments of ACTARA applied at petal fall contained more mines per cluster than the ADMIRE (treated at petal fall) and the ACTARA treatments applied at pink. However, mines per cluster in the 79 g ai/ha ACTARA treated plots were lower than all other treatments. Similar results were observed for percent mined clusters, except that the ADMIRE treatment was the only petal fall application that was significantly different from the control. Percentages of mines parasitised by *P. ornigis* or *Sympiesis spp* were the same in all treatments (Table 2). In the 12 June sample for MB, all treated plots showed significantly lower numbers of MB than the control (Table 3). However, numbers in the 96 g ai/ha treatment of ACTARA and the MATADOR treatment were significantly lower than the ADMIRE treatment or the 48 g ai/ha ACTARA treatment applied at pink. Also, both 79 g ai/ha treatments of ACTARA had lower numbers than ADMIRE, but not more than in the 48 g ai/ha rate of ACTARA. No differences in numbers of European red mite were observed in any plots (Table 4), but the plots treated with MATADOR had significantly fewer predator mites than the control.

Table 1. Effects on spotted tentiform leafminer.

Treatment	Rate (a.i./ha)	STLM mines/cluster 18 June	% Mined Clusters 18 June
ACTARA 25 WG[1]	79 g	0.25 d[3]	20.2 c
ACTARA 25 WG[1]	48 g	0.98 c	61.3 b
ADMIRE 240 F[2]	91.2 g	1.06 c	54.9 b
ACTARA 25 WG[2]	79 g	1.57 b	71.6 ab
ACTARA 25 WG[2]	96 g	1.62 b	68.5 ab
MATADOR 120 EC[2]	10 g	1.94 b	86.3 a
CONTROL	-	3.34 a	89.3 a

[1] Applied 7 May (pink).
[2] Applied 22 May (petal fall).
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Effects of insecticides on parasitoids.

Treatment	Rate (a.i./ha)	% Parasitised Mines 18 June	% of Mines Containing *Pholetesor* 18 June	% of Mines Containing *Chalcid* 18 June
ACTARA 25 WG[1]	96 g	69.9 a[3]	48.5 a	21.4 a
MATADOR 120 EC[1]	10 g	50.2 a	35.9 a	14.3 a
ACTARA 25 WG[1]	79 g	54.2 a	34.0 a	20.2 a
ACTARA 25 WG[2]	79 g	26.5 a	21.0 a	5.5 a
ACTARA 25 WG[2]	48 g	44.2 a	25.4 a	18.7 a
ADMIRE 240 F[1]	91.2 g	37.2 a	29.8 a	7.4 a
CONTROL	-	43.6 a	32.4 a	11.3 a

[1] Applied 22 May (petal fall).
[2] Applied 7 May (pink).
[3] 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.

Treatment	Rate (a.i./ha)	MB/6 taps per plot (12 June)
ACTARA 25 WG[1]	96 g	1.25 d[3]
MATADOR 120 EC[1]	10 g	1.50 d
ACTARA 25 WG[1]	79 g	3.50 cd
ACTARA 25 WG[2]	79 g	3.50 cd
ACTARA 25 WG[2]	48 g	8.00 bc
ADMIRE 240 F[1]	91.2 g	8.25 b
CONTROL	-	17.75 a

[1] Applied 22 May (petal fall).
[2] Applied 7 May (pink).
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 4. Effects of insecticides on numbers of phytophagous and predatory mites.

Treatment	Rate (a.i./ha)	European Red Mite/leaf 3 July	*A. fallacis*/leaf 3 July
ACTARA 25 WG[1]	96 g	6.6 a[3]	0.85 ab
MATADOR 120 EC[1]	10 g	7.1 a	0.08 b
ACTARA 25 WG[1]	79 g	9.1 a	0.67 ab
ACTARA 25 WG[2]	79 g	8.5 a	0.41 ab
ACTARA 25 WG[2]	48 g	4.7 a	0.64 ab
ADMIRE 240 F[1]	91.2 g	3.3 a	0.48 ab
CONTROL	-	4.0 a	2.93 a

[1] Applied 22 May (petal fall).
[2] Applied 7 May (pink).
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 24 **SECTION A: TREE FRUIT - Insect pests**

CROP: Sweet cherry, cv. Van, Lambert
PEST: Western cherry fruit fly, *Rhagoletis indifferens* Curran

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TITLE: PRELIMINARY ASSESSMENT OF THE EFFICACY OF SPINOSAD, IMIDACLOPRID AND THIOCLOPRID AGAINST WESTERN CHERRY FRUIT FLY

MATERIALS: DIMETHOATE 480 EC, SUCCESS 480 SC (480 g spinosad/L), ADMIRE 240 F (240 g imidacloprid/L), CALYPSO 480 SC (480 g thiocloprid/L), DIAZINON 50 WP

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, BC in a 40 year old sweet cherry block planted at a density of 346 trees/ha. Each treatment rate (see Table 2) was applied using a Solo backpack mist blower to four adjacent trees in a row with no replications. SUCCESS, ADMIRE and CALYPSO treatments were applied four times at weekly intervals beginning June 14, 2001; DIMETHOATE was applied on the same date followed by a single application of DIAZINON 21 days later on July 6. Each 4-tree plot received 10 L of spray solution, equivalent to 865 L of solution/ha. Treatments were applied in early morning under calm conditions, partial cloudy to clear skies, temperature 15-25º C. Three yellow sticky traps were placed in the trial block May 18 to monitor adult abundance during the trial period. On July 13, 7 days after the last treatments were applied, 50 fruit were randomly selected from the within-row sides of the centre two trees of each plot. This would avoid selecting fruit possibly contaminated by treatments applied to adjacent rows. Fruit were crushed with a potato masher and a brown sugar solution (680 g sugar/L) was added to the fruit pulp. The fruit slurry was gently stirred while being examined under a 1.5X magnifier for larvae floating to the surface.

RESULTS: Table 1 shows the seasonal abundance of adult flies in the cherry block. Adult fruit flies were present throughout the trial period. Table 2 shows the results of the treatments on prevalence of fruit fly larvae in the fruit. All rates of imidacloprid (ADMIRE) and thiocloprid (CALYPSO) protected the fruit from infestation. Only one larva was recovered from the fruit sample treated with the DIMETHOATE-DIAZINON treatment combination (standard treatment). The two rates of spinosad (SUCCESS) failed to prevent infestation of the fruit and there was essentially no difference between the efficacy of the two rates.

CONCLUSIONS: Weekly applications of imidacloprid and thiocloprid can prevent infestation of cherry fruit from fruit flies at the rates tested in this field trial. Weekly application of spinosad at the rates tested may not prevent infestation of cherry fruit under the population pressure present in this trial.

Table 1. Seasonal abundance of adult fruit flies in the cherry block.

Number of adult fruit flies captured over the trial period (total of three traps) at indicated date						
June 4	June 7	June 14	June 22	June 29	July 6	July 14
0	2	3	14	30	17	4

Table 2. Effect of the treatments on prevalence of fruit fly larvae in the fruit.

Treatment	Application Rate (g AI/ha)	Number of larvae recovered from 50-fruit samples/product rate
Check	N/A	17
Dimethoate + diazinon	1080	1
Spinosad	87.5	7
Spinosad	105	6
Imidacloprid	56	0
Imidacloprid	112	0
Thiocloprid	70	0
Thiocloprid	140	0
Thiocloprid	280	0

2001 PMR REPORT # 25 **SECTION A: TREE 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 WITH ACARICIDES, 2001

MATERIALS: ENVIDOR 240 SC (spirodiclofen), FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a five-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 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 8, 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 mites 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 24 July showed similar numbers of ERM motiles (approximately 12 motiles per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots. Numbers of beneficial mites were too few to analyse.

CONCLUSIONS: In the 8-day sample, all treated plots had fewer ERM motiles than the control (Table 1), but the plots treated with ENVIDOR and PYRAMITE had significantly fewer ERM motiles than the plots treated with FLORAMITE. In the 14-day and 21-day samples, all treated plots had significantly fewer ERM motiles than the control, but were not different from each other.

Table 1. Number of ERM motiles per leaf.

Treatment[1]	Rate a.i./ha	Days After Treatment		
		8 days (8 August)	14 days (14 August)	21 days (21 August)
ENVIDOR 240 SC	240 g	1.47 c[2]	0.42 b	0.15 b
ENVIDOR 240 SC	180 g	1.59 c	0.35 b	0.05 b
PYRAMITE 75 WP	225 g	1.24 c	0.35 b	0.07 b
FLORAMITE 50 W	560 g	4.19 b	0.64 b	0.20 b
FLORAMITE 50 W	280 g	5.95 b	1.31 b	0.75 b
CONTROL	-	11.96 a	18.08 a	12.91 a

[1] Applied 31 July.

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

2001 PMR REPORT # 26 **SECTION A: TREE 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 GRAPE BERRY MOTH ON GRAPE, 2001

MATERIALS: CONFIRM 240 F (tebufenozide), GUTHION 240 SC (azinphos-methyl), RH 2485 240 SC (methoxyfenozide)

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). On 5 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 16 July (11 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 of the treated plots.

CONCLUSIONS: In the 16 July sample, only the 144 g ai/ha CONFIRM treatment was not significantly different from the control. The GUTHION and 144 g ai/ha RH 2485 treatments had lower GBM infestations than the 144 g ai/ha CONFIRM treatment, but were not different from the 72 g ai/ha RH 2485 or 240 g ai/ha CONFIRM treatments.

Table 1. Percent grape bunches infested by grape berry moth 11 days after application.

Treatment[1]	Rate (a.i./ha)	% Infested Bunches (16 July)
GUTHION 240 SC	1.8 kg	3.0 c[2]
RH 2485 240 SC	144 g	3.0 c
RH 2485 240 SC	72 g	9.0 bc
CONFIRM 240 F	240 g	16.0 bc
CONFIRM 240 F	144 g	22.0 ab
CONTROL	-	40.0 a

[1] Applied 5 July.
[2] Numbers followed by the same letter are not significantly different $P<0.05$, Tukey test.

2001 PMR REPORT # 27 **SECTION A: TREE 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 ON GRAPE WITH INSECTICIDES, 2001

MATERIALS: BIOPROTEC CAF (*Bacillus thuringiensis, subsp. kurstaki*), BIOPROTEC 3P *Bacillus thuringiensis, subsp. kurstaki*), GUTHION 240 SC (azinphos-methyl), PARATHION 960 EC (parathion)

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 BIOPROTEC 3P were compared to a single rate of BIOPROTEC CAF, PARATHION, GUTHION, and an unsprayed control. On 5 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 16 July (11 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 of the treated plots.

CONCLUSIONS: In the 16 July sample, none of the treatments were significantly different from each other; only the GUTHION treatment had a lower GBM infestation than the control.

Table 1. Percent grape bunches infested by grape berry moth 11 days after application.

Treatment[1]	Rate	% Infested Bunches (16 July)
GUTHION 240 SC	1.8 kg a.i./ha	3.0 b[2]
PARATHION 960 EC	936 g a.i./ha	12.0 ab
BIOPROTEC 3P	1.1 kg/ha	18.0 ab
BIOPROTEC 3P	0.55 kg/ha	25.0 ab
BIOPROTEC CAF	2.8 L/ha	25.0 ab
CONTROL	-	32.0 a

[1] Applied 5 July.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 28 **SECTION A: TREE FRUIT - Insect/mite 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 WITH ACARICIDES, 2001

MATERIALS: ENVIDOR 240 SC (spirodiclofen), FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a ten-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 and assigned to one-tree plots, and arranged according to a randomised complete block design. Two rates each of ENVIDOR and FLORAMITE were compared to a PYRAMITE standard and an unsprayed control. 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 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled pre-treatment 24 July, and three times post-treatment, 1 August, 8 August, and 15 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 mites (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 24 July showed similar numbers of ERM motiles (approximately 8 ERM motiles per leaf) in all plots. No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 7 day sample, only the plots treated with FLORAMITE did not have fewer ERM motiles than the control, while the ENVIDOR and PYRAMITE treatments were significantly lower (Table 1). Numbers of ERM motiles per leaf in all treated plots were significantly lower than the control in the 14 day and 21 day samples, but were not different from each other. None of the treatments had a significant effect on beneficial mites 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 (1 August)	14 days (8 August)	21 days (15 August)
PYRAMITE 75 WP	225 g	1.57 b[2]	0.07 b	0.05 b
ENVIDOR 240 SC	240 g	1.55 b	0.15 b	0.11 b
ENVIDOR 240 SC	180 g	0.84 b	0.15 b	0.09 b
FLORAMITE 50 W	560 g	3.91 ab	0.38 b	0.05 b
FLORAMITE 50 W	280 g	3.96 ab	1.17 b	0.31 b
CONTROL	-	8.18 a	18.31 a	14.96 a

[1] Applied 25 July.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Numbers of beneficial mites 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	0.025 a[2]	0.000 a	0.000 a
ENVIDOR 240 SC	240 g	0.013 a	0.075 a	0.000 a
ENVIDOR 240 SC	180 g	0.050 a	0.013 a	0.000 a
FLORAMITE 50 W	560 g	0.025 a	0.144 a	0.000 a
FLORAMITE 50 W	280 g	0.038 a	0.113 a	0.038 a
CONTROL	-	0.155 a	0.300 a	0.063 a

[1] Applied 25 July.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 29 **SECTION A: TREE 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 ORIENTAL FRUIT MOTH ON PEACH WITH INSECTICIDES, 2001

MATERIALS: CALYPSO 480 F (thiocloprid), DECIS 5 EC (deltamethrin), RH 2485 240 F (methoxyfenozide)

METHODS: The trial was conducted in a five-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 and assigned to two-tree plots, and arranged according to a randomised complete block design. Application was timed for egg hatch of second generation, determined from pheromone trap catches of male moths. Treatments were applied 10 July, 668 DD (base 7.2 C) after first male moth catch, and reapplied 20 July, 10 days after first application. RH 2485 was applied as two treatments at different rates, 240 g ai/ha and 360 g ai/ha, all treatments 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. Plots were sampled post-treatment 30 July; all infested terminals and fruit were removed. Data were transformed (log(x+1)) and analysed using analysis of variance; means were 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 of the treated plots.

CONCLUSIONS: In the 30 July sample, all treatments showed a significant difference from the control, but damage was higher in the plots treated with the 240 g ai/ha rate of RH 2485. Infestations were considered heavy.

Table 1. OFM damage per plot on July 30.

Treatment	Rate (a.i./ha)	Infested Terminals per Plot	Damaged Fruit per Plot	Total OFM Damage
DECIS 5 EC[1]	10.0 g	12.50 c	1.50 c	14.00 c[2]
CALYPSO 480 F	140.0 g	20.50 c	3.25 bc	23.75 c
RH 2485 240 F	360.0 g	22.00 c	3.25 bc	25.25 c
RH 2485 240 F	240.0 g	41.75 b	5.00 b	46.75 b
CONTROL	-	81.50 a	12.00 a	93.50 a

[1] Applied 10 July, reapplied 20 July.

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

2001 PMR REPORT # 30 **SECTION A: TREE 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 ORIENTAL FRUIT MOTH ON PEACH WITH INSECTICIDES, 2001

MATERIALS: LORSBAN 50 W (chlorpyrifos), RH 2485 240 F (methoxyfenozide)

METHODS: The trial was conducted in a five-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 and 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 16 May, 103.5 DD (base 7.2 C) after first male moth catch (May 3); 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 post-treatment 12 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 of the treated plots.

CONCLUSIONS: In the 12 June sample, both the LORSBAN and the RH 2485 treatments showed a significant difference from the control. Infestations were considered heavy.

Table 1. OFM damage per plot.

Treatment[1]	Rate (a.i./ha)	Infested Terminals/Plot 12 June	Damaged Fruit/Plot 12 June	Total Damage 12 June
LORSBAN 50 W	1.7 kg	19.50 b	0.75 b	20.25 b[2]
RH 2485 240 F	360.0 g	30.75 b	0.25 b	31.00 b
CONTROL	-	108.50 a	15.75 a	124.25 a

[1] Applied 7 July.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 31 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Peach cv. Harrow Diamond
PESTS: Plum Curculio, *Conotrachelus nenuphar* (Herbst)

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TITLE: ASSESSMENT OF INSECTICIDES AGAINST PLUM CURCULIO ON PEACH, 2001

MATERIALS: GUTHION 50 WP (azinphos-methyl), LORSBAN 50 W (chlorpyrifos)

METHODS: The trial was conducted in a five-year-old orchard in the Beamsville, Ontario area; trees cv. Harrow Diamond were spaced 3.0 m by 5.5 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Treatments were applied at petal fall (24 May); 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 20 June (27 days after application); 100 peaches per plot were examined on the tree for PC damage, and results expressed as percent fruit damage. 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 the table below. No phytotoxic effects were observed in any plots.

CONCLUSIONS: In the 20 June sample for PC damage, all treated plots contained significantly lower damage than the control (Table 1).

Table 1. Percent fruit damaged by plum curculio.

Treatment	Rate (a.i./ha)	20 June (27 days after first application)
LORSBAN 50 W[1]	1.7 kg	2.75 b[2]
GUTHION 50 WP[1]	1.0 kg	5.68 b
CONTROL	-	19.00 a

[1] Applied 24 May.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 32 **SECTION A: TREE FRUIT - Insect/mite Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Peach cv. Loring
PEST: Peach Silver Mite, *Aculus cornutus* (Banks)
PREDATOR: *Amblyseius fallacis* (Garman)

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TITLE: CONTROL OF PEACH SILVER MITE ON PEACH WITH ACARICIDES, 2001

MATERIALS: ENVIDOR 240 SC (spirodiclofen), FLORAMITE 50 W (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was conducted in a ten-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 and assigned to one-tree plots, and arranged according to a randomised complete block design. Two rates each of ENVIDOR and FLORAMITE were compared to a PYRAMITE standard and an unsprayed control. 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 11-12 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled pre-treatment 24 July, and three times post-treatment, 1 August, 8 August, and 15 August (7, 14, and 21 days after treatment). Efficacy ratings consisted of counts of Peach Silver Mite (PSM) on 50 leaves per plot, picked randomly at arm's length into the canopy. Leaves were examined using a stereomicroscope and assigned a rating based on numbers of live PSM; individual leaves were given a rating of 0 (zero PSM/leaf); 1 (1-10 PSM/leaf); 2 (11-25 PSM/leaf); 3 (26-50 PSM/leaf); 4 (51-100 PSM/leaf); or 5 (101+ PSM/leaf). Numbers of beneficial mites (primarily *A. fallacis*) were also 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 and 2 below. Prespray samples 24 July showed similar numbers of PSM in all plots, with an average rating of approximately 3 (26-50 PSM/leaf). No phytotoxic effects were observed in any of the treated plots. Numbers of PSM were observed to decline naturally.

CONCLUSIONS: In the 7-day sample, only the plots treated with the 560 g a.i./ha rate of FLORAMITE did not have fewer PSM than the control (Table 1); the ENVIDOR and PYRAMITE treatments were significantly lower than the FLORAMITE treatments. Numbers of PSM in all treated plots were significantly lower than the control in the 14-day sample, but the numbers of PSM in plots treated with the 240 g a.i./ha rate of ENVIDOR was lower than those treated with the 560 g a.i./ha rate of FLORAMITE. None of the treatments had a significant effect on beneficial mites in the 7, 14, or 21-day samples (Table 2).

Table 1. Average PSM rating[1].

Treatment[2]	Rate (a.i./ha)	Days After Treatment		
		7 days (1 August)	14 days (8 August)	21 days (15 August)
PYRAMITE 75 WP	225 g	0.1 c[3]	0.3 cd	0.2 a
ENVIDOR 240 SC	240 g	0.2 c	0.1 d	0.0 a
ENVIDOR 240 SC	180 g	0.2 c	0.2 cd	0.0 a
FLORAMITE 50 W	560 g	2.3 ab	1.3 b	0.4 a
FLORAMITE 50 W	280 g	1.3 b	0.9 bc	0.6 a
CONTROL	-	2.5 a	2.1 a	0.7 a

[1] PSM Rating: 0 = 0; 1 = 1-10; 2 = 11-25; 3 = 26-50; 4 = 51-100; 5 = 100+.
[2] Applied 25 July.
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Numbers of beneficial mites per leaf.

Treatment[1]	Rate (a.i./ha)	Days After Treament		
		7 days (1 August)	14 days (8 August)	21 days (15 August)
PYRAMITE 75 WP	225 g	0.025 a[2]	0.000 a	0.000 a
ENVIDOR 240 SC	240 g	0.013 a	0.075 a	0.000 a
ENVIDOR 240 SC	180 g	0.050 a	0.013 a	0.000 a
FLORAMITE 50 W	560 g	0.025 a	0.144 a	0.000 a
FLORAMITE 50 W	280 g	0.038 a	0.113 a	0.038 a
CONTROL	-	0.155 a	0.300 a	0.063 a

[1] Applied 25 July.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 33 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Pear cv. Bartlett
PEST: Pear Rust Mite, *Epitrimerus pyri* (Nalepa)

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TITLE: CONTROL OF PEAR RUST MITE ON PEAR WITH ACARICIDES, 2001

MATERIALS: KELTHANE 50 W (dicofol), ENVIDOR 240 SC (spirodiclofen)

METHODS: The trial was conducted in a five-year-old orchard in the Jordan Station, Ontario area; trees cv. Bartlett were spaced 2.0 m by 4.3 m. Treatments were replicated four times and assigned to two-tree plots separated by guard trees, and arranged according to a randomised complete block design. Plots were sampled pre-treatment 17 July, and three times post-treatment, 23 July, 31 July, and 8 August (5, 13, and 21 days after treatment), and consisted of counts made on 20 leaves per plot, picked randomly at arm's length into the canopy. Leaves were examined using a stereomicroscope and assigned a rating based on numbers of live pear rust mite (PRM); individual leaves were given a rating of 0 (zero PRM/leaf); 1 (1-10 PRM/leaf); 2 (11-25 PRM/leaf); 3 (26-50 PRM/leaf); 4 (51-100 PRM/leaf); or 5 (101+ PRM/leaf). Two rates of ENVIDOR (180 g a.i./ha and 240 g a.i./ha) were compared to a KELTHANE standard and an unsprayed control. On 18 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 9-10 L of spray mix were used per plot; pressure was set at 2000 kPa. 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 the table below. Prespray samples 17 July showed similar numbers of PRM in all plots, with an average rating of approximately 1.7 (11-25 PRM/leaf). No phytotoxic effects were observed in any of the treated plots. Numbers of PRM were observed to decline naturally in August, numbers of PRM in the 21-day (8 August) sample were too few to analyse.

CONCLUSIONS: Numbers of PRM in all treated plots were significantly lower than the control in each of the 5 and 13-day samples. The ENVIDOR treatments were not significantly different from the KELTHANE treatment in any of the samples.

Table 1. Average PRM rating[1].

Treatment[2]	Rate a.i./ha	Days After Treatment	
		5 days (23 July)	13 days (31 July)
KELTHANE 50 W	1.6 kg	0.2 b[3]	0.1 b
ENVIDOR 240 SC	240 g	0.2 b	0.0 b
ENVIDOR 240 SC	180 g	0.5 b	0.1 b
CONTROL	-	1.5 a	0.5 a

[1] PRM Rating: 0 = 0; 1 = 1-10; 2 = 11-25; 3 = 26-50; 4 = 51-100; 5 = 100+.

[2] Applied 18 July.

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

2001 PMR REPORT # 34 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Pear cv. Bosc
PESTS: Pear Psylla, *Psylla pyricola* (Foerster),
Plum Curculio, *Conotrachelus nenuphar* (Herbst)

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TITLE: CONTROL OF PEAR PSYLLA AND PLUM CURCULIO ON PEAR, 2001

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

METHODS: The trial was conducted in a five-year-old orchard in the Beamsville, Ontario area; trees cv. Bosc were spaced 5.4 m by 6.0 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Treatments were applied at petal fall (24 May); one treatment included a second application (5 June) of ACTARA at the 79 g ai/ha rate. 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) 22 May (pre-treatment), and twice post-treatment, 29 May and 5 June (5 and 12 days after treatment). Plots were sampled for plum curculio (PC) damage 5 June and 20 June (5 and 27 days after treatment). Efficacy ratings consisted of counts of nymphs of PP on 20 clusters per plot, and percent PC damage on 50 fruit 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 significance level.

RESULTS: Data are presented in tables 1 and 2. Prespray samples 22 May showed similar numbers of psylla nymphs (approximately 1.0 nymphs per cluster) in all plots. Plots were also sampled for PP 14 June (21 days after treatment), but PP nymphs had developed to the adult stage in all plots, so no data was recorded. No phytotoxic effects were observed.

CONCLUSIONS: All of the treated plots had fewer PP nymphs per cluster than the control in both the 5 and 12 day samples; none of the treatments were significantly different from each other (Table 1). None of the treatments were different from the control in the 12-day (5 June) PC sample (Table 2). However, all plots treated with ACTARA contained lower % PC damaged fruit than the check plots in the 27-day (20 June) sample; the MATADOR treatment was not significantly different from either the ACTARA treatments or the control.

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment	Rate (a.i./ha)	Days After Treatment	
		5 days (29 May)	12 days (5 June)
ACTARA 25 WG[1]	96 g	0.09 b[3]	0.06 b
ACTARA 25 WG[1]	79 g	0.05 b	0.06 b
ACTARA 25 WG[2]	79 g	0.09 b	0.05 b
MATADOR 120 EC[1]	10 g	0.26 b	0.21 b
CONTROL	-	0.93 a	0.94 a

[1] Applied 24 May.
[2] Applied 24 May, reapplied 5 June (plots were sampled before second application).
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Per cent fruit damaged by plum curculio.

Treatment	Rate (a.i./ha)	Days After Treatment	
		12 Days (5 June)	27 Days (20 June)
ACTARA 25 WG[1]	96 g	0.00 a	2.00 b[3]
ACTARA 25 WG[1]	79 g	0.00 a	2.25 b
ACTARA 25 WG[2]	79 g	4.44 a	2.00 b
MATADOR 120 EC[1]	10 g	1.25 a	5.00 ab
CONTROL	-	6.25 a	13.50 a

[1] Applied 24 May.
[2] Applied 24 May, reapplied 5 June (plots sampled before second application).
[3] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMR REPORT # 35 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Pear cv. Bosc
PESTS: Pear Psylla, *Psylla pyricola* (Foerster),
Plum Curculio, *Conotrachelus nenuphar* (Herbst)

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TITLE: ASSESSMENT OF INSECTICIDES FOR CONTROL OF PEAR PSYLLA AND PLUM CURCULIO ON PEAR, 2001

MATERIALS: EXP 61486A 70 WP (acetamiprid), MITAC 50 W (amitraz)

METHODS: The trial was conducted in a twenty-two-year-old orchard in the Beamsville, Ontario area; trees cv. Bosc 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 (24 May); 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) 22 May (pre-treatment), and three times post-treatment, 28 May, 31 May, and 7 June (4, 7, and 14 days after treatment). Plots were sampled for plum curculio (PC) 31 May and 20 June (7 and 27 days after treatment). Efficacy ratings consisted of counts of PP nymphs on 20 clusters per plot, and percent PC damage on 50 fruit per plot, picked randomly. Clusters were examined using a stereomicroscope and numbers of live PP nymphs were recorded. Data were transformed (square root (x+½)) and analysed using analysis of variance, means were separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in tables 1 and 2. Prespray samples 22 May showed similar numbers of psylla nymphs (approximately 1.0 nymphs per cluster) in all plots. Plots were sampled for PP 20 June (27 days after treatment), but PP nymphs had developed to the adult stage in all plots, so no data was recorded. No phytotoxic effects were observed in any plots.

CONCLUSIONS: All of the treated plots had fewer PP nymphs per cluster than the control in all three samples; none of the insecticide treatments were significantly different from each other (Table 1). All treated plots contained lower % PC damaged fruit than the check plots (Table 2) but were not different from each other.

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		4 Days (28 May)	7 Days (31 May)	14 Days (7 June)
EXP 61486A 70 WP	168 g	0.04 b[2]	0.00 b	0.14 b
EXP 61486A 70 WP	120 g	0.12 b	0.06 b	0.15 b
EXP 61486A 70 WP	56 g	0.19 b	0.20 b	0.20 b
MITAC 50 W	1.25 kg	0.09 b	0.09 b	0.10 b
CONTROL	-	0.88 a	1.08 a	0.85 a

[1] Applied 24 May.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

Table 2. Per cent fruit damaged by plum curculio.

Treatment[1]	Rate (a.i./ha)	Days After Treament	
		% Damaged Fruit 7 Days (31 May)	% Damaged Fruit 27 Days (20 June)
EXP 61486A 70 WP	168 g	0.0 b[2]	5.3 b
EXP 61486A 70 WP	120 g	2.0 b	7.5 b
EXP 61486A 70 WP	56 g	0.0 b	4.3 b
MITAC 50 W	1.25 kg	4.3 b	6.8 b
CONTROL	-	11.6 a	17.5 a

[1] Applied 24 May.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

2001 PMRR REPORT # 36 **SECTION A: FRUIT- Insect/mite Pests**
STUDY DATA BASE: 306-1261-9705

CROP: Pear, cv. Clapp's favourite
PESTS: European red mite (ERM), *Panonychus ulmi* (Koch), two-spotted spider mite (TSSM) *Tetranychus urticae* (Koch)
PREDATOR: *Typhlodromus pyri* (TP) Scheuten

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TITLE: **EFFICACY OF A NOVEL SUMMER MITICIDE AGAINST TWO SPOTTED SPIDER MITES AND EUROPEAN RED MITES ON PEAR IN 2001**

MATERIALS: ACRAMITE 50 WP (bifenazate), PYRAMITE 75 WP (pyridaben)

METHODS: The trial was done in an 30 yr-old orchard of Clapp Favourite pear trees planted at a spacing of 7.5 x 6.0 m and a density of 230 trees/ ha at an experimental orchard at Sheffield Mills, Nova Scotia. The control and the 4 treatments were arranged in a randomized complete block design with each treatment replicated 4 times. Two blocks were located on the westernmost row and 2 blocks on the easternmost row of the orchard. Three weeks prior to the pretreatment count on 9 August, apple shoots with high densities of ERM and TSSM were used to innoculate the 16 trees used in the trial. Pesticides were diluted to a rate comparable to 600 litres/ha. and were applied by a backpack mounted mist blower (Solo 423 port, SOLO Kleinmotoren, Sindelfingen Germany). Each 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. Samples of 20 leaves per tree, totalling 80 leaves per treatment, were taken on the dates shown below and passed through a mite-brushing machine. Counts for TSSM and ERM were from 1/16th of the glass collecting plate. The pre-count of 9 August was taken the same day the treatments were applied. Plate counts of TP motile stages were multiplied by a scaling factor of 2.58 because data indicate that plate counts represent an average of 39% of the *T. pyri* actually found on leaves.

RESULTS: Data are shown in Table 1.

CONCLUSIONS: Pretreatment counts 9 August indicated low numbers of TSSM and ERM, in all plots (Table 1) with no significant differences between treatments. Low numbers of ERM and *T. pyri* were detected sporadically among all plots throughout the trial. Mean densities of motile TSSM on the control trees increased gradually from 2.7 per leaf on 9 August to 4.75 per leaf by 6 September. Densities of motile TSSM on trees treated with ACRAMITE were significantly lower than on the control trees on the final four sampling dates, from 19 to 41 days after treatment.

Table 1. Densities of eggs (ERME, TSSME, TPE) for European red mite, two-spotted spider mite and *Typhlodromus pyri,* respectively, as well as motile stages (ERM, TSSM, TPM) of the same species. 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 square root transformation of the data ($P = 0.05$).

	Rate g [a.i.]/ha	ERME	ERM	TSSME	TSSM	TPE	TPM
			9 August	Precount			
Control		1.00 a	0.25 a	3.61 a	2.67 a	0.00 a	0.00 a
ACRAMITE	280	0.75 a	0.25 a	1.00 a	2.75 a	0.00 a	0.06 a
ACRAMITE	420	1.24 a	0.50 a	3.96 a	7.21 a	0.00 a	0.00 a
PYRAMITE	225	4.04 a	0.78 a	5.04 a	3.82 a	0.08 a	0.00 a
			13 August	4 days			
Control		0.00 a	0.25 a	2.43 a	2.49 a	0.00 a	0.00 a
ACRAMITE	280	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a	0.00 a
ACRAMITE	420	0.00 a	0.00 a	0.50 a	1.50 a	0.00 a	0.00 a
PYRAMITE	225	0.25 a	0.00 a	1.01 a	0.51 a	0.00 a	0.06 a
			20 August	11 days			
Control		0.50 a	0.00 a	4.50 a	1.75 a	0.00 a	0.00 a
ACRAMITE	280	0.00 a	0.00 a	0.56 a	0.00 a	0.00 a	0.00 a
ACRAMITE	420	0.00 a	0.00 a	0.25 a	0.75 a	0.00 a	0.00 a
PYRAMITE	225	0.25 a	0.00 a	1.53 a	0.75 a	0.00 a	0.00 a
			30 August	19 days			
Control		0.53 a	0.00 a	1.25 a	2.50 a	0.00 a	0.13 a
ACRAMITE	280	0.00 b	0.00 a	0.00 a	0.00 b	0.00 a	0.00 a
ACRAMITE	420	0.00 b	0.00 a	0.00 a	0.00 b	0.00 a	0.00 a
PYRAMITE	225	0.00 b	0.50 a	1.25 a	0.50 ab	0.08 a	0.06 a
			6 Sept.	28 days			
Control		0.00 a	0.00 a	2.00 a	4.75 a	0.00 a	0.13 a
ACRAMITE	280	0.25 a	0.00 a	0.00 b	0.50 b	0.00 a	0.00 a
ACRAMITE	420	0.00 a	0.25 a	0.25 b	0.00 b	0.00 a	0.06 a
PYRAMITE	225	0.00 a	0.00 a	0.00 b	0.25 b	0.00 a	0.00 a
			19 Sept.	41 days			
Control		0.00 a	0.00 a	0.29 a	0.60 a	0.03 a	0.03 a
ACRAMITE	280	0.00 a	0.00 a	0.00 a	0.10 b	0.00 a	0.03 a
ACRAMITE	420	0.00 a	0.00 a	0.10 a	0.00 b	0.00 a	0.05 a
PYRAMITE	225	0.00 a	0.00 a	0.00 a	0.00 b	0.00 a	0.05 a

2001 PMR REPORT # 37 **SECTION A: TREE FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Pear cv. Clapp's Favourite
PEST: Pear Psylla, *Psylla pyricola* (Foerster)

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TITLE: CONTROL OF PEAR PSYLLA ON PEAR WITH INSECTICIDES, 2001

MATERIALS: ENVIDOR 240SC (spirodiclofen), GUTHION 50WP (azinphos-methyl)

METHODS: The trial was conducted in a fifteen-year-old orchard in the Fenwick, Ontario, area; trees cv. Clapp's Favourite 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. Plots were sampled pre-treatment 22 May, and three times post-treatment, 29 May, 5 June, and 14 June (5, 12, and 21 days after treatment). Efficacy ratings consisted of counts of nymphs of pear psylla (PP) on 20 clusters per plot, picked randomly. Clusters were examined using a stereomicroscope and numbers of live PP nymphs were recorded. On 24 May, 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. 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. Prespray samples 22 May showed similar numbers of psylla nymphs (approximately 4.5 nymphs per cluster) in all plots. No phytotoxic effects were observed. Pear psylla populations were considered high.

CONCLUSIONS: In the 29 May and 5 June samples (5 and 12 days after application), only the plots treated with the 240 g a.i./ha rate of ENVIDOR did not have significantly lower numbers of PP nymphs per cluster the control. However, the infestation at this rate of ENVIDOR was not different from that in any of the insecticide treated plots. None of the treated plots had fewer PP nymphs per cluster than the control in the 21-day sample.

Table 1. Numbers of pear psylla nymphs per cluster.

Treatment[1]	Rate (a.i./ha)	Days After Treatment		
		5 days (29 May)	12 days (5 June)	21 days (14 June)
ENVIDOR 240 SC	300 g	5.0 b[2]	3.9 b	3.4 a
ENVIDOR 240 SC	240 g	6.3 ab	6.4 ab	2.9 a
ENVIDOR 240 SC	180 g	5.5 b	4.0 b	4.8 a
GUTHION 50 WP	1.00 kg	4.2 b	3.5 b	8.4 a
CONTROL	-	10.5 a	8.0 a	6.8 a

[1] Applied 24 May.
[2] Numbers followed by the same letter are not significantly different P<0.05, Tukey test.

END OF SECTION A: TREE FRUIT - Insect/mite Pests - REPORT # 1 - 37
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SECTION B:	VEGETABLES AND SPECIAL CROPS / LÉGUMES ET CULTURES SPÉCIALES
REPORT/RAPPORT #:	38 - 54
PAGES:	77 - 123
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2001 PMR REPORT # 38 SECTION B: VEGETABLE 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, 2001

MATERIALS: DECIS (deltamethrin 50 g/L), POUNCE (permethrin 38.4%), MATADOR (lambda cyhalothrin 120g/L), WARRIOR (lambda cyhalothrin 114 g/L), GUTHION (azinphos-methyl; 50% w/w a.i.)

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 13 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 broccoli was machine-planted (mechanical cell transplanter) on 6 June. To control cabbage maggot, GUTHION was added to the planting water for all treatments except Trt. 9 (CONTROL - GUTHION). All foliar treatments were applied with a Solo backpack sprayer with a flat spray nozzle #33, pressurized by a hand pump to 172 kPa using water equivalent to 350 L/ha). Applications took place on 25 June (Site 1), 26 June (Site 2), 10 July (both sites) and 31 July (both sites). 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 between treatments were determined using analysis of variance and Duncan's multiple range test.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: At Site 1 plots treated with the higher rate of MATADOR (Trt. 5) had the least SM damage, but the reduction was not significantly different from other insecticide treatments (P>0.05). At Site 2 plots treated with the higher rates of MATADOR (Trt. 5) and WARRIOR (Trt. 7) had significantly less SM damage than all other treatments (P<0.05).

Table 1. Mean season damage rating of broccoli treated with various insecticides, near Markham (Site 1) and Stouffville (Site 2), ON, 2001.

Treatment No.	Insecticide	Rate (mL/ha)	Mean damage rating[1]	
			Site 1	Site 2
1	DECIS	200	0.18 ± 0.05b[2]	1.08 ± 0.10cd
2	POUNCE	90	0.09 ± 0.03b	1.00 ± 0.08d
3	POUNCE	180	0.08 ± 0.03b	1.12 ± 0.09bcd
4	MATADOR	41.7	0.14 ± 0.04b	1.22 ± 0.10abcd
5	MATADOR	83.3	0.06 ± 0.02b	0.69 ± 0.07e
6	WARRIOR	43.9	0.13 ± 0.04b	1.23 ± 0.10abc
7	WARRIOR	87.7	0.09 ± 0.03b	0.66 ± 0.07e
8	Control (+ GUTHION)	--	0.29 ± 0.05a	1.37 ± 0.09ab
9	Control (- GUTHION)	--	0.33 ± 0.07a	1.41 ± 0.09a

[1] 0= least, 3 = greatest degree of damage (± standard error).

[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.

2001 PMR REPORT # 39 SECTION B: VEGETABLE AND SPECIAL CROPS - Insect Pests
ICAR: 30601

CROP: Cabbage, cv. Bronco
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: RELATIVE EFFICACY OF FOUR APPLICATION METHODS FOR GUTHION TO CONTROL CABBAGE MAGGOT ON CABBAGE, 2001

MATERIALS: GUTHION 50 WP (azinphos-methyl; 50% w/w a.i.)

METHODS: Cabbage seedlings cv. Bronco were grown in plug trays and then hand-transplanted at the Muck Research Station (Site 1; muck soil), near Kettleby, ON, on 22 May, 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 1.5 m alley (E-W). Five treatments were replicated 5 times in a randomized complete block design. The same experiment was repeated at a nearby farm (Site 2; muck soil) where cabbage was hand-transplanted on 22 May. The same experiment, but with a 3 m alley (E-W) and10 replications, was repeated at the Cambridge Research Station (Site 3; mineral soil), near Cambridge, ON, where cabbage was machine-planted (Holland transplanter) on 16 May. Methods and timing of GUTHION-application are outlined in Table 1. For plug tray treatments the rate used was 6.41 g product per 475 mL water per 128-plant plug tray (= 25 mg a.i. per plant). For transplanting and post-transplanting treatments the rate used was 5.75 g product per 10 L water per plot with 200 mL of solution poured around the base of each plant with a beaker (= 57.5 mg a.i. per plant for all field applications). At Site 1, destructive sampling of 4 plants per plot took place on 26 June, 27 July and 13 August and harvest took place on 13 August. At Site 2, destructive sampling of 4 plants per plot took place on 27 June and 24 July and harvest took place on 14 August. A post-harvest destructive sampling of 4 plants per plot took place at Site 2 on 15 August. At Site 3, destructive sampling of 4 plants per plot took place on 25 June, 30 July and 22 August and harvest took place on 22 August. CM-damage was rated on a scale of 0 to 4 (0 represents < 10% of root damaged; 1 represents 10-25% of root damaged; 2 represents 26-50% of root damaged; 3 represents 51-75% of root damaged; 4 represents > 76% of root damaged). Differences in ratings between treatments were determined using analysis of variance and Duncan's multiple range test.

RESULTS: The results are summarized in Tables 1 and 2.

CONCLUSIONS: All four GUTHION treatments reduced CM damage relative to non-treated controls at all three sites except on the last sampling date at Site 1 where the majority of plants developed severe club root and CM damage symptoms were obscured (Table 1). At Site 1 (muck soil) CM damage was lowest in Treatment 4 (3 Days After Planting + 2 Weeks) but this reduction was not significantly different from other GUTHION treatments ($P>0.05$). At Site 2 (muck soil), on the second sampling date, CM damage was lowest in Treatments 1 & 2 (Plug Tray and Plug Tray + 2 Weeks). On the last sampling date CM damage was lowest in Treatments 2 and 3 (Plug Tray + 2 Weeks and Planting + 2 Weeks). At Site 3 (mineral soil) CM damage was lowest in Treatment 2 (Plug Tray + 2 weeks). No treatment had any significant impact on cabbage-yield at any site (Table 2). Plug tray applications of GUTHION were

at least as effective as conventional methods of application and provided season-long control of CM-damage on muck and mineral soils. Plug tray application uses only 22% the amount of active ingredient applied in conventional methods.

Table 1. Mean damage rating of cabbage treated with GUTHION 50 WP using different application methods, near Kettleby (Sites 1 and 2) and Cambridge (Site 3), ON, 2001.

Treatment No.	Rate (g a.i. per plant)	Method[2]	Mean damage rating[1] for indicated date		
			Site 1		
			26 June	27 July	13 August
1	25	Plug tray	0.0 ± 0.0a[4]	0.06 ± 0.06a	0.0 ± 0.0a
2	25.0 + 57.5	Plug tray + 2 wks	0.0 ± 0.0a	0.06 ± 0.06a	0.0 ± 0.0a
3	57.5 + 57.5	Planting + 2 wks	0.0 ± 0.0a	0.13 ± 0.09a	0.25 ± 0.11b
4	57.5 + 57.5	3 d after planting +	0.0 ± 0.0a	0.0 ± 0.0a	0.19 ± 0.10ab
5	0	--	0.31 ± 0.12b	0.44 ± 0.18b	0.0 ± 0.0a
			Site 2		
			27 June	24 July	14 August
1	25	Plug tray	0.0 ± 0.0a	0.06 ± 0.06ab	0.25 ± 0.19ab
2	25.0 + 57.5	Plug tray + 2 wks	0.0 ± 0.0a	0.0 ± 0.0a	0.13 ± 0.09ab
3	57.5 + 57.5	Planting + 2 wks	0.0 ± 0.0a	0.13 ± 0.09ab	0.06 ± 0.06a
4	57.5 + 57.5	3 d after planting +	0.0 ± 0.0a	0.19 ± 0.14ab	0.25 ± 0.14ab
5	0	--	0.13 ± 0.09b	0.31 ± 0.12b	0.56 ± 0.18b
			Site 3		
			25 June	30 July	22 Aug.
1	25	Plug tray	0.0 ± 0.0a	0.45 ± 0.08ab	0.78 ± 0.15ab
2	25.0 + 57.5	Plug tray + 2 wks	0.0 ± 0.0a	0.25 ± 0.07a	0.50 ± 0.1a
3	57.5 + 57.5	Planting + 2 wks	0.0 ± 0.0a	0.63 ± 0.09b	1.0 ± 0.14b
4	57.5 + 57.5	3 d after planting +	0.0 ± 0.0a	0.46 ± 0.08ab	0.88 ± 0.14ab
5	0	--	0.19 ± 0.08b	1.23 ± 0.11c	1.63 ± 0.14c

[1] 0= least, 4 = greatest degree of damage (± standard error).

[2] Plug tray = application to plug tray 3 days prior to transplanting; Plug tray + 2 wks = application to plug tray 3 days prior to transplanting and to soil 2 weeks after transplanting; Planting + 2 wks = application to soil at transplanting and 2 weeks after transplanting; 3 d after planting + 2wks = application to soil 3 days after transplanting and 2 weeks after transplanting.

[3] Not determined.

[4] 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 of cabbage treated with GUTHION 50 WP using different application methods, near Kettleby (Sites 1 and 2) and Cambridge (Site 3), ON, 2001.

Rate (g a.i. per plant)	Method[1]	Mean yield (t/ha)		
		Site 1	Site 2	Site 3
25	Plug tray	32.7 ± 10.5a[2]	51.2 ± 2.5a	6.1 ± 0.6a
25/57.5	Plug tray + 2 wks	26.7 ± 9.4a	56.6 ± 7.4a	6.6 ± 0.6a
57.5	Planting + 2 wks	23.7 ± 6.7a	53.8 ± 1.7a	6.3 ± 0.5a
57.5	3 d after planting + 2wks	25.1 ± 8.6a	55.0 ± 5.6a	7.5 ± 0.3a
control	--	21.6 ± 7.4a	56.7 ± 5.5a	6.9 ± 0.7a

[1] Plug tray = application to plug tray 3 days prior to transplanting; Plug tray + 2 wks = application to plug tray 3 days prior to transplanting and to soil 2 weeks after transplanting; Planting + 2 wks = application to soil at transplanting and 2 weeks after transplanting; 3 d after planting + 2wks = application to soil 3 days after transplanting and 2 weeks after transplanting.

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

2001 PMR REPORT # 40 SECTION B: VEGETABLE AND SPECIAL CROPS - Insect Pests
ICAR: 30601

CROP: Cabbage, cv. Bronco
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: RELATIVE EFFICACY OF THREE APPLICATION METHODS FOR LORSBAN 4E OR LORSBAN 50 W TO CONTROL CABBAGE MAGGOT ON CABBAGE, 2001

MATERIALS: LORSBAN 4 E (chlorpyrifos; 480 g/L), LORSBAN 50 W (chlorpyrifos; 50% w/w)

METHODS: Cabbage seedlings cv. Bronco were grown in plug trays and then hand-transplanted near the Muck Research Station (Site 1; muck soil), near Kettleby, ON, on 22 May, 2001 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 1.5 m alley (E-W). Four treatments were replicated 5 times in a randomized complete block design. The same experiment was repeated at a nearby farm (Site 2; muck soil) where cabbage was hand-transplanted on 22 May. The same experiment, but with a 3 m alley (E-W) and 10 replications, was repeated at the Cambridge Research Station (Site 3; mineral soil), near Cambridge, ON, where cabbage was machine-planted (Holland transplanter) on 16 May. Treatment 1 consisted of LORSBAN 4E applied to plug trays three days prior to transplanting at a rate of 2.7 mL in 475 mL water applied with a watering can (128 plants; = 10.1 mg a.i. per plant). Treatment 2 consisted of LORSBAN 50W applied within an hour after transplanting at a rate of 4.9 g in 15L of water with 200 mL poured around the base of each plant (= 32.7 mg a.i. per plant). Treatment 3 consisted of LORSBAN 4E applied 3 days after transplanting with a watering can at a rate of 8.4 mL in 5.2 L water (= 20.2 g a.i./100 m row) in an approximately 10 cm band, applied to 20 m of row. Treatment 4 was the control and consisted of the application to each plant of 200 mL of water within an hour after transplanting. At Site 1, destructive sampling of 4 plants per plot took place on 26 June and 24 July and harvest took place on 13 August. A post-harvest destructive sampling of 4 plants per plot took place at Site 1 on 14 August. At Site 2, destructive sampling of 4 plants per plot took place on 27 June and 24 July and harvest took place on 14 August. A post-harvest destructive sampling of 4 plants per plot took place at Site 2 on 15 August. At Site 3, destructive sampling of 4 plants per plot took place on 25 June, 27 July and 22 August and harvest took place on 22 August. CM-damage was rated on a scale of 0 to 4 (0 represents < 10% of root damaged; 1 represents 10-25% of root damaged; 2 represents 26-50% of root damaged; 3 represents 51-75% of root damaged; 4 represents > 76% of root damaged). Differences in ratings between treatments were determined using analysis of variance and Duncan's multiple range test.

RESULTS/OBSERVATIONS: The results are summarized in Tables 1, 2 and 3. At all three sites it was noted on 5 June that plants in all plots treated with LORSBAN applied to plug trays (Treatment 1) were stunted and pale coloured to varying degrees. This apparent phytotoxicity was especially pronounced at Site 3 where approximately 11% of plants from this treatment group subsequently died. Plants which survived grew more slowly than plants receiving other treatments but eventually recovered and produced smaller, but otherwise normal, heads. Mortality and smaller head size resulted in reduced yields from the LORSBAN plug-tray treatment. In previous years the identical treatment did not produce phytotoxic effects.

CONCLUSIONS: At Site 1 (muck soil) none of the LORSBAN treatments differed significantly from controls ($P>0.05$) on the first and third sampling dates. On the second sampling date LORSBAN applied to plug trays significantly reduced CM-damage. At Site 2 (muck soil) there were no significant differences among treatments on the first and second sampling dates. On the third sampling date plants where LORSBAN was applied 3 days after transplanting had significantly less CM-damage than control plots. At Site 3 (mineral soil) all three LORSBAN treatments significantly ($P<0.05$) reduced CM-damage relative to controls on the first two sampling dates. On the last sampling date LORSBAN applied to plug trays and at transplanting resulted in the greatest reduction; damage was significantly lower than in controls. At all three sites LORSBAN applied at transplanting or three days later resulted in yields not significantly different ($P>0.05$) from control plot yields. At Sites 1 and 3 the yields from plots with LORSBAN applied to plug trays were significantly lower than yields from control plots. At Site 2, yield was lowest from plots with LORSBAN applied to plug trays but the difference was not significant.

Table 1. Mean damage rating of cabbage planted on organic soil (muck) and treated with LORSBAN 4 E or LORSBAN 50 W using different application methods, near Kettleby (Sites 1 and 2), ON, 2001.

Trtmt. No.	Treatment	Rate	Method[2]	Mean damage rating[1] for indicated date		
				Site 1		
				26 June	24 July	14 August
1	LORSBAN 4 E	10 mg a.i. per plant	Plug tray	0.25 ± 0.08a[3]	0.40 ± 0.09a	0.50 ± 0.14a
2	LORSBAN 50 W	32 mg a.i. per plant	Transplanting	0.38 ± 0.09ab	0.78 ± 0.11b	0.75 ± 0.12ab
3	LORSBAN 4 E	20.2 g a.i. per 100 m row	Three days after transplanting	0.58 ± 0.13b	0.85 ± 0.12b	1.15 ± 0.18b
4	Control	--	--	0.38 ± 0.10ab	0.75 ± 0.12b	0.70 ± 0.16ab
				Site 2		
				27 June	24 July	15 August
1	LORSBAN 4 E	10 mg a.i. per plant	Plug tray	0a	0.30 ± 0.13a	0.55 ± 0.19ab
2	LORSBAN 50 W	32 mg a.i. per plant	Transplanting	0a	0.30 ± 0.15a	0.75 ± 0.22ab
3	LORSBAN 4 E	20.2 g a.i. per 100 m row	Three days after transplanting	0a	0.20 ± 0.12a	0.25 ± 0.12a
4	Control	--	--	0.10 ± 0.10a	0.50 ± 0.17a	0.85 ± 0.17b

[1] 0= least, 4 = greatest degree of damage (± standard error).

[2] Plug tray = application to plug tray 3 days prior to transplanting; Transplanting = application to soil immediately after transplanting; Three days after transplanting = application to soil 3 days after transplanting.

[3] 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 damage rating of cabbage planted on mineral soil (sandy loam) and treated with LORSBAN 4 E or LORSBAN 50 W using different application methods, near Cambridge (Site 3), ON, 2001.

Treatment No.	Treatment	Rate	Method[2]	Mean damage rating[1] for indicated date		
				Site 3		
				25 June	27 July	22 August
1	LORSBAN 4 E	10 mg a.i. per plant	Plug tray	0a[3]	0.28 ± 0.10a	0.38 ± 0.09a
2	LORSBAN 50 W	32 mg a.i. per plant	Transplanting	0a	0.28 ± 0.08a	0.43 ± 0.10a
3	LORSBAN 4 E	20.2 g a.i. per 100 m row	Three days after transplanting	0.03 ± 0.03a	0.30 ± 0.08a	0.68 ± 0.12ab
4	Control	--	--	0.15 ± 0.06b	0.75 ± 0.08b	0.98 ± 0.12b

[1] 0= least, 4 = greatest degree of damage (± standard error).

[2] Plug tray = application to plug tray 3 days prior to transplanting; Transplanting = application to soil immediately after transplanting; Three days after transplanting = application to soil 3 days after transplanting.

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

Table 3. Mean yield of cabbage treated with LORSBAN 4 E or LORSBAN 50 W using different application methods, near Kettleby (Sites 1 and 2) and Cambridge (Site 3), Ontario, 2001.

Treatment	Method[1]	Mean yield (t/ha)		
		Site 1	Site 2	Site 3
LORSBAN 4 E	Plug tray	44.6 ± 3.1a	54.8 ± 1.5a	5.8 ± 0.9a[2]
LORSBAN 50 W	Transplanting	63.3 ± 2.51b	63.6 ± 3.5a	12.6 ± 1.4c
LORSBAN 4 E	Three days after transplanting	65.9 ± 1.0b	63.0 ± 3.3a	8.6 ± 1.7ab
Control	--	66.2 ± 1.9b	61.5 ± 3.7a	11.9 ± 0.8bc

[1] Plug tray = application to plug tray 3 days prior to transplanting; Transplanting = application to soil immediately after transplanting; Three days after transplanting = application to soil 3 days after transplanting.

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

2001 PMR REPORT # 41 SECTION B: VEGETABLE 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 TO CONTROL SWEDE MIDGE ON CABBAGE, 2001

MATERIALS: DECIS (deltamethrin 50 g/L), POUNCE (permethrin 38.4%), MATADOR (lambda cyhalothrin 120g/L), WARRIOR (lambda cyhalothrin 114 g/L), ORTHENE (acephate 75%), GUTHION (azinphos-methyl; 50% w/w a.i.)

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 13 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). Ten 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 6 June. To control cabbage maggot, GUTHION was added to the planting water for all treatments except Trt. 10 (CONTROL - GUTHION). All foliar treatments were applied with a Solo backpack sprayer with a flat spray nozzle #33, pressurized by a hand pump to 172 kPa using water equivalent to 350 L/ha. Applications took place on 25 June (Site 1), 26 June (Site 2), 10 July (both sites) and 31 July (both sites). 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. Harvest took place on 20 and 21 August at Site 1 and on 8 August at Site 2. Differences in damage ratings and yield between treatments were determined using analysis of variance and Duncan's multiple range test.

RESULTS: The results are summarized in Tables 1 and 2.

CONCLUSIONS: At Site 1, plots treated with the higher rate of WARRIOR (Trt. 7) had the lowest SM-damage, significantly less than all other treatments except the lower rate of WARRIOR (Trt. 6) and the higher rate of MATADOR (Trt.5). At Site 2, all insecticides significantly reduced SM-damage relative to that recorded in CONTROL plots. The organophosphorus insecticide ORTHENE (Trt. 8), however, proved significantly less effective than any rate of any pyrethroid (Trt. 1-7). At Site 1, application of only the lower of WARRIOR (Trt. 6) resulted in a significant increase in cabbage yield relative to yields in CONTROL plots. At Site 2, application of either rate of POUNCE (Trts. 2, 3) resulted in cabbage-yields significantly higher than those recorded in CONTROL plots. Overall, pyrethroids provided more effective management of SM-damage to cabbage than did the organophosphorus insecticide, ORTHENE.

Table 1. Mean season damage rating of cabbage treated with various insecticides, near Markham (Site 1) and Stouffville (Site 2), ON, 2001.

Treatment No.	Insecticide	Rate (product/ha)	Mean damage rating[1]	
			Site 1	Site 2
1	DECIS	200 mL	0.27 ± 0.04b[2]	0.37 ± 0.06c
2	POUNCE	90 mL	0.23 ± 0.04bc	0.31 ± 0.05c
3	POUNCE	180 mL	0.26 ± 0.04b	0.33 ± 0.05c
4	MATADOR	41.7 mL	0.26 ± 0.05b	0.34 ± 0.05c
5	MATADOR	83.3 mL	0.20 ± 0.04bcd	0.31 ± 0.05c
6	WARRIOR	43.9 mL	0.13 ± 0.03cd	0.32 ± 0.05c
7	WARRIOR	87.7 mL	0.10 ± 0.03d	0.28 ± 0.05c
8	ORTHENE	1 kg	0.25 ± 0.04bc	0.54 ± 0.06b
9	Control (+ GUTHION)	--	0.39 ± 0.05a	0.71 ± 0.07a
10	Control (- GUTHION)	--	0.27 ± 0.04b	0.76 ± 0.08a

[1] 0= least, 3 = greatest degree of damage (± standard error).

[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) of cabbage treated with various insecticides, near Markham (Site 1) and Stouffville (Site 2), ON, 2001.

Treatment No.	Insecticide	Rate (product/ha)	Mean yield (t/ha)	
			Site 1[1]	Site 2[2]
1	DECIS	200 mL	13.0 ± 2.7ab[3]	22.2 ± 2.3ab
2	POUNCE	90 mL	15.7 ± 3.7ab	26.4 ± 4.4a
3	POUNCE	180 mL	13.6 ± 5.5ab	27.3 ± 1.2a
4	MATADOR	41.7 mL	18.6 ± 3.1ab	20.8 ± 1.6abc
5	MATADOR	83.3 mL	12.7 ± 4.1ab	22.0 ± 3.3ab
6	WARRIOR	43.9 mL	23.9 ± 3.1a	22.1 ± 4.5ab
7	WARRIOR	87.7 mL	18.0 ± 4.0ab	21.8 ± 4.7ab
8	ORTHENE	1 kg	10.4 ± 1.5b	18.8 ± 3.2abc
9	Control (+ GUTHION)	--	10.0 ± 4.6b	13.3 ± 3.7bc
10	Control (- GUTHION)	--	10.7 ± 3.8b	10.4 ± 1.8c

[1] Based on 3 or 4 repetitions due to loss of plots due to fusarium yellow disease.
[2] Based on 3 repetitions due to loss of plots due to skuffling damage during drought conditions.
[3] Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.

2001 PMR REPORT # 42 SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests
ICAR: 206003

CROP: Midseason Cabbage (*Brassica oleracea* var. *capitata* L.) cv. Atlantis
PEST: Onion Thrips, *Thrips tabaci* L.

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TITLE: EFFECT OF NITROGEN APPLICATION RATE ON ONION THRIPS DAMAGE IN CABBAGE, 2000-01

MATERIALS: CALCIUM AMMONIUM NITRATE (nitrogen 27.5%), POTASSIUM NITRATE (nitrogen 13.75%)

METHODS: Cabbage, cv. Atlantis, were seeded in plug trays on 10 May (2000) and 27 Apr (2001) at the Simcoe Campus, University of Guelph. Seedlings were transplanted into the field on 30 May in 4 row plots, 7 m in length (2000) and 9 m in length (2001), with a row spacing of 75 cm and an in-row plant spacing of 45 cm. Nitrogen was applied at 0%, 50%, 100%, 150%, and 200% of the OMAFRA (Ontario Ministry of Agriculture, Food, and Rural Affairs) recommended rate for mineral soil (170 kg/ha N: split 75% preplant incorporated/25% sidedress 3 weeks after planting) using CALCIUM AMMONIUM NITRATE preplant and POTASSIUM NITRATE for sidedress applications. A randomised complete block arrangement with four blocks per treatment was used. All other nutrients were applied based on soil test results and OMAFRA recommendations. Due to uneven maturation on 16 Aug, 30 Aug, and 11 Sep (2000) and 17 Aug and 5 Sep (2001), cabbage plants were harvested from a 4 m section of the middle 2 rows of each experimental unit. Depending on the number of heads harvested on each harvest date, up to 5 heads from the harvested area were placed at 1ºC for one week. In 2001, 5 heads were removed on 17 Aug from each treatment to compare thrips damage across treatments on the same date. Cabbages were rated for thrips damage after storage by assessing the outer 5 head leaves. Each leaf was rated on a scale of 0 to 5 (0=no damage, 5=severe damage) and the ratings from all 5 leaves were totalled for a single rating per head. Thrips damage ratings were compared among treatments by averaging the rating per head across all harvest dates. Weather data for the two years are presented in Table 1. Data were analysed using the General Analysis of Variance function of the Linear Models section of Statistix V.4.1 and the General Linear Models section of SAS version 8.0 (SAS Institute, Cary NC).

RESULTS: Thrips and yield data are presented in Table 2.

CONCLUSIONS: The data show that the damage caused by onion thrips in cabbage is significantly affected by N application rate. Since ratings within the same harvest date are not significantly different, the effect of N application rate on thrips damage must be due to delayed maturity of low N treatments. The additional period in the field in the low N treatments allowed for further thrips development. However, application of nitrogen beyond 150% of the recommended rate in 2001 caused thrips damage to increase because of delayed maturity. Yield was significantly affected by N application rate in 2000 but not in 2001. The data show a clear link between cabbage fertilization practices and pest pressures. Fertilization practices should be included in the integrated pest management program for thrips on cabbage.

Table 1. Simcoe mean monthly temperatures, monthly precipitation, and long term averages (LTA) for the 2000 and 2001 growing seasons.

Month	Mean Temp. (°C)			Precipitation (mm)		
	2000	2001	LTA	2000	2001	LTA
May	14.4	14.7	12.6	103	109	74
Jun	18.5	19.3	17.8	181	63	82
Jul	19.8	20.7	20.4	146	11	77
Aug	19.7	21.8	19.5	81	105	80
Sep	15.8	15.9	15.5	99	37	89

Table 2. Effect of nitrogen application rates on thrips damage ratings in 2000 and 2001 on cabbage cv. Atlantis.

N application rate		Average Thrips Damage Rating[1]			Total Yield (t/ha)	
Preplant	Sidedress	2000 season[2]	2001 season[2]	2001 (17-Aug only)[2]	2000[3]	2001[2]
0	0	8.15a	12.10a	7.15a	30.1a	59.1a
64	21	5.48ab	9.90ab	5.85a	62.8b	63.8a
128	42	5.08b	10.02ab	6.00a	61.4b	57.9a
192	63	4.78b	7.30b	5.50a	68.5b	70.5a
256	84	4.50b	10.50a	5.65a	69.6b	58.1a

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

[2] Regression analysis not significant at P=0.05.

[3] Regression: $P<0.0001$, $R^2=0.67$, Equation: $Yield=1.23 + (0.0174)Nrate – (0.000052)Nrate^{2.}$

2001 PMR REPORT # 43 SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests
ICAR: 30601

CROP: Celery, cv. Florida 683
PEST: Pea Leafminer (PLM), *Liriomyza huidobrensis* (Blanchard)

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TITLE: EFFICACY OF SUCCESS 480 SC FOR CONTROL OF PEA LEAFMINER ON CELERY, 2001

MATERIALS: SUCCESS 480 SC (spinosad 480 g/L) and SYLGARD 309 (siloxylated polyether 76% + surfactant mixture 24%)

METHODS: Celery seedlings cv. Florida 683 were grown in plug trays and then hand-transplanted at the Muck Research Station near Kettleby, ON, on 5 July, in 6 row plots, 5 m in length, with a row spacing of 55 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Five treatments were replicated 5 times (with the exception of the control which was replicated 4 times) in a randomized complete block design. Where necessary, the surfactant SYLGARD was added to the spray solution at a concentration of 2.5 ml/L water. All treatments were applied with a Solo backpack sprayer with a flat spray nozzle #33, pressurized by a hand pump to 172 kPa using water equivalent to 350 L/ha. Applications took place on 20 July, 8, 23 August, and 7 September. Plots were monitored for PLM-leaf mining (caused by larvae) and stippling (caused by ovipositing adult females) twice each week. Both sides of the youngest, most fully expanded two leaves per plant on five randomly chosen plants per plot were examined. The total number of mines per leaf was counted. PLM-mining damage was also rated on a scale of 0 to 4 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards stalk; 4 = mines present on stalk). PLM-stippling damage was determined by counting the number of stipples within a 1 cm^2 grid held against the centre of each leaf. Season mean damage was calculated from all damage data collected after the first spray date. Celery was harvested on 21 September. Ten plants from each plot were weighed and graded according to damage. The total weight of all 10 plants was recorded before and after trimming. The trimmed weight of each plant was determined and rated on a scale of 0 to 2 (0 = < 0.80 kg; 1 = 0.80-0.99 kg; 2 = ≥1.0 kg). Mining damage was determined before and after trimming and rated on a scale of 0 to 4 (0 = all stalks undamaged; 1 = 1-25% of stalks damaged; 2 = 26-50% of stalks damaged; 3 = 51-75% of stalks damaged; 4 = 75-100% of stalks damaged). Differences in ratings and weights among treatments were determined using analysis of variance and Duncan's multiple range test.

RESULTS: The results are summarized in Tables 1 and 2.

CONCLUSIONS: The mean number of PLM mines and mean mine damage rating were significantly lower ($P<0.05$) in plots treated with SUCCESS combined with a surfactant (Trt. 4). Stippling damage was slightly but not significantly lower for all four insecticide treatments versus controls (Table 1). Mean weight per plant before and after trimming and mean weight class were highest in plots treated with the higher rate of SUCCESS combined with a surfactant (Trt. 4) and this was significantly greater than in all other treatments (Table 2). The pre-trimming mine damage rating was significantly reduced only in plots treated with the higher rate of SUCCESS combined with the surfactant (Trt. 4) (Table 2).

The post-trimming damage rating was significantly reduced only in plots receiving the lower rate of SUCCESS alone (Trt.1) (Table 2). Based on our results, foliar application of SUCCESS, particularly in combination with a suitable surfactant, may have some impact on PLM-damage to celery.

Table 1. Season mean (± standard error) pea leafminer-mining and stippling damage on celery treated with SUCCESS 480 SC ± the surfactant SYLGARD 309, near Kettleby, ON, 2001.

Treatment No.	Insecticide	Rate (g a.i./ha)	Surfactant	Mines[1]	Mining damage rating[2]	Stippling[3]
1	SUCCESS	101	--	1.58 ± 0.08ab	1.33 ± 0.05ab	8.27 ± 0.54a
2	SUCCESS	101	yes	1.43 ± 0.06b	1.32 ± 0.05ab	7.81 ± 0.49a
3	SUCCESS	169	--	1.57 ± 0.08ab	1.35 ± 0.05a	8.45 ± 0.55a
4	SUCCESS	169	yes	1.36 ± 0.06b	1.20 ± 0.05b	8.47 ± 0.51a
5	none	--	--	1.71 ± 0.09a	1.42 ± 0.05a	9.35 ± 0.59a

[1] Mean number of mines per leaf.
[2] 0= least, 4 = greatest degree of damage.
[3] Mean number of stipples per 1 cm^2.
[4] Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.

Table 2. Mean (± standard error) weight per plant, pea leafminer damage and weight class of celery at harvest treated with SUCCESS 480 SC ± the surfactant SYLGARD 309, near Kettleby, ON, 2001.

Treat No.	Insecticide (g a.i./ha) ± surfactant	Pre-trimming		Post-trimming		
		Wt/plant (kg)	Damage[1]	Wt/plant (kg)	Wt. Class[2]	Damage
1	101 -	1.36 ± 0.06ab[3]	1.00 ± 0.09ab	0.75 ± 0.02b	0.40 ± 0.08b	1.46 ± 0.13b
2	101 +	1.32 ± 0.08b	0.98 ± 0.08ab	0.72 ± 0.05b	0.40 ± 0.09b	1.64 ± 0.12ab
3	169 -	1.28 ± 0.05bc	1.06 ± 0.07ab	0.71 ± 0.02b	0.38 ± 0.08b	1.72 ± 0.14ab
4	169 +	1.54 ± 0.04a	0.84 ± 0.07b	0.86 ± 0.02a	0.82 ± 0.11a	1.72 ± 0.13ab
5	--	1.12 ± 0.08c	1.15 ± 0.11a	0.61 ± 0.04c	0.15 ± 0.06b	2.05 ± 0.19a

[1] Rated on a scale of 0 to 4 (0 = all stalks undamaged; 1 = 1-25% of stalks damaged; 2 = 26-50% of stalks damaged; 3 = 51-75% of stalks damaged; 4 = 75-100% of stalks damaged).

[2] Rated on a scale of 0 to 2 (0 = < 0.80 kg; 1 = 0.80-0.99 kg; 2 = ≥1.0 kg).

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

2001 PMR REPORT # 44 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
ICAR: 440204

CROP: Sweet corn (*Zea mays saccharata* L.), cvs. Aladdin, Seneca Nation, Delectable
PEST: European corn borer (ECB), *Ostrinia nubilalis* (Hubner)

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TITLE: RELATIVE EFFICACY OF SUCCESS 480 SC, FURADAN 4F AND RIPCORD 400EC FOR CONTROL OF EUROPEAN CORN BORER (*Ostrinia nubilalis* (Hubner)) IN ATTACKING SWEET CORN ON SANDY LOAM SOIL (Cambridge Research Station), 2001

MATERIALS: SUCCESS 480 SC® (spinosad, *Saccharopolyspora spinosa*), FURADAN 4 F® (carbofuran), RIPCORD 400 EC® (cypermethrin).

METHODS: Sweet corn was seeded at the Cambridge Research Station in 4 row blocks, 15 m long. Rows were spaced on 0.75 m centres with 20-22 cm plant spacing. Three metre spray lines separated the blocks. Six treatments were replicated four times in a randomized complete block design. ECB populations were monitored using pheromone traps (univoltine Iowa strain lures, Bioforest Technologies Inc., Sault Ste. Marie, Ontario). Foliar insecticides were applied to all 4 rows of each block, using a tractor-mounted, boom sprayer that delivered 1000 L/ha at 400 kPa (Teejet nozzles # 8003 VS). The first application took place when the crop was tasselling, approximately 10 days to 2 weeks before maturity. The sweet corn was harvested by sampling 25 ears from the centre two rows of each plot. Details of planting, application and harvest are outlined in Table 1. ECB-control was determined by examining the 25 ears for tunneling on the husk and the ear, counting the number of larvae per ear and assessing marketability of each ear. Marketable considerations included ear size, tip fill and colour. A rating scale of 0-10 was used, where ratings of 6 or less were not considered marketable. Results were analyzed using analysis of variance (ANOVA) and Tukey's Means Test ($p<0.05$).

RESULTS: As outlined in Tables 2-4.

CONCLUSIONS: All treatments significantly reduced the number of ECB larvae at harvest and numbers of tunnels on the husk and in the ear. Marketability of ears harvested from all treated plots was significantly higher than in untreated plots. No treatment had a significant impact on yield. Considering all results at this site, control by SPINOSAD of ECB-damage to sweet corn appears equivalent to or better than that provided by FURADAN or RIPCORD. SPINOSAD should thus be considered an acceptable alternative to these commercial insecticides.

Table 1. Management parameters for sweet corn field trials, Cambridge Research Farm, 2001.

Cultivar	Maturity (days)	Planting Date	Application Date		Harvest Date
			First	Second	
Aladdin	53/63	14 May	22 July	1 August	7 August
Seneca Nation	73	14 May	26 July	2 August	17 August
Delectable	82	14 May	31 July	7 August	21 August

Table 2. Relative efficacy of SPINOSAD, FURADAN and RIPCORD for control of European corn borer on sweet corn, cv. Aladdin, on sandy loam soil at the Cambridge Research Farm - University of Guelph, 2001.

Treatments	Rate (g a.i./ha)	Tunnels on the Husk	Tunnels in the Ear	Larvae / Ear	Marketability (0 - 10 scale)	Yield (t/ha)[2]
Untreated	--	3.3 a[1]	2.0 a	1.7 a	1.6 a	9.3 a
SUCCESS 480 SC	40+40	0.6 b	0.3 b	0.3 b	6.1 b	9.3 a
SUCCESS 480 SC	60+60	0.5 b	0.4 b	0.2 b	6.4 b	9.5 a
SUCCESS 480 SC	80+80	0.7 b	0.5 b	0.4 b	5.1 b	9.4 a
FURADAN 4F	530+530	0.7 b	0.5 b	0.4 b	5.6 b	9.6 a
RIPCORD 400 EC	70+70	0.9 b	0.6 b	0.4 b	5.3 b	9.3 a

[1] Treatment means in a column followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

[2] Based on 20cm plant spacingin 0.75 m rows.

Table 3. Relative efficacy of SPINOSAD, FURADAN and RIPCORD for control of European corn borer on sweet corn, cv. Seneca Nation, on sandy loam soil at the Cambridge Research Farm -- University of Guelph, 2001.

Treatments	Rate (g a.i./ha)	Tunnels on the Husk	Tunnels in the Ear	Larvae / Ear	Marketability (0 - 10 scale)	Yield (t/ha)[2]
Untreated	--	1.9 a[1]	1.1 a	0.6 a	3.9 a	10.5 a
SUCCESS 480 SC	40+40	0.2 b	0.1 b	0.1 b	8.1 b	10.5 a
SUCCESS 480 SC	60+60	0.2 b	0.1 b	0.1 b	7.9 b	10.4 a
SUCCESS 480 SC	80+80	0.2 b	0.1 b	0.0 b	8.4 b	10.3 a
FURADAN 4F	530+530	0.3 b	0.2 b	0.2 b	7.4 b	10.6 a
RIPCORD 400 EC	70+70	0.3 b	0.4 b	0.2 b	6.7 b	10.6 a

[1] Treatment means in a column followed by the same letter are not significantly different (p=0.05, Tukey's HSD).
[2] Based on 20 cm plant spacing in 0.75 m rows.

Table 4. Relative efficacy of SPINOSAD, FURADAN and RIPCORD for control of European corn borer on sweet corn, cv. Delectable, on sandy loam soil at the Cambridge Research Farm -- University of Guelph, 2001.

Treatments	Rate (g a.i./ha)	Tunnels on the Husk	Tunnels in the Ear	Larvae / Ear	Marketability (0 - 10 scale)	Yield (t/ha)[2]
Untreated	--	1.5 a[1]	1.0 a	0.6 a	3.5 a	17.8 a
SUCCESS 480 SC	40+40	0.1 bc	0.1 b	0.0 b	7.1 bc	18.3 a
SUCCESS 480 SC	60+60	0.1 c	0.1 b	0.1 b	7.2 bc	18.9 a
SUCCESS 480 SC	80+80	0.0 c	0.1 b	0.0 b	7.5 b	18.4 a
FURADAN 4F	530+530	0.2 bc	0.2 b	0.1 b	7.0 bc	20.3 a
RIPCORD 400 EC	70+70	0.6 b	0.5 b	0.3 b	5.5 c	18.8 a

[1] Treatment means in a column followed by the same letter are not significantly different (p=0.05, Tukey's HSD).
[2] Based on 20 cm plant spacing in 0.75 m rows.

2001 PMR REPORT # 45 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
ICAR: 440204

CROP: Sweet corn (*Zea mays saccharata* L.), cvs. Aladdin, Seneca Nation, Delectable
PEST: European corn borer (ECB), *Ostrinia nubilalis* (Hubner)

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TITLE: RELATIVE EFFICACY OF SUCCESS 480 SC, FURADAN 4F AND RIPCORD 400EC CONTROL OF EUROPEAN CORN BORER (*Ostrinia nubilalis* (Hubner)) IN ATTACKING SWEET CORN ON SANDY SOIL (Delhi Research Farm), 2001

MATERIALS: SUCCESS 480 SC® (spinosad, *Saccharopolyspora spinosa*), FURADAN 4 F® (carbofuran), RIPCORD 400 EC® (cypermethrin)

METHODS: Sweet corn was seeded at the Delhi Research Farm in 6 row blocks, 15 m long. Rows were spaced on 0.75 m centres with 30-32 cm plant spacing. Three metre spray lines separated the blocks. Six treatments were replicated four times in a randomized complete block design. ECB populations were monitored using pheromone traps (univoltine Iowa strain lures, Bioforest Technologies Inc., Sault Ste. Marie, Ontario). Foliar insecticides were applied to all 6 rows of each block, using a tractor-mounted, boom sprayer that delivered 750 L/ha at 276 kPa (Teejet nozzles # 11008). The first application took place when the crop was tasselling, approximately 10 days to 2 weeks before maturity. The sweet corn was harvested by sampling 25 ears from the centre two rows of each plot. Details of planting, application and harvest are outlined in Table 1. ECB-control was determined by examining the 25 ears for tunneling on the husk and the ear, counting the number of larvae per ear and assessing marketability of each ear. Marketable considerations included ear size, tip fill and colour. A rating scale of 0-10 was used, where ratings of 6 or less were not considered marketable. Results were analyzed using analysis of variance (ANOVA) and Tukey's Means Test ($p<0.05$).

RESULTS: As outlined in Tables 2-4.

CONCLUSIONS: The Aladdin variety displayed no significant differences in the amount of damage inflicted by ECB, or crop marketability between any of the treated or untreated plots. All treatments significantly reduced the number of ECB larvae at harvest and numbers of tunnels on the husk and in the ear for the Seneca Nation and Delectable cultivars. Marketability of ears harvested from all treated plots in these two cultivars was equivalent or significantly higher than in untreated plots. The Aladdin variety, with the SUCCESS treatment at 80 g ai/ha, was the only occurrence of a plot producing corn of a significantly greater yield than all other plots. Considering all results at this site, control by SPINOSAD of ECB-damage to sweet corn appears equivalent to or better than that provided by FURADAN or RIPCORD. SPINOSAD should thus be considered an acceptable alternative to these commercial insecticides.

Table 1. Management parameters for sweet corn field trials, Delhi Research Farm, 2001.

Cultivar	Maturity (days)	Planting Date	Application Date		Harvest Date
			First	Second	
Aladdin	53/63	7 May	13 July	- [1]	31 July
Seneca Nation	73	7 May	19 July	26 July	9 August
Delectable	82	7 May	19 July	26 July	10 August

[1] No insecticide application.

Table 2. Relative efficacy of SPINOSAD, FURADAN and RIPCORD for control of European corn borer on sweet corn, cv. Aladdin, on sandy soil at the Delhi Research Farm -- AAFC, 2001.

Treatments	Rate (g a.i./ha)	Tunnels on the Husk	Tunnels in the Ear	Larvae / Ear	Marketability (0 - 10 scale)	Yield (t/ha)[2]
Untreated	--	0.3 a[1]	0.3 a	0.2 a	7.2 a	7.0 a
SUCCESS 480 SC	40	0.2 a	0.2 a	0.1 a	7.7 a	7.5 b
SUCCESS 480 SC	60	0.1 a	0.1 a	0.1 a	7.9 a	7.3 ab
SUCCESS 480 SC	80	0.1 a	0.2 a	0.1 a	7.9 a	7.8 b
FURADAN 4F	530	0.3 a	0.1 a	0.1 a	7.9 a	7.6 b
RIPCORD 400 EC	70	0.3 a	0.1 a	0.1 a	7.7 a	7.7 b

[1] Treatment means in a column followed by the same letter are not significantly different (p=0.05, Tukey's HSD).

[2] Based on 30 cm plant spacing in 0.75 m rows.

Table 3. Relative efficacy of SPINOSAD, FURADAN and RIPCORD for control of European corn borer on sweet corn, cv. Seneca Nation, on sandy soil at the Delhi Research Farm -- AAFC, 2001.

Treatments	Rate (g a.i./ha)	Tunnels on the Husk	Tunnels in the Ear	Larvae / Ear	Marketability (0 - 10 scale)	Yield (t/ha)[2]
Untreated	--	0.5 a[1]	0.5 a	0.4 a	6.0 a	8.3 a
SUCCESS 480 SC	40+40	0.0 b	0.0 b	0.0 b	8.8 b	8.3 a
SUCCESS 480 SC	60+60	0.0 b	0.0 b	0.0 b	9.0 b	8.5 a
SUCCESS 480 SC	80+80	0.0 b	0.0 b	0.0 b	8.6 b	7.8 a
FURADAN 4F	530+530	0.0 b	0.1 b	0.1 b	8.6 b	8.3 a
RIPCORD 400 EC	70+70	0.1 b	0.1 b	0.0 b	8.7 b	8.4 a

[1] Treatment means in a column followed by the same letter are not significantly different (p=0.05, Tukey's HSD).
[2] Based on 30 cm plant spacing in 0.75 m rows.

Table 4. Relative efficacy of SPINOSAD, FURADAN and RIPCORD for control of European corn borer on sweet corn, cv. Delectable, on sandy soil at the Delhi Research Farm -- AAFC, 2001.

Treatments	Rate (g a.i./ha)	Tunnels on the Husk	Tunnels in the Ear	Larvae / Ear	Marketability (0 - 10 scale)	Yield (t/ha)[2]
Untreated	--	0.4 a[1]	0.3 a	0.3 a	6.8 a	11.0 a
SUCCESS 480 SC	40+40	0.1 ab	0.1 ab	0.0 b	8.2 ab	11.1 a
SUCCESS 480 SC	60+60	0.0 b	0.0 ab	0.0 b	8.5 b	11.0 a
SUCCESS 480 SC	80+80	0.0 b	0.0 b	0.0 b	8.6 b	10.9 a
FURADAN 4F	530+530	0.0 b	0.0 ab	0.0 b	8.8 b	11.3 a
RIPCORD 400 EC	70+70	0.1 ab	0.1 ab	0.1 b	8.4 ab	11.3 a

[1] Treatment means in a column followed by the same letter are not significantly different (p=0.05, Tukey's HSD).
[2] Based on 30cm plant spacing in 0.75 m rows.

2001 PMR REPORT # 46 SECTION B: VEGETABLE AND SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

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

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TITLE: EVALUATION OF FOLIAR TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL, 2001

MATERIALS: ACTARA 25 WG (thiamethoxam), ADMIRE 240 F (imidacloprid), ASSAIL 70 WP (acetamiprid), CALYPSO 480 SC (thiacloprid), FURY 1.5 EC (zeta-cypermethrin), MATADOR 120 EC (lambda-cyhalothrin), ORTHENE 75 SP (acephate), NOVALURON 0.83 EC (novaluron), SUCCESS 480 F (spinosad), SURROUND (kaolin), WARRIOR T (lambda-cyhalothrin), COMPANION Agricultural Adjuvant (octylphenoxy polyethoxy ethanol), SYLGARD 309 (siloxylated polyether + surfactant mixture), TECHMANGAM (29.5% manganese sulphate)

METHODS: On 08 May, onion seed was planted (135 seeds/row) 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 3 times in a randomized complete block design. Using a hand-held, CO_2-pressurized R&D field-plot sprayer with a 0.6 m boom fitted with two XR11002VS flat fan nozzles, WARRIOR T at 100.0 ml/ha was applied, at 200 kPa in 500 L/ha, to all plots on 18 May to control darksided cutworm, *Euxoa messoria*. To improve onion growth, on 09 July, 6.0 kg/1000 L TECHMANGAM was applied at 200 kPa in 300 L/ha 0.2% COMPANION using a hand-held, CO_2 - pressurized R&D field-plot sprayer with a 0.6 m boom fitted with a central XR11002VS and XR8002VS flat fan spray nozzles on either end. All plots received 10 mm water via overhead sprinkler irrigation on 29 June, 10, 17, 31 July, 08 and 14 August. To ensure buildup of OT-populations, 3 shallot plants heavily infested with OT from an untreated onion block were transplanted into each microplot on 18 July. On 30 July, 10 and 17 August, all treatments were applied in 900L/ha, at 200 kPa, with the same sprayer used to apply TECHMANGAM. On 03 August SURROUND only was re-applied due to irrigation. 0.2% COMPANION served as surfactant on 30 July and 10 August; 0.375% SYLGARD replaced COMPANION on 17 August. On 16, 23, 30 July (2 plants/plot), 01, 09, 13, 15, 20 and 27 August (4 plants/plot), OT were counted by destructive sampling. Significance of observed differences among treatment means was determined using ANOVA and Least Significant Difference test.

RESULTS: Experimental results are shown in Table 1. On 30 July there were no significant differences in OT-populations among plots scheduled to receive any of the 11 treatments in the trial. On 30 July, OT-numbers first exceeded the OMAFRA-recommended threshold of 3.0 OT/leaf for yellow seed cooking onions on untreated onions. While very high intra-plot variation in OT-numbers made statistical significance impossible to attain following any of the subsequent 3 foliar applications of control agents, some trends may have been present. On 2 of 6 sampling dates, OT-populations were lowest in plots that had been treated with ORTHENE (Tmt. 8), 62%-72% lower than in CONTROL plots. Foliar application of MATADOR (Tmt. 11) was also most effective on 2 of 6 sampling dates; OT-populations were 48%-62% lower than in CONTROL plots on those dates (Table 1). Foliar application

of SUCCESS (Tmt. 6) was also followed by the lowest OT-populations on 2 of 6 sampling dates; population reductions ranged from 8%-61% (Table 1). OT-population reductions following foliar application of FURY or CALYPSO also rated among the top 3 on at least 2 of 6 sampling dates.

CONCLUSIONS: Highly variable intra-plot variation in OT-numbers challenge the capabilities of statistical analysis. Although results were not statistically significant, OT-populations were sufficiently reduced following foliar application of ORTHENE, MATADOR and SUCCESS, to warrant further investigation of the impact of foliar application of these control agents. To collect additional information on possible impact of the growth regulator NOVALURON, efficacy should be evaluated again in 2002 emphasizing application early in the season before OT-populations reach threshold levels.

Table 1. Impact of foliar treatments on populations of onion thrips on dry yellow seed cooking onion, 2001.

Tmt. No.	Treatment Applied	Rate/ha	Mean Number OT /Plant on Indicated Date						
			30 Jul	01 Aug	09 Aug	13 Aug	15 Aug	20 Aug	27 Aug
1	ACTARA	200.0 g	51.3 a	17.4 a	113.0 a	72.8 a	115.8 a	53.0 ab	56.2 a
2	ADMIRE	200.0 ml	33.8 a	14.4 ab	73.2 abc	84.2 a	115.2 a	33.8 b	39.8 a
3	ASSAIL	70.0 g	53.5 a	13.8 ab	97.6 ab	102.0 a	89.8 a	36.0 b	37.0 a
4	CALYPSO	100.0 ml	29.3 a	11.4 ab	82.8 ab	48.4 a	86.6 a	26.0 b	40.4 a
5	NOVALURON	750.0 ml	33.3 a	15.6 ab	97.8 ab	89.8 a	114.4 a	37.8 ab	42.2 a
6	SUCCESS	300.0 ml	21.7 a	7.6 ab	64.4 abc	62.4 a	93.4 a	17.4 b	20.4 a
7	SUCCESS	400.0 ml	32.3 a	10.6 ab	55.2 bc	51.0 a	67.4 a	20.2 b	26.6 a
8	ORTHENE	700.0 g	32.5 a	4.6 b	21.4 c	47.2 a	55.4 a	30.8 b	44.0 a
9	SURROUND	11.0 kg	27.5 a	10.4 ab	88.0 ab	74.4 a	100.0 a	32.2 b	40.4 a
10	FURY	300.0 ml	30.0 a	7.4 ab	64.4 abc	60.4 a	41.6 a	31.2 b	29.6 a
11	MATADOR	188.0 ml	51.0 a	7.0 ab	77.8 abc	36.4 a	38.6 a	85.8 a	54.4 a
12	CONTROL[2]	---	31.0 a	12.2 ab	76.6 abc	118.2 a	73.6 a	25.8 b	51.8 a
Mean Number Leaves/Plant			5	5	7	9	9	9	10
Mean Number OT/Leaf[3]			6.2	2.4	10.9	13.1	8.2	2.8	5.2
Days after Most Recent Foliar Treatment			N.A.[4]	2	9	3	5	3	10

[1] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Least Significant Difference test.

[2] No insecticide applied.

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

[4] Not Applicable. First foliar insecticide not applied until after OT-counts on July 30.

2001 PMR REPORT # 47 SECTION B: VEGETABLE AND SPECIAL CROPS - Insect Pests

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

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TITLE: EVALUATION OF PLANTING-WATER TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING SPANISH ONION ON MINERAL SOIL, 2001

MATERIALS: ACTARA 25 WG (thiamethoxam), ADMIRE 240 F (imidacloprid), ASSAIL 70 WP (acetamiprid), CANON 200 SC (fipronil), MATADOR 120 EC (lambda-cyhalothrin), ORTHENE 75 SP (acephate), TI-435 600 F (clothianidin), COMPANION Agricultural Adjuvant (octylphenoxy polyethoxy ethanol)

METHODS: Commercially produced Spanish onion seedlings were grown singly in plastic propagation-plug trays each containing 12 rows of 24 plugs. On 09 May, just prior to planting, seedlings were clipped to a height of 10-12 cm. All treatments (64 plants/plot) were planted on the SCPFRC-London Research Farm in 4-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. All treatments received 30 ml transplant-water in the planting hole; the desired rate of insecticide was added to the transplant-water. All plots received 10 mm water via overhead sprinkler irrigation on 29 June, 10, 17, 31 July and 08 August. On 09 July, MATADOR was applied in 900L/ha 0.2% COMPANION at 200kPa, using a hand-held, CO_2-pressurized, R&D field-plot sprayer with a 0.6 m boom fitted with a central XR11002VS and XR8002VS flat fan spray nozzles on either end. On 14, 21, 28 June (2 plants/plot), 05, 11, 19, 26 July (3 plants/plot) and 02 August (4 plants/plot), OT were counted by destructive sampling. Significance of observed differences among treatment means was determined using ANOVA and Least Significant Difference test.

RESULTS: Experimental results are outlined in Table 1. No phytotoxicity was observed following any planting-water treatment. OT-numbers did not increase to high levels during the course of this trial. Not until 11 July, 9 weeks after planting, did OT-populations on untreated onions exceed the OMAFRA-recommended threshold of 1.0 OT/leaf for Spanish onions. On that date OT-populations were significantly lower following all planting water treatments except ORTHENE (Tmt. 10). While there were no statistically significant differences among effective treatments, lowest OT-numbers were recorded in plots planted with onions treated with ADMIRE (Tmt. 3, 4). On 02 August, 12 weeks after treatment, OT-populations were still significantly lower than in CONTROL plots in plots receiving ADMIRE (Tmt. 3, 4), CANON (Tmt. 5) and TI-435 (Tmt. 8). Foliar application of MATADOR (Tmt. 11) also resulted in significantly lower OT-populations as long as 3 weeks post application.

CONCLUSIONS: Planting-water application of a systemic insecticide such as ADMIRE, ACTARA or TI-435 to Spanish onion seedlings had sufficient impact on subsequent development of OT-populations to warrant further investigation.

Table 1. Impact of planting water-treatments on populations of onion thrips on Spanish onion, 2001.

Tmt. No.	Treatment Applied	Rate/1000 plants	Mean Number OT/Plant on Indicated Date							
			14 Jun	21 Jun	28 Jun	05 Jul	11 Jul	19 Jul	26 Jul	02 Aug
1.	ACTARA	4.0 g	0.4 b[1]	2.2 a	1.4 bc	2.8 bcd	3.6 bc	11.6 abcd	13.6 ab	4.6 ab
2.	ACTARA	6.0 g	0.4 b	0.6 a	0.8 bc	1.4 d	4.4 bc	8.2 abcd	19.2 a	5.0 ab
3.	ADMIRE	6.0 ml	0.2 b	0.0 a	0.2 c	0.8 d	0.6 c	4.4 bcd	2.8 b	1.8 b
4.	ADMIRE	12.0 ml	0.0 b	0.2 a	0.0 c	0.6 d	1.2 c	1.8 d	5.6 b	3.8 b
5.	CANON	1.0 ml	0.2 b	0.4 a	0.2 c	5.4 bcd	3.2 bc	9.8 abcd	8.8 ab	2.0 b
6.	CANON	1.5 ml	0.2 b	0.0 a	0.6 bc	1.6 cd	2.4 bc	15.6 abc	4.4 b	5.8 ab
7.	TI-435	1.5 ml	0.4 b	0.6 a	1.2 bc	2.6 bcd	4.4 bc	16.8 ab	7.0 b	6.0 ab
8.	TI-435	1.5 ml	0.2 b	0.6 a	0.6 bc	2.0 cd	4.2 bc	12.8 abcd	14.2 ab	2.4 b
9.	ASSAIL	3.0 g	0.4 b	8.0 b	2.6 bc	6.6 bc	3.6 bc	18.8 a	5.4 b	5.6 ab
10.	ORTHENE	70.0 g	0.4 b	1.8 a	0.8 bc	5.2 bcd	7.3 ab	15.0 abcd	10.2 ab	5.2 ab
11.	MATADOR[2]	188.0 ml[2]	4.8 a	7.6 b	1.2 bc	11.8 a	1.2 c	2.2 cd	2.8 b	3.6 b
12.	CONTROL[3]	---	2.0 ab	2.0 a	4.4 a	7.6 ab	12.0 a	15.0 abcd	9.6 ab	10.4 a
Mean Number Leaves/Plant			6	7	9	10	11	11	11	11
Mean Number OT/Leaf[4]			0.4	0.3	0.5	0.8	1.1	1.4	0.9	0.9

[1] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Least Significant Difference test.

[2] Foliar application in 0.2% COMPANION.

[3] No insecticide applied.

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

2001 PMR REPORT # 48 SECTION B: VEGETABLE AND SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

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

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TITLE: EVALUATION OF SEED TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL, 2001

MATERIALS: ADAGE 5 FS (thiamethoxam), GAUCHO 480 FL (imidacloprid), ICON 6.2 FS (fipronil), MATADOR 120 EC (lambda-cyhalothrin), TI-435 600 F (clothianidin), WARRIOR T (lambda-cyhalothrin), COMPANION Agricultural Adjuvant (octylphenoxy polyethoxy ethanol), PRO GRO (carbathiin + thiram) TECHMANGAM (29.5% manganese sulphate)

METHODS: On May 09, onion seed was treated in the laboratory at SCPFRC-London by tumbling for 2 minutes in an air-filled plastic bag with the appropriate seed treatment. 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 then tumbled for an additional 0.5 minute. On May 10, all seed was planted (135 seeds/row) 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 3 times in a randomized complete block design. Using a hand-held, CO_2- pressurized R&D field-plot sprayer with a 0.6 m boom fitted with two XR11002VS flat fan nozzles, WARRIOR T at 100.0 ml/ha was applied at 200 kPa in 500 L/ha to all plots on May 18 to control darksided cutworm, *Euxoa messoria*. To improve onion growth, on July 09, 6.0 kg/1000 L TECHMANGAM was applied at 200 kPa in 300 L/ha 0.2% COMPANION using a hand-held, CO_2 -pressurized R&D field-plot sprayer with a 0.6 m boom fitted with a central XR11002VS and XR8002VS flat fan spray nozzles on either end. All plots received 10 mm water via overhead sprinkler irrigation on June 29, July 10, 17, 31, August 08 and 14. On July 09 and August 10, MATADOR (Tmt. 8) was applied at 200 kPa in 900 L/ha 0.2% COMPANION with the same sprayer used to apply TECHMANGAM. To ensure buildup of OT-populations, 3 shallot plants heavily infested with OT from an untreated onion block were transplanted into each microplot on July 18. On July 03, 09 (2 plants/plot), 16, 23, 30 (3 plants/plot), August 09 and 13 (4 plants/plot), OT were counted by destructive sampling. Significance of observed differences among treatment means was determined using ANOVA and a Least Significant Difference test.

RESULTS: Experimental results are outlined in Tables 1 and 2. No seed treatment had any significant impact on emergence of onion seedlings on any of the 4 dates when populations were counted (Table 1). OT-populations on untreated onions did not exceed the OMAFRA-recommended threshold of 3.0 OT/leaf for dry yellow seed cooking onions until 09 August (Table 2). On that date OT-populations were significantly lower in plots planted with seed treated with ADAGE (Tmt. 1). On 09 July, 8 weeks after planting, when OT-populations were below threshold levels, populations were significantly lower in all plots planted with treated seed than in plots treated with untreated seed. By 9 weeks post-planting, OT-populations were significantly lower only in plots planted with seed treated with ADAGE (Tmt. 1) or either rate of GAUCHO (Tmts. 2, 3). Foliar application of MATADOR (Tmt. 8), reduced OT-

populations on the first sampling date following each application (Table 2).

CONCLUSIONS: Application of systemic insecticides such as ADAGE or 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 seed treatments on emergence of cooking onion-seedlings on organic soil, 2001.

Tmt. No.	Treatment Applied	Rate/unit[1] seed	Mean Number Plants/Row on Indicated Date			
			25 May	28 May	31 May	06 June
1.	ADAGE	80.0 ml	82.0 a	89.7 a	89.0 a	94.3 a
2.	GAUCHO	75.0 ml	82.3 a	95.3 a	91.7 a	95.0 a
3.	GAUCHO	100.0 ml	71.7 a	83.0 a	80.3 a	84.0 a
4.	TI-435	60.0 ml	69.3 a	79.0 a	82.0 a	85.3 a
5.	TI-435	85.0 ml	84.0 a	96.7 a	96.0 a	100.0 a
6.	ICON	45.0 ml	81.3 a	91.0 a	92.3 a	93.3 a
7.	ICON	65.0 ml	68.7 a	89.0 a	81.0 a	94.7 a
8.	MATADOR[3]	188.0 ml[3]	79.7 a	86.3 a	83.0 a	83.7 a
9.	CONTROL[4]	---	79.7 a	83.7 a	81.7 a	88.0 a

[1] 1 unit contains 250,000 seeds.

[2] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Least Significant Difference test.

[3] Foliar application in 0.2% COMPANION.

[4] No insecticide applied.

Table 2. Impact of seed treatments on populations onion thrips on dry yellow seed cooking onion on organic soil, 2001.

Tmt. No.	Treatment Applied	Rate /unit[1] seed	Mean Number OT/Plant on Indicated Date						
			03 Jul	09 Jul	16 Jul	23 Jul	30 Jul	09 Aug	13 Aug
1.	ADAGE	80.0	0.6 ab[2]	0.2 b	0.2 c	8.4 a	14.4 a	51.0 c	65.0 ab
2.	GAUCHO	75.0	0.0 b	0.2 b	0.0 c	5.6 a	31.6 a	112.8 a	113.8
3.	GAUCHO	100.0	0.6 ab	0.2 b	0.2 c	4.2 a	11.8 ab	60.6 bc	75.2 ab
4.	TI-435	60.0	0.2 ab	0.6 b	2.4 a	7.4 a	29.0 ab	92.2	145.4 a
5.	TI-435	85.0	0.2 ab	0.2 b	0.4 bc	11.2 a	23.2 ab	113.8 a	129.2 a
6.	ICON	45.0	0.0 b	0.4 b	0.8 bc	5.4 a	9.4 ab	63.8	78.6 ab
7.	ICON	65.0	0.2 ab	0.0 b	0.8 bc	9.4 a	11.2 ab	97.4	133.8 a
8.	MATADOR	188.0	1.0 a	1.8 ab	0.2 c	9.6 a	7.8 b	83.6	29.4 b
9.	CONTROL[4]	---	0.8 ab	2.6 a	1.4 ab	13.0 a	22.4 ab	108.4	111.2
Mean Number Leaves/Plant			5	5	6	7	8	8	8
Mean Number OT/Leaf[5]			0.2	0.5	0.2	1.8	2.8	13.6	13.9
Days after Most Recent			N.A.[6]	N.A.	7	14	21	31	3

[1] 1 unit contains 250,000 seeds.

[2] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Least Significant Difference test.

[3] Foliar application in 0.2% COMPANION.

[4] No insecticide applied.

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

[6] Not Applicable. First foliar insecticide not applied until after OT-counts on July 09.

2001 PMR REPORT # 49 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

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

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TITLE: EVALUATION OF FOLIAR, BIORATIONAL TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL, 2001

MATERIALS: SUCCESS 480 F (spinosad), BotaniGard ES (*Beauveria bassiana* - 2.1 x 10^{13} viable spores/L), FOLICUR 432 F (tebuconazole), NOVALURON 0.83 EC (novaluron), MATADOR 120 EC (lambda-cyhalothrin), CaB'y (10% Ca, 0.5% B solution), CALTRAC 400 (23.7% calcium), COMPANION Agricultural Adjuvant (octylphenoxy polyethoxy ethanol), SYLGARD 309 (siloxylated polyether + surfactant mixture)

METHODS: Onion seeds were planted on the 01 - 05 May, in a commercial grower's 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 ran down each side of all treatment plots. All treatments were replicated 4 times in a randomized complete block design. On 26 June, 06, 11, 17, 26, and 31 July, CaB'y was applied in 450 L/ha and on August 03 and 10 in 650 L/ha. Remaining treatments were applied on 28 June, 11, 26 July in 450 L/ha and 03 August in 650 L/ha. Where surfactant was required, treatments were applied in either 0.2% Companion (28 June, 11, 26 July) or 0.375% SYLGARD (03 August). All treatments were applied at 200 kPa using a hand-held, CO_2 pressurized R&D field-plot sprayer with a 1.1 m boom fitted with either four TG-2 solid cone spray tips (28 June) or four XR1102VS flat fan spray nozzles (remaining dates). On 03 (3 plants/plot), 10, 17, 24 (4 plants/plot), 31 July, 08 and 14 August (5 plants/plot), OT were counted by destructive sampling. Significance of observed differences among treatment means was determined using ANOVA and Least Significant Difference test.

RESULTS: Experimental results are outlined in Table 1. OT-numbers exceeded the OMAFRA-recommended threshold of 3.0 OT/leaf for yellow seed cooking onions on untreated onions from 24 July through 14 August. Although the difference was not always statistically significant, plots receiving treatments including SUCCESS usually had the lowest OT-numbers. Very high intra-plot variation in OT-numbers made statistical significance difficult to attain. On 14 August, OT-populations were significantly lower in plots treated with NOVALURON. Application of CaB'y, CALTRAC and MATADOR did not significantly decrease OT-numbers. In fact until 24 July, OT-numbers were lower in CONTROL plots than in plots receiving any of these treatments.

CONCLUSIONS: Foliar application of SUCCESS had sufficient impact on subsequent OT-populations to warrant further investigation. Addition of BOTANIGARD to SUCCESS did not appear to improve OT-control. Replacement of COMPANION with SYLGARD appeared to improve control of

subsequent OT-populations by NOVALURON. Further research on the performance of this growth regulator-surfactant combination is justified especially earlier in the season when OT-populations are lower. Foliar application of the nutrient, calcium (CaB'y; CALTRAC) did not reduce OT-populations.

Table 1. Impact of foliar, biorational treatments on populations of onion thrips on dry yellow seed cooking onion on the Thedford Marsh, 2001.

Tmt. No.	Treatment Applied	Rate/ha	Mean Number OT/Plant on Indicated Date						
			03 Jul	10 Jul	17 Jul	24 Jul	31 Jul	08 Aug	14 Aug
1.	SUCCESS + BOTANIGARD	200.0 ml + 2.0 L	1.4 ab[1]	2.2 b	3.2 c	31.6 a	47.8 a	27.0 ab	9.8 bcd
2.	SUCCESS + BOTANIGARD	400.0 ml + 2.0 L	1.8 ab	5.6 ab	5.0 c	45.0 a	78.6 a	11.8 ab	5.4 d
3.	BOTANIGARD	2.0 L	1.8 ab	4.4 ab	10.0 abc	39.8 a	89.6 a	49.0 ab	41.0 abcd
4.	SUCCESS	400.0 ml	0.2 b	0.2 b	4.6 c	28.4 a	71.8 a	0.8 b	6.4 cd
5.	FOLICUR[2]	1.0 L	3.8 ab	4.4 ab	9.0 bc	49.6 a	72.8 a	74.6 a	56.8 a
6.	NOVALURON	750.0 ml	4.8 a	11.6 a	26.6 a	70.4 a	69.2 a	16.8 ab	4.8 d
7.	CaB'y[2]	2.5 L	2.2 ab	5.8 ab	18.8 abc	90.0 a	107.4 a	71.0 a	44.4 abc
8.	CALTRAC[2]	5.0 L	3.0 ab	3.2 ab	17.5 abc	66.6 a	100.0 a	33.8 ab	49.4 a
9.	MATADOR	188.0 ml	3.4 ab	5.8 ab	25.3 ab	91.2 a	132.4 a	31.8 ab	35.0 abcd
10.	CONTROL[3]	---	1.0 ab	3.6 ab	14.8 abc	84.0 a	81.4 a	58.8 ab	47.6 ab
Mean Number Leaves/Plant			5	6	7	8	9	10	11
Mean Number OT/Leaf[4]			0.2	0.6	1.1	10.5	9.0	5.9	4.4
Days after Most Recent Foliar Treatment			5	10	6	13	5	5	11

[1] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Least Significant Difference test.
[2] No surfactant included in spray mixture.
[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.

2001 PMR REPORT # 50 SECTION B: VEGETABLE AND SPECIAL CROPS - Insect Pests
ICAR: 206003

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

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TITLE: EVALUATION OF TRANSPLANTED ONION LINES FOR RESISTANCE TO ONION MAGGOT DAMAGE, 2001

MATERIALS: Two onion breeding lines (W456B and W457B) obtained from Dr. Scott Hendricks, Seminis Vegetable Seed, and 10 commercial cultivars, Cortland, Fortress, Frontier, Hamlet, Hoopla, Mars, Millennium, Norstar, Stanley and 15073

METHODS: Twelve onion lines were seeded into 288 plug trays using ASB soilless mix on 25 March. Onions were planted out (25 plants/meter) on 4 Jun at the Muck Crops Research Station where onion maggot flies occur naturally. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of two rows (42 cm apart), 2 meters in length. Damage assessments began one week after transplanting, and continued twice each week from June through August. The first generation peak for onion maggot flies occurred on 16 Jun and damage from the first generation was recorded until 23 July. Damage was assessed by roguing out wilted plants and assessing the plants for onion maggot damage at the base of the onion plant. A final damage assessment was conducted on 24 August on the remaining onion bulbs. The yield of the remaining bulbs was recorded on 19 September. The air temperatures in 2001 were above the long term (10 year) average for May (13.9°C) and August (20.6°C), below average for July (18.9°C), and average for June (18.3°C) and September (14.7°C). Monthly rainfall was above the long term (10 year) average for May (85 mm), and below average for June (63 mm), July (60 mm), August (32 mm) and September (53 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 outlined in Table 1.

CONCLUSIONS: Significant differences were found among cultivars in the first generation damage and the total OM damage. Cultivar Cortland had the lowest percent damage after the first generation (0.5%) and the lowest total damage (3.2%). Hoopla and 15073 also had total damage less than 5.0%. W457B and Frontier had significantly higher total OM damage than Cortland, Hoopla and 15073. Significant differences were observed in the average weight/bulb and t/ha. Hoopla had the highest yield of any cultivar. Both breeding lines (W456B and W457B) had the lowest yields and the lowest weight/bulb, possibly because both cultivars were very early maturing.

Table 1. Evaluation of onion cultivars for resistance to the onion maggot fly *Delia antiqua*, 2001.

Cultivar	% OM Damage 1st Generation	Total % OM Damage	Average Weight/Bulb (g)	Yield t /ha
Cortland	0.5 a[1]	3.2 a	90 c	48.4 de
Fortress	2.5 abc	6.5 a-d	97 bc	67.5 bc
Frontier	7.3 de	13.0 de	97 bc	61.2 bcd
Hamlet	3.1 abc	5.1 abc	109 ab	73.5 ab
Hoopla	1.8 ab	3.8 ab	122 a	82.3 a
Mars	2.2 ab	6.1 abc	88 cd	58.9 cde
Millennium	3.8 a-d	4.8 abc	107 ab	71.3 abc
Norstar	4.4 b-e	11.3 cde	72 d	46.6 e
Stanley	4.3 bcd	10.7 cde	117 a	31.9 f
W456B	6.2 cde	9.9 b-e	31 e	20.3 fg
W457B	8.1 e	16.6 e	26 e	12.2 g
15073	2.1 ab	3.9 ab	88 cd	64.2 bc

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

2001 PMR REPORT # 51 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
ICAR: 206003

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

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TITLE: EVALUATION OF SEEDED ONION LINES FOR RESISTANCE TO ONION MAGGOT DAMAGE, 2001

MATERIALS: Onion breeding lines (W456B AND W457B) obtained from Dr. Scott Hendricks, Seminis Vegetable Seed, and 10 commercial cultivars, Cortland, Fortress, Frontier, Hamlet, Hoopla, Mars, Millennium, Norstar, Stanley and 15073

METHODS: Twelve onion lines were seeded by hand on 4 May. The onions were seeded into a 1.5 cm seed furrow. To ensure uniform seed spacing a wooden board was placed on top of the seed furrow, with holes every 2.5 cm, a single seed was dropped in each hole. A natural onion maggot fly population is present at the Muck Crops Research Station. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of two rows (42 cm apart), 2 meters in length. Germination counts were recorded on 29 May and 1, 5, 7 and 11 June to determine initial stands. The first generation peak of onion maggot flies occurred on 16 Jun and damage from the first generation was recorded until 23 July. Damaged plants were counted and removed twice each week from June through August. Damage was assessed by roguing out wilted plants and assessing the plants for OM damage at the base of the onion plant. A final damage assessment was conducted on 21 September on the remaining onion bulbs. The yield of the remaining bulbs was recorded on 2 October. The air temperatures in 2001 were above the long term (10 year) average for May (13.9°C) and August (20.6°C), below average for July (18.9°C), and average for June (18.3°C) and September (14.7°C). Monthly rainfall was above the long term (10 year) average for May (85 mm), and below average for June (63 mm), July (60 mm), August (32 mm) and September (53 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 outlined in Table 1.

CONCLUSIONS: Significant differences were found among cultivars in the first generation OM damage and total OM damage. Cortland and Fortress were the only cultivars with OM damage less than 10% for the first generation and 30% total OM damage. Frontier had significantly higher damage (40.6%) than any other cultivar in the first generation and the highest total damage numerically. The yield of cultivar Hoopla (89.9 t/ha) was significantly higher than all other cultivars. Cortland, Fortress and 15073 also had high yields.

Table 1. Evaluation of onion cultivars for resistance to the onion maggot fly *Delia antiqua*, 2001.

Cultivar	% OM Damage 1st Generation	Total % OM Damage	Average Weight/Bulb (g)	Yield t /ha
Cortland	5.9 a[1]	24.5 a	183.0 bc	54.0 bc
Fortress	8.6 ab	27.6 a	163.0 cd	60.7 b
Frontier	40.6 f	53.3 e	182.0 c	37.0 c-f
Hamlet	27.6 de	47.8 cde	179.09 c	37.0 c-f
Hoopla	25.5 de	36.3 a-d	177.0 c	89.9 a
Mars	24.9 cde	44.6 b-e	214.0 a	24.7 efg
Millennium	24.0 cde	43.0 b-e	184.0 bc	50.1 bcd
Norstar	29.3 e	49.6 de	119.0 e	30.4 def
Stanley	15.3 abc	35.4 abc	207.0 ab	43.4 b-e
W456B	28.9 e	47.5 cde	39.0 f	8.2 g
W457B	18.3 bcd	34.0 ab	41.0 f	20.2 fg
15073	21.0 cde	36.0 abc	145.0 d	57.5 b

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

2001 PMR REPORT # 52 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
ICAR: 440204

CROP: Transplanted tomato (*Lycopersicon esculetum* L.), 9478
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

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TITLE: RELATIVE EFFICACY OF SUCCESS 480 SC AND ADMIRE 240 F FOR CONTROL OF COLORADO POTATO BEETLE (*Leptinotarsa decemlineata* (Say)) ON TRANSPLANTED TOMATO (*Lycopersicon esculentum* L.) (Cambridge Research Farm), 2001

MATERIALS: SUCCESS 480 SC® (spinosad, *Saccharopolyspora spinosa*), ADMIRE 240 F® (imidacloprid)

METHODS: Processing Roma tomato plugs were transplanted at the Cambridge Research Station on 24 May in 4 row blocks (10m by 3m). Rows were spaced on 0.75 m centers with 50 cm plant spacing. Three meter spray lanes separated the blocks. Seven treatments (Table 1) were replicated four times in a randomized complete block design. Foliar insecticides were applied to all rows of each 4 row block, using a tractor mounted, boom sprayer that delivered 750 L/ha at 500 kPa (Colorjet nozzles # 80-28). CPB population levels were extremely low early in the season, making it was necessary to inoculate the trial on 21 June by clipping 4-5 potato leaves with CPB egg masses on each of 5 plants per plot. All inoculated plants (140 in total) were marked using coloured flags, and monitored daily to determine percent egg hatch. By 26 June, 30% of each egg mass had hatched. Treatments were applied on 26 June and 5 July. On 4 July (Day 7), 11 July (Day 14/6) and 18 July (Day 21/13), treatments were assessed by counting the number of egg masses, larvae and adult CPB present on each of the 5 marked plants per plot. The tomatoes were harvested on 7 September by assessing 5 flagged plants per plot. Total plant weight, total fruit number, number of red and green fruit, total fruit weight, and red and green fruit weights were recorded. Projected yield per hectare was also calculated. Results were analyzed using analysis of variance (ANOVA) and Tukey's Means Test ($p<0.05$).

RESULTS: As outlined in Tables 1 and 2.

CONCLUSIONS: Significantly fewer CPB were counted in all treated plots compared to untreated plots (Table 1). There were no significant differences among treatments, which may be due to the low CPB densities. The low CPB population may be caused by the rarity of tomato crops in this region. Local CPB prefer potato and infest potato fields before tomato fields. Higher CPB infestations may occur where tomatoes are more commonly grown, such as in the Leamington region. Differences in yield between treated and untreated plots were slight and statistically insignificant (Table 2). Although, it appears that SUCCESS® provides efficacy and yield results similar to the commercial standard ADMIRE® , higher CPB infestation levels would clarify these results.

Table 1. Relative Efficacy of SUCCESS 480 SC® and ADMIRE 240 2F® for control of Colorado potato beetle on tomatoes grown in sandy loam soil at the Cambridge Research Farm, 2001.

Treatments	Rate (g a.i./ha)	Mean Number of CPB[1] / plant on indicated day		
		July 4 (Day 7)	July 11 (Day 14/6)	July 18 (Day 21/13)
Untreated	--	7.5 a[2]	2.2 a	0.3 a
SUCCESS 480 SC	60 + 60	0.0 b	0.0 b	0.0 b
SUCCESS 480 SC	60	0.0 b	0.0 b	0.0 b
SUCCESS 480 SC	80	0.0 b	0.0 b	0.0 b
ADMIRE 240 2F	50 + 50	0.0 b	0.0 b	0.0 b
ADMIRE 240 2F	50	0.0 b	0.0 b	0.0 b
ADMIRE 240 2F	70	0.0 b	0.0 b	0.0 b

[1] Total number of egg masses, larvae and adults present
[2] Treatment means followed by the same letter are not significantly different (P<0.05, Tukey's HSD).

Table 2. Relative impact of SUCCESS 480 SC® and ADMIRE 240 2F® on quality and yield of tomatoes grown in sandy loam soil at the Cambridge Research Farm, 2001.

Treatments	Rate (g a.i./ha)	Mean plant weight (kg / plant)	Mean fruit number / plant	Mean number green (g) fruit / plant	Mean number ripe (r) fruit / plant	Mean fruit (g, r) weight (kg/plant)	Mean fruit (g, r) yield (tonnes / ha)
Untreated	--	1.91 a[1]	43.8 a	22.1 a	21.7 a	1.37 a	36.5 a
SUCCESS 480 SC	60 + 60	1.57 a	48.2 a	24.3 a	23.9 a	1.16 a	30.8 a
SUCCESS 480 SC	60	2.02 a	55.3 a	28.4 a	26.8 a	1.48 a	39.6 a
SUCCESS 480 SC	80	1.50 a	49.0 a	24.9 a	24.1 a	1.05 a	27.9 a
ADMIRE 240 2F	50 + 50	2.22 a	53.9 a	26.6 a	27.4 a	1.66 a	44.4 a
ADMIRE 240 2F	50	2.14 a	55.2 a	29.3 a	25.9 a	1.57 a	41.9 a
ADMIRE 240 2F	70	1.79 a	50.4 a	25.2 a	25.2 a	1.31 a	34.9 a

[1] Treatment means followed by the same letter are not significantly different (P<0.05, Tukey's HSD).

2001 PMR REPORT # 53 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
ICAR: 440204

CROP: Transplanted tomato (*Lycopersicon esculetum* L.), 9478
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: RELATIVE EFFICACY OF SUCCESS 480 SC AND ADMIRE 240 F FOR CONTROL OF COLORADO POTATO BEETLE (*Leptinotarsa decemlineata* (Say)) ON TRANSPLANTED TOMATO (*Lycopersicon esculentum* L.) (Delhi Research Farm), 2001

MATERIALS: SUCCESS 480 SC® (spinosad, *Saccharopolyspora spinosa*), ADMIRE 240 F® (imidacloprid)

METHODS: Processing Roma tomato plugs were transplanted at the Delhi Research Farm on 23 May, in 4 row blocks (10m by 3m). Rows were spaced on 0.75 m centers with 50 cm plant spacing. Three meter spray lanes separated the blocks. Seven treatments (Table 1), were replicated four times in a randomized complete block design. Foliar insecticides were applied to all rows of each block, using a tractor mounted, boom sprayer that delivered 300 L/ha at 276 kPa (Teejet nozzles # 11004). Due to a magnesium deficiency on 29 June 1.5 tonnes of lime was applied to the field. All plots were irrigated prior to liming and again immediately afterwards. Bravo 500F was applied on 30 June and 19 July, at 4 L/ha, to mitigate early blight. CPB populations were extremely low early in the season, making it was necessary to inoculate the trial on 3 July by clipping 4 potato leaves with CPB egg masses onto each of 5 plants per plot. All inoculated plants (140 in total) were marked using coloured flags, and monitored daily to determine percent egg hatch. By 9 July, 30% of each egg mass had hatched. Treatments were applied on 9 and 16 July. On 16 July (Day 7), 23 July (Day 14/7) and 30 July (Day 21/14), treatments were assessed by counting the number of egg masses, larvae and adult CPB present on each of the 5 marked plants per plot. Tomatoes were harvested on 11 September from 5 flagged plants per plot. Total plant weight, total fruit number, number of red and green fruit, total fruit weight, and red and green fruit weights were recorded. Projected yield per hectare was also calculated. Results were analyzed using analysis of variance (ANOVA) and Tukey's Means Test ($p<0.05$).

RESULTS: As outlined in Tables 1 and 2.

CONCLUSIONS: Significantly fewer CPB were counted in all treated plots compared to untreated plots (Table 1). There were no significant differences among treatments which may be due to the low CPB densities. The low CPB population may be caused by the rarity of tomato crops in this region. Local CPB prefer potato, and infest potato fields before tomato fields. Higher CPB infestations may occur where tomatoes are more commonly grown, such as in the Leamington region. Differences in yield between treated and untreated plots were slight and statistically insignificant (Table 2). Mean plant weight, mean fruit number, mean number of green fruit, mean number of ripe fruit, and mean fruit weight were however, consistently higher in treated plots than in untreated plots. SUCCESS® provided

efficacy and yield results similar to those of the commercial standard ADMIRE®.

Table 1. Relative Efficacy of SUCCESS 480 SC® and ADMIRE 240 2F® for control of Colorado potato beetle on tomato in sandy soil at the Delhi Research Farm, 2001.

Treatments	Rate (g a.i./ha)	Mean Number of CPB[1] / plant on indicated day		
		July 16 (Day 7/0)	July 23 (Day 14/7)	July 30 (Day 21/14)
Untreated	--	6.6 a[2]	1.0 a	0.3 a
SUCCESS 480 SC	60 + 60	0.0 b	0.0 b	0.0 b
SUCCESS 480 SC	60	0.0 b	0.0 b	0.0 b
SUCCESS 480 SC	80	0.0 b	0.0 b	0.0 b
ADMIRE 240 2F	50 + 50	0.0 b	0.0 b	0.0 b
ADMIRE 240 2F	50	0.0 b	0.0 b	0.0 b
ADMIRE 240 2F	70	0.0 b	0.0 b	0.0 b

[1] Total number of egg masses, larvae and adults present.
[2] Treatment means followed by the same letter are not significantly different (P<0.05, Tukey's HSD)

Table 2. Relative impact of SUCCESS 480 SC® and ADMIRE 240 2F® on quality and yield of tomatoes grown in sandy soil at the Delhi Research Station – AAFC, 2001.

Treatments	Rate (g a.i./ha)	Mean plant weight (kg) / plant	Mean fruit number / plant	Mean number of green (g) fruit / plant	Mean number of ripe (r) fruit / plant	Mean fruit (g & r) weight (kg)/plant	Mean fruit (g & r) weight (tonnes / ha)
Untreated	--	3.81 a [1]	56.0 a	26.5 a	29.5 a	3.26 a	87.0 a
SUCCESS 480 SC	60 + 60	4.23 a	61.5 a	26.6 a	34.8 a	3.44 a	91.9 a
SUCCESS 480 SC	60	4.85 a	64.8 a	33.9 a	34.3 a	4.10 a	109.4 a
SUCCESS 480 SC	80	4.19 a	62.2 a	31.2 a	30.9 a	3.53 a	94.2 a
ADMIRE 240 2F	50 + 50	4.47 a	65.2 a	28.5 a	36.7 a	3.77 a	100.4 a
ADMIRE 240 2F	50	4.69 a	66.3 a	28.6 a	38.2 a	3.82 a	101.9 a
ADMIRE 240 2F	70	4.99 a	70.8 a	35.7 a	35.2 a	4.17 a	111.1 a

[1] Treatment means followed by the same letter are not significantly different ($P<0.05$, Tukey's HSD).

2001 PMR REPORT # 54 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-1252-9904

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

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TITLE: EVALUATION OF DRENCH TREATMENTS FOR CONTROL OF CABBAGE MAGGOT ATTACKING SUMMER TURNIP IN MINERAL SOIL, 2001

MATERIALS: CANON 200 SC (fipronil), TI-435 600 F (clothianidin), NOVALURON 0.83 EC (novaluron), PYRINEX 480 EC (chlorpyrifos)

METHODS: Summer turnip seed was planted on the SCPFRC-London Research Farm on May 10 in 1-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. On June 15 when seedlings had 8-10 true leaves, PRE drench treatments were applied at 200 kPa in 20 L/100 m row in a 5-7 cm band over the crown of developing plants, using a hand-held, CO_2-pressurized, single-nozzled (6506 flat fan) R&D plot sprayer. On June 20, to augment the native CM-population, 200-250 CM-eggs from an insecticide-susceptible, laboratory strain, originally collected near Chatham, ON, were buried 1 cm deep beside an approximate 1.0-1.3 m length of row of developing plants in each plot. To improve egg hatch and maggot survival, plots were watered after infestation. The infested row length was delineated with a dated, plastic plant marker (1.5 cm x 12.5 cm). On June 25, POST drench insecticides were applied as described above. On July 10, the 12 largest turnips from both the artificially augmented and the naturally infested lengths of row in each plot 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, Table 1). Within each plot, separate rating scores were developed for roots damaged by the augmented CM-population and for turnips damaged only by wild CM. A Damage Index (D.I.) was then calculated for each group of turnips in 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 drench treatment was calculated according to the formula: % Control = D.I.(Control) - D.I.(Tmt.)/D.I.(Control) x 100%.

RESULTS/OBSERVATIONS: Temperature reached 30.8°C on June 15, Day 0 for PRE-treatments; the average daily maximum temperature during the 10 days until the POST-treatments was 23.7°C. A total of 22.8 mm of rainfall fell within 24 hours of PRE-application; an additional 5.4 mm subsequently accumulated by 5 days after treatment (DAT). No significant phytotoxicity was observed following any treatment.

Results are presented in Table 1. Augmenting the natural CM by burial of laboratory-produced CM-eggs beside growing turnip roots increased the mean D.I.'s in untreated plots (Tmt. 12). While PRE-

application of PYRINEX (Tmt. 10) reduced damage by both natural and augmented CM-populations, the reduction was statistically significant only for the augmented CM-population. Significantly reduced D.I.'s in the presence of the higher insect pressure of the augmented population were also observed following drench application of CANON (Tmt. 1) and the lower rate of application of TI-435 (Tmt. 4). No treatment significantly reduced D.I.'s in the presence of the natural CM-population.

CONCLUSIONS: Drench-application of the current commercial standard PYRINEX on June 15 effectively controlled feeding damage by both natural and augmented CM-populations. Since similar application of PYRINEX 10 days later on June 25 did not significantly reduce CM-damage, it is likely that maggots emerging from eggs oviposited by wild-CM just before June 15 or during the intervening 10 days, had moved into the turnip roots and were not affected by the non-systemic chlorpyrifos. Application of all treatments to an earlier stage of plant development may have improved control and should be investigated. Earlier timing of application is especially important for novaluron, a growth regulator known to affect development of immature insects. Although benzoylphenyl urea compounds such as novaluron are generally tightly bound in the soil further research is nonetheless warranted since diflubenzuron, a related benzoylphenyl urea compound, has been shown to reduce CM-damage in rutabaga.

Table 1. Experimental drench treatments for control of cabbage maggot, *Delia radicum*, attacking summer turnip in mineral soil in microplots, London, ON, 2001.

Tmt. No.	Treatment Applied	Rate Applied (pdct/ 100 m)	Timing[1]	Treatment-Impact for Indicated CM-Population			
				Augmented[2] Population		Natural[3] Population	
				Dam. Index[4]	% Control[5]	Dam. Index	% Control
1.	CANON 200SC	10.0 ml	PRE	24.2 d[6]	64.8	45.4 abc	***[7]
2.	CANON 200SC	10.0 ml	POST	58.3 abc	15.3	20.1 cd	42.2
3.	TI-435 600F	6.0 ml	PRE	76.4 ab	***	52.0 ab	***
4.	TI-435 600F	3.0 ml	POST	40.3 cd	41.4	22.2 bcd	36.2
5.	TI-435 600F	6.0 ml	POST	56.1 bc	18.5	33.3 bcd	4.3
6.	RIMON 0.83EC	7.0 ml	PRE	67.7 ab	1.1	45.8 abc	***
7.	RIMON 0.83EC	7.0 ml	POST	76.4 ab	***	43.1 abc	***
8.	RIMON 0.83EC	14.0 ml	PRE	60.1 abc	12.6	50.0 abc	***
9.	RIMON 0.83EC	14.0 ml	POST	79.2 a	***	65.3 a	***
10.	PYRINEX 480EC	21.0 ml	PRE	0.0 e	100.0	10.0 d	71.3
11.	PYRINEX 480EC	21.0 ml	POST	56.1 bc	18.5	20.8 cd	40.2
12.	No Insecticide	-----	----	68.8 ab	---	34.8 bcd	---

[1] PRE = insecticide applied 5 days prior to CM-egg infestation; POST = insecticide applied 5 days after infestation.

[2] 200-250 CM-eggs buried adjacent to row.

[3] root injury solely due to feeding by maggots hatching from eggs deposited by native CM-flies

[4] Damage Index (D.I.) developed by King and Forbes (1954) where harvested roots rated for feeding damage according to the following scale: **clean** = factor of 0, no damage; **light** = factor of 0, 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. Damage 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.;

[5] Mean % Control relative to Damage Index (D.I.) for Untreated plots.
% Control = D.I.(Control) - D.I.(Tmt.)/D.I.(Control) x 100%

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

[7] Damage greater than in plots with No Insecticide (Tmt. 12).

END OF SECTION B: VEGETABLES AND SPECIAL CROPS - REPORT # 38-54
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SECTION C:	POTATOES/POMMES DE TERRE

REPORT/RAPPORT #: **55 - 60**

PAGES: **124 - 143**

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2001 RAPPORT # 55 **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 2001

PRODUITS : ACTARA 25 WG (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 8 répétitions. Les pommes de terre ont été plantées le 10 mai 2001 à 25 cm d'espacement. Les parcelles de 7,0 m de longueur comprenaient 4 rangs espacés de 0,9 m. Les traitements étaient les suivants : ACTARA 240SC en bandes au sol à la plantation (dose 380 mL/ha); ACTARA 240SC en bandes au sol à la plantation (dose 485 mL/ha); ACTARA 25WG en pulvérisations foliaires; ADMIRE 240F en pulvérisations foliaires; ADMIRE 240F en bandes au sol à la plantation; TÉMOIN (sans traitement).

Lors de la première intervention foliaire, la population larvaire était composée à 70 % de larves de stade 1 et 2. Pour les traitements prévoyant des pulvérisations foliaires, celles-ci ont été faites le 28 juin et le 5 juillet à l'aide d'un pulvérisateur monté sur tracteur (pression : 690 kPa, volume : 435 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 65 L/ha. L'évaluation des densités du doryphore a été effectuée sur 5 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

23 août avec du RÉGLONE (diquat 2,5 L p.c./ha) et le 30 août avec le même produit (diquat 1,5L 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 5 septembre 2001. 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 No1 grosse.

RÉSULTATS : Voir le tableau ci-dessous.

CONCLUSION : À Deschambault, en 2001, la saison n'a pas été très favorable au développement du doryphore de la pomme de terre. Les populations larvaires sont demeurées relativement faibles. Par contre, le climat a favorisé une croissance vigoureuse des plants. Malgré tout, les traitements insecticides contre le doryphore ont permis d'obtenir un rendement supérieur à un témoin non traité. L'ensemble des traitements au sol ont une efficacité qui se compare lorsque nous analysons le rendement vendable. Toujours au niveau du rendement, pour l'ensemble des traitements insecticides, seul une application au sol avec le ACTARA 240SC à la dose de 380 mL/ha de produit commercial s'est montrée supérieure à une application foliaire faite avec le ADMIRE 240F. Au niveau des populations larvaires, les traitements au sol avec le ACTARA 240SC et le ADMIRE 240F se comparent en début de saison. Par la suite, on observe une augmentation significative du nombre de larves dans les parcelles traitées avec le ADMIRE 240F au sol. Pour les traitements foliaires, l'efficacité entre le ACTARA 25WG et le ADMIRE 240F est très comparable. Par contre, ils se montrent supérieurs au traitement au sol fait avec le ADMIRE 240F lorsque nous mesurons la population larvaire à la fin juillet.

Dans l'ensemble, les résultats obtenus au niveau du dommage au feuillage sont le reflet de ceux observés au niveau de la population larvaire. En début de saison, les traitements au sol permettent de maintenir le % de dommage au feuillage à des niveaux très bas. Avec le ADMIRE 240F appliqué au sol, on observe une remontée des dommages qui suit l'augmentation de la population larvaire. Dans l'ensemble, les traitements foliaires ont permis de limiter les dommages au feuillage au moment où la plante est la plus vulnérable, soit à la floraison.

Table 1. Nombre moyen de larves de doryphore/plant, dommage en % et rendement vendable, Deschambault, Québec, 2001.

Traitement Insecticide	Dose (p.c. /ha)	Population larvaire					Dommage					Rendement vendable (t/ha)
		Juin	Juillet				Juin	Juillet				
		26	3	12	19	26	26	3	12	19	26	
ACTARA au sol	485 ml	0,0b	0,0d	0,0c	0,0c	0,1d	0,3b	0,1b	0,1d	0,1b	0,3c	60,14ab
ACTARA au sol	380 ml	0,0b	0,4d	0,1c	0,1c	0,4cd	0,4b	0,2b	0,6cd	0,2b	0,3c	63,27a
ACTARA foliaire	104 g	9,8a	2,9b	0,2c	0,1c	0,3cd	2,7a	1,0b	2,3b	0,8b	0,6c	62,04ab
ADMIRE foliaire	200 ml	4,7a	2,2bc	0,1c	0,4c	0,7c	2,3a	1,4b	1,9bc	0,7b	1,0c	58,48b
ADMIRE au sol	850 ml	0,0b	1,0cd	1,4b	3,1b	4,9b	0,9b	0,7b	1,2bcd	1,9b	4,9b	60,06ab
Témoin	---	8,5a	12,9a	16,7a	11,7a	7,5a	2,9a	8,9a	19,3a	17,1a	30,7a	49,92c

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 (%x /100). Ces données sont présentées non transformées dans le tableau.

2001 PMR REPORT # 56 **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);
European corn borer (ECB), *Ostrinia nubilalis (*Hubner);
Aphids, wireworms

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TITLE: EFFECT OF SEED-PIECE OR IN-FURROW INSECTICIDE TREATMENT ON INSECT PEST POPULATIONS AND DAMAGE ON POTATOES

MATERIALS: SENATOR 10% (benzimidazole), GENESIS XT (LO228-A1) 1.25% (imidacloprid & thiophanate-methyl), GENESIS (LO149-A1) (imidacloprid), and ADMIRE 240 F (imidacloprid)

METHODS: Cut seed-potato pieces were planted at Harrington, PEI, on May 29, 2001, in four-row plots with plant spacing of either 0.3 m or 0.5 m 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 secondary being the presence/absence and rate of insecticide. There were four replications. The plots measured 7.6 m in length and 3.7 m in width, and were separated from each other within each replicate 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: Check - SENATOR 10% at 50.0 g AI/100 kg seed; GENESIS XT at 6.3 g AI/100 kg seed; GENESIS XT at 9.4 g AI/100 kg seed; GENESIS at 6.7 g AI/100 kg seed plus SENATOR 10% at 50.0 g AI/100 kg seed; and 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 when Colorado potato beetle (CPB) adults first appeared 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, determinations of PFB population levels were made 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.

A one-time examination of twenty stems per plot for the presence of European corn borer damage was done on August 16. 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. There was no need to spray the buffer rows to prevent the inter-plot movement of insects. Diquat was applied at the rate of 370 g AI/ha on September 07* for top desiccation. Tubers from the centre two rows of each plot were harvested on September 17, 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) 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.

*Due to lack of moisture, plant tops died before normal time of senescence.

RESULTS: Regardless of seed spacing, GENESIS XT at 6.3 and 9.4 g AI/100 kg seed, GENESIS at 6.7 g AI/100 kg seed, and ADMIRE 240 F in-furrow at 1.8 g AI/100 m row, were equally efficacious at reducing numbers of CPB adults on July 19 and 25, August 08 and 16, and on a seasonally-averaged basis, compared to the SENATOR treated Check (Table 1). Results were similar for CPB egg masses from June 29 through July 25 (Table 2), for L1-L2 larvae from July 04 through August 08 (Table 3), and for L3-L4 larvae from July 19 through August 16 (Table 4). In comparison with the non-treated Check, all treatments gave significant early-season control of the potato flea beetle, however no treatment was consistently more efficacious than another, and later-season counts and the seasonal average number of holes per fourth terminal leaf indicated that the trend did not continue (Table 5). Although aphid populations were very low throughout the entire summer, aphids on top, middle, and bottom leaves of plants were controlled by all treatments at both spacings throughout July (data not shown), and this held true for total aphids per plant throughout most of July and for the seasonally-averaged count (Table 6). Although 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), no significant decrease of European corn borer damage was achieved by any of the treatments (data not shown). From July 16 through August 27, all treatments were equally effective at reducing defoliation by the Colorado potato beetle (data not shown). Seasonally averaged, all treatments performed equally well at reducing defoliation compared to the Check (Table 7). In-row seed spacing significantly affected yields, which at both spacings were already diminished due to early dying of the plants (data not shown). When data for both seed spacings were combined, there was a significant treatment/rate response for both total and marketable yields/ha. The higher rate of GENESIS XT, GENESIS, and ADMIRE, produced significantly better total and marketable yields than did the lower rate of GENESIS XT, and 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, defoliation, or yields, data were pooled for all tables.

CONCLUSIONS: Seed spacing did not have any appreciable effect on insect populations or defoliation throughout the summer. Seed treatments of two rates of GENESIS XT, GENESIS, and an at-planting application of ADMIRE in-furrow, were all equally effective at reducing populations of the Colorado potato beetle relative to the fungicide-treated Check. All treatments were equally effective at reducing both seasonally-averaged aphid populations and summer-long defoliation due to the CPB. No control of the ECB, or of the PFB after mid-July, was achieved by any treatment. Both total and marketable tuber yields were greatly below what might be considered “normal”, due to the extreme moisture stress suffered by all plants throughout the summer. As might be expected, 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. GENESIS, ADMIRE, and the high rate of GENESIS XT were all equally effective, and superior to GENESIS XT at the lower rate, at reducing yield loss due to insect damage.

Table 1. Efficacy of two rates of GENESIS XT seed-piece treatment, one rate of GENESIS 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, 2001. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB Adults/Plant					Seas. Avg.
		July 19	July 25	July 31	Aug. 08	Aug. 16	
SENATOR 10%	50	0.2a[1]	0.2a	0	3.9a	5.9a	1.5a
GENESIS XT 1.25%	6.3	0.1b	0.0b	0.1	0.3b	4.4bc	1.1b
GENESIS XT 1.25%	9.4	0.0b	0.0b	0	0.3b	1.6c	0.4b
GENESIS 2F + SENATOR 10%	6.7 + 50.0	0.0b	0.0b	0	0.3b	3.6b	0.7b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.1b	0.1b	0	0.3b	2.1bc	0.6b
ANOVA P≤ 0.05		s	s	ns	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.

Table 2. Efficacy of two rates of GENESIS XT seed-piece treatment, one rate of GENESIS 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, 2001. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB Egg Masses/ Plant					Seas. Avg.
		June 29	July 04	July 11	July 19	July 25	
SENATOR 10%	50	1.5a[1]	1.6a	1.1a	0.9a	0.2a	0.6a
GENESIS XT 1.25%	6.3	0.0b	0.0b	0.0b	0.1b	0.0b	0.1b
GENESIS XT 1.25%	9.4	0.0b	0.0b	0.1b	0.0b	0.0b	0.1b
GENESIS 2F + SENATOR 10%	6.7 + 50.0	0.0b	0.0b	0.0b	0.1b	0.0b	0.1b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.1b	0.1b	0.0b	0.0b	0.0b	0.1b
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.

Table 3. Efficacy of two rates of GENESIS XT seed-piece treatment, one rate of GENESIS seed-piece treatment, and an in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) L1-L2 instars on potatoes planted at two seeding rates, Harrington, PE, 2001. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB L1-L2 Instars/ Plant					Seas. Avg.
		July 11	July 19	July 25	July 31	Aug. 08	
SENATOR 10%	50	4.0a[1]	12.2a	17.5a	11.2a	4.2a	5.7a
GENESIS XT 1.25%	6.3	0.0b	0.0b	0.0b	0.0b	0.2b	0.0b
GENESIS XT 1.25%	9.4	0.0b	0.0b	0.0b	0.0b	0.7b	0.1b
GENESIS 2F + SENATOR 10%	6.7 + 50.0	0.0b	0.0b	0.0b	0.1b	0.0b	0.2b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.0b	0.0b	0.0b	0.0b	0.1b	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.

Table 4. Efficacy of two rates of GENESIS XT seed-piece treatment, one rate of GENESIS seed-piece treatment, and an in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) L3-L4 instars on potatoes planted at two seeding rates, Harrington, PE, 2001. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB L3-L4 Instars/ Plant					Seas. Avg.
		July 19	July 25	July 31	Aug. 08	Aug. 16	
SENATOR 10%	50	3.8a[1]	7.6a	9.6a	5.7a	1.6a	4.1a
GENESIS XT 1.25%	6.3	0.0b	0.0b	0.0b	0.0b	0.4b	0.1b
GENESIS XT 1.25%	9.4	0.0b	0.0b	0.0b	0.0b	0.0b	0.0b
GENESIS 2F + SENATOR 10%	6.7 + 50.0	0.0b	0.0b	0.0b	0.1b	0.1b	0.0b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.0b	0.0b	0.0b	0.4b	0.3b	0.1b
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.

Table 5. Effect of two rates of GENESIS XT seed-piece treatment, one rate of GENESIS seed-piece treatment, and an in-furrow treatment of ADMIRE 240 F, on PFB damage on potatoes planted at two seeding rates, Harrington, PE, 2001. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. of PFB Holes/4th Terminal Leaf					Seas. Avg.
		June 29	July 04	July 11	Aug. 08	Aug. 16	
SENATOR 10%	50	10.9a[1]	8.3a	13.0a	6.8	11	7.4
GENESIS XT 1.25%	6.3	0.5bc	0.3b	1.6c	9.8	31.2	12.6
GENESIS XT 1.25%	9.4	0.2c	0.4b	0.2d	4.4	13.7	9.8
GENESIS 2F + SENATOR 10%	6.7 + 50.0	0.1c	0.6b	0.7cd	3.5	59.2	15.2
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	1.0b	1.0b	4.8b	10.4	25.4	11.8
ANOVA P≤ 0.05		s	s	s	ns	ns	ns

[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.

Table 6. Efficacy of two rates of GENESIS XT seed-piece treatment, one rate of GENESIS seed-piece treatment, and an in-furrow treatment of ADMIRE 240 F, against aphids on potatoes planted at two seeding rates, Harrington, PE, 2001. Seeding rate data combined.

Treatment	Rate (g AI/100 kg seed)	Mean No. of Aphids/Plant					Seas. Avg.
		July 11	July 19	July 25	July 31	Aug. 08	
SENATOR 10%	50	0.5a[1]	0.6	2.7a	4.0a	0.1	0.9a
GENESIS XT 1.25%	6.3	0.0b	0	0.3b	0.1b	0.3	0.1b
GENESIS XT 1.25%	9.4	0.0b	0.2	0.5b	0.2b	0.1	0.1b
GENESIS 2F + SENATOR 10%	6.7 + 50.0	0.0b	0	0.0b	0.4b	0.3	0.1b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.0b	0	0.2b	0.2b	0.2	0.1b
ANOVA P≤ 0.05		s	ns	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.

Table 7. Effect of two rates of GENESIS XT seed-piece treatment, one rate of GENESIS seed-piece treatment, and an 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, 2001. 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	0.6a[1]	44.6a	12.6c	12.3c
GENESIS XT 1.25%	6.3	0.1b	3.6b	15.1b	14.9b
GENESIS XT 1.25%	9.4	0.0b	2.2b	17.7a	17.3a
GENESIS 2F + SENATOR 10%	6.7 + 50.0	0.1b	3.0b	17.6a	17.4a
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[2]	0.1b	3.5b	18.2a	17.8a
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.

2001 PMR REPORT # 57 **SECTION C: POTATOES - Insect Pests**
STUDY DATA BASE: 280-2126-9904

CROP: Potato, cv. Chieftain
PEST: Potato leafhopper (PLH), *Empoasca fabae* (Harris)

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TITLE: PLANTING TREATMENTS FOR CONTROL OF DAMAGE TO POTATO FOLIAGE BY POTATO LEAFHOPPER, 2001

MATERIALS: CANON 200 SC (fipronil), PYRINEX 480 EC (chlorpyrifos), PYRIFOS 15 G (chlorpyrifos), TI-435 600 F (clothianidin), CAPTURE 2 EC (bifenthrin), MATADOR 120 EC (lambda cyhalothrin), THIMET 15 G (phorate)

METHODS: Seed treatments (Tmt. 5, 6) were uniformly applied to freshly cut potato seed-pieces using a hand-operated mist-applicator on May 10. Treated seed-pieces were allowed to dry and stored in vented, plastic tubs until planting. With the exception of Tmts. 5 and 6, freshly cut potato seed-pieces were hand-planted in single row plots (20 seed-pieces/4 m) in sandy loam soil on Lot 12, VIII Concession, Zone Township, Kent County on May 11. All treatments were replicated 4 times in a randomized complete block design. Furrow-granular treatments (Tmt. 4, 10) were hand-applied in a 5-7 cm band on top of the seed-pieces before the seed furrow was closed. Furrow-spray treatments (Tmts. 1-3, 7-9) were applied in a 5-7 cm band over seed-pieces in the bottom of the open planting furrow, using a hand-held, CO_2-pressurized, single-nozzled (8004 flat fan) R&D plot sprayer, at 200 kPa in 5 L water/100 m row. On July 09 and 25, a total of 10 randomly selected, terminal leaflets in each plot were rated for PLH damage on a 0 - 2 scale assigned as follows: 0 - no symptoms of PLH feeding; 1 - leaf-curling only; 2 - leaf-curling + necrosis and/or brown leaf margins around at least part of the leaflet. On each date a Cumulative PLH-Rating was then calculated for each plot by summing individual leaf-ratings for that plot. Statistical significance of observed impact of planting treatments on PLH-damage to potato foliage was determined by analysis of variance (ANOVA). The Least Significant Difference (LSD) was then calculated and used to estimate significance of differences among treatment means.

RESULTS: Experimental results are outlined in Table 1. No significant phytotoxicity was observed following any planting treatment. Damaging PLH-populations did not develop in the experimental block until the beginning of July. By July 09, over 8 weeks after planting, pronounced leaf curling was observed in untreated plots (Tmt. 11) and in plots treated with CANON (Tmt. 1), CAPTURE (Tmt. 8), MATADOR (Tmt. 9) or any treatment containing chlorpyrifos (Tmts. 2, 3, 4). Significantly less damage was recorded in plots treated with THIMET (Tmt. 10) and TI-435 (Tmt. 7) or planted with seed-pieces treated with both rates of TI-435 (Tmts. 5, 6)(Table 1). By July 25, over 11 weeks post-planting, foliage of plants grown from seed-pieces treated with TI-435 (Tmts. 5, 6) or from seed-pieces treated in-furrow with the same insecticide (Tmt. 7) showed little evidence of PLH-feeding (Table 1). In all other plots significant leaf-curling and tissue necrosis were recorded at that time (Table 1).

CONCLUSIONS: The neonicotinyl insecticide, TI-435, applied as a seed-piece treatment or as an in-furrow spray, provided effective systemic protection of potato foliage for over 11 weeks. In

comparison, in-furrow application of the granular formulation of the standard organophosphorus insecticide, THIMET, reduced damage by feeding PLH for just over 8 weeks in this test.

Table 1. Impact of planting treatments on damage to potato foliage by the potato leafhopper, *Empoasca fabae,* 2001.

Tmt No.	Insecticide Applied	Method[1] of Applic'n	Rate Applied (Pdct./100 m)	Mean Cumulative PLH-Rating[2] on Indicated Date	
				09 July	25 July
1.	CANON 200SC	IFS	12.5 ml	9.3 a[3]	15.8 abc
2.	PYRINEX 480EC	IFS	30.0 ml	9.5 a	19.3 a
3.	PYRINEX 480EC	IFS	45.0 ml	10.0 a	16.0 abc
4.	PYRIFOS 15G	IFG	100.0 g	9.0 a	17.8 ab
5.	TI-435 600F	SD	10.4 ml[4]	1.0 c	7.5 d
6.	TI-435 600F	SD	20.8 ml[4]	0.3 c	4.8 d
7.	TI-435 600F	IFS	5.0 ml	1.5 c	5.8 d
8.	CAPTURE 2EC	IFS	4.0 ml	9.8 a	16.3 abc
9.	MATADOR 120EC	IFS	8.0 ml	10.8 a	16.0 abc
10.	THIMET 15G	IFG	215.0 g	4.0 b	13.5 c
11.	no insecticide	---	-----	9.5 a	14.3 bc

[1] Method of application: IFS = in-furrow spray; IFG = in-furrow granular; SD = seed dressing.

[2] 0 - 2 scale assigned as follows: 0 = no symptoms of PLH feeding; 1 = leaf-curling only; 2 = leaf-curling + necrosis and/or brown leaf margins around at least part of the leaflet. Cumulative rating is sum of ratings for all 10 leaves selected from each plot.

[3] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and the Least Significant Difference.

[4] Amount/100 kg seed.

2001 PMR REPORT # 58 **SECTION C: POTATOES - INSECT PESTS**
STUDY DATA BASE: 280-2126-9904

CROP: Potato, cv. Chieftain
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, 2001

MATERIALS: ACTARA 25 WG (thiamethoxam), ADMIRE 240 F (imidacloprid), CONFIDOR 200 SL (imidacloprid), TI-435 600 F (clothianidin), CALYPSO 480 SC (thiacloprid)

METHODS: Chitted seed potatoes were planted on the SCPFRC-London Research Farm on July 05 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. On August 13 when plants were beginning to bud, 55 fully expanded compound leaves were tagged in each plot. Later on August 13, all treatments were applied at 250 kPa in 900 L/ha using a hand-held, CO_2-pressurized, single-nozzled (D-4-25 hollow cone) R&D plot sprayer. 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 for bioassay. Tagged compound leaves were thereafter collected at regular intervals for further bioassay (Tables 1-4). 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 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 then subjected to arcsin square root transformation prior to statistical analysis by analysis of variance (ANOVA). The Least Significant Difference (LSD) was then calculated and 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/OBSERVATIONS: After application on August 13, no rain fell during the 72 hrs after treatment. A total of 10.8 mm of rainfall subsequently accumulated by 5 days after treatment (DAT) and reached 37.8 mm by 14 DAT. Temperature reached 25.4°C on Day 0 (August 13); the average daily maximum temperature over the first 5 DAT was 24.4°C. No phytotoxicity was noted following any treatment.

In bioassay, all tested rates of neonicotinoid insecticides were toxic to virtually all exposed adult CPB for 2 DAT (Table 1). By 4 DAT, significantly lower adult CPB mortality was observed on plants treated with the tested rate of CONFIDOR (Tmt. 3). By 10 DAT, bioassays of both tested rates of imidacloprid (Tmts. 2, 3) revealed significantly less mortality of exposed adult CPB. As long as 14 DAT, over 90% of adult CPB died after exposure to the tested rate of TI-435 (Tmt. 4)(Table 1). While significantly fewer adult CPB died in bioassays of ACTARA (Tmt. 1) and CALYPSO (Tmt. 6), mortality still exceeded 70% in those bioassays 14 DAT.

Adult feeding damage was significantly reduced in bioassays of all tested insecticides as long as 14 DAT (Table 2). Best foliage-protection at that time was observed in bioassays of leaves treated with TI-435 and CALYPSO; feeding damage was reduced by 96% and 93% respectively (Table 2). At 14 DAT, significantly better foliage protection was observed in bioassays of the higher rate of imidacloprid (Tmt. 2); feeding damage was reduced by an average of 42% in these bioassays compared to only 23% in bioassays of the lower rate of imidacloprid (Tmt. 3)(Table 2).

Average corrected mortality of 1st instar CPB larvae exposed to leaves treated with TI-435 exceeded 80% in every bioassay until 14 DAT (Table 3). Similar results were recorded for CALYPSO until 10 DAT (Table 3). Results were less consistent for the remaining 3 treatments; average mortality of 1st instar larvae fell below 80% in bioassay as soon as 4 DAT, increasing to higher levels in bioassays established at later dates (Table 3).

Measurement of leaf consumption by 1st instar CPB larvae provided more consistent results than did counts of mortality of the same life stage (cf. Tables 3, 4). While all tested treatments significantly reduced leaf consumption by 1st instars as long as 14 DAT, damage was least in bioassays of leaves treated with TI-435 and CALYPSO (Table 4). In those bioassays, leaf consumption was respectively reduced by 74% and 71% at 14 DAT. Application of ACTARA and the higher rate of imidacloprid (ADMIRE - Tmt. 2) was significantly less effective 14 DAT than application of either TI-435 or CALYPSO (Table 4). Application of the lower rate of imidacloprid (CONFIDOR - Tmt. 3) proved the least effective treatment 14 DAT, resulting in only 20% reduction in average leaf consumption in those bioassays (Table 4).

CONCLUSIONS: Based on the overall results of this experiment, foliar application of the tested rate of ACTARA was at least as effective as the recommended rate of application of ADMIRE, the current commercial standard for CPB-control on potato. As indicated by both CPB-mortality and foliage-protection, foliar application of TI-435 and CALYPSO proved more persistent than similar application of the label rate of ADMIRE. Decreasing the effective rate of application of imidacloprid shortened the residual activity of the insecticide on potato foliage; by the end of the observation period, 14 DAT, less CPB-mortality and greater leaf damage were recorded following application of the tested rate of CONFIDOR than were observed after the label rate of application of ADMIRE.

Table 1. Effect of treated potato foliage on mortality of Colorado potato beetle (CPB) adults after feeding for 72 hours in bioassay, 2001.

Tmt. No.	Treatment Applied	Formulation Applied	Rate Applied (g a.i../ha)	Average % Corrected CPB Mortality on Indicated Day After Treatment					
				0	2	4	7	10	14
1.	thiamethoxam	ACTARA 25WG	26.0 g	100.0 a[1]	100.0 a	84.4 ab	81.8 bc	85.3 a	73.3 b
2.	imidacloprid	ADMIRE 240F	48.0 g	92.0 a	95.5 a	82.3 b	72.7 c	42.5 b	28.9 c
3.	imidacloprid	CONFIDOR 200SL	25.0 g	82.7 b	100.0 a	53.3 c	38.9 d	33.9 b	24.4 c
4.	clothianidin	TI-435 600F	25.0 g	100.0 a	100.0 a	100.0 a	100.0 a	92.7 a	93.3 a
5.	thiacloprid	CALYPSO 480SC	25.0 g	100.0 a	100.0 a	100.0 a	95.4 ab	85.4 a	71.1 b

Table 2. Effect of treated potato foliage on feeding damage by Colorado potato beetle (CPB) adults after 72 hours in bioassay, 2001.

Tmt. No.	Treatment Applied	Formulation Applied	Rate Applied (pdct./ha)	Average Feeding Damage Rating[2] on Indicated Day After Treatment					
				0	2	4	7	10	14
1.	thiamethoxam	ACTARA 25WG	26.0 g	0.4 b	0.3 b	0.5 bc	1.4 bc	0.6 cd	1.7 d
2.	imidacloprid	ADMIRE 240F	48.0 g	0.1 c	0.2 b	0.7 b	0.7 cd	1.3 bc	4.7 c
3.	imidacloprid	CONFIDOR 200SL	25.0 g	0.1 c	0.3 b	0.8 b	2.0 b	2.2 b	6.3 b
4.	clothianidin	TI-435 600F	25.0 g	0.1 c	0.1 b	0.2 c	0.2 d	0.2 d	0.3 e
5.	thiacloprid	CALYPSO 480SC	25.0 g	0.1 c	0.1 b	0.2 c	0.3 cd	0.3 d	0.5 de
6.	untreated	no insecticide	---	3.5 a	3.4 a	4.9 a	6.6 a	7.5 a	8.1 a

[1] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and the Least Significant Difference.

[2] 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).

Table 3. Effect of treated potato foliage on mortality of 1st instar Colorado potato beetle (CPB) larvae after feeding for 72 hours in bioassay, 2001.

Tmt. No.	Treatment Applied	Formulation Applied	Rate Applied (g a.i../ha)	Average % Corrected CPB Mortality on Indicated Day After Treatment					
				0	2	4	7	10	14
1.	thiamethoxam	ACTARA 25WG	26.0 g	100.0 a	86.2 ab	77.8 ab	41.1 bc	90.9 a	60.0 a
2.	imidacloprid	ADMIRE 240F	48.0 g	100.0 a	86.5 b	79.6 ab	28.9 c	93.2 a	70.6 a
3.	imidacloprid	CONFIDOR 200SL	25.0 g	100.0 a	86.5 b	67.6 b	62.2 b	95.5 a	86.7 a
4.	clothianidin	TI-435 600F	25.0 g	100.0 a	100.0 a	100.0 a	93.3 a	93.2 a	81.7 a
5.	thiacloprid	CALYPSO 480SC	25.0 g	100.0 a	100.0 a	100.0 a	97.8 a	93.2 a	55.6 a

Table 4. Effect of treated potato foliage on feeding damage by 1st instar Colorado potato beetle (CPB) larvae after 72 hours in bioassay, 2001.

Tmt. No.	Treatment Applied	Formulation Applied	Rate Applied (pdct./ha)	Average Leaf Area Consumed (cm^2) on Indicated Day After Treatment					
				0	2	4	7	10	14
1.	thiamethoxam	ACTARA 25WG	26.0 g	0.0 b	0.0 b	0.4 c	1.0 c	1.0 c	1.3 c
2.	imidacloprid	ADMIRE 240F	48.0 g	0.0 b	0.0 b	0.9 b	1.3 bc	1.7 b	1.4 c
3.	imidacloprid	CONFIDOR 200SL	25.0 g	0.0 b	0.0 b	1.0 b	1.6 b	1.9 b	1.7 b
4.	clothianidin	TI-435 600F	25.0 g	0.0 b	0.0 b	0.0 d	0.0 d	0.4 d	0.5 d
5.	thiacloprid	CALYPSO 480SC	25.0 g	0.0 b	0.0 b	0.0 d	0.0 d	0.4 d	0.6 d
6.	untreated	no insecticide	---	1.2 a	2.0 a	1.9 a	2.8 a	2.9 a	2.1 a

[1] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and the Least Significant Difference.

[2] Actual area (cm^2) of leaf-disc consumed during 72 hour feeding period.

2001 PMR REPORT # 59 **SECTION C: POTATOES - INSECT PESTS**
STUDY DATA BASE: 280-1252-9904

CROP: Potato, cv. Chieftain
PEST: Eastern Field Wireworm (WW), *Limonius agonus* (Say)

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TITLE: PLANTING TREATMENTS FOR CONTROL OF DAMAGE TO POTATO BY FIELD WIREWORMS, 2001

MATERIALS: CANON 200 SC (fipronil), PYRINEX 480 EC (chlorpyrifos), PYRIFOS 15 G (chlorpyrifos), TI-435 600 F (clothianidin), CAPTURE 2 EC (bifenthrin), MATADOR 120 EC (lambda cyhalothrin), THIMET 15 G (phorate)

METHODS: Seed treatments (Tmt. 5, 6) were uniformly applied to freshly cut potato seed-pieces using a hand-operated mist-applicator on May 10. Treated seed-pieces were allowed to dry and stored in vented, plastic tubs until planting. With the exception of Tmts. 5 and 6, freshly cut potato seed-pieces were hand-planted in single row plots (20 seed-pieces/4 m) in sandy loam soil on: Lot 12, VIII Concession, Zone Township, Kent County on May 11 (site I); and, on Lot 21, II Concession, Mulmur Township, Dufferin County on May 17 (site II). At both sites, all treatments were replicated 4 times in a randomized complete block design. Furrow-granular treatments (Tmt. 4, 10) were hand-applied in a 5-7 cm band on top of the seed-pieces before the seed furrow was closed. Furrow-spray treatments (Tmts. 1-3, 7-9) were applied in a 5-7 cm band over seed-pieces in the bottom of the open planting furrow, using a hand-held, CO_2-pressurized, single-nozzled (8004 flat fan) R&D plot sprayer, at 200 kPa in 5 L water/100 m row. On June 04 (site I) and June 19 (site II), either 6 (site II) or 7 (site I) developing plants were carefully excavated from each plot and potato seed-pieces checked for WW-feeding damage. After examination, plants were re-established. On August 20 (site I) and 21 (site II) potatoes were dug by hand; guard plants at either row end were not harvested. All potatoes from each plot were bagged and returned to the laboratory. Two samples of 50 tubers were randomly selected from each plot for grading. Each potato was graded according to the scale: light = 1-2 holes/tuber with total tunnel length < 12.5 mm; moderate = > 2 feeding holes, none > 12.5 mm and total tunnel length < 19 mm; severe = trim required to remove WW-damage > 5% of total weight of tuber. For the purposes of analysis, the number of potatoes in all damage categories in each plot were summed and the total % damaged potatoes recorded. For each plot, % WW-damage to seed-pieces and harvested tubers was subjected to arcsin square root transformation prior to statistical analysis by analysis of variance (ANOVA); the Least Significant Difference (LSD) was then calculated and used to estimate significance of differences among treatment means. Untransformed data are presented.

RESULTS: No significant phytotoxicity was observed following any of the planting treatments. Impact of planting treatments on WW-damage to potato seed-pieces and to harvested potato tubers is shown in Table 1 and Table 2 respectively.

At each site, WW fed on approximately 20% of sampled seed-pieces in untreated plots (Table 1). At site I, in the presence of more early season WW-feeding, only in furrow application of both CANON (Tmt.

1) and THIMET (Tmt. 10) resulted in significant reduction in damage to potato seed-pieces relative to damage to seed-pieces sampled in untreated plots (Table 1). Early season WW-damage was lower at site II (Table 1). At site II, only in plots receiving in-furrow application of the lower rate of PYRINEX, was the number of damaged seed-pieces significantly reduced (Table 1).

WW-damage to harvested potato tubers was also quite low in untreated plots; only approximately 15% of sampled tubers showed signs of WW-feeding at each site (Table 2). At site I, relative to untreated plots, WW-damage was significantly reduced for all treatments except in-furrow application of TI-435 (Tmt. 7) or CAPTURE (Tmt. 8) (Table 2). At site II, only in-furrow application of PYRIFOS (Tmt. 4) failed to result in significantly reduced WW-feeding damage (Table 2). Most consistent control of WW-damage following in-furrow application of either CANON (Tmt. 1) or THIMET, the current commercial standard (Tmt. 10). At both sites, damage reduction following these treatments ranked in the top 3 (Table 2). While treatments containing chlorpyrifos (Tmt. 2, 3, 4) also significantly reduced WW-damage at site I, control by these treatments was not reliable at site II (Table 2).

CONCLUSION: In-furrow application of CANON or THIMET reduced WW-damage to potato more consistently than did other experimental treatments in these trials.

Table 1. Impact of planting treatments on damage to potato seed-pieces by wireworms, 2001.

Tmt No.	Insecticide Applied	Method[1] of Applic'n	Rate Applied (Pdct./100 m)	Mean % Wireworm Damage at Indicated Site	
				I	II
1.	CANON 200SC	IFS	12.5 ml	7.2 cd[2]	4.2 ab
2.	PYRINEX 480EC	IFS	30.0 ml	14.3 abcd	0.0 b
3.	PYRINEX 480EC	IFS	45.0 ml	21.4 abc	12.5 ab
4.	PYRIFOS 15G	IFG	100.0 g	21.5 abc	16.7 ab
5.	TI-435 600F	SD	10.4 ml[3]	7.2 bcd	4.2 ab
6.	TI-435 600F	SD	20.8 ml[3]	7.8 bcd	8.4 ab
7.	TI-435 600F	IFS	5.0 ml	14.3 bcd	12.5 ab
8.	CAPTURE 2EC	IFS	4.0 ml	35.7 a	8.4 ab
9.	MATADOR 120EC	IFS	8.0 ml	25.0 ab	12.4 ab
10.	THIMET 15G	IFG	215.0 g	0.0 d	8.3 ab
11.	no insecticide	---	-----	25.0 ab	20.8 a

[1] Method of application: IFS = in-furrow spray; IFG = in-furrow granular; SD = seed dressing.

[2] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and the Least Significant Difference.

[3] Amount/100 kg seed.

Table 2. Impact of planting treatments on damage to harvested potato tubers by wireworms, 2001.

Tmt No.	Insecticide Applied	Method[1] of Applic'n	Rate Applied (Pdct./100 m)	Mean % Wireworm Damage at Indicated Site	
				I	II
1.	CANON 200SC	IFS	12.5 ml	4.0 de[2]	4.8 d
2.	PYRINEX 480EC	IFS	30.0 ml	7.2 bcd	5.0 cd
3.	PYRINEX 480EC	IFS	45.0 ml	2.7 e	6.0 bcd
4.	PYRIFOS 15G	IFG	100.0 g	4.9 cde	9.6 ab
5.	TI-435 600F	SD	10.4 ml[3]	8.0 bcd	6.8 bcd
6.	TI-435 600F	SD	20.8 ml[3]	8.4 bc	4.8 d
7.	TI-435 600F	IFS	5.0 ml	12.3 ab	5.5 cd
8.	CAPTURE 2EC	IFS	4.0 ml	13.2 ab	6.0 bcd
9.	MATADOR 120EC	IFS	8.0 ml	8.8 bc	8.6 bc
10.	THIMET 15G	IFG	215.0 g	2.2 e	4.9 d
11.	no insecticide	---	-----	16.5 a	14.0 a

[1] Method of application: IFS = in-furrow spray; IFG = in-furrow granular; SD = seed dressing.

[2] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and the Least Significant Difference.

[3] Amount/100 kg seed.

2001 PMR REPORT # 60 **SECTION C: POTATOES - INSECT PESTS**
STUDY DATA BASE: 280-1252-9904

CROP: Potato, cv. Chieftain
PEST: Eastern Field Wireworm (WW), *Limonius agonus* (Say)

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TITLE: PRE-PLANT INCORPORATED TREATMENTS FOR CONTROL OF DAMAGE TO POTATO BY FIELD WIREWORMS, 2001

MATERIALS: PYRINEX 480 EC (chlorpyrifos), MATADOR 120 EC (lambda cyhalothrin)

METHODS: Trials were established in sandy loam soil on: Lot 12, VIII Concession, Zone Township, Kent County on May 11 (site I); and, on Lot 21, II Concession, Mulmur Township, Dufferin County on May 17 (site II). At both sites, all treatments were replicated 4 times in a randomized complete block design. Both incorporated treatments were applied at 200 kPa in 900 L/ha using a hand-held, CO_2-pressurized R&D plot sprayer with a 2 m boom fitted with 4, XR11002VS flat fan spray nozzles. Within 10 minutes of application both treatments were incorporated to a depth of 6-8 cm by a single pass of a tractor-mounted rototiller. Freshly cut potato seed-pieces were then hand-planted in 3-row plots (20 seed pieces/4 m row). On June 04 (site I) and June 19 (site II), either 6 (site II) or 7 (site I) developing plants were carefully excavated from each plot and seed-pieces checked for WW-feeding damage. After examination, plants were re-established. On August 20 (site I) and 21 (site II) potatoes were dug by hand; guard plants at either row end were not harvested. All potatoes from each plot were bagged and returned to the laboratory. Two samples of 50 tubers were randomly selected from each plot for grading. Each potato was graded according to the scale: light = 1-2 holes/tuber with total tunnel length < 12.5 mm; moderate = > 2 feeding holes, none > 12.5 mm and total tunnel length < 19 mm; severe = trim required to remove WW-damage > 5% of total weight of tuber. For the purposes of analysis, the number of potatoes in all damage categories in each plot were summed and the total % damaged potatoes recorded. For each plot, % WW-damage to seed-pieces and harvested tubers was subjected to arcsin square root transformation prior to statistical analysis by analysis of variance (ANOVA); the Least Significant Difference (LSD) was then calculated and used to estimate significance of differences among treatment means. Untransformed data are presented.

RESULTS: No significant phytotoxicity was observed following any of the planting treatments. WW-damage was not uniformly distributed throughout the experimental block in Site I. Impact of pre-plant incorporated treatments on WW-damage to potato seed-pieces and to harvested potato tubers is shown in Table 1 and Table 2 respectively.

At least 1/3 of examined potato seed-pieces in untreated plots showed evidence of WW-feeding (Table 1). At Site I, incorporation of MATADOR prior to planting resulted in significantly less damage to potato seed-pieces (Table I). Reduced damage to seed-pieces was recorded following both treatments at Site II; the decrease, however, was statistically significant only following incorporation of PYRINEX (Table 1).

No treatment exerted a significant impact on WW-damage to harvested potato tubers at site I (Table 2). The 76% reduction in damage to harvested tubers following incorporation of PYRINEX at site II was statistically significant (Table 2).

CONCLUSION: In 1 of 2 trials, broadcast incorporation of PYRINEX prior to planting, reduced WW-damage to both potato seed-pieces and harvested potato tubers. Further research on the reliability of this application is warranted.

Table 1. Impact of pre-plant incorporated treatments on damage to potato seed-pieces by wireworms, 2001.

Tmt No.	Insecticide Applied	Rate Applied (Pdct./ha)	Mean % Wireworm Damage at Indicated Site	
			I	II
1.	MATADOR 120EC	0.25 L	3.6 b[2]	16.7 ab
2.	PYRINEX 480EC	4.00 L	28.6 a	4.2 b
3.	no insecticide	-----	33.3 a	41.7 a

[1] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and the Least Significant Difference.

Table 2. Impact of pre-plant incorporated treatments on damage to harvested potato tubers by wireworms, 2001.

Tmt No.	Insecticide Applied	Rate Applied (Pdct./ha)	Mean % Wireworm Damage at Indicated Site	
			I	II
1.	MATADOR 120EC	0.25 L	23.9 a[1]	16.8 a
2.	PYRINEX 480EC	4.00 L	20.7 a	5.8 b
3.	no insecticide	-----	26.5 a	24.4 a

[1] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and the Least Significant Difference.

END OF SECTION C: POTATOES/POMMES DE TERRE - REPORT # 55-66
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SECTION D:	MEDICAL and VETERINARY/MÉDICAL et VÉTÉRINAIRE

REPORT/RAPPORT #: **61 - 62**

PAGES: **144 - 148**

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2001 PMR REPORT # 61 **SECTION D: MEDICAL and VETERINARY - Insect Pests**

CROP: Beef cattle
PEST: Rocky Mountain wood tick, *Dermacentor andersoni*

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TITLE: EVALUATION OF PERMETHRIN, LAMBDA-CYHALOTHRIN, AMITRAZ, COUMAPHOS AND IVERMECTIN FOR CONTROL OF ROCKY MOUNTAIN WOOD TICK ON BEEF CATTLE

MATERIALS: CO-RAL Flowable (42% coumaphos), DELICE Pour-On (1% permethrin), IVOMEC SR Bolus (1.72 g ivermectin), TAKTIC EC (12.5% amitraz), SABER Pour-On (1% lambda-cyhalothrin)

METHODS: This project was conducted from September 2000 to February 2001 in a cattle barn at the Agriculture and Agri-Food Research Station, Kamloops. Each candidate product was applied to one of six beef cattle (water only applied to one animal as an untreated check). Animals were identified by numbered ear tags and weighed (280- to 590-kg) immediately prior to and after the bioassay period (6 weeks). Each animal was held in separate stanchion and fed a maintenance ration with access to water *ad libitum*. Products, rates and method of application were: DELICE, 15 mL/45 kg body weight (BW) pour-on; SABER, 15 mL/animal pour-on; TAKTIC, 0.03% backline spray to run-off (1.05 – 1.3 L/animal) with a back-pack sprayer; CO-RAL, 0.25% backline spray to run-off (0.7 – 1.35 L/animal); and IVOMEC SR bolus (one/animal). All products were applied 7 days prior to first bioassay except for the IVOMEC

SR Bolus that was administered 2 weeks prior to the first bioassay. Subsequent bioassays were performed at 14, 21 and 28 days posttreatment. Bioassays involved placing 20 female and 20 male laboratory-reared Rocky Mountain ticks (Lethbridge Research Centre) in stocking cages glued along the backline of each animal at weekly intervals for 4 consecutive weeks. The cages were examined at 7 and 10 days after introduction and the sex and number of dead ticks and detached engorged female ticks was recorded. At 14 days, any remaining ticks were removed and their condition recorded. This procedure was replicated three times with different groups of cattle. Application dates were Sept. 12, Oct. 24 and Dec. 5 for all products except IVOMEC SR that was applied Aug. 30, Oct. 11 and Nov. 22. Ticks were held in cold storage (10°C) until used. Each treated animal was examined throughout the bioassay period for any adverse reactions to the treatments.

RESULTS: Table 1 summarizes the results of the bioassays showing the proportion of recovered female ticks that managed to fully engorge (take a complete blood meal). Since some female ticks managed to escape from the cages, % engorged females is based on the total number of live or dead female ticks recovered at the end of each 14-day exposure period for each weekly posttreatment bioassay. One animal treated with Saber™ died during the first bioassay due to a health condition unrelated to the treatment. To compensate for this loss, the second bioassay included two animals treated with SABER. Data from the first bioassay of IVOMEC SR Bolus was discarded because the animal's initial weight was greater than the initial weight recommended for animals being treated with the bolus. Subsequently the second bioassay included two animals treated with IVOMEC SR Bolus. A very high proportion of female ticks caged on untreated animals managed to fully engorge. All products managed to prevent or minimize engorgement for the first 3 weeks posttreatment. However only Saber prevented engorgement up to 4 weeks posttreatment. No adverse reactions to any of the treatments were observed. Except for two animals, all animals gained weight over the 6-week trial periods.

CONCLUSIONS: SABER 1% pour-on applied at the recommended dosage of 15 mL/animal (if BW > 273 kg) prevents engorgement of female ticks for up to 4 weeks posttreatment under indoor conditions. All other candidate products prevented significant engorgement for up to 3 weeks posttreatment.

Table 1. Percent of dead or alive female ticks recovered at 7, 14, 21 and 28 days posttreatment that were fully engorged after exposure to candidate products and check. Figures after % values represent the total number of female ticks recovered from each bioassay.

Product	Rep	% engorged females / Total number of females recovered			
		7 days	14 days	21 days	28 days
Check	1	85/18	95/20	90/19	70/20
	2	90/19	100/20	100/20	90/19
	3	35/17	75/18	90/18	40/18
DELICE	1	0/19	0/17	0/0	30/17
Pour-on	2	15/20	0/20	0/16	15/10
	3	0/18	0/20	0/20	0/19
SABER	1	0/19	0/21	0/19	0/20
Pour-on	2	0/19	0/21	0/19	0/18
	3	0/20	0/20	0/20	0/20
TAKTIC	1	0/19	0/18	0/18	35/16
Spray	2	10/19	0/18	5/18	65/15
	3	0/19	0/20	0/20	0/20
CO-RAL	1	0/20	0/20	5/19	20/18
Spray	2	0/20	0/16	0/11	15/14
	3	0/20	15/19	0/16	35/7
IVOMEC	1	15/20	0/21	5/11	35/13
Bolus	2	0/19	0/18	0/18	15/14
	3	0/19	0/19	5/19	20/19

2001 PMR REPORT # 62 **SECTION D: MEDICAL and VETERINARY - Insect Pests**

CROP: Beef cattle
PEST: Rocky Mountain wood tick, *Dermacentor andersoni*

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TITLE: EVALUATION OF PERMETHRIN AND LAMBDA-CYHALOTHRIN FOR CONTROL OF ROCKY MOUNTAIN WOOD TICK ON BEEF CATTLE

MATERIALS: DELICE Pour-On (1% permethrin) and SABER Pour-On (1% lambda-cyhalothrin)(RMWT)

METHODS: This project was conducted from April 2001 to June 2001 at the Agriculture and Agri-Food Research Station, Kamloops. This timing was selected in order to expose the products to weather conditions during the period of Rocky Mountain wood ticks (RMWT) activity in the BC southern Interior. Three beef cattle were treated per product on April 17 (DELICE, 15 mL/45 kg body weight (BW) backline pour-on; SABER, 15-mL/animal-backline pour-on); three animals were left untreated as checks. Animals were identified by numbered ear tags and weighed (276- to 298-kg) immediately prior to treatment. Each animal was penned individually in a small outside pen and fed a maintenance ration with access to water *ad libitum*. Weekly bioassays up to 6 weeks began 3 weeks after application because earlier bioassays conducted indoors showed both products provided 100% protection up to 3 weeks after application. Bioassays involved placing 25 female and 25 field-collected and laboratory-reared male ticks in stocking cages glued along the backline of each animal (total of 75 female ticks per product/bioassay period). The cages were examined at 7 and 10 days after introduction and the number of detached engorged female ticks was recorded. At 14 days, any remaining ticks were removed and their condition recorded.

RESULTS: Table 1 summarizes the results of the bioassays showing the proportion of the female ticks/bioassay/product that managed to fully engorge (take a complete blood meal) over the 14-day exposure period. There was a problem keeping cages properly attached or sealed, resulting in the loss of either unengorged or engorged ticks. Thus the percent values shown are based on the engorged ticks recovered from only those animals from which few if any ticks were likely to have escaped. No further bioassays of the DELICE-treated animals were performed after 4 weeks due to the high number of engorged females recovered. No adverse reactions to any of the treatments were observed.

CONCLUSIONS: SABER 1% pour-on applied at the recommended dosage of 15 mL/animal (if BW > 273 kg) provided very good protection of beef cattle for up to 5 weeks after application under outdoor weather conditions. DELICE 1% pour-on did not provide satisfactory protection at 3 weeks after application under the same conditions.

Table 1. Percent of female ticks introduced at 3, 4, 5, and 6 weeks after treatment that were fully engorged after exposure to treated and untreated animals. Figures after % values represent the number of test animals from which the data was used.

Product	% of engorged female ticks / No. of test animals			
	3 weeks	4 weeks	5 weeks	6 weeks
Check	87/3	100/2	100/1	92/3
DELICE	76/3	98/2	-	-
SABER	11/3	1/3	16/3	69/3

END OF SECTION D: MEDICAL and VETERINARY - REPORT # 61-62
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SECTION E:	**CEREAL, FORAGE and OILSEED CROPS /CÉRÉALES, CULTURES FOURRAGÈRES et OLÉAGINEUX**
REPORT/RAPPORT #:	**63 - 74**
PAGES:	**149 - 207**

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2001 PMR REPORT # 63 **SECTION J: CEREAL, FORAGE, AND OILSEED CROPS - Insect Pests**
ICAR: 61006537

CROP: Edible beans (*Phaseolus vulgaris* L.), cv. Stingray white bean, Berna Dutch Brown, GTS-306 light red kidney bean
PEST: Potato Leafhopper *Empoasca fabae* Harris

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TITLE: CONTROL OF POTATO LEAFHOPPERS IN DRY EDIBLE BEANS WITH SEED TREATMENTS

MATERIALS: APRON MAXX RTA 19.05 (metalaxyl-m + fludioxonil,19.05 g ai/L); CRUISER 350 FS (thiamethoxam, 350 g ai /L) ; AGROX DL (diazinon + lindane + captan, 25% + 15% + 15% w/w); CYGON 480 E (dimethoate, 480 g ai/L); DCT (diazinon + captan + thiophanate methyl, 18% + 6% + 14% w/w); U2051-15; G7014-0; G7009-0; G7047-01

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 4.7 ml per kg.) of material via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. Beans were planted 15 June, 2001 at a seeding rate of 20 seeds per m for the white bean cultivar and 15 seeds per m for the kidney and brown bean cultivars, using a four-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were 2 rows 6 m in length and spaced 0.76 m apart arranged in a RCBD split plot with 4 replications. CYGON was applied as the treated check every week dependent on plots reaching nymph threshold stages; where Stage 1 = unifoliate leaf with average 0.25 nymphs per leaf, Stage 2 = up to 2nd unifoliate leaf with average 0.5 nymphs per trifoliate leaf (or 1.0 nymph for 2 trifoliate leaves), Stage 3 = 2nd trifoliate to 4th trifoliate leaf with average 1.0 nymphs per trifoliate leaf; and Stage 4 = 4th trifoliate leaf to bloom with average 2.0 nymphs per trifoliate leaf. CYGON was applied at 1 L of product per ha using a CO_2 pressurized sprayer with a three 8002VS TEEJET nozzles spaced at 50 cm, at 30 psi in 186 L/ha water. Plant emergence was assessed weekly for 4 weeks, starting at 7 days after planting. Emergence was expressed as a percent of seed planted. Plant vigour was assessed weekly for 9 weeks, starting at 14 days

after planting, using a 1 - 10 scale (1 = poor, 10 = excellent). Potato leafhopper nymph counts were assessed weekly for 9 weeks, starting at 14 days after planting. The average number of nymphs per leaf was calculated, based on a 10 leaf sample per experimental unit. Leaf burn was assessed weekly for 6 weeks, starting at 27 days after planting, using a 1 - 10 scale (1 = high leaf burn, 10 = low leaf burn). Yield was determined using both rows from each plot, with a total of 4 m harvested from each row. Plant maturity was determined by recording the days needed for 95% of the pods to reach physiological maturity (loss of green colour). Visual seed quality was determined using a scale of 1-5 (1 = excellent seed quality, 5 = poor seed quality). Seed weight was determined by recording the weight of 100 randomly selected seed from each plot.

RESULTS: See Tables 1-21.

CONCLUSIONS: Crop emergence and crop vigor were superior in most of the treatments that contained significant amounts of insecticide (CRUISER, AGROX DL, G7014-0, G7009-0 and G7047-01), despite the fact that very little visual damage from soil borne insects was noted. CRUISER, G7009-0 and G7047-01 consistently provided the best crop emergence, particularly in the white bean (Table 1) and Dutch brown bean (Table 3) cultivars. CRUISER, G7009-0 and G7047-01 consistently provided the best crop vigor in all of the edible bean cultivars tested, with CRUISER and G7009-0 providing superior crop vigor for up to 8 weeks after planting (Tables 7-9).

A significant number of leafhopper adults were present at 2 weeks after planting (WAP). However, attempts to assess the impact of the seed treatments on adult populations were unsuccessful. Potato leafhopper nymphs were present in the study at 3 WAP. Significant differences between treatments for nymph numbers were detected at 3, 4 and 5 WAP for the white bean cultivar (Tables 10 and 13), at 3, 4, 5 and 8 WAP for the light red kidney cultivar (Tables 11 and 14) and at 3, 4, 5, 6, 7, 8 and 9 WAP for the Dutch brown cultivar (Tables 12 and 15). These differences are due, at least in part, to:

i) Leafhoppers prefer a Dutch brown bean cultivar over most other edible bean cultivars, which has been documented in earlier work.
ii) Potato leafhopper nymph populations fluctuated a great deal over the length of the assessment period. Populations began to decrease dramatically between 5 - 6 WAP, reached a low point at 7 WAP and then began to increase again between 7 - 8 WAP. By 9 WAP, nymph populations were at their highest point for the assessment period, particularly for the light red and Dutch brown bean cultivars. However at 10 WAP, nymph populations crashed again to very low levels.

The assessment period for leafhopper nymphs ended at 10 WAP due to the low levels of nymphs recorded, and the advanced maturity of the cultivars in the study. Compared to the check treatments (treatments 1, 2, 8 and 9), the product CRUISER had significantly lower leafhopper nymph populations for 5 WAP for all three edible bean cultivars. Higher rates of CRUISER had significantly lower leafhopper nymph populations for 8 WAP for the light red bean cultivar, and for 9 WAP for the Dutch brown bean cultivar. The product G7009-0 had significantly lower leafhopper nymph populations than the check treatments for 5 WAP, for all three edible bean cultivars. However, the results for the highest rate of G7009-0 tested were inconsistent with the two lower rates of G7009-0 tested. The product G7047-01 had significantly lower leafhopper nymph populations than the check treatments for 5 WAP. However, these differences were detected for the white bean cultivar only.

Significant differences in leaf burn were detected at 5, 6 and 10 WAP (Tables 16-18). There was significantly less leaf burn for the products CRUISER and G7009-0 at 5 and 6 WAP, compared to the check treatments. These differences were undetectable at 10 WAP.

Crop assessment is detailed in Tables 19-21. The product CRUISER consistently provided the greatest yield increase. Compared to the untreated check, the highest tested rate of CRUISER provided a yield increase of 47%, 87% and 110%, for white bean, light red kidney bean and Dutch brown bean cultivars, respectively. G7009-0 and CYGON consistently provided yield increases that were slightly less than CRUISER, across all three cultivars. Other treatments provided yield increases as well, but the increases were not as large, and they were not consistent across the bean cultivars. Since CYGON is the only registered potato leafhopper control measure in dry edible beans, from this study only G7009-0 and CRUISER appear to consistently give results that are equal or superior to the registered control measure. Compared to the check treatments, CRUISER was the only treatment to provide significantly higher seed weights in the light red kidney cultivar. In the Dutch brown cultivar, a number of other treatments had seed weights that were significantly higher than the untreated check. The product CRUISER provided the greatest increase in seed weight. There were very minor differences between treatments for plant maturity, but the differences do not appear to provide any consistent pattern, and therefore are considered to be meaningless. There were no significant differences between treatments for seed quality.

Table 1. Crop emergence for Stingray white beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Emergence (as a percent of seed planted)			
		7 DAP	14 DAP	20 DAP	27 DAP
Untreated Check		57a	78	84a	83a
APRONMAXX RTA	3.28 ml	67b	77	86a	85a
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	79cd	98	105e	107d
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	84d	95	102cd	101cd
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	85de	98	101c	99c
Agrox DL	1.1 ml	79cd	98	101c	97bc
Cygon 480E	1.0 l ha^{-1}	67b	83	91b	87ab
DCT + Water	5.2 g + 10 ml	66b	85	93b	91b
UI2051-15	2.6 ml	61ab	86	90ab	89ab
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	72bc	87	94bc	91b
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	66b	82	93b	91b
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	74c	100	103cd	102cd
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	87de	97	102cd	101cd
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	85de	103	99c	101cd
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	81d	98	103cd	102cd
G7047-01	6.25 ml	89e	102	104cd	107d
PR>F		0.06	0.18	0.06	0.03
LSD (P=.05)		8.1	NS	6.9	7.5
CV		15.6	NS	7.0	7.7

Table 2. Crop emergence for GTS 306 light red kidney beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Emergence (as a percent of seed planted)			
		7 DAP	14 DAP	20 DAP	27 DAP
Untreated Check		18a	66	80bc	79b
APRONMAXX RTA	3.28 ml	23b	59	75ab	76b
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	28bc	70	80bc	80bc
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	29bc	82	91d	90c
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	31c	81	85c	85c
Agrox DL	1.1 ml	30c	81	87cd	86c
Cygon 480E	1.0 l ha^{-1}	22b	64	76b	75ab
DCT + Water	5.2 g + 10 ml	16a	60	69a	68a
UI2051-15	2.6 ml	19ab	72	77b	74ab
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	19ab	65	76b	76b
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	14a	66	74ab	74ab
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	28bc	73	83c	82bc
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	22b	70	84c	82bc
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	24b	74	86c	86c
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	20ab	74	84c	73ab
G7047-01	6.25 ml	32c	84	89cd	89c
PR>F		0.06	0.18	0.06	0.03
LSD (P=.05)		8.1	NS	6.9	7.5
CV		15.6	NS	7.0	7.7

Table 3. Crop emergence for Berna Dutch brown beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Emergence (as a percent of seed planted)			
		7 DAP	14 DAP	20 DAP	27 DAP
Untreated Check		31ab	60	66a	63a
APRONMAXX RTA	3.28 ml	30a	64	75bc	75bc
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	41bc	81	85d	85cd
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	34ab	74	79c	78c
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	41bc	77	80c	80c
Agrox DL	1.1 ml	36b	76	81cd	80c
Cygon 480E	1.0 l ha^{-1}	27a	53	64a	63a
DCT + Water	5.2 g + 10 ml	28a	59	73b	70ab
UI2051-15	2.6 ml	29a	62	68ab	66a
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	34ab	67	73b	72b
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	32ab	61	69a	70ab
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	41bc	81	86d	86d
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	38b	79	82cd	82cd
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	40bc	78	86d	85cd
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	38b	80	85d	84cd
G7047-01	6.25 ml	48c	77	81cd	81c
PR>F		0.06	0.18	0.06	0.03
LSD (P=.05)		8.1	NS	6.9	7.5
CV		15.6	NS	7.0	7.7

Table 4. Crop vigor for Stingray white beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Visual Crop Vigour (1 = poor, 10 = excellent) at Days After Planting (DAP)				
		14 DAP	21 DAP	28 DAP	35 DAP	42 DAP
Untreated Check		6.3	7.0a	6.5a	6.5	7.8a
APRONMAXX RTA	3.28 ml	6.8	7.5ab	8.3cd	7.5	8.5b
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	7.8	9.0cd	8.3cd	8.0	8.8bc
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	8.0	9.0cd	8.5cd	8.0	9.0bc
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	7.3	8.3bc	8.8d	8.8	9.0bc
Agrox DL	1.1 ml	7.8	8.0b	8.3c	8.0	8.8bc
Cygon 480E	1.0 l ha^{-1}	6.8	7.8ab	7.5b	7.5	8.8bc
DCT + Water	5.2 g + 10 ml	6.5	7.8ab	7.8c	7.3	8.3ab
UI2051-15	2.6 ml	6.8	7.5ab	7.8bc	7.5	8.0a
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	7.5	8.5bc	8.3cd	7.8	8.3ab
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	7.0	7.8ab	7.8bc	7.5	8.0a
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	7.5	8.3bc	8.8d	8.3	9.0bc
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	8.0	9.0cd	9.0d	8.5	9.0bc
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	8.0	8.8c	9.0d	8.8	8.8bc
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	8.0	8.8c	8.5cd	8.3	8.5b
G7047-01	6.25 ml	8.0	8.8c	9.0d	8.5	9.0bc
PR>F		0.91	0.07	0.01	0.19	0.01
LSD (P=.05)		NS	0.8	0.7	NS	0.6
CV		NS	8.5	7.3	NS	5.9

Table 5. Crop vigor for GTS 302 light red kidney beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Visual Crop Vigour (1 = poor, 10 = excellent) at Days After Planting				
		14	21	28	35	42
Untreated Check		6.5	7.8b	6.8a	6.3	7.8b
APRONMAXX RTA	3.28 ml	6.3	7.0	6.5a	6.3	7.0a
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	7.3	8.3bc	8.3c	8.0	9.0d
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	7.5	8.5a	8.3c	7.8	8.5c
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	7.5	8.5c	8.5c	8.3	9.0d
Agrox DL	1.1 ml	7.5	8.5c	8.0c	7.5	8.3c
Cygon 480E	1.0 l ha^{-1}	6.3	7.0a	7.5b	7.3	7.8b
DCT + Water	5.2 g + 10 ml	6.0	6.8a	6.8a	6.0	7.0a
UI2051-15	2.6 ml	6.3	6.8a	6.8a	6.5	7.3ab
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	6.5	7.0a	7.0ab	6.5	7.3ab
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	6.0	7.3ab	6.8a	6.8	7.3ab
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	7.0	7.8b	7.3b	7.0	8.0bc
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	6.8	7.8b	8.0c	7.0	7.8b
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	7.8	8.5c	8.5c	7.8	8.5c
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	7.0	8.3bc	7.5b	7.5	8.3c
G7047-01	6.25 ml	7.5	8.5c	7.5b	7.8	8.3c
PR>F		0.91	0.07	0.01	0.19	0.01
LSD (P=.05)		NS	0.8	0.7	NS	0.6
CV		NS	8.5	7.3	NS	5.9

Table 6. Crop vigour for Berna Dutch brown beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Visual Crop Vigour (1 = poor, 10 = excellent) at Days After Planting				
		14	21	28	35	42
Untreated Check		5.5	6.5b	6.5ab	6.5	7.3ab
APRONMAXX RTA	3.28 ml	6.0	7.3c	7.3bc	7.5	7.5b
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	7.0	8.0d	8.5d	8.3	9.0d
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	7.3	7.5c	8.5d	8.3	8.8d
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	7.5	8.3d	8.5d	8.3	9.0d
Agrox DL	1.1 ml	7.0	7.3c	7.5c	7.3	7.8bc
Cygon 480E	1.0 l ha^{-1}	5.0	5.5a	6.5ab	7.0	7.0a
DCT + Water	5.2 g + 10 ml	6.0	6.0a	6.0a	6.5	6.8a
UI2051-15	2.6 ml	5.8	6.5b	6.8b	6.5	7.0a
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	6.0	6.8bc	7.3bc	6.8	7.0a
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	6.5	6.8bc	7.8c	6.8	7.5b
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	7.0	7.8cd	8.0cd	8.0	8.0bc
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	6.5	7.8cd	8.0cd	8.0	8.3c
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	7.3	8.0d	8.5d	8.0	8.3c
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	6.8	8.3d	8.0cd	8.3	8.5cd
G7047-01	6.25 ml	7.5	8.0d	8.0cd	7.8	8.0bc
PR>F		0.91	0.07	0.01	0.19	0.01
LSD (P=.05)		NS	0.8	0.7	NS	0.6
CV		NS	8.5	7.3	NS	5.9

Table 7. Crop vigour for Stingray white beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Visual Crop Vigour (1 = poor, 10 = excellent) at Days After Planting			
		50	57	63	71
Untreated Check		7.3a	7.5a	7.3a	6.5
APRONMAXX RTA	3.28 ml	8.3bc	8.5bc	8.3b	7.5
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	8.8c	8.5bc	8.3b	7.3
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	8.5bc	8.8c	8.5bc	7.0
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	9.0c	8.8c	8.8c	6.3
Agrox DL	1.1 ml	8.5bc	8.5bc	8.3b	7.0
Cygon 480E	1.0 l ha^{-1}	8.8c	8.8	8.5bc	7.3
DCT + Water	5.2 g + 10 ml	8.0b	8.0ab	8.0b	6.8
UI2051-15	2.6 ml	7.5a	8.3b	8.0b	7.0
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	8.0b	8.5bc	8.8c	7.3
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	7.8ab	7.8a	8.0b	6.8
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	8.0b	8.3b	8.5bc	7.3
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	8.5bc	8.5bc	8.5bc	8.0
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	8.8c	8.8c	8.5bc	7.3
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	8.5bc	8.5bc	8.5bc	6.5
G7047-01	6.25 ml	8.8c	8.8c	8.8c	7.3
PR>F		0.01	0.01	0.03	0.59
LSD (P=.05)		0.6	0.6	0.6	NS
CV		7.3	6.9	6.8	NS

Table 8. Crop vigour for GTS 302 light red kidney beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Visual Crop Vigour (1 = poor, 10 = excellent) at Days After Planting			
		50	57	63	71
Untreated Check		7.0b	7.5bc	7.3ab	5.5
APRONMAXX RTA	3.28 ml	6.3a	6.5a	7.0a	5.0
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	8.3d	8.3cd	7.8b	6.0
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	7.8c	8.0c	7.8bc	6.0
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	9.0e	9.0e	8.8d	6.8
Agrox DL	1.1 ml	7.5bc	7.8c	8.0bc	6.0
Cygon 480E	1.0 l ha^{-1}	7.3bc	7.3b	7.3ab	5.3
DCT + Water	5.2 g + 10 ml	6.8ab	6.8a	7.0a	5.3
UI2051-15	2.6 ml	6.5a	7.0ab	6.8a	5.0
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	6.8ab	7.0ab	7.3ab	5.0
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	6.5a	7.0ab	7.0a	5.0
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	7.0b	7.5bc	7.5b	5.5
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	6.8ab	7.5bc	7.3ab	5.8
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	8.0cd	8.3cd	8.0bc	6.3
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	7.8c	8.3cd	8.3c	6.0
G7047-01	6.25 ml	7.5bc	7.5bc	7.8bc	6
PR>F		0.01	0.01	0.03	0.59
LSD (P=.05)		0.6	0.6	0.6	NS
CV		7.3	6.9	6.8	NS

Table 9. Crop vigour for Berna Dutch brown beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Visual Crop Vigour (1 = poor, 10 = excellent) at Days After Planting			
		50	57	63	71
Untreated Check		5.5a	6.0a	5.8a	4.3
APRONMAXX RTA	3.28 ml	6.8c	6.8b	6.8bc	5.3
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	7.5d	8.0d	7.3c	5.5
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	8.0e	7.8cd	7.8d	5.3
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	8.3e	8.0d	7.8d	5.5
Agrox DL	1.1 ml	6.5bc	7.0bc	6.3ab	5.3
Cygon 480E	1.0 l ha^{-1}	7.3cd	7.5cd	7.3c	5.0
DCT + Water	5.2 g + 10 ml	5.8a	6.5ab	6.0a	4.5
UI2051-15	2.6 ml	5.8a	6.3a	6.3ab	4.3
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	6.3b	6.5ab	6.5b	4.5
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	6.8c	6.8b	6.5b	4.5
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	7.0cd	7.3c	6.8bc	5.3
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	7.8de	7.8cd	7.3c	5.8
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	7.5d	7.5c	7.3c	5.0
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	7.5d	7.5c	7.3c	5.5
G7047-01	6.25 ml	7.3c	7.0bc	7.0bc	5.5
PR>F		0.01	0.01	0.03	0.59
LSD (P=.05)		0.6	0.6	0.6	NS
CV		7.3	6.9	6.8	NS

Table 10. Nymph counts for Stingray white beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Number of Nymphs per Leaf at Days After Planting				
		14	21	28	35	42
Untreated Check		0.0	0.8b	1.5d	3.0cd	1.0ab
APRONMAXX RTA	3.28 ml	0.0	0.8b	1.4d	2.6c	1.4b
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	0.0	0.0a	0.2a	0.9ab	0.6a
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	0.0	0.2a	0.1a	0.8ab	1.1ab
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	0.0	0.2a	0.1a	0.4a	0.5a
Agrox DL	1.1 ml	0.0	0.4ab	1.7d	2.8cd	1.0ab
Cygon 480E	1.0 l ha^{-1}	0.0	0.3ab	0.2a	1.0ab	0.1a
DCT + Water	5.2 g + 10 ml	0.0	0.6b	1.7d	3.1cd	1.3b
UI2051-15	2.6 ml	0.0	0.0a	0.6b	1.9bc	1.3b
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	0.0	0.1a	0.6b	3.8d	1.6b
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	0.0	0.2a	0.6b	2.4c	1.1ab
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	0.0	0.0a	0.3a	1.6b	1.5b
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	0.0	0.1a	0.1a	0.7a	1.1ab
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	0.0	0.1a	0.1a	0.9a	1.2b
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	0.0	0.9c	1.0c	3.4d	1.5b
G7047-01	6.25 ml	0.0	0.0a	0.1a	0.4a	0.4a
PR>F		100	0.09	0.00	0.00	0.03
LSD (P=.05)		NS	0.4	0.4	0.9	1.0
CV		NS	191.6	77.4	51.6	65.8

Table 11. Nymph counts for GTS 306 light red kidney beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Number of Nymphs per Leaf at Days After Planting				
		14	21	28	35	42
Untreated Check		0.0	0.1a	0.3ab	1.3b	0.9a
APRONMAXX RTA	3.28 ml	0.0	0.4ab	0.7bc	1.4b	0.7a
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	0.0	0.1a	0.0a	0.4a	0.9ab
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	0.0	0.0a	0.1a	0.2a	0.2a
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	0.0	0.2a	0.2a	0.4a	0.2a
Agrox DL	1.1 ml	0.0	0.2a	0.5b	1.2b	0.9ab
Cygon 480E	1.0 l ha^{-1}	0.0	0.1a	0.1a	0.0a	0.3a
DCT + Water	5.2 g + 10 ml	0.0	0.1a	0.8bc	1.5b	0.6a
UI2051-15	2.6 ml	0.0	0.0a	0.2a	1.3b	0.7a
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	0.0	0.2a	0.2a	1.4b	0.7a
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	0.0	0.1a	0.0a	1.0b	0.5a
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	0.0	0.2a	0.4ab	0.9ab	0.7a
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	0.0	0.1a	0.2a	0.6a	0.7a
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	0.0	0.2a	0.1a	0.4a	0.9ab
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	0.0	0.2a	0.1a	0.5a	0.7a
G7047-01	6.25 ml	0.0	0.5a	1.1c	1.3b	1.3b
PR>F		100	0.09	0.00	0.00	0.03
LSD (P=.05)		NS	0.4	0.4	0.9	1.0
CV		NS	191.6	77.4	51.6	65.8

Table 12. Nymph counts for Berna Dutch brown beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Number of Nymphs per Leaf at Days After Planting				
		14	21	28	35	42
Untreated Check		0.0	0.0a	1.0c	3.0d	2.1b
APRONMAXX RTA	3.28 ml	0.0	0.2a	0.9bc	2.8cd	2.9c
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	0.0	0.0a	0.2a	0.9ab	1.6ab
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	0.0	0.0a	0.3a	1.7bc	1.5ab
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	0.0	0.0a	0.3a	0.2a	0.6a
Agrox DL	1.1 ml	0.0	0.1a	1.0c	2.7cd	2.5bc
Cygon 480E	1.0 l ha^{-1}	0.0	0.1a	0.1a	0.2a	1.7b
DCT + Water	5.2 g + 10 ml	0.0	0.3ab	1.1c	2.8cd	2.8c
UI2051-15	2.6 ml	0.0	0.1a	1.0c	2.7cd	3.6cd
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	0.0	0.1a	0.8b	2.7cd	4.1d
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	0.0	0.1a	0.3a	2.0bc	3.3cd
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	0.0	0.0a	0.5ab	1.4b	2.2b
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	0.0	0.1a	0.1a	1.4b	2.1b
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	0.0	0.1a	0.2a	0.8ab	0.9a
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	0.0	0.0a	0.1a	0.8ab	1.7b
G7047-01	6.25 ml	0.0	0.7b	1.2c	3.8e	1.7b
PR>F		100	0.09	0.00	0.00	0.03
LSD (P=.05)		NS	0.4	0.4	0.9	1.0
CV		NS	191.6	77.4	51.6	65.8

Table 13. Nymph counts for Stingray white beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Number of Nymphs per Leaf at Days After Planting			
		50	57	63	71
Untreated Check		0.3ab	1.4ab	2.0ab	0.4
APRONMAXX RTA	3.28 ml	0.2a	1.5ab	2.7b	0.7
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	0.4b	1.9b	2.5b	0.7
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	0.2a	2.3b	3.0b	0.9
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	0.2a	1.4ab	2.4b	1.1
Agrox DL	1.1 ml	0.3ab	1.6ab	2.3b	0.7
Cygon 480E	1.0 l ha^{-1}	0.1a	0.4a	0.7a	0.2
DCT + Water	5.2 g + 10 ml	0.5b	1.6ab	2.8b	0.7
UI2051-15	2.6 ml	0.4b	1.3ab	1.9ab	0.7
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	0.4b	1.4ab	2.6b	0.4
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	0.4b	1.5ab	3.3b	0.5
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	0.4b	1.8b	3.0b	0.5
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	0.4b	1.6ab	2.2b	0.6
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	0.3ab	1.3ab	2.8b	0.7
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	0.4b	2.2b	2.6b	0.6
G7047-01	6.25 ml	0.2a	1.6ab	2.6b	0.5
PR>F		0.00	0.00	0.00	0.17
LSD (P=.05)		0.2	1.2	1.4	NS
CV		47.7	39.9	39	NS

Table 14. Nymph counts for GTS 306 light red kidney beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Number of Nymphs per Leaf at Days After Planting			
		50	57	63	71
Untreated Check		0.2a	2.2bc	2.3b	0.3
APRONMAXX RTA	3.28 ml	0.2a	2.2bc	1.3a	0.3
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	0.3ab	1.5ab	1.5ab	0.2
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	0.3ab	1.1ab	1.3a	0.1
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	0.1a	0.3a	0.5a	0.1
Agrox DL	1.1 ml	0.2a	3.3c	2.4b	0.2
Cygon 480E	1.0 l ha^{-1}	0.1a	2.4bc	0.7a	0.2
DCT + Water	5.2 g + 10 ml	0.3ab	2.5bc	1.9ab	0.3
UI2051-15	2.6 ml	0.3ab	2.5bc	1.2a	0.3
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	0.2a	2.8c	2.0b	0.3
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	0.2a	2.6bc	2.5b	0.1
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	0.1a	2.2bc	1.9ab	0.1
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	0.3ab	2.2bc	1.7ab	0.2
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	0.1a	1.7b	1.8ab	0.2
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	0.3ab	1.9b	1.3a	0.3
G7047-01	6.25 ml	0.5b	2.4bc	1.8ab	0.2
PR>F		0.00	0.00	0.00	0.17
LSD (P=.05)		0.2	1.2	1.4	NS
CV		47.7	39.9	39	NS

Table 15. Nymph counts for Berna Dutch brown beans with seed treatments for potato leafhoppers at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Number of Nymphs per Leaf at Days After Planting			
		50	57	63	71
Untreated Check		0.6c	4.7d	6.4f	0.5
APRONMAXX RTA	3.28 ml	0.9de	3.6cd	4.5e	1.1
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	0.8d	4.7d	6.7f	0.9
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	0.3ab	4.1d	5.8ef	0.5
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	0.3ab	1.7b	2.2c	0.5
Agrox DL	1.1 ml	1.0e	5.2de	6.2f	0.8
Cygon 480E	1.0 l ha^{-1}	0.1a	0.2	0.2a	0.2
DCT + Water	5.2 g + 10 ml	1.1ef	4.4d	6.1f	0.5
UI2051-15	2.6 ml	1.1ef	4.7d	6.3f	0.4
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	1.7h	6.1e	5.7ef	0.6
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	0.9cd	6.3e	6.5f	0.8
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	0.7cd	4.1d	5.1e	0.3
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	0.9de	4.2d	5.3ef	0.6
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	1.0e	4.9de	6.7f	0.8
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	0.6c	5.3e	6.8f	0.7
G7047-01	6.25 ml	1.1ef	4.2d	5.4ef	0.8
PR>F		0.00	0.00	0.00	0.17
LSD (P=.05)		0.2	1.2	1.4	NS
CV		47.7	39.9	39	NS

Table 16. Leaf burn for Stingray white beans with seed treatments for potato leafhoppers at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Leaf Burn (1 = high, 10 = low) at Days after Planting					
		27	35	42	56	63	71
Untreated Check		4.5	5.0a	6.5a	7.5	8.3	3.0ab
APRONMAXX RTA	3.28 ml	5.5	5.8ab	7.5b	7.0	8.0	2.5a
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	7.0	7.5c	7.3ab	7.5	8.0	3.3b
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	7.8	7.3c	8.0bc	8.5	8.5	3.5b
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	7.5	7.5c	8.0bc	7.5	8.0	3.3b
Agrox DL	1.1 ml	6.8	5.5a	7.5b	7.8	8.3	3.0ab
Cygon 480E	1.0 l ha^{-1}	6.3	6.5b	8.3c	7.5	8	2.8a
DCT + Water	5.2 g + 10 ml	6.5	5.3a	7.0ab	8.3	8	3.3ab
UI2051-15	2.6 ml	6.0	6.0ab	7.8b	7.5	7.8	2.8a
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	7.0	5.8ab	7.5b	7.8	7.8	3.3b
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	6.8	5.8ab	6.8a	7.3	7.8	3.3b
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	7.3	6.8bc	7.3ab	7.3	8.0	3.0ab
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	7.5	7.5c	7.5b	7.8	8.3	3.5b
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	7.0	7.3c	8.0bc	7.8	7.8	3.8c
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	6.0	5.5a	7.5b	7.8	8.0	3.0ab
G7047-01	6.25 ml	6.8	7.3c	7.3ab	7.8	7.8	3.0ab
PR>F		0.22	0.05	0.01	0.47	0.62	0.07
LSD (P=.05)		NS	0.9	0.8	NS	NS	0.6
CV		NS	12.7	10.4	NS	NS	11.3

Table 17. Leaf burn for GTS 302 light red kidney beans with seed treatments for potato leafhoppers at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Leaf Burn (1 = high, 10 = low) at Days after Planting					
		27	35	42	56	63	71
Untreated Check		79	3.5a	5.3a	95	7.3	4.3b
APRONMAXX RTA	3.28 ml	5.3	5.0bc	6.0ab	7.0	7.0	3.8a
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	7.0	6.5d	7.3c	7.5	6.8	4.3b
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	6.8	6.3d	7.3c	7.8	7.3	4.5bc
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	7.3	7.3e	8.3d	7.5	7.5	3.5a
Agrox DL	1.1 ml	6.3	5.0bc	6.3b	7.3	7.0	4.8c
Cygon 480E	1.0 l ha^{-1}	5.8	5.8	6.5b	7.0	7.0	4.3b
DCT + Water	5.2 g + 10 ml	5.3	5.0bc	6.0ab	7.5	7.0	3.5a
UI2051-15	2.6 ml	6.0	4.8b	5.5a	7.0	6.8	4.5bc
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	6.0	5.3bc	6.5b	7.5	6.5	4.5bc
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	5.8	4.5b	6.5b	6.8	6.5	4.5bc
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	7.3	5.8c	6.5b	7.3	6.8	4.5bc
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	6.3	5.8c	6.8bc	6.8	6.8	4.5bc
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	6.8	7.0de	7.3c	8.0	7.3	4.8c
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	6.3	6.5d	7.5cd	7.8	7.0	4.0ab
G7047-01	6.25 ml	5.8	4.8b	6.0ab	7.5	6.8	4.8c
PR>F		0.22	0.05	0.01	0.47	0.62	0.07
LSD (P=.05)		NS	0.9	0.8	NS	NS	0.6
CV		NS	12.7	10.4	NS	NS	11.3

Table 18. Leaf burn for Berna Dutch brown beans with seed treatments for potato leafhoppers at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Leaf Burn (1 = high, 10 = low) at Days after Planting					
		27	35	42	56	63	71
Untreated Check		5.0	4.8a	5.3a	4.8	4.3	7.0b
APRONMAXX RTA	3.28 ml	4.8	5.5ab	5.5ab	4.5	4.8	6.5a
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	5.8	6.5bc	6.8c	4.8	4.5	7.5bc
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	7.0	6.8c	7.5d	5.3	5.0	6.5a
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	6.5	7.8d	8.5e	4.8	5.5	6.3a
Agrox DL	1.1 ml	5.0	5.0a	5.5ab	4.5	4.5	7.5bc
Cygon 480E	1.0 l ha^{-1}	4.5	6.0b	7.0cd	6.0	5.5	6.3a
DCT + Water	5.2 g + 10 ml	5.0	5.3a	5.5ab	5.0	4.5	6.8ab
UI2051-15	2.6 ml	4.8	5.0a	5.0a	4.5	4.0	7.3bc
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	5.3	6.0b	6.0b	4.5	4.0	7.8c
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	5.8	6.0b	6.5bc	4.5	3.5	7.5bc
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	6.8	6.5bc	7.3cd	4.5	5.0	7.0b
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	6.0	7.0c	7.3cd	5.5	4.5	7.3bc
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	6.5	7.0c	7.3cd	5.3	4.8	7.0b
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	6.5	6.8c	7.3cd	4.8	5.0	7.3bc
G7047-01	6.25 ml	5.5	5.0a	5.5ab	4.8	4.0	6.8ab
PR>F		0.22	0.05	0.01	0.47	0.62	0.07
LSD (P=.05)		NS	0.9	0.8	NS	NS	0.6
CV		NS	12.7	10.4	NS	NS	11.3

Table 19. Crop assessment for Stingray white beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Crop Assessment			
		Yield (kg $ha^{-1)}$	Plant Maturity	Seed Weight	Seed Quality
Untreated Check		864a	92.8ab	18.9a	4.3
APRONMAXX RTA	3.28 ml	1079b	92.3a	20.3a	3.6
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	1191c	92.0a	20.3a	3.3
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	1275d	91.5a	20.0a	3.0
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	1267d	92.5ab	20.6a	3.0
Agrox DL	1.1 ml	1182c	91.8a	20.7a	2.8
Cygon 480E	1.0 l ha^{-1}	1201cd	92.8ab	20.2a	4.6
DCT + Water	5.2 g + 10 ml	984ab	92.8ab	20.4a	3.5
UI2051-15	2.6 ml	1112c	93.3b	20.7a	4.1
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	1148c	93.3b	20.6a	2.9
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	1004b	92.5ab	20.3a	3.3
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	1044b	92.0a	20.1a	3.9
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	1205cd	93.0ab	20.4a	3.5
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	1213cd	92.3a	20.5a	3.4
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	1219cd	92.0a	20.2a	2.6
G7047-01	6.25 ml	1251d	92.5ab	20.9a	3.5
PR>F		0.05	0.03	0.05	0.12
LSD (P=.05)		123.1	1.5	3.5	NS
CV		13.9	1.4	9.3	NS

Table 20. Crop assessment for GTS 302 light red kidney beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml /kg seed	Crop Assessment			
		Yield (kg $ha^{-1)}$	Plant Maturity	Seed Weight	Seed Quality
Untreated Check		483a	93.0a	45.7a	4.4
APRONMAXX RTA	3.28 ml	432a	94.0ab	45.6a	5.0
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	709c	94.3b	48.1b	4.9
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	726c	94.3b	48.0ab	4.3
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	905d	93.5a	48.8b	4.0
Agrox DL	1.1 ml	558b	93.3a	45.1a	4.4
Cygon 480E	1.0 l ha^{-1}	577b	92.8a	45.5a	4.6
DCT + Water	5.2 g + 10 ml	433a	93.8ab	46.8a	4.9
UI2051-15	2.6 ml	525ab	92.5a	47.2ab	4.5
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	549ab	93.5a	45.4a	4.8
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	532ab	93.0a	46.6a	4.4
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	582b	92.8a	44.6a	4.3
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	570b	93.0a	44.5a	4.9
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	708c	93.8ab	46.8a	5.0
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	698c	92.8a	46.3a	4.6
G7047-01	6.25 ml	659bc	92.5a	46.9a	4.5
PR>F		0.05	0.03	0.05	0.12
LSD (P=.05)		123.1	1.5	3.5	NS
CV		13.9	1.4	9.3	NS

Table 21. Crop assessment for Berna Dutch brown beans with seed treatments for potato leafhopper at the Huron Research Station, Exeter, Ontario, 2001.

Treatment	Rate g or ml/ kg seed	Crop Assessment			
		Yield (kg $ha^{-1)}$	Plant Maturity	Seed Weight	Seed Quality
Untreated Check		382a	87.0a	18.9a	3.3
APRONMAXX RTA	3.28 ml	299a	89.5b	17.7a	0.0
APRONMAXX RTA + Cruiser	3.28 ml + 0.86 ml	488b	88.3ab	27.7cd	3.3
APRONMAXX RTA + Cruiser	3.28 ml + 1.43 ml	731d	90.0bc	31.4de	3.0
APRONMAXX RTA + Cruiser	3.28 ml + 2.86 ml	803e	88.5ab	32.7e	2.9
Agrox DL	1.1 ml	480b	87.5a	27.4cd	3.4
Cygon 480E	1.0 l ha^{-1}	676d	92.0c	30.2d	2.1
DCT + Water	5.2 g + 10 ml	427b	89.5b	29.0d	3.4
UI2051-15	2.6 ml	402ab	89.0b	28.9d	3.3
UI2051-15 + G7014-0	2.6 ml + 0.52 ml	432b	88.5ab	27.5c	3.9
UI2051-15 + G7014-0	2.6 ml + 1.04 ml	475b	89.8bc	28.5d	3.5
UI2051-15 + G7014-0	2.6 ml + 2.08 ml	550c	88.5ab	29.3d	3.0
UI2051-15 + G7009-0	2.6 ml + 0.42 ml	586c	89.3b	28.9d	3.4
UI2051-15 + G7009-0	2.6 ml + 0.83 ml	557c	89.8bc	28.6d	3.4
UI2051-15 + G7009-0	2.6 ml + 1.67 ml	558c	89.5b	29.7d	3.0
G7047-01	6.25 ml	477b	88.0a	27.6cd	3.5
PR>F		0.05	0.03	0.05	0.12
LSD (P=.05)		123.1	1.5	3.5	NS
CV		13.9	1.4	9.3	NS

2001 PMR REPORT # 64 **SECTION E: CEREAL, FORAGE, AND OILSEED CROPS - Insect Pests**
ICAR: 61006537

CROP: Beans (*Phaseolus vulgaris* L.), cvr Stingray white beans
PEST: Seed corn maggot, *Delia platura* Meigen

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TITLE: CONTROL OF SEED CORN MAGGOT WITH SEED TREATMENTS IN WHITE BEANS

MATERIALS: APRON MAXX RTA 19.05 FS (fludioxonil + metalaxyl-m, 6.25 g ai/L), APRON MAXX 19.05 FS (fludioxinil + metalaxyl-m, 96.5 + 144 g ai/L), CRUISER 350 FS (thiamethoxam, 350 g ai/L), DCT (diazinon + captan + thiophanate-methyl, 15% + 6% + 14% w/w), FORCE 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 3.1 ml/kg seed using water). The seed was then mixed for 1 min to ensure thorough seed coverage. The crop was planted on 9 May, 2001 at Ridgetown using a 2-row cone seeder at 100 seeds per plot. Plots were 1 row , 6 m in length and spaced 0.76 m apart in a RCBD with 4 replications. Manure was spread on the plots on 12 April, 2001 and the soil was worked shortly after the manure application. The plots were fertilized and maintained according to provincial recommendations. Total plot emergence was evaluated on 22 May and 1 June, 2001 respectively. Vigor was assessed using a scale of 0-100% (100 = furthest developed plant in the trial, 0=dead plant) on 22 May and 1 June, 2001 respectively. Seed corn maggot damage was assessed and maggots counted on 22 May, 2001 by exhuming a 1 m trench of soil 15 cm long and 10 cm deep from row. All seeds within the 1 m were counted, whether they had emerged or not and checked for seed corn maggot damage. On 1 June, 2001 seed corn maggots were counted in 1m of check plots. Leafhopper burn was assessed on 29 June, 2001 at the 8th trifoliate stage using a scale of 1-10 where 1 = no damage and 10 = severe burn, leaf curl and stunting. Fresh weights were taken on 26 July, 2001 from 1 row and the second row was hand pulled and threshed using a ALMACO stationary thresher. Yields were adjusted to 18 % moisture. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: See Tables 1, 2 and 3.

CONCLUSIONS: APRON MAXX RTA alone significantly improved emergence (4 fold) from the untreated control. DCT was not different from the fungicide check. CRUISER on the other hand significantly improved the stand of beans. There was no rate response, however, with CRUISER. Tefluthrin seed treatment was not as effective as CRUISER. DCT at the full rate, Tefluthrin and CRUISER all lowered hopper burn scores from the untreated and fungicide checks. The fewest SCM damaged plants were observed in plots treated with the highest rate of CRUISER. The fewest SCM larvae/pupae were recovered in DCT-treated plots followed by CRUISER-treated plots. The fewest maggots were recovered in plots treated with DCT at the full rate or half rate.
Table 1. Plant stand and vigor for white beans with seed treatments at Ridgetown, Ontario, 2001.

Treatment	Rate g ai/100 kg	Plant Stand Plants/plot			Plant Vigor 0-100 %	
		7DAP	14DAP	21DAP	7DAP	14DAP
Check	0	5d	28e	29d	12.5d	17.5e
Fungicide Check -APRON MAXX RTA 19.05 FS	6.25	85c	108cd	112b	75.0c	60.0cd
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	108ab	132ab	137a	82.5bc	80.0b
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	102ab	135ab	138a	95.0ab	75.0bc
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 100	115a	150a	146a	100.0a	92.5a
DCT	197	92bc	125bc	118b	82.5bc	67.5bc
APRON MAXX RTA 10.05 FS + + Tefluthrin 200 ME	6.25 40	104ab	130b	128ab	95.0ab	67.5bc
DCT half rate	98.8	93bc	108cd	114b	82.5bc	62.5cd
LSD (P=.05)		16	14.6	14	10.91	11.27
CV		13	9.73	9.32	10.63	13.22

* Means followed by the same letter do not significantly differ (P=.05, LSD).

Table 2. Seed corn maggot and leafhopper damage assessments for seed treatments in white beans at Ridgetown, Ontario, 2001.

Treatment	Rate	Maggot Damage	Leafhopper Burn	Maggots
	g ai/100kg seed	Plants/m May 22-01	1 - 10 8 trifoliate June 29-01	No./ m May 22-01
Check	0	7.8a	5.5a	2.4a
Fungicide Check APRON MAXX RTA 19.05 FS	6.25	9.5a	6.0a	1.9a
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	9.8a	3.8bc	0.9abc
APRON MAXX RTA 19.05 FS +Cruiser 350 FS	6.25 50	7.5a	3.0cd	0.2bc
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 100	2b	2.5d	0.2bc
DCT	197	11.8a	3.8bc	0.0c
APRON MAXX RTA 10.05 FS + Tefluthrin 200 ME	6.25 40	12.5a	4.3b	1.2ab
DCT half rate	98.8	9a	5.8a	0.0c
LSD (P=.05)		4	1.2	2.1
CV		30.5	19.5	100.5

* Means followed by same letter do not significantly differ (P=.05, LSD).

Table 3. Mid crop fresh and field weights and yield in white beans with seed treatments at Ridgetown, Ontario, 2001.

Treatment	Rate g ai/100kg seed	Fresh Weight kg/row Jul-26-01	Final Weight g/row	Yield T/ha
Check	0	2.17 d	554.5 b	1.2 b
Fungicide Check APRON MAXX RTA 19.05 FS	6.25	7.02 bc	942.0 a	2.1 a
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	9.12 a	980.0 a	2.2 a
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	8.15 ab	935.0 a	2.1 a
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 100	9.11 a	958.0 a	2.1 a
DCT	197	7.96 abc	952.8 a	2.1 a
APRON MAXX RTA 10.05 FS + + Tefluthrin 200 ME	6.25 40	8.60 ab	996.5 a	2.2 a
DCT half rate	98.8	6.24 c	880.5 a	2.0 a
LSD (P=.05)		1.7	235.5	0.5
CV		16.2	19.76	19.6

* Means followed by same letter do not significantly differ (P=.05, LSD).

2001 PRM REPORT # 65 SECTION E: CEREAL, FORAGE CROPS, and OILSEEDS - Insect Pests
ICAR: 61006537

CROP: Corn (*Zea maize* L.), Z20650 Cry 1F, IsoLine 2657, NK N15B7
PEST: Black Cutworm, *Agrotis ipsilon*, Hufnagel

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TITLE: CONTROL OF BLACK CUTWORM IN CORN WITH SEED TREATMENTS

MATERIALS: G7009-00 AMS 600 FS (clothianidin 600 g ai/L); Lorsban 4E (chlorpyrifos, 40%)

METHODS: Seed was treated on 23 July, 2001 in 1 kg lots in individual bags by applying a slurry of the 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 minute to ensure thorough seed coverage. The crop was planted on 24 July, 2001 at Ridgetown at a seeding rate of 10 seeds per m using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were 4 rows, 4 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications. Round galvanized metal enclosures 7.32 m X 40 cm high were installed in each plot to enclose two rows prior to the third leaf stage. The number of plants in each enclosure was thinned to 24 before infestation. Plots were infested at dusk with 3rd instars (0.75 cm average length) at a rate of 1 larva per plant on 10 August, 2001 when the corn had reached the 3 leaf stage. The larvae were placed in the centre of the enclosure and covered with straw to provide protection from birds and heat. The number of individual missing/damaged/cut plants were counted and rated using the Guthrie scale (1-10), (Tseng et al, Journal of Economic Entomology, Vol. 77, no 3, June 1984) until feeding stopped. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: See Table 1.

CONCLUSIONS: Damage was light even with 1 larva/plant. Perhaps the heat and drought this year affected survival of larvae. There were no significant differences between treatments at the low damage levels.

Table 1. Control of black cutworm with seed treatments at Ridgetown, Ontario, 2001.

Treatment	Rate	Cutworm Damage (Guthrie 1-10)			
	g ai/ 100kg	Aug-13-01	Aug-17-01	Aug-20-01	Aug-24-01
		4 leaf stage	4-6 leaf stage	6-8 leaf stage	8-10 leaf stage
Z20650 Cry 1F		1.2	1.8	2.1	2.4
Isoline 2657		1.3	1.8	2.2	2.8
TI-435 G7009-00	0.125	1.4	1.8	2.2	2.8
TI-435 G7009-00	0.25	1.2	1.7	2.2	2.6
TI-435 G7009-00	0.5	1.3	1.8	1.9	2.4
Lorsban	1.5	1.1	1.6	2.1	2.6
Untreated Check		1.3	1.9	2.5	2.9
LSD (P=.05)		NS	NS	NS	NS
CV		11.9	13.9	13.6	16.7

2001 PMR REPORT # 66 SECTION E: CEREAL, FORAGE, AND OILSEED CROPS - Insect Pests
ICAR: 61006537

CROP: Corn (Zea Mays) Hybrid N15B7
PEST: Wireworm, *Elateridae*, sp unknown

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TITLE: CONTROL OF WIREWORM IN CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (metalaxyl-m + fludioxonil, 324 g ai/L), CRUISER 350 FS (thiamethoxam, 350 g ai/L), AGROX DL PLUS (lindane + captan + diazinon, 25 % + 15 % +15 % w/w), HELIX 156, FORCE ST 200 ME (tefluthrin, 200 g ai/L), L0281-A1, L0112-A1, G7009-00, L1039-A1, L0122-A1, FORCE 3G (tefluthrin,1.5% w/w)

METHODS: Seed was treated on 3 May, 2001 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 to ensure thorough seed coverage. The crop was planted on 4 May, 2001 at Rodney, and 5 May, 2001 at St. Thomas and Florence using a two-row cone-seeder mounted on a John Deere Max Emerge planter at 80 seeds/row. Plots were single rows spaced at 0.76 m apart and 10 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was assessed on 22, 24 and 31 May, 2001. Vigor assessment, using a scale of 0-100 (100 = most advanced plant and 0 = plants dead) was recorded on 22 ,24 and 31 May, 2001. Wireworm populations were counted on 15 June, 2001, 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. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: See Tables 1, 2 and 3. There were 1.5, 6.5, and 7.8 wireworms/m in the check plots at Rodney, St. Thomas and Dorchester, respectively.

CONCLUSIONS: All treatments resulted in better plant stand than untreated and fungicide-treated controls. FORCE seed treatment provided better emergence than FORCE applied in-furrow.

Table 1. Plant stand and vigor assessments at Rodney, Ontario, 2001.

Treatment	Rate g ai/100kg or g ai/100m row or ml/80,000 seed[1]	Plant Stand Plants/plot			Vigor 0-100 %	
		May-22-01 7DAP	May-31-01 14DAP	Jun-14-01 21DAP	May-22-01 7DAP	May-31-01 14DAP
Untreated Check		73 ef [2]	72 ef	64 f	62.5 bc	72.5
Fungicide Check +MAXIM XL 324 FS	3.5	71 f	71 f	71 e	65.0 bc	75.0
MAXIM XL 324 FS +CRUISER 350 FS	3.5 50	77 bcd	77 bcd	77 abc	65.0 bc	73.8
MAXIM XL 324 FS +CRUISER 350 FS	3.5 100	78 abc	79 bc	78 abc	57.5 c	77.5
MAXIM XL 324 FS +CRUISER 350 FS	3.5 200	77 a-d	79 bc	78 abc	72.5 abc	85.0
AGROX DL	110	77 bcd	78 bc	78 abc	62.5 bc	76.3
MAXIM XL 324 FS +FORCE 200 ME (seed treatment)	3.5 40	81 a	82 a	81 a	85.0 a	90.0
HELIX	234	78 abc	80 abc	80 ab	65.0 bc	77.5
L0281-A1	3.46	74 def	74 de	73 de	70.0 abc	80.0
L0112-A1 +L0281-A1	13[1] 3.46	80 ab	80 ab	80 ab	77.5 ab	86.3
G7009-00 +L0281-A1	10[1] 3.46	78 abc	79 bc	80 ab	75.0 ab	85.0
L0281-A1 +L1039-A1	3.46 59	77 bcd	78 bc	77 bc	75.0 ab	83.8
L0281-A1 +L0122 A1	3.46 133	78 abc	78 bc	78 abc	72.5 abc	83.8
FORCE 3G (In-furrow)	1.13	75 cde	78 bc	75 cd	62.5 bc	76.3
G7009-00 +L0281-A1	40 3.46	76 b-e	79 bc	77 abc	75.0 ab	85.0
G7009-00	20	75 cde	77 cd	77 abc	70.0 abc	82.5
LSD (P=.05)		3.9	3.1	4.0	15.0	NS
CV		3.5	2.8	3.6	15.1	9.9

[2] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 2. Plant stand and vigor assessments at St. Thomas, Ontario, 2001.

Treatment	Rate g ai/100kg or g ai/100m row or ml/80,000 seed[1]	Plant Stand Plants/plot			Vigor 0-100 %	
		May-23-01 7DAP	May-31-01 14DAP	Jun-15-01 21 DAP	May-23-01 7DAP	May-31-01 14DAP
Untreated Check		55 e [2]	56 f	52 d	55.0	52.5 e
Fungicide Check +MAXIM XL 324 FS	3.5	69 bcd	67 de	68 bc	72.5	80.0 bcd
MAXIM XL 324 FS +CRUISER 350 FS	3.5 50	76 a	74 ab	74 a	87.5	92.5 ab
MAXIM XL 324 FS +CRUISER 350 FS	3.5 100	74 abc	76 ab	78 a	77.5	87.5 abc
MAXIM XL 324 FS +CRUISER 350 FS	3.5 200	70 a-d	71 bcd	75 a	77.5	87.5 abc
AGROX DL	110	70 a-d	75 ab	74 a	77.5	85.0 a-d
MAXIM XL 324 FS +FORCE 200 ME (seed treatment)	3.5	75 a	74 ab	74 a	72.5	80.0 bcd
HELIX	234	69 cd	74 abc	75 a	80.0	87.5 abc
L0281-A1	3.46	67 d	67 de	66 bc	70.0	72.5 d
L0112-A1 +L0281-A1	13[1] 3.46	76 a	76 ab	76 a	80.0	80.0 bcd
G7009-00 +L0281-A1	10[1] 3.46	75 ab	74 ab	75 a	85.0	95.0 a
L0281-A1 +L1039-A1	3.46 59	75 ab	77 a	75 a	70.0	75.0 cd
L0281-A1 +L022-A1	3.46 133	75 a	77 a	77 a	85.0	90.0 ab
FORCE 3G (In-furrow)	1.13	59 e	69 cde	70 b	65.0	75.0 cd
G7009-00 +L0282-A1	40 3.46	72 a-d	74 abc	76 a	75.0	85.0 a-d
G7009-00	20	60 e	64 e	65 c	72.5	75.0 cd
LSD (P=.05)		5.7	5.2	3.9	NS	14.6
CV		5.7	5.1	3.8	16.5	12.6

[2] Means followed by same letter do not significantly differ (P =.05, LSD).

Table 3. Plant stand and vigor assessments at Florence, Ontario, 2001.

Treatment	Rate g ai/100kg or g ai/100m row or ml/80,000 seed[1]	Plant Stand Plants/plot			Vigor 0-100 %	
		May-24-01 7DAP	Jun-05-01 14DAP	Jun-14-01 21DAP	May-24-01 7DAP	Jun-05-01 14DAP
Untreated Check		63 d [2]	61 d	60 d	62.5 ef	65.0 d
Fungicide Check +MAXIM XL 324 FS	3.5	62 d	66 c	65 c	62.5 ef	72.5 cd
MAXIM XL 324 FS +CRUISER 350 FS	3.5 50	76 ab	80 a	78 ab	82.5 abc	93.8 a
MAXIM XL 324 FS +CRUISER 350 FS	3.5 100	75 abc	78 ab	77 b	72.5 b-e	82.5 abc
MAXIM XL 324 FS +CRUISER 350 FS	3.5 200	78 ab	78 ab	78 ab	65.0 def	75.0 bcd
AGROX DL	110	74 abc	77 ab	76 b	80.0 a-d	90.0 ab
MAXIM XL 324 FS +FORCE 200 ME (seed treatment)	3.5 40	76 ab	78 ab	78 ab	80.0 a-d	93.8 a
HELIX	234	75 abc	77 ab	77 b	75.0 b-e	82.5 abc
L0281-A1	3.46	61 d	62 d	61 d	55.0 f	65.0 d
L0112-A1 +L0281-A1	13[1] 3.46	78 ab	78 ab	78 ab	92.5 a	96.3 a
G7009-00 +L0281-A1	10[1] 3.46	76 ab	78 ab	77 b	82.5 abc	97.5 a
L0281-A1 +L1039-A1	3.46 59	77 ab	77 ab	78 ab	72.5 b-e	85.0 abc
L0281-A1 +L0122-A1	3.46 133	78 a	80 ab	81 a	77.5 a-e	87.5 abc
FORCE 3G (In-furrow)	1.13	73 abc	76 b	76 b	83.8 ab	88.8 ab
G7009-00 +L0281-A1	40 3.46	72 bc	77 ab	77 ab	75.0 b-e	88.8 ab
G7009-00	20	70 c	77 ab	76 b	67.5 c-f	76.3 bcd
LSD (P=.05)		5.9	4.0	3.8	15.7	15.7
CV		5.6	3.7	3.6	14.8	13.1

[2] Means followed by same letter do not significantly differ (P=.05, LSD).

2001 PMR REPORT # 67 SECTION E: CEREAL, FORAGE CROPS, and OILSEEDS - Insect Pests
ICAR: 61006537

CROP: Corn (*Zea maize* L.), Hybrid N15B7
PEST: European chafer, *Rhizotrogus majalis*, Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL IN CORN

MATERIALS: MAXIM XL 324 FS (fludioxonil, 324 g ai/L), CRUISER 350 FS (thiamethoxam, 350 g ai/L), HELIX 156, GAUCHO 600 FS (imidacloprid, 600 g ai/L), FORCE 200 ME (tefluthrin, 200 g ai /L), AGROX DL PLUS (lindane +captan +diazinon, 25% + 15% + 15% w/w), COUNTER 15G (terbufos, 15% w/w), L0281-A1, G7009-00

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 to ensure thorough seed coverage. In furrow granular insecticides were applied using a Noble® applicator. Corn was planted at 2 locations on 5 May , 2001 in St Thomas and Dorchester 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 96 seeds per plot. Plant emergence was taken at both sites on 23 and 31May and 15 June, 2001 at the 4-5 and 5-6 leaf stage respectively. Vigor rating was assessed on 23 and 31 May and 15 June , 2001 using a scale of 0-100% (100 = most advance plant and 0 = dead plants). Chafers were counted by removing a 1 m trench of soil 15 cm wide and 10 cm deep from each check plot on 15 June, 2001 and sifting out them out of the soil. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: The results are presented in Tables 1, 2, 3 and 4. There were 6.3 and 5.3 plants/m and 0.3 and 0.8 chafer grubs/m row in the check plots at the St. Thomas and Dorchester sites, respectively.

CONCLUSIONS: HELIX ,L0281-A1 and G7009-00 were the only treatments which improved and sustained emergence over the checks. G7009-00 provided the best emergence protection . While many treatments improved vigor over the controls, G7009-00 at the 100.2 g ai/100 kg rate with L0281-A1 at 3.5 g ai/100 kg was significantly better including when plant height was measured at the St. Thomas site. There were no significant differences in vigor or plant height at the Dorchester site.

Table 1. Emergence counts at St Thomas, Ontario, 2001.

Treatment		Rate g ai /100kg ST[1] or g ai/100m row IF[2]	Plant Stand plants per plot		
			May-23-01 7DAP	May-31-01 14DAP	Jun-15-01 21DAP
Fungicide Check			62 d[3]	64 d	61 d
-MAXIM XL 324 FS	ST	3.5			
MAXIM XL 324 FS	ST	3.5	67 cd	63 d	66 cd
+ CRUISER 350 FS	ST	50			
MAXIM XL 324 FS	ST	3.5	65 cd	67 cd	66 cd
+CRUISER 350 FS	ST	100			
MAXIM XL 324 FS	ST	3.5	66 cd	67 cd	62 d
+ CRUISER XL 350 FS	ST	200			
HELIX 156	ST	234	71 c	70 c	71 c
MAXIM XL 324 FS	ST	3.5	67 cd	66 cd	67 cd
+FORCE 3G	IF	1.13			
MAXIM XL 324 FS		3.5	66 cd	66 cd	66 cd
+ GAUCHO	ST	256			
MAXIM XL 324 FS		3.5	66 cd	66 cd	66 cd
+FORCE 200 ME	ST	40			
MAXIM XL324 FS		3.5	65 cd	65 cd	65 d
+FORCE 3G	IF	1.13			
+AGROX DL plus	ST	110			
MAXIM XL 324 FS		3.5	70 c	65 cd	67 cd
+COUNTER 15 G	IF	11.25			
+AGROX DL plus	ST	110			
MAXIM XL 324 FS		3.5	67 cd	67 cd	65 d
+COUNTER 15 G	IF	11.25			
L0281-A1	ST	3.5	87 b	88 b	85 b
G7009-00	ST	100.2*	92 ab	94 a	93 a
+ L0281-A1	ST	3.5			
G7009-00	ST	19.8*	96 a	96 a	95 a
+ L0281-A1	ST	3.5			
LSD (P=.05)			5.8	5.6	5.6
CV			5.6	5.5	5.5

[1] ST- seed treatment.
[2] IF- in furrow.
[3] Means follow by same letter do not significantly differ (P=.05,LSD).
* ml/80,000 seeds.

Table 2. Assessments for plant vigor and average plant height at St.Thomas, Ontario, 2001.

Treatment		Rate Unit gai/100kg ST[1] gai/100m row IF[2]	Plant Vigor 0-100 %		Plant Height (cm) June-15-01
			May-23-01 7DAP	May-31-01 14DAP	
Fungicide Check			55.0 d [3]	62.5 e	34.4
-MAXIM XL 324 FS	ST	3.5			
MAXIM XL 324 FS	ST	3.5	74.0 bc	77.5 bcd	35.0
+ CRUISER 350 FS	ST	50			
MAXIM XL 324 FS	ST	3.5	55.0 d	65.0 de	34.9
+CRUISER 350 FS	ST	100			
MAXIM XL 324 FS	ST	3.5	65.0 cd	72.5 cde	35.8
+ CRUISER XL 350 FS	ST	200			
HELIX 156	ST	234	61.5 cd	70.0 cde	35.1
MAXIM XL 324 FS	ST	3.5	72.5 bc	82.5 bc	38.1
+FORCE 3G	IF	1.13			
MAXIM XL 324 FS		3.5	62.5 cd	72.5 cde	37.0
+ GAUCHO ST	ST	256			
MAXIM XL 324 FS		3.5	67.5 cd	77.5 bcd	37.8
+FORCE 200 ME	ST	40			
MAXIM XL324 FS		3.5	65.0 cd	72.5 cde	36.0
+FORCE 3G	IF	1.13			
+AGROX DL plus	ST	110			
MAXIM XL 324 FS		3.5	67.5 cd	72.5 cde	36.7
+COUNTER 15 G	IF	11.25			
+AGROX DL plus	ST	110			
MAXIM XL 324 FS		3.5	65.0 cd	75.0 cde	38.4
+COUNTER 15 G	IF	11.25*			
L0281-A1	ST	3.5	72.5 bc	82.5 bc	37.1
G7009-00	ST	100.2*	82.5 ab	90.0 ab	36.8
+ L0281-A1	ST	3.5			
G7009-00	ST	19.8	95.0 a	97.5 a	38.5
+ L0281-A1	ST	3.5			
LSD (P=.05)			14.1	14.3	NS
CV			14.4	13.1	6.8

[1] ST - seed treatment.
[2] IF- in furrow.
[3] Means followed by same letter do not significantly differ (P=.05 , LSD).
* ml/80,000 seeds.

Table 3. Plant stand counts at Dorchester, Ontario, 2001.

Treatment		Rate Unit gai/100kg ST[1] gai/100m row IF[2]	Plant Stand plants per plot		
			May-23-01 7 DAP	May-31-01 14 DAP	Jun-15-01 21 DAP
Fungicide Check			65 d [3]	64 de	64 d
-MAXIM XL 324 FS	ST	3.5			
MAXIM XL 324 FS	ST	3.5	67 d	67 cde	66 cd
+ CRUISER 350 FS	ST	50			
MAXIM XL 324 FS	ST	3.5	66 d	66 de	65 d
+CRUISER 350 FS	ST	100			
MAXIM XL 324 FS	ST	3.5	67 d	67 cde	66 d
+ CRUISER XL 350 FS	ST	200			
HELIX 156 ST	ST	234	67 d	67 cde	67 cd
MAXIM XL 324 FS	ST	3.5	72 c	72 c	72 c
+FORCE 3G IF	IF	1.13			
MAXIM XL 324 FS		3.5	64 d	63 e	65 d
+ GAUCHO ST	ST	256			
MAXIM XL 324 FS		3.5	68 cd	68 cde	67 cd
+FORCE 200 ME	ST	40			
MAXIM XL324 FS		3.5	68 cd	68 cde	67 cd
+FORCE 3G	IF	1.13			
+AGROX DL plus	ST	110			
MAXIM XL 324 FS		3.5	68 cd	69 cd	68 cd
+COUNTER 15 G	IF	11.25			
+AGROX DL plus	ST	110			
MAXIM XL 324 FS		3.5	65 d	64 de	64 d
+COUNTER 15 G	IF	11.25			
L0281-A1	ST	3.5	91 b	89 b	90 b
G7009-00	ST	100.2*	97 a	95 a	94 ab
+L0281-A1	ST	3.5			
G7009-00	ST	19.8*	97 a	96 a	97 a
+L0281-A1	ST	3.5			
LSD (P=.05)			5.5	5.6	6.2
CV			5.3	5.5	6.0

[1] ST- seed treatment.
[2] IF - in furrow.
[3] Means followed by same letter do not significantly differ (P=.05, LSD).
* ml/80,000 seeds.

Table 4. Assessments for plant vigor and average plant height at Dorchester, Ontario, 2001.

Treatment		Rate g ai/100kg ST[1] or g ai/100m row IF[2]	Plant Vigor 0-100 %		Plant Height (cm)
			May-23-01 7DAP	May-31-01 14DAP	Jun-14-01
Fungicide Check			60.0	62.5	22.0
-MAXIM XL 324 FS	ST	3.5			
MAXIM XL 324 FS	ST	3.5	77.5	80.0	24.1
+ CRUISER 350 FS	ST	50			
MAXIM XL 324 FS	ST	3.5	51.8	70.0	23.3
+CRUISER 350 FS	ST	100			
MAXIM XL 324 FS	ST	3.5	72.5	77.5	24.0
+ CRUISER XL 350 FS	ST	200			
HELIX 156 ST	ST	234	67.5	70.0	23.2
MAXIM XL 324 FS	ST	3.5	75.0	80.0	24.3
+FORCE 3G IF	IF	1.13			
MAXIM XL 324 FS		3.5	67.5	67.5	22.3
+ GAUCHO ST	ST	256			
MAXIM XL 324 FS		3.5	72.5	80.0	23.1
+FORCE 200 ME	ST	40			
MAXIM XL324 FS		3.5	65.0	67.5	22.4
+FORCE 3G	IF	1.13			
+AGROX DL plus	ST	110			
MAXIM XL 324 FS		3.5	72.5	77.5	24.2
+COUNTER 15 G	IF	11.25			
+AGROX DL plus	ST	110			
MAXIM XL 324 FS		3.5	70.0	80.0	25.5
+COUNTER 15 G	IF	11.25			
L0281-A1	ST	3.5	80.0	85.0	24.3
G7009-00	ST	100.2*	85.0	87.5	23.1
+L0281-A1	ST	3.5			
G7009-00	ST	19.8*	80.0	87.5	23.5
+L0281-A1	ST	3.5			
LSD (P=.05)			NS	NS	NS
CV			23.1	16.2	7.5

[1] ST - seed treatment.
[2] IF - in furrow.
[3] Means follow by same letter do not significantly differ (P=.05, LSD).

2001 PMR REPORT # 68 SECTION E: CEREAL, FORAGE CROPS, and OILSEEDS - Insect Pests
ICAR: 61006537

CROP: Corn (*Zea maize* L.), Hybrid N15 B7
PEST: Corn Root Worm, *Diabrotica virgifera virgifera* LeConte

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TITLE: CONTROL OF CORN ROOTWORM IN CORN WITH SEED TREATMENTS

MATERIALS: L0281-A1, G7014-02, L0110-A1, L1012-A1, G7009-00, FORCE 3G (telfluthrin 3% w/w), ADAGE 600 (thiamethoxam 600 g ai/L)

METHODS: Seed was treated on 16 May, 2001 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 to ensure thorough seed coverage. Seed weight for N15B7 was 4251 seeds/kg. Corn was planted in 2 row plots on 17 May, 2001 at Ridgetown, using a two-row cone-seeder at a seeding rate of 8 seeds/m. FORCE 3G was applied in-furrow at planting using a Noble® plot scale applicator. Plots were spaced 0.76 m apart and were 8 m long in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand and plot vigor were assessed on 12 June, 2001. Plant lodging was assessed as % plants per plot on 29 August, 2001. Root damage assessments were recorded on 9 August, 2001. 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. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: See Table 1.

CONCLUSIONS: Extreme drought in these naturally infested plots probably resulted in poor survival of CRW larvae. Crop growth was also seriously affected by the drought. All treatments had less lodging than the non treated and fungicide controls.

Table 1. Plant stand, vigor and insect damage at Ridgetown, Ontario, 2001.

Treatment	Rate g ai/100 kg seed or g ai/100m row	Plant Stand Plants/Plot Jun-12-01 2-3Leaf Stage	Vigor 0-100 % Jun-12-01 2-3Leaf Stage	Root ratings Iowa Scale 1-6 Aug-09-01 After Pollination	Lodging % Plants/plot Aug-29-01 Dent Stage
Check		128 b *	5.8	1.9	7.3 a
L0281-A1	3.46	130 ab	7.8	1.5	6.6 a
G7014-02 +L0281-A1	1103.46	131 ab	7.3	1.4	0.0 b
L0110-A1 +L0282-A1	1103.46	128 b	7	1.5	0.9 b
L1012-A1 +L0281-A1	1103.46	136 a	6.8	1.4	0.2 b
G7009-00 +L0281-A1	1003.46	126 b	7.8	1.5	0.6 b
FORCE 3G (In-furrow)	1.13	123 b	6	1.2	0.4 b
G7009-00 +L0281-A1	403.46	126 b	7	1.6	1.0 b
ADAGE	100	122 b	2.8	1.2	0.0 b
LSD (P=.05)		5.6	NS	NS	0.6
CV		3	38.7	21	31.5

* Means followed by same letter do not significantly differ (P=.05, LSD).

2001 PMR REPORT # 69 **SECTION E: CEREAL, FORAGE CROPS, and OILSEEDS - Insect Pests**
ICAR: 61006537

CROP: Soybean (*Glycine max* (L.) Merr), Variety SW 3308
PEST: European chafer, *Rhizotrogus majalis* Razoumowsky
Soybean aphid, *Aphis glycine*, Matsumura

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TITLE: EUROPEAN CHAFER CONTROL WITH SEED TREATMENTS IN SOYBEANS

MATERIALS: L0281-A1, G7009-00, L0110-A1

METHODS: Seed was treated in 1 kg lots in individual plastic bags by applying a slurry of the 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 minute to ensure thorough seed coverage. Beans were planted at 2 locations on 5 May, 2001 (St.Thomas and Dorchester) at a seeding rate of 8 seeds per m using a 2 row cone-seeder mounted on a John Deere Max Emerge planter. Plots were 2 rows, 6 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications. Plant stand (total emergence of plot) and vigor ratings using a scale of 0-100 (100 = most advanced plant and 0 = dead plants) were taken on 23 and 31 May, 2001at St. Thomas and Dorchester, respectively. Aphid counts were taken on 3 August, 2001 at both sites. Yields were taken on 13 and 14 Nov. 2001 at Dorchester and St. Thomas respectively from 2 rows, 6 m long, converted to T/ha and corrected to 14% moisture. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: See Tables 1and 2. There were 1.3 and 1.0 chafer grubs/m recovered on 30 May, 2001 at the St. Thomas and Dorchester sites, respectively.

CONCLUSIONS: G7009-00 plus L2081-A1 provided significantly better emergence than controls under grub pressure at both sites. There was no rate response for G7009-00. The best vigor was obtained when the low rate of G7009-00 was used. Aphid numbers were significantly lower than the controls for all insecticides treatments at the Dorchester site only. Yield differences at the St. Thomas location could not be explained logically.

Table 1. Emergence, vigor, aphid infestation and yield assessments at St. Thomas, Ontario, 2001.

Treatment	Rate g ai/100 kg or ml/80,000 seeds[1]	Emergence Plants/ plot		Plant Vigor 0-100 %		Soybean Aphids Nymphs/plant Aug-03-01	Yield T/ha Nov-27-01
		7 DAP	14 DAP	7 DAP	14 DAP		
Check		115 bc[2]	84 b	50.0 d	52.5 d	475	0.36 abc
L0281-A1	3.5	97 c	87 b	55.0 cd	55.0 d	450	0.25 c
G7009-00 +L2081-A1	100.2[1] 3.5	147 ab	145 a	65.0 bc	75.0 bc	175	0.27 c
G7009-00 +L2081-A1	19.8[1] 3.5	153 a	122 a	77.5 b	85.0 ab	225	0.29 c
L0110-A1 +L2081-A1	107.04[1] 3.5	119 abc	113 ab	57.5 cd	65.0 cd	225	0.50 a
G7009-00 +L2081-A1	10.8[1] 3.5	148 ab	146 a	95.0 a	97.5 a	250	0.42 abc
LSD(P=.05)		35.6	33.4	14.6	13.0	NS	0.14
CV		18.2	19.1	14.6	12.0	67.8	24.6

[2] Means followed by same letter do not significantly differ (P=.05, LSD).

Table 2. Emergence, vigor, aphid infestation and yield assessments at Dorchester, Ontario, 2001.

Treatment	Rate g ai/100kg or ml/80,000 seeds[1]	Emergence Plants/plot		Vigor 0-100%		Soybean Aphid Nymphs/plant Aug-03-01	Yield T/ha Nov-27-01
		7DAP	14DAP	7DAP	14 DAP		
Check		142 b[2]	137 b	77.5	82.5 a	475.0 a	1.2
L0281-A1	3.5	144 b	141 b	67.5	67.5 b	450.0 ab	1.3
G7009-00 +L0281-A1	100.2[1] 3.5	161 a	163 a	77.5	82.5 a	75.0 c	1.4
G7009-00 +L0281-A1	19.8[1] 3.5	160 a	160 a	85.0	90.0 a	175.0 bc	1.3
L0110-A1 +L0281-A1	107.04[1] 3.5	145 b	146 ab	82.5	87.5 a	50.0 c	1.3
G7009-00 +L0281-A1	10.8 3.5	162 a	163 a	92.5	95.0 a	187.5 bc	1.3
LSD (P=.05)		14.1	17.1	NS	13.6	283.2	NS
CV		6.1	7.5	12.8	10.7	79.8	14.3

[2] Means followed by same letter do not significantly differ (P= .05 , LSD).

2001 PMR REPORT # 70 **SECTION E: CEREAL, FORAGE, AND OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Soybean (*Glycine max)*, CVR West-Ag 97
PEST: Seed corn maggot, *Delia platura*, Meigen
Soybean aphid, *Aphis glycine*, Matsumura

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TITLE: CONTROL OF SEED CORN 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), TEFLUTHRIN 200 ME (tefluthrin, 200 g ai/L), G7009-00, U2051-15, L1039-A1, L0122-A1, G7047 -01

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 to ensure thorough seed coverage. Manure was broadcast on the plots on 12 April, 2001 and the soil was worked shortly after the manure application. The crop was planted on 09 May, 2001 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 22 May and 1 June, 2001 respectively. Vigor was assessed using a scale of 0-100% (100 = furthest developed plant in the trial and 0 = plant dead) on 22 May and 1 June, 2001 respectively. Seed corn maggot damage and number of maggots were assessed on 24 May, 2001 by exhuming a 1 m length of row. All seeds within the 1 m were counted, whether they had emerged or not and checked for seed corn maggot damage. On 1 June, 2001 seed corn maggots were counted in 1m of the check plots. On 27 July, 2001the number of plants per1 m and the average number of aphids per plant was recorded. Fresh weights from plants in 1 row were measured 26 July, 2001. Yields were taken on 31 Oct, 2001 from 1 row, 6m long, converted to T/ha and corrected to 14% moisture. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: See Tables 1, 2 & 3. No differences in the incidence of SCM damage and larvae were detected.

CONCLUSIONS: Fungicide and insecticide combinations are a must to fully protect against insect damage. It seems insect damage opens seedlings to infestation by fungi. G7047-01 treatment was the best overall for SCM management. APRON MAXX RTA plus CRUISER at the two lower rates managed to SCM effects well, better than the half rate of DCT. There were no significant differences amongst treatments for soybean aphid counts. Only CRUISER at the low rate plus APRON MAXX RTA, DCT at the full rate and G7047-01 resulted in higher fresh weights than the controls. The best soybean yields were obtained with APRON MAXX RTA and CRUISER at the mid rate, DCT at the full rate and G7047-01.

Table 1. Plant stand in soybeans at Ridgetown, Ontario, 2001.

Treatment	Rate g ai/100kg	Plant Stand Plants per plot		
		7DAP	14DAP	21DAP
Check		53 e *	86 c	77 d
Fungicide Check - APRON MAXX RTA 19.05 FS	6.25	68 cde	102 bc	109 bcd
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	108 a	126 ab	122 abc
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	96 ab	130 ab	132 ab
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 100	92 ab	112 abc	111 bc
DCT	197	65 de	114 abc	117 abc
APRON MAXX RTA 19.05 FS + TEFLUTHRIN 200 ME	6.25 40	88 a-d	112 abc	115 abc
DCT	98.8	65 de	88 c	92 cd
G7009-00 + U2051-15	50 73	90 abc	129 ab	126 ab
L1039-A1	59	73 b-e	104 bc	102 bcd
L0122-A1	132	58 e	89 c	104 bcd
G7047-01	188	102 a	142 a	147 a
LSD		24.0	34.0	34.0
CV		20.8	21.0	20.6

* Means followed by same letter do not significantly differ (P=.05, LSD).

Table 2. Vigor, fresh weight and yield assessments in soybeans at Ridgetown, Ontario, 2001.

Treatment	Rate g ai/100kg	Plant Vigor 0-100 %		Fresh Plant Weight	Yield T/ha
		7DAP	14DAP	kg/row Jul-26	Nov-28
Check		42.5 d *	62.5 d	4.4 dc	2.9 c
Fungicide Check - APRON MAXX RTA 19.05 FS	6.25	62.5 a-d	77.5 bc	5.2 b-e	3.9 ab
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	77.5 ab	85.0 ab	6.1 ab	4.0 ab
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	72.5 abc	90.0 a	5.4 a-e	4.3 a
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 100	67.5 abc	82.5 abc	5.6 a-d	3.9 ab
DCT	197	72.5 abc	82.5 abc	5.9 abc	4.2 a
APRON MAXX RTA 19.05 FS + TEFLUTHRIN 200 ME	6.25 40	67.5 abc	77.5 bc	5.5 a-e	3.7 abc
DCT	98.8	55.0 bcd	72.5 cd	5.3 a-e	3.9 ab
G7009-00 + U2051-15	50 73	77.5 ab	87.5 ab	5.5 a-e	3.7 abc
L1039-A1	59	52.5 cd	77.5 bc	4.6 cde	3.3 bc
L0122-A1	132	52.5 cd	72.5 cd	4.1 e	3.6 abc
G7047-01	188	80.0 a	92.5 a	6.7 a	4.3 a
LSD		24.2	11.8	1.5	0.8
CV		25.7	10.2	18.9	15.1

* Means followed by same letter do not significantly differ (P=.05, LSD).

Table 3. Assessments for soybean aphids at Ridgetown, Ontario, 2001.

Treatment	Rate g ai/100kg	No. Plants infested per m Jul-27-01	No. nymphs per plant Jul-27-01
Check		61	150
Fungicide Check - APRON MAXX RTA 19.05 FS	6.25	46	113
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 30	35	75
APRON MAXX RTA 19.05 FS +CRUISER 350 FS	6.25 50	33	75
APRON MAXX RTA 19.05 FS + CRUISER 350 FS	6.25 100	23	50
DCT	197	48	113
APRON MAXX RTA 19.05 FS + TEFLUTHRIN 200 ME	6.25 40	48	113
DCT	98.8	49	125
G7009-00 + U2051-15	50 73	45	88
L1039-A1	59	55	125
L0122-A1	132	40	150
G7047-01	188	38	113
LSD		NS	NS
CV		38.7	42.3

2001 PMR REPORT # 71 SECTION E: CEREAL, FORAGE, AND OILSEED CROPS - Insect Pests
ICAR : 61006537

CROP: Soybeans (Glycine max) variety SW 3308
PEST: Wireworm, Elateridae, sp unknown

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TITLE: CONTROL OF WIREWORM IN SOYBEANS WITH SEED TREATMENTS

MATERIALS: G7009-00, U2051-15, L1039-A1, L0122-A1, G7047-0, FORCE 3G (tefluthrin, 3% w/w)

METHODS: Seed was treated on 3 May, 2001 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 to ensure thorough seed coverage. The crop was planted on 4 May, 2001 at Rodney, 5 May, 2001 at St Thomas and Florence using a two-row cone-seeder mounted on a John Deere Max Emerge planter at a rate of 160 seeds/row . Plots were single rows spaced at 0.76 m apart and 10 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was assessed on 22 and 31 May, 2001. Vigor assessment, using a scale of 0-100 (100 = most advanced plant and 0 = plants dead) was done on 22 and 31 May, 2001. Wireworm populations were estimated on 15 June, 2001, by digging up 1 m of row in a trench 15 cm deep and 10 cm wide in the FORCE 3G plots, sifting the soil and separating the wireworms. Yields were taken on 5 Nov. 2001 from 1 row, 10 m and converted to T/ha and corrected to 14.5% moisture. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: See Tables 1, 2 and 3. There were 1.3, 3.5, and 2.3 wireworm larvae/m in the FORCE 3G plots for Rodney, St. Thomas, and Florence, respectively. A flaw in this study is the absence of an untreated control. However the fact that wireworms were present in the commercial standard (FORCE 3G) allows us to make some comparisons among treatments. Locations with the higher wireworm counts also had lower emergence.

CONCLUSIONS: The best plant stand was achieved with G7047-01. Although L1039-A1 resulted in slightly better stand than FORCE 3G , it was less effective than the other three treatments. Significantly higher yields were obtained with G7009-00 and U2051-15 compared with FORCE 3G alone at Florence and St. Thomas, while all treatments were better than FORCE 3G at the St. Thomas location.

Table 1. Plant stand, vigor and yield assessments at Rodney, Ontario, 2001.

Treatment	Rate g ai/100kg or g ai/100 m row	Plant Stand Plants per plot 7 DAP	Plant Stand Plants per plot 14 DAP	Plant Vigor 1-100 % 7 DAP	Plant Vigor 1-100 % 14 DAP	Yield T/ha Nov-26-01
FORCE 3G IF (no Fungicide)	1.13	130 b *	141	65.0	81.3	1.41
G7009-00 +U2051-15	50 83	146 a	145	82.5	90.0	1.52
L1039-A1	59	144 a	146	72.5	83.8	1.48
L0122-A1	132	145 a	150	65.0	82.5	1.59
G7047-01	188	143 a	149	72.5	87.5	1.41
LSD (P=.05)		9.9	NS	NS	NS	NS
CV		4.5	5.4	26.3	12.5	17.0

*Means followed by same letter do not significantly differ (P=.05, LSD).

Table 2. Plant stand, vigor and yield assessments at St. Thomas, Ontario, 2001.

Treatment	Rate g ai/100 kg or g ai/100 m row	Plant Stand Plants per plot 7DAP	Plant Stand Plants per plot 14DAP	Plant Vigor 0-100 % 7DAP	Plant Vigor 0-100 % 14DAP	Yield T/ha Nov-26-01
FORCE 3G IF (no Fungicide)	1.13	67 b *	98 c	62.5 bc	72.5 bc	0.97 b
G7009-00 +U2051-15	50 83	97 a	122 ab	80.0 ab	87.5 ab	1.49 a
L1039-A1	59	60 b	86 d	55.0 c	67.5 c	1.36 a
L0122-A1	132	98 a	120 b	70.0 abc	80.0 abc	1.30 a
G7047-01	188	108 a	131 a	92.5 a	95.0 a	1.52 a
LSD (P=.05)		18.5	9.8	23.4	19.0	0.3
CV		13.9	5.7	21.1	15.3	13.9

* Means followed by same letter do not significantly differ(P=>05, LSD).

Table 3. Plant stand, vigor and yield assessments at Florence, Ontario, 2001.

Treatment	Rate g ai/100 kg or g ai/100 m row	Plant Stand Plants per plot 7DAP	Plant Stand Plants per plot 14DAP	Plant Vigor 0-100 % 7DAP	Plant Vigor 0-100 % 14DAP	Yield T/ha Nov-26-01
FORCE 3G IF (no Fungicide)	1.13	95 ab *	122 b	82.5 b	90.0 ab	0.21 ab
G7009-00 +U2051-15	50 83	85 bc	107 c	67.0 c	77.5 b	0.43 a
L1039-A1	59	52 d	86 d	50.0 d	60.0 c	0.19 b
L0122-A1	132	78 c	123 b	60.0 cd	77.5 b	0.24 ab
G7047-01	188	107 a	147 a	100.0 a	100.0 a	0.28 ab
LSD (P=.05)		12.9	12.3	10.0	13.6	0.2
CV		10.1	6.8	9.1	10.9	56.2

* Means followed by same letter do not significantly differ (P=.05, LSD).

2001 PMR REPORT # 72 SECTION E: CEREAL, FORAGE, AND OILSEED CROPS - Insect Pests
ICAR : 61006537

CROP: Spring Wheat (Triticum aestivum L.), B89-11-13-1788
PEST: Wireworm, *Elateridae, sp* unknown

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TITLE: CONTROL OF WIREWORM IN SPRING WHEAT WITH SEED TREATMENTS

MATERIALS: L1007-A1, U2106-04, G7009-00, G7014-02, G7040-06, U2051-15, L0112-A1

METHODS: Spring wheat seed was treated on 3 May, 2001 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 to ensure thorough seed coverage. The wheat was planted on 4, 5 and 9 May, 2001 at Rodney, St. Thomas and Florence, Ontario respectively, using a two-row cone-seeder mounted on a John Deere Max Emerge planter Plots were single rows spaced 0.76 m apart and 10 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant stand was determined on 18 and 29 May, 2001 at Rodney, 23 and 30 May, 2001 at St. Thomas and 22 and 31 May, 2001 at Florence. Vigor assessments, using a scale of 0 -100 were recorded on the same dates. Wireworm populations were estimated on 20 and 21 June, 2001, 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, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: See Tables 1, 2 and 3. The mean population of wireworm larvae was 2.0, 2.8, and 5.8 per m of row in the control plots at St. Thomas, Rodney and Florence, respectively.

CONCLUSIONS: All treatments but U2106-04 and G7009-00 plus G7040-06 accelerated emergence. All treatments tended to significantly increase final stands of wheat but the last five treatments were slightly better than the three treatments above them.

Table 1. Plant stand and vigor assessments for wireworm in spring wheat at St. Thomas, Ontario, 2001.

Treatment	Rate g ai/100 kg	Plant Stand plants/plot		Plant Vigor 0-100 %	
		7DAP	14DAP	7DAP	14DAP
Check		172 b *	188 c	55.0 b	52.5 b
L1007-A1	3.5	326 a	292 b	65.0 ab	70.0 ab
U2106-04	104	326 a	290 b	75.0 ab	75.0 a
G7009-00	140	224 b	267 b	57.5 b	67.5 ab
+G7014-02	10				
G7014-02	20	390 a	401 a	80.0 ab	85.0 a
+G7040-06	2.0				
G7014-02	10	381 a	397 a	77.5 ab	87.5 a
+U2051-15	106				
G7014-02	10	325 a	411 a	72.5 ab	80.0 a
+G7040-06	2.0				
G7009-00	10	389 a	385 a	80.0 ab	82.5 a
+G7040-06	2.0				
G7040-06	10	376 a	392 a	87.5 a	\90.0 a
+L0112-A1	10.2				
LSD (P=.05)		53.2	36.6	18.2	16.7
CV		11.2	7.4	17.2	14.9

* Means followed by same letter do not significantly differ (P=.05, LSD).

Table 2. Plant stand and vigor assessments for wireworm in spring wheat at Rodney, Ontario, 2001.

Treatment	Rate g ai/100 kg	Plant Stand plants/plot		Plant Vigor 0-100 %	
		7DAP	14DAP	7DAP	14DAP
Check		242 b *	227 d	57.5 c	57.5 c
L1007-A1	3.5	393 a	329 bc	70.0 bc	67.5 c
U2106-04	104	339 a	326 bc	70.0 bc	73.8 bc
G7009-00 +G7014-02	140 10	338 a	295 c	62.5 bc	65.0 c
G7014-02 +G7040-06	20 2.0	417 a	410 a	85.0 ab	97.5 a
G7014-02 +U2051-15	10 106	385 a	393 ab	77.5 abc	87.5 ab
G7014-02 +G7040-06	10 2.0	407 a	389 ab	62.5 bc	70.0 bc
G7009-00 +G7040-06	10 2.0	409 a	408 a	95.0 a	95.0 a
G7040-06 +L0112-A1	10 10.2	432 a	422 a	75.0 bc	87.5 ab
LSD (P=.05)		60.8	50.3	14.8	13.9
CV		11.2	9.7	13.9	12.2

* Means followed by same letter do not significantly differ (P=.05, LSD).

Table 3. Plant stand and vigor assessments of wireworm in spring wheat at Florence, Ontario, 2001.

Treatment	Rate g ai/100 kg	Plant Stand plants/plot		Plant Vigor 0-100 %	
		7DAP	14DAP	7DAP	14DAP
Check		200 b *	214 b	52.5	53.8
L1007-A1	3.5	348 a	380 ab	65.0	66.3
U2106-04	104	291 ab	320 b	70.0	70.0
G7009-00 +G7014-02	140 10	291 ab	270 ab	62.5	62.5
G7014-02 +G7040-06	20 2.0	445 a	426 a	65.0	77.5
G7014-02 +U2051-15	10 106	364 a	372 ab	77.5	86.3
G7014-02 +G7040-06	10 2.0	403 a	395 a	62.5	76.3
G7009-00 +G7040-06	10 2.0	431 a	359 ab	62.5	72.5
G7040-06 +L0112-A1	10 10.2	358 a	395 a	77.5	76.3
LSD (P=.05)		102.5	112.2	NS	NS
CV		20.2	22.1	21.3	22.3

* Means followed by same letter do not significantly differ (P=.05, LSD).

2001 PMR REPORT # 73 SECTION E: CEREAL, FORAGE CROPS, and OILSEEDS - Insect Pests
ICAR: 61006537

CROP: Winter Wheat (Triticum Aestivum spp.)
PEST: European chafer, *Rhizotrogus majalis*, Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL WITH SEED TREATMENTS IN WINTER WHEAT

MATERIALS: DIVIDEND XL RTA 36 FS (difenoconazole, 36 g ai/L), CRUISER (thiamenthoxam, 350 g ai/L), VITAVAX DUAL PURPOSE (carbathiin + lindane, 180 + 165 g ai/L), RAXIL FL (tebuconazole, 1.5 g ai/L), GAUCHO 600 FS (imidacloprid, 600 g ai/L), AMS 13594, AGROX DL (lindane + captan + diazinon, 25% + 15% + 15% w/w)

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 to ensure thorough seed coverage. Wheat was planted at London and Dorchester on 19 October, 2000 using a twelve-row Wintersteiger cone seeding drill. Plots were 6 rows 4 m in length and spaced 15 cm apart with 40 cm between plots and arranged in a RCBD with 4 replications. Plant emergence was taken at both sites on 1 November, 2000. A final plant stand after winter was taken on 18 April, 2001. On 13 and 14 June, 2001 wheat heads per 1m were counted and soil samples with wheat roots were collected for chafer counts. Yields were assessed on 26 July, 2001 and dry weights corrected to 14% moisture content. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

RESULTS: See Tables 1 and 2.

CONCLUSIONS: In the fall at planting time we counted 30-50 grubs/m^2. We had a wet fall and suspect that natural mortality of grubs was high. There were no significant differences between treatments for all parameters measured.

Table 1. Emergence, wheat head counts, chafer counts and yields at London, Ontario, 2001.

Treatment	Rate g ai/100kg	Emergence plants/2m		Heads /2m	Chafer Grubs /2m	Yield T/ha
		Nov-01-00	Apr-18-01	Jun-14-01	Jun-14-01	Jul-26-01
DIVIDEND XL RTA	13	147	132	79	0.8	2.9
+CRUISER (low)	10					
DIVIDEND XL RTA	13	150	140	94	2.4	3.0
+CRUISER (mid.)	20					
DIVIDEND XL RTA	13	159	150	85	0.8	3.2
+CRUISER (high)	35					
VITAVAX Dual Purpose	124	171	154	94	0.8	3.0
RAXIL FL	1.5	171	137	92	1.0	3.0
+GAUCHO	204					
RAXIL FL	1.5	169	141	93	0.8	3.1
+ AMS 13954	204					
DIVIDEND XL	13	184	164	88	1.4	3.0
+AGROX DL plus	100					
DIVIDEND XL RTA	13	182	142	83	1.6	2.8
RAXIL FL	1.5	186	142	83	1.4	3.1
Untreated Check		177	141	73	2.0	2.9
Untreated Check		186	132	91	0.8	2.8
LSD (P=.05)		NS	NS	NS	NS	NS
CV		18.4	18.4	20.6	108.9	8.8

* Means followed by same letter do not significantly differ (P=.05, LSD)

Table 2. Emergence , wheat head counts, chafer counts and yields at Dorchester, Ontario, 2001.

Treatment	Rate g ai/100kg	Emergence plants/2m		Heads /m	Chafer Grubs/m	Yield T/ha
		Nov-01-00	Apr-18-01	Jun-13-01	Jun-13-01	Jul-26-01
DIVIDEND XL RTA	13	168	133 * abc	93	2.8	3.4 bc
+CRUISER (low)	10					
DIVIDEND XL RTA	13	136	107 de	92	1.4	3.6 abc
+CRUISER (mid.)	20					
DIVIDEND XL RTA	13	165	146 a	95	1.2	3.7 abc
+CRUISER (high)	35					
VITAVAX Dual Purpose	124	130	133 abc	106	1.6	3.6 abc
RAXIL FL	1.5	174	141 ab	99	1	3.9 a
+GAUCHO	204					
RAXIL FL	1.5	146	110 cde	116	1.4	3.7 ab
+ AMS 13954	110					
DIVIDEND XL	13	141	132 abc	99	1.6	3.5 abc
+AGROX DL plus	110					
DIVIDEND XL RTA	13	132	113 cde	106	2.2	3.3 cd
RAXIL FL	1.5	162	120 bcd	94	4.2	3.3 cd
Untreated Check		135	115 cde	95	3.2	3.3 cd
Untreated Check		130	95 e	80	1.8	3.0 d
LSD (P=.05)		NS	23.2	NS	NS	0.4
CV		19.6	14.8	24.5	85.3	8.4

* Means followed by same letter do not differ significantly (P=.05, LSD).

2001 PMR REPORT # 74 SECTION E: CEREALS, FORAGE CROPS AND OILSEEDS - Insect Pests
STUDY MANAGEMENT SYSTEM: 364-2120-9604

CROP: Spring wheat
PEST: Hessian fly, *Mayetiola destructor* (Say)

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TITLE: RESISTANCE TO THE HESSIAN FLY IN VARIOUS SPRING WHEAT LINES

MATERIALS: 6 spring wheat cultivars and 7 spring wheat line selections

METHODS: All wheats were sown in single rows of 5 m on 31 May and 05 June 2000 in separate fields at the Cereal Research Centre Experimental Farm, Glenlea, Manitoba. The plots were replicated 4 times and the experiment was arranged in a random complete block design. The rows were spaced 30 cm apart and the blocks were separated by a 1 m cultivated strip. Weeds were removed by hand, as needed, throughout the growing season. The early seeded test was abandoned because of extensive crop lodging in all plots caused by severe wind and rain storms in late August and early September. The plots of the later seeded test were assessed 13 September 2000 by counting the number of unbroken and broken stems from a 1 m length section of row in about the middle of the plot. Ten broken stems, where found, and 10 unbroken stems were collected randomly from each row by severing the stem at ground level. The stems were stored at room temperature and later examined by removing the leaf sheathes from the stem to determine the presence of pupae just above the nodes. The number of pupae on each stem was counted for both broken and unbroken stems. The percentage of infested broken and unbroken stems in each sample was multiplied by the corresponding number of stems in each plot to calculate the number of broken and unbroken infested stems per m row. The number (x) of total, broken and unbroken stems per m row, and of total, broken and unbroken infested stems per m row were transformed by the $\log_{10}(x + 1)$ and analyzed by Tukey's Studentized Multiple Range test. The totals for the stem counts in the table are the means calculated from the transformed data.

RESULTS: Hessian fly populations at the experimental site were much higher than those found in most commercial fields. In nearly all stems, larvae concentrated their feeding on the first 2 nodes from the base of the stem. Infestations on each stem were comprised mostly of single larvae (63%) with multiples of 2 (25%), 3 (9%), and 4 (3%) larvae per stem being less frequent. Stem breakage in infested stems occurred mostly just above the feeding site of the larvae where the stem tissue had been killed. In noninfested stems, stem breakage was mostly at the node or at the base of the stem and was not accompanied by any necrotic lesions at the site of the break.

CONCLUSIONS: All '99' wheat lines had totals of broken and infested stems that were as low as the resistant cultivar 'Guard' (Table 1). No broken stems were found in 2 of the wheat lines and 3 other lines averaged about 1 broken stem per plot. Only 6 of the 28 plots seeded to these wheat lines had any broken stems. The wheat cultivars 'Nordic' and BW252 had slightly higher numbers of broken stems ($P>0.05$) than 'Guard' but results were significantly less than 'AC Barrie', 'AC Crystal' or 'AC Foremost' (Table 1). BW252 also had fewer infested stems ($P<0.05$) than the two highly susceptible

cultivars ‘AC Crystal’ and ‘AC Foremost’, which had 36±1% of their stems infested by Hessian fly larvae.‘Nordic’ was the most tolerant of the susceptible cultivars to feeding injury by the Hessian fly, with only about 16% of infested stems being broken. However, all stems of ‘Nordic’ broke if they had >1 larvae per stem. BW252 (68% breakage of infested stems) and ‘AC Crystal’ (74%) were less tolerant to feeding than ‘Nordic’ but unbroken infested stems with >1 larvae per stem were found for both cultivars. ‘AC Foremost’ (90%) also had low tolerance to feeding injury and all stems broke if there was >1 larvae per stem. ‘AC Barrie’ was the least tolerant cultivar to feeding injury as no unbroken infested stems were found.

Table 1. Number of broken and unbroken stems in various spring wheats exposed to field populations of the Hessian fly in Manitoba.

Wheat Line*/ Cultivar	Stems/m row			Infested stems/m row			Larvae/ inf. stem
	Broken	Unbroken	Total	Broken	Unbroken	Total	
99 EPWA FHB 134[1]	0.6c§	81.1a	81.7a	0b	0a	0c	-
99 CBW A4 169[2]	0.2c	79.0ab	79.2ab	0b	0a	0c	-
99 CBW A4 174[3]	0.5c	79.0ab	79.5ab	0b	0.8a	0.8c	1
99 W945 173[4]	0.2c	67.3ab	67.5abc	0b	0a	0c	-
99 W947 175[4]	0.2c	71.5ab	71.1abc	0b	0.7a	0.7c	1
99 W948 176[4]	0c	69.9ab	69.9abc	0b	0a	0c	-
99 W950 177[4]	0c	69.1ab	69.1abc	0b	0a	0c	-
Guard	0.4c	73.9ab	74.3abc	0b	0a	0c	-
Nordic	2.0c	58.3b	60.3bcd	1.3b	6.6a	7.9bc	1.7:1**
BW252	3.8c	70.3ab	74.1abc	2.1b	1.0a	3.1c	1.3:1.5
AC Barrie	15.4b	58.1b	73.5abc	10.6ab	0a	10.6bc	1.7
AC Crystal	21.3ab	35.5c	56.8cd	15.3a	5.4a	20.7a	1.7:1.2
AC Foremost	30.0a	17.4c	47.4d	15.3a	1.6a	16.9ab	1.3:1

* Wheat line Hessian fly resistant parents are [1]SD 8070, [2]Caldwell, [3]Unknown, and [4]Guard.

§ Means followed by the same letter are not significantly different (*P*>0.05, Tukey’s Studentized Multiple Range test).

** Mean number of larvae per infested stem on broken:unbroken stems.

END OF SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insect Pests
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SECTION F: ORNAMENTALS and GREENHOUSE/PLANTES ORNEMENTALES et DE SERRE
0 reports

SECTION G:	BASIC STUDIES (ENTOMOLOGY) / ÉTUDES DE BASE (ENTOMOLOGIE)
REPORT/RAPPORT #:	75
PAGES:	208 - 210
EDITOR:	Mrs. Stephanie Hilton
1 report	Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre, 1391 Sandford St. London, On N5V 4T3 Email: hiltons@em.agr.ca Tel: (519) 457-1470 Fax: (519) 457-3997

2001 PMR REPORT # 75

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 IN BIOASSAY TO IMIDACLOPRID, THIAMETHOXAM AND OTHER INSECTICIDES OF FIELD-COLLECTED ADULT COLORADO POTATO BEETLES FROM ACROSS CANADA, 2001

MATERIALS: Technical (>95% purity) imidacloprid, thiamethoxam, cypermethrin, azinphosmethyl, endosulfan

METHODS: Two replicates of ten adult CPB collected from field populations from six 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. Five concentrations were selected to kill from 0% to 100% of the treated insects. LC_{50}'s were estimated from a log-probit graph of the regression line for each insecticide. The Tolerance Ratio (LC_{50} subject population/LC_{50} most susceptible population) was developed for each population to facilitate comparison among populations and provide an index of the variation in susceptibility among populations to tested insecticides. The results for 2001 were compared to the previous five years; the numbers of field populations and insecticides tested were not the same each year (Table 1).

RESULTS: In direct contact bioassays in 2001, the LC_{50} of imidacloprid to the Lab-S strain was 2.2 ppm at 1 day after treatment (DAT) and increased to 5.4 ppm at 8 DAT, representing adult recovery from intoxication after exposure to the insecticide. The amount of recovery in one population was 156-fold which is an order of magnitude higher than the degree of recovery seen in previous years. At 8 DAT, only 1 out of 39 field populations tested was slightly more susceptible to imidacloprid than the Lab-S

strain. Calculation of the TR using the most susceptible population produced maximum TR's for imidacloprid of 11.2x at 1 DAT and 17.9x at 8 DAT (Table 2). The TR for thiamethoxam at 8 DAT was 5.5x; little recovery from thiamethoxam was noted. For the other insecticides tested, the laboratory CPB strain was the most susceptible. Comparisons of maximum TR's for 1997-2001 did not indicate any major change in tolerance to cypermethrin, azinphosmethyl and endosulfan in tested populations.

CONCLUSIONS: Since the first limited survey in 1996 of susceptibility to imidacloprid, there has been no significant change in maximum TR, either 1 or 8 DAT of populations tested within each year. However, when LC_{50}'s were compared to the most susceptible strain in any year, there was a marked increase of as much as 450% in the maximum TR. Based on these results, some growers in eastern Canada where the more tolerant populations were found may experience problems if imidacloprid is the sole control applied for CPB adults in 2002. The 2001 range in susceptibility to thiamethoxam for CPB populations was narrower than for imidacloprid. Differences in susceptibility among field populations likely reflected natural variability among populations and difference in ages of collected adults. In the limited 2001 survey, observed TR's for cypermethrin, azinphosmethyl and endosulfan had not changed significantly, indicating that resistance has remained stable.

Table 1. Number of field populations of CPB-adults tested in direct contact bioassays for each insecticide in each year.

Insecticide	Number of field populations tested					
	1996	1997	1998	1999	2000	2001
imidacloprid	14	14	29	30	36	38
thiamethoxam	-	-	-	-	40	27
cypermethrin	9	8	8	8	13	8
azinphosmethyl	6	8	9	4	5	9
endosulfan	7	7	8	4	3	2

Table 2. Dose-response of populations of CPB to selected insecticides applied by direct contact in bioassay, 2001.

Insecticide	DAT	Range[1] LC_{50} (ppm)	Maximum Tolerance Ratio[2]					
			1996	1997	1998	1999	2000	2001
imidacloprid	1	0.5-5.6	14	10	10.7	6	10.4	11.2
	8	4.8-86.0	-	23.1	4	13	18.3	17.9
thiamethoxam	1	0.7-11.0	-	-	-	-	<8.3	15.7
	8	3.3-18.0	-	-	-	-	4.8	5.5
cypermethrin	2	11.0 - 600	64	28	34.2	>45.0	75	55
azinphosmethyl	2	250 - 2800	30	12	4.6	10.9	9.2	11
endosulfan	2	65.0 - 3800	166	111.1	>100.0	>100.0	51	58

[1] Observed range in LC_{50} (ppm) in 2001.

[2] Maximum Tolerance Ratio (TR) = LC_{50} of most tolerant CPB population/LC_{50} of most susceptible CPB population.

END OF SECTION G: BASIC STUDIES - Entomology - REPORT # 75
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SECTION H:	**PEST MANAGEMENT METHODS /Méthodes de lutte dirigée**
0 Reports	**BIOLOGICAL CONTROL of Insects, Mites, Nematodes /Lutte biologiques - insectes, acariens, nématodes** **Insect Pheromones and Natural Products / Phéromones des insectes et prodruits naturelles** **Other Methods**

Cross-reference: See index for related reports on Predators, Parasites, Resistant Crops or cultivars.

SECTION I:	**INSECT AND MITE PEST SURVEYS AND OUTBREAKS /Enquêtes phytosanitires et infestations**
REPORT/RAPPORT #:	**76 - 79**
PAGES:	**211 - 219**
EDITOR:	**Mr. Hugh G. Philip**
4 reports	British Columbia Ministry of Agriculture and Food 200-1690 Powick Road, Kelowna, BC V1X 7G5 Email: hugh.philip@gems8.gov.bc.ca Tel: (250) 861-7230 Fax: (250) 861-7490

2001 PMR REPORT # 76 SECTION I: SURVEYS and OUTBREAKS - Insects and mites
STUDY DATA BASE: 375 - 1122 - 9614

CROP: Alfalfa (*Medicago officianalis* L.)
PEST: Alfalfa blotch leafminer (*Agromyza frontinella*) Rondani

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TITLE: SURVEY FOR THE OCCURRENCE OF ALFALFA BLOTCH LEAFMINER IN EASTERN SASKATCHEWAN, 2001

METHODS: On July 5-6, September 6, and October 15, 2001, surveys of alfalfa fields were conducted by JJS in two transects, southeast and east of Regina (July) or Saskatoon (September) to the Manitoba border. The method of field selection was to choose a field composed of a substantial amount of alfalfa that was at least 50 km from the last sampling location. In the field, 30 stems of alfalfa were collected by randomly severing a stem at soil level every 3 to 5 walking steps in a transect at 30 stops across the field. The samples were inspected for alfalfa blotch leafminer damage and placed in a paper bag that was labeled with the global positioning system location, field type and size. Samples were subsequently examined under a stereomicroscope for closer inspection.

RESULTS: Twenty-four sites of alfalfa under various management practices were inspected in the survey. Unlike previous years, when no evidence of alfalfa blotch leafminer was found, alfalfa leaflets exhibiting damage similar to that caused by this insect were found in 21 of the 24 fields surveyed. Two types of foliar damage were seen: pinhole feeding sites on leaflets, and mines, usually extending some distance down a leaflet. One larva was found in a mined leaflet from the Red Jacket site, but it died in the mine. While the pinholes were typical of alfalfa blotch leafminer injury, some mines found did not

have the classical question mark pattern of alfalfa blotch leafminer. Rather, they appeared somewhat but not exactly like those of the serpentine leafminer, *Liriomyza brassicae* (Riley). These aberrantly-shaped mines were excluded from the results of the September survey, but were included in the July one, which may, therefore, overestimate leafminer damage incidence. The level of damage on individual alfalfa stems was generally very low, and likely would not have resulted in any economic loss. Field locations and alfalfa blotch leafminer damage incidence, expressed as the number and percentage of stems infested, are listed in Table 1.

The reasons for the sudden apparent proliferation of alfalfa blotch leafminer in many locations in the province following two years of fruitless surveys are uncertain. The first survey in 2001 was conducted earlier than usual and in a previously unsurveyed region. The area had received considerable rainfall in the spring, and cutting had yet to occur in all but one of the hay fields. On the other hand, the September survey was conducted at a time and in an area in which previous surveys were conducted, but in which no evidence of alfalfa blotch leaf miner damage had been found. The high number of damaged stems in the Manitoba location, where alfalfa blotch leafminer is known to occur, and decreasing levels of damage the farther west the survey, suggests that the insect may have been in Saskatchewan previously, but at levels too low to detect.

The survey also detected considerable evidence of alfalfa weevil (*Hypera postica* Gyll.) injury to leaflets and stems in seven of the alfalfa fields surveyed. This represents a marked spread, both eastward and northward, in the distribution of this insect in Saskatchewan.

CONCLUSIONS: This survey presents the first report of alfalfa blotch leafminer injury to alfalfa in the province of Saskatchewan. The levels of damaged leaflets found were not high, but the number and locations of infested fields suggest that the insect has been present in the province for some time, despite not being detected in previous surveys.

Table 1. Location of alfalfa fields sampled for the presence of alfalfa blotch leaf miner (ABLM) in eastern Saskatchewan in July and September, 2001.

Nearest Centre	Global Positioning System Location	Field Type[1]	Field Size (ha)	ABLM Infestation /Comments
a) Survey July 5 - 6, 2001				
Richardson	N 50°23.41' W 104°24.70'	Hay	15	no ablm, bad leaf spot
Sedley	N 50°03.20' W 103°46.53'	Hay	8	6 stems, 20%
Heward	N 49°45.73' W 103°11.51'	Alfalfa/Grass Hay	12	3 stems,10 %
Estevan west	N 49°10.11' W 103°02.53'	Hay	6	2 stems, 6.7%, heavy alfalfa weevil damage
Estevan east	N 49°10.55' W 102°39.40'	Seed	40	3 stems, 10%, rank growth poor seed set
Glen Ewen	N 49°12.38' W 103°00.12'	Alfalfa/Grass Hay	12	4 stems, 13%, alfalfa weevil damage
Pierson, MB	N 49°09.39' W 101°16.43'	Alfalfa/Grass Hay	25	24 stems, 80%
Moosomin	N 49°55.45' W 101°39.19'	Ditch	Sporadic	9 stems, 30% alfalfa
Red Jacket	N 50°13.68' W 101°50.93'	Grass/Alfalfa Hay	8	1 stem, 3.3%
Grenfell	N 50°24.68' W 102°54.99'	Alfalfa/Grass Hay	8	1 stem, 3.3%
Abernethy	N 50°44.38' W 103°24.36'	Hay	32	no ablm, producer just started cutting
b) Survey September 6, 2001				
Allan	N 51-58.19' W 106-01.63'	Hay	50	no ablm, alfalfa weevil damage
Guernsey	N 51-58.19' W 106-01.63'	Hay	40	5 stems, 17%, alfalfa weevil damage
Dafoe	N 51-46.73' W 104-32.84'	Alfalfa/Grass Hay	8	2 stems, 7%
Quinton	N 51-23.25' W 104-24.81'	Alfalfa/ Red clover/Grass Hay	20	3 stems, 10 %, alfalfa weevil damage
Leross	N 51-15.62' W 103-45.10'	Alfalfa/Grass Hay	50	6 stems, 20%, alfalfa weevil damage
Goodeve	N 51-03.95' W 103-12.01'	Grass	32	5 stems, 17%
Melville	N 50-54.93' W 102-39.40'	Seed	80	16 stems, 53%, heavy grasshopper infestation
Atwater	N 50-54.93' W 102-39.40'	Seed	60	6 stems, 20%
Yorkton	N 51-12.72' W 102-34.08'	Grass/Alfalfa Hay	25	5 stems, 17%, 1 alfalfa weevil larva
Tuffnell	N 51-19.15' W 103-21.12'	Ditch/Alfalfa	300 m	8 stems, 27%
Wadena	N 51-57.21' W 103-50.20'	Hay	4	18 stems, 60%
Watson	N 52-08.10' W 106-33.22'	Hay	50	3 stems, 10%, alfalfa weevil damage
c) Survey October 15, 2001				
Saskatoon	N 52-04.15' W 106-34.34'	Seed	1	no ablm

[1] Hay - all fields from July 5-6 survey had not been cut except for Abernethy; all fields from September 6 survey had been cut once, except Watson, which had two cuts; Seed samples - only stems with leaves were collected.

2001 PMR REPORT # 77 SECTION I: SURVEYS and OUTBREAKS - Insects and Mites
STUDY DATA BASE: 364-2120-9604

CROP: Alfalfa, annual field crops, weeds
INSECT: Multicoloured Asian lady beetle, *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae)

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TITLE: DISCOVERY OF THE MULTICOLOURED ASIAN LADY BEETLE IN MANITOBA

MATERIALS: Sweep net

METHODS: A lady beetle species not previously found in annual lady beetle surveys was collected by W. J. Turnock in Winnipeg in August 2000. Four more specimens were collected from the shore of Lake Manitoba at the Delta Field Station (50°11'N, 98°23'W) in October, 2000. The specimens were submitted to Dr. Rob Roughley, University of Manitoba, Winnipeg, Manitoba, who forwarded them to Dr. Robert Gordon, former coccinellid taxonomist at the Systematic Entomology Laboratory, Washington, DC. Beach collections from the shore were repeated in May and September, 2001. Samples comprised all the beetles found in 0.5 m to 1 m transects, extending at a right angle from the edge of the water to the beach ridge. Sweep net collections of lady beetles were taken along the edges of fields of cereal crops, canola, flax, alfalfa, and herbaceous weeds in the Red River Valley of Manitoba in August and September, 2001. The beetles from the beach and sweep collections were brought to the Cereal Research Centre, Winnipeg, and were counted and identified to species.

RESULTS: All specimens submitted in 2000 for identification were *Harmonia axyridis*. The relative abundance of *H. axyridis* and its ranking of abundance compared to other lady beetle species are included in the table below. Early collections sampled the beetles that emerged after overwintering and the later collections sampled beetles that recently completed their development. All the major lady beetle species in Manitoba have one generation per year.

CONCLUSIONS: The discovery of *H. axyridis* in sweep net samples in the Red River Valley and from collections on the shore of Lake Winnipeg indicate this species has become widely distributed in southern Manitoba. The species appears to have arrived very recently for it was absent in field and beach collections in 1999 and from beach collections in May 2000. It already comprises 1.5% of lady beetles in fields in the Red River Valley and was ranked in 2001 behind only *Hippodamia tredecempunctata* and *Coccinella septempunctata* in abundance. It was found to be less abundant in beach samples relative to field collections, but this may be due to later flight habits. Adults of *H. axyridis* were collected in 2001 in Winnipeg and LaSalle, Manitoba as late as the first week of November. Although adults of *H. axyridis* were collected on the shore of Lake Manitoba in the spring along with indigenous species of lady beetles, the ability of *H. axyridis* to overwinter can be inferred but not confirmed. Studies in 2002 will be undertaken to determine if this species can successfully overwinter in Manitoba.

Table 1. The relative abundance and species ranking of *Harmonia axyridis* in southern Manitoba, 2001.

Collection Sites	Sample Dates	Relative Abundance		
		n	% of n	Spp. Ranking[1]
Fields - Red River Valley	August - September	1110	1.5	3 (5)
Beach - Lake Manitoba	May	1991	<1.0	5 (8)
	September	1292	<1.0	4 (6)

[1] Number in brackets is the number of species found in collections.

2001 PMR REPORT # 78 SECTION 1: SURVEYS and OUTBREAKS - Insect and Mites

CROP: Grapes (Vitis *vinifera, V. labrusca* and hybrids)
PESTS: Grape Leafhopper, *Erythroneura comes* (Say), Potato leafhopper, *Empoasca fabae* (Harris), Threebanded leafhopper, *Erythroneura trincata* Fitch, European Red Mite, *Panonychus ulmi* Koch, Grape erineum mite, *Colomerus vitis* (Pagenstecher), Grape berry moth, *Endopiza viteana* Clemens, Japanese beetle, *Popillia japonica* Newman

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TITLE: INSECT PEST ACTIVITY ON GRAPES IN NIAGARA REGION ONTARIO, 2001

METHODS: Approximately 1,360 hectares were monitored weekly by visual observation from 30 April to 31 August 2001. The monitored area was comprised of 368 blocks at over 110 farm locations covering entire Niagara peninsula. Labrusca (*Vitis labrusca*) cultivars (juice and fresh market), French hybrids and vinifera (*V. vinifera*) cultivars (for wine) were monitored for pest activity, crop phenology, crop load estimations and overall plant health weekly for routine evaluations. Fruit sampling for harvest indices and pest activity continued through to harvest (25 October 2001) at approximately 225 hectares each week. The pests/indicators are listed below along with the number of separate blocks that had measurable injury at some point during the growing from the identified agent. Approximately half of the monitored blocks used overhead irrigation

RESULTS: The dominant pest of grapes was the leafhopper group (grape leafhopper, *Erythroneura comes* (Say), potato leafhopper, *Empoasca fabae* (Harris), threebanded leafhopper, *Erythroneura trincata* Fitch) being detected at 135 of the 368 monitored blocks. The grape leafhopper (GLH) was detected at 88 blocks, potato leafhopper (PLH) at 74 blocks and the threebanded leafhopper (3BLH) at 4 blocks. GLH were first detected just prior to bloom. PLH activity in vineyards was not apparent until after fruit set in July. Young vines were more severely affected than older vines bearing crop. Peripheral vines of the vineyard had more injury than those located in the central portions of the vineyard.

European red mites (*Panonychus ulmi* Koch) continue to be detected in commercial vineyards causing some minor leaf bronzing. Mite populations greater than 5 mites per leaf were found at 51 blocks of which 46 were *V. vinifera* cultivars and 5 were hybrid cultivars.

A second mite species, the grape erineum mite (*Colomerus vitis* (Pagenstecher), was found at 22 blocks. This pest was noted causing leaf injury at 15 *V. vinifera* blocks and 7 hybrid cultivar blocks. The hybrid cultivar Vidal appeared extremely sensitive to this pest with some infested vines having 50% reduction in leaf size and shoot length inhibition.

Grape berry moth, *Endopiza viteana* Clemens, was detected causing direct fruit injury at 22 blocks. *V. vinifera* cultivars had the most injury with damage levels ranging from 1.5% to 4 % crop loss at harvest. Secondary pathogens were also evident at harvest along with the berry moth larvae.

A new pest causing economic injury directly to grapevines in the Niagara peninsula, the Japanese beetle, *Popillia japonica* Newman, was found at 8 locations. Direct injury to shoot terminals was noted at one location on 50% of the vines and 3 to 5 shoots per vine. This pest has been noted on ornamentals and turf in small numbers but 2001 was the first record of significant commercial vineyard injury.

CONCLUSIONS: Leafhopper species continue to become more dominant in the peninsula area especially over the past 3 years. Effective use of mating disruption technology for grape berry moth appears to be keeping this insect at or below economic damage thresholds. Dry weather conditions over the past three seasons is leading to more detection of mite species in commercial vineyards that are causing leaf injury and reduced photosynthetic activity. There is need to do further surveys to determine presence of native beneficial predators and parasites of leafhoppers and mites, numbers and potential for augmentation to control these expanding pest populations in commercial vineyards.

2001 PMR REPORT # 79 SECTION I: SURVEYS and OUTBREAKS - Insects and mites

CROP: Spring wheat, *Triticum aestivum* (L)
Spring barley, *Hordeum vulgare* (L)
PEST: Hessian fly, *Mayetiola destructor* (Say)

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TITLE: OCCURRENCE OF HESSIAN FLY ON SPRING WHEAT AND BARLEY IN QUEBEC, FOR THE CROP SEASONS, 1998-2001

METHODS: Spring wheat seed production fields and experimental field plots were scouted in crop seasons 1998 to 2001 during the period of last larval instar or puparium stage of Hessian fly. Sampling dates were selected to coincide with appearance of the first generation (between June 4 and June 15) and the second generation (between July 30 and August 17). Wheat plants were sampled randomly in seed grower fields in 1998 and in experimental fields at Saint-Augustin-de-Desmaures and at Saint-Joseph-de-la-Pointe-de-Lévy in 2001. Wheat and barley plants were sampled following a predetermined pattern in experimental fields at Saint-Hyacinthe, Normandin and Sainte-Rosalie. The number of infested plants with larvae or pupae (vs total number of plants examined) was recorded.

RESULTS: The data are shown in Table 1.

CONCLUSIONS: Hessian fly-infested wheat plants had poor vigour, reduced tillering and secondary tiller mortality. Hessian flies were observed in many spring wheat and barley fields of Quebec. Its presence could pose a threat to expected crop yields since Hessian fly can cause severe injury and increase lodging in wheat and barley plants. Hessian fly infestations have not been reported in Quebec for many decades.

Table 1. Number of spring wheat and barley plants infested by larvae or pupae of Hessian fly in Quebec for the crop seasons 1998-2001.

Fields location	Crop	Scouting period	Gen.	Field type[1]	Year			
					1998	1999	2000	2001
Sainte-Rosalie	Wheat	June 4	1	Prod	2 (127)[2]	-	-	-
Beloeil	Wheat	June 4	1	Prod	3 (76)	-	-	-
Saint-Damasse	Wheat	June 4	1	Prod	5 (83)	-	-	-
Saint-Hugues	Wheat	June 4	1	Prod	2 (70)	-	-	-
Sainte-Rosalie	Wheat	July 30	2	Exp	-	91 (420)	-	-
Sainte-Rosalie	Barley	July 30	2	Exp	-	25 (434)	-	-
Normandin	Barley	Aug. 5&15	2	Exp	-	3 (522)	7 (1120)	-
Saint-Hyacinthe	Wheat	Aug. 3&17	2	Exp	-	4 (313)	8 (101)	-
Saint-Hyacinthe	Wheat	June 6	1	Exp	-	-	-	86 (929)
Saint-Hyacinthe	Barley	June 6	1	Exp	-	-	-	3 (293)
Saint-Augustin de Desmaures	Wheat	June 15	1	Exp	-	-	-	3 (50)
Saint-Joseph-de-la-pointe-de-Lévy	Wheat	June 14	1	Exp	-	-	-	9 (75)

[1] Exp = experimental field and Prod = seed production field.
[2] The number of plants observed is enclosed in parentheses.

End of Section I: OUTBREAKS and SURVEYS - Insects and mites
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SECTION J: **NEMATODES/ Nématodes**

REPORT /RAPPORT #: **80 - 82**

PAGES: **220 - 229**

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2001 PMR REPORT # 80 **SECTION J: NEMATODES**
ICAR: 206003

CROP: Various crops (See Table 1.)
PEST: Lesion Nematode, *Pratylenchus penetrans*

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TITLE: NEMATODE POPULATIONS IN DIFFERENT CROPS

METHODS: The trial was conducted during 1995 - 1998 at the AAFC Research Farm at Harrington, Prince Edward Island. The site had a fine sandy loam with a pH of 5.8-6.0, the previous crop in each year was soybean (*Glycine max* L. cv. Maple Amber). The individual plot sizes were 6.5 m by 1.8 m, the experimental design was a randomized complete bock with four replicates. Seeding took place in late May and nematode samples were taken in late September in each year. Recommended cultural practices were followed for each crop species. Statistical analyses were conducted on $\log_{10}(X+1)$ data.

RESULTS: See Table 1.

CONCLUSIONS: Orthogonal comparisons indicated that the marigold species and cultivars harbored significantly ($P \leq 0.001$) fewer root lesion nematodes in soil and roots than the other crop species and cultivars. Only black-eyed Susan had root counts in the same range as the marigolds. Nematode levels in annual ryegrass and meadow fescue roots were also low and orthogonal comparisons indicated that counts in the grasses were significantly ($P \leq 0.001$) less than in the legumes. The effects of the different population levels of root lesion nematodes on subsequent potato crops are being analysed.

Table 1. Population levels of root lesion nematodes[1] in root zone soils and roots of different crop species and cultivars.

Common name	Species and cultivar	Nematodes (per kg soil)[2]	Nematodes (per g root)[2]
Marigold	*Tagetes erecta*	780	580
	T. patula	930	390
	T. tenuifolia cv. Lemon Gem	800	220
	T. erecta cv. Crackerjack	1140	580
Black-eyed Susan	*Rudbeckia hurta*	1590	490
Annual ryegrass	*Lolium multiflorum* cv. Lemtal	2180	920
Meadow fescue	*Fustuca elatior* cv. Miner	1870	1000
Chicory	*Cichorum intybus*	2390	1140
Common buckwheat	*Fagopyrum sagittatum*	1800	1240
Oilseed radish	*Raphanus sativus* cv. Baladi	2940	1500
	R. sativus cv. Common	2850	3510
Alfalfa	*Medicago sativa* cv. Surpass	2770	1770
Phacelia (Bee plant)	*Phacelia tanacetifolia* cv. Gipha	3440	1780
Canola	*Brassica napus, B. campestris, B. rapa*	2220	2070
Sorghum	*Sorghum bicolor*	2860	2340
Sweet clover	*Melilotus officinalis*	3050	2830
Alsike clover	*Trifolium hybridum*	5560	2890
Berseem clover	*T. alexandrinum*	7980	6820
Persian clover	*T. resupinatum*	2570	3090
Red clover	*T. prantense* cv. Marino	2430	3280
White clover	*T. repens*	3970	4440
Japanese millet	*Echinochloa frumentacea*	6380	3660
Sunola	*Helianthus annuus* cv. Sunola	6250	4240
Soybean	*Glycine max* cv. Proteus	5530	5280
Hairy vetch	*Vicia villosa*	5190	6500

[1] Primarily *Pratylenchus penetrans*; samples collected in late September for 1995, 1996, 1997 and 1998.

[2] Back-transformed means; statistical analyses conducted on $\log_{10}(X+1)$ data averaged over 4 years.

2001 PMR REPORT # 81 **SECTION J: NEMATODES**
ICAR: 206003

CROP: Soybean (*Glycine max* (L.) Merr) cvs Jack, Sterling
PEST: *Fusarium oxysporum, Fusarium* spp., *Macrophomina phaseolina, Trichoderma* spp. Soybean cyst nematode *Heterodera glycines* (SCN)

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TITLE: EFFECT OF FUNGICIDE SEED TREATMENTS ON FUNGAL AND NEMATODE PATHOGENS IN ROOTS OF SCN RESISTANT AND SUSCEPTIBLE CULTIVARS

MATERIALS: APRON MAXX RTA (metalaxyl-m + fludioxonil 96.5 + 144 g a.i./l), ANCHOR (carbathiin 66.7 g a.i./l, thiram 66.7 g a.i./l), PROTEGÉ ALLEGIANCE (oxystrobin 153g a.i./kg metalaxyl, 208 g a.i./kg)

METHODS: Liquid seed treatments were applied to the two soybean cvs Jack (SCN resistant) and Sterling (SCN susceptible) with sufficient distilled water to ensure even distribution of the treatment, air dried, packaged and stored at 3°C for 24 hr prior to planting. PROTEGE ALLEGIANCE was applied as a powder. Plots were single rows, 4.5 m in length with 100 seeds/row. Plots were replicated 5X in a randomized block design. The experiment was planted 00/07/21. At each sample date, 5 adjacent plants for root bioassay were selected from each plot. Tap roots from replications 1-3 were surface sterilized in 1.5% sodium hypochloride for 3-4 min. Sections of tap roots from near the soil line were plated on acidified potato dextrose agar. Observations of infected sections were made after 5 days incubation at 22°C in the laboratory. Germination counts and vigour ratings were made 14 days and 35 days, respectively, after planting. Roots were sampled for fungal pathogens at 2, 4 and 8 weeks after planting. To assess SCN infection, roots of 5 plants/control plot in replications 1-3 were dug carefully and cysts were removed by washing.

RESULTS: The experiment was planted much later than the normal date for planting soybeans in the Harrow area; therefore, the warmer temperatures at planting may have influenced fungal and SCN populations and activity.

The most common pathogen isolated from root sections was *Fusarium oxysporum* and the frequency of isolation increased with plant age. Sterling had significantly more infection than Jack four weeks after planting. Four weeks after planting, incidence of *F. oxysporum* was significantly lower in plots treated with PROTEGÉ ALLEGIANCE and significantly greater in plots treated with APRON MAXX RTA than in the control (Table 1). The 3 additional fungi that were most frequently isolated were *Fusarium* spp., *Macrophomina phaseolina* and *Trichoderma* spp. (Table 2). Seed treatments and cultivars did not significantly affect the incidence of these fungi in this experiment. Emergence of Jack (81%) was significantly greater than Sterling (58%). This may be the result of seed vigour. PROTEGÉ ALLEGIANCE significantly improved overall emergence. Overall vigour of Jack was significantly

greater than Sterling. PROTEGÉ ALLEGIANCE and APRON MAXX RTA improved vigour but not significantly (Table 2). Numbers of mature SCN cysts on roots of Jack were 0, 145 and 37 g of wet root after 2, 4 and 8 weeks, respectively. Numbers of mature SCN cysts on roots of Sterling were 0, 342 and 139 per g of wet root after 2, 4 and 8 weeks, respectively (Table 3).

CONCLUSIONS: Based on these preliminary results, it is difficult to draw conclusions. Both Jack and Sterling sustained damage by SCN which would allow entry into roots by fungal pathogens. Fewer cysts developed on Jack than Sterling and it appeared that with a late planting, most infection occurred in the first 4 weeks following planting. It is also possible that infection was uniform throughout the period and development of SCN females was slower during the last 4 weeks. More detailed research is required to relate penetration of SCN juveniles into soybean roots with infection by fungi and the role of fungicide seed treatments in this process. The seed treatments evaluated appeared to affect the fungi differently. *F. oxysporum* was the most common pathogen isolated at this site.

ACKNOWLEDGEMENTS: The authors would like to thank C.P. Meharg and S. Duransky for technical and secretarial assistance, respectively.

Table 1. Effect of seed treatments and cultivars on the percentage of soybean roots infected with fungi.

Cultivar		Treatment	Rate Product /kg seed	*F. oxysporum*			*Fusarium* spp.		
				2 wk	4 wk	8 wk	2 wk	4 wk	8 wk
1	Jack			2	14	29	4	12	5
2	Sterling			4	24	28	3	13	5
		$LSD_{0.05}$		4.1	5.1	10.5	4.0	6.4	3.7
		Pr > F		NS	.0051	NS	NS	NS	NS
1		Control		2	19	29	4	14	3
2		APRON MAXX RTA	3.28 ml	1	29	30	3	9	7
3		ANCHOR	6 ml	5	19	27	5	18	5
4		PROTEGÉ ALLEGIANCE	1 g	3	10	29	2	10	7
		$LSD_{0.05}$		5.8	7.3	14.8	5.7	9.0	5.2
		Pr > F		NS	.0034	NS	NS	NS	NS
1	Jack	Control		2.7	14.7	34.7	4.0	13.3	2.7
2		APRON MAXX RTA	3.28 ml	0	20.0	18.7	2.7	8.0	5.3
3		ANCHOR	6 ml	6.7	14.7	37.3	6.7	14.7	4.0
4		PROTEGÉ ALLEGIANCE	1 g	0	8.0	26.7	2.7	13.3	8.0
5	Sterling	Control		1.3	22.7	23.0	4.0	14.7	2.3
6		APRON MAXX RTA	3.28 ml	2.7	38.7	41.3	2.7	9.3	8.0
7		ANCHOR	6 ml	4.0	22.7	16.0	4.0	21.3	5.3
8		PROTEGÉ ALLEGIANCE	1 g	6.7	12.0	32.0	1.3	6.7	5.3
		$LSD_{0.05}$		8.1	10.3	20.9	8.0	12.8	7.4
		Pr > F		NS	NS	NS	NS	NS	NS

Table 2. Effect of seed treatments and cultivars on percentage of roots infected and emergence and vigour of soybeans.

	Cultivar	Treatment	Rate product /kg seed	*Macrophomina phaseolina*			*Trichoderma sp .*			Emer-gence (%)	Vigour (1-5)
				2 wk	4 wk	8 wk	2 wk	4 wk	8 wk	2 wk	5 wk
1	Jack			4	5	5	3	4	10	81	4.1
2	Sterling			2	4	5	3	10	18	58	2.6
		$LSD_{0.05}$		2.6	2.6	3.4	3	5.5	8.2	8.3	0.4
		Pr > F		NS	NS	NS	NS	NS	NS	0.000	0.000
1		Control		3	5	7	3	15	21	54	3.1
2		APRON MAXX RTA	3.28 ml	2	6	4	1	5	10	80	3.5
3		ANCHOR	6 ml	2	5	7	2	7	10	64	3.1
4		PROTEGÉ ALLEGIANCE	1 g	5	1	2	5	2	17	80	3.6
		$LSD_{0.05}$		3.7	3.7	4.9	4.3	7.8	11.6	11.8	0.62
		Pr > F		NS	NS	NS	NS	NS	NS	0.001	NS
1	Jack	Control		5.3	4.0	5.3	4.0	12.0	13.3	69	4.4
2		APRON MAXX RTA	3.28 ml	2.7	6.7	2.7	2.7	1.3	9.3	90	4.2
3		ANCHOR	6 ml	4.0	6.7	8.0	1.3	1.3	10.7	79	3.6
4		PROTEGÉ ALLEGIANCE	1 g	2.7	1.3	2.7	2.7	1.3	8.0	87	4.2
5	Sterling	Control		1.3	5.3	9.0	1.3	17.3	28.0	38	1.8
6		APRON MAXX RTA	3.28 ml	1.3	5.3	5.3	0.0	8.0	10.7	70	2.8
7		ANCHOR	6 ml	0.0	4.0	5.3	2.7	13.3	9.3	50	2.6
8		PROTEGÉ ALLEGIANCE	1 g	6.7	1.3	1.3	6.7	2.7	25.3	73	3.0
		$LSD_{0.05}$		5.3	5.19	6.9	6.1	11.0	16.3	16.6	0.89
		Pr > F		NS	NS	NS	NS	NS	NS	NS	NS

Table 3. Cysts[1] of SCN on roots of the soybean cvs. Jack and Stirling at Harrow on infested soil, 2000.

Cultivar	Weeks after Planting		
	2	4	8
Jack (resistant)	0	145	37
Sterling (susceptible)	0	342	139

[1] All cysts were removed from roots of 5 plants and counted. Egg counts in cysts were not determined.

2001 PMR REPORT # 82 **SECTION J: NEMATODES**
ICAR: 206003

CROP: Wheat (*Triticum aestivum*), cvs. AC Barrie, AC Walton, AC Wilmot, Belvedere, Glenlea
PEST: Lesion Nematode, *Pratylenchus penetrans*

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TITLE: CONTROL OF NEMATODES IN WHEAT

MATERIALS: TEMIK (aldicarb 15 G) and fosthiazate (900g/L EC)

METHODS: The trial was conducted in 2000 at the AAFC Research Farm at Harrington, Prince Edward Island. The site had a fine sandy loam soil with a pH of 5.8-6.0, the previous crop was soybean (*Glycine max* L. cv. Proteus), and cereals had not been planted in the past four years. The individual plot sizes were 6.5 m by 1.8 and the experimental design was a randomized complete bock with four replicates. NPK fertilizer was broadcast at 300 kg/ha and worked in with spring-toothed harrows. The nematicide treatments were: 1) untreated check, 2) TEMIK granular broadcast by hand at 2.24 kg a.i./ha, and 3) fosthiazate emulsifiable concentrate applied with a back sprayer at 13.5 kg a.i./ha. The chemicals were applied on June 2 and all plots were worked to a depth of 10 cm with a rototiller. On the same date after the chemicals were applied, seeding took place at a rate of 350 seeds per m^2, at a depth of 2 cm and with row spacings of 18 cm. On June 5 a top dressing of ammonium nitrate at 150 kg/has was broadcast. Refine Extra at 20 g/ha, and 2,4-D at 1 L/ha with Agrol 90 surfactant at 0.2 L/ha were applied on June 27. Samples for nematode analyses were taken from root zone soil on May 31and from root zone soil and roots on August 29. Statistical analyses were conducted on $\log_{10}(X+1)$ nematode data. Harvest was on October 1.

RESULTS: See Tables 1 and 2.

CONCLUSIONS: The application of the chemicals, as expected, reduced the root lesion nematode populations significantly in roots and fosthiazate was more effective than TEMIK ($P \leq 0.001$). There were no cultivar effect for nematodes in soil or roots nor were there treatment x cultivar interactions (Table 1). The nematicide treatments increased grain yields by an average of 89 % ($P \leq 0.001$), and this was most pronounced in AC Walton (Table 2). This variation resulted in a cultivar effect ($P \leq 0.001$) and a cultivar x treatment interaction ($P \leq 0.002$) for yield.

Table 1. Effect of nematicides on the population density of root lesion nematodes[1] in root zone soils and roots of different spring wheat cultivars.

Cultivar	Number of root lesion nematodes			
	Untreated	TEMIK	Fosthiazate	Cultivar means
Per kg of oven dried soil[2]				
AC Barrie	1070[3]	830	330	660
AC Walton	950	400	200	420
AC Wilmot	2790	720	400	930
Belvedere	830	760	200	500
Gleanlea	570	720	280	490
Treatment means	1060 a[4]	670 a	270 b	
Per g of oven dried root[2]				
AC Barrie	2570	1190	110	690
AC Walton	1460	600	90	430
AC Wilmot	2140	1170	100	620
Belvedere	6840	540	90	690
Glenlea	3440	360	140	560
Treatment means	2860 a[4]	700 b	100 c	

1 Primarily *Pratylenchus penetrans*

2 Samples collected on 29 August 2000; density just prior to planting (n=60) was 1090/kg of soil.

3 Back-transformed mean; statistical analyses conducted on $\log_{10}(X+1)$ data.

4 Cultivar means in the column or treatment means in the row followed by the same letter are not different ($P \leq 0.05$) according to Duncan's multiple range test; letters omitted if not significant.

Table 2. Effect of nematicide treatments on grain yields in different spring wheat cultivars.

Cultivar	Grain yields (kg/ha)				
	Untreated	ALDICARB	Fosthiazate	Cultivar means	% increase[1]
AC Barrie	1466	1721	2406	1865 a[2]	41.0
AC Walton	1156	1842	3491	2163 b	244.5
AC Wilmot	1121	1792	2413	1775 a	87.6
Belvedere	1124	1730	2287	1714 a	78.7
Glenlea	1411	2231	3872	2505 c	216.3
Treatment means	1256 a[2]	1863 b	2894 c		89.4

[1] Mean of grain yields in nematicide-treated plots vs. mean in untreated plots at harvest on 1 October 2000.

[2] Cultivar means in the column or treatment means in the row followed by the same letter are not different ($P \leq 0.05$) according to Duncan's multiple range test.

END OF SECTION J: NEMATODES
REPORT # 80-82
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TITLE: 2001 PEST MANAGEMENT RESEARCH REPORT - VOLUME 40

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EDITOR:	**Ms. Leslie MacDonald**
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2001 PMR REPORT # 83

SECTION K: FRUIT - Diseases
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 MINERALL CLAY ON APPLE POWDERY MILDEW AND COLOUR, 2000

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

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. Twenty trees were separated into 5 blocks of 4 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), and 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. Foliage chlorophyll was recorded with a Minolta SPAD 502 leaf chlorophyll meter (Minolta Canada, Mississauga, ON) on 22 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 from each single tree replicate evaluating each fruit for net russetting and sunburn. Fruit colour was assessed with a Minolta CR 200 chroma meter (Minolta Canada, Mississauga, ON) on 25 harvested apples from each single tree replicate 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. 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 significantly different between treatments and control (Table 1). The lower number of white tips in the treatments could have been the result of NOVA , applied during bloom, eliminating some of the less severe primary infections. However, although fewer white tips were present in the treatments then the control there was more than enough white tips to act as inoculum sources. In 1999 the average number was 2.1 white tips per tree compared to 14.4 or more white tips in 2000. Incidence of foliar powdery mildew was effectively controlled by MINERALL CLAY throughout the growing season. The low rate of MINERALL CLAY appeared to be slightly less effective than the high rate although it did not differ significantly. KUMULUS was more effective than CLAY in June and July but was no more effective than CLAY in September. According to the SPAD meter the foliage treated with MINERALL CLAY had a higher chlorophyll concentration (Table 2). The effect of this on growth and yield was not determined in this trial. Both rates of MINERALL CLAY were as effective as KUMULUS in reducing fruit russet caused by powdery mildew (Table 3). However, fruits treated with KUMULUS showed some phytotoxicity (sulphur burn) during the summer and fruits treated with clay did not. Incidence of sunburn was relatively low in the control and it was not possible to determine if MINERALL CLAY would reduce it. The high rate of MINERALL CLAY and KUMULUS had a significantly different chroma and hue than the control fruit for the red colour readings and could indicate a saturated red colour (Table 4). However, the amount of solid red in the apples were the same in all treatments. The green readings were more uniform although the chroma for the high rate of MINERALL CLAY and KUMULUS were different from the control.

CONCLUSIONS: MINERALL CLAY is an effective cover spray for apples and could provide benefits to apple growth not supplied by KUMULUS.

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					
		June 13		July 14		September 7	
		Incid.	Severity	Incid.	Severity	Incid.	Severity
NOVA bloom sprays 11.3 g followed by 6 KUMULUS 200 g sprays	14.4 b	13.2 c	1.8 c	78.4 c	17.4 b	86.0 b	29.1 b
NOVA bloom sprays 11.3 g followed by 6 CLAY 2.0 kg sprays	23.6 b	28.0 b	6.6 b	92.0 b	40.4 a	92.4 ab	45.6 b
NOVA bloom sprays 11.3 g followed by 6 CLAY 4.0 kg sprays	21.4 b	27.6 b	4.9 bc	90.0 b	36.4 a	86.8 b	41.4 b
Control	27.2 a	96.4 a	41.2 a	98.0 a	41.6 a	94.8 a	62.3 a
ANOVA Pr>F	0	<.0001	<.0001	<.0001	0.006	0.0237	0.007

* 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 Duncan's Multiple Range Test.

Table 2. SPAD Model 502 chlorophyll meter readings of Jonagold apple leaves treated with MINERALL CLAY.

Treatment and Rate per 100 L	SPAD Reading
NOVA bloom sprays 11.3 g followed by 6 KUMULUS 200 g sprays	37.6 b*
NOVA bloom sprays 11.3 g followed by 6 CLAY 2.0 kg sprays	40.9 a
NOVA bloom sprays 11.3 g followed by 6 CLAY 4.0 kg sprays	40.2 a
Control	36.0 b
ANOVA Pr>F	0.0013

* Each treatment was replicated four times. Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Duncan's Multiple Range Test.

Table 3. 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	2.0 a
NOVA followed by MINERALL CLAY 2.0 kg/100 L	16.0 b	1.4 b	5.3 a
NOVA followed by MINERALL CLAY 4.0 kg/100L	07.2 b	0.8 b	2.0 a
Control	56.0 a	8.4 a	5.3 a
ANOVA	0.0417	0.0494	0.1718

* Powdery mildew 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 Duncan's Multiple Range Test.

Table 4. Analysis of apple skin colour at a red and green location of fruit treated with MINERALL CLAY.

Treatment	Colour Characteristics[1]					
	L	a	b	Chroma	Hue	%Red[2]
A. RED AREA READINGS						
KUMULUS	43.8 a[3]	37.4 a	19.4 a	42.0 a	27.6 b	64.0 a
CLAY - low rate	44.8 a	33.7 bc	18.9 a	39.1 b	29.9 ab	57.0 a
CLAY - high rate	44.9 a	35.5 ab	19.4 a	40.7 a	28.8 b	60.3 a
Control	45.3 a	31.5 c	20.6 a	38.0 b	34.0 a	55.6 a
ANOVA Pr>F	0.6861	0.0041	0.3937	0.0005	0.0708	0.1548
B. GREEN AREA READINGS						
KUMULUS	73.8 ab	-6.3 a	37.0 b	38.9 b	92.9 a	not applic.
CLAY - low rate	73.9 ab	-8.6 a	38.6 ab	40.2 ab	101.7 a	not applic.
CLAY - high rate	74.4 a	-4.9 a	37.6 ab	39.2 b	97.4 a	not applic.
Control	71.2 b	-8.6 a	40.2 a	42.1 a	100.6 a	not applic.
ANOVA Pr>F	0.0883	0.1811	0.0677	0.025	0.243	not applic.

[1] Colour characteristics are the means of 25 fruit per treatment from a Minolta CR-200 Chroma meter where 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. \

[2] Percent Red colour data was arcsin transformed prior to analysis of variance. The detransformed means are presented here.

[3] Numbers followed by the same letter are not significantly different at $p = 0.05$ as decided by the Duncan's Multiple Range Test.

2001 PMR REPORT # 84 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Apples cv. Gala
PEST: Fire blight, *Erwinia amylovora* (Burrill) Winslow et al.

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TITLE: SCREENING COMMERCIAL MATERIALS FOR CONTROL OF FIRE BLIGHT, 2001

MATERIALS: STREPTOMYCIN (streptomycin sulfate 22.5% WP), GWN-9200 (gentimycin 10 WP), SO208 (oxolinic acid 20% WP)

METHODS: Two trials were conducted at the Pacific Agri-Food Research Centre, Summerland, B.C on two year-old Gala apple trees on M.9 rootstocks. The bare root trees were planted after trimming the roots in 5 gallon pots containing Sunshine mix #1. Approximately 2.5 cm of sand was placed on the bottom of each pot to help stabilize the trees. Sixty of these trees were put in a screen house on 9 April to be used in the first screening trial and the other 45 trees were kept in a 1°C cold room until needed. The trees were irrigated twice weekly for 2 hr with an automatic overhead sprinkler system. The experimental design of the trial was a randomised block with individual trees as replicates. Each treatment was replicated five times. Trees were separated from one another by 1 metre on all sides and were arranged in 10 rows with two rows forming a block. All treatments were applied with a spray bottle (80 ml per tree) on 9 May (20% bloom) and 14 May (full bloom). Regulaid (0.3%) was applied with some treatments (see Table 1). Blossoms were inoculated with a cell suspension of *Erwinia amylovora* (5.6×10^8 CFU/mL) 48 hr later on 16 May (full bloom). The suspension was a mixture of two different isolates of *E. amylovora* grown in nutrient broth for 24 hr. The isolates were known to be virulent on apple and were sensitive to streptomycin. Forty-eight hours after the blossoms were inoculated, the trees were wetted for 3 h. Trees for use in the second trial were placed in the screen house on 8 June. The statistical design and arrangement of the trees was the same as in the first trial. Treatments were applied on 22 June (early bloom) and 25 June (Full bloom). Blossoms were inoculated with a cell suspension of *E. amylovora* (3.2×10^7 CFU/mL) 48 hr later on 27 June (Full bloom). Forty-eight hours after the blossoms were inoculated, the trees were wetted for 3 h. Clusters displaying symptoms of fire blight indicated by blackening of flowers were recorded on 30 May (14 days after inoculation) for the first trial and on the 05 July (8 days after inoculation) for the second trial. Shoots displaying symptoms of fire blight indicated by blackening and wilting were only recorded for the second trial on July 26. Fire blight incidence was converted to percent infected clusters per tree, and the arcsin-transformed data were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan Multiple Range test was used for multiple comparison of means of fire blight incidence. Fruit finish was evaluated by spraying five year old Golden Delicious apple trees (replicated three times for each treatment) to runoff with a backpack sprayer on 11 May (early bloom) and 17 May (Full bloom). Fruit were harvested on 18 September by removing all fruit from each tree and examining each apple for russet (incidence) and percent of russett over the fruit (severity). Incidence and severity were converted to percent infected fruit per tree, and the arcsin-transformed data were subjected to analysis of variance with the General Linear Models

Procedure (SAS Institute, Cary, NC). The Waller-Duncan (K-ratio = 100) t Test was used for multiple comparison of means.

RESULTS and DISCUSSION: Fire blight infection was severe enough to evaluate the various treatments in this trial (Table 1). In the first trial SO208 at the 2.5 lb/acre rate and GWN-9200 at 3 g/L rate applied with Regulaid were significantly better than STREPTOMYCIN in controlling blossom blight. However the lowest rate of S0208 and GWN-9200 were ineffective, and SO208 at the 2.5 lb/acre rate was not effective when used without Regulaid. In the second trial all rates of GWN-9200 and SO208 tested were as effective as STREPTOMYCIN. None of the treatments prevented shoot infections under these conditions. The effect of these treatments on fruit finish was not significantly different than STREPTOMYCIN.

CONCLUSIONS: S0208 at the 2.5 lb/acre rate or better and GWN-9200 at the 200 ppm rate or better are as effective as STREPTOMYCIN when used with a surfactant such as Regulaid for reducing fire blight blossom infection.

Table 1. Percent Gala blossom clusters and shoots blighted by *Erwinia amylovora* .

Treatment and Rate	% Fire blight incidence[1]		
	Trial 1 Clusters	Trial 2 Clusters	Trial 2 Shoots
S0208 1.25 lb/acre (100 ppm) + 0.3% Regulaid	71.7 a[2]	---	---
GWN-9200 100 ppm ai + 0.3% Regulaid	69.7 a	---	---
S0208 (200 ppm) 2.5 lb/acre	61.3 a	---	---
GWN-9200 200 ppm ai + 0.3% Regulaid	60.7 a	11.1 b	29.1 a
Control	58.4 a	72.9 a	40.0 a
Streptomycin 0.6 g/L	46.4 ab	15.2 b	30.9 a
GWN-9200 300 ppm ai + 0.3% Regulaid	19.1 bc	11.1 b	46.0 a
SO208 2.5 lb/acre (200 ppm) + 0.3% Regulaid	14.1 c	14.1 b	46.6 a
SO208 3.75 lb/acre (300 ppm) + 0.3% Regulaid	---	14.3 b	25.7 a
ANOVA Pr>F	0.0005	<0.0001	0.3824

[1] These values are means of five replications of Gala potted trees.

[2] Numbers followed by the same letter are not significantly different at $p \leq 0.05$ as decided by Duncan's Multiple Range Test. Raw data were arcsin transformed before ANOVA and the detransformed means are presented here.

Table 2. Effect of treatments on fruit finish of Golden Delicious apples.

Treatment and Rate	Fruit Finish at Harvest	
	% Incidence of russett	% Severity of russett
Control	10 b[1]	1 b
Streptomycin 0.6 g/L	67 a	6 a
GWN-9200 300 ppm ai + 0.3% Regulaid	69 a	5 a
SO208 2.5 lb/acre (200 ppm) + 0.3% Regulaid	41 ab	3 ab
ANOVA Pr>F	0.0317	0.0209

[1] Numbers followed by the same letter are not significantly different at K-ratio = 100 as decided by Waller-Duncan K-ratio t Test. Raw data were arcsin transformed before ANOVA and the detransformed means are presented here.

2001 PMR REPORT # 85 **SECTION K: FRUIT - Diseases**
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 FLINT AGAINST POWDERY MILDEW ON APPLE, 2001

MATERIALS: FLINT 50 WG (Trifloxystrobin), NOVA 40 WP (Myclobutanil), SOVRAN 50 WG (Kresoxim methyl)

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 statistical design of the trial was the randomized complete block with four treatments replicated five times on single tree replicates. 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 approximately 400 kPa. Treatments were applied on 26 April (Tight cluster), 7 May (Pink), 15 May (Petal fall), 29 May (First cover), 19 June (Second cover), 10 July (Third cover), 31 July (fourth cover), and 4 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. Fruit mildew was determined on 28 September on 25 harvested apples from each single tree replicate by 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 Waller-Duncan K-ratio t Test 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 6.8 to 14.2 per tree (Table 1). FLINT was more effective than SOVRAN in controlling apple foliage powdery mildew incidence and was as effective as NOVA in controlling disease severity on the 25 July reading. For the other two readings it was as effective as SOVRAN but not as effective as NOVA. FLINT was as effective as NOVA and SOVRAN in controlling fruit russet due to powdery mildew.

CONCLUSIONS: FLINT is a very effective fungicides for the control of apple powdery mildew.

Table. 1. Powdery mildew of foliage on Jonagold apple trees treated with FLINT.

Treatment and Rate per 100 L (kg/ha)	White Tips	% Foliage Powdery Mildew					
		June 29		July 25		September 12	
		Incid.	Sev.	Incid.	Sev.	Incid.	Sev.
Control	14.2 a	80.1 a[1]	11.3 a	76.5 a	16.6 a	88.0 a	16.4 a
SOVRAN 8.0 g (0.24 kg/ha)	10.2 a	33.1 b	3.3 b	53.1 b	7.7 b	55.5 b	5.7 b
FLINT 7.0 g (0.21 kg/ha)	12.0 a	22.3 bc	1.8 b	32.3 c	3.7 c	43.9 b	4.1 b
NOVA 11.3 g (0.34 kg/ha)	06.8 a	04.8 c	0.8 b	13.7 d	2.3 c	17.3 c	1.8 c
ANOVA Pr>F	0.176	0.002	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 Kratio = 100 as decided by the Waller-Duncan K-ratio t Test.

Table 2. Percent Jonagold apples russetted and sunburned at harvest.

Treatment	Powdery mildew fruit russetting		Sunburn Incidence
	Incidence	Severity	
Control	52.1 a[1]	7.8 a	10.7 a
NOVA 11.3 g (0.34 kg/ha)	21.6 b	1.2 b	6.9 a
FLINT 7.0 g (0.21 kg/ha)	13.7 b	0.9 b	6.8 a
SOVRAN 8.0 g (0.24 kg/ha)	9.5 b	0.6 b	8.0 a
ANOVA	0.0026	0.0006	0.8964

[1] Powdery mildew data were arcsin transformed prior to analysis of variance. The detransformed means are presented here. Means followed by the same letter are not significantly different at Kratio = 100 as decided by the Waller-Duncan K-ratio t Test.

2001 PMR REPORT # 86 **SECTION K: FRUIT - Diseases**

CROP: Grape, *Vitis vinifera*, cv. Cabernet Franc
PEST: Powdery Mildew, *Uncinula necator*, (Schw.) Burr.

NAME AND AGENCY:
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TITLE: CONTROL OF GRAPEVINE POWDERY MILDEW WITH FUNGICIDES

MATERIALS: BAS 500, FLINT (trifloxystrobin), KUMULUS 80W (sulphur), NOVA 40W (myclobutanil), NUTROL (monopotassium phosphate), PRUDENT PLUS (urea + monopotassium phosphate), AGSIL25 (potassium silicate), QRD131 (*Bacillus subtilis* (Ehrenberg) Cohn, QST-713 Strain), QRD132 (*B. subtilis* (Ehrenberg) Cohn, QST-713 Strain), QRD137 (*B. subtilis* (Ehrenberg) Cohn, QST-713 Strain), QRD282 (*B. subtilis* (Ehrenberg) Cohn, QST-713 Strain), SOVRAN (kresoxim-methyl)

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 9 June. Sprays were applied with a hydraulic tunnel sprayer at 1380 kPa at a rate of 500 L per ha pre-bloom and 1000 L per ha post-bloom. Treatments were applied: 15 May (5-7.5 cm shoot length); 25 May (12.5-17.5 cm shoot length); 6 June (20-25 cm shoot length); 21 June (immediate pre-bloom); 28 June (immediate post-bloom); 10 July (fruit set); 25 July (berry touch); 15 August (early veraison); and 4 September (late veraison). BAS 500 (110 g ai/ha), QRD131 (18.7 L product/ha), QRD132 (6.7 L product/ha), QRD137 (6.7 L product/ha), QRD282 (18.7 L product/ha), NUTROL (9 kg product/ha) and AGSIL25 (2.4 L product/ha) were applied at all dates. The spray schedules for the remaining treatments included rotations of KUMULUS (10.1 g ai/ha) with NOVA (80 and 112 g ai/ha), FLINT (70 g ai/ha) and SOVRAN (150 g ai/ha), 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 (SAS).

RESULTS: As outlined in Table 2.

CONCLUSIONS: The growing season of 2001 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 significant control compared with the unsprayed check at early veraison. Good to excellent control of pre-harvest fruit infection was provided by QRD131, QRD132, NUTROL, PRUDENT PLUS and AGSIL and rotations of KUMULUS with NOVA (80 or 112 g ai/ha), FLINT (3 or 5 applications), SOVRAN and BAS 500. The KUMULUS rotations with NOVA, FLINT, SOVRAN and BAS 500 maintained good control of powdery mildew on the leaf surface. The protective activity of QRD131, QRD132, QRD137, QRD282, NUTROL, PRUDENT PLUS and AGSIL was not sufficient to maintain control of late season powdery mildew infections for the 7 wk interval between the final spray and October 23 disease evaluations. There was no significant increase in control of powdery mildew on leaves or fruit by increasing the rate of NOVA or increasing the number of FLINT applications. No phytotoxicity was observed in any treatment.

Table 1. Date of fungicide applications for treatments including more than 1 product.

Date	NOVA	FLINT 1	FLINT 2	SOVRAN
May 15	KUMULUS	KUMULUS	KUMULUS	KUMULUS
May 25	KUMULUS	FLINT	KUMULUS	KUMULUS
June 6	KUMULUS	FLINT	KUMULUS	KUMULUS
June 21	NOVA	FLINT	FLINT	SOVRAN
June 28	KUMULUS	FLINT	FLINT	KUMULUS
July 10	KUMULUS	FLINT	KUMULUS	SOVRAN
July 25	NOVA	NOVA	FLINT	NOVA
Aug 15	KUMULUS	KUMULUS	KUMULUS	KUMULUS
Sept 4	KUMULUS	KUMULUS	KUMULUS	KUMULUS

Table 2. Evaluation of fungicides for control of grapevine powdery mildew.

Treatment	Leaves				Fruit			
	Incidence (%)		Severity (% area)		Incidence (%)		Severity (% area)	
Untreated	100	a	88	a	84	a	61	a
NOVA (80 g ai/ha)	0	c	0	g	4	cd	0	e
NOVA (112 g ai/ha)	0	c	0	g	16	bcd	2	de
FLINT 1	1	c	0	g	0	d	0	e
FLINT 2	0	c	0	g	0	d	0	e
BAS 500	10	c	0	g	4	cd	0	e
SOVRAN	10	c	0	g	16	bcd	3	cde
QRD131	46	b	9	f	4	cd	1	e
QRD132	100	a	68	b	32	bc	9	c
QRD137	94	a	68	b	52	b	26	b
QRD282	100	a	41	d	16	bcd	4	cde
NUTROL	96	a	57	c	8	bcd	1	e
PRUDENT PLUS	100	g	60	c	14	bcd	2	cd
AGSIL	66	a	26	e	24	bcd	8	c

Means in the same column followed by the same letter are not significantly different (á=0.05), Student Neuman-Keuls multiple range test.

2001 PMR REPORT # 87 **SECTION K: FRUIT - Diseases**
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, 2000

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 16 year old Chancellor grapes (4 replicates). 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 2 half vines. The treatments were applied until run-off with a handgun operated at approximately 400 kPa at a rate of 1000L water/ha. The grower standard treatment was applied on 16 May (3-8 cm shoot), 23 May (13-18 cm shoot), and 30 May (20-25 cm shoot), 6 June (Pre-bloom), 27 June (Postbloom), 18 July (Fruit set), 8 August (Berry touch), 29 August (Veraison), 12 September (Post Veraison), and 28 September (8 days Preharvest). MINERALL CLAY treatments were applied on 6 June (Prebloom), 27 June Postbloom) 18 July (Fruit set), 9 August (Berry touch), 29 August (Veraison), 12 September (Post Veraison), and 28 September (8 days Preharvest). See below for application times and fungicides that were used in each treatment for the Grower Program. Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 1 August, 15 September, 10 October by examining ten leaves on each of five shoots per three middle vines, and on 5 berry clusters per three middle vines 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 top and bottom leaf sides of 30 leaves located opposite to fruit clusters on 13 to 15 shoots per three middle vines. 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 Duncan's Multiple Range Test was used to separate means ($P = 0.05$).

GROWER Program consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) on 16 May, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 23 May, DITHANE M 45 (450 g/100 L or 4.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 30 May, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 6 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 27 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 18 July, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 8 August, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with KUMULUS (300 g/100 L or 3.0 kg/ha) on 29 August, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) 12 September, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 28 September. Harvest on 6 October.

MINERALL CLAY Low Program consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 6 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 27 June, MINERALL CLAY (1.0 kg/100 L or 10.0 kg/ha) on 18 July, MINERALL CLAY (1.0 kg/100 L or 10.0 kg/ha) on 8 August, MINERALL CLAY (1.0 kg/100 L or 10.0 kg/ha) on 29 August, MINERALL CLAY (1.0 kg/100 L or 10.0 kg/ha) on 14 September, and MINERALL CLAY (1.0 kg/100 L or 10.0 kg/ha) on 28 September.

MINERALL CLAY Medium Program consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 6 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 27 June, MINERALL CLAY (2.0 kg/100 L or 20.0 kg/ha) on 18 July, MINERALL CLAY (2.0 kg/100 L or 20.0 kg/ha) on 8 August, MINERALL CLAY (2.0 kg/100 L or 20.0 kg/ha) on 29 August, MINERALL CLAY (2.0 kg/100 L or 20.0 kg/ha) on 14 September, and MINERALL CLAY (2.0 kg/100 L or 20.0 kg/ha) on 28 September.

MINERALL CLAY High Program consisted of MINERALL CLAY (4.0 kg/100 L or 40.0 kg/ha) on 6 June, MINERALL CLAY (4.0 kg/100 L or 40.0 kg/ha) on 27 June, MINERALL CLAY (4.0 kg/100 L or 40.0 kg/ha) on 18 July, MINERALL CLAY (4.0 kg/100 L or 40.0 kg/ha) on 8 August, MINERALL CLAY (4.0 kg/100 L or 40.0 kg/ha) on 29 August, MINERALL CLAY (4.0 kg/100 L or 40.0 kg/ha) on 14 September, and MINERALL CLAY (4.0 kg/100 L or 40.0 kg/ha) on 28 September.

RESULTS and DISCUSSION: The low rate of MINERALL CLAY and the Grower standard were the only treatments that initially reduced foliage powdery mildew after the first reading in August (Table 1). In September and October all rates of MINERALL CLAY were as effective as the Grower standard in reducing cluster powdery mildew incidence and severity (Tables 2 and 3). Foliage treated with MINERALL CLAY had significantly less leafhopper damage and slightly higher chlorophyll counts than the Grower standard (Table 4). At harvest the MINERALL CLAY program yielded slightly higher quantities of grapes than the Grower program (Table 5). Bunch rot was not a problem in Chancellor grapes in 2000 and no significant differences were found in any of the treatments (Table 6).

CONCLUSIONS: All MINERALL CLAY programs were as effective as the GROWER program in controlling cluster powdery mildew which is the economically important phase of the disease. MINERALL CLAY programs suppressed leafhopper damage and maintained high chlorophyll counts in grape foliage.

Table 1. Percent powdery mildew incidence and severity of Chancellor grapes treated with MINERALL CLAY on 1 August.

Treatment	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
CLAY low	33.4 b[1]	2.2 a	0.0 a	0.0 a
CLAY medium	50.0 ab	3.8 a	2.9 a	3.5 a
CLAY high	52.8 ab	3.9 a	8.0 a	6.0 a
Grower Program	6.4 c	0.0 b	0.0 a	0.0 a
Control	66.1 a	1.5 a	6.4 a	6.4 a
Pr> F	0.0002	0.0018	0.3785	0.2523

[1] 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 five replications.

Table 2. Percent powdery mildew incidence and severity of Chancellor grapes treated with MINERALL CLAY on 15 September.

Treatment	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
CLAY low	95.5 ab[1]	45.2 bc	0.0 b	0.0 b
CLAY medium	98.9 ab	54.7 ab	0.6 b	0.0 b
CLAY high	71.0 b	30.5 c	0.0 b	0.0 b
Grower Prog.	50.0 c	10.2 d	0.6 b	0.1 b
Control	100.0 a	71.5 a	79.2 a	19.3 a
Pr> F	0.001	0.0001	0.0001	0.0219

[1] 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 five replications.

Table 3. Percent powdery mildew incidence and severity of Chancellor grapes treated with MINERALL CLAY on 10 October.

Treatment	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
CLAY low	99.5 ab[1]	70.5 a	22.1 b	04.8 b
CLAY medium	99.9 a	69.5 a	01.8 b	00.5 b
CLAY high	98.1 ab	77.8 a	12.2 b	05.5 b
Grower Prog.	91.4 b	20.2 b	06.4 b	03.3 b
Control	100.0 a	84.5 a	84.7 a	50.6 a
Pr > F	0.0951	0.0024	0.0003	0.0007

[1] 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 five replications.

Table 4. Effect of MINERALL CLAY on leafhopper damage and chlorophyll count.

Treatment	Leafhopper damage to foliage		Chlorophyll
	% Incidence	% damaged	SPAD counts
CLAY low	19.1 b[1]	3.1 b	32.6 ab
CLAY medium	16.2 b	2.4 b	32.4 ab
CLAY high	22.5 b	3.6 b	36.8 a
Grower Program	10.3 b	1.7 b	31.7 b
Control	44.9 a	9.5 a	33.0 ab
Pr> F	0.0098	0.012	0.1931

[1] 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 five replications.

Table 5. Effect of MINERALL CLAY on number of clusters, and weight of Chancellor grapes.

Treatment	No. Clusters	Weight (kg)
CLAY low	372.2 a[1]	48.6 a
CLAY medium	325.2 a	48.4 a
CLAY high	405.2 a	52.9 a
Grower Program	314.8 a	38.1 a
Control	412.0 a	47.6 a
Pr> F	0.6443	0.5919

[1] 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 five replications.

Table 6. Effect of MINERALL CLAY on bunch rot of Chancellor grapes.

Treatment	% Incidence	% Severity
CLAY low	0.1 a[1]	0.0 a
CLAY medium	0.0 a	0.0 a
CLAY high	0.9 a	0.3 a
Grower Program	0.9 a	0.6 a
Control	0.8 a	0.6 a
Pr> F	0.7281	0.6469

[1] 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 five replications.

2001 PMR REPORT # 88 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Pinot noir
PEST: Powdery mildew, *Uncinula necator* Pers.:Fr.

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TITLE: EFFICACY OF MINERALL CLAY AGAINST POWDERY MILDEW OF PINOT NOIR GRAPE, 2000

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 16 year old Pinot noir grapes (5 replicates). 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 1000L water/ha. The grower standard treatment was applied on 16 May (3-8 cm shoot), 23 May (13-18 cm shoot), and 30 May (20-25 cm shoot), 6 June (Pre-bloom), 27 June (Postbloom), 18 July (Fruit set), 8 August (Berry touch), 29 August (Veraison), 12 September (Post Veraison), and 28 September (8 days Preharvest). MINERALL CLAY treatments were applied on 6 June (Prebloom), 27 June (Postbloom) 18 July (Fruit set), 9 August (Berry touch), 29 August (Veraison), 12 September (Post Veraison), and 28 September (8 days Preharvest). See below for application times and fungicides that were used in each treatment for the Grower Program. Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 1 August, 15 September, 10 October by examining ten leaves on each of five shoots per three middle vines, and on 5 berry clusters per three middle vines 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 top and bottom leaf sides of 30 leaves located opposite to fruit clusters on 13 to 15 shoots per three middle vines. 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. A 50 g subsample from each sample of 100 berries from randomly selected clusters in each replicate were subjected to a nonvolatile acid extraction procedure and titratable acidity was determined on the obtained extracts using a Brinkmann Titroprocessor ensemble. The rest of the sample was juiced, and soluble solids concentration (°Brix), and pH were measured on settled juice using an Abbé refractometer and a pH meter, respectively. 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 Duncan's Multiple Range Test was used to separate means ($P = 0.05$).

GROWER Program consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) on 16 May, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 23 May, DITHANE M 45 (450 g/100 L or 4.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 30 May, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 6 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 27 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 18 July, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 8 August, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with KUMULUS (300 g/100 L or 3.0 kg/ha) on 29 August, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) 12 September, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 28 September. Harvest on 6 October.

MINERALL CLAY Program consisted of 7 applications of MINERALL CLAY (4.0 kg/100 L or 40 kg/ha) on dates as indicated above.

RESULTS and DISCUSSION: MINERALL CLAY was as effective as the grower standard in controlling powdery mildew on Pinot Noir grapes after evaluation in August (Table 1), September (Table 2), and October (Table 3). Foliage treated with MINERALL CLAY had less leafhopper damage and higher chlorophyll counts than the control but the differences were not statistically significant (Table 4). Although bunch rot was not a problem in 2000 a small amount did occur. MINERALL CLAY used alone was ineffective against bunch rot (Table 5). The Grower program was specifically designed to control bunch rot by the use of fungicides such as MAESTRO and ROVRAL. These materials need to be added to the MINERALL CLAY program where bunch rot needs to be controlled. At harvest the MINERALL CLAY program yielded slightly higher quantities of grapes than the Grower program (Table 6). MINERALL CLAY had no significant effect on grape pH, soluble solids, or titratable acidity (Table 6).

CONCLUSIONS: MINERALL CLAY alone will control powdery mildew without changing the quality of pinot noir grapes.

Table 1. Percent powdery mildew incidence and severity of Pinot Noir grapes treated with MINERALL CLAY on 1 August.

Treatment	Leaf powdery mildew		Cluster powdery mildew	
	Incidence	Severity	Incidence	Severity
Clay program	47.5 a[1]	12.1 b	56.0 a	05.1 a
Grower program	45.0 a	12.9 b	60.4 a	02.5 a
Control	70.3 a	10.1 a	81.0 a	19.8 a
Pr> f	0.1019	0.0368	0.7514	0.2331

[1] 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 five replications.

Table 2. Percent powdery mildew incidence and severity of Pinot Noir grapes treated with MINERALL CLAY on 15 September.

Treatment	Leaf powdery mildew		Cluster powdery mildew	
	Incidence	Severity	Incidence	Severity
Clay program	78.6 b[1]	09.3 b	45.9 a	05.6 b
Grower program	73.2 b	09.8 b	49.5 a	03.4 b
Control	95.0 a	28.4 a	87.7 a	35.2 a
Pr> f	0.0356	0.0019	0.1489	0.0458

[1] 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 five replications.

Table 3. Percent powdery mildew incidence and severity of Pinot Noir grapes treated with MINERALL CLAY on 10 October.

Treatment	Leaf powdery mildew		Cluster powdery mildew	
	Incidence	Severity	Incidence	Severity
Clay program	96.7 a[1]	34.0 ab	32.5 b	24.3 b
Grower program	98.0 a	30.7 b	34.7 b	20.9 b
Control	99.9 a	59.9 a	85.9 a	56.8 a
Pr > f	0.1009	0.066	0.0204	0.0403

[1] 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 five replications.

Table 4. Effect of MINERALL CLAY on leafhopper damage and chlorophyll count.

Treatment	Leafhopper damage to foliage		Chlorophyll
	%incidence	%damaged	Spad counts
Clay program	33.4 a[1]	4.4 a	43.8 a
Grower program	48.7 a	8.5 a	42.4 a
Control	68.2 a	14.9 a	40.1 a
Pr> f	0.1648	0.1994	0.1137

[1] 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 five replications.

Table 5. Effect of MINERALL CLAY on bunch rot of harvested grapes.

Treatment	% bunch rot at harvest	
	Incidence	Severity
Clay program	8.0 a[1]	8.0 a
Grower program	0.0 b	0.0 b
Control	2.9 a	1.7 b
Pr> f	0.0061	0.0043

[1] 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 five replications.

Table 6. Effect of MINERALL CLAY on number of clusters, weight, pH, soluble solids, and titratable acidity of Pinot noir grapes

Treatment	No. Clusters	Weight (kg)	ph	Ss	Ta
Clay	246.4 a[1]	22.72 a	3.33 a	20.84 a	15.98 a
Grower	232.2 a	20.63 a	3.33 a	22.72 a	16.16 a
Control	240.6 a	17.85 a	--------	---------	---------
Pr> f	0.9621	0.6939	0.9379	0.189	0.9279

[1] 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 five replications.

2001 PMR REPORT # 89 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Reisling
PEST: Powdery mildew, *Uncinula necator* Pers.:Fr.

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TITLE: EFFICACY OF MINERALL CLAY AGAINST POWDERY MILDEW OF REISLING GRAPE, 2000

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 16 year old Reisling grapes (4 replicates). Spacing was 2.0 x 2.9 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 3-vine replicate had half vines 1 and 3 as guards for disease evaluation, thus treatments were separated by 1/2 buffer vines. The treatments were applied until run-off with a handgun operated at approximately 500 kPa at a rate of 1000L water/ha. The grower standard treatment was applied on 16 May (3-8 cm shoot), 23 May (13-18 cm shoot), and 30 May (20-25 cm shoot), 6 June (Pre-bloom), 27 June (Postbloom), 18 July (Fruit set), 8 August (Berry touch), 29 August (Veraison), 12 September (Post Veraison), and 28 September (8 days Preharvest). MINERALL CLAY treatments were applied on 6 June (Prebloom), 27 June (Postbloom) 18 July (Fruit set), 9 August (Berry touch), 29 August (Veraison), 12 September (Post Veraison), and 28 September (8 days Preharvest). See below for application times and fungicides that were used in each treatment for the Grower Program. Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 1 August, 15 September, 10 October by examining ten leaves on each of five shoots per three middle vines, and on 5 berry clusters per three middle vines on 1 August and 15 September. Fifty clusters were examined for bunch rot 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 Duncan's Multiple Range Test was used to separate means (P = 0.05).

GROWER Program consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 6 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 27 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 18 July, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 8 August, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with KUMULUS (300 g/100 L or 3.0 kg/ha) on 29 August, MAESTRO 75 DF (350 g/100 L or

3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) 12 September, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 28 September. Harvest on 6 October.

MINERALL CLAY Program consisted of 7 applications of MINERALL CLAY (4.0 kg/100 L or 40 kg/ha) on 6 June, 27 June, 18 July, 8 August, 29 August, 14 September, and 28 September.

RESULTS and DISCUSSION: Foliage and cluster powdery mildew developed late in the season on the Reisling grapes and was not very severe until the last reading in October. There were no significant differences between the grower standard and the clay treatment for readings taken in August, September, and October (Tables 1, 2, and 3). However only the MINERALL CLAY treatment significantly reduced leafhopper incidence and severity (Table 4). There were no significant differences between number of clusters and weight of harvested grapes although the clay treatment had a higher number of clusters and weighed more than the grower standard (Table 5). Bunch rot at harvest was relatively high in these reisling grapes with 13% in the control however there was no significant differences between the treatments (Table 6).

CONCLUSIONS: MINERALL CLAY will reduce damage caused by leafhoppers in reisling grapes.

Table 1. Percent powdery mildew incidence and severity of Reisling grapes treated with MINERALL CLAY on 1 August.

Treatment	Leaf powdery mildew		Cluster powdery mildew	
	Incidence	Severity	Incidence	Severity
Clay program	11.5 a[1]	0.5 a	0.0 a	0.0 a
Grower program	16.0 a	0.5 a	0.0 a	0.0 a
Control	21.5 a	0.9 a	1.3 a	0.0 a
Pr> F	0.1229	0.125	0.4219	0.4219

[1] 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 five replications.

Table 2. Percent powdery mildew incidence and severity of Reisling grapes treated with MINERALL CLAY on 15 September.

Treatment	Leaf powdery mildew		Cluster powdery mildew	
	Incidence	Severity	Incidence	Severity
Clay program	46.2 a[1]	5.3 a	20.7 a	1.0 a
Grower program	45.4 a	6.7 a	20.7 a	0.6 a
Control	62.3 a	7.1 a	23.7 a	2.9 a
Pr> F	3258	0.7404	0.8937	0.4476

[1] 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 five replications.

Table 3. Percent powdery mildew incidence and severity of Reisling grapes treated with MINERALL CLAY on 10 October.

Treatment	Leaf powdery mildew		Cluster powdery mildew	
	Incidence	Severity	Incidence	Severity
Clay program	83.5 a[1]	21.5 a	8.8 a	2.1 a
Grower program	89.4 a	24.7 a	2.6 a	0.3 a
Control	91.4 a	26.9 a	13.9 a	2.7 a
Pr > F	0.5481	0.3766	0.6204	0.7049

[1] 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 five replications

Table 4. Effect of MINERALL CLAY on leafhopper damage.

Treatment	Leafhopper damage to foliage	
	% incidence	% damaged
Clay program	04.7 b[1]	0.0 b
Grower program	16.0 a	1.2 a
Control	22.7 a	2.2 a
Pr> F	0.0065	0.0117

[1] 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 5. Effect of MINERALL CLAY on number of clusters, and weight of Reisling grapes.

Treatment	No. Clusters	Weight (kg)
Clay	191.5 a[1]	17.5 a
Grower	195.2 a	15.7 a
Control	205.8 a	18.1 a
Pr> F	0.6933	0.7157

[1] 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 6. Effect of MINERALL CLAY on bunch rot.

Treatment	%Bunch rot at harvest	
	Incidence	Severity
Clay Program	14.2 a[1]	17.4 a
Grower Program	05.3 a	13.4 a
Control	13.0 a	11.8 a
Pr> F	0.1033	0.4629

[1] 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.

2001 PMR REPORT # 90 **SECTION K: FRUIT - Diseases**
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, 2000

MATERIALS: NOVA 40W (Myclobutanil), ROVRAL 50W (Iprodione), KUMULUS (Sulphur), DITHANE 75 DF (Mancozeb), MAESTRO 75 DF (Captan), 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 5 Pinot noir and 3 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 1000L water/ha. The grower standard treatment was applied on 16 May (3-8 cm shoot), 23 May (13-18 cm shoot), 30 May (20-25 cm shoot), 6 June (Pre-bloom), 27 June (Postbloom), 18 July (Fruit set), 8 August (Berry touch), 29 August (Veraison), 12 September (Post Veraison), and 28 September (8 days Preharvest). FLINT treatments were applied on 8 June (Prebloom), 27 June (Postbloom) 19 July (Fruit set), 9 August (Berry touch), 17 August (Cluster closure), 24 August (Veraison), 31 August (Post Veraison) 12 September (Post Veraison), and 29 September (7 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 1 August, 15 September, 10 October by examining ten leaves on each of five shoots per three middle vines; and 5 or 10 berry clusters per three middle vines on 1 August and 10 September, respectivelly. Fifty clusters were examined for powdery mildew at harvest on October 6, 2000. 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. 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 Duncan's Multiple Range Test was used to separate means (P = 0.05).

GROWER Program consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) on 16 May, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 23 May, DITHANE M 45 (450 g/100 L or 4.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 30 May, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 6 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 27 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 18 July, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA

(20 g/100 L or 200 g/ha) on 8 August, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with KUMULUS (300 g/100 L or 3.0 kg/ha) on 29 August, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) 12 September, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 28 September. Harvest on 6 October.

FLINT Program consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) on 16 May, FLINT 50 WG (14 g/100 L or 0.14 kg/ha) on 23 May, DITHANE M 45 (450 g/100 L or 4.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 30 May, FLINT 50 WG (14 g/100 L or 0.14 kg/ha) on 6 June, FLINT 50 WG (14 g/100 L or 0.14 kg/ha) on 27 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 18 July, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with FLINT (14 g/100 L or 0.14 kg/ha) on 8 August, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with KUMULUS (300 g/100 L or 3.0 kg/ha) on 29 August, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 12 September, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 28 September, 8 days before harvest on October 6, 2000.

RESULTS and DISCUSSION: Powdery mildew was first observed on grape foliage in late July. FLINT almost completely prevented powdery mildew from developing on Pinot noir and Chancellor grape clusters and was more effective than the Grower program on Pinot noir (Table 1 and 2). FLINT had no significant effect on grape quality as measured by pH, soluble solids, titratable acidity of Pinot noir grapes (Table 3). Number of clusters or yield for both Pinot noir and Chancellor grapes did not differ between the treatments (Table 3 and 4). FLINT had no significant effect on bunch rot of Pinot noir or Chancellor grapes although the disease pressure was very low in these trials (Table 5).

CONCLUSIONS: The FLINT program provided excellent control of powdery mildew and provided better control than the Grower program on powdery mildew of Pinot Noir grape clusters under extremely high powdery mildew disease pressure.

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. 1)	22.2 b[1]	02.2 b	00.8 b	00.0 b
Grower (Aug. 1)	50.0 a	05.0 b	60.4 ab	02.5 ab
Control (Aug. 1)	70.3 a	10.2 a	81.0 a	19.8 a
Pr> F	0.0038	0.0109	0.0566	0.0711
FLINT (Sept. 15)	57.5 b	08.5 b	01.9 b	00.1 b
Grow. (Sep.15)	73.2 b	09.9 b	49.5 a	03.4 b
Cont. (Sep. 15)	95.0 a	28.4 a	87.7 a	35.2 a
Pr> F	0.0130	0.0101	0.0129	0.0153
FLINT (Oct. 10)	85.9 b	13.4 b	00.2 c	00.2 c
Grow. (Oct. 10)	98.0 a	30.7 b	34.7 b	20.9 b
Cont. (Oct. 10)	99.9 a	59.9 a	85.9 a	56.8 a
Pr > F	0.0006	0.0053	0.0008	0.0027

[1] 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 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. 1)	07.3 b[1]	00.0 b	0.0 a	0.0 a
Grow. (Aug.1)	06.4 b	00.0 b	0.0 a	0.0 a
Cont. (Aug. 1)	66.0 a	01.5 a	6.4 a	6.4 a
Pr > F	0.0035	0.0160	0.2451	0.2451
FLINT (Sept. 15)	046.2 b	08.0 b	00.0 b	00.0 b
Grow. (Sep.15)	058.8 b	10.2 b	00.6 b	00.1 b
Cont. (Sep.15)	100.0 a	71.5 a	79.2 a	19.3 a
Pr > F	0.0009	0.0007	.0050	0.0739
FLINT (Oct. 10)	088.6 b	22.6 b	00.2 b	00.2 b
Grow. (Oct.10)	091.4 b	20.2 b	06.4 b	03.3 b
Cont. (Oct. 10)	100.0 a	84.5 a	84.7 a	50.6 a
Pr > F	0.0401	0.0011	0.0009	0.0058

[1] 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, weight, pH, soluble solids, and titratable acidity of harvested pinot noir grapes.

Treatment	No. Clusters	Weight (kg)	pH	SS	TA
FLINT	256.4 a[1]	33.41 a	3.29 a	19.86 a	14.07 a
Grower	232.2 a	20.63 a	3.33 a	22.72 a	16.16 a
Control	240.6 a	17.85 a	.....	.....	.....
Pr> F	0.9367	0.1614	0.5265	0.0959	0.2212

[1] 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 five replications.

Table 4. Effect of FLINT on number of clusters and weight of Chancellor grapes at harvest.

Treatment	No. Clusters	Weight (kg)
FLINT	370.5 a[1]	42.74 a
Grower	314.8 a	38.08 a
Control	412.0 a	47.64 a
Pr> F	0.1147	0.5306

[1] 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 5. Effect of FLINT on percent bunch rot of Pinot noir and Chancellor grapes.

Treatment	Pinot Noir		Chancellor	
	Incidence	Severity	Incidence	Severity
FLINT	0.8 a[1]	0.4 a	0.0 a	0.1 a
Grower	0.0 a	0.0 a	0.9 a	0.6 a
Control	2.9 a	1.7 a	0.8 a	0.6 a
Pr> F	0.1471	0.2269	0.5299	0.8578

[1] 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 five replications.

2001 PMR REPORT # 91 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Chancellor
PEST: Powdery mildew, *Uncinula necator* (Schwein) Burrill

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TITLE: EFFICACY OF SOVRAN FOR CONTROL OF POWDERY MILDEW ON GRAPE, 1999

MATERIALS: SOVRAN (kresoxim-methyl), NOVA 40W (myclobutanil), ROVRAL 50W (iprodione), KUMULUS (sulphur), DITHANE 75 DF (mancozeb), MAESTRO 75 DF (captan)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 9 year old vines. Spacing was 3.6 x 7.2 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 five replicates. Each 3-vine replicate had one half of vines 1 and 3 as guards for disease evaluation, thus treatments were separated by 2 half-vine buffers. The six treatments were applied until run-off with a handgun operated at approximately 860 kPa at a rate of 1000L water/ha. Treatments were applied on 17 June (Prebloom), 30 June (Postbloom), 20 July (First cover), 3 August (Second cover), 24 August (Third cover), 17 September (Fourth cover), and 5 October (Fifth cover). Percent incidence and severity of leaf and cluster powdery mildew were initially evaluated on 26 August, by examining ten leaves on each of four shoots per vine, and on 10 berry clusters per three vines. This was repeated on 14 October when infection of canes was also determined by visually examining five internodes on each of three canes per vine and estimating percent infection. At harvest on 21 October, yield, number of clusters and number of clusters with bunch rot were recorded. Clusters were considered to have bunch rot if gray mold was observed growing among the berries. Counts of cluster, leaf, and cane powdery mildew and bunch rot were converted to the percent infected per replicate and arcsin-transformed. Number of clusters, yield and the transformed data for leaf, cane, and cluster mildew were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Duncan's Multiple Range Test was used to separate means (P = 0.05).

RESULTS: Results are presented in Tables 1-3. According to the Gubler model for grape powdery mildew, ascospore infection would have occurred on 21 June with the powdery mildew index being triggered on 10 July. Foliage mildew was first noticed in late July on control leaves. The index remained high for powdery mildew throughout the season. SOVRAN at both rates was as effective as the grower standard in controlling powdery mildew on grape leaves on 26 August but the low rate appeared less effective later in the season. Powdery mildew was present on a high proportion of grape clusters indicating that disease pressure was high. SOVRAN at the high rate was very effective in preventing infection on developing fruit on 26 August. However, SOVRAN at the low rate was not as effective as the grower standard. Near harvest on 14 October all treatments were equal in preventing cluster infection. SOVRAN at the high rate was as effective as the grower program in reducing the severity of cane infection at the end of the season. Number of clusters or yield of grapes was not significantly

affected by treatment with SOVRAN.

CONCLUSIONS: SOVRAN at a rate of 300g/ha in 1000 litres of water provides very effective control of grape powdery mildew on grape foliage, clusters, and canes. SOVRAN at a rate of 240 g/ha provides less effective control on developing fruit, and late in the season on leaves and canes.

Table 1. Percent powdery mildew on leaves of Chancellor grapes.

Treatment Program	26 August, 1999		14 October, 1999	
	Incidence	Severity	Incidence	Severity
Control	25.7 a[1]	5.8 a	56.0 a	22.0 a
Grower[2]	4.3 b	0.5 b	28.5 b	7.4 ab
Sovran 24.0 g/100 L water	0.0 b	0.0 b	38.2 ab	10.9 ab
Sovran 30.0 g/100 L water	0.2 b	0.0 b	20.0 b	3.4 b
P>F	0.001	0.002	0.04	0.149

[1] Figures are the means of five replications. Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan Multiple Range Test.

[2] Grower program consisted of Dithane 75 DF (450 g/100 L) on 21 May; Maestro 75 W (350 g/100 L) on 3 June; Dithane 75 DF (450 g/100 L) on 10 June; Nova and Maestro (20 g + 350 g/ 100 L) on 17 June; Nova and Maestro (20 g + 350 g/ 100 L) on 30 June; Nova and Maestro (20 g + 350 g/ 100 L) on 20 July; Rovral and Kumulus (150 g + 300 g/100 L) on 3 August; Nova and Rovral (20.0 g + 150 g/100 L) on 24 August; Nova and Rovral (20.0 g + 150 g/100 L) on 17 September; Maestro + Kumulus (350g/100 L +300g/100L) on 5 October; Harvest on 21 October.

Table 2. Percent powdery mildew on fruit clusters of Chancellor grapes.

Treatment Program	26 August, 1999		14 October, 1999	
	Incidence	Severity	Incidence	Severity
Control	100.0 a[1]	32.5 a	50.0 a	13.8 a
Grower[2]	6.0 c	0.3 c	2.0 b	0.1 b
Sovran 24 g/ 100 L water	36.0 b	5.9 b	0.0 b	0.0 b
Sovran 30 g/ 100 L water	2.0 c	0.0 c	0.0 b	0.0 b
P>F	0.0001	0.0001	0.0001	0.0007

[1] Figures are the means of five replications. Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan Multiple Range Test.

[2] Grower program consisted of Dithane 75 DF (450 g/100 L) on 21 May; Maestro 75 W (350 g/100 L) on 3 June; Dithane 75 DF (450 g/100 L) on 10 June; Nova and Maestro (20 g + 350 g/ 100 L) on 17 June; Nova and Maestro (20 g + 350 g/ 100 L) on 30 June; Nova and Maestro (20 g + 350 g/ 100 L) on 20 July; Rovral and Kumulus (150 g + 300 g/100 L) on 3 August; Nova and Rovral (20.0 g + 150 g/100 L) on 24 August; Nova and Rovral (20.0 g + 150 g/100 L) on 17 September; Maestro + Kumulus (350g/100 L +300g/100L) on 5 October; Harvest on 19 October.

Table 3. Percent cane powdery mildew and bunch rot, number of clusters, and weight at harvest of Chancellor grapes.

Treatment Program	Cane Powdery Mildew		Bunch Rot	Number of Clusters	Weight (kg)
	Incidence	Severity			
Control	42.7 a[1]	23.9 a	5.0 a	153.2 a	15.0 a
Grower[2]	14.7 a	1.4 b	4.0 a	189.8 a	20.6 a
Sovran 24 g/100 L water	37.4 a	6.7 ab	2.0 a	172.6 a	29.0 a
Sovran 30 g/100 L water	12.0 a	0.7 b	4.0 a	133.2 a	14.2 a
Pr>F	0.159	0.10300	0.915	0.659	0.197

[1] Figures are the means of five replications. Numbers followed by the same letter are not significantly different at p=0.05 as decided by the Duncan Multiple Range Test.

[2] Grower program consisted of Dithane 75 DF (450 g/100 L) on 21 May; Maestro 75 W (350 g/100 L) on 3 June; Dithane 75 DF (450 g/100 L) on 10 June; Nova and Maestro (20 g + 350 g/ 100 L) on 17 June; Nova and Maestro (20 g + 350 g/ 100 L) on 30 June; Nova and Maestro (20 g + 350 g/ 100 L) on 20 July; Rovral and Kumulus (150 g + 300 g/100 L) on 3 August; Nova and Rovral (20.0 g + 150 g/100 L) on 24 August; Nova and Rovral (20.0 g + 150 g/100 L) on 17 September; Maestro + Kumulus (350g/100 L +300g/100L) on 5 October; Harvest on 19 October.

2001 PMR REPORT # 92 **SECTION K: FRUIT - Diseases**
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 SOVRAN AGAINST POWDERY MILDEW OF GRAPE, 2000

MATERIALS: NOVA 40W (myclobutanil), ROVRAL 50W (iprodione), KUMULUS (sulphur), DITHANE 75 DF (mancozeb), MAESTRO 75 DF (captan), FLINT 50 WDG (trifloxystrobin), SOVRAN 50 WG (kresoxim-methyl)

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 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 1000L water/ha. The grower standard treatment was applied on 16 May (3-8 cm shoot), 23 May (13-18 cm shoot), 30 May (20-25 cm shoot), 6 June (Pre-bloom), 27 June (Postbloom), 18 July (Fruit set), 8 August (Berry touch), 29 August (Veraison), 12 September (Post Veraison), and 28 September (8 days Preharvest). There were two SOVRAN treatment programs on Pinot noir grapes: one program where SOVRAN was the only fungicide applied up to harvest and the other where other fungicides and SOVRAN were applied in an integrated program. Only the SOVRAN integrated fungicide program was used on Chancellor grapes. SOVRAN only was applied to Pinot noir grapes on 6 June (Prebloom), 27 June (Postbloom) 19 July (Fruit set), 9 August (Berry touch), 29 August (Post Veraison) 12 September (Post Veraison), and 28 September (7 days Preharvest). The SOVRAN integrated program was applied to Pinot noir and Chancellor grapes 16 May (3-8 cm shoot), 23 May (13-18 cm shoot), 30 May (20-25 cm shoot), 6 June (Prebloom), 27 June (Postbloom) 18 July (Fruit set), 8 August (Berry touch), 29 August (Veraison) 12 September (Post Veraison), and 28 September for only Pinot noir grapes (8 days Preharvest). FLINT treatments were applied to Pinot noir and Chancellor grapes on 16 May (3-8 cm shoot), 23 May (13-18 cm shoot), 30 May (20-25 cm shoot), 6 June (Prebloom), 27 June Postbloom) 18 July (Fruit set), 8 August (Berry touch), 29 August (Post Veraison) 12 September (Post Veraison), and 28 September for only Pinot noir grapes (8 days Preharvest). See below for application dates and fungicides that were used in each treatment. Percent incidence and severity of leaf and cluster powdery mildew were evaluated on 1 August, 12 September, 12 October by examining ten leaves on each of five shoots per three middle vines, and on 5 and 10 berry clusters per three middle vines on 1 August and 15 September, respectively. Fifty clusters were examined for powdery mildew at harvest on October 6, 2000. Yield, number of clusters and number of clusters with bunch rot were also recorded at harvest. Clusters were considered to have bunch rot if gray mold was observed growing among the berries. 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 Duncan's Multiple Range Test was used to separate means (P = 0.05).

GROWER Program consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) on 16 May, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 23 May, DITHANE M 45 (450 g/100 L or 4.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 30 May, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 6 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 27 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 18 July, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with NOVA (20 g/100 L or 200 g/ha) on 8 August, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with KUMULUS (300 g/100 L or 3.0 kg/ha) on 29 August, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) 12 September, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 28 September. Harvest on 6 October.

FLINT Integrated Program consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) on 16 May, FLINT 50 WG (14 g/100 L or 0.14 kg/ha) on 23 May, DITHANE M 45 (450 g/100 L or 4.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 30 May, FLINT 50 WG (14 g/100 L or 0.14 kg/ha) on 6 June, FLINT 50 WG (14 g/100 L or 0.14 kg/ha) on 27 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 18 July, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with FLINT (14 g/100 L or 0.14 kg/ha) on 8 August, ROVRAL 50W (150 g/100 L or 1.5 kg/ha) tank mixed with KUMULUS (300 g/100 L or 3.0 kg/ha) on 29 August, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 12 September, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 28 September, 8 days before harvest on October 6, 2000.

SOVRAN only (SOVRAN1) Program was only on Pinot noir grapes and consisted of SOVRAN 50 WG (30 g/100 L or 0.3 kg/ha) applied on 6 June, 27 June, 18 July, 8 August, 29 August, 12 September, and 28 September, 8 days before harvest on October 6, 2000.

SOVRAN integrated (SOVRAN2) Program on Pinot noir and Chancellor grapes consisted of MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) on 16 May, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 23 May, DITHANE M 45 (450 g/100 L or 4.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 30 May, SOVRAN 50 WG (24 g/100 L or 0.24 kg/ha) on 6 June, SOVRAN 50 WG (24 g/100 L or 0.24 kg/ha) on 27 June, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 18 July, SOVRAN (24 g/100 L or 0.24 kg/ha) on 8 August, SOVRAN (24 g/100 L or 0.24 kg/ha) on 29 August, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on 12 September, MAESTRO 75 DF (350 g/100 L or 3.5 kg/ha) tank mixed with KUMULUS 80 (300 g/100 L or 3.0 kg/ha) on Pinot noir grapes only on 28 September, 8 days before harvest on October 6, 2000.

RESULTS and DISCUSSION: Powdery mildew was first observed on grape foliage in late July. Both SOVRAN programs and FLINT were more effective than the Grower program in preventing powdery mildew on Pinot noir grape clusters at harvest (Table 1). The SOVRAN2 program was as effective as the FLINT and the Grower program in preventing powdery mildew at harvest on Chancellor grapes (Table 2). The greatest yield of Pinot noir grapes came from those treated with the SOVRAN2 program

although the soluble solids of these grapes were slightly less than those in the Grower program (Table 3). There was no significant difference between the treatments in the yield and number of clusters of Chancellor grapes (Table 4). There was no phytotoxicity observed in this trial that could be attributed to any of the treatments. The SOVRAN1 program did not control bunch rot in Pinot noir grapes compared to the other programs (Table 5). Bunch rot inidence was very low, however.

CONCLUSIONS: The SOVRAN programs provided excellent control of powdery mildew and provided much better control than the Grower program on powdery mildew of Pinot noir grape clusters at harvest under extremely high powdery mildew pressure.

Table 1. Percent powdery mildew incidence and severity of Pinot Noir grapes treated with SOVRAN.

Treatment (Evaluated)	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
Sov.1 (Aug.1)	30.0 b[1]	00.2 c	00.0 b	00.0 b
Sov.2 (Aug.1)	30.6 b	00.2 c	01.9 b	0.00 b
Flint (Aug. 1)	22.2 b	02.2 b	00.8 b	00.0 b
Grower (Aug. 1)	58.7 a	05.0 b	60.4 a	02.5 b
Control (Aug. 1)	87.4 a	10.2 a	81.0 a	19.8 a
Pr> F	0.0060	<0.0001	0.0018	0.0110
Sov.1 (Sept.15)	53.2 c	05.9 b	00.0 c	00.0 b
Sov.2 (Sept.15)	80.2 ab	09.2 b	00.0 c	00.0 b
Flint (Sept. 15)	57.5 bc	08.5 b	01.9 c	00.1 b
Grow. (Sep.15)	73.2 bc	09.9 b	49.5 b	03.4 b
Cont. (Sep. 15)	95.0 a	28.4 a	87.7 a	35.2 a
Pr> F	0.0036	0.0015	<0.0001	0.0005
Sov.1 (Oct. 10)	96.2 b	23.7 b	00.0 c	00.0 c
Sov.2 (Oct. 10)	95.6 b	23.2 b	00.4 c	00.2 c
Flint (Oct. 10)	85.9 c	13.4 b	00.2 c	00.2 c
Grow. (Oct. 10)	98.0 ab	30.7 b	34.7 b	20.9 b
Cont. (Oct. 10)	99.9 a	59.9 a	85.9 a	56.8 a
Pr > F	0.0025	0.0025	<0.0001	<0.0001

[1] 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 five replications.

Table 2. Percent powdery mildew incidence and severity of Chancellor grapes treated with SOVRAN.

Treatment (Evaluated)	Leaf Powdery Mildew		Cluster Powdery Mildew	
	Incidence	Severity	Incidence	Severity
Sov.2 (Aug.1)	05.0 b[1]	00.0 b	0.0 a	0.0 a
Flint (Aug. 1)	07.3 b	00.0 b	0.0 a	0.0 a
Grow. (Aug.1)	06.4 b	00.0 b	0.0 a	0.0 a
Cont. (Aug. 1)	66.0 a	01.5 a	6.4 a	6.4 a
Pr > F	0.0012	0.0034	0.2183	0.2183
Sov.2 (Sep. 15)	042.5 b	04.9 b	01.3 b	00.1 b
Flint (Sept. 15)	046.2 b	08.0 b	00.0 b	00.0 b
Grow. (Sep.15)	058.8 b	10.2 b	00.6 b	00.1 b
Cont. (Sep.15)	100.0 a	71.5 a	79.2 a	19.3 a
Pr > F	0.0009	<0.0001	0.0021	0.0467
Sov.2 (Oct. 10)	075.4 b	10.4 b	00.3 b	00.1 b
Flint (Oct. 10)	088.6 b	22.6 b	00.2 b	00.2 b
Grow. (Oct.10)	091.4 b	20.2 b	06.4 b	03.3 b
Cont. (Oct. 10)	100.0 a	84.5 a	84.7 a	50.6 a
Pr > F	0.0336	<0.0001	<0.0001	0.0009

[1] 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 SOVRAN on number of clusters, weight, pH, soluble solids, and titratable acidity of harvested Pinot noir grapes.

Treatment	No. Clusters	Weight (kg)	pH	SS	TA
SOVRAN1	243.2 a[1]	26.80 ab	3.32 a	21.60 ab	15.13 a
SOVRAN2	294.6 a	34.05 a	3.25 a	18.26 c	15.98 a
FLINT	256.4 a	33.41 ab	3.29 a	19.86 bc	14.07 a
Grower	232.2 a	20.63 ab	3.33 a	22.72 a	16.16 a
Control	240.6 a	17.85 b	.....	.....	.....
Pr> F	0.8080	0.1061	0.5499	0.0137	0.5027

[1] 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 five replications.

Table 4. Effect of SOVRAN on number of clusters and weight of Chancellor grapes at harvest.

Treatment	No. Clusters	Weight (kg)
SOVRAN2	423.8 a[1]	52.39 a
FLINT	370.5 a	42.74 a
Grower	314.8 a	38.08 a
Control	412.0 a	47.64 a
Pr> F	0.4035	0.6577

[1] 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 5. Effect of SOVRAN on percent bunch rot in Chancellor and Pinot noir grapes at harvest.

Treatment	Chancelor		Pinot noir	
	Incidence	Severity	Incidence	Severity
SOVRAN1	.....	.....	3.4 a	2.2 a
SOVRAN2	0.5 a[1]	0.2 a	1.4 ab	0.6 a
FLINT	0.0 a	0.1 a	0.8 ab	0.4 a
Grower	0.9 a	0.6 a	0.0 b	0.0 a
Control	0.8 a	0.6 a	2.9 a	1.7 a
Pr> F	0.7504	0.9029	0.1280	0.2311

[1] 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 five replications.

END OF SECTION K: FRUIT - Diseases
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SECTION L:	VEGETABLES and SPECIAL CROPS - Diseases /les maladies des légumes et cultures spéciales
REPORT /RAPPORT #:	93 - 97
PAGES:	270 - 281
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2001 PMR REPORT # 93 SECTION L:VEGETABLE and SPECIAL CROPS - Diseases

CROP: Carrot (*Daucus carota* subsp. *sativus* (Hoffm.) Arkang.), cv. Cellobunch
PEST: Sclerotinia rot, *Sclerotinia sclerotiorum* (Lib.) De Bary

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TITLE: EVALUATION OF FOLIAR CLIPPING TREATMENTS FOR THE CULTURAL CONTROL OF SCLEROTINIA ROT OF CARROT, 2001

MATERIALS: Gas operated hand-held hedge trimmer (STIHL, Model # HS45, 27cc engine with a 24 inch double edge cutting blade)

METHODS: The trial was conducted in naturally infested organic soils of the Muck Crop Research Station, Bradford Marsh, Ontario. Carrots were direct seeded with a precision seeder (90-100 seeds/m) on raised beds 86 cm apart, on 22 May. Each treatment plot consisted of four 8 m long rows. The trial was arranged as a randomized block design with four treatments and four replications. The treatments consisted of: i) Untreated check; ii) Hand-picked lodged senescing leaves; iii) Vertically clipped canopy with plant debris left in the furrow; and iv) Vertically clipped canopy with plant debris removed from the furrow. Hand-picking of lodged senescing leaves was performed in bi-weekly intervals starting at first appearance of senescing leaves on the ground (17 Aug) through harvest. Vertical clipping was performed using a gas operated hand-held hedge trimmer after full canopy closure and initial development of apothecia (04 Sep). 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. As a result of the clipping, an average of 3 out of 10 leaves per carrot in the side lines were trimmed at ca.15 cm long petioles. The carrot canopy width was reduced by 40% (20% on each side of the row) and the opening between the rows averaged 40 cm wide. Naturally-occurring apothecia of *S. sclerotiorum* were monitored by weekly counts of apothecia present in 1.72 x 8 m sections/plot over a three week period (02, 09 and 16 Oct). Foliar disease incidence, fresh foliar and root weight were evaluated at harvest (30 Oct). Air temperatures were above the long term (10 year) average in May (13.9^{O}C) and August (20.6^{O}C), below average in July (18.9^{O}C), and average in June (18.3^{O}C) and

September (14.7^{O}C). Monthly rainfall was above the long term (10 year) average in May (85 mm), and below average in June (63 mm), July (60 mm), August (32 mm) and September (53 mm). Data were analysed using the *Proc GLM* (General Linear Models) procedure of SAS 6.12. Mean separation was obtained using Fisher's Protected LSD test at P= 0.05.

RESULTS: As outlined in Tables 1 & 2.

CONCLUSIONS: Vertical clipping treatments significantly reduced the number of germinated apothecia in the first (P = 0.0015), second (P = 0.0017) and third (P = 0.0325) observation days except for the vertical clipping with debris left in furrow in the third observation day (Table 1). Generally, the number of germinated apothecia was reduced by 77 - 85% over the three week period. In clipped plots apothecia were primarily localized on the hill surface, directly under the clipped canopy, whereas in unclipped plots they were distributed along the furrow and the slopes of the bed. Foliar disease incidence in both unclipped plots was significantly higher (P=0.0001) than in vertically clipped plots, being absent in the latter. No significant differences were observed among treatments in fresh foliar weight (P=0.6591), fresh root weight (P=0.1216) or yield (P=0.1549) (Table 2). Vertical clipping apparently modified the micro-climate within the crop rendering it unfavourable for the pathogen development. In addition to reducing the amount of primary inoculum, clipping removed efficiently the lodged senescing leaves (susceptible tissue) from the carrot plant for the rest of the growing season preventing foliar disease development. *S. sclerotiorum* was never recovered from the foliar debris left in the furrow after clipping, which was fully decomposed in about 3 weeks. These results demonstrate that vertical clipping of carrot canopy is a cultural modification that has potential as an effective strategy for integrated management of sclerotinia rot of carrot.

Table 1. Effect of foliar clipping of carrot canopy on density of naturally occurring apothecia of *S. sclerotiorum* and foliar incidence of sclerotinia rot of carrot at harvest, Muck Crop Research Station, Bradford Marsh, Ontario, 2001.

Treatment	Apothecia count /m^2			Foliar disease incidence (plants/m row)
	09 Oct[1]	16 Oct[1]	23 Oct[1]	
Untreated (Check)	2.14a[2]	1.68a	1.20a	6.54b
Hand-picking of lodged senescing leaves	1.92a	2.29a	1.34a	7.96a
Vertical clipping with debris in furrow	0.49b	0.65b	0.80ab	0.00c
Vertical clipping with removed debris	0.31b	0.34b	0.31b	0.00c

[1] Statistics performed on log transformed data; reported means represent back-transformed values.
[2] Numbers in a column followed by the same letter are not significantly different (P = 0.05, Fisher's Protected LSD test).

Table 2. Effect of foliar clipping of carrot canopy on fresh foliar and root weight in experimental crop at Muck Crop Research Station, Bradford Marsh, Ontario, 2001.

Treatment	Fresh foliar weight kg/m row	Fresh root weight kg/m row	Yield T/ha
Untreated (Check)	0.86a[1]	7.24a	83.98a
Removal of lodged senescing leaves	1.06a	8.65a	100.33a
Vertical clipping with debris in furrow	0.97a	7.86a	91.21a
Vertical clipping with removed debris	0.88a	7.36a	85.43a

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

2001 PMR REPORT # 94 SECTION L: VEGETABLES and SPECIAL CROPS - Diseases
ICAR: 206003

CROP: Carrot (*Daucus carota* subsp. *sativus* (Hoffm.) Arkang.), cvs. Annapolis, Indiana, Idaho
PEST: Alternaria (*Alternaria dauci)* and Cercospora (*Cercospora carotae*) leaf blight

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TITLE: EFFECT OF NITROGEN APPLICATION RATE ON LEAF BLIGHT SEVERITY IN CARROTS GROWN ON MUCK AND MINERAL SOIL, 2000-01

MATERIALS: CALCIUM AMMONIUM NITRATE (nitrogen 27.5%), POTASSIUM NITRATE (nitrogen 13.75%)

METHODS: Carrots were seeded into muck soil at the Muck Crops Research Station and into mineral soil at the Simcoe Research Station in 2000 and 2001. Cultivars Annapolis (2000) and Idaho (2001) were seeded on 14 Jun (2000) and 13 Jun (2001) in mineral soil, and cultivars Indiana and Idaho (2000) and Idaho and Annapolis (2001) were seeded on 28 Jul (2000) and 24 May (2001) in muck soil. The experiments were arranged in a randomised complete block design with four replications per treatment. Mineral soil plots consisted of 3 rows, 7 m in length, spaced 35 cm apart, at a seeding rate of 80 seeds/m with 3 guard rows between experimental units. Muck soil plots consisted of 4 hills (2 hills/cultivar), 20 cm high, 5 m in length, spaced 86 cm apart at a seeding rate of 80 seeds/m. Nitrogen (N) was applied at 0%, 50%, 100%, 150%, and 200% of the OMAFRA (Ontario Ministry of Agriculture, Food, and Rural Affairs) recommended rate (60 kg/ha N all preplant on muck soil, 110 kg/ha N preplant and 35 kg/ha N sidedress on mineral soil) using CALCIUM AMMONIUM NITRATE preplant and POTASSIUM NITRATE for sidedress applications. Once leaf blight symptoms developed, carrots were rated bi-weekly until harvest for the combined damage caused by Alternaria and Cercospora. The carrot canopy of the middle 2 rows (muck) and all 3 rows (mineral) of each cultivar and treatment was rated on a scale of 1-5 (5-no lesions, 3-moderate lesions on leaves and some on petioles, 1-tops completely rotted). Carrots were harvested on muck soil from 2.33 m of row from each cultivar on 17 Nov (2000) and 25 Oct (2001) and on mineral soil from a 2 m section of 3 rows of each experimental unit on 6 Nov (2000) and 24 Oct and 30 Oct (2001) and assessed for marketable yield. Weather data for the two years and locations are presented in Table 1. In 2001 in both locations carrots were irrigated as required. A linear and quadratic regression analysis was performed on both the yield data and the final leaf blight rating of each season using the General Linear Models section of SAS version 8.0 (SAS Institute, Cary NC).

RESULTS: Disease severity was reduced by dry and warm weather during the infection period in both years and locations (Table 1). Leaf blight data are presented in Table 2. Only selected harvest dates are shown including the final rating of each season in each location when leaf blight damage was at its peak. Leaf blight did not develop in the plot on muck soil in 2000. Leaf blight data are not presented for this plot. Yield data are presented in Table 3. Data from the two cultivars on muck soil were combined.

CONCLUSIONS: In the final rating of each season, when leaf blight was present, disease severity was significantly affected by N application rate in both locations and both years. As N application rate increased, leaf blight severity generally decreased. The decrease in leaf blight severity with increased N application is most likely due to delayed senescence of the leaf tissue. Since *Alternaria dauci* infects senescing tissue, a delay in senescence also delayed the infection of the leaves. The overall leaf blight rating differences likely reflect differences in Alternaria infection. Yield was not significantly affected by leaf blight damage or N application rate in either location or year. The data shows a strong link between the fertilization practices of carrots and disease severity. Fertilization practices should be included in the integrated pest management program for carrot leaf blight.

Table 1. Mean monthly temperatures, monthly precipitation, and long-term averages (LTA) in 2000 and 2001 for Simcoe and the Holland/Bradford Marsh.

Month	Simcoe						Holland/Bradford Marsh					
	Mean Temp. (°C)			Precip. (mm)			Mean Temp. (°C)			Precip. (mm)		
	2000	2001	LTA	2000	2001	LTA	2000	2001	LTA	2000	2001	LTA
May	14.4	14.7	12.6	103	109	74	13.1	13.9	12.9	160	85	70
Jun	18.5	19.3	17.8	181	63	82	17.3	18.3	17.5	173	63	78
Jul	19.8	20.7	20.4	146	11	77	18.4	18.9	20.3	86	60	82
Aug	19.7	21.8	19.5	81	105	80	18.3	20.6	19.0	76	32	84
Sep	15.8	15.9	15.5	99	37	89	14.2	14.7	14.6	80	53	84

Table 2. Effect of nitrogen application rate on leaf blight severity on carrots grown on muck and mineral soil in 2000 and 2001.

Rate (% of Recommended) N Application	Leaf Blight Rating[1] - Mineral Soil				Leaf Blight Rating[1] - Muck Soil	
	2000		2001		2001	
	11-Oct	6-Nov[2]	19-Sep	17-Oct[3]	1-Oct	15-Oct[4]
0	3.13	1.88	3.38	2.75	3.31	3.13
50	3.88	2.88	3.75	2.88	3.94	3.44
100	3.88	3.13	4.25	3.38	4.25	3.56
150	4	3.13	4.38	3.75	4.31	3.75
200	4.38	3.25	4.25	3.88	4.38	3.63

[1] Rating: 5-no lesions, 3-moderate lesions on leaves and some on petioles, 1-tops completely rotted.
[2] Regression: $P<0.0001$, $R^2=0.67$, Equation: blight rating=1.96 + (0.0174)Nrate - (0.000057)Nrate^2.
[3] Regression: $P<0.0001$, $R^2=0.64$, Equation: blight rating=2.70 + (0.0063)Nrate.
[4] Regression: $P=0.0088$, $R^2=0.32$, Equation: blight rating=3.24 + (0.0026)Nrate.

Table 3. Effect of nitrogen application rate on yield of carrots grown on muck and mineral soil in 2000 and 2001.

N Application Rate (% of Recommended)	Yield (t/ha)(Mineral Soil)[1]		Yield (t/ha)(Muck Soil)[1]	
	2000	2001	2000	2001
0	64.1	47.4	21.5	83.1
50	79.8	49.7	19.1	76.6
100	73.6	40.6	18.9	80.8
150	76.7	48.4	17.0	80.1
200	74.6	51.6	16.8	80.2

[1] Linear and quadratic regression analysis not significant.

2001 PMR REPORT # 95 SECTION L: VEGETABLE and SPECIAL CROPS - Diseases
ICAR: 3330718

CROP: Cauliflower (*Brassica oleracea* L.), cv. Cumberland
PEST: Clubroot, *Plasmodiophora brassicae* (Woronin)

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TITLE: EVALUATION OF FUNGICIDE AND FERTILIZER TREATMENTS FOR CONTROL OF CLUBROOT, 2000

MATERIALS: AGRAL 90, calcium nitrate, agricultural lime (calcium carbonate), OMEGA (fluazinam), PREVICUR N (propamocarb)

METHODS: Treatments were applied at transplanting on June 21, 2000 in a fresh-market commercial field on organic soil in Cloverdale, British Columbia, in a randomized complete block with 4 replicates. Average soil pH at transplanting was 6.5. Each plot consisted of 20 plants (5 m of row) on raised beds with a row width of 90 cm centre to centre. Just before transplanting, the agricultural lime ($CaCO_3$) treatments were applied as a band in a root-zone furrow and liquid treatments were mixed with water and poured into each transplanting hole in 20 mL of solution/plant. Calcium nitrate ($CaNO_3$) was applied as a side-dressing at 90 kg N/ha three weeks after transplanting. The field was maintained by the grower following standard commercial practices. A visual rating of plant vigour (growth and leaf colour) was done on August 28, on a scale of 1-5, where 1=stunted plants with yellow/purplish leaves and 5=large plants with green leaves. Four plants from each plot were harvested on Sept. 20 and again on Sept. 26. Roots were washed and root clubbing was rated on a scale of 1-5: 0=no clubs; 1=1 clubbed root; 2= 2-3 clubbed roots or 10-25% of root system clubbed; 3=3-4 clubs or 25-50% of root system clubbed; 4=50-75% of root system clubbed and 5=75-100% of root system clubbed. Means were compared by Tukey-Kramer HSD at P = 0.05 using JMP 3.1.5. Head weights were taken from 4 plants randomly selected from each plot on a single harvest date in early September. Soil pH (mean of 5 cores) at harvest averaged 7.2 in the untreated control plots and 7.5 in the plots treated with the high rate of banded lime.

RESULTS: OMEGA (fluazinam 500 g/L) at 2 kg ai/ha, the high rate of banded lime at 44.8 tonnes/ha (20 tons/acre) and the side-dressing of calcium nitrate fertilizer at 90 kg N/ha all resulted in a significant decrease in root clubbing (Table 1). Fluazinam produced the lowest clubroot ratings, but was not statistically different from the other two. No phytotoxicity was observed with fluazinam, but the other two treatments, particularly the side-dressing of calcium nitrate, rated higher for overall plant growth and vigour. The low rate of banded lime at 22.4 tonnes/ha (10 tons/acre), Agral 90 at l mL/plant and Previcur N (propamocarb) at 0.4 mL/plant were not statistically different from the untreated control in root clubbing or plant vigour. No difference in head weights was found on the single harvest date (data not shown).

CONCLUSIONS: A side-dressing of calcium nitrate three weeks after transplanting provided very good clubroot control and plant vigour on this organic soil. OMEGA (fluazinam) shows promise as fungicide treatment.

Table 1. Clubroot disease rating of fresh-market cauliflower at harvest.

Treatment/Rate	Total Club - Root Rating	Mean Club-Root Rating[1]	% of Ratings > or = 3	Mean Plant Vigour Rating[1]
Check	84	2.6ab	56.3	2.3b
Banded lime @ 22.4 t/ha	69	2.2b	40.6	3.5ab
Banded lime @ 44.8 t/ha	44	1.4c	15.6	4.0ab
Agral 90 @ 1 mL/plant	54	1.7bc	34.4	2.5b
OMEGA (fluazinam) 2 kg ai/ha	32	1.0c	12.5	3.3ab
Ca nitrate @ 90 kg N/ha	47	1.5bc	25.0	4.8a
Lime slurry @ 10 g/plant	107	3.3a	68.8	2.5b
Previcur N @ 0.4 mL/plant	72	2.3bc	43.7	3.3ab

[1] Means followed by same letter are not significantly different in Tukey-Kramer (P=0.05).

2001 PMR REPORT # 96 SECTION L: VEGETABLE and SPECIAL CROPS - Diseases
ICAR: 3330718

CROP: Cauliflower (*Brassica oleracea* L.), cv. Shasta
PEST: Clubroot, *Plasmodiophora brassicae* (Woronin)

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TITLE: EVALUATION OF FUNGICIDE AND FERTILIZER TREATMENTS FOR CONTROL OF CLUBROOT, 2001

MATERIALS: agricultural lime (calcium carbonate), GAVEL 75DF (zoxamide + mancozeb), OMEGA (fluazinam), RANMAN (cyazofamid) + SYLGARD (surfactant)

METHODS: Treatments were applied at transplanting on July 16, 2001 in a commercial processing crop field on a silt loam soil in Abbotsford, British Columbia, in a randomized complete block with 5 replicates. Lime at 2 tons/acre was applied by the grower to the entire field before transplanting. Each plot consisted of 20 plants (8 m of row) with a row width of 110 cm centre to centre. Just before transplanting, the agricultural powdered lime ($CaCO_3$) treatments were applied as a band in a root-zone furrow and liquid treatments were mixed with water and poured into each transplanting hole in 20 mL of solution/plant. RANMAN was applied with SYLGARD surfactant at a 4:3 ratio. The field was maintained by the grower following standard commercial practices. A visual rating of plant vigour (growth and leaf colour) was done on Sept.11 on a scale of 1-5, where 1=stunted plants with yellow/purplish leaves and 5=large plants with green leaves. Eight plants from each plot were harvested on Sept. 25. Roots were washed and root clubbing was rated on a scale of 1-4 following a modified scale of Humpherson-Jones, 1989. Tests. Agro Cult. 10:36-37: 0=no clubs; 1=<25% of root system clubbed; 2= 25-50% of root system clubbed; 3= 50-75% of root system clubbed; 4=75-100% of root system clubbed. Means were compared by Tukey-Kramer HSD at P=0.05 in JMP 3.1.5. Soil pH at transplanting was 6.7. Average soil pH at harvest was 6.9 in the check; 7.1 in the high rate of RANMAN; 6.9 in the low rate of banded lime and 7.5 in the high rate of banded lime.

RESULTS: RANMAN (cyazofamid) + SYLGARD surfactant provided excellent clubroot control with no phytotoxicity (Table 1). OMEGA (fluazinam) and GAVEL 75DF were phytotoxic. Untreated control plants produced large, green plants and a very good heads despite almost 100% root clubbing at harvest. Both the high rate of banded lime and the high rate of RANMAN + SYLGARD raised the soil ph above 7.0.

CONCLUSIONS: Cyazofamid is a very promising treatment for clubroot. Fluazinam gave very good control on an organic soil in 2000 with no plant damage, but was phytotoxic on this silt loam soil.

Table 1. Plant vigour and clubroot disease rating of processing cauliflower at harvest.

Treatment/Rate	Mean Vigour Rating/Plot[1]	Mean Clubroot Rating/Plant[1]
Check	4.3a	3.1a
Banded lime @ 22.4 t/ha	3.9a	2.1ab
Banded lime @ 44.8 t/ha	4.0a	1.3ab
OMEGA (fluazinam) 2 kg ai/ha	2.8b	2.1ab
OMEGA (fluazinam) 3 kg ai/ha	2.9b	0.97b
RANMAN (cyazofamid) 2 kg ai/ha + SYLGARD @ 3.3 mL/plot	4.4a	0.50b
RANMAN (cyazofamid) 3 kg ai/ha + SYLGARD @ 5.0 mL/plot	4.4a	0.43b
GAVEL 75DF @ 2.25 kg/ha	2.4b	0.95b

[1] Means followed by same letter are not significantly different in Tukey-Kramer at P=0.05.

2001 PMR REPORT # 97 SECTION L: VEGETABLES and SPECIAL CROPS - Diseases
STUDY DATA BASE 280-2124-9911

CROP: Ginseng (*Panax quinquefolius* L.)
PEST: Damping-off, *Rhizoctonia solani* (Kuehn)

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TITLE: COMPARISON OF FUNGICIDES FOR MANAGEMENT OF RHIZOCTONIA DAMPING-OFF IN GINSENG, 1999-2001

MATERIALS: NUTRI-Q 0-0-5 (quintozene 6%), SOVRAN (kresoxim-methyl 50%), ROVRAL 50 WP (iprodione 50%)

METHODS: The trial was established on a brunisolic grey-brown luvisol (Fox loamy sand; Delhi research farm) on 25 Oct 1999. 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 (10 Nov 99), or the following spring (3 Mar 00). 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. On 10 Nov 99, 5 g (fresh wt) of colonized root, held in a cheesecloth bag, was placed in a shallow depression in the center of each fall-inoculum subplot. Additional inoculum, prepared simultaneously, was stored at 8 C until 3 Mar 00, when it was added to spring-inoculum subplots. Fall fungicide applications (SOVRAN, ROVRAL, NUTRI-Q) were made 12 Nov 99, after placement of an oat straw mulch over the seeded beds. Spring fungicide applications (SOVRAN, ROVRAL) were made on 4 Apr 00 over the existing straw mulch. ROVRAL and SOVRAN applications were made once in the fall and once 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. Efficacy was evaluated during 2000 and 2001 but no further treatment applications were made after 4 Apr 00. Ginseng stand counts for each 1.0 m^2 area subplot were recorded in Aug 2000 and 2001. 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.

CONCLUSIONS: Significant differences were observed in 2001 in fall-inoculum subplots only. NUTRI-Q 0-0-5 was superior to both the control and ROVRAL @ 0.6 kg a.i./ha with respect to the radius of damped-off plants in 2001 but not in 2000. Other treatments were not significantly different from the control. Disease in all plots spread in a roughly circular pattern from the site of inoculum addition. Disease development in check plots was adequate in fall-inoculum subplots; the radii of areas of damped-off plants were 31-40 cm of a maximum 50 cm. Disease development in spring-inoculum subplots was erratic. Delayed emergence resulted in higher stand counts in 2001 than in 2000.

Quintozene is currently the only active ingredient with full registration for this ginseng disease. Quintozene is generally more effective when applied prior to mulching of ginseng beds (Fungicide and Nematicide Tests 56:M2). Neither SOVRAN nor ROVRAL appear to be effective when applied over mulch. In a similar trial, azoxystrobin (QUADRIS) was shown to be efficacious in controlling damping-off in ginseng when applied over mulch (Fungicide and Nematicide Tests 56:M3).

Table 1. Comparison of fungicides for control of damping-off in ginseng, 1999-2001.

Treatment and rate a.i./ ha	Fall-inoculated subplots				Spring-inoculated subplots			
	2000		2001		2000		2001	
	St[4]	Rd[5]	St[4]	Rd[5]	St[4]	Rd[5]	St[4]	Rd[5]
Rovral 50WP @ 0.6 kg[1] + 0.6 kg [2]	76.3	36.3	99.3	43.3 a	124.3	14.7	129	22
Rovral 50WP @ 1.1 kg [1] + 1.1 kg [2]	83.7	34.3	83.7	36.3 ab	139	13.5	91.5	13.5
Sovran @.0.1 kg [1] + 0.1 kg [2]	81	36	83.7	36.0 ab	113.3	15.7	124.7	19.3
Sovran @.0.2 kg [1] + 0.2 kg [2]	82.3	32	86	35.0 ab	114.3	18	88.3	22.3
Nutri-Q 0-0-5 @ 6.8 kg [3]	102	27.3	129.7	29.3 b	135.7	7.3	150.3	7.7
Control	81	40	108.5	44.0 a	99	31.5	131	31.5
P > F	0.857	0.08	0.402	0.045	0.752	0.129	0.271	0.1

[1] Application of treatment was made 12 Nov 99. No applications were made in fall 2000 or spring 2001.
[2] Application of treatment was made 4 Apr 00. No applications were made in fall 2000 or spring 2001.
[3] Nutri-Q 0-0-5 was applied 12 Nov 99 only.
[4] St: Plants per square metre at end of growing season (August).
[5] Rd: Radius of damped-off area in centimetres at end of growing season (August).

END OF SECTION L: VEGETABLE SPECIAL CROPS - Diseases
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SECTION M:	**FIELD LEGUMES /LÉGUMINEUSES DE GRANDE CULTURE**
REPORT /RAPPORT #:	**98 - 119**
PAGES:	**282 - 330**
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2001 PMR REPORT # 98 **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 TO CONTROL RHIZOCTONIA ROOT ROT OF DRY BEAN IN 2001

MATERIALS: L0020 (metalaxyl, 320 g/L FL), L1022 (metalaxyl 12 g/L + ipconazole, 7.5 g/L SU), L1031 (HEC 5725, 37.5 g/L + triazolinthion, 37.5 g/L SU), U2051 (carbathiin, 169.6 g/L + thiram, 150.6 g/L SU), U2789 (carbathiin, 233 g/L SU)

METHODS: Seed of dry bean cv. US 1140 was treated with U2051, L1022 or with L0020 at 0.128 mL/kg seed, either alone or in combination with L1031 at 1.33 mL/kg, U2051 at 2.6 mL/kg or U2789 at 1.92 mL/kg seed in a Hege II small batch seed treater. Experimental plots were established on 17 May at Brooks, Alberta in brown chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. *Rhizoctonia*-inoculated and non-inoculated controls were seeded along with the treatments. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. *Rhizoctonia solani* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 40 mL/row (4×10^2 cfu/mL) at the time of seeding. Emerged seedlings were counted on 15 June. Plots were harvested using a small plot combine on 5 August. 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 significantly greater ($P \leq 0.05$) for all seed treatments tested

compared to both the inoculated and noninoculated controls, except for the L0020 and the L0020 + U2789 treatments (Table 1). Seed yield was similar among all fungicidal seed treatments in the trial and was significantly greater ($P \leq 0.05$) for the L0020 + U2051 seed treatment compared to the inoculated control.

CONCLUSIONS: All fungicidal seed treatments in the trial, except for L0020 alone and L0020 + U2789, improved plant stand over the nontreated inoculated control. While all seed treatments in the trial resulted in a similar yield, the L0020 + U2051 treatment produced a greater seed yield than the inoculated control.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of dry bean cv. US 1140 grown in soil infested with *Rhizoctonia solani* at Brooks, Alberta in 2001.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Control + *R*[1]	-	54.6 c[2]	1.91 b
U2051 + *R*	2.6	63.2 ab	2.33 ab
L1022 +*R*	3.1	62.0 ab	2.10 ab
L0020 +*R*	0.128	54.4 c	2.32 ab
L0020 + L1031 + *R*	0.128 + 1.33	64.1 a	2.17 ab
L0020 + U2051 +*R*	0.128 + 2.6	61.2 ab	2.76 a
L0020 + U2789 +*R*	0.128 + 1.92	59.5 abc	2.50 ab
Noninoculated control	-	57.5 c	2.57 ab

[1] Denotes inoculation with *Rhizoctonia solani.*

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 99 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry Bean (*Phaseolus vulgaris* L.), cv. Thunder
PEST: Root Rot, *Fusarium avenaceum* (Fr.) Sacc.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF FUSARIUM ROOT ROT OF DRY BEAN IN ALBERTA IN 2001

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of dry bean cv. Thunder was treated with VITAFLO 280 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 16 May, 2001 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 20 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 (4×10^2 cfu/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted on 15 June. At maturity (4 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 was significantly greater ($P \leq 0.05$) for all seed treatments compared to the inoculated control (Table 1) and was significantly greater ($P \leq 0.05$) for the APRON MAXX treatments than for the VITAFLO 280 treatment. Seed yield was similar among all fungicidal treatments in the trial, but was significantly greater ($P \leq 0.05$) than the inoculated control only for the APRON MAXX treatment at the lower rate.

CONCLUSIONS: All fungicidal treatments in the trial improved emergence over the inoculated control, but only APRON MAXX improved it to the level found in the noninoculated control. Only APRON MAXX at the lower rate improved yield over the inoculated control.

Table 1. Effect of seed treatments on plant stand and seed yield of dry bean cv. Thunder sown into soil inoculated with *Fusarium avenaceum* at Brooks, Alberta in 2001.

Treatment	Rate (g a.i./100 kg seed)	Stand (plants/6m)	Seed yield (T/ha)
APRON MAXX	6.25	42.2 a[1]	2.51 a
APRON MAXX	12.5	40.5 a	2.39 ab
VITAFLO 280	88	33.6 b	2.00 ab
Inoculated Control	--	27.6 c	1.81 b
Noninoculated Control	--	39.1 a	2.31 ab

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 100 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry Bean (*Phaseolus vulgaris* L.), cvs. US 1140 and Thunder
PEST: Root Rot, *Pythium ultimum* Trow, *P. irregulare* Buisman

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF PYTHIUM ROOT ROT OF DRY BEAN IN ALBERTA IN 2001

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of dry bean cvs. US 1140 and Thunder was treated with VITAFLO 280 at 88 g ai/100 kg seed or APRON MAXX at 6.25 or 12.5 g ai/100kg seed in a Hege II small batch seed treater. An experimental plot was established on 18 May, 2001 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was seeded in a split-plot randomized complete block design with four replications. Dry bean cultivars served as main plots and fungicide seed treatment served as subplots. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 18 g of seed per row. *Pythium ultimum* and *P. irregulare* were grown on sterilized oat grains for 14 days, dried, ground, mixed and incorporated at the time of seeding at the rate of 40 mL/row (5×10^2 cfu/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted on 15 June. At maturity (5 August), plants were harvested by small-plot combine. Seed was 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 significantly greater ($P \leq 0.05$) for the APRON MAXX treatments compared to the inoculated control (Table 1). Seed yield was similar among all treatments in the trial. Seedling emergence and seed yield were significantly greater ($P \leq 0.05$) for US 1140 than for Thunder (Table 2).

CONCLUSIONS: Emergence was improved over the inoculated control by both APRON MAXX treatments, but seed yield was unaffected by seed treatment. US 1140 had higher emergence and yield levels than Thunder.

Table 1. Effect of seed treatments on plant stand and seed yield of dry bean cvs. US 1140 and Thunder grown in soil infested with *Pythium ultimum* and *P. irregulare* at Brooks, Alberta in 2001.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Seed yield (T/ha)
APRON MAXX + *P*	6.25	53.8 a[1]	3.45 a
APRON MAXX + *P*	12.5	53.4 a	3.63 a
VITAFLO 280 + *P*	88	51.0 ab	3.34 a
Control + *P*	--	49.3 b	3.14 a
Noninoculated Control	--	51.7 ab	3.72 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

Table 2. Comparison of seedling establishment and seed yield of dry bean cvs. US 1140 and Thunder at Brooks, Alberta in 2001.

Cultivar	Stand (plants/6m)	Seed yield (T/ha)
US 1140	62.4 a[1]	3.93 a
Thunder	41.3 b	2.98 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 101 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry Bean (*Phaseolus vulgaris* L.), cv. Navigator
PEST: Anthracnose, *Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib.

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TITLE: EFFICACY OF FOLIAR SPRAY FORMULATIONS AGAINST ANTHRACNOSE OF DRY BEAN IN ALBERTA IN 2001

MATERIALS: BRAVO 500F (chlorothalonil, 500 g/L SU), DITHANE RAINSHIELD NT (mancozeb 75% DG), QUADRIS 250 SC (azoxystrobin, 250 g/L SU), TILT 250 EC (propiconazole, 250 g/L EC)

METHODS: Experimental plots were established on 1 June, 2001 at Vegreville, Alberta, in black chernozemic sandy loam soil. Dry bean cv. Navigator was seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. The foliar fungicide treatments BRAVO (at 1000 g ai/ha), TILT (at 125 g ai/ha), DITHANE (at 1688 g ai/ha) or QUADRIS (at 125 or 175 g ai/ha) were applied on 1 August and/or 13 August using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa using 360 L/ha water volume. Anthracnose severity was rated on 29 August at five sites per plot on the basis of percent foliar infection on the upper, middle and lower portions of the plants. 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. Pre- and post-inoculated trials were set up under greenhouse conditions. Clean seed of dry bean cv. Navigator was planted in 12-cm pots (10 seeds/pot) in a sterilized 1:1:1 sand:soil:vermiculite mix (v:v:v) and grown until seedlings were eight days old. In the post-inoculated trial, a spore suspension of 10^6 conidia/mL of *Colletotrichum* was amended with 0.05% Tween 20, then sprayed onto the plants using a fine mist from a ULV sprayer to provide thin, uniform coverage. The plants were incubated in a humid chamber for 48 h, then placed in a 2 m^2 area and treated with BRAVO, TILT, DITHANE or QUADRIS at the rates described above. Treatments were replicated four times, with five pots per replicate. Disease was rated on a 0-10 scale, based on percentage of leaf area infected, where 0= healthy, 1 = 1-10% infection, 2 = 10-20% infection, etc. In the pre-inoculated trial, the fungicide treatments were applied to eight-day-old seedlings, which were incubated for 48 h, then exposed to the spore suspension spray. Disease severity was rated on the same scale at 8, 13, 18, 23 and 28 days following inoculation.

RESULTS: Disease severity was similar to the untreated control for all treatments on all three portions of the plants (Table 1). For the upper portions, disease was significantly more severe ($P \leq 0.05$) for the plots treated with BRAVO + QUADRIS than for plots treated with DITHANE on August 1. In both greenhouse trials, all fungicide treatments significantly reduced ($P \leq 0.05$) lesion length compared the controls (Table 2). In the pre-inoculated trial, QUADRIS and TILT showed significantly shorter ($P \leq 0.05$) lesions than DITHANE and DITHANE showed significantly lower ($P \leq 0.05$) disease levels than

BRAVO. By the end of the post-inoculation trial, disease severity levels were significantly different ($P \leq 0.05$) for each treatment: Untreated control > BRAVO > TILT > QUADRIS (low rate) > DITHANE > QUADRIS (high rate).

CONCLUSIONS: In field trials, none of the fungicide treatments significantly reduced foliar disease severity below the level in the nontreated control. In the pre-inoculated greenhouse trial, the TILT treatment and both QUADRIS treatments produced the greatest reduction in disease severity, followed by DITHANE, then BRAVO. In the post-inoculated greenhouse trial, QUADRIS at the high rate produced the greatest reduction in foliar disease severity, followed by DITHANE, QUADRIS (low rate), TILT, then BRAVO.

Table 1. Effect of foliar spray treatments on the severity of anthracnose on dry bean cv. Navigator at Vegreville in 2001.

Treatment	Timing	Rate	Disease severity		
		(g ai/ha)	Upper	Middle	Lower
Control			3.8 ab[1]	14.5 ab	54.5
QUADRIS	E[2]	125	2.8 ab	15.0 ab	48.0
QUADRIS	M	125	2.0 ab	12.5 ab	43.0
QUADRIS	E+M	125+125	2.3 ab	15.8 ab	52.0
QUADRIS	E	175	1.0 ab	11.3 ab	39.5
QUADRIS	M	175	2.1 ab	13.0 ab	41.5
BRAVO	E	1000	1.5 ab	10.0 ab	38.5
BRAVO	E+M	1000+1000	2.3 ab	12.0 ab	54.0
DITHANE	E	1688	0.5 b	8.0 ab	38.0
DITHANE	E+M	1688+1688	1.3 ab	13.3 ab	42.5
QUADRIS + BRAVO	E+M	125+1000	2.5 ab	13.3 ab	46.5
BRAVO + QUADRIS	E+M	1000+125	4.5 a	23.5 a	52.5
TILT	E	125	3.3 ab	10.5 ab	44.0
TILT	E+M	125+125	3.8 ab	18.5 ab	56.5
ANOVA ($P \leq 0.05$)			s	s	ns

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

[2] E - Foliar fungicide applied on 1 August; M - Foliar fungicide applied on 13 August.

Table 2. Effect of five foliar fungicidal spray treatments on severity levels of anthracnose in dry bean under greenhouse conditions.

Treatment	Rate	Percent leaf area infected					
	(g ai/ha)	8dy[1]	8 dy[2]	13 dy[3]	18 dy	23 dy	28 dy
QUADRIS	125	2 d[4]	0 b	0 c	3 bc	7 b	14 d
QUADRIS	175	1 d	0 b	0 c	1 d	3 c	8 f
BRAVO	1000	46 b	2 b	4 b	5 b	9 b	25 b
DITHANE	1688	39 c	6 b	1 c	2 cd	5 c	12 e
TILT	125	0 d	0 b	1 c	3 bc	7 b	17 c
Control	-	66 a	11a	20 a	24 a	28 a	47 a
LSD ($P \leq 0.05$)		0.24	2.2	2.3	2.0	1.8	1.4

[1] Foliar fungicides applied 48h after inoculation (pre-inoculation trial).
[2] Foliar fungicides applied 48h before inoculation (post-inoculation trial).
[3] Days between inoculation and data collection.
[4] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 102 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry Bean (*Phaseolus vulgaris* L.), cv. US 1140 (Great Northern)
PEST: Anthracnose, *Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF ANTHRACNOSE OF DRY BEAN IN 2001

MATERIALS: L0020 (metalaxyl, 320 g/L FL), L1022 (metalaxyl 12 g/L + ipconazole, 7.5 g/L SU), L1030 (HEC 5725, 100 g/L SU), L1031 (HEC 5725, 37.5 g/L + triazolinthion, 37.5 g/L SU), U2051 (carbathiin, 170 g/L + thiram, 150 g/L SU), Z0107 (captan, 140 g/kg + TPM, 180 g/kg + diazinon, 60 g/kg SU)

METHODS: Seed of dry bean cv. Navigator, naturally infested with anthracnose, was treated with Z0107, U2051, L1022 or with L0020 at 0.128 mL/kg seed, in combination with L1030 at 0.50 or 1.00 mL/kg seed, L1031 at 1.33 mL/kg or U2051 at 2.6 mL/kg seed in a Hege II small batch seed treater. Experimental plots were established on 5 June at Vegreville, Alberta in black chernozemic sandy loam soil. Plots were seeded in a randomized complete block design with four replications. A non-treated control was seeded along with the treatments. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart and was separated from adjacent plots by a four-row plot of canola. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Emerged seedlings were counted on 20 June. Disease severity was rated as percentage of leaf area infected in the upper, middle and lower portions of the plant canopy on 29 August. 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: Seedling emergence was significantly greater ($P \leq 0.05$) for all seed treatments tested compared to the untreated control (Table 1). Disease severity was similar among all fungicidal seed treatments in the trial for the lower leaves, and was significantly lower ($P \leq 0.05$) than the untreated control for the L0020 + L1031 treatment and the L0020 + L1030 seed treatment at the higher rate. For the middle and upper leaves, none of the treatments differed significantly ($P \leq 0.05$) from the untreated control. However, the L0020 + L1031 treatment and the L0020 + L1030 seed treatment at the higher rate had significantly lower disease levels than Z0107 for the middle leaves. L1031 and L1030 at the lower rate had significantly lower disease levels than Z0107 for the upper leaves.

CONCLUSIONS: While all fungicidal seed treatments improved seedling emergence over the untreated control, only L0020 + L1031 treatment and the L0020 + L1030 seed treatment at the higher rate, reduced disease severity compared to the untreated control.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of dry bean cv. Navigator at Vegreville, Alberta in 2001.

Treatment	Rate	Plant stand	Disease severity (% leaf area infected)		
	(mL/kg seed)	(No./6m)	Lower	Middle	Upper
Control	-	32.2 b[1]	83 a	27 ab	7 ab
U2051	2.6	40.8 a	79 ab	30 ab	6 ab
L1022	3.1	46.9 a	76 ab	34 ab	7 ab
Z0107	5.2	45.6 a	78 ab	35 a	8 a
L0020 + U2051	0.128 + 2.60	45.6 a	76 ab	29 ab	7 ab
L0020 + L1031	0.128 + 1.33	45.4 a	65 b	25 b	5 b
L0020 + L1030	0.128 + 0.50	42.9 a	71 ab	26 ab	4 b
L0020 + L1030	0.128 + 1.00	43.7 a	68 b	25 b	6 ab

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 103 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry Bean (*Phaseolus vulgaris* L.), cv. US 1140 (Great Northern)
PEST: Anthracnose, *Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF ANTHRACNOSE OF DRY BEAN IN 2001

MATERIALS: L0020 (metalaxyl, 320 g/L FL), L1022 (metalaxyl 12 g/L + ipconazole, 7.5 g/L SU), L1030 (HEC 5725, 100 g/L SU), L1031 (HEC 5725, 37.5 g/L + triazolinthion, 37.5 g/L SU), U2051 (carbathiin, 170 g/L + thiram, 150 g/L SU), Z0107 (captan, 140 g/kg + TPM, 180 g/kg + diazinon, 60 g/kg SU)

METHODS: Seed of dry bean cv. Navigator, naturally infested with anthracnose, was treated with Z0107, U2051, L1022 or with L0020 at 0.128 mL/kg seed, in combination with L1030 at 0.50 or 1.00 mL/kg seed, L1031 at 1.33 mL/kg or U2051 at 2.6 mL/kg seed in a Hege II small batch seed treater. Experimental plots were established on 5 June at Vegreville, Alberta in black chernozemic sandy loam soil. Plots were seeded in a randomized complete block design with four replications. A non-treated control was seeded along with the treatments. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart and was separated from adjacent plots by a four-row plot of canola. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Emerged seedlings were counted on 20 June. Disease severity was rated as percentage of leaf area infected in the upper, middle and lower portions of the plant canopy on 29 August. 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: Seedling emergence was significantly greater ($P \leq 0.05$) for all seed treatments tested compared to the untreated control (Table 1). Disease severity was similar among all fungicidal seed treatments in the trial for the lower leaves, and was significantly lower ($P \leq 0.05$) than the untreated control for the L0020 + L1031 treatment and the L0020 + L1030 seed treatment at the higher rate. For the middle and upper leaves, none of the treatments differed significantly ($P \leq 0.05$) from the untreated control. However, the L0020 + L1031 treatment and the L0020 + L1030 seed treatment at the higher rate had significantly lower disease levels than Z0107 for the middle leaves. L1031 and L1030 at the lower rate had significantly lower disease levels than Z0107 for the upper leaves.

CONCLUSIONS: While all fungicidal seed treatments improved seedling emergence over the untreated control, only L0020 + L1031 treatment and the L0020 + L1030 seed treatment at the higher rate, reduced disease severity compared to the untreated control.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of dry bean cv. Navigator at Vegreville, Alberta in 2001.

Treatment	Rate	Plant stand	Disease severity (% leaf area infected)		
	(mL/kg seed)	(No./6m)	Lower	Middle	Upper
Control	-	32.2 b[1]	83 a	27 ab	7 ab
U2051	2.6	40.8 a	79 ab	30 ab	6 ab
L1022	3.1	46.9 a	76 ab	34 ab	7 ab
Z0107	5.2	45.6 a	78 ab	35 a	8 a
L0020 + U2051	0.128 + 2.60	45.6 a	76 ab	29 ab	7 ab
L0020 + L1031	0.128 + 1.33	45.4 a	65 b	25 b	5 b
L0020 + L1030	0.128 + 0.50	42.9 a	71 ab	26 ab	4 b
L0020 + L1030	0.128 + 1.00	43.7 a	68 b	25 b	6 ab

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 104 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61006537

CROP: Dry bean (*Phaseolus vulgaris* L.) cv. Stingray
PEST: Root Rot, *Fusarium solani*, var *phaseoli*

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TITLE: CONTROL OF FUSARIUM DAMPING OFF IN DRY EDIBLE BEANS WITH SEED TREATMENTS

MATERIALS: VITAFLO 280 (carbathiin + thiram, 150 + 130 g ai/L), APRON MAXX RTA (fludioxonil + metalaxyl-m, 19.05 g ai/L), DCT (diazinon + captan + thiophanate methyl, 18% + 6% + 14% w/w), ICIA 5504 100 FS

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 2.3 ml per kg) of material via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. Beans were planted 8 June, 2001 at a seeding rate of 15 seeds per m using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were 4 rows, 4 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications. Inoculum was applied in-furrow with dry oat inoculum (see below) at a rate of 80 g per row. Plot emergence was assessed on 3 m from 2 rows (6m) on 20, 25 June and 3, 24 July, 2001. Plant vigor, using a scale of 0-100 (100 = best plant development and 0 = poorest plant development), was assessed on the same dates. Yields were taken on 5 Nov, 2001 from 2 rows, 4m long and converted to T/ha and corrected to 15.5% moisture. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

INOCULUM: A strain of *Fusarium solani*, var *phaseoli* (III-3) was obtained from Dr. Robert Hall, University of Guelph and cultured onto potato dextrose agar (PDA). One kg of hulless oats was added to each of several 4 litre plastic jugs and covered with 2% V8 juice. Bottles were capped and left to stand for 2-3 hrs. After standing, excess liquid was poured off and the bottles autoclaved at 15 psi and 121 C for 1 hr. Autoclaving procedure was repeated after 3 d. The PDA plates of *F. solani* were cut up into small squares and 5-6 plugs placed in the bottles of sterile oats. The bottles were incubated for 2 wks. After 2 d of incubation there were golf ball sized chunks of inoculum present and the bottles were shaken every 2 d to ensure even distribution of inoculum. After 2 wks incubation, the inoculum was dried and weighed into 80 g packages.

RESULTS: See Tables 1 and 2.

CONCLUSIONS: The highest plant stand occurred with APRON MAXX RTA combined with the low rate of ICIA 5504. None of the other treatments resulted in greater emergence than the inoculated check. High rates of ICIA 5504 were antagonistic. ICIA 5504 tended to reduce plant vigor in the earlier part of the emergence period. APRON MAXX RTA alone at the highest rate resulted in the most vigorous plants. No significant differences were noted for yields. Plots were ruined by late, heavy rains.

Table 1. Emergence and plant stand of Stingray white beans with seed treatments for seedling disease at Ridgetown, Ontario, 2001.

Treatment	Rate g ai/100 kg seed	Emergence Plants/6m	Plant Stand Plants/6m		
		20-6-01	25-6-01	1-7-01	24-7-01
Uninoculated Check [2]		45.0 [1]	85.5	85.5	80.8
Inoculated Check		18.5 a-d	62.3 a-d	66.3 bcd	66.3
APRON MAXX RTA	6.25	19.0 abc	68.3 ab	71.5 abc	69.3
APRON MAXX RTA + ICIA 5504	6.25 5	5.5 d	70.0 a	76.3 a	71.3
APRON MAXX RTA + ICIA 504	6.25 10	2.5 e	58.3 bcd	71.8 abc	68.5
APRON MAXX RTA + ICIA 5504	6.252	7.3 cde	51.5 d	61.0 d	67.3
ICIA 5504	10	10.8 b-e	56.5 cd	63.3 cd	63
APRON MAXX RTA	12.5	26.3 a	67.8 abc	73.0 ab	66.8
DCT	197.6	23.0 ab	64.0 abc	70.5 abc	70.3
DCT (half rate)	98.8	29.5 a	67.5 abc	70.8 abc	69.5
LSD		13.1	11.6	9	NS
CV		56.7	12.6	8.9	11.6

[1] Means followed by same letter do not significantly differ (P=.05, LSD).
[2] Data for uninoculated checks not included in ANOVA.

Table 2. Crop vigor ratings of Stingray white beans with seed treatments for seedling disease at Ridgetown, Ontario, 2001.

Treatment	Rate g ai/100 kg seed	Vigor 0-100 %			
		20-6-01	25-6-01	1-7-01	24-7-01
Uninoculated Check **		100.0 *	100	100	90
Inoculated Check		15.9 ab	24	72.5 bc	57.5 c
APRON MAXX RTA	6.25	19.8 ab	26.3	77.5 ab	73.8 abc
APRON MAXX RTA + ICIA 5504	6.25 5	12.2 b	27.5	72.5 bc	77.5 abc
APRON MAXX RTA + ICIA 504	6.25 10	10.0 b	16.3	67.5 bc	75.0 abc
APRON MAXX RTA + ICIA 5504	6.25 20	10.7 b	18.8	60.0 c	63.8 bc
ICIA 5504	10	14.6 ab	36.3	67.5 bc	67.5 bc
APRON MAXX RTA	12.5	26.5 a	34.3	90.0 a	92.5 a
DCT	197.6	27.2 a	32.5	72.5 bc	73.8 abc
DCT (half rate)	98.8	27.0 a	38.8	80.0 ab	83.8 ab
LSD		14.2	NS	15.1	25
CV		16.9	55.8	14.1	23.2

[1] Means followed by same letter do not significantly differ (P=.05, LSD).
[2] Data for uninoculated checks not included in ANOVA.

2001 PMR REPORT # 105 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61006537

CROP: Cranberry bean (*Phaseolus vulgaris* L.) cv. SVM Taylor
Dark red kidney bean (*Phaseolus vulgaris* L.) cv. Montcalm
PEST: Rhizoctonia root rot, *Rhizoctonia solani* Kühn

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TITLE: CONTROL OF SEEDLING ROOT ROT IN DRY EDIBLE BEANS WITH SEED TREATMENTS

MATERIALS: VITAFLO 280 (carbathiin + thiram, 150 + 130 g ai/L), APRON MAXX RTA (fludioxonil + metalaxyl-m, 19.05 g ai/L), DCT (diazinon + captan + thiophanate-methyl, 18% + 6% + 14% w/w), ICIA 5504 100 FS

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 2.3 ml per kg) of material via a syringe to each bag. The seed was then mixed for 1 min to ensure thorough seed coverage. Beans were planted 8 June, 2001 at a seeding rate of 15 seeds per m using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were 4 rows, 4 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications. Plot emergence was assessed on 3 m from 2 rows (6m) on 19, 25 June and 1, 24 July, 2001. Plant vigor, using a scale of 1-100 (100 = best plant development and 0 = plants dead), was assessed on the same dates. Data were analysed using analysis of variance, least significant differences (LSD) were calculated and means separated at the 0.05 significance level.

INOCULUM: A strain of *Rhizoctonia solani* (86-8b) was cultured onto potato dextrose agar (PDA). One kg of hulless oats was added to each of several 4 litre plastic jugs and covered with 2% V8 juice. Bottles were capped and left to stand for 2-3 hr. After standing, excess liquid was poured off and the bottles autoclaved at 15 psi and 121 C for 1 hr. Autoclaving procedure was repeated after 3 d. The PDA plates of *R. solani* were cut up into small squares and 5-6 plugs placed in the bottles of sterile oats. The bottles were incubated for 2 wks. After 2 d of incubation there were golf ball sized chunks of inoculum present and the bottles were shaken every 2 d to ensure even distribution of inoculum. After 2 wks incubation, the inoculum was dried and weighed into 80 g packages.

RESULTS: See Tables 1, 2, 3 and 4.

CONCLUSIONS: All treatments improved emergence of cranberry bean significantly, but the best emergence was only 17%. The *Rhizoctonia* pressure was very severe in this test and overwhelmed all untreated inoculated checks, something that seldom happens in nature. For kidney beans only APRON MAXX RTA at the lower rate plus ICIA 5504 at the higher rate significantly improved emergence compared with the inoculated check. This combination treatment also contributed to significantly higher vigor for surviving plants. This trial was not harvested due to overall poor emergence.

Table 1. Plant stand of cranberry beans with seed treatments for seedling disease at Ridgetown, Ontario. 2001

Treatment	Rate g ai/100 kg seed	Plant Stand Plants per 6m			
		20-6-01	25-6-01	1-7-01	24-7-01
Uninoculated Check [2]		48.3 [1]	52.5	51.8	52.5
Inoculated Check		0.6 b	0.1 c	0.1 b	0.1 b
APRON MAXX RTA	6.25	3.9 a	5.6 b	6.2 a	6.4 a
APRON MAXX RTA + ICIA 5504	6.255	8.2 a	13.1 a	11.4 a	10.0 a
APRON MAXX RTA +ICIA 5504	6.251	8.4 a	8.7 ab	9.5 a	7.8 a
APRON MAXX RTA +ICIA 5504	6.252	8.4 a	10.3 ab	10.1 a	8.5 a
ICIA 5504	10	5.5 a	7.3 ab	6.9 a	6.8 a
APRON MAXX RTA	12.5	5.9 a	9.5 ab	9.9 a	8.9 a
DCT	197.6	3.6 ab	5.0 b	5.8 a	5.7 a
DCT (half rate)	98.8	4.2 a	6.6 ab	6.9 a	7.0 a
LSD		3.3	4.5	5.7	4.6
CV		35.5	32.5	32.6	33.8

[1] Means followed by similar letter are not different (P=.05, LSD).
[2] Data for uninoculated check not included in ANOVA.

Table 2. Crop vigor of cranberry beans with seed treatments for seedling disease at Ridgetown, Ontario. 2001.

Treatment	Rate g ai/100 kg seed	Vigor 0-100 %			
		20-6-01	25-6-01	1-7-01	24-7-01
Uninoculated Check [2]		86.8 [1]	93.8	100	100
Inoculated Check		0.0 d	0.5 c	2.5 b	2.5 b
APRON MAXX RTA	6.25	3.8 cd	3.7 bc	20.0 ab	21.3 ab
APRON MAXX RTA + ICIA 5504	6.255	6.8 abc	11.1 a	30.0 a	35.0 a
APRON MAXX RTA +ICIA 5504	6.251	8.3 ab	6.3 ab	30.0 a	35.0 a
APRON MAXX RTA +ICIA 5504	6.252	9.8 a	10.0 a	27.5 a	33.8 a
ICIA 5504	10	3.0 cd	4.7 ab	22.5 a	25.0 a
APRON MAXX RTA	12.5	4.5 bc	7.4 ab	25.0 a	26.3 a
DCT	197.6	4.5 bc	3.7 bc	15.0 ab	23.8 ab
DCT (half rate)	98.8	3.8 cd	5.6 ab	17.5 ab	22.5 ab
LSD		4.1	3.2	17.8	21.9
CV		57.4	32.2	57.7	60.1

[1] Means followed by similar letter are not different (P=.05, LSD).
[2] Data for uninoculated check not included in ANOVA.

Table 3. Plant stand of kidney beans with seed treatments for seedling disease at Ridgetown, Ontario. 2001.

Treatment	Rate g ai/100 kg seed	Plant Stand Plants per 6 m			
		19-6-01	25-6-01	1-7-01	24-7-01
Uninoculated Check [2]		25.0 [1]	43.5	45.3	44.3
Inoculated Check		9.0 a	3.8 ab	3.5 b	3.0 b
APRON MAXX RTA	6.25	6.8 ab	7.8 ab	9.5 ab	7.5 ab
APRON MAXX RTA + ICIA 5504	6.255	4.5 ab	8.3 ab	9.8 ab	8.5 ab
APRON MAXX RTA +ICIA 5504	6.251	4.0 ab	4.3 ab	4.8 ab	4.5 ab
APRON MAXX RTA +ICIA 5504	6.252	6.0 ab	10.5 a	12.0 ab	10.8 a
ICIA 5504	10	4.5 ab	6.8 ab	6.0 ab	5.3 ab
APRON MAXX RTA	12.5	3.0 ab	7.3 ab	7.5 ab	6.8 ab
DCT	197.6	1.5 b	2.5 b	3.5 b	3.3 b
DCT (half rate)	98.8	4.0 ab	4.0 ab	3.8 b	3.3 b
LSD		7.1	7.6	8.1	7.2
CV		101	86.6	82.8	85.1

[1] Means followed by same letter do not significantly differ (P=.05, LSD)
[2] Data for uninoculated check not included in ANOVA

Table 4. Crop vigor of kidney beans with seed treatments for seedling disease at Ridgetown, Ontario. 2001.

Treatment	Rate g ai/100 kg seed	Vigor 0-100 %			
		19-6-01	25-6-01	1-7-01	24-7-01
Uninoculated Check [2]		80.0 [1]	78	100	100
Inoculated Check		11.3 ab	5.8 ab	15.0 b	12.5 b
APRON MAXX RTA	6.25	30.0 a	15.0 ab	17.5 b	32.5 ab
APRON MAXX RTA + ICIA 5504	6.255	16.0 ab	11.3 ab	27.5 ab	28.8 ab
APRON MAXX RTA +ICIA 5504	6.251	8.5 ab	6.5 ab	12.5 b	20.0 ab
APRON MAXX RTA +ICIA 5504	6.252	29.0 a	19.3 a	47.5 a	42.5 a
ICIA 5504	10	9.0 ab	9.3 ab	22.5 ab	25.0 ab
APRON MAXX RTA	12.5	12.0 ab	10.0 ab	20.0 ab	22.5 ab
DCT	197.6	4.0 b	3.5 b	10.0 b	12.5 b
DCT (half rate)	98.8	7.0 ab	3.5 b	7.5 b	15.0 b
LSD		23.3	23.3	29.2	25.6
CV		113.4	113.4	100.1	74.6

[1] Means followed by same letter do not significantly differ (P=.05, LSD).
[2] Data for uninoculated check not included in ANOVA.

2001 PMR REPORT # 106 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Dwelley
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL RHIZOCTONIA SEEDLING BLIGHT AND ROOT ROT OF CHICKPEA IN 2001

MATERIALS: L0020 (metalaxyl, 320 g/L FL), L1022 (metalaxyl 12 g/L + ipconazole, 7.5 g/L RTU), U2521 (carbathiin, 90 g/L + TBZ, 58 g/L FS), L1030 (HEC 5725, 100 g/L SU), L1031 (HEC 5725, 37.5 g/L + triazolinthion, 37.5 g/L SU), U2051 (carbathiin, 170 g/L + thiram, 150 g/L SU), L0202 (carbathiin, 100 g/L + thiram, 100 g/L + metalaxyl, 16.2 g/L SU)

METHODS: Seed of chickpea cv. Dwelley was treated in a Hege II small batch seed treater with L1022 at 3.1 mL/kg seed, L0202 at 4.4 mL/kg seed and with L0020 at 0.16 mL/kg seed, either alone or in combination with U2521 at 3.0 or 4.5 mL/kg seed, U2051 at 3.3 mL/kg seed, L1030 at 1.0 mL/kg seed, or with L1031 at 1.33 mL/kg seed. Experimental plots were established on 20 May at Brooks, Alberta in brown chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. *Rhizoctonia*-inoculated and non-inoculated controls were seeded along with the treatments. 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 a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 25 mL/row at the time of seeding. Emerged seedlings were counted for each plot on 18 June. At maturity (24 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 significantly ($P \leq 0.05$) higher than the inoculated control for all of the seed treatments in the study (Table 1). All fungicide seed treatments also produced plant stands and seed yields that were significantly ($P \leq 0.05$) higher than for L0020 applied alone, but emergence for L1022 was significantly ($P \leq 0.05$) lower than for the other treatments in this group. There were no significant ($P \leq 0.05$) differences in emergence or yield between the inoculated and noninoculated controls.

CONCLUSIONS: All fungicidal seed treatments provided some measure of protection against the combined effect of inoculum and indigenous soil fungi, and they improved both emergence and seed yield. However, treatment with L0020 alone resulted in less improvement in emergence and yield than the rest of the fungicidal seed treatments. L1022 produced higher emergence levels than L0020 but lower emergence than the rest of the fungicidal seed treatments.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of chickpea cv. Dwelley at Brooks, Alberta in 2001.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Control +*R* [1]		0.0 e[2]	0.00 c
L0020 + U2521 +*R*	0.16 + 3.0	49.4 ab	1.65 a
L1022 +*R*	3.1	35.6 c	2.09 a
L0020 + L1030 +*R*	0.16 + 1.0	52.2 ab	2.38 a
L0020 + U2521 +*R*	0.16 + 4.5	54.9 a	2.25 a
L0020 + U2051 +*R*	0.16 + 3.3	55.9 a	1.98 a
L0020 + L1031 +*R*	0.16 + 1.33	51.4 ab	1.83 a
L0020 + *R*	0.16	11.8 d	0.87 b
L0202 + *R*	4.4	55.7 a	1.94 a
Control	--	1.8 e	0.34 bc

[1] Denotes inoculation with *Rhizoctonia solani.*

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 107 **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 AND ROOT ROT OF CHICKPEA IN ALBERTA IN 2001

MATERIALS: CROWN (carbathiin, 92 g/L + TBZ, 58 g/L SU), APRON MAXX 240.5 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC)

METHODS: Seed of chickpea cv. B-90 was treated in a Hege small batch seed treater with APRON MAXX at 6.25 or 12.5 g ai/100 kg seed, or with CROWN at 90.0 g ai/100 kg seed. An experimental plot was established on 15 May, 2001 at Brooks, Alberta, in brown chernozemic clay loam soil. The plot was 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 30 mL/row (3×10^2 cfu/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted on 11 June. At maturity (17 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 and seed yields were significantly ($P \leq 0.05$) higher for all seed treatments in the trial than for the inoculated control (Table 1). Emergence and yield were similar among all seed treatments and the noninoculated control.

CONCLUSIONS: All seed treatments in the trial improved emergence and seed yield over the inoculated control.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of chickpea cv. B-90 at Brooks, Alberta in 2001.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Yield (T/ha)[1]
APRON MAXX +*R*	6.25	28.8 a[2]	1.77 a
APRON MAXX +*R*	12.5	34.4 a	2.49 a
CROWN +*R*	90	35.9 a	2.15 a
Control +*R*	-	0.9 b	0.04 b
Control	-	27.4 a	1.71 a

[1] Denotes inoculation with *Rhizoctonia*.

[2] Means within a column followed by the same letter are not significantly different for each experimental variable using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 108 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Myles
PEST: Seedling blight, *Botrytis cinerea* Pers.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL SEEDLING BLIGHT OF CHICKPEA CAUSED BY BOTRYTIS IN 2001

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE FL(metalaxyl, 320 g/L SN)

METHODS: Naturally-infested seed (10-20% of seedlot) of chickpea cv. Myles was treated with ALLEGIANCE at 0.16 mL/kg seed alone as a control or in combination with VITAFLO 280 at 3.3 mL/kg seed or CROWN at 3.0 and 6.0 mL/kg seed in a Hege II small batch seed treater. Experimental plots were established on 18 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. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Emerged seedlings were counted on 15 June. At maturity (21 August), the plot was 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 similar for all treatments, but seed yield was significantly ($P \leq 0.05$) higher where CROWN was applied at 6.0 g a.i./kg seed with ALLEGIANCE than where ALLEGIANCE was applied alone (Table 1).

CONCLUSIONS: CROWN combined with ALLEGIANCE resulted in improved seed yield over ALLEGIANCE applied alone.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of chickpea cv. Myles at Brooks, Alberta in 2001.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
ALLEGIANCE + CROWN	0.16 + 3.0	34.3	0.81 ab[1]
ALLEGIANCE + CROWN	0.16 + 6.0	36.2	1.08 a
ALLEGIANCE + VITAFLO	0.16 + 3.3	36.0	1.01 ab
ALLEGIANCE (CONTROL)	0.16	32.6	0.62 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT #109 **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: EFFICACY OF FOLIAR FUNGICIDE FORMULATIONS AGAINST ASCOCHYTA BLIGHT OF CHICKPEA IN ALBERTA IN 2001

MATERIALS: BAS 500F (pyraclostrobin, 250 g/L EC), BRAVO 500F (chlorothalonil, 500 g/L SU), (QUADRIS 250 SC (azoxystrobin, 250 g/L SU), TILT (propiconazole, 250 g/L EC)

METHODS: Experimental plots were established at two sites near Brooks, Alberta on 22 and 23 May, 2001, in brown chernozemic sandy loam soil. At both sites, chickpea cv. Sanford was seeded in a randomized complete block design with four replications. Healthy seed was sown at site A; naturally infected seed with a low germination rate was sown at site B. 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. The foliar fungicide treatments were applied on 10 July, 1 August, or 13 August. BAS 500F was applied at 150 g ai/ha on July 10 either alone or in combination with BRAVO (1500 g ai/ha) and a second spray of BAS 500 F alone on 1 August. BRAVO was applied to four additional treatments at 1500 g ai/ha and to a fifth treatment at 2600 g ai/ha on 10 July. A second application (at 1000 g ai/ha) was made to two of the four treatments on 1 August, and a third application was made to one of these two treatments at the same rate on 13 August. The fourth treatment was sprayed with QUADRIS (at 125 g ai/ha) on 1 August and the fifth treatment was sprayed with QUADRIS at the same rate on both 1 and 13 August. TILT was applied to two treatments on 10 July. Both of these treatments received an application of QUADRIS (at 125 g ai/ha) on 1 August; the second treatment received an additional application of QUADRIS at the same rate on 13 August. QUADRIS was applied alone at (at 125 g ai/ha) to one treatment on 10 July, to another on 1 August, and to a third on both dates. QUADRIS was also applied to a single treatment at 175 g ai/ha on 10 July. All foliar fungicides were applied using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa using 360 L/ha water volume. Ascochyta severity was rated on 30 and 31 August at Sites A and B, respectively, at 5 sites per plot on a 0-3 scale, where 0=healthy, 1=0-25% of leaf area infected, 2=25-50% of leaf area infected and 3=>50% of leaf area infected. Sites A and B were harvested on 24 and 17 September, respectively and seeds were weighed to determine yield. 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: Yield was higher for Site A than for Site B, but disease levels were higher at site A (Table 1). Yield was similar for all treatments at Site A, but was significantly greater for the treatment where BRAVO was applied on 10 July and 1 August than for most of the QUADRIS treatments alone (except where applied only on 1 August), and for the TILT+ two QUADRIS treatments. All fungicide treatments

significantly reduced ($P \leq 0.05$) disease levels at Site A, but at site B, disease levels were similar to the control for QUADRIS applied early at the low rate, as well as for BRAVO applied on 10 July and for BRAVO applied on both 10 July and 1 August. The treatment where BRAVO was applied early at the high rate followed by two applications of QUADRIS showed significantly lower disease levels than the aforementioned treatments.

CONCLUSIONS: Where disease incidence was low, all fungicides reduced disease. Under more severe disease pressure, a single application of BRAVO at 2600 g ai/ha, followed by two applications of QUADRIS, spaced two weeks apart, provided greater disease protection compared to a single application of BRAVO or QUADRIS at the low rate, or to two applications of BRAVO.

Table 1. Effect of foliar spray treatments on the severity of ascochyta on chickpea cv. Sanford at Brooks in 2001.

Treatment	Timing	Rate	Site A		Site B	
		(g ai/ha)	Disease (0-3)[1]	Yield (t/ha)	Disease (0-3)	Yield (t/ha)
Control			1.00 a[2]	5.61 a	0.26 a	0.71 ab
QUADRIS (Q)	E[3]	125	0.74 abc	4.46 a	0.08 b	0.60 b
Q	M	125	0.56 bcde	5.64 a	0.01 b	0.70 ab
Q + Q	E+M	125+125	0.59 bcde	5.23 a	0.05 b	0.61 b
Q	E	175	0.61 bcde	5.83 a	0.05 b	0.64 b
BRAVO (B)	E	1500	0.71 abcd	4.67 a	0.10 b	0.80 ab
B + B	E+M	1500+1000	0.80 ab	5.18 a	0.01 b	1.01 a
B + B + B	E+M+L	1500+1000+1000	0.44 cde	4.96 a	0.01 b	0.84 ab
B + Q	E+M	1500+125	0.45 cde	4.82 a	0.01 b	0.76 ab
B + Q + Q	E+M+L	1500+125+125	0.35 e	4.82 a	0.01 b	0.72 ab
BAS	E	150	0.63 bcde	5.06 a	0.04 b	0.73 ab
B + BAS + BAS	E+M+L	1500+150+150	0.39 de	5.16 a	0.01 b	0.70 ab
TILT + Q	E+M	125+125	0.60 bcde	5.44 a	0.04 b	0.71 ab
TILT + Q + Q	E+M+L	125+125+125	0.54 bcde	5.12 a	0.00 b	0.55 b

[1] 0 = healthy; 1 = 0-25% of leaf area infected; 2 = 25-50% of leaf area infected; 3= >50% of leaf area infected.

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

[3] E - Foliar fungicide applied on 10 July; M - foliar fungicide applied on 1August; L - foliar fungicide applied on 13August.

2001 PMR REPORT # 110 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cv. Milestone
PEST: Root Rot, *Fusarium avenaceum* (Fr.) Sacc.

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TITLE: EVALUATION OF APRON MAXX TO CONTROL FUSARIUM ROOT ROT OF LENTIL IN ALBERTA IN 2001

MATERIALS: APRON MAXX 240.5 (metalaxyl-M 13.6% + fludioxonil 9.11% MEC)

METHODS: Seed of lentil cv. Milestone was treated with 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 17 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 25 cm apart. Seeds were planted 5 cm deep at a rate of 6 g per row. *Fusarium avenaceum* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 30 mL/row at the time of seeding. Emerged seedlings were counted on 15 June. At maturity (14 August), plants from the middle 5 m of each plot 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 for both seed treatments was significantly greater ($P \leq 0.05$) than for the inoculated control, but significantly less ($P \leq 0.05$) than the noninoculated control (Table 1). Where APRON MAXX was applied at the higher rate, a significantly greater ($P \leq 0.05$) number of seedlings established than where the fungicide was applied at the lower rate. Although seed yield was significantly greater ($P \leq 0.05$) for the noninoculated control than the inoculated control, the two seed treatments produced yields of intermediate size that were not significantly different from either the inoculated or the noninoculated control. However, there was a general upward trend in seed yield with the heavier application of APRON MAXX.

CONCLUSIONS: Both seed treatments improved seedling establishment relative to the inoculated control, but did not restore it to the level observed in the noninoculated control. Similarly, although increased application rates of APRON MAXX corresponded with increases in seed yield, the treatments did not result in significantly higher yields compared to the inoculated control.

Table 1. Effects of fungicidal seed treatments on seedling survival and seed yield of lentil cv. Milestone at Brooks, Alberta in 2001.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Seed yield (T/ha)
APRON MAXX +*F*[1]	6.25	56.8 c[2]	1.01 ab
APRON MAXX +*F*	12.5	77.0 b	1.60 ab
Control +*F*	--	23.8 d	0.56 b
Control	--	142.4 a	1.63 a

[1] Denotes inoculation with *Fusarium avenaceum*.

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 111 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cv. Laird
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL RHIZOCTONIA ROOT ROT OF LENTIL IN 2001

MATERIALS: U2521 (carbathiin, 90 g/L + TBZ, 58 g/L FS), L1031 (HEC 5725, 37.5 g/L + triazolinthion, 37.5 g/L SU), U2051 (carbathiin, 170 g/L + thiram, 150 g/L SU), L0202 (carbathiin, 100 g/L + thiram, 100 g/L + metalaxyl, 16.2 g/L SU)

METHODS: Seed of lentil cv. Laird was treated with U2521 at 2.6 or 3.3 mL/kg seed, U2051 at 3.0 or 6.0 mL/kg seed, L1031 at 1.0 mL/kg seed, or L 0202 at 4.4 mL/kg seed, in a Hege II small batch seed treater. Experimental plots were established on 16 May at Vegreville, Alberta in black chernozemic sandy loam soil. Plots were seeded in a randomized complete block design with four replications. *Rhizoctonia*-inoculated and non-inoculated controls were seeded along with the treatments. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 10 g per row. *Rhizoctonia solani* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 30 mL/row at the time of seeding. Emerged seedlings were counted on 20 June. At maturity (11 September), the plot was hand-harvested. Seeds were threshed and 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 for all seed treatments tested, except for L1031, was significantly greater ($P \leq 0.05$) than for the inoculated control (Table 1). Where U2521 was applied at 6.0 mL/kg, stand counts were significantly greater than for U2051 at either rate or for L1031. Both U2521 treatments, as well as L0202, showed seedling emergence levels similar to the noninoculated control. Seed yield for every treatment, except for U2051 at the higher rate, was significantly greater ($P \leq 0.05$) than for the inoculated control, and was similar to the seed yield observed for the noninoculated control.

CONCLUSIONS: All seed treatments in the trial, except for L1031, improved seedling emergence relative to the inoculated control. Both U2521 treatments and L0202 improved seedling emergence relative to U2051 at either rate and L1031. All seed treatments in the trial, except for U2051 at the higher rate, improved seed yield over the inoculated control.

Table 1. Effects of fungicidal seed treatments on seedling survival and seed yield of lentil cv. Laird at Vegreville, Alberta in 2001.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Control +*R* [1]	--	22.8 d[2]	0.64 c
U2521 +*R*	3	49.7 abc	1.01 ab
U2521 +*R*	6	58.5 a	1.24 a
U2051 +*R*	2.6	43.1 bc	0.96 ab
U2051 +*R*	3.3	37.3 c	0.78 bc
L1031 +*R*	1	35.5 cd	1.07 a
L0202 + *R*	4.4	53.9 ab	1.11 a
Control	--	62.9 a	0.34 bc

[1] Denotes inoculation with *Rhizoctonia solani.*

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 112 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cv. Milestone
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA ROOT ROT OF LENTIL IN ALBERTA IN 2001

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% MEC)

METHODS: Seed of lentil cv. Milestone was treated with APRON MAXX at 3.7 or 7.4 mL/kg seed or CROWN at 6.0 mL/kg seed in a Hege II small batch seed treater. An experimental plot was established on 16 May, 2001 at Vegreville, Alberta, in black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 6 g of seed 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 30 mL/row (3×10^2 cfu/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted on 20 June. At maturity (6 September), plants were hand-harvested. Seeds were threshed and 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 ($P \leq 0.05$) greater than the inoculated control for all seed treatments in the trial (Table 1). Emergence was significantly lower ($P \leq 0.05$) for the inoculated seed treatments compared to the noninoculated control, but yields were similar.

CONCLUSIONS: Plant stand and seed yield were improved over the inoculated control by all seed treatments in the trial.

Table 1. Effect of seed treatments on plant stand and seed yield of lentil cv. Milestone at Vegreville, Alberta in 2001.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
APRON MAXX	3.7	60.6 b	0.96 a
APRON MAXX	7.4	62.5 b	1.12 a
CROWN	6	79.8 b	0.98 a
Inoculated Control	--	35.6 c	0.66 b
Noninoculated Control	--	103.7 a	1.14 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 113 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cv. Laird
PEST: Seedling blight, *Botrytis cinerea* Pers.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL BOTRYTIS SEEDLING BLIGHT OF LENTIL IN 2001

MATERIALS: CROWN (carbathiin 92 g/L + thiabendazole 58 g/L FL), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Two seedlots of lentil cv. Laird, one naturally infested with *Botrytis*, the other as clean seed, were treated with VITAFLO 280 at 3.3 mL/kg seed or CROWN at 3.0 or 6.0 mL/kg seed in a Hege II small batch seed treater. The naturally-infested seed was sown on 14 May and the clean seed was sown on 15 May at Vegreville, Alberta in black chernozemic sandy loam soil. Both plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 10 g per row. *Botrytis cinerea* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum with the clean seed at the rate of 40 mL/row at the time of seeding. Emerged seedlings were counted on 20 June. At maturity (14 September), the plots were hand-harvested. Seeds were threshed and 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: In inoculated plots, seedling emergence for all seed treatments where CROWN was applied was significantly greater ($P \leq 0.05$) than for the control (Table 1). Where CROWN was applied at 6.0 mL/kg seed, stand counts were significantly greater ($P \leq 0.05$) than where applied at 3.0 mL/kg seed. Seed yield for every fungicide treatment was significantly greater ($P \leq 0.05$) than the control. Plots planted with CROWN-treated seed produced significantly higher ($P \leq 0.05$) yields than those planted with VITAFLO-treated seed. In noninoculated plots grown from infested seed, seedling emergence and seed yield were similar for both treated and nontreated seed (Table 2).

CONCLUSIONS: For seed sown into *Botrytis*-infested soil, treatment of seed with CROWN improved both seedling emergence and seed yield. Application of CROWN at the higher rate improved seedling establishment over the lower rate, but this did not translate into higher yields. While treatment of seed with VITAFLO did not improve seedling emergence from infested soil, it did result in higher yields than the control. For *Botrytis*-infested seed, emergence and seed yield were not affected by seed treatment.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of lentil cv. Laird sown into *Botrytis*-infested soil at Vegreville, Alberta in 2001.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
CROWN + *B* [1]	3.0	44.4 b[2]	1.30 a
CROWN + *B*	6.0	64.8 a	1.12 a
VITAFLO + *B*	3.3	7.0 c	0.28 b
CONTROL + *B*		0.5 c	0.02 c

[1] Denotes inoculation with *Botrytis cinerea*.
[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

Table 2. Effects of fungicidal seed treatments on plant stand and seed yield of lentil cv. Laird grown from seed infested with *Botrytis* at Vegreville, Alberta in 2001.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
CROWN	3	70.81	1.14
CROWN	6	78.6	1.13
VITAFLO	3.3	80.4	1.12
CONTROL		64.7	0.86

[1] ANOVA for stand and seed yield were non-significant at $P \leq 0.05$.

2001 PMR REPORT # 114 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Swing
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL RHIZOCTONIA ROOT ROT OF FIELD PEA IN 2001

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of field pea cv. Swing was treated with VITAFLO 280 at 88 g ai/100 kg and with APRON MAXX at 6.25 and 12.5 g ai/100 kg seed in a Hege II small batch seed treater. Experimental plots were established on 15 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 25 cm apart. Seeds were planted 5 cm deep at a rate of 20 g per row. Nontreated seed was planted as a control. Emerged seedlings were counted for each plot on 11 June. Plants were harvested by small-plot combine on 16 August and seed was weighed to determine yield. 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: Seedling emergence was significantly greater ($P \leq 0.05$) for both APRON MAXX treatments compared to the inoculated control (Table 1). Yields were significantly ($P \leq 0.05$) greater for all fungicidal treatments in the trial relative to the inoculated control. Fungicide treatments did not significantly improve stand or yield relative to the noninoculated control.

CONCLUSIONS: Both APRON MAXX treatments improved seedling emergence over the inoculated control. All seed treatments in the trial improved seed yield over the control.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of field pea cv. Swing grown in *Rhizoctonia*-infested soil at Brooks, Alberta in 2001.

Treatment	Rate (g ai/100 kg seed)	Stand (plants/6m)	Yield (T/ha)
APRON MAXX +*R*	6.25	55.1 a[1]	4.69 a
APRON MAXX +*R*	12.5	57.6 a	4.59 a
VITAFLO 280 +*R*	88	45.6 ab	4.65 a
INOCULATED CONTROL	--	30.3 b	3.41 b
NONINOCULATED CONTROL	--	61.4 a	5.56 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 115 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Swing
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: ASSESSMENT OF FUNGICIDAL SEED TREATMENTS TO CONTROL RHIZOCTONIA ROOT ROT OF FIELD PEA IN 2001

MATERIALS: U2051 (carbathiin, 170 g/L + thiram, 150 g/L SU), L0020 (metalaxyl, 320 g/L FL), L1022 (metalaxyl 12 g/L + ipconazole, 7.5 g/L SU), L1030 (HEC 5725, 100 g/L SU), L1031 (HEC 5725, 37.5 g/L + triazolinthion, 37.5 g/L SU), L0202 (carbathiin, 100 g/L + thiram, 100 g/L + metalaxyl, 16.2 g/L SU)

METHODS: Seed of pea cv. Swing was treated in a Hege II small batch seed treater with U2051 at 2.6 and 3.3 mL/kg seed, L1022 at 3.1 mL/kg seed, L0202 at 4.4 mL/kg seed or L0020 at 0.128 mL/kg seed, either alone or in combination with U2051 at 2.6 mL/kg seed, L1030 at 1.0 mL/kg seed, or with L1031 at 1.33 mL/kg seed. Experimental plots were established on 17 May at Vegreville, Alberta in black chernozemic sandy loam soil. Plots were seeded in a randomized complete block design with four replications. *Rhizoctonia*-inoculated and non-inoculated controls were seeded along with the treatments. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 5 cm deep at a rate of 20 g per row. *Rhizoctonia solani* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 30 mL/row (3×10^2 cfu/mL) at the time of seeding. Emerged seedlings were counted for each plot three weeks after seeding. At maturity (29 August), plants were harvested by small plot combine. Seeds were dried and 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 significantly greater ($P \leq 0.05$) for all seed treatments except for L0020 alone (metalaxyl), than for the inoculated control (Table 1). Seed yield was significantly greater ($P \leq 0.05$) than the inoculated control for L1022, L1030 + L0020 and L1031 + L0020. The noninoculated control produced a significantly greater ($P \leq 0.05$) seed yield than L0020 alone and the inoculated control.

CONCLUSIONS: All seed treatments in the trial, except L0020, improved plant stand. L1022, L1030 and L1031, combined with L0020, significantly improved seed yield over the inoculated control.

Table 1. Effects of fungicidal seed treatments on seedling survival and seed yield of pea cv. Swing at Vegreville, Alberta in 2001.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Control +*R* [1]	--	33.0 c[2]	1.29 d
L0020 + U2051 +*R*	0.128 + 2.6	43.3 b	1.43 bcd
U2051 +*R*	2.6	46.9 b	1.54 abcd
U2051 +*R*	3.3	46.6 b	1.51 abcd
L0020 + L1030 +*R*	0.128 + 1.0	46.5 b	1.71 a
L0020 + L1031 +*R*	0.128 + 1.33	45.1 b	1.65 abc
L1022 +*R*	3.1	46.3 b	1.70 a
L0202 +*R*	4.4	41.4 b	1.48 abcd
L0020 +*R*	0.128	32.3 c	1.40 cd
Control	--	58.3 a	1.68 ab

[1] Denotes inoculation with *Rhizoctonia solani.*

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 116 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Swing
PEST: Mycosphaerella Blight, *Mycosphaerella pinodes* Berk. & Blox.

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TITLE: EVALUATION OF FOLIAR SPRAY TREATMENTS FOR THE CONTROL OF MYCOSPHAERELLA BLIGHT OF FIELD PEA IN ALBERTA IN 2001

MATERIALS: BRAVO 500F (chlorothalonil, 500 g/L SU), DITHANE RAINSHIELD NT (mancozeb 75% DG), NOVA 40W (myclobutanil, 40% WP)

METHODS: Experimental plots were established on 17 May, 2001 near Edmonton, Alberta, in black chernozemic loam soil. Field pea cv. Swing was seeded in plots consisting of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 20 g per row. Foliar fungicide treatments (BRAVO 500F, DITHANE RAINSHIELD NT and NOVA 40W) were applied at 1000, 1500 and 56 g ai/ha, respectively) in a randomized complete block design with four replications. Each treatment was applied to two sub-plots in each replicate on 18 July using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa at early bloom using 360 L/ha water volume. A second treatment of each fungicide was applied to one sub-plot in each replication on 31 July. Mycosphaerella blight severity was rated on 10 August at 5 sites per plot based on percent foliar infection for the upper, middle and lower leaves and on a 0-9 scale for the stem based on lesion size and abundance. At maturity, on 5 September, plants from each plot 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 Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: The double application of NOVA 40W and the single application of BRAVO showed significantly lower ($P \leq 0.05$) disease severity on the upper leaves than the untreated control (Table 1). Foliar disease severity was significantly lower ($P \leq 0.05$) than the untreated control for all fungicide treatments on the middle leaves and was significantly lower ($P \leq 0.05$) for the single application of NOVA 40W than for the double application. On the lower leaves, disease severity was significantly lower ($P \leq 0.05$) than the untreated control for all treatments except the double application of NOVA 40W. Disease severity was significantly higher ($P \leq 0.05$) for this treatment than for the single application of either BRAVO or DITHANE. Stem disease severity was significantly lower ($P \leq 0.05$) than the untreated control for all of the BRAVO and DITHANE treatments, but for neither of the NOVA treatments. Yield was significantly greater ($P \leq 0.05$) for both of the DITHANE treatments, but not for the

NOVA treatments or for BRAVO at the lower rate.

CONCLUSIONS: Application of BRAVO or DITHANE reduced disease severity on both middle and lower leaves and also on the stems. The BRAVO and DITHANE treatments also improved seed yield. Two applications of the NOVA 40W treatment reduced disease severity on the upper and middle leaves, but did not reduce severity on the lower leaves or stems and did not improve yield.

Table 1. Effect of foliar spray treatments on the severity of mycosphaerella blight and seed yield of field pea cv. Swing near Edmonton, Alberta in 2001.

Treatment	Timing	Rate	Disease severity on leaves(%) and stems				Yield
		(g ai/ha)	Upper	Middle	Lower	Stem (0-9)	(T/ha)
Control	--		1.5 a[1]	22.5 a	80.0 a	5.0 a	1.65 bc
BRAVO 500F	A[2]	1000	0.9 b	7.9 bc	55.5 c	3.4 bc	2.31 a
BRAVO 500F	A+B	1000+1000	1.1 ab	8.3 bc	61.5 bc	3.1 c	2.12 ab
DITHANE	A	1688	1.0 ab	9.9 bc	56.5 c	3.4 bc	2.21 a
DITHANE	A+B	1688+1688	1.0 ab	9.3 bc	60.5 bc	3.2 c	2.24 a
NOVA 40W	A	56	1.0 ab	6.4 c	64.5 bc	4.2 abc	1.79 abc
NOVA 40W	A+B	56+56	0.8 b	13.4 b	75.0 ab	4.6 ab	1.57 c
ANOVA ($P \leq 0.05$)			s	s	s	s	s

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

[2] A- Foliar fungicide applied on 18 July; B- Foliar fungicide applied on 31 July.

2001 PMR REPORT # 117 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cv. Carneval
PEST: Powdery Mildew, *Erysiphe pisi* Syd.

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TITLE: EVALUATION OF FOLIAR SPRAY TREATMENTS FOR THE CONTROL OF POWDERY MILDEW OF FIELD PEA IN ALBERTA IN 2001

MATERIALS: NOVA 40W (myclobutanil, 40% WP)

METHODS: Experimental plots were established on 17 May, 2001 near Edmonton, Alberta, in black chernozemic loam soil. Field pea cv. Swing was seeded in plots consisting of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 20 g per row. Foliar fungicide treatments of NOVA 40W were applied at 56 and 112 g ai/ha in a randomized complete block design with four replications. Each treatment was applied to two sub-plots in each replicate on 5 August using a knapsack sprayer with a 8002 tee-jet nozzle at 250 kpa at early bloom using 360 L/ha water volume. A second treatment of each fungicide was applied to one sub-plot in each replication on 20 August. Powdery mildew severity was rated on 31 August at five sites per plot on a 0-9 scale based on percent foliar infection. At maturity, on 11 September, plants from each plot 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: Disease severity was significantly lower ($P \leq 0.05$) for all treatments than for the untreated control (Table 1). A single application of NOVA 40W at the higher rate showed significantly lower ($P \leq 0.05$) disease severity compared to application at the lower rate and two applications of NOVA 40W showed significantly lower ($P \leq 0.05$) disease severity compared to the single applications. Yield was similar among all treatments.

CONCLUSIONS: Application of NOVA 40W reduced powdery mildew severity at all rates, but a single application at the higher rate reduced disease severity more than at the lower rate, and double applications of NOVA 40W reduced the disease more than single applications. Yield was not significantly improved by fungicide application.

Table 1. Effect of foliar spray treatments on the severity of powdery mildew and seed yield of field pea cv. Carneval near Edmonton, Alberta in 2001.

Treatment	Timing	Rate (g ai/ha)	Disease severity (0-9)	Yield (T/ha)
Control	--		4.0 a [1]	1.12
NOVA 40W	A [2]	56	2.3 b	1.34
NOVA 40W	A	112	0.9 c	1.33
NOVA 40W	A+B	56+56	0.2 d	1.64
NOVA 40W	A+B	112+112	0.0 d	1.39
ANOVA ($P \leq 0.05$)			s	ns

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

[2] A- Foliar fungicide applied on 5 August; B- Foliar fungicide applied on 20 August.

2001 PMR REPORT # 118 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field pea (*Pisum sativum* L.), cvs. Chroma and Swing
PEST: Root Rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA ROOT ROT OF FIELD PEA IN ALBERTA IN 2001

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% MEC), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU)

METHODS: Seed of pea cvs. Chroma and Swing was treated with VITAFLO 280 at 88.0 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 2 May, 2001 at Westlock, Alberta, in black chernozemic loam soil. The plot was seeded in a split-plot randomized complete block design with four replications. Pea cultivars served as main plots and fungicide seed treatment served as subplots. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 20 g of seed 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 30 mL/row (3×10^2 cfu/mL). Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted on 19 June. Plots were trimmed to 4.5 m before harvest. At maturity (24 August), 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 was similar among all treatments (Table 1). Seed yield was significantly greater ($P \leq 0.05$) than the inoculated control for both APRON MAXX treatments, but not for the VITAFLO 280 treatment. For all seed treatments in the trial, seedling emergence was significantly greater ($P \leq 0.05$) for cv. Swing than cv. Chroma, but yield was similar between the two cultivars (Table 2).

CONCLUSIONS: Seed yield was improved over the inoculated control by both APRON MAXX treatments.

Table 1. Effect of seed treatments on plant stand and seed yield of pea cvs. Swing and Chroma at Westlock, Alberta in 2001.

Treatment	Rate (g ai/100 kg seed)	Stand (Plants/6m)	Seed yield (T/ha)
APRON MAXX	6.25	47.9 a[1]	3.18 a
APRON MAXX	12.5	48.1 a	3.27 a
VITAFLO 280	88	45.7 a	3.01 ab
Inoculated Control	--	44.3 a	2.69 b
Noninoculated Control	--	46.0 a	3.16 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

Table 2. Comparison of seedling establishment and seed yield of field pea cvs. Chroma and Swing at Westlock, Alberta in 2001.

Cultivar	Stand (Plants/6m)	Seed yield (T/ha)
Chroma	42.3 b[1]	3.07 a
Swing	50.5 a	3.06 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2001 PMR REPORT # 119 **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 TO CONTROL RHIZOCTONIA ROOT ROT OF SOYBEAN IN 2001

MATERIALS: L0020 (metalaxyl, 320 g/L FL), L1022 (metalaxyl 12 g/L + ipconazole, 7.5 g/L SU), L1031 (HEC 5725, 37.5 g/L + triazolinthion, 37.5 g/L SU), U2051 (carbathiin, 170 g/L + thiram, 150 g/L SU), U2789 (carbathiin, 233 g/L SU)

METHODS: Seed of soybean cv. Gaillard was treated with U2051, L1022 or with L0020 at 0.128 mL/kg seed, either alone or in combination with L1031 at 1.33 mL/kg, U2051 at 2.6 mL/kg or U2789 at 1.92 mL/kg seed in a Hege II small batch seed treater. Experimental plots were established on 17 May at Brooks, Alberta in brown chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. *Rhizoctonia*-inoculated and non-inoculated controls were seeded along with the treatments. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. *Rhizoctonia solani* was grown on a mixture of sterilized oat and rye kernels for 14 days, dried, ground and incorporated as inoculum at the rate of 40 mL/row (4×10^2 cfu/mL) at the time of seeding. Emerged seedlings were counted on 18 June. Plots were harvested using a small plot combine on 5 September. 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 significantly greater ($P \leq 0.05$) for all seed treatments tested compared to both the inoculated and noninoculated controls, except for L0020 alone and U2051 alone (Table 1). Seedling emergence was significantly greater ($P \leq 0.05$) for L1022 alone than for these two and the L0020 + U2789 treatment. Seed yield was statistically similar among all fungicidal seed treatments in the trial and was significantly greater ($P \leq 0.05$) for L0020 + U2051 compared to the inoculated control.

CONCLUSIONS: All fungicidal seed treatments in the trial, except for L0020 and U2051 applied singly, improved plant stand over the nontreated inoculated control. While all fungicidal seed treatments in the trial produced similar yields, the L0020 + U2051 treatment produced a much higher yield than the inoculated control.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of soybean cv. Gaillard grown in soil infested by *Rhizoctonia solani* at Brooks, Alberta in 2001.

Treatment	Rate (mL/kg seed)	Stand (plants/6m)	Seed yield (T/ha)
Control +*R*[1]	-	37.2 d[2]	1.12 b
U2051 +*R*	2.6	41.6 bcd	1.20 ab
L1022 +*R*	3.1	48.8 a	1.38 ab
L0020 +*R*	0.128	39.1 cd	1.40 ab
L0020 + L1031 + *R*	0.128 + 1.33	46.6 ab	1.56 ab
L0020 + U2051 +*R*	0.128 + 2.6	44.7 ab	1.72 a
L0020 + U2789 +*R*	0.128 + 1.92	42.7 bc	1.44 ab
Noninoculated control	-	49.3 a	1.59 ab

[1] Denotes inoculation with *Rhizoctonia solani.*

[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

END OF SECTION M: FIELD LEGUMES - Diseases
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SECTION N:	**POTATOES - Diseases /LES MALADIES DES POMMES DE TERRES**
REPORT /RAPPORT #:	**120**
PAGES:	**331-333**
EDITOR:	**Ms. Agnes M. Murphy**

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2001 PMR Report # 120 **SECTION N: POTATOES - Diseases.**
STUDY DATA BASE: 303-1251-9601

CROP: Potato (*Solanum tuberosum* L.) cv. Kennebec
PEST: Black scurf (*Rhizoctonia solani* Kühn), common scab (*Streptomyces* spp.), silver scurf (*Helminthosporium solani* Dur. and Mont.), and dry rot (*Fusarium* spp.)

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TITLE: EFFECT OF PUROGENE AND SENATOR ON CONTROL OF BLACK SCURF (*RHIZOCTONIA SOLANI*) OF POTATO IN PEI, 2000-2001

MATERIALS: PUROGENE (200 ppm chlorine dioxide) and SENATOR (thiophanate methyl 10% PSPT)

METHODS: Efficacy of the seed piece treatment fungicides Purogene, Senator, and a combination of Purogene and Senator in reducing black scurf, silver scurf, dry rot and common scab on potato cv. Kennebec was evaluated at the Crops and Livestock Research Centre's Research Farm in Harrington, PEI in 2000. Treatments were: 1) PUROGENE A; 2) SENATOR A; 3) PUROGENE + SENATOR A; 4) PUROGENE B; 5) SENATOR B; 6) PUROGENE + SENATOR B. Seed tubers with 5.0% black scurf were used in treatments 1 to 3 and seed tubers with 10.0% black scurf were used in treatments 4 to 6. Seed tuber pieces of potato were dip treated with PUROGENE for a minimum of 3 minutes, and then air- dried. Seed tuber pieces, including some of the ones that were treated with PUROGENE, were

treated with SENATOR by agitation in a plastic bag for a minimum of 2 minutes. Two checks, ‘untreated check A’ with 5.0% black scurf and ‘untreated check B’ with 10.0% black scurf symptoms on the seed tuber surface, did not receive any fungicides. Fungicide-treated seed tuber pieces and the checks (without the fungicide treatment), were planted within two hours of treatment. The trial was planted on 31 May, 2000 in rows 0.90 m apart with a seed spacing of 0.30 m. Plots were 3.6 m long and 3 rows wide for a total of 36 seed pieces per plot. Each treatment was replicated 4 times in a randomized complete block design. Fertilizers, late blight fungicides, herbicides and insecticides were applied as and when required, at standard recommended rates (Publ. 1300A, Potato crop: variety, weed and pest untreated check guide 2000 for the Atlantic Provinces). Plant emergence counts and stem counts were made on 19 June, 2000. Potatoes were harvested on 2 October, 2000 and yields were recorded. Fifty potatoes from each of the treatments were rated for black scurf, silver scurf, common scab and dry rot soon after harvest (27 October, 2000) and also after 3 months in storage (1 February, 2001). Statistical analyses of the data were conducted using Genstat 5.0 (Lawes Agricultural Trust, Rothamsted Experimental Station, UK).

RESULTS: As outlined in Table 1.

CONCLUSIONS: Similar (treatments 1to3) and increased (treatments 4to6) emergence in plots treated with fungicides and checks showed that the treatments were not phytotoxic. In this study, either PUROGENE alone or SENATOR alone were not effective against black scurf. PUROGENE + SENATOR treatment significantly reduced black scurf in the progeny of seed tubers with moderate (5.0%) but not in progeny of seed tubers with high (10.0%) black scurf disease. The effectiveness of the combination treatment on rhizoctonia disease complex indicates that under field conditions, the PUROGENE treatment is a relatively effective biocide, but not an eradicant of *R. solani.* The PUROGENE + SENATOR treatment did not reduce either silver scurf or common scab. None of the treatments had significant effect on dry rot. With the exception of treatment, Purogene alone on seed tubers with 5 % infection, the yield in the treatments was similar to the yield in checks. In conclusion, in 2000 field season, the combination treatment of PUROGENE + SENATOR provided most effective control of black scurf on progeny tubers from the seed tubers with 5.0% black scurf infection.

Table 1. Effect of PUROGENE and SENATOR on black scurf, common scab, silver scurf and dry rot of potato, and on marketable yield of harvested tubers.

#	Treatment	Rate of product	% Tuber area affected[ab]				yield (t/ha)[e]
			Black scurf[c]	Common scab[c]	Silver scurf[d]	Dry rot[d]	
	Seed tubers with 5% black scurf						
	Untreated check A	-----	6.3	1.3	11.8	3.4	24.2
1	PUROGENE A	200 ppm	6.2	1.3	11.6	3.9	26.7
2	SENATOR A	0.50 g ai/kg	4.3	1.2	10.9	4.0	25.9
3	PUROGENE +SENATOR A	200 ppm /0.50 g ai/kg	2.0	1.2	10.2	3.7	27.2
	Seed tubers with 10% black scurf						
	Untreated check B	-----	7.1	1.6	11.3	4.2	25.4
4	PUROGENE B	200 ppm	7.2	1.3	9.9	3.6	19.8
5	SENATOR B	0.50 g ai/kg	4.0	1.4	10.1	4.4	28.2
6	PUROGENE +SENATOR B	200 ppm /0.50 g ai/kg	4.0	1.2	9.7	4.5	28.4
	LSD for comparing means ($P \leq 0.05$)		3.6	0.4	2.5	1.1	5.5

[a] Mean of 4 replications per treatment.
[b] 50 tubers/replication were rated for each of the diseases.
[c] Severity of black scurf and common scab at harvest.
[d] Severity of silver scurf and dry rot after 3 months storage.
[e] Canada No.1 marketable yield (55-85 mm).

END OF SECTION N: POTATOES - Diseases
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SECTION O:	**CEREAL, FORAGE AND OILSEED CROPS /CÉRÉALES, CULTURES FOURRAGÈRES ET OLÉAGINEUX**
REPORT /RAPPORT #:	**121 - 136**
PAGES:	**334 - 366**
EDITOR:	**Dr. Richard A. Martin**

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2001 PMR REPORT # 121 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
- Diseases
ICAR: 61009653

CROP: Alfalfa (*Medicago sativa* L.)
PEST: Spring black stem and leaf spot, *Phoma medicaginis* Malbr.& Roum.

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TITLE: ***IN VITRO*** **EVALUATION OF FUNGICIDES FOR THE CONTROL OF SPRING BLACK STEM AND LEAF SPOT OF ALFALFA IN ALBERTA IN 2001**

MATERIALS: BRAVO 500 F (chlorothalonil, 500 g/L SU), BENLATE (benomyl, 50 WP), FLINT 125 EC (CGA-279202, 125 g/L EC), QUADRIS 250 SC (azoxystrobin, 250 g/L SU), ROVRAL (iprodione, 50 WP), and TILT 250 EC (propiconazole, 250 g/L EC)

METHODS: *In vitro* fungicide bioassays were conducted by growing *Phoma medicaginis* on potato-dextrose agar (PDA) plates amended with BRAVO, BENLATE, FLINT, QUADRIS, ROVRAL or TILT. The final concentration of fungicides in the plate was adjusted to 1, 10, 50, 100, and 250 ng/mL. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *Phoma*. The plugs were inserted into the center of the bioassay plates which were then incubated at 20-25 °C. The plates were arranged in a completely randomized design. Colony diameters were measured every 24 hr until the non-fungicide control plates

were fully overgrown. Each treatment was tested on 10 plates and the bioassay was repeated once. EC_{50} (fungicide concentration required to inhibit growth by 50%) and EC_{90} (fungicide concentration required to inhibit growth by 90%) were estimated using linear regression between fungicide concentration and inhibiting effect on mycelial growth. Data were transformed to percent inhibition of mycelial growth by comparing with non-amended controls, and subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System 8.1 (SAS Institute, Cary, NC). Linear regression for fungicides on inhibition of mycelial growth of *Phoma medicaginis* was performed using SigmaPlot 2000 (SPSS Inc., Chicago, IL).

RESULTS: TILT and BENLATE had the greatest suppressive effect on *Phoma*. The EC_{50} values were 1.4 and 6.3 ng/mL and the EC_{90} values were 49.3 and 53.3 ng/mL, respectively. ROVRAL had a low EC_{50}, but a high EC_{90}. All EC values for BRAVO, FLINT and QUADRIS were over 500 ng/mL (Figure 1,Table 1).

CONCLUSIONS: TILT and BENLATE were the most effective fungicides at controlling *Phoma medicaginis*. ROVRAL was also effective at higher concentrations. BRAVO, FLINT and QUADRIS did not control *Phoma* very effectively.

Figure 1. Linear regression for six fungicides on inhibition of mycelial growth of *Phoma medicaginis* on potato-dextrose agar plates in the laboratory assay. In Figure A, a = BRAVO, b = BENLATE, c = FLINT; in Figure B, a = QUADRIS, b = ROVRAL, and c = TILT.

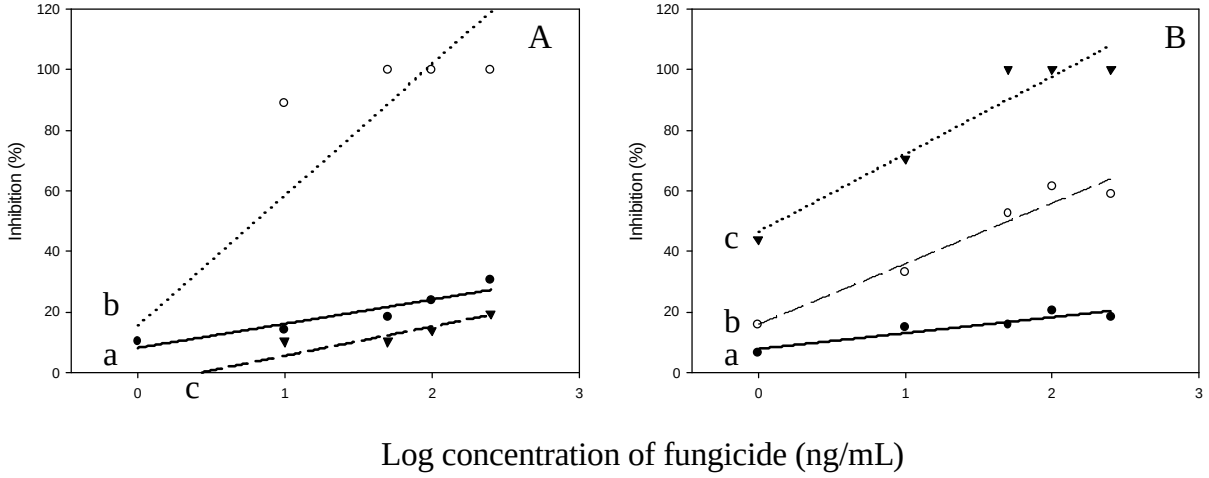

Table 1. Estimated regression parameters from linear regression of six fungicides on inhibition of mycelial growth of *Phoma medicaginis* on PDA plate bioassays

Fungicide	*b*	EC_{50} (ng/mL)	EC_{90} (ng/mL)	R^2 (%)
BRAVO	8.0	>500.0	>500.0	88.5*
BENLATE	43.2	6.3	53.3	78.3*
FLINT	9.7	>500.0	>500.0	91.0**
QUADRIS	5.3	>500.0	>500.0	88.4*
ROVRAL	20.1	50.7	>500.0	95.3**
TILT	25.7	1.4	49.3	93.1**

* and ** represent significance at $P \leq 0.05$ and $P \leq 0.01$, respectively.

2001 PMR REPORT # 122 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
- Diseases **ICAR:** 61009653

CROP: Alfalfa (*Medicago sativa* L.)
PEST: Leptosphaerulina leaf spot, *Leptosphaerulina briosiana* (Pollacci) J. H. Graham & Luttrel

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TITLE: ***IN VITRO*** **EVALUATION OF FUNGICIDES FOR THE CONTROL OF LEPTOSPHAERULINA LEAF SPOT OF ALFALFA IN ALBERTA IN 2001**

MATERIALS: BRAVO 500 F (chlorothalonil, 500 g/L SU), BENLATE (benomyl, 50 WP), FLINT 125 EC (CGA-279202, 125 g/L EC), QUADRIS 250 SC (azoxystrobin, 250 g/L SU), ROVRAL (iprodione, 50 WP), and TILT 250 EC (propiconazole, 250 g/L EC)

METHODS: *In vitro* fungicide bioassays were conducted in the laboratory by growing *Leptosphaerulina briosiana* on potato-dextrose agar (PDA) plates amended with BRAVO, BENLATE, FLINT, QUADRIS, ROVRAL or TILT. The final concentration of fungicides in the plate was adjusted to 1, 10, 50, 100, and 250 ng/mL. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *Leptosphaerulina*. The plugs were inserted into the center of the bioassay plates which were then incubated at 20-25 °C. The plates were arranged in a completely randomized design. Colony diameters were measured every 24 hr until the non-fungicide control plates were fully overgrown. Each treatment was tested on 10 plates and the bioassay was repeated once. EC_{50} (fungicide concentration required to inhibit growth by 50%) and EC_{90} (concentration required to inhibit growth by 90%) were estimated using linear regression between fungicide concentration and inhibiting effect on mycelial growth. Data were transformed to percent inhibition of mycelial growth by comparing with non-amended controls, and subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System 8.1 (SAS Institute, Cary, NC). Linear regression for fungicides on inhibition of mycelial growth of *Leptosphaerulina briosiana* was performed using SigmaPlot 2000 (SPSS Inc., Chicago, IL).

RESULTS: FLINT and QUADRIS had the highest suppressive effect on *Leptosphaerulina* growth. The EC_{50} for both fungicides was 0.1 ng/mL; the EC_{90} was 22.2 ng/mL for FLINT and 23.9 ng/mL for QUADRIS. BENLATE and TILT had higher EC values than FLINT and QUADRIS, but were more effective for inhibiting *Leptosphaerulina* growth than ROVRAL and BRAVO. The EC_{90} for both ROVRAL and BRAVO was over 500 ng/mL (Figure 1,Table 1).

CONCLUSIONS: FLINT and QUADRIS were the most effective fungicides for controlling *Leptosphaerulina*, *in vitro*. BENLATE and TILT effectively controlled the pathogen at higher concentrations. ROVRAL and BRAVO did not control *Leptosphaerulina* very effectively.

Figure 1. Linear regression for six fungicides on inhibition of mycelial growth of *Leptosphaerulina briosiana* on potato-dextrose agar plates in the laboratory assay. In Figure A, a = BRAVO, b = BENLATE, c = FLINT; in Figure B, a = QUADRIS, b = ROVRAL, and c = TILT.

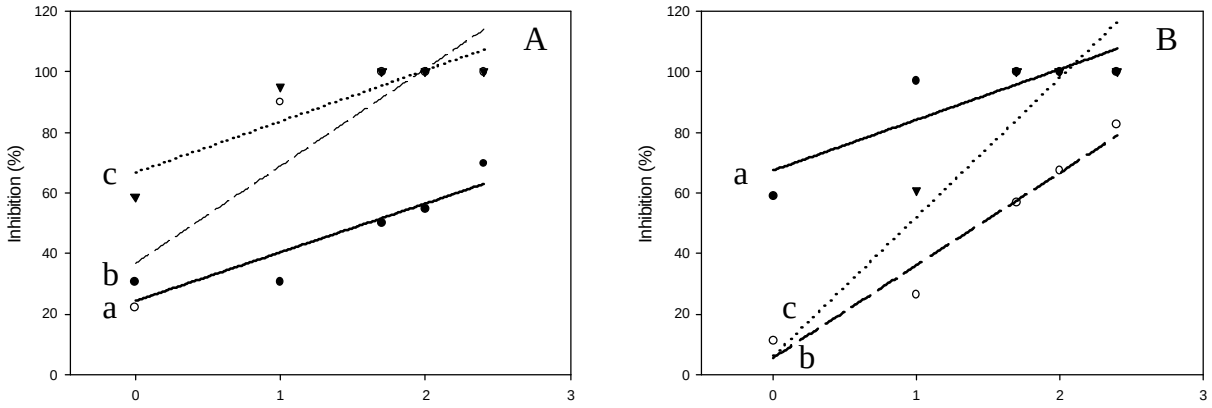

Table 1. Estimated regression parameters from linear regression of six fungicides on inhibition of mycelial growth of *Leptosphaerulina briosiana* on PDA plate bioassays.

Fungicide	*b*	EC_{50} (ng/mL)	EC_{90} (ng/mL)	R^2 (%)
BRAVO	16.1	39.5	>500.0	83.2*
BENLATE	32.2	2.6	45.2	79.9*
FLINT	16.9	0.1	23.9	79.5*
QUADRIS	16.7	0.1	22.2	76.1*
ROVRAL	30.5	28.6	>500.0	95.9**
TILT	45.9	9	66.9	91.5**

* and ** represent significance at $P \leq 0.05$ and $P \leq 0.01$, respectively.

2001 PMR REPORT # 123 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
- Diseases
ICAR: 61009653

CROP: Alfalfa (*Medicago sativa* L.)
PEST: Sclerotinia crown and stem rot, *Sclerotinia sclerotiorum* (Lib.) de Bary

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TITLE: *IN VITRO* EVALUATION OF FUNGICIDES FOR THE CONTROL OF SCLEROTINIA CROWN AND STEM ROT OF ALFALFA IN ALBERTA IN 2001

MATERIALS: BRAVO 500 F (chlorothalonil, 500 g/L SU), BENLATE (benomyl, 50 WP), FLINT 125 EC (CGA-279202, 125 g/L EC), QUADRIS 250 SC (azoxystrobin, 250 g/L SU), ROVRAL (iprodione, 50 WP), and TILT 250 EC (propiconazole, 250 g/L EC)

METHODS: *In vitro* fungicide bioassays were conducted by growing *Sclerotinia sclerotiorum* on potato-dextrose agar (PDA) plates amended with BRAVO, BENLATE, FLINT, QUADRIS, ROVRAL or TILT. The final concentration of fungicides in the plate was adjusted to 1, 10, 50, 100, and 250 ng/mL. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *Sclerotinia*. The plugs were inserted into the center of the bioassay plates which were then incubated at 20-25 °C. The plates were arranged in a completely randomized design. Colony diameters were measured every 24 hr until the non-fungicide control plates were fully overgrown. Each treatment was tested on 10 plates and the bioassay was repeated once. EC_{50} (fungicide concentration required to inhibit growth by 50%) and EC_{90} (concentration required to inhibit growth by 90%) were estimated using linear regression between fungicide concentration and inhibiting effect on mycelial growth. Data were transformed to percent inhibition of mycelial growth by comparing with non-amended controls, and subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System 8.1 (SAS Institute, Cary, NC). Linear regression for fungicides on inhibition of mycelial growth of *Sclerotinia sclerotiorum* was performed using SigmaPlot 2000 (SPSS Inc., Chicago, IL).

RESULTS: BRAVO, BENLATE, ROVRAL and TILT effectively inhibited *Sclerotinia* growth. The EC_{50} values ranged from less than 0.1 ng/mL to 1.6 ng/mL, and EC_{90} ranged from 1.6 ng/mL to 41.8 ng/mL. All EC values for FLINT and QUADRIS were over 500 ng/mL (Figure 1,Table 1).

CONCLUSIONS: BRAVO, BENLATE, ROVRAL and TILT were all effective fungicides for controlling *Sclerotinia*. FLINT and QUADRIS did not effectively inhibit this pathogen, *in vitro*.

Figure 1. Linear regression for six fungicides on inhibition of mycelial growth of *Sclerotinia sclerotiorum* on potato-dextrose agar plates in the laboratory assay. In Figure A, a = BRAVO, b = BENLATE, c = FLINT; in Figure B, a = QUADRIS, b = ROVRAL, and c = TILT.

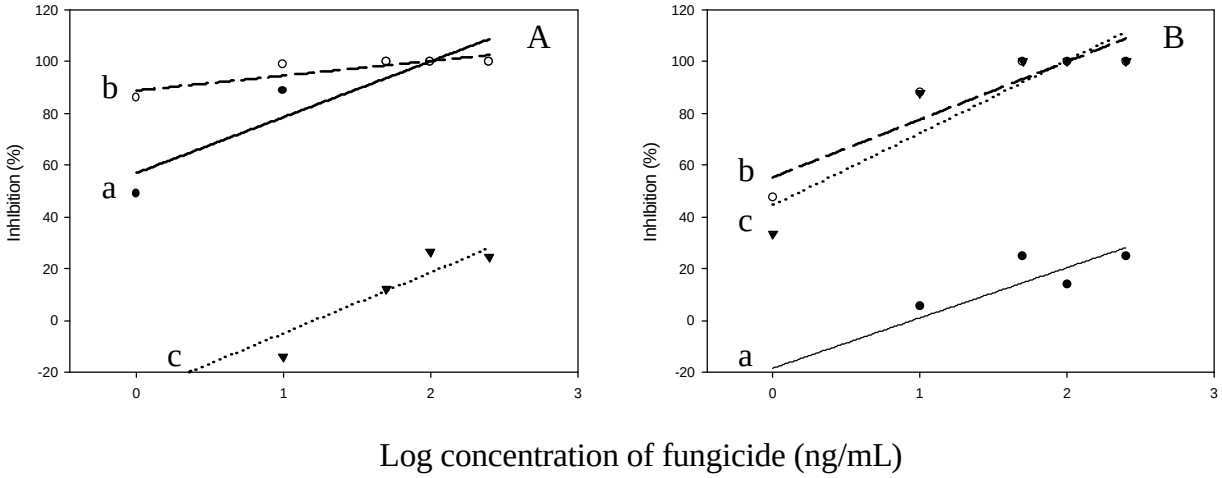

Table 1. Estimated regression parameters from linear regression of six fungicides on inhibition of mycelial growth of *Sclerotinia sclerotiorum* on PDA plate bioassays.

Fungicide	*b*	EC_{50} (ng/mL)	EC_{90} (ng/mL)	R^2 (%)
BRAVO	21.6	0.5	34.1	85.4*
BENLATE	5.7	<0.1	1.6	77.0*
FLINT	23.4	>500.0	>500.0	92.1**
QUADRIS	19.4	>500.0	>500.0	87.5*
ROVRAL	22.3	0.6	36.0	85.8*
TILT	28.0	1.6	41.8	83.2*

* and ** represent significance at $P \leq 0.05$ and $P \leq 0.01$, respectively.

2001 PMR REPORT # 124 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
- Diseases
ICAR: 61009653

CROP: Alfalfa (*Medicago sativa* L.), cv. Algonquin
PEST: Alfalfa foliar disease complex (*Leptosphaerulina Briosiana* (Pollacci) J. H. Graham & Luttrel, *Phoma medicaginis* Malbr.& Roum., *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 2001

MATERIALS: BENLATE (benomyl, 50 WP), ROVRAL (iprodione, 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. Plots were sprayed with a single application of BENLATE (1500 g/ha), ROVRAL (1500 g/ha) or TILT (500 g/ha). The fungicides were applied with 360 L/ha water in a randomized complete block design on early August 2001 using 2.5 L Spray-Doc Sprayer (Gilmour Manufactory Co., Somerset, PA). Treatments were replicated four times. Disease assessments (leaf spots and stem spots) were made from 20 upper and 20 lower leaves, and 20 upper stems and 20 lower stems for each replication 2 weeks after fungicide application according to the rating scales described by James (1971). 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: The results from leaves and stems were combined since there were no significant interactions between them at both field sites. Disease incidence was significantly lower ($P \leq 0.05$) for all fungicide treatments than for the untreated control for upper part of plants at both sites and for the lower plants at the Vegreville site (Table 1). Lower parts of plant had very high disease incidence. At Camrose, disease incidence was at or near 100% for both treated and nontreated plots. On the upper plants at Camrose, plots treated with BENLATE or ROVRAL showed a significantly lower ($P \leq 0.05$) disease incidence than those treated with TILT. Disease severity was significantly lower ($P \leq 0.05$) for all fungicide treatments than for the untreated control for both upper and lower plants at both sites.

CONCLUSIONS: A single application of BENLATE, ROVRAL or TILT reduced alfalfa foliar disease incidence and severity levels at two sites in central Alberta.

REFERENCE:
James, W.C. 1971. An illustrated series of assessment keys for plant diseases, their preparation and usage. Can. Plant Dis. Surv. 51: 39 - 65.

Table 1. Effects of fungicide foliar application on alfalfa foliar disease[1] development in field experiments at Camrose and Vegreville, Alberta in 2001.

Treatment	Disease incidence (%)[2]		Disease severity (%)[2]	
	Upper plants	Lower plants	Upper plants	Lower plants
Camrose site:				
BENLATE	59.5 c	99.9 a	1.7 b	20.9 b
ROVRAL	59.1 c	100.0 a	1.8 b	20.8 b
TILT	64.1 b	100.0 a	1.9 b	20.9 b
Non-treated	79.6 a	100.0 a	3.2 a	27.7 a
Vegreville site:				
BENLATE	24.8 b	93.1 b	0.3 b	10.6 b
ROVRAL	24.6 b	94.7 b	0.3 b	10.3 b
TILT	26.7 b	95.5 b	0.3 b	10.2 b
Non-treated	51.3 a	99.4 a	0.9 a	18.6 a

[1] Foliar disease complex included leaf and stem spots caused by *Leptosphaerulina Briosiana*, *Phoma medicaginis*, *Pseudopeziza medicaginis*, etc.

[2] Values are means of four replications in each of four fungicide applications. Means in a column within each site followed by a common letter are not significantly different according to least significant difference at $P \leq 0.05$.

2001 PMR REPORT # 125 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
- Diseases **ICAR:** 61009653

CROP: Alfalfa (*Medicago sativa* L.)
PEST: Stemphylium leaf spot, *Stemphylium botryosum* Wallr.

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TITLE: *IN VITRO* EVALUATION OF FUNGICIDES FOR THE CONTROL OF STEMPHYLIUM LEAF SPOT OF ALFALFA IN ALBERTA IN 2001

MATERIALS: BRAVO 500 F (chlorothalonil, 500 g/L SU), BENLATE (benomyl, 50 WP), FLINT 125 EC (CGA-279202, 125 g/L EC), QUADRIS 250 SC (azoxystrobin, 250 g/L SU), ROVRAL (iprodione, 50 WP), and TILT 250 EC (propiconazole, 250 g/L EC)

METHODS: *In vitro* fungicide bioassays were conducted by growing *Stemphylium botryosum* on potato-dextrose agar (PDA) plates amended with BRAVO, BENLATE, FLINT, QUADRIS, ROVRAL or TILT. The final concentration of fungicides was adjusted to 1, 10, 50, 100, and 250 ng/mL. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *Stemphylium*. The plugs were inserted into the center of the bioassay plates which were then incubated at 20-25 °C. The plates were arranged in a completely randomized design. Colony diameters were measured every 24 hr until the non-fungicide control plates were fully overgrown. Each treatment was tested on 10 plates and the bioassay was repeated once. EC_{50} (fungicide concentration required to inhibit growth by 50%) and EC_{90} (concentration required to inhibit growth by 90%) were estimated using linear regression between fungicide concentration and inhibiting effect on mycelial growth. Data were transformed to percent inhibition of mycelial growth by comparing with non-amended controls, and subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System 8.1 (SAS Institute, Cary, NC). Linear regression for fungicides on inhibition of mycelial growth of *Stemphylium botryosum* was performed using SigmaPlot 2000 (SPSS Inc., Chicago, IL).

RESULTS: ROVRAL was the most effective fungicide to inhibit growth of *Stemphylium.* The EC_{50} and EC_{90} values were both less than 0.1 ng/mL. BRAVO, TILT and QUADRIS also effectively inhibited the mycelial growth. The EC_{50} values ranged from 0.8 ng/mL to 7.9 ng/mL, and the EC_{90} values ranged from 35.4 ng/mL to 104.6 ng/mL. FLINT and BENLATE were the least effective fungicides with all EC values above 400 ng/mL (Figure 1,Table 1).

CONCLUSIONS: ROVRAL was the most effective inhibitor of *Stemphylium botryosum*. BRAVO, TILT and QUADRIS were effective at higher concentrations. FLINT and BENLATE were not very effective against *Stemphylium.*

Figure 1. Linear regression for six fungicides on inhibition of mycelial growth of *Stemphylium botryosum* on potato-dextrose agar plates in the laboratory assay. In Figure A, a = BRAVO, b = BENLATE, c = FLINT; in Figure B, a = QUADRIS, b = ROVRAL, and c = TILT.

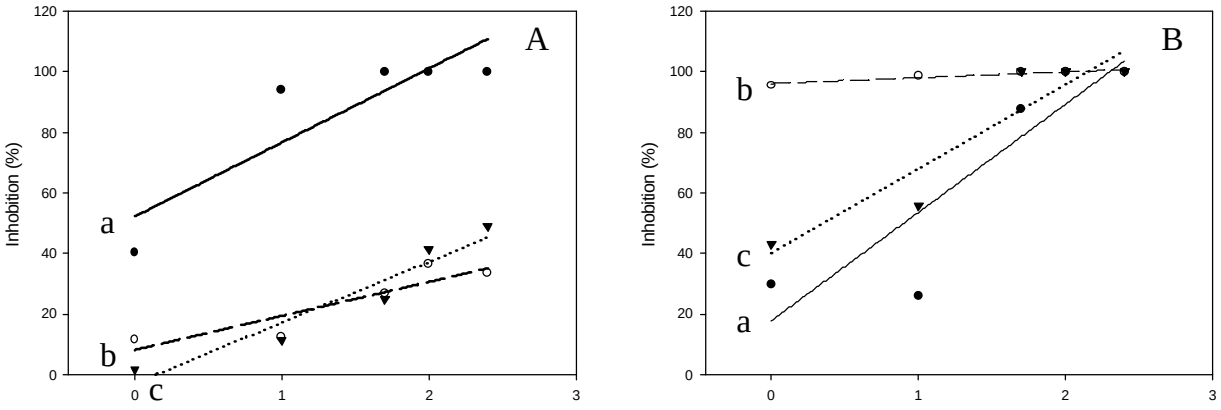

Table 1. Estimated regression parameters from linear regression of six fungicides on inhibition of mycelial growth of *Stemphylium botryosum* on PDA plate bioassays.

Fungicide	*b*	EC_{50} (ng/mL)	EC_{90} (ng/mL)	R^2 (%)
BRAVO	24.4	0.8	35.4	77.8*
BENLATE	11.2	>500.0	>500.0	82.3*
FLINT	20.1	428.4	>500.0	92.1**
QUADRIS	35.7	7.9	104.6	80.3*
ROVRAL	1.9	<0.1	<0.1	87.7*
TILT	27.8	2.2	61.3	87.8*

* and ** represent significance at $P \leq 0.05$ and $P \leq 0.01$, respectively.

2001 REPORT # 126 **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, 2001

MATERIALS: VITAFLO 280 (carbathiin 14.9%, thiram 13.2%), BAYTAN 30 (triadimenol, 30%), RAXIL FL (tebuconazole 6 gai/L), DIVIDEND XL RTA (difenoconazole 3.37%, metalaxyl-m 0.27%), CHARTER (triticonazole 2.5%)

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 25, 2001, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide and five metres long, 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) 25. Treatments were replicated four times in a randomized complete block design. Due to a high aphid infestation, Cygon 4-E was applied (425ml/ha) on July 24, to all plots.

Seedling blight/root rot was rated on a 0-10 scale (zero = no symptoms, 10 = severe symptoms on the subcrown internode region) on July 13. Scald was rated on a whole plot basis at the same time on a scale of 0-10. Net blotch severity was rated on July 26, at ZGS 64, 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, August 27, 2001.

RESULTS: Results are contained in Table 1. It should be noted that the 2001 growing season was well below normal for moisture, 54 and 10 mm in July and August, respectively, compared to a mean of 100 and 75 in the previous 6 years.

CONCLUSIONS: The 2001 growing season was very dry and, as a result, late foliar disease development was restricted. Yields did not appear to be restricted as a result of foliar diseases. While seed treatment had no effects on late season foliar disease development, all treatments had a significant effect on seedling blight/root rot in comparison with the untreated control. There was a certain similarity between the azole materials, with BAYTAN 30 (triadimenol) and DIVIDEND XL RTA (difenoconazole) being numerically the most effective followed closely by RAXIL (tebuconazole) and CHARTER (triticonazole). However there were substantial differences in the active ingredient application rates between treatments, with tebuconazole (RAXIL) being applied at 1:100 the rate of triadimenol (BAYTAN 30), which may have a significant implication on control potential of the various materials in different

formulation or at different rates.

Table 1. Efficacy of fungicide seed treatments in barley, Charlottetown, PEI, 2001.

Treatment	Rate (ml product/ kg seed)	Seedling Blight (0-10)	Scald (0-10)	% Net blotch		Yield (kg/ha)	1000 Kwt (g)
				Flag-3	Flag-4		
Untreated Control	0	5.8	2.8	4.0	10.2	4314	46.00
VITAFLO 280	3.3	4.0	2.3	5.7	15.6	4298	47.50
BAYTAN 30	2.5	2.8	1.3	4.5	10.7	4391	48.40
BAYTAN 30	5.0	2.3	1.0	4.2	9.6	4092	45.70
RAXIL FL	2.5	3.0	1.8	5.2	13.1	4358	48.10
DIVIDEND RTA	3.25	2.5	1.5	6.2	16.8	4520	47.65
CHARTER	4.0	3.4	1.8	5.7	14.5	3994	45.55
CHARTER	6.0	3.3	1.8	4.3	11.1	4466	47.40
SEM		0.360	0.440	1.074	3.44	210.6	0.788
LSD (0.05)		1.06	(ns)	(ns)	(ns)	(ns)	(ns)

(ns) - no significant difference, p=0.05.

2001 REPORT # 127 **SECTION O: CEREALS, FORAGE CROPS AND OILSEEDS** - Diseases
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. AC Westeck
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 FUNGICIDE APPLICATIONS, 2000

MATERIALS: TILT 250EC (propiconazole, 125 g ai/L), FOLICUR 3.6F (tebuconazole, 38.7%)

METHODS: Barley plots, cv. AC Westeck, were established on June 2, 2000, at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide and five metres long, 17.8 cm between rows. Between each treatment plot was an equal sized wheat guard plot. Plots received a herbicide application of MCPA (1L/ha) plus REFINE EXTRA (20g/ha) at Zadok's Growth Stage (ZGS) 32. Treatments were applied at the Zadok's 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 a delivery volume of 250 L/ha. The surfactant AGSURF was used at 0.125% on all FOLICUR treatments. 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 off the solids and adding 15g/L NaCl. After autoclaving in flasks and inoculating with *Fusarium graminearum*, the media was 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. The inoculated plots depended on natural environmental conditions for infection and disease development.

Net blotch was rated on Aug 11, at ZGS 86, 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, Aug 30, 2000. Harvested seed was evaluated for fusarium damaged kernels (FDK) based on a weight of fusarium damaged kernels against total sample weight. Samples used for FDK were ground and DON levels determined via an ELISA test.

RESULTS: Results are contained in Table 1. FDK symptoms were too low to warrant rating. Symptoms of fusarium head blight were very slight in the field, and were not rated.

CONCLUSIONS: Net blotch severity on the Flag-1 leaf was significantly reduced by all treatments. Severity on the Flag-2 leaf was also reduced significantly by most treatments. Later applications of FOLICUR at ZGS 65, and without an application at ZGS 37-39, were not as effective as the early

application alone or the double applications. There was no significant effect of treatments on either yield or thousand kernel weight. This may have been in part due to the relatively low severity level of net blotch in the trial.

Fusarium head blight was effected by treatment, as measured by DON levels, but results were very variable. Fusarium head blight symptoms on barley are often not well expressed and as such DON levels provide an indication of disease severity. Evidence, based on DON levels as high as 9.8 ppm, indicated a good level of infection in the trial. There was some reductions in DON levels which were significant. DON reduction was limited, in this trial, to two FOLICUR treatments only. As the DON levels were still high enough to cause limitations in usage, further testing is warranted to determine if there is a long term advantage to fungicide usage for fusarium head blight control.

Table 1. Efficacy of fungicide foliar sprays in barley, Charlottetown, PEI, 2000.

Treatment	Rate[1]	Applied (ZGS)	% Net blotch		Yield (Kg/ha)	1000 kwt (g)	DON (ppm)
			Flag-1	Flag-2			
Control	0	-	5.5	18.5	4777	37.65	5.15
FOLICUR	125	37-39					
FOLICUR	125	65	2.6	6.3	4717	39.10	2.78
FOLICUR	125	37-39					
FOLICUR	187.5	65	2.5	5.4	5161	40.85	4.48
FOLICUR	125	37-39	2.6	6.1	5055	40.70	6.70
FOLICUR	125	65	4.3	14.4	4635	39.45	4.88
FOLICUR	187.5	65	3.4	12.3	5059	39.05	2.73
TILT	125	37-39					
TILT	125	65	2.3	4.3	5079	38.95	6.05
TILT	125	37-39	2.7	6.6	4747	40.80	4.15
TILT	125	65	2.8	8.6	5029	40.05	4.50
SEM			0.319	1.585	165.6	0.982	0.804
LSD (0.05)			0.93	4.625	(ns)	(ns)	2.345

[1] rate (g ai/kg seed).
ZGS - Zadoks Growth Stage.
(ns) - no significant differences at 0.05.

2001 PMR REPORT # 128 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
- Diseases
ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cv. OAC Summit
PEST: Damping-off (*Pythium* species)

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TITLE: CONTROLLED ENVIRONMENT EVALUATION OF SEED TREATMENTS TO CONTROL PYTHIUM DAMPING-OFF OF CANOLA

MATERIALS: 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, cv OAC Summit, were HELIX 289 FS at 10 or 20 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 inoculated and uninoculated seed not treated with the test products. A commercial potting mix (Promix BX) was infested with *Pythium paroecandrum* (isolate b), *P. paroecandrum* (isolate s), or *P. ultimum* by incorporating cultures of the fungus growing on V8 agar at a rate of two 9-cm diameter 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 (20-22°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. Five seeds per 5 x 7.5 cm pot were planted 3 cm deep. Pots were placed on 7.5 cm aluminum pans and covered with plastic bags to maintain high humidity. Bags were removed and plants were watered daily once emergence occurred and all 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-h photoperiod. There were three replicate pots per treatment and treatments were arranged in a completely randomized design. Plant stand was determined 28 days after seeding. Treatment effects on stand were determined by ANOVA and treatment means were compared by LSD at $P = 0.05$. Two trials were conducted using the same isolates and methods.

RESULTS: The results are presented in Table 1.

CONCLUSIONS: All isolates of *Pythium* completely suppressed stand. No product was phytotoxic. Stand from inoculated treated seed was increased by all products and rates compared to inoculated untreated seed in all 6 tests (2 trials x 3 fungi). Both rates of HELIX were completely effective in all tests, i.e. stands from untreated uninoculated seed and treated inoculated seed were not significantly different. VITAVAX RS was completely effective in 4 tests and PREMIERE PLUS was completely effective in 1 test.

Table 1. Effect of seed treatments on stand (day 28) of canola seedlings, cv. OAC Summit, from 5 seeds sown in pots containing potting mix infested with the named *Pythium* species.

Treatment	Product rate (mL/kg seed)	*P. paroecandrum* (isolate b)		*P. paroecandrum* (isolate s)		*P. ultimum*	
		Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
Untreated uninfested		4.7ab[1]	4.0abc	4.7ab	4.0abc	4.7ab	4.0abc
Untreated infested		0.0e	0.0f	0.0e	0.0f	0.0e	0.0e
VITAVAX RS infested	22.5	2.3d	4.0ab	3.7abcd	2.0e	3.7abcd	4.7ab
PREMIERE PLUS infested	28.2	2.3d	2.0e	2.7cd	2.7de	2.7cd	4.7ab
HELIX infested	20	4.3ab	3.3cd	4.3ab	4.7ab	3.3bcd	5.0a
HELIX infested	10	4.0abc	4.7ab	4.0abc	3.0cde	3.7abcd	4.7ab
VITAVAX RS uninfested	22.5	4.3ab	4.7ab	4.3ab	4.7ab	4.3ab	4.7ab
PREMIERE PLUS uninfested	28.2	5.0a	3.7bcd	5.0a	3.7bcd	5.0a	3.7bcd
HELIX uninfested	20	5.0a	4.0abc	5.0a	4.0abc	5.0a	4.0abc
HELIX uninfested	10	4.7ab	5.0a	4.7ab	5.0a	4.7ab	5.0a

[1] Within a column, means followed by the same letter are not significantly different at P = 0.05 (PLSD).

2001 PMR REPORT # 129 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
- Diseases
ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cv. OAC Summit
PEST: Damping-off (*Rhizoctonia solani*)

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TITLE: CONTROLLED ENVIRONMENT EVALUATION OF SEED TREATMENTS TO CONTROL RHIZOCTONIA DAMPING-OFF OF CANOLA

MATERIALS: 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, cv OAC Summit, were HELIX 289 FS at 10 or 20 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 inoculated and uninoculated seed not treated with the test products. To prepare inoculum, moist rye kernels were autoclaved for 1 h, cooled, and inoculated with agar plugs cut from the growing margin of cultures of *Rhizoctonia solani* AG2-1. The inoculated rye kernels were incubated at room temperature (20-22°C) for 2 weeks, dried at room temperature for 2 days, ground in a blender, and sieved to collect particles 0.5-1.2 mm in diameter. Inoculum was added to extra fine vermiculite at rates of 0.01, 0.05 and 0.1 g infested rye/L vermiculite. Infested vermiculite was added to 5 x 7.5 cm pots and 9 canola seeds per pot were sown 3 cm deep. The untreated checks consisted of untreated seed sown in vermiculite amended with infested rye or uninfested rye at 0.01, 0.05 or 0.1 g rye/L vermiculite. Pots were placed on 7.5 cm aluminum pans and covered with plastic bags to maintain high humidity. Bags were removed and plants were watered daily once emergence occurred and all 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-h photoperiod. There were three replicate pots per treatment and treatments were arranged in a completely randomized design. Plant stand was determined 28 days after seeding. Treatment effects on stand were determined by ANOVA and treatment means were compared by LSD at P = 0.05. Two trials were conducted using the same isolate and methods.

RESULTS: The results are presented in Table 1.

CONCLUSIONS: All levels of infestation of vermiculite with *R. solani* reduced stand. Demonstration of efficacy depended on the definition of efficacy and the concentration of inoculum. Over 6 tests (2 trials x 3 inoculum concentrations) stand was higher from inoculated treated seed than from inoculated untreated seed in 5 tests at the high rate of HELIX, in 3 tests at the low rate of HELIX, and in 1 test each of VITAVAX RS and PREMIERE PLUS. Complete efficacy (i.e., means for the treated infested treatment and the untreated uninfested check were not significantly different) was shown once by HELIX at both rates (trial 1 at 0.01 g rye). However, in this test, the two rates of HELIX could also be

considered ineffective because the means for the treated infested treatments were not significantly different from the untreated infested check. The incidence of efficacy increased at higher inoculum concentrations. Over 8 comparisons (2 trials x 4 products) per inoculum concentration, efficacy (stand greater in the treated infested treatment than in the untreated infested treatment) was shown twice at 0.01 g rye/L, 3 times at 0.05 g rye/L, and 5 times at 0.1 g rye/L. All products significantly increased stand in 1 trial at the highest level of infestation and highest level of disease (trial 2). Lower levels of infestation produced less disease but also allowed more variation among replications, thus reducing the number of treatments with significantly different means.

Table 1. Effect of seed treatments on stand (day 28) of canola seedlings, cv. OAC Summit, from 9 seeds sown in pots containing *Rhizoctonia solani* at 0.01, 0.05, or 0.1 g infested rye/L vermiculite.

Treatment	Product rate (mL/kg seed)	0.01 g rye		0.05 g rye		0.1 g rye	
		Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
Untreated uninfested		8.7a[1]	8.7a	7.3a	8.3a	8.0a	8.3a
Untreated infested		2.0b	1.7d	0.7c	0.7d	0.0c	0.0d
VITAVAX RS infested	22.5	3.7b	3.3cd	2.3bc	1.3d	0.7c	1.3c
PREMIERE PLUS infested	28.2	3.7b	2.7d	0.3c	1.0d	0.7c	1.0c
HELIX infested	20	5.3ab	5.7b	4.7b	4.7b	2.7b	2.7b
HELIX infested	10	5.7abc	5.0bc	2.7bc	2.3c	1.0c	1.7c

[1] Within a column, means followed by the same letter are not significantly different at P = 0.05 (PLSD).

2001 PMR REPORT # 130 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
- Diseases
ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cv. OAC Summit
PEST: Damping-off (*Fusarium avenaceum*)

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TITLE: CONTROLLED ENVIRONMENT EVALUATION OF SEED TREATMENTS TO CONTROL FUSARIUM DAMPING-OFF OF CANOLA

MATERIALS: 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, cv OAC Summit, were HELIX 289 FS at 10 or 20 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 inoculated and uninoculated seed not treated with the test products. To prepare inoculum, moist rye kernels were autoclaved for 1 h, cooled, and inoculated with agar plugs cut from the growing margin of cultures of *Fusarium avenaceum*. The inoculated rye kernels were incubated at room temperature (20-22°C) for 2 weeks, dried at room temperature for 2 days, ground in a blender, and sieved to collect particles 0.5-1.2 mm in diameter. Inoculum was added to extra fine vermiculite at a rate of 2.5 g infested rye/L vermiculite. Infested vermiculite was added to 5 x 7.5 cm pots and 9 canola seeds per pot were sown 2.5 cm deep. The untreated checks consisted of untreated seed sown in vermiculite amended with infested rye or uninfested rye at 2.5 g rye/L vermiculite. Pots were placed on 7.5 cm aluminum pans and covered with plastic bags to maintain high humidity. Bags were removed and plants were watered daily once emergence occurred and all 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-h photoperiod. There were three replicate pots per treatment and treatments were arranged in a completely randomized design. Four weeks after seeding, plants were harvested and the roots were washed thoroughly to remove all vermiculite. Roots and shoots were separated and weighed after being dried at 65°C for 4 days. Treatment effects on plant weight were determined by ANOVA and treatment means were compared by LSD at $P = 0.05$. Two trials were conducted using the same isolate and methods.

RESULTS: The results are presented in Table 1.

CONCLUSIONS: Infestation of vermiculite with *F. avenaceum* reduced shoot weight, root weight and plant weight in both trials. Demonstration of efficacy depended on the definition of efficacy and the measure of plant growth. All products were effective, (i.e., increased growth compared to the untreated infested check), by all measures of growth in both trials. Over 6 tests (2 trials x 3 measures of plant growth) complete efficacy (i.e., means for the treated infested treatment and the untreated uninfested check were not significantly different) was shown in 4 tests (shoot weight twice and root weight and

plant weight once) by HELIX at the low rate, in 3 tests (shoot weight twice and plant weight once) by HELIX at the high rate, in 2 tests (shoot weight and plant weight once each) by PREMIERE PLUS, and in 1 test (shoot weight) by VITAVAX RS. Over 8 comparisons (2 trials x 4 products) per measure of plant growth, complete efficacy was shown 6 times for shoot weight, 3 times for plant weight, and once for root weight. Thus, root weight provided a more stringent test of efficacy than shoot weight. In plants produced from untreated uninoculated seed, shoots were 3.3 times heavier than roots. In plants produced from untreated inoculated seeds, shoot weight was reduced by 70-75% whereas root weight was reduced 56-59%, so that shoots were only 2.1 to 2.3 times heavier than roots. Treatment of inoculated seed with all products increased shoot weight relatively more (range 75-113%, mean 91%) than root weight (range 72-92%, mean 78%), thus producing shoot-to- root ratios in the range 3.6-4.3 to 1, approximating the ratio found in uninoculated plants. Root weight may therefore have provided a more stringent test of efficacy than shoot weight because of the lower proportional effect of the seed treatments on root weight than on shoot weight. All products protected shoot and root weight and the shoot-to-root ratio. The rank in descending order of complete efficacy was HELIX low rate, HELIX high rate, PREMIERE PLUS, and VITAVAX RS.

Table 1. Effect of seed treatments on dry shoot weight, dry root weight and total dry weight per plant (day 28) of canola, cv. OAC Summit, produced from seeds sown in vermiculite infested with *Fusarium avenaceum* at a rate of 2.5 g infested rye/L, averaged over nine plants per pot and three replications per treatment.

Treatment	Product rate mL/kg seed	Shoot weight (g)		Root weight (g)		Plant weight (g)	
		Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
Untreated uninfested		1.327ab[1]	1.349a	0.392a	0.403a	1.719ab	1.754a
Untreated infested		0.332c	0.410c	0.161c	0.176d	0.493d	0.586d
VITAVAX RS infested	22.5	0.996b	1.225b	0.281b	0.297c	1.278c	1.522c
PREMIERE PLUS infested	28.2	1.060b	1.228b	0.287b	0.294c	1.347bc	1.523c
HELIX infested	20	1.133b	1.301a	0.309b	0.344b	1.442bc	1.645b
HELIX infested	10	1.497a	1.300a	0.360a	0.302c	1.857a	1.602bc

[1] Within a column, means followed by the same letter are not significantly different at P = 0.05 (PLSD).

2001 PMR REPORT # 131 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
- Diseases
ICAR: 306001

CROP: Spring canola (*Brassica napus* L.), cv. OAC Summit
PEST: Blackleg (*Leptosphaeria maculans*)

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TITLE: CONTROLLED ENVIRONMENT EVALUATION OF SEED TREATMENTS TO CONTROL BLACKLEG OF CANOLA

MATERIALS: 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: Canola seed, cv. OAC Summit, was surface-sterilized with 0.6% sodium hypochlorite for 3 min and rinsed three times with sterile distilled water. Surface-sterilized seed was infested with *Leptosphaeria maculans* at a rate of 4 g seed/10mL spore suspension (10^7 conidia/mL). Seed was soaked in the spore suspension for 18 h then dried in a fumehood for 24 h. Seed that was surface sterilized, soaked in sterile distilled water for 18 h, and air-dried for 24 h was used in the untreated uninfested control. Infested seed was treated with HELIX 289 FS at 10 or 20 mL/kg seed, VITAVAX RS at 22.5 mL/kg seed, or 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 infested and uninfested seed not treated with the test products. Fifteen seeds were sown 2.5 cm deep in fine vermiculite in 15-cm diam pots. Each treatment was replicated 3 times. Pots were covered with plastic bags to maintain high humidity. Bags were removed and plants were watered daily once emergence occurred and all 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-h photoperiod. Treatments were arranged in a completely randomized design. Plant stand per pot was determined 7, 21, and 35 days after seeding. Treatment effects on stand were determined by ANOVA and treatment means were compared by LSD at $P = 0.05$. Two trials were conducted using the same isolate and methods.

RESULTS: The results are presented in Table 1.

CONCLUSIONS: Infestation of seed with *L. maculans* reduced stand at days 21 and 35 but not at day 7 in both trials, indicating that the inoculation technique produced post-emergence damping-off. At days 21 and 35, means within a trial for the treated infested treatments and the untreated uninfested check were not significantly different. It is concluded that all products were completely effective in both trials in protecting plants from post-emergence damping-off at days 21 and 35.

Table 1. Effect of seed treatments on stand per pot of canola seedlings, cv. OAC Summit, produced from 15 seeds infested with *Leptosphaeria maculans*, averaged over three replications per treatment.

Treatment	Product rate (mL/kg seed)	Stand, day 7		Stand, day 21		Stand, day 35	
		Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
Untreated uninfested		13.7b[1]	14.3b	13.7a	14.3a	13.7a	14.3ab
Untreated infested		15.0a	15.0a	6.3b	6.3b	1.7b	2.3c
VITAVAX RS infested	22.5	15.0a	15.0a	14.7a	14.6a	13.7a	14.0ab
PREMIERE PLUS infested	28.2	15.0a	15.0a	15.0a	14.3a	13.7a	13.7b
HELIX infested	20	15.0a	15.0a	15.0a	15.0a	14.7a	14.7a
HELIX infested	10	14.3ab	15.0a	14.3a	14.7a	13.7a	14.3ab

[1] Within a column, means followed by the same letter are not significantly different at P = 0.05 (PLSD).

2001 PMR REPORT # 132 SECTION O: CEREALS , FORAGE CROPS AND OILSEEDS
- Diseases
STUDY DATA BASE: 303-1212-8907

CROP: Wheat, cv. Belvedere
PEST: Seedling blight/root rot, various pathogens
Powdery Mildew, *Erysiphe graminis*

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TITLE: EFFICACY OF FUNGICIDE SEED TREATMENTS FOR CONTROL OF WHEAT DISEASES AND ON YIELD, 2001

MATERIALS: VITAFLO 280 (carbathiin 14.9%, thiram 13.2%), BAYTAN 30 (triadimenol, 30%), RAXIL FL (tebuconazole, 6 g ai/L), DIVIDEND XL RTA (difenoconazole 3.37%, metalaxyl-m 0.27%), CHARTER (triticonazole 2.5%)

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 25, 2001, 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. 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(425ml/ha) was also applied at ZGS 69.

Emergence was taken on 2 x 1m of row prior to tillering. Seedling blight/root rot was rated on a 0-10 scale (zero = no symptoms, 10 = severe symptoms on the subcrown internode region) on July 13, 2001. Powdery Mildew was rated on July 13, at ZGS 45, July 20, at ZGS 55, July 26, ZGS 69, and on Aug 2, ZGS 71, on a whole plot basis (0 - 10 scale). Yield and thousand kernel weight were determined on Sept 30, from the harvest of nine rows, using a small plot combine.

RESULTS: Emergence was taken on June 11, with no significant difference between treatments. Mildew ratings were taken on four occasions, only one is being reported on, as there were no significant treatment effects. Results are contained in Table 1. It should be noted that the 2001 growing season was well below normal for moisture, 54 and 10 mm in July and August, respectively, compared to a mean of 100 and 75 in the previous 6 years.

CONCLUSIONS: The 2001 growing season was dry, which restricted the development and progression of the foliar diseases. The yields did not appear to be restricted as a result of foliar diseases. All of the treatments seemed to have an impact on the severity of seedling blight/ root rot, when compared to the untreated control. Although differences were nonsignificant.

Table 1. Efficacy of fungicide seed treatments in wheat, Charlottetown, PEI, 2001.

Treatment	Rate (ml product /kg seed)	Root rot (0-10)	Powdery mildew (0-10)	Yield (kg/ha)	1000 Kwt (g)
Untreated Control	-	6.25	5.00	3792	30.50
VITAFLO 280	3.3	3.00	5.00	3499	31.60
BAYTAN 30	2.5	3.75	4.50	3808	31.45
BAYTAN 30	5.0	3.00	4.25	3368	29.40
RAXIL FL	2.5	3.75	4.50	3653	32.70
DIVIDEND XL RTA	3.25	4.50	4.25	3572	32.30
CHARTER	4.0	4.50	4.25	3541	31.60
CHARTER	6.0	3.50	4.25	3540	29.70
SEM		0.769	0.950	134.3	0.901
LSD (0.05)		(ns)	(ns)	(ns)	(ns)

(ns) - no significant difference, p=0.05

2001 PMR REPORT # 133 SECTION O: CEREALS ,FORAGE CROPS AND OILSEEDS
- Diseases
STUDY DATA BASE: 303-1212-8907

CROP: Wheat, cv.Grandin
PEST: Septoria leaf blotch, *Septoria nodorum*
Fusarium head blight, *Fusarium graminearum*

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TITLE: CONTROL OF SEPTORIA LEAF BLOTCH AND FUSARIUM HEAD BLIGHT ON SPRING WHEAT WITH FUNGICIDE APPLICATIONS, 2000

MATERIALS: TILT 250EC (propiconazole, 125 g ai/L), FOLICUR 3.6F (tebuconazole, 38.7%)

METHODS: Wheat plots, cv. Grandin, were established on June 2, 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. Between each treatment plot was an equal sized barley 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 applied at the Zadok's 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. The surfactant AGSURF was used at 0.125% with all FOLICUR treatments. 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 off the solids thru cheesecloth and adding 15g/L NaCl to the liquid. 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.

Septoria leaf blotch was rated on Aug 11, at ZGS 86, on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. Fusarium head blight was rated on ten randomly selected tillers when symptom expression was well displayed.

Yield and thousand kernel weight were determined from the harvest of nine rows, August 30th, using a small plot combine. Harvested seed was evaluated for fusarium damaged kernels (FDK) based on a weight of fusarium damaged kernels against total sample weight. Samples used for FDK determination were ground and DON levels determined via an ELISA test.

RESULTS: Results are contained in Table 1.

CONCLUSIONS: While there was numerical indication of reduced severity of septoria leaf blotch with some of the treatments, there were no significant treatment differences in the trial (0.05 level). There were significant differences in yield, with the most effective treatment being FOLICUR, when applied twice or at the highest rates at the later growth stages. The effect of a high rate at a late growth stage may

have been an effect of rate, and not application timing. Earlier applications at the higher rates were not evaluated in this trial. Nearly all treatments resulted in significant increases in thousand kernel weight.

While there were definitive effects of treatment on yield and some indication of potential for septoria leaf blotch control, there was no significant effect of any treatment on fusarium head blight symptoms in the field, on fusarium damaged kernels or on DON levels in the in the harvested samples. Fusarium head blight was severe in the trial, noting that DON levels were as high as 19.0 ppm in one plot.

Table 1. Efficacy of fungicide foliar sprays in wheat, Charlottetown, PEI, 2000.

Treatment	Rate (g ai/ha)	Applied (ZGS)	Septoria leaf blotch		Fusarium head blight (0-9)	Yield (kg/ha)	1000 kwt (g)	FDK (%, wt)	DON (ppm)
			2nd leaf (%)	3rd leaf (%)					
Control	0	-	21.1	45.9	2.7	2531	36.90	6.56	7.35
FOLICUR	125	37-39							
FOLICUR	125	65	8.3	19.7	2.5	2984	42.65	5.04	6.77
FOLICUR	125	37-39							
FOLICUR	187.5	65	10.3	26.0	3.1	3218	43.55	5.56	6.02
FOLICUR	125	37-39	24.5	49.3	2.2	2777	40.05	7.43	8.47
FOLICUR	125	65	12.2	28.7	2.9	2781	41.80	4.44	7.52
FOLICUR	187.5	65	10.4	26.5	2.6	2930	40.55	6.87	6.22
TILT	125	37-39							
TILT	125	65	10.7	28.4	2.4	2776	42.70	6.47	5.67
TILT	125	37-39	18.3	39.9	2.6	2685	39.05	6.52	8.72
TILT	125	65	12.1	28.0	2.4	2811	40.70	4.78	5.57
SEM			4.59	6.85	0.21	106.1	0.851	0.867	1.494
LSD (0.05)			(ns)	(ns)	(ns)	309.7	2.484	2.532	(ns)

ZGS - Zadoks Growth Stage.
(ns) - no significant differences at p=0.05.
FDK- % Fusarium damaged kernels on a weight basis.

2001 PMR REPORT # 134 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
-Diseases

CROP: Winter wheat (*Triticum aestivum* L.), cv. Harus
PEST: Fusarium head blight**,** *Fusarium graminearum* Schwabe

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TITLE: CONTROL OF FUSARIUM HEAD BLIGHT IN WINTER WHEAT WITH FUNGICIDES

MATERIALS: FOLICUR 432 F (432 g a.i./L tebuconazole, AGRAL 90 (surfactant), BRAVO 500 (chlorothalonil 500 g ai/L)

METHODS: The fungicides were applied with tractor sprayer (4 m boom width). Plots were 40 m long. Twin Jet nozzles were used aimed front and back at 210 L/ha. Spray applications were made when primary wheat heads were three days after 50 % anthesis. The experiment was done under natural Fusarium Head Blight infection. Design was paired strips treated vs non-treated. Five paired samples for *Fusarium* and DON were taken about 2 m apart out of each strip and a t-test was run for each set of 5 paired-samples. Wheat heads were selected at random, and rated for disease incidence and severity using the scoring system developed by Stack and McMullen (ND State). Disease levels were calculated as fusarium head blight index (FHBI), which was the product of the percent heads infected and the percent spikelets infected /100. Deoxynivalenol (DON) content was estimated in the grain using a quantitative ELISA test (Beacon Analytic Systems, Inc., Scarborough, ME).

RESULTS: Results are given in the table below.

CONCLUSION: There were significant differences (t-test) between fungicide treatments and control for all parameters measured, except for severity after BRAVO application, and incidence after FOLICUR application. FOLICUR brought DON levels to below 1 ppm. With this design multiple comparisons cannot be made, only comparisons between check and treated strips.

Table 1. Strip Plot for fungicides to control for Fusarium Head Blight in winter wheat cvr Harus, Ridgetown, ON, 2001.

	Rate product /ha	Sprayed				Control			
		Severity	Incidence	FHBI (%)	DON (ppm)	Sev.	Inc.	FHBI (%)	DON (ppm)
FOLICUR + AGRAL 90	0.432 L	6.75 *	32.5 NS	2.41*	0.35 *	12.50	40	4.89	5.75
BRAVO 500	2.0 L	11.5 NS	35.0 *	3.99 *	1.55 *	12.75	45	5.91	2.83

* significantly different from unsprayed at P<0.05 (paired t-test).

2001 PMR REPORT # 135 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
-Diseases

CROP: Winter wheat (*Triticum aestivum* L.), cv. Freedom and Harus
PEST: Fusarium head blight**,** *Fusarium graminearum* Schwabe

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TITLE: CONTROL OF FUSARIUM HEAD BLIGHT IN WINTER WHEAT WITH FUNGICIDES IN ARTIFICIALLY INOCULATED, MISTED PLOTS

MATERIALS: FOLICUR 432 F (432 g a.i./L tebuconazole), AGRAL 90 (0.25 %)

METHODS: Two varieties of winter wheat (Freedom and Harus) were planted on October 20, 2000 at Ridgetown using a 6-row cone seeder at 400 seeds/m^2. Plots were six rows wide, planted at a row spacing of 17.8 cm and 4.0 m in length, in a randomized complete block design with two replications for each cultivar. Spray applications were made when primary wheat heads were at 50 % anthesis for each variety (Zadoks growth stage 60 to 69) using a back pack precision sprayer with a 1-m boom fitted with 2 twin jet nozzles spaced at 50 cm operated at 240 kPa delivering 240 L/ha. Each plot was inoculated with a 100-ml suspension of mixture of macroconidia contained four isolates of *F. graminearum* at 50,000 spores/ml two days following first treatment of fungicide. The suspension was produced in liquid shake culture using modified Bilay's medium. Plots were misted daily beginning after the first plots were inoculated. The overhead mister operated at one 8 s burst every minute from 10:00-16:00 hr each day. The misters delivered about 7.5 mm of water each day. Each variety was assessed for visual symptoms when the early dough stage was reached. Ten heads were selected at random out of each plot, and rated for disease incidence and severity using the scoring system developed by Stack and McMullen (ND State). Disease levels were calculated as fusarium head blight index (FHBI), which was the product of the percent heads infected and the percent spikelets infected /100.The plots were harvested on July 18, 2001 and the yields were corrected to 14 % moisture. The first control included machine harvested grain, while second control included the grain harvested by hand. Deoxynivalenol (DON) content was estimated using a quantitative ELISA test (Beacon Analytic Systems, Inc., Scarborough, ME).

RESULTS: Results are given in the tables below.

CONCLUSIONS: There was no significant differences between the fungicides sprayed and control for DON level, FHB index or yield (T/ha) in Freedom variety (Table 1). However, FHB index was significantly lower in treated compared with control plots after fungicide application in Harus variety (Table 2), and when both varieties were analyzed together (Table 3). Yield (T/ha) was significantly higher in Harus variety after application of FOLICUR 432 FL at 435 ml/ha (Table 2), or when both varieties were analyzed together (Table 3). We assume that the fungicides did not reduce DON level as expected because the plots were irrigated daily for 3 weeks, which was longer than necessary. Under these conditions, either the fungicide treatment was overwhelmed, or excessive moisture reduced its efficacy, or the fungicide retarded initial infection, but the secondary spread of the primary infections was not prevent, with high moisture.

Table 1. Fusarium head blight control in winter wheat (Freedom, two replications) with foliar application of FOLICUR 432 F, Ridgetown, Ontario, 2001.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index (0-100)	Yield T/ha	DON (ppm)
FOLICUR 432 F + AGRAL 90	289 ml/ha	18.0	35.0	28.0	4.3	2.6
FOLICUR 432 F + AGRAL 90	435 ml/ha	17.5	35.0	6.3	4.9	2.9
Control[1]		60.0	75.0	45.5	3.5	3.8
Control[2]		60.0	75.0	44.5	3.3	3.5
LSD(P=.05)		40.8	26.7	36.6	2.6	1.7
CV		56.1	25.5	64.1	19.3	22.5

[1] machine harvested grain.
[2] the grain harvested by hand.

Table 2. Fusarium head blight control in winter wheat (Harus, two replications) with foliar application of FOLICUR 432 F. Ridgetown, Ontario. 2001.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index (0-100)	Yield T/ha	DON (ppm)
FOLICUR 432 F + AGRAL 90	289 ml/ha	34.0	55.0	18.6	4.0	4.9
FOLICUR 432 F + AGRAL 90	435 ml/ha	26.0	50.0	14.2	4.8	5.8
Control[1]		80.0	75.0	60.0	2.9	6.4
Control[2]		70.0	80.0	56.0	3.1	6.3
LSD(P=.05)		17.4	35.7	20.7	1.1	2.2
CV		15.6	24.9	28.6	11.1	15.8

[1] machine harvested grain.
[2] the grain harvested by hand.

Table 3. Fusarium head blight control in winter wheat (Harus and Freedom, four replications when pooled) with foliar application of FOLICUR 432 F. Ridgetown, Ontario. 2001.

Treatments	Rate of product/ha	Percent spikelets infected	Percent heads infected	FHB index (0-100)	Yield T/ha	DON (ppm)
FOLICUR 432 F + AGRAL 90	289 ml/ha	26.0	45.0	23.3	3.9	3.7
FOLICUR 432 F + AGRAL 90	435 ml/ha	21.8	42.5	10.2	4.6	4.4
Control[1]		70.0	75.0	52.8	3.1	5.1
Control[2]		65.0	77.5	50.3	3.5	4.9
LSD(P=.05)		17.0	18.1	17.6	0.8	1.2
CV		29.7	24.0	43.7	12.5	17.9

[1] machine harvested grain.
[2] the grain harvested by hand.

2001 PMR REPORT # 136 SECTION O: CEREALS, FORAGE CROPS and OILSEEDS
-Diseases

CROP: Winter wheat (*Triticum aestivum* L.), cv. AC Ron
PEST: Fusarium seedling blight, *Fusarium graminearum* Schwabe

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TITLE: SEED TREATMENTS TO CONTROL FUSARIUM SEEDLING BLIGHT IN WINTER WHEAT

MATERIALS: BAYTAN-THIRAM RTU (thiram 159.7 g/L + triadimenol 51.6 g/L), RAXIL MD (metalaxyl 6.6 g/L + tebuconazole 4.9 g/L), DIVIDEND XL RTA (difeconazole 36.9 g/L + metalaxyl-M 3.1 g/L), VITAFLO 280 (thiram 150.6 g/L + vitavax 169.6 g/L), RAXIL FL (tebuconazole 8.3 g/L), RAXIL-THIRAM FL (tebuconazole 6.6 g/L + thiram 206.6 g/L)

METHODS: Seed was obtained from non-treated infected plots from the previous season. Fusarium damaged kernels were not removed. Seed was treated on 20 October, 2000 in individual plastic bags and rolled until throughly covered, in 750 g lots. The crop was planted on 24 October, 2000 at Ridgetown, and on 22 October, 2000 at Centralia, Ontario, using a 6-row cone seeder at 400 seeds/m2. Plots were six rows planted at a row spacing of 17.8 cm and 4 m in length, in a randomized complete block design with four replications. The plots were fertilized and maintained according to Ontario provincial recommendations. The number of emerged plants in 1 m each of 2 rows was determined on 1 December, 2000 at Ridgetown, and 1 November, 2000 at Centralia. Survival notes were taken on 18 April, 2001 at Centralia in the same 1 m strip (2 rows) as with emergence data. Yields were taken on 18 July, 2001 at both locations and corrected to 14 % moisture.

RESULTS: Results are presented in the Table below.

CONCLUSIONS: Even thought seed was heavily infected with *F. graminearum* there was no evidence of seedling blight in the control plots. None of the treatments resulted in significant increases in emergence or yield. Neither was the number of tillers in the spring significantly different between the treatments and control at Centralia location.

Table 1. Emergence, survival, and yield of winter wheat treated with fungicides for the control of Fusarium seedling blight, Ridgetown and Centralia, Ontario, 2001.

Seed Treatment	(mL product) / kg seed)	Emergence (Plants/2 m)		Survival Tillers/2m	Yield T/ha	
		Ridgetown	Centralia	Centralia	Ridgetown	Centralia
RAXIL FL	1.80[1]	150.3	167.8	77.3	3.9	4.1
DIVIDENT XL RTA	3.25	175.3	191.5	95.8	3.4	4.2
VITAFLO 280	3.30	205.3	167.8	101.5	3.6	4.2
RAXIL-THIRAM FL	2.20	186.5	185.8	96.3	3.2	4.0
RAXIL MD	3.25	171.0	157.5	69.0	3.6	4.1
BAYTAN-THIRAM RTU	2.85	189.5	173.5	93.8	3.5	4.1
APRON FL + RAXIL FL	0.064 + 1.80	149.0	167.5	96.3	3.7	4.1
CONTROL		176.8	191.8	90.5	3.5	3.8
LSD (P=.05)		39.6	37.4	35.6	0.6	0.8
CV		15.7	14.9	27.3	11.5	12.5

[1] + 0.7 ml of water.

END OF SECTION O: CEREAL, FORAGE AND OILSEED CROPS
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SECTION P:	ORNAMENTALS, GREENHOUSE and TURF DISEASES /Les maladies de plantes ornementales, de serre et de gazon
REPORT /RAPPORT #:	**137-142**
PAGES:	**367 - 381**
EDITOR:	**Dr. Raj Utkhede**
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2001 PMR REPORT # 137 **Section P: ORNAMENTALS - Diseases**
ICAR # 3330725

CROP: Clematis (*Clematis jackmanii* T. Moore) cv. Vyvyan Pennell
PEST: Leaf Spot and Wilt, *Ascochyta clematidina* Thuem. (*Phoma clematidina* (Thuem.) Boerema) and *Botrytis cinerea* Pers.:Fr.

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TITLE: EFFICACY OF FUNGICIDES FOR CONTROL OF CLEMATIS LEAF SPOT AND WILT IN GREENHOUSE PROPAGATION, 2001

MATERIALS: ABOUND 80WG (azoxystrobin), DECREE 50WDG (fenhexamid), SENATOR 70W (thiophanate-methyl)

METHODS: Mother stock plants were maintained in a commercial propagation greenhouse in 22.5 L (5 gallon) containers of a commercial planting mix on raised wooden pallets with foliage on floor to ceiling wires. On June 15th, 7 days before cuttings were taken, ABOUND 80WG at 0.3 g ai/L, 0.6 g ai/L and 1.2 g ai/L and SENATOR 70WP at 0.75 g product/L were applied as soil drenches to 50 mother stock plants each, in 1 L of solution per container, and DECREE 50WDG was applied using a back-pack sprayer as a foliar spray to 50 mother plants at 1.12 kg/ha = 336 mg/estimated 3 m^2 surface area in 10 L water per 50 plants. Cuttings were taken by the grower on June 21st and received a dip in 0.3% sodium hypochlorite (10% household bleach) followed by a dip in a solution of STIM-ROOT™ before sticking in a commercial soil mix as per commercial practice. Eight flats of 72 cuttings each from each mother plant treatment (1.2 m^2) then received a foliar spray with the same fungicide as the mother plant treatment in 2 L of solution/8 flats. Mother plants and cutting flats in the check were treated with drenches and foliar sprays of water. Cutting flats were placed on the bench in the commercial nursery under frequent misting, but without plastic cover, in a randomized complete block design with 4 replicates per treatment. Natural inoculum was used. Four weeks after sticking, the number of rotted and severely necrotic cuttings/flat was counted and cuttings with stem rot or large necrotic leaf spots (>30% of leaf area necrotic) were removed. One week later, the remaining "green" cuttings were pulled and rated for percent rooted. Data was analysed using one-way ANOVA performed using JMP Version 3.1.5 and means were compared by Tukey-Kramer HSD at P=0.05 and P=0.1.

RESULTS: As outlined in Table 1. Leaf and stem necrosis of cuttings was associated with both *Ascochyta clematidina* and *Botrytis cinerea*. Treatment of mother stock plants and cuttings with ABOUND or SENATOR significantly reduced the percentage of necrotic cuttings, the mean % rooted cuttings/flat did not increase significantly. Although fewer cuttings survived in the untreated control flats, a greater percentage of surviving cuttings rooted than in any of the fungicide treatments.

CONCLUSIONS: While a significant reduction in leaf and stem necrosis can be obtained by application of ABOUND or SENATOR to mother plants and cuttings, rooting may be inhibited. Factors other than disease need to be addressed to improve rooting percentage.

Table 1. Percent necrotic and rooted cuttings[1].

Treatment	Rate	Mean % Necrotic Cuttings/Flat[2]	Mean % Rooted Cuttings/Flat[2]	% of "Green" Cuttings Rooted[3]
CHECK	---	48.6a	26.4a	60.3a
ABOUND 80WG	0.3 g ai/L	29.2b	32.5a	46.9ab
ABOUND 80WG	0.6 g ai/L	11.3c	27.6a	33.8b
ABOUND 80WG	1.2 g ai/L	20.5bc	34.4a	47.4ab
DECREE 50 WDG	1.12 kg/ha	48.1a	21.5a	44.9ab
SENATOR 70WP	2.25 g/mL	23.1bc	25.2a	34.1b

[1] Total of 72 cuttings per flat, 8 flats per treatment.
[2] Means followed by the same letter are not significantly different in Tukey-Kramer HSD at P=0.05.
[3] Means followed by the same letter are not significantly different in Tukey-Kramer HSD at P=0.1.

2001 PMR REPORT # 138 **Section P: ORNAMENTALS - Diseases**
ICAR # 33330725

CROP: Clematis (*Clematis jackmanii* T. Moore), cv. Jackmanii
PEST: Leaf Spot and Wilt, *Ascochyta clematidina* Thuem. (*Phoma clematidina* (Theum.) Boerema)

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TITLE: EFFICACY OF FUNGICIDES FOR CONTROL OF CLEMATIS LEAF SPOT AND WILT IN GREENHOUSE PROPAGATION, 1999-2000

MATERIALS: CAPTAN 80W (captan), DACONIL 2787F (chlorothalonil 500 g/L), DITHANE M-45 (mancozeb 80%), EASOUT 70W (thiophanate-methyl), MYCOSTOP (*Streptomyces griseoviridis*), QUADRIS 80WG (azoxystrobin), SULPHUR 80W (sulphur), TOPAS 250E (propiconazole), ZINEB 80W (zineb)

METHODS: In a preliminary screening in 1999, potential fungicides for control of clematis leaf spot and wilt were each applied to a single commercial plug flat containing 49 clematis cuttings/flat. In 2000, the 4 best fungicide treatments from 1999 were each applied to 24 cuttings (1/2 of a commercial plug flat) in 4 replicates arranged in a randomized complete block design on a greenhouse bench. In both years, fungicides were applied as foliar sprays to run-off (approximately 100 mL/flat) with a hand-sprayer to newly-stuck stem cuttings obtained from a commercial propagator in a commercial potting mix and maintained in the BCMAFF greenhouse. Cuttings were then misted with water using a hand-sprayer and covered with a plastic tent to simulate a commercial mist chamber. After 24 hours, the cuttings were wounded on the leaves and lower stem using a sterile needle and a spore suspension of 1 X 10^6 c.f.u./mL from a fresh culture of *A. clematidina* obtained from commercial greenhouse plants, was applied in a foliar spray of 100 mL/flat using a hand-sprayer. Inoculated plants were then recovered with the plastic tent, with twice-daily misting, for another 48 h. The cover was then removed and the cuttings were watered twice a week with overhead irrigation. Slow-release 20-20-20 granular fertilizer was applied once in the first week as a top-dressing as per commercial practice. Disease severity was rated weekly for 5 weeks in 1999 and 9 weeks in 2000 on a scale of 0-5: 0 = no disease; 1 = occasional leaf spots covering less than 20% of the leaf area; 2 = 20-30% of leaf area affected; 3 = 31-50% of leaf area affected; 4 = more than 50% of leaf area affected; 5 = overall wilting and leaf necrosis. In 1999, 4 rows (10 plants each) in each flat were rated separately and averaged to obtain the overall rating/treatment on each date. In 2000, each 1/2 flat treatment was given an overall rating, averaged over 4 replicates. One-way analysis of variance was performed using the General Linear Models Procedure of the SAS Institute, Cary, NC and means were compared using Fisher's Protected LSD at P=0.05.Treatments were also observed for phytotoxicity.

RESULTS: As outlined in Tables 1 and 2. The best disease control was achieved in the 1999 preliminary screening with EASOUT 70W, QUADRIS 80WG, ZINEB 80W and CAPTAN 80W. DACONIL 2787F suppressed the disease somewhat. DITHANE M-45, SULPHUR 80WP or TOPAS 250EC had no effect. SULPHUR 80WP appeared to be somewhat phytotoxic (yellow leaves). Untreated control plants and those treated with DITHANE M-45 or SULPHUR 80WP had less root and shoot

growth than the best 4 treatments. Fungicide residue (commercially undersirable) was visible on leaves after 4 weeks in the SULPHUR, DACONIL and DITHANE treatments. In the 2000 replicated trial, EASOUT 70W and QUADRIS 80WG both provided good control of clematis leaf spot and wilt. No phytotoxicity was observed. CAPTAN 80W, MYCOSTOP, and ZINEB 80W did not provide a commercially acceptable level of control.

CONCLUSIONS: EASOUT and QUADRIS show promise for reducing cutting infection by *A. clematidina* and should be tested further under commercial production conditions.

Table 1. 1999 mean disease severity ratings.

Treatment	Rate	16/09	23/09	30/09	07/10	14/10	Mean[1]
CHECK (water)	---	2.4	2.9	3.3	3.3	3.3	3.0a
CAPTAN 80W	1.5 g/L	0.1	0.3	0.4	0.5	0.5	0.4d
DACONIL 2787F	1.0 g/L	1.5	1.8	1.8	1.9	1.9	1.6bc
DITHANE M-45	3.0 g/L	1.5	2.6	2.6	2.6	2.6	2.4ab
EASOUT 70W	0.75 g/L	0.4	0.4	0.5	0.9	0.9	0.6cd
QUADRIS 80WG	1.5 g/L	0.5	0.5	0.5	0.6	0.6	0.5cd
SULPHUR 80W	11.5 g/L	2.0	2.3	2.3	2.5	2.5	2.3ab
TOPAS 250EC	2.5 mL/L	1.0	2.3	2.4	2.4	2.4	2.1ab
ZINEB 80W	1.5 g/L	0.1	0.4	0.5	0.9	0.9	0.6cd

[1] Means followed by the same letter do not differ significantly in Fisher's Protected LSD (P= 0.05).

Table 2. 2000 mean disease severity ratings.

Treatment	Rate g/L	29 /08	06 /09	13 /09	20 /09	27 /09	05 /10	12 /10	19 /10	26 /10	Mean[1]
CHECK	---	1.0	1.5	2.0	2.0	2.5	3.0	3.0	3.5	3.5	2.2a
CAPTAN 80W	1.5	0.5	0.75	0.75	1.25	1.5	1.75	2.0	2.0	2.0	1.3b
EASOUT 70W	0.75	0	0	0.25	0.25	0.5	0.5	0.5	0.75	0.75	0.4c
MYCOSTOP	0.1	0.5	1.0	1.25	1.5	2.0	2.0	2.25	2.5	2.5	1.6b
QUADRIS 80WG	1.5	0	0	0.25	0.5	0.5	0.5	0.5	0.75	0.75	0.4c
ZINEB 80W	1.5	0.25	0.5	0.75	1.0	1.0	1.25	1.75	2.0	2.0	1.1bc

[1] Means followed by the same letter are not significantly different based on Fisher's Protected LSD (P=0.05).

2001 PMR REPORT # 139 SECTION P: GREENHOUSE CROPS, ORNAMENTALS and TURF - Diseases
STUDY DATA BASE: 390 1252 9201

CROP: *Heuchera sanguinea* Engelm.
PEST: *Puccinia heucherae* (Schwein) Dietel

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TITLE: **EFFICACY OF FUNGICIDES FOR THE CONTROL OF RUST (*PUCCINIA HEUCHERAE*) ON *HEUCHERA SANGUINEA*, 2001**

MATERIALS: FUNGINEX 190EC (triforine), DACONIL 2787F (40.4% chorothalonil), ZINEB 80W(zineb), NOVA 40W (myclobutanil), PLANTVAX 75W (oxycarboxin), TOPAS 250E (propiconazole)

METHODS: The trial was conducted at a commercial nursery in Abbotsford, B.C. The plants were grown in 10 cm pots in a commercial potting mix in an unheated polyhouse. Natural inoculum was used. Lower leaves were already heavily infected at the start of the trial. There were 5 flats, each containing 24 plants, for each treatment. The 5 flats were placed in a row for spraying, with a plot area of 85 cm x 265 cm, then separated and arranged in a randomized block design with 5 replicates per treatment. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 1500 L/ha of water at a pressure of 350 kPA. There were four application dates: May 29, June 12, June 26 and July 10, 2001. Five plants from each flat were rated for disease severity on newly developed leaves on June 12, June 26, July 10 and July 17, 2001. Disease Severity Index: estimated % of new leaves infected x leaf area with pustules: 0=no pustules; 1 =1-2 pustules or 1-19% of leaf area affected ; 2=20-40% of leaf area affected ; 3=41-60%; 4=61-80%; 5=81-100%. 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 is presented in Table 1.

CONCLUSIONS: NOVA, PLANTVAX and the higher rate of TOPAS significantly decreased disease severity compared to the check after the second application and this continued for the duration of the trial. After 8 weeks, plants treated with NOVA had significantly less disease than any other treatment.

Table 1. Efficacy of fungicides for control of rust (*Puccinia heucherae*) of *Heuchera*: mean disease severity index on each date.

Treatment	Rate product/1000L	Mean Disease Severity Index [1]			
		June 12	June 26	July 10	July 17
CHECK (water)	-	3.2 bc[2]	3.4 ab	3.8 ab	2.3 ab
FUNGINEX 190EC	1000 ml	3.7 a	3.4 ab	3.6 abc	2.6 ab
DACONIL 2787F	250 ml	3.3 b	3.8 a	4.0 a	2.8 a
ZINEB 80W	2000 g	3.6 a	3.3 b	3.8 ab	2.2 bc
NOVA 40W	227 g	2.9 c	1.3 d	2.0 e	0.4 e
PLANTVAX 75W	1792 g	3.5 ab	2.5 c	3.1 d	1.1 d
TOPAS 250E	210 ml	3.4 ab	2.5 c	3.6 bc	2.2 bc
TOPAS 250E	420 ml	3.7 a	2.5 c	3.4 cd	1.8 c

[1] Disease Severity Index: estimated % of new leaves infected x leaf area with pustules: 0=no pustules; 1 =1-2 pustules or 1-19% of leaf area affected ; 2=20-40% of leaf area affected; 3=41-60% of leaf area affected; 4=61-80% of leaf area affected; 5=81-100% of leaf area affected.

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

2001 PMR REPORT # 140 **SECTION P:** **GREENHOUSE CROPS, ORNAMENTALS and TURF** - Diseases
STUDY DATA BASE: 390 1252 9201

CROP: *Hypericum calycinum* L.
PEST: *Melampsora hypericorum* G.Wint in Rabenh.

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TITLE: **EFFICACY OF FUNGICIDES FOR THE CONTROL OF RUST (*MELAMPSORA HYPERICORUM)* ON *HYPERICUM CALYCINUM*, 2001**

MATERIALS: DITHANE RAINSHIELD 75DG (mancozeb), DACONIL 2787F (40.4% chorothalonil), SENATOR 70WP (thiophanate-methyl), NOVA 40W (myclobutanil), TOPAS 250E (propiconazole), PLANTVAX 75W (oxycarboxin), QUADRIS 80WG (azoxystrobin), CHEMPROCIDE 7.5 % (didecyl dimethyl ammonium chloride)

METHODS: The trial was conducted at a commercial nursery in Surrey, B.C. The plants were grown in 10 cm pots in an unheated polyhouse. Natural inoculum was used. Lower leaves were already infected at the start of the trial. There were 5 flats, each containing 24 plants, for each treatment. The 5 flats were placed in a row for spraying, with a plot area of 35 cm x 280 cm, then separated and arranged in a randomized block design with 5 replicates per treatment. The treatments were applied with a hand held boom attached to a pressurized CO2 backpack sprayer in 1500L/ha of water at a pressure of 350 kPA. There were four application dates: April 3, April 17, May 1, and May 15, 2001. Five plants from each flat were rated for disease severity on newly developed leaves, 2 weeks after each application on a scale of 0-4, where 0=healthy leaves; 1=1-2 pustules or 1-19% of leaf area affected; 2=20-49% of leaf area affected; 3=50-75% of leaf area affected; 4=abundant pustules on all new leaves or 76-100% of leaf area affected. 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 is presented in Table 1.

CONCLUSIONS: Two weeks after the second application, plants treated with TOPAS, PLANTVAX and CHEMPROCIDE had a significantly lower mean disease severity rating than the other treatments. However, CHEMPROCIDE was phytotoxic and subsequent ratings of this product were not possible due to plant damage. After 8 weeks, plants treated with TOPAS or PLANTVAX had significantly lower mean disease severity ratings than the other treatments.

Table 1. Efficacy of fungicides for control of rust (*Melampsora hypericorum*) of *Hypericum*: mean disease severity rating on each date.

Treatment	Rate (product /1000L)	Mean Disease Severity Rating[1]			
		Apr.17	May 1	May 15	May 29
CHECK (water)	-	2.7 ab[1]	2.8 ab	3.8 a	3.7 a
DITHANE 75DG RAINSHIELD	2000 g	2.5 ab	1.9 bc	3.2 a	2.8 bc
DACONIL 2787F	250 ml	2.6 ab	2.5 ab	3.2 a	3.2 ab
SENATOR 70W	750 g	3.0 a	3.0 a	3.8 a	3.4 ab
NOVA 40W	227 g	2.8 a	2.5 ab	1.8 b	2.3 cd
TOPAS 250E	625 ml	1.8 b	1.1 c	1.2 b	1.1 e
PLANTVAX 75W	1792 g	2.7 ab	1.5 c	2.0 b	1.8 de
QUADRIS 80WG	207 g	3.0 a	3.4 a	3.5 a	3.3 ab
CHEMPROCIDE	7.5 % v/v	2.0 ab	1.3 c	-	-

[1] Disease Severity Rating 0-4, where 0=healthy leaves; 1=1-2 pustules or 1-19% of leaf area affected; 2=20-49% of leaf area affected; 3=50-75% of leaf area affected; 4=abundant pustules on all new leaves or 76-100% of leaf area affected.

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

2001 PMR REPORT # 141 **Section P: ORNAMENTALS - Diseases**
ICAR #33330724

CROP: Roses (*Rosa* sp. L.), cv. Noare and Meikrotal (Scarlet Meidiland™)
PEST: Downy mildew, *Peronospora sparsa* Berk.

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TITLE: EFFICACY OF FUNGICIDES FOR CONTROL OF ROSE DOWNY MILDEW, 2000

MATERIALS: ACROBAT MZ (dimethomorph 9% + mancozeb 60%), ALIETTE WDG (fosetyl-AL 80%), DACONIL 2787 F (chlorothalonil 500 g/L), GAVEL 75DF (zoxamide 6.3% + mancozeb 66.7%), IBR™ (organic amendment), PHYTON 27 (elemental copper 5.5%), PREVICUR N (propamocarb hydrochloride 722 g/L), RIDOMIL 240EC (metalaxyl 240 g/L), SUBDUE 2G (metalaxyl granular 2%)

METHODS: Trials were conducted at commercial nurseries using natural inoculum. Trial 1 was conducted on outdoor potted mini-roses cv. 'Noare' produced by tissue culture and transplanted as rooted plug plants into 4.5 L (1 gallon) pots grown outdoors. Trial 2 was conducted on 6-week-old cuttings from cv. 'Scarlet Meidiland'™ mother stock plants maintained in 22.5 L (5 gallon) pots in a greenhouse. Cuttings were rooted in plug trays under misting for 3 weeks and then moved to a second greenhouse for 3-4 weeks before transplanting into 10 cm pots in a third greenhouse. For outdoor potted plants, Table 1, treatments were added to the potting mix as either granulars ($g/m^{3)}$ or liquids in 10 L of solution/m^3, and mixed well before transplanting. Each m^3 of potting mix filled approximately 400, 4.5 L pots. Subsequent foliar sprays were applied at 4 and 8 weeks after potting (June 1 and June 28), in 2 L water per m^2 of total container surface area or as a volume dilution to run-off. All plants dedicated for foliar sprays were treated by the grower with RIDOMIL 240EC in the potting mix. Treatments were replicated 4 times in a randomized complete block with 10 plants/replicate. Outdoor plants received nightly overhead irrigation and were fertilized by the grower following commercial practice. In cutting propagation, mother stock plants were cut back to stimulate production of new shoots 6 weeks before cuttings were taken. New shoots showed no symptoms of downy mildew. Two weeks before cuttings were taken, Table 2, mother plants were treated with water (CHECK), SUBDUE 2G at 2.5 g/m^2 of pot surface area worked into the top 6 cm of soil, PREVICUR N at 2.5 mL/L water/m^3 of pot volume in 300 mL solution/pot or IBR liquid at 15 mL/L water/m^3 pot volume in 300 mL solution/pot. Five flats of 49 cuttings/flat were obtained from each mother plant treatment. After 3 weeks in a mist chamber, each of these 5 flats then received an application to run-off (100-120 mL of solution/flat) of one of the following foliar treatments: water (CHECK); PHYTON 27 at 2.25 mL/L; PREVICUR N at 2.5 mL/L; ALIETTE WDG at 2.8 kg/ha; or ACROBAT MZ at 2.5 kg/ha, as a volume dilution or per m^2 of surface area of the flats. Treated flats were placed in a completely randomized design on the greenhouse bench. Disease severity was rated weekly in both trials on a scale of 0-5, where 0=healthy plants; 1=1-10% of leaf area affected (spotted or chlorotic); 2=11-25% of leaf area affected, occasional leaf drop; 3=26-49% of total leaf area affected, leaf yellowing and drop; 4=50-79% of leaf area affected, severe leaf yellowing and drop; 5=80-100% of leaves spotted or yellow, severe defoliation. On outdoor potted plants, ratings were an average of 10 individual plants/treatment/replicate. In propagated cuttings, 4 groups (sub-samples) of 10 plants each were selected from each flat. Each plant received a disease severity rating and an average rating was calculated for each of the 4 sub-samples. These ratings were averaged to obtain a rating/treatment on each date. Analysis of variance was done by one-way ANOVA using JMP Version 3.1.5 and means were compared by Tukey-Kramer HSD at P=0.1.

RESULTS: As shown in Tables 1 and 2. On outdoor-grown potted mini-roses (Table 1), the best control was achieved with two post-potting foliar applications of ACROBAT MZ (dimethomorph + mancozeb) or GAVEL 75DF (zoxamide + mancozeb). PREVICUR N added to the transplant potting mix, or as two post-potting foliar sprays applied in a tank-mix with DACONIL, provided significant suppression of downy mildew symptoms for 9 weeks under conditions of severe disease pressure. Disease suppression was also observed with IBR™, an organic

amendment produced from composted vegetative waste. In cutting propagation (Table 2), application of SUBDUE 2G to mother plants 2 weeks before cuttings were taken provided good suppression of downy mildew. Additional applications of foliar fungicides to cuttings did not improve control significantly. PREVICUR N applied to mother plants also reduced disease symptoms on cuttings but best results were achieved when the mother plant treatment was followed by a foliar application to cuttings after removal from the misting chamber.

CONCLUSIONS: PREVICUR N (propamocarb hydrochloride)**,** ACROBAT MZ (dimethomorph + mancozeb) and GAVEL 75DF (zoxamide) all provided good suppression of rose downy mildew and may be alternatives where disease resistance to metalaxyl is a problem.

Table 1. Disease severity rating of outdoor potted mini-roses.

Treatment	Disease Severity Rating/Date										
	07/6	14/6	21/6	28/6	06/7	13/7	23/7	30/7	06/8	13/8	Mean[1]
Potting Mix Treatment[2]											
Untreated Check	1.0	1.0	1.5	1.5	2.0	2.0	2.5	2.5	2.75	2.75	2.0 a
Previcur N 25 mL/L	0.25	0.25	0.75	0.75	1.0	1.0	1.25	1.5	1.5	1.5	0.98 bcde
Previcur N 30 mL/L	0.25	0.5	0.75	1.0	1.0	1.0	1.0	1.25	1.5	1.75	1.0 bcde
IBR liquid 15 mL/L	0.5	0.5	0.75	0.75	1.0	1.0	1.0	1.0	1.0	1.0	0.85 cde
IBR granular 8 kg/m^3	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.25	1.25	0.95 cde
Foliar Sprays[3]											
Check (Ridomil 240)[4]	0.25	0.5	1.0	1.25	1.5	2.0	2.0	2.5	3.0	3.0	1.7 a
Acrobat MZ 2.5 kg/ha	0	0.25	0.25	0.5	0.75	0.75	0.75	0.5	0.5	0.5	0.48 e
Gavel 75DF 2.25 kg/ha	0	0	0.25	0.25	0.5	0.5	0.5	0.75	0.75	0.75	0.42 e
Aliette WDG 2.8 kg/ha	0.25	0.5	0.75	1.25	1.5	1.5	1.75	2.0	2.0	2.0	1.3 abc
Previcur N + Daconil[5]	0	0.25	0.5	0.75	0.75	0.75	1.0	1.0	1.0	1.0	0.7 cde
Phyton 27 2.25 mL/L	0.25	0.75	1.25	1.25	1.5	1.5	1.5	1.5	1.5	1.5	1.2 bcd
IBR liquid 15 mL/L	0.25	0.5	0.5	0.5	0.5	0.75	0.75	1.0	1.0	1.0	0.68 de

[1] Means followed by the same letter do not differ significantly in Tukey-Kramer HSD at P=0.1. Each rating is an average of 10 plants/treatment/replicate.

[2] Previcur N was applied in 10 L of water/m^3 of potting mix = 0.62-0.75 mL Previcur N/4.5 L (1 gallon) pot.

[3] First foliar spray was applied June 1; second spray August 28. Phyton 27 was applied as a volume dilution to run-off. All other sprays applied per m^2 of total pot surface area.

[4] All foliar treatments had RIDOMIL 240EC added to the transplant potting mix by the grower at 11.5 ml/L in 10 water/m^3.

[5] Previcur N and Daconil 2787F, 2.5 mL/L of each product applied in a tank-mix.

Table 2. Disease severity rating of propagated cuttings.

Treatment	Disease Severity Rating/Date										Mean[1]
	07/7	13/7	20/7	26/7	02/8	09/8	16/8	23/8	30/8	06/9	
Mother Plant Treatment/Foliar Application to Cuttings											
Check/Check	1.0	2.0	2.5	2.5	3.0	3.0	3.0	3.25	3.25	3.25	2.7a
Check/Phyton 27	1.0	1.0	1.5	1.5	1.5	1.5	1.75	1.75	2.0	2.5	1.6bc
Check/Previcur N	1.0	1.0	1.0	1.0	1.25	1.25	1.25	1.5	1.5	1.5	1.2cd
Check/Acrobat MZ	0.75	0.75	0.75	1.0	1.25	1.25	1.25	1.0	1.0	1.0	1.0de
Check/Aliette	1.0	1.25	1.5	1.75	2.0	2.0	2.0	2.0	2.0	2.0	1.8b
Subdue 2G/Check	0	0.25	0.25	0.5	0.75	0.75	0.75	1.0	1.0	1.0	0.62ef
Subdue 2G/Phyton 27	0.5	0.5	0.5	0.5	0.5	0.75	0.75	0.75	1.0	1.0	0.68def
Subdue 2G/Previcur N	0.25	0.5	0.5	0.5	0.5	0.75	0.75	0.75	1.0	1.0	0.65ef
Subdue 2G/Acrobat MZ	0.25	0.5	0.25	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.48fg
Subdue 2G/Aliette	0.5	0.5	0.75	0.75	1.0	1.0	1.0	1.0	1.25	1.25	0.90de
Previcur N/Check	0.5	0.5	0.75	0.75	1.0	1.0	1.0	1.0	1.25	1.25	0.90de
Previcur N/Phyton 27	0.5	1.0	1.0	0.75	1.0	1.0	1.0	1.25	1.5	1.5	1.0de
Previcur N/Previcur N	0.25	0.25	0.5	0.5	0.75	0.5	0.5	0.5	0.5	0.5	0.48fg
Previcur N/Acrobat MZ	0.5	0.5	0.75	0.75	0.75	0.75	0.75	0.75	1.0	1.0	0.75def
Previcur N/Aliette	0.5	0.75	0.75	1.0	1.0	1.25	1.5	1.5	1.5	1.5	1.1d
[2]IBR™/IBR™	0.5	0.5	0.75	0.5	0.75	0.75	0.75	0.75	1.0	1.0	0.72def

[1] Means followed by the same letter do not differ significantly in Tukey-Kramer HSD AT P=0.1.

[2] IBR™ 15 mL/L water applied to mother stock plants; 10 mL/L as a foliar application to cuttings.

2001 PMR REPORT # 142 **SECTION P: ORNAMENTALS - Diseases**
ICAR # 33330724

CROP: Roses (*Rosa* sp. L.), cv. Noare; cv. Meikrotal (Scarlet Meidiland™)
PEST: Downy mildew, *Peronospora sparsa* Berk.

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TITLE: EFFICACY OF FUNGICIDES FOR CONTROL OF ROSE DOWNY MILDEW, 1999

MATERIALS: DITHANE M-45 (mancozeb 80%), PHYTON 27 (elemental copper 5.5%), RIDOMIL 240EC (metalaxyl 240 g/L), SUBDUE 2G (metalaxyl granular 2%), SUBDUE MAXX (metalaxyl-m liquid 480 g/L), TOPAS 250E (propiconazole 250 g/L)

METHODS: Trials were conducted at commercial nurseries with natural inoculum. Trial 1 was conducted on mini-roses (cv. Noare) produced by tissue culture and transplanted as rooted plug plants into 4.5 L (1 gallon) pots outdoors. Trial 2 was conducted on stem cuttings from cv. Scarlet Meidiland™ greenhouse stock plants, rooted in plug trays under misting for 3 weeks. Cuttings were then moved to a second greenhouse for 3-4 weeks before transplanting to 10 cm pots. On outdoor plants, fungicides were applied at transplanting in the potting mix as indicated in Table 1, with subsequent foliar sprays applied weekly as volume dilutions to run-off or drenches applied in 100 mL water/pot for 4 weeks from July 5 to 26. Treatments were replicated 4 times in a randomized complete block with 10 plants/replicate. Plants received nightly overhead irrigation and fertilizer by the grower following commercial practice. In cutting propagation, Table 2, mother stock plants in 22.5 L (5 gallon) pots were cut back according to commercial practice 6 weeks before cuttings were taken. Treatments were applied to each mother plant 4 weeks later. No disease symptoms were observed on any of the new shoots, which were approximately 15 cm in length when cut. SUBDUE 2G was applied per m^2 of container surface area and worked into the top 6 cm of soil; liquid drenches were applied in 300 mL water/container. Cuttings were dipped in 35 mL of 3% sodium hypochlorite (household bleach)/L followed by STIM-ROOT™ #3 before sticking, as per commercial practice. Three flats of 49 cuttings each were obtained from each mother plant treatment. One flat from each mother plant treatment then received a foliar spray to run-off of either water (CHECK), PHYTON 27 at 2.25 mL/L or DITHANE M-45 at 1.8 g/L in 100 mL solution/flat, before placement in a greenhouse bench mist chamber for rooting. Flats were placed in a completely randomized design. Sprays were applied again 3 weeks later after removal of the flats from the mist chamber. Disease severity was rated weekly in both trials on a scale of 0-5, where 0 = healthy plants, good root and shoot growth; 1=5-10% of leaf area affected (spotted or chlorotic); 2=11-25% of leaf area affected, occasional leaf drop; 3=26-49% of total leaf area affected, leaf drop, reduced root and shoot growth; 4=50-79% of leaf area affected, severe leaf drop, poor growth/stunting; 5= 80-100% of leaves spotted and yellowing, severe defoliation and stunted plants. On outdoor potted plants, Table. 1, each disease rating is an average of 4 plants/replicate (16 plants/treatment) on each date. Analysis of variance was done by one-way ANOVA using the General Linear Models Procedure, SAS Institute, Cary, NC and overall means/treatment were compared by Fisher's Protected LSD at P=0.05. In propagated cuttings, the single flat/treatment received one overall disease rating at removal from the mist chamber and each week thereafter. An F test showed that none of the foliar sprays resulted in a significantly different mean disease rating compared to mother plant treatments alone (Prob.>F= 0.69), so the 3 flats from each

mother plant treatment were analysed statistically as 3 replicates using JMP Version 3.1.5 and means were compared using Tukey-Kramer HSD at P=0.05.

RESULTS: As outlined in Tables 1 and 2. Plants treated with SUBDUE 2G or SUBDUE MAXX were observed to have greater root and shoot growth than the other treatments (data not shown).

CONCLUSIONS: SUBDUE 2G added to the plug transplant potting mix, or worked into the top layer of soil of container-grown mother plants two weeks before cuttings were taken, suppressed downy mildew symptoms for four to six weeks after treatment. A liquid drench with SUBDUE MAXX was also effective, but did not provide as long-lasting control as the granular formulation of SUBDUE 2G. The liquid formulation of RIDOMIL 240EC was ineffective. PHYTON 27 suppressed disease symptoms somewhat when applied as a drench to mother plants or new plug transplants, but did not provide a commercially acceptable level of control on outdoor plants under nightly overhead irrigation and high disease pressure. DITHANE M-45 and TOPAS 250E had no effect on the disease.

Table 1. Disease severity rating of outdoor potted mini-roses.

Treatment	Rate	Disease Severity Rating/Date					Mean[1]
		05/7	12/7	19/7	26/7	02/8	
Potting Mix Treatments Only:							
Check		2.0	2.25	3.0	3.75	4.0	3.0a
SUBDUE 2G	125 g/m^3	0.25	1.0	1.25	1.75	1.25	1.2d
SUBDUE 2G	250 g/m^3	0.25	0.5	1.0	1.0	1.0	0.75c
Post-Potting Drenches:							
SUBDUE MAXX	0.075 mL/L	0.7	1.0	1.75	2.0	2.5	1.6cd
RIDOMIL 240EC	11.5 mL/L	2.25	2.25	2.75	3.25	3.75	2.8a
PHYTON 27	5.2 mL/L	1.75	2.0	2.0	2.5	3.0	2.2bcd
Post-Potting Foliar Treatments:							
DITHANE M-45	1.8 g/L	1.5	2.0	2.5	3.0	3.75	2.6ab
TOPAS 250E	0.75 mL/L	1.5	1.5	2.25	3.0	3.5	2.4ab
PHYTON 27	2.25 mL/L	1.25	2.0	2.0	2.5	3.25	2.2bcd

[1] Means followed by the same letter do not differ significantly in Fisher's Protected LSD (P=0.05).

Table 2. Disease severity rating of propagated cuttings.

Treatment/Rep.[1]	Rate	Disease Severity Rating/Date					
		22/7	29/7	05/8	12/8	19/8	Mean[2]
Check/1		2	3	3	4	4	
Check/2		2	2	3	3	3	
Check/3		1	2	3	3	3	
							2.7a
PHYTON 27/1	5.2 mL/L	1	2	2	2	3	
PHYTON 27/2	A	1	1	2	2	2	
PHYTON 27/3	A	1	1	2	2	2	
							1.7b
RIDOMIL 240EC/1	11.5 mL/L	1	2	2	3	3	
RIDOMIL 240EC/2	A	1	2	2	2	2	
RIDOMIL 240EC/3	A	1	2	3	3	3	
							2.1ab
SUBDUE 2G/1	2.5 g/m^2	0	0	1	1	1	
SUBDUE 2G/2	A	1	1	1	1	1	
SUBDUE 2G/3	A	0	0	0	1	2	
							0.7c
SUBDUE MAXX/1	0.075 mL/L	0	1	1	1	2	
SUBDUE MAXX/2	A	0	0	0	1	2	
SUBDUE MAXX/3	A	0	1	1	1	2	
							0.7c

[1] All Replicate 2 cutting flats were treated with PHYTON 27 at 2.25 mL/L and all Replicate 3 flats were treated with DITHANE M-45 at 1.8 kg/ha. Neither treatment had any effect on disease severity (F=0.69).

[2] Mean disease severity rating per treatment. Means followed by the same letter do not differ significantly in Tukey-Kramer HSD (P=0.05).

END OF SECTION P: GREENHOUSE CROPS, ORNAMENTALS AND TURF - Diseases
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SECTION Q:	CHEMICAL RESIDUES/ Résidus
REPORT /RAPPORT #:	**143-144**
PAGES:	**382-387**
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2001 PMR REPORT # 143 **SECTION Q: CHEMICAL RESIDUES**
STUDY DATA BASE: 387-2112-9701

CROP: n/a
PEST: n/a

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TITLE: DETECTION OF HERBICIDES IN ALBERTA RAINFALL IN 2000

MATERIALS: 2,4-D, 2,4-DB, atrazine, bromacil, bromoxynil, clopyralid, dicamba, dichlorprop, diclofop, ethalfluralin, fenoxaprop, imazethapyr, lindane, MCPA, mecoprop, picloram, quinclorac, triallate, trifluralin

METHODS: A 25-cm i.d. stainless steel funnel, setup 60 cm above ground over a 4 liter amber bottle, was used to sample rainfall at the following Alberta locations (duplicate funnels at each location): 2 remote southern Alberta locations at Lundbreck and Stavely, 2 City of Lethbridge residences, 9 southern Alberta rural locations at Fort Macleod, Lethbridge Research Centre (2 locations), Coaldale, Tempest, Grassy Lake, Seven Persons, Warner and Champion, and 4 central Alberta rural locations at Strathmore, Three Hills, Clive and Vegreville. Rainfall samples were collected at intervals of 3-14 d from April 17 to September 27, 2000. Some samples were intentionally collected during dry periods by rinsing the funnels to check for dry deposition. Samples were extracted by liquid-liquid partitioning into dichloromethane, methylated using diazomethane and analyzed for 19 herbicides (listed above) using MSD-GC with ion-ratio confirmation.

RESULTS: Major detections are summarized in Table 1 with herbicide detections expressed on both a $\mu g/m^2$ and a ppb ($\mu g/L$) basis. The ppb values depend on the amount of rainfall, but relate to the Canadian Water Quality guidelines and to other reports. Herbicides were detected in the rainfall on most sample dates, at every location. Herbicide detections were lowest at the remote sites (non-farming areas), intermediate at the City of Lethbridge sites, and highest at the rural locations. In southern Alberta, 2,4-D was detected most frequently (100 of 127 samples) and in the highest amounts (max. 149 $\mu g/m^2$, 53 ppb) with bromoxynil, dicamba and MCPA usually also present. In central Alberta, MCPA

(max. 84 μg/m^2, 2.9 ppb) and 2,4-D (max. 89 μg/m^2, 2.4 ppb) were detected in the highest amounts, with bromoxynil usually also present. The dry sample collections (all at southern Alberta sites) yielded small amounts of 2,4-D (0.4-2 μg/m^2) and traces (0.2-1 μg/m^2) of bromoxynil, dicamba and MCPA. No dry samples were collected in central Alberta because of the frequency of rain events in that area. Eleven of the other 15 herbicides were detected sporadically in 2000 rainfall (atrazine, bromacil, ethalfluralin, trifluralin not detected), but usually only in trace amounts (<10 μg/m^2).

CONCLUSION: The herbicide levels detected in Alberta rainfall in 2000 confirmed the levels we previously reported in 1999. The highest levels were 50-200 times higher (ppb basis) than levels previously reported in rainfall at other Canadian (MB, ON) locations. These herbicide detections raise the possibility of sub-lethal effects on sensitive plant species (sugar beets, pulse crops, mustard, canola) and negative impacts on surface water quality. Initial results from a limited survey conducted across the Prairies in 2001 suggest that the highest levels of herbicides in rainfall occur in southern Alberta.

Table 1. Major detections of herbicides in Alberta rainfall in 2000.

Site type (No. sites)	Herbicide	Units	No. sample collections	No. detections	Average detection	Maximum detection
Remote (2)			25			
	2,4-D	$\mu g/m^2$		13	5.5	14
		ppb		12*	0.4	0.9
	Bromoxynil	$\mu g/m^2$		7	2.4	4.4
		ppb		7	0.1	0.2
	Dicamba	$\mu g/m^2$		9	1.0	2.0
		ppb		8*	0.2	0.7
	MCPA	$\mu g/m^2$		5	6.6	11
		ppb		5	0.3	0.3
City of Lethbridge (2)			27			
	2,4-D	$\mu g/m^2$		22	9.6	36
		ppb		18*	0.9	2.4
	Bromoxynil	$\mu g/m^2$		8	5.8	8.5
		ppb		8	0.5	0.8
	Dicamba	$\mu g/m^2$		17	0.8	1.7
		ppb		16*	0.1	0.2
	MCPA	$\mu g/m^2$		7	11	17
		ppb		7	0.7	1.2
Rural Southrn AB (9)			127			
	2,4-D	$\mu g/m^2$		100	14	149
		ppb		77*	2.8	53
	Bromoxynil	$\mu g/m^2$		58	6.5	25
		ppb		48*	0.7	7.7
	Dicamba	$\mu g/m^2$		80	2.1	23
		ppb		66*	0.4	9.1
	MCPA	$\mu g/m^2$		49	13	38
		ppb		43*	1.8	26
Rural Central AB (4)			57			
	2,4-D	$\mu g/m^2$		29	12	89
		ppb		29	0.5	2.4
	Bromoxynil	$\mu g/m^2$		23	9.1	49
		ppb		23	0.3	1.8
	Dicamba	$\mu g/m^2$		14	1.0	2.9
		ppb		14	0.1	0.1
	MCPA	$\mu g/m^2$		21	22	84
		ppb		21	0.8	2.9

* No. of ppb detections is less because some sample collections were dry samples, ppb not applicable.

2001 PMR REPORT # 144 **SECTION Q: CHEMICAL RESIDUES**
STUDY DATA BASE: 387-2112-9701

CROP: n/a
PEST: n/a

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TITLE: DETECTION OF HERBICIDES IN PRAIRIE RAINFALL IN 2000-01

MATERIALS:
2,4-D, 2,4-DB, atrazine, bromacil, bromoxynil, clopyralid, dicamba, dichlorprop, diclofop, ethalfluralin, fenoxaprop, imazethapyr, lindane, MCPA, mecoprop, picloram, quinclorac, triallate, trifluralin

METHODS: A 25-cm i.d. stainless steel funnel, setup 60 cm above ground over a 4 liter amber bottle, was used to sample rainfall at the following Prairie locations (duplicate funnels at each location): Stavely (remote site), Tempest, Grassy Lake, Fairview and Rycroft in Alberta; Swift Current, Regina and Southey in Saskatchewan; Minnedosa in Manitoba. Rainfall samples were collected at intervals of 2-15 d from April to September during 2000 (5 locations only) and 2001 (all 9 locations). Samples were extracted by liquid-liquid partitioning into dichloromethane, methylated using diazomethane and analyzed for 19 herbicides (listed above) using MSD-GC with ion-ratio confirmation.

RESULTS: Major detections are summarized on both a $\mu g/m^2$ (Table 1) and a μg/L (Table 2) basis. The μg/L values depend on the amount of rainfall, but relate to the Canadian Water Quality guidelines and to other reports. Herbicides were frequently detected in the rainfall at most locations. The total number of detections was lowest (8-13 per season) at Stavely, Fairview, Rycroft and Southey, and highest (39-49 per season) at Tempest and Regina. In total (for both years, over all sites), 2,4-D was detected most frequently (124 times), then bromoxynil (95 times), MCPA (58 times) and dicamba (54 times); 2,4-D was also detected in the highest amounts (1405 $\mu g/m^2$), then MCPA (601 $\mu g/m^2$), bromoxynil (398 $\mu g/m^2$) and dicamba (189 $\mu g/m^2$). Among locations, Stavely (remote site) had the lowest total seasonal deposits of the four herbicides (53-59 $\mu g/m^2$); Fairview (69 $\mu g/m^2$) and Southey (85 $\mu g/m^2$) also had low deposits; whereas Regina (234-277 $\mu g/m^2$), Swift Current (175-302 $\mu g/m^2$) and Tempest (293-429 $\mu g/m^2$) had the highest total seasonal deposits. The highest maximum deposit in any one sample occurred at Tempest for 2,4-D (69-149 $\mu g/m^2$), at Regina for bromoxynil (28 $\mu g/m^2$), at Swift Current for dicamba (59 $\mu g/m^2$) and at Regina for MCPA (34 $\mu g/m^2$). The highest concentration of herbicide in any one sample occurred at Tempest for 2,4-D (16 μg/L) and bromoxynil (7.7 μg/L), and at Grassy Lake for dicamba (9.1 μg/L) and MCPA (26 μg/L). The other 15 herbicides were detected sporadically (most detected <5 times per season; ethalfluralin, trifluralin not detected) usually in trace amounts (<10 $\mu g/m^2$). Of note, dichlorprop was detected in 21-30 times per season and diclofop 7-14 times per season.

CONCLUSION: Results of this survey for herbicides in Prairie rainfall indicate that 2,4-D is detected most frequently and in the highest amounts. Results also suggest that the highest amounts of herbicides in rainfall occur in southern Alberta despite the low rainfall in this region. The highest herbicide concentrations (μg/L) usually occur in small rainfalls and occasionally exceed the Canadian aquatic life guidelines.

Table 1. Major detections (μg/m^2) of herbicides in AB, SK and MB rainfall during 2000-01.

Province and Site	Year	No. samples	2,4-D			Bromox.			Dicamba			MCPA			Site totals	
			Detections: (**N**)umber, (**M**)aximum deposit, (**T**)otal deposits [1]													
			N	**M**	**T**	**N**	**M**	**T**	**N**	**M**	**T**	**N**	**M**	**T**	**N**	**T**
Alberta																
Stavely	2000	13	5	12	29	3	4	9	3	1	2	2	11	19	13	59
	2001	12	7	10	34	4	4	8	0	0	0	1	11	11	12	53
Tempest	2000	14	11	149	261	11	20	65	9	16	32	10	23	71	41	429
	2001	10	10	69	213	8	14	25	2	4	6	4	29	49	24	293
Grassy L.	2000	12	8	45	99	4	16	30	9	5	19	3	17	48	24	196
	2001	10	10	19	89	8	8	21	2	3	5	2	8	16	22	131
Fairview	2000	na [2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2001	9	3	9	18	3	3	4	0	0	0	2	29	47	8	69
Rycroft	2000	na [2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2001	9	6	28	94	3	3	5	0	0	0	2	14	20	11	119
Sask.																
Swift C	2000	16	10	39	129	5	19	52	9	59	74	4	22	47	28	302
	2001	8	7	24	90	7	16	31	1	21	21	2	18	33	17	175
Regina	2000	18	14	14	93	11	28	70	14	4	15	10	34	99	49	277
	2001	16	16	29	141	14	8	44	3	2	3	6	15	46	39	234
Southey	2000	na [2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2001	8	6	28	47	5	9	13	0	0	0	2	20	25	13	85
Manitoba																
Minnedosa	2000	na [2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2001	11	11	25	68	9	8	21	2	9	12	8	16	70	30	171
Totals		166	124		1405	95		398	54		189	58		601	331	2593

[1] Maximum deposit is the highest μg/m2 in any one sample. Total deposits are a summation of deposits over all samples (April-Sept).

[2] Not applicable, site not sampled in 2000.

Table 2. Major detections (μg/L) of herbicides in AB, SK and MB rainfall during 2000-01.

Province and Site	Year	No. Samples	Total mm[1]	2,4-D		Bromox.		Dicamba		MCPA	
				Detections: (**M**)aximum deposit, in (**R**)ainfall[2]							
				M	**R**	**M**	**R**	**M**	**R**	**M**	**R**
Alberta											
Stavely	2000	13	276	0.33	33	0.12	68	0.03	68	0.30	68
	2001	12	173	0.73	2.7	0.27	2.7	0	-	0.32	33
Tempest	2000	14	117	**16**	9.2	**7.7**	1.0	0.95	1.0	**3.4**	1.0
	2001	10	94.2	**9.3**	0.5	1.1	12	2.1	2.0	2.3	12
Grassy L.	2000	12	140	**6.8**	0.9	2.1	0.9	9.1	0.6	**26**	0.6
	2001	10	51.9	**9.8**	1.6	4.0	1.6	0.49	5.8	**4.8**	1.6
Fairview	2000	na [3]	-	-	-	-	-	-	-	-	-
	2001	9	286	0.25	35	0.04	73	0	-	0.83	35
Rycroft	2000	na [3]	-	-	-	-	-	-	-	-	-
	2001	9	286	0.96	17	0.07	23	0	-	0.62	23
Sask.											
Swift C	2000	16	324	2.2	11	0.99	11	1.3	46	0.67	11
	2001	8	159	3.3	6.7	1.3	6.7	0.33	63	2.6	6.7
Regina	2000	18	355	1.1	13	0.91	31	0.21	17	2.1	16
	2001	16	186	2.3	3.8	0.88	6.6	0.12	13	1.6	3.8
Southey	2000	na [3]	-	-	-	-	-	-	-	-	-
	2001	8	92.1	1.2	22	0.38	22	0	-	0.85	22
Manitoba											
Minnedosa	2000	na [3]	-	-	-	-	-	-	-	-	-
	2001	11	233	**5.7**	4.4	1.3	4.4	0.63	15	**3.6**	4.4

[1] Total rainfall (mm) over all samples (April-Sept).

[2] (M)aximum deposit is the highest μg/L in any one sample. This maximum depends on the (R)ainfall (mm) for that sample period. **Bolded** maxima are in excess of the Canadian Aquatic Life Guidelines.

[3] Not applicable, site not sampled in 2000.

END OF SECTION Q: CHEMICAL RESIDUES
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