1994 PEST MANAGEMENT RESEARCH REPORT

Compiled for:

THE EXPERT COMMITTEE ON INTEGRATED PEST MANAGEMENT

Chairperson: Hugh G. Philip, P.Ag.

by:

Information and Planning Services
Research Branch, Agriculture and Agri-Food Canada
Ottawa, Ontario CANADA K1A 0C6

JANUARY, 1995

This annual report is designed to encourage and facilitate the rapid dissemination of pest management research results 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 Plant Industry Directorate, Food Production and Inspection Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario, K1A 0C5.

This year there were 158 reports. The Expert Committe on Integrated Pest Management is indebted to the researchers from provincial and federal departments, universitites, and industry who submitted reports, for without their involvement there would be no report. Our special thanks is also extended to the section editors for reviewing the scientific content and merit of each report, and to the staff members of the Research Information Management Service for editorial and computer compilation services.

Suggestions for improving this publication are always welcome. Please send your comments by mail or FAX to the Chairperson of the ECIPM c/o Information and Planning Services.

RAPPORT DE RECHERCHE EN LUTTE DIRIGÉE 1994

Préparé pour:

LE COMITÉ D'EXPERTS SUR LA LUTTE INTÉGRÉE

Président : Hugh G. Philip, P.Ag.

par:

Services d'information et de planification
Direction générale de la recherche, Agriculture et Agroalimentaire Canada
Ottawa (Ontario) CANADA K1A 0C6

JANVIER 1995

La compilation du rapport annuel vise à faciliter la diffusion des résultats de la recherche dans le domaine de la lutte antiparasitaire 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 la Direction de l'industrie des produits végétaux, Direction générale de la production et de l'inspection des aliments, Agriculture et Agroalimentaire Canada, Ottawa (Ontario) K1A 0C5.

Cette année, nous avons donc reçu 158 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 le personnel du Service à la direction de l'information sur la recherche scientifique 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. Veuillez donc envoyer vos commentaires par la poste ou par télécopieur au président du Comité d'experts sur la lutte intégrée, aux Services d'information et de planification.

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NOTE: IF YOU ARE USING A PROPORTIONAL SPACED FONT, PLEASE ENSURE THAT KERNING IS SWITCHED OFF UNDER YOUR PRINTER FUNCTION OPTIONS.

NOTA : SI VOUS UTILISEZ UNE POLICE DE CARACTÈRES À ESPACEMENT PROPORTIONNEL, ASSUREZ-VOUS QUE LE CRÉNAGE, QUI FAIT PARTIE DES FONCTIONS OPTIONNELLE DE IMPRIMANTE, EST DÉSACTIVÉ.

Instructions for using the Pest Management Research Report diskette

There are five WordPerfect 5.1 text files on this diskette. This file is **README.DOC.** The file **94INSECT.REP** contains the biological practices and entomology sections of the "Pest Management Research Report for 1994" and its title page and table of contents. **94DISEAS.REP** contains the diseases, nematode and residue sections. The file **CHEMDEF.LIS** contains the pest control products and chemical definitions. The indices for the Pest Management Research Report will be found in **INDEX.LIS**. All of the files can be read by any IBM or IBM compatible PC using WordPerfect software.

Due to the size of the Pest Management Research Report, we recommend that it be copied to a hard disk drive (space permitting) and then be used in a word processing or text retrieval package which can accept large files without any problems.

The pitch and margin settings, 12 cpi (NLQ), 1.0" left margin and 1.0" right margin, are stored as part of the document and should not be changed. Due to tables embedded within the text, expect hard carriage returns at the end of each line.

Please note that numbers in the indices refer to report numbers and not page numbers.

To print individual research reports, or a complete paper version of the report, we advise that you RETRIEVE the document into WordPerfect. WordPerfect will automatically reformat the file for your printer's settings - the default printer. If you are using a proportional spaced font, ensure that the WordPerfect KERNING feature under format - printer settings, is switched off. (If left on tables and indices will appear ragged.)

The 1994 Pest Management Research Report, along with the Pest Management Research Reports for the years 1983 to 1993, are available as part of the Pest Management Research Information System (PRIS) on CD-ROM and on-line from the Canadian Centre for Occupational Health and Safety. PRIS is also available to Agriculture Canada officers via AgriNet.

If you encounter any problems with the diskette, or if you have any questions concerning the availability of printed versions of this report, please contact Rosalyn McNeil at (613) 995-7084 (ext. 7261).

Hugh G. Philip
Chairperson, ECIPM
January, 1995

Instructions pour l'utilisation de la disquette du Rapport de recherche sur la lutte dirigée

Cette disquette contient cinq fichiers de texte WordPerfect 5.1. Le fichier dans lequel vous vous trouvez en ce moment porte le nom de **README.DOC**. Le fichier **94INSECT.REP** contient les sections visant les pratiques biololgiques et l'entomologie du *Rapport de recherche sur la lutte dirigée de 1994* ainsi que l'avant-propos et la table des matières. Le fichier **94DISEAS.REP** englobe les sections sur les maladies, les nématodes et les résidus. Le fichier **CHEMDEF.LIS**, quant à lui, contient la liste des produits anti-parasitaires et les définitions chimiques. C'est dans le fichier **INDEX.LIS** qu'on retrouve les indices pour le *Rapport de recherche sur la lutte dirigée*. On peut accéder à ces fichiers à l'aide d'un ordinateur personnel IBM ou d'un ordinateur personnel compatible IBM et d'un logiciel WordPerfect.

À cause de la taille du Rapport de recherche sur la lutte dirigée (760 kb environ), nous conseillons de le recopier dans une unité de disque dur (selon l'espace disponible) et ensuite de le récupérer à l'aide d'un logiciel de traitement de textes ou de récupération de textes qui soit capable de traiter sans problème de gros fichiers.

Les paramètres pour l'interligne et les marges (12 caractères par pouce (NLQ), marge de gauche 1,0", marge de droite 1,0") sont enregistrés comme faisant partie du document et ne devraient pas être modifiés. À cause des tableaux insérées dans le texte, vous trouverez des retours de chariot fixes à la fin de chaque ligne.

Veuillez noter que les numéros dans les indices correspondent aux numéros de rapport et non pas aux numéros de page.

Si vous désirez imprimer des rapports de recherche partiels, ou la version complète du rapport, nous vous suggérons de RÉCUPÉRER le document dans WordPerfect. WordPerfect va automatiquement reformater le fichier selon les valeurs implicites de votre imprimante. Si vous utilisez une police de caractères à espacement proportionnel, assurez-vous que la fonction CRÉNAGE (kerning) dans WordPerfect, qui figure sous format - paramètre d'impression, est désactivée. (Si elle est activée les tableaux et les indices seront décalés.)

Le *Rapport de recherche sur la lutte dirigée de 1994*, tout comme les Rapports de recherche sur la lutte dirigée des années 1983 à 1993, fait partie intégrante du Système d'information sur la lutte dirigée (SILD) et est disponible sur disque compact-ROM. Il est possible de se procurer ce disque auprès du Centre canadien d'hygiène et de sécurité au travail. On peut aussi consulter le *Rapport* en communiquent directement (par ordinateur) avec le Centre canadien d'hygiène et de sécurité au travail. Les employés d'Agriculture et Agroalimentaire Canada peuvent aussi accéder au SILD via AgriNet.

Si la disquette vous pose des problèmes, ou si vous avez des questions relativement à la disponibilité des imprimés de ce rapport, veuillez contacter Rosalyn McNeil au (613) 995-7084, (poste 7261).

Hugh G. Philip
Président, CELI
Janvier, 1995

SECTION A

PEST MANAGEMENT METHODS / MÉTHODES DE LUTTE DIRIGÉE

BIOLOGICAL CONTROL / LUTTE BIOLOGIQUES

Section Editors / Réviseurs de section :
Weeds / Mauvaises herbes : R. DeClerck-Floate,
Insects, Mites, Nematodes / Insectes, acariens, nématodes : D.R. Gillespie

#001 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 387-1211-8717

CROP: Corn, grain

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

NAME AND AGENCY:
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P O Box 3000 Main, Lethbridge, Alberta T1J 4B1
Tel: (403) 327-4561 **Fax:** (403) 382-3156

TITLE: RELEASE METHOD FOR *TRICHOGRAMMA BRASSICAE* FOR CONTROL OF EUROPEAN CORN BORER

MATERIALS: *Trichogramma brassicae*

METHODS: *Trichogramma brassicae* Bezdenko, reared on Mediterranean flour moth eggs, were supplied by Bio-Logicals, Ciba-Geigy Canada Ltd., Guelph, Ontario. The wasp pupae, conditioned to enter diapause in early spring, were stored at 3°C until 8 d before release, when they were placed in 25°C to initiate post-diapause development. The ready to eclose wasp pupae were placed in release cards consisting of a 20 x 20 Lumite mesh pocket to exclude predators and an overhanging card to protect against sun and rain. The release cards were attached to corn plants with a twist tie (1993) or a cardboard collar (1994). Releases were carried out in three full central-pivot irrigation circles (50 ha) of grain corn. The European corn borer (ECB) population was monitored by four sex-pheromone traps placed along the western edge of the field. The first wasp release was approximately 2 weeks after the first male ECB moth was caught in the pheromone traps. Four, 1 ha plots were staked out in each field and randomly assigned to 1 of 4 treatments: 1) 9 release points per ha; 2) 16 release points per ha; 3) 25 release points per ha; and 4) no release (control). The total actual release rate in 1993 was 162,000 wasps per ha in 6 weekly releases starting 13 July, which was lower than planned because only 50% of the wasps emerged. In 1994, the total actual release rate was 508,000 wasps per ha in 4 weekly releases starting 7 July. During each release in 1994, 30 sentinel ECB egg masses were placed near three release points in each field and retrieved after 1 week, to determine the effectiveness of the wasps. Also at each release, the longevity of a sample of wasps and their ability to parasitize ECB egg masses were determined in the laboratory. At the end of August, 480 plants in each plot were examined for ECB damage. Percent reductions in plants infested and number of ECB larvae were determined by comparing with the control plot. The percent reductions were arcsin-transformed and subjected to analysis of variance.

RESULTS: In 1993, field number three was excessively wet during much of the season, causing stunted growth of the plants in parts of the field and a possible reason for the variable results in the field (Table 1). Excluding this field from the analysis, no significant difference was detected among the three release point densities with respect to reduction in infested plants nor in the reduction in larval numbers (Table 1). Sentinel egg masses in the field were parasitized at rates of 86-100%, with no significant drop in parasitism during later release dates. In the laboratory, longevity was not significantly different among the wasps from the different release dates, but parasitism rate was lower for wasps from the later release dates.

CONCLUSIONS: Reducing the release point density from the currently recommended rate of 50 release points per ha to nine release points per ha would reduce the time to release wasps in the field by approximately 60%. Although the parasitism rates of the sentinel egg masses among the 4 weekly releases were not significantly different, the parasitism rates in another study declined after 4 weeks. This appeared to support the laboratory results indicating a possibility of reduced wasp efficacy if kept too long in cold storage before release.

Table 1. Infestation rates in control plots, and percent reduction in plots where *Trichogramma brassicae* were released from different numbers of release points per ha. Data obtained by *in situ* inspection of 480 plants per plot.

	CONTROL PLOTS		RELEASE PLOTS					
	% Plants Infested	No. of Larvae	% Reduction in infestation			% Reduction in number of larvae		
			9rp*	16rp	25rp	9rp	16rp	25rp
1993								
Field 1	72	1207	75	64	62	87	81	76
Field 2	43	493	45	69	60	47	71	76
Field 3	34	485	87	30	27	93	47	46
1994								
Field 4	55	616	69	75	89	77	83	94
Field 5	33	357	80	89	89	87	92	89
Field 6	28	305	66	67	70	71	86	78

* 9rp, 16rp and 25rp = 9, 16 and 25 release points per ha.

#002

STUDY DATA BASE: 387-1431-8312

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TITLE: A MODEL TO PREDICT THE SUITABILITY OF LEAFY SPURGE SITES FOR BIOCONTROL BY THE BEETLE '*APHTHONA NIGRISCUTIS*'

MATERIALS: *Aphthona nigriscutis* Foudras, Black-dot spurge beetle

METHODS: The root-feeding beetle, *Aphthona nigriscutis*, introduced from the European steppes, can reduce stands of leafy spurge from a cover of 100% to <5%, if it is released at the correct site. The beetle site requirements are difficult for the non-expert to recognize as they involve the interaction of several site, vegetation and soil factors. Some of these factors are: the presence of other grass species; slope, aspect, and relief of the spurge site; amount of bare ground; amount of shade; and height of the spurge flowering stems. We used commercially available neural network software (BrainMaker Pro v3.0 from California Scientific, Nevada City, CA; and AIM v1.1 from AbTech Corp., Charlottesville, VA) to model the data from 126 sites across Manitoba, Saskatchewan and Alberta. Briefly, the neural network software learns from example data with known inputs (site factors) and known outputs (beetle numbers), finds the subtle non-linear relationships in the data, and produces a best-fit, solved network in the form of a large mathematical weight matrix. Inputs for unknown sites can then be fed into the solved network and beetle numbers predicted.

RESULTS: Our solved network predicted the number of surviving beetles in five net-sweeps two years after release. Predictions ranged from 0 to 105 beetles per five sweeps. As a reference, we used 0-2, 2-10 and >10 beetles per five sweeps as an indicator of poor, good and excellent sites, respectively. In practice, the most critical predictions are for the low beetle numbers near the boundary between poor and good sites. Our testing indicated that for actual beetle numbers of 0-0.6 per five sweeps (a poor site), the program will predict 0-2.2 beetles, 85% of the time.

CONCLUSIONS: The program will be useful for predicting the best sites for release of the black-dot spurge beetle on the Canadian prairies. A copy of the program, Spurge Biocontrol Site Selector for *Aphthona nigriscutis* (v 1.0), is available on request from the authors.

SECTION B

PEST MANAGEMENT METHODS / MÉTHODES DE LUTTE DIRIGÉE

MONITORING METHODS / MÉTHODES DE DÉPISTAGE

Section Editor / Réviseur de section : T. Lysyk

#003 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 306-1262-9020

CROP: Blueberry, lowbush

PEST: Blueberry maggot adult, *Rhagoletis mendax* Curran (L.)

NAME AND AGENCY:
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TITLE: EFFICACY OF SLOW RELEASE BAITED PHEROCON TRAPS COMPARED WITH CONVENTIONAL BAITED PHEROCON TRAP

MATERIALS: Pherocon traps baited with experimental slow release formulation bait (SR), conventional baited Pherocon traps.

METHODS: The experimental site was 6 commercial lowbush blueberry fields (4-10 ha each) in the Parrsboro area of Nova Scotia. Traps (9 sets) were paired by site location and placed 6 m apart at each location within each field. Adult *R. mendax* captures were monitored three times a week from June 27 to August 22, 1994. The Pherocon traps (but not the SR) were replaced after 3 weeks. A comparison of cumulative captures on each type of trap was conducted using regression analysis with a logit model. Mean counts per trap type were analyzed to determine the relative efficacy of the traps.

RESULTS: Using the logit model 99.7% of the variance in cumulative captures on conventional baited Pherocon traps was explained by cumulative captures on slow release baited Pherocon traps. The mean number of captures on each type of trap were similar (Table 1.).

CONCLUSIONS: The conventional baited Pherocon trap and the slow release baited Pherocon trap were equally effective in capturing adult *R. mendax* in commercial lowbush blueberry fields.

Table 1. Mean seasonal adult *R. mendax* captures on nine sets of paired traps set in commercial lowbush blueberry fields in Nova Scotia.

Treatment	*R. mendax* adult captures (Number)
Conventional baited Pherocon trap	53.0
Slow release baited Pherocon trap	53.4
SEM	13.03

SECTION C

PEST MANAGEMENT METHODS / MÉTHODES DE LUTTE DIRIGÉE

SEMIOCHEMICALS / SÉMIOCHIMIQUES

Section Editors / Réviseurs de section :

Insect Pheromones / Phéromones des insectes : G. Judd
Natural Products / Produits naturelles : M. Isman

#004 REPORT NUMBER / NUMÉRO DE RAPPORT

CROP: Apple, cv. Red delicious, Golden delicious, Spartan, McIntosh

PEST: Fruittree leafroller, *Archips argyrospila* (Walker)
Codling moth, *Cydia pomonella* (Linnaeus)

NAME AND AGENCY:
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TITLE: EFFICACY OF ATMOSPHERIC PERMEATION WITH SEX PHEROMONE FOR CODLING MOTH AND FRUITTREE LEAFROLLER CONTROL

MATERIALS: HAMAKI-CON leafroller sex pheromone dispensers,
(93:7 Z11-14:OAc and E11-14:OAc)
ISOMATE-C codling moth sex pheromone dispensers,
(51.8:29.1:6.0 E,E-8, 10-Dodecadien-1-ol: Dodecanol: Tetradecanol)
DIPEL WP (*Bacillus thuringiensis)*
FORAY 48B (*Bacilluis thuringiensis*)
GUTHION 50 WP (Azinphos-methyl)
BASUDIN 50 WP (Diazinon)

METHODS: The trial was conducted near Kelowna, British Columbia in a 4.5 ha orchard divided into 2 blocks, A and B. Block A (2 ha, conventional block) consisted of 3-4 m high McIntosh apple trees (5.5 x 5.5 m spacing) interplanted with younger McIntosh within the rows. Block B (2.5 ha, pheromone block) adjacent to Block A had plantings of 3-4 m high spur-type Red delicious with some Spartan and Golden delicious trees (4.3 x 2.7 m spacing). Block B also included a 1 ha planting of young McIntosh (2.5-3.0 m high, 4.3 x 2.7 spacing) along one side.

In 1993 Block A was sprayed with 4.5 kg BASUDIN 50 WP/ha at petal fall for control of leafroller and twice with 1.4 kg GUTHION 50 WP/ha for control of codling moth. In the same year, Block B was sprayed on May 10 (early bloom) with 2.25 kg DIPEL WP/ha. Four days later, 160 blossom clusters were examined for the presence of live leafroller larvae. On May 16 (late bloom) Block B was sprayed with 4 L FORAY 48B plus 4.5 kg BASUDIN 50 WP/ha for control of leafroller. BASUDIN 50WP was included to control the mullein bug, *Campylomma verbasci* Meyer. Block B was sprayed once with 1.4 kg GUTHION 50 WP/ha for control of first-brood codling moth larvae. ISOMATE-C dispensers were applied, at pink stage, at a rate of 1000 dispensers per ha; HAMAKI-CON dispensers were applied June 8-10 at a rate of 1000 dispensers per ha. Due to a severe hail storm in June 1993, no damage data could be collected for 1993.

In 1994 Block A was sprayed on May 5 (late bloom) with 4.0 L FORAY 48B/ha for control of leafroller larvae. FORAY 48B was applied again on May 14 at 5.0 L/ha for control of green and brown fruitworms. GUTHION 50 WP was applied once at 1.4

kg/ha for control of first-brood codling moth. Block B was sprayed on May 4 (late bloom) with 3.7 L FORAY 48B plus 2.25 kg BASUDIN 50 WP/ha. ISOMATE-C and HAMAKI-CON pheromone dispensers were applied on May 3 and 4 at a rate of 1000 dispensers per ha. At harvest, 100 apples from each of 10 bins in Block A (September 9/94) and 30 bins in Block B (October 2-3/94) were examined for feeding damage due to leafroller, and codling moth larvae. Between February 28 and March 1, 1994, the difference in the density of leafroller egg masses laid in 1992 (hatched) and 1993 (unhatched) in Blocks A and B was determined by recording the number of egg masses found on 20-30 limbs (2.5 cm x 100 cm long) pruned from the upper canopy of randomly selected trees.

The effect of the 1994 treatment programme on egg mass density will not be determined until the spring of 1995. No assessments of leafroller larval mortality due to the spray treatments were done in 1994. All spray treatments were applied with an airblast orchard sprayer calibrated to deliver 1235 L/ha at 4.8 km/h except in 1994 when it was calibrated to deliver the same volume at 3.2 km/h to Block B to improve coverage. Leafroller sprays were applied when approximately 90% of the eggs had hatched.

RESULTS: The DIPEL/FORAY and GUTHION treatments were applied to reduce the abundance of leafroller and codling moth larvae, respectively, as part of the mating-disruption strategy of atmospheric permeation with sex pheromone to prevent mating. In 1993, Block B had to be sprayed a second time with FORAY 48B because of unsatisfactory control achieved by the first DIPEL WP spray (17% of blossom clusters still infested). The poor performance was attributed to poor coverage due to excessive travel speed for the size and canopy density of the Red delicious trees. The density of egg masses decreased 54% (8.4-3.9/sq m) and 84% (26.9-4.4/sq m) in Block A (conventional) and Block B (pheromone), respectively. The greater decrease (30%) in Block B is attributed to mating disruption. In 1994, the percentage of fruit damaged by fruittree leafroller in Block B was 1.2 compared to 1.7 in Block A. For codling moth, 2.1% of the fruit was infested in Block B compared to 0% in Block A. Based on pre-harvest visual inspection, the outer 2 rows of trees in the pheromone-treated Block B had more codling moth damage (4.2%) compared to the interior trees (0.84%), and over 80% of the damage was caused by third brood larvae which began to appear in late August. The lack of codling moth damage in the conventional Block A could be a result of the fruit being harvested September 7-9 before noticeable damage could be inflicted by third-brood larvae.

CONCLUSIONS: HAMAKI-CON pheromone dispensers provided some reduction in fruittree leafroller mating based on reduced density of egg masses (30%). ISOMATE-C pheromone dispensers provided acceptable protection of fruit away from crop margins but must be supplemented by cover sprays or some other control method in the outer 3 rows where pheromone concentration is insufficient to prevent mating. This practice will apply to all mating disruption programmes unless all surrounding blocks of host trees are adequately treated.

SECTION D

INSECTS OF FRUIT CROPS / INSECTES DES FRUITS

Section Editors / Réviseurs de section :

Tree Fruits / Arbres fruitiers : R. Smith
Berry Crops / Petits fruit : S. Fitzpatrick

#005 REPORT NUMBER / NUMÉRO DE RAPPORT

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. McIntosh

PEST: Codling moth, *Cydia pomonella* (L)

NAME AND AGENCY:
SMITH R F, LOMBARD J, PATTERSON G and NEWTON A
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Tel: (902) 679-5730 **Fax:** (902) 679-2311

TITLE: EFFICACY OF CONFIRM 240 F (TEBUFENOZIDE) AGAINST CODLING MOTH IN NOVA SCOTIA ORCHARDS

MATERIALS: CONFIRM 240 F, (Tebufenozide)
DIPEL WP, (*Bacillus thuringiensis kurstaki*)
RIPCORD 400 EC, (Cypermethrin)
COMPANION, (spreader/sticker)

METHODS: The test site was a 1.5 ha block of 35-year old apple, cv. McIntosh, at the Kentville Research Centre, Kentville, Nova Scotia. Using a sex pheromone baited trap, at 'biofix' of first moth capture, a heat unit accumulation was initiated. On June 28th, 250 degree-day heat units had accumulated indicating ca 3% codling moth egg hatch had occurred thus setting the timing of needed control measures. A Rittenhouse orchard mist sprayer delivering a 5x concentration of pesticide at a tank pressure of 1380 kPa was used to treat blocks of 30 trees, each with one rate of the following pesticides: DIPEL WP 560 g (product) plus RIPCORD 400 EC 5.2 mL, CONFIRM 240 F at rates of 360, 300, 240 or 180 g a.i./ha. A 0.1% (v/v) COMPANION spreader sticker was added to the CONFIRM treatments. An additional 30 tree portion of the orchard was left unsprayed and served as a check plot.

On September 1st, fruit injury in all plots was assessed by randomly examining 500 fruit in each plot. Percent damaged fruit was transformed to arcsin prior to analysis of variance and separation of the means by Tukey's pairwise comparison.

RESULTS: Pheromone trap captures, commencing June 1st, had a cumulative count of 20 male moths, and peaked within 10 d post-treatment in the orchard; this indicated timing of the treatments was optimum. Damage levels ranged from a low of 0.42% in the CONFIRM plots to a high of 26.9% in the untreated check plots.

CONCLUSIONS: A single application of CONFIRM 240 F, regardless of rate, gave fully satisfactory fruit protection from codling moth. The DIPEL/RIPCORD tank mixture, although a less harsh pesticide to beneficial predators than conventional insecticides, did not give acceptable protection of the apples allowing over 7% damage. Both treatments were better than the unsprayed check.

Table 1. Comparison of injury levels of apples protected for codling moth damage by one application of CONFIRM or DIPEL and RIPCORD mixture of insecticide.

Treatment	Rate g a.i./ha		Percent fruit damaged Mean	(SEM)*
Unsprayed check	-		26.89	(2.71)a
DIPEL WP +	560	g product		
RIPCORD 400 EC	5.2 mL		7.39	(1.19)b
CONFIRM	360		1.77	(0.63)c
CONFIRM	300		0.63	(0.31)c
CONFIRM	240		0.42	(0.25)c
CONFIRM	180		1.45	(1.07)c

* Means within a column sharing a common letter are not significantly different P = 0.05, according to Tukey's pairwise comparison.

#006

CROP: Apple, cv. Red delicious, Golden delicious, McIntosh

PEST: Fruittree leafroller, *Archips argyrospila* (Wlk.)
Green fruitworms, *Lithophane georgi* Girt., *Orthosia hibisci* (Guen.)
Apple grain aphid, *Rhopalosiphum fitchii* (Sand.)
Apple aphid, *Aphis pomi* Deg.

NAME AND AGENCY:
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Tel: (604) 861-7211 **Fax:** (604) 861-7490

TITLE: EFFICACY OF AZADIRACHTIN AGAINST VARIOUS ORCHARD PESTS

MATERIALS: NEEM EC (Phero Tech Inc., 20 g Azadirachtin/L)
FORAY 48B (*Bacillus thuringiesis kurstaki*)
BASUDIN 50 WP (Diazinon)

METHODS: The trial was conducted near Kelowna, British Columbia, in a 0.29 ha block of 3-4 m high apple trees (3.7 x 4.6 m spacing). The orchard block was divided into seven treatments, replicated four times in a randomized complete block design. Each replicate plot consisted of 4-8 trees x 2 rows. Treatments were applied, on April 27, 1994 (09:00-10:00 h) and on May 5, 1994 (14:00-18:00 h) under clear skies and temperatures of 21-25°C, using an air-blast orchard sprayer calibrated to deliver 593 L/ha at 3.4 km/h. Treatments (and application dates) were 30 ppm azadirachtin (May 5), 40 ppm azadirachtin (April 27, May 5), 40 ppm azadirachtin (May 5), 60 ppm azadirachtin (May 5), FORAY 48B at 3.4 L/ha (April 27), FORAY 48B at 2.8 L/ha plus BASUDIN 50 WP at 2.25 kg/ha (May 5) and water only (untreated check April 27, May 5). The trees were in early bloom stage on April 27, late bloom stage on May 5. No rainfall was recorded at the test site within 48 h of any treatment dates. From June 2 to August 19, the block was treated four times with IMIDAN 50 WP and twice with GUTHION 50 WP to control codling moth.

Plots sprayed on April 27 were sampled for live leafroller larvae and for aphid-infested leaves on May 5, 11, and 19 before any repeat application was made. Plots sprayed on May 5 were sampled May 11 and 19. Green fruitworm larvae were only numerous enough to sample in all plots on May 5. Leafroller survival was determined by examining 10 nests per replicate for the presence or absence of live larvae. Fruitworms were sampled by taking six limb taps per replicate. Aphids were sampled by recording the number of 10 expanded leaves infested on each of 10 terminals per replicate. Assessment of leafroller and fruitworm feeding damage was done September 15 by examining 100 apples per replicate (50:50 upper:lower canopy) still on the trees. Because each plot consisted of only 2 rows of trees, all sampling for insects and damage was done on the inside portion of the middle two or four trees. All data were analyzed using ANOVA and means compared using LSD test (P = <0.05)

RESULTS: There were few significant differences observed among the treatments with respect to their efficacy against leafroller and fruitworm larvae and aphids (Table 1). The proportion of leafroller nests containing larvae in the FORAY 48B treatment (52.5%) was significantly less than that of the check (82.5%) only. The average number of aphid-infested leaves per terminal on May 11 for the repeated 40 ppm azadirachtin treatment (6.0) was significantly greater than the 60 ppm azadirachtin treatment (1.5) and check (1.5) only. There was no significant difference among the treatments for average number of green fruitworm per beat on May 5 (range 0.25-1.25) or average percent fruit damaged (range 0.5-2.75%). FORAY 48B (3.5%) and FORAY 48B plus BASUDIN 50 WP (3.75%) treatments resulted in significantly less leafroller damage than only the 30 ppm azadirachtin treatment (11.5%).

CONCLUSIONS: Neither FORAY 48B alone or in combination with BASUDIN 50 WP nor azadirachtin provided satisfactory protection of apple fruit from fruittree leafroller and green fruitworm larvae at the rates tested and under the conditions of this trial. The FORAY 48B plus BASUDIN 50 WP and the azadirachtin treatments were not effective in significantly reducing aphid abundance. Preliminary field tests in 1993 revealed both FORAY 48B and 30 and 60 ppm azadirachtin were effective in controlling fruittree leafroller and in reducing fruit damage when applied by a high-pressure hand-gun sprayer.

Table 1.

Treatment	% Damage LR	% Damage GFW	% Live Leafroller May 5	% Live Leafroller 11	% Live Leafroller 19	Ave. No. Leaves/10 May 5	Aphid-Infested Leaves/Terminal 11	Aphid-Infested Leaves/Terminal 19
30 ppm aza	11.50b	1.50		80.0	85.0		2.75ab	2.25
40 ppm aza	6.25ab	0.75		72.5	77.5		4.50ab	4.25
40 ppm aza(x2)	6.75ab	1.25	70.0ab	75.0	70.0	2.50	6.00b	3.25
60 ppm aza	7.00ab	3.00		75.0	82.5		1.50ab	1.00
FORAY 48B	3.50b	1.75	52.5b	65.0	65.0	3.00	5.50ab	1.25
FORAY 48B + BASUDIN 50 WP	3.75b	1.75		57.5	67.5		2.00ab	3.00
Check	8.50ab	2.75	82.5a	75.0	65.0	1.25	1.50a	2.50
LSD (P = 0.05)	*	ns	*	ns	ns	ns	*	ns

* Mean values followed by the same letter in same column are not significantly different (LSD, P = 0.05).

#007

STUDY DATA BASE: 348-1261-4801

CROP: Apple, cv. McIntosh and Delicious

PEST: European red mite, *Panonychus ulmi* (Koch)

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TITLE: EFFECTIVENESS OF A SUMMER OIL APPLICATION FOR THE CONTROL OF EUROPEAN RED MITE

MATERIALS: SMOTHER-OIL, Petroleum oil 80%

METHODS: Mite control was evaluated using single tree plots of nine-year old Delicious and McIntosh trees on M.26 rootstock. For each cultivar, plots were replicated 10 times using a completely randomized design. The trees were sprayed to runoff (5.5 L/plot) using a hydraulic hand-gun attached to a Rittenhouse sprayer operating at 2700 kPa. SMOTHER-OIL was sprayed on July 19 at 2 L of product per 100 L of water.

Pre-spray counts on July 13 were estimated by counting the number of mites on 25 mid-shoot leaves, per cultivar, taken from throughout the experimental area. There was an average of 16.1 eggs and 5.9 actives (nymphs + adults) per leaf on McIntosh; 18.6 eggs and 4.6 actives per leaf on Delicious. On July 26, 7 day post-treatment, 20 mid-shoot leaves per tree were examined for mites. Fifteen days (August 3) and 21 days (August 9) post-treatment, 10 mid-shoot leaves per tree were examined for active mites. All leaves were checked under a binocular microscope. The plots were examined for signs of phytoxicity 1, 2 and 4 weeks post-application.

RESULTS: The results are summarized in the table. The results collected from one oil-treated Delicious plot were inconsistent with the rest of the trial. The data for this plot were, hence, analyzed as missing values. A T-test was performed on the data.

CONCLUSIONS: The SMOTHER-OIL treatment reduced the number of active mites as compared to the unsprayed check on both McIntosh and Delicious trees. The population levels were maintained well below threshold 3 weeks post-treatment in the oil-treated plots of both cultivars. No phytotoxicity from the SMOTHER-OIL application was noticed on the leaves or fruit of either the McIntosh or Delicious trees.

An anomalous high number of mites initially may account for the apparent lack of mite control on the inconsistent oil-treated Delicious plot.

Table 1. Efficacy of SMOTHER-OIL against European red mite.

Treatment	Mean number of mites per leaf: eggs	Days post-treatment: 7 Days actives*	15 Days actives	21 Days actives
McIntosh				
Check	30.10 (19.2)**	30.20 (21.0)	28.00 (20.4)	18.10 (9.1)
SMOTHER-OIL	12.00 (16.3)	0.60 (0.3)	3.40 (2.4)	6.70 (4.7)
Prob. > F value	0.63	<0.01	<0.01	0.06
Delicious				
Check	58.80 (44.1)	34.70 (32.4)	50.00 (25.5)	17.40 (13.9)
SMOTHER-OIL	34.10 (22.9)	1.70 (1.2)	2.60 (1.0)	5.00 (1.5)
Prob. > F value	0.08	<0.01	<0.01	<0.01

* Actives = nymphs + adults.
** Standard deviation is shown in brackets as determined using a T-test.

#008

STUDY DATA BASE: 306-1461-9007

CROP: Apple, cv. McIntosh

PEST: European red mite (ERM), *Panonychus ulmi* (Koch)
Apple rust mite (ARM), *Aculus schlechtendali* (Nalepa)

PREDATORS: *Typhlodromus pyri* Scheuten (TP), *Zetzellia mali* Ewing (ZM)

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TITLE: EFFECTS OF PREDATOR MITES AND PETROLEUM OIL APPLIED AT TIGHT CLUSTER ON EUROPEAN RED MITE ON APPLE

MATERIALS: PETRO-CANADA SUPERIOR 70 SPRAY OIL, 2.17 L/100 L
SUPERIOR OIL (70 SEC), 2.17 L/100 L

METHODS: Four single-tree plots of semi-dwarf mature McIntosh trees were sprayed to runoff at tight cluster (12 May 1994) using a truck-mounted lance sprayer at a pressure of 2800 kPa and a volume of 15 L/tree. Petroleum oils were diluted at a rate comparable to 3000 L/ha. On 11 May four 5.0 cm subterminal twigs were taken from each tree, placed under a binocular microscope, and pre-counts of ERM winter eggs were recorded. Samples of 25 leaves per tree were taken on the dates presented in the table and passed through a mite-brushing machine. Counts of *T. pyri* were based on numbers on half of the glass collecting plate (i.e. equivalent to 12.5 leaves). Plate counts of *T. pyri* motile stages and eggs were multiplied by scaling factors of 2.58 and 2.89, respectively, because data indicate that plate counts represent an average of 39% of the motile *T. pyri* and 35% of the *T. pyri* eggs actually found on leaves. Counts per leaf for other mites were based on numbers on one-sixteenth of the plate.

RESULTS: On both sampling dates in late June, counts of *P. ulmi* were higher on the SUPERIOR OIL trees than on the others (Table 1), probably because these trees had the highest initial populations of *P. ulmi* winter eggs and possibly because of toxicity to *T. pyri*. (Mean pre-counts of winter eggs were 276 on control trees, 203 on PETRO-CANADA trees and 388 on SUPERIOR OIL trees). Counts of active stages of *P. ulmi* (larvae, nymphs and adults) were above the damage threshold of 5 per leaf from 29 June to 28 July on the trees treated with SUPERIOR OIL. On the control trees counts were above threshold on the 19th and 28th of July. With PETRO-CANADA OIL the count was only above threshold once (19 July). In all treatments, counts of *P. ulmi* actives declined steadily to zero in the month of August, undoubtedly because of predation by *T. pyri* and *Z. mali*. *T. pyri* were first detected in late June, *Z. mali* in late July. Both predators were found in all trees. Counts of *A. schlechtendali* were also present in low numbers in all trees. These rust mites were also strongly suppressed by both predators.

CONCLUSIONS: In this trial both PETRO-CANADA OIL and the predator mites gave effective control of *P. ulmi*. SUPERIOR OIL was less effective in keeping *P. ulmi* below injurious levels partly because red mite numbers were initially higher on those trees and also because of possible interference with control by predators.

Table 1. Mean number of mites per leaf on McIntosh trees. For each date means in the same row 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.

Mites*	22 June Control	22 June PETRO-CANADA OIL	22 June SUPERIOR OIL 70	29 June Control	29 June PETRO-CANADA OIL	29 June SUPERIOR OIL 70
ERME	0.80b	0.40b	23.60a	1.40b	0.40b	10.00a
ERMA	0.00b	0.00b	4.20a	0.00b	1.00b	17.80a
ARM	0.40a	0.60a	0.00a	0.20a	0.00a	0.00a
TP	0.00a	0.00a	0.00a	0.00a	0.05a	0.05a
ZM	0.00a	0.00a	0.00a	0.00a	0.00a	0.00a

Mites*	12 July Control	12 July PETRO-CANADA OIL	12 July SUPERIOR OIL 70	19 July Control	19 July PETRO-CANADA OIL	19 July SUPERIOR OIL 70
ERME	22.40a	27.80a	71.20a	24.60b	70.60a	20.60b
ERMA	2.60a	3.80a	14.20a	8.40b	37.80a	5.80b
ARM	1.20a	3.00a	5.80a	19.00a	23.40a	25.80a
TP	0.10a	0.05a	0.05a	0.16ab	0.00b	0.26a
ZM	0.00a	0.00a	1.40a	0.00a	0.00a	0.00a

Mites*	28 July Control	28 July PETRO-CANADA OIL	28 July SUPERIOR OIL 70	3 August Control	3 August PETRO-CANADA OIL	3 August SUPERIOR OIL 70
ERME	20.40a	3.00c	7.80b	26.40a	8.40b	4.40b
ERMA	11.60a	3.80b	13.00a	3.20a	2.00a	1.80a
ARM	9.80a	1.80b	2.40b	3.40a	7.40a	8.40a
TP	0.21b	1.24a	0.31a	0.93a	0.93a	0.78a
ZM	0.40a	0.00a	0.40a	1.40a	0.60a	1.40a

Mites*	8 August Control	8 August PETRO-CANADA OIL	8 August SUPERIOR OIL 70	15 August Control	15 August PETRO-CANADA OIL	15 August SUPERIOR OIL 70
ERME	7.80a	5.60a	10.40a	0.40a	1.80a	0.40a
ERMA	2.00a	2.60a	1.80a	0.20a	0.80a	0.20a
ARM	14.40a	11.80a	8.60a	2.80b	8.40a	5.00ab
TP	1.44a	1.80a	0.67a	1.19a	0.57ab	0.05b
ZM	2.40a	3.00a	1.20a	0.40a	0.80a	1.80a

Mites*	24 August Control	24 August PETRO-CANADA OIL	24 August SUPERIOR OIL 70	31 August Control	31 August PETRO-CANADA OIL	31 August SUPERIOR OIL 70
ERME	0.20a	0.80a	0.40a	1.00a	0.60a	0.20a
ERMA	0.00a	0.40a	0.00a	0.00a	0.00a	0.00a
ARM	4.00a	3.40a	5.60a	2.60a	0.40b	0.20b
TP	1.49a	0.52b	0.52b	1.03a	0.78a	0.31a
ZM	2.00a	1.40a	1.40a	0.60a	0.80a	2.00a

* ERME, ERMA- *P. ulmi* eggs and actives per leaf; ARM, TP, ZM- active stages per leaf of *A. schlechtendali*, *T. pyri* and *Z. mali* respectively.

#009

ICAR: 91000658

CROP: Apple, cv. McIntosh

PEST: European red mite, *Panonychus ulmi* (Koch)

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TITLE: EVALUATION OF BAS-300 11 I FOR THE CONTROL OF EUROPEAN RED MITE IN APPLES, 1994

MATERIALS: BAS-300 11 I-75 WP
KELTHANE 35 WP (Dicofol)
OMITE 30 WP (Propargite)

METHODS: Trial was established in a 24-year old block of McIntosh trees on MM-106 rootstock, spaced 1.83 m x 4.45 m, using a R.C.B. design with five-tree plots and four replicates. Applications were made with a diaphragm-pump-hand-gun system, operating at 1655 kPa, and were made on a spray to runoff basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis.

TREATMENT SCHEDULE: Treatments were to be first applied when the plots reached a population threshold of 7–10 active mites per leaf. Some or all treatments would receive further applications, if population levels dictated that this was necessary. Repeat applications of BAS-300 11 I, made in plots with elevated levels of ERM, would give supplementary information on the "knock-down" capabilities of this adulticide product.

PRE-TREATMENT MITE COUNT INFORMATION: The plot area was monitored on a weekly basis, prior to the initiation of treatments, to determine the average number of active mites present per leaf. The first adults were found on June 10, but development was slow, with only 0.9 active forms per leaf present on July 1. On July 6, after a significant egg hatch, the population jumped to 19 active forms per leaf (17 nymphs, 2 adults), indicating treatments should begin.

APPLICATIONS: First applications were made on July 7 (16:00, temp. 28°C, R.H. 77%). On August 3 (05:30, temp. 17°C, R.H. 99%), with the populations in the two commercial standard rapidly getting out of control, a second application was made in each of these treatments; OMITE was applied over the treatment that had received KELTHANE at the first application, and KELTHANE was applied over the treatment that had received OMITE. BAS-300 11 I, at the lower rate, was applied over these same treatments on September 1 (08:30, temp. 10°C, R.H. 85%), with the populations well above the threshold level.

ASSESSMENTS: At each sampling, 10 leaves of uniform age and size were collected. Counts of the adults and nymphs present on each leaf were made using a binocular microscope (10-20X). The data shown are the numbers of each form present for the entire 10 leaf sample.

RESULTS: As presented in the table.

DISCUSSION: BAS-300 11 I provided excellent season-long suppression of the heavy ERM pressure present within the trial with a single application. There was some indication the higher rate provided more complete residual control (particularly by 3 weeks after treatment (WAT)), but at no time did the two treatments of BAS-

300 11 I differ significantly from one another. Both commercial standards, even after 2nd spray, had difficulty in controlling the high population. By three WAT the counts indicated retreatment was necessary and bronzing was becoming evident. Despite the fact that some of the count data from August did not show statistical differences between the standards and the BAS-300 11 I treatments, there were clear visual differences. The plots of the BAS-300 11 I treatments remained dark green throughout the year, while the standards, and the control, were heavily bronzed (>75%). The application of BAS-300 11 I made on treatments 4 and 5 at the end of the season, essentially eliminated the heavy infestations present at the time of its application. By late August, the populations in the untreated control plots had fallen off and were highly variable. This was likely due to the near total bronzing of the foliage in these plots, and the relative attractiveness of adjacent plots. The untreated control was not included in the analysis of September 8.

Table 1. European red mite: adults and nymphs per 10 leaf sample* : 1, 2 and 3 weeks after treatment of 1st applications.

Treatment	Rate g a.i./ 100 L	ERM-July 14 Adults	ERM-July 14 Nymphs	ERM-July 21 Adults	ERM-July 21 Nymphs	ERM-July 28 Adults	ERM-July 28 Nymphs
1.Control	-	105.0a	123.0a	105.7a	350.8a	343.1a	760.3a
2.BAS-300 11 I	7.2	0.9c	5.2b	1.7c	2.9b	5.7c	3.4c
3.BAS-300 11 I	15.0	3.6bc	2.9b	0.4c	1.1b	1.9c	0.7c
4.KELTHANE;	60.0;	38.7ab	45.6ab	45.1ab	61.9b	83.4b	146.8b
5.OMITE;	72.0;	15.9bc	19.3b	22.4bc	28.6b	53.6b	81.3b

* In each column, means followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test), data square root transformed before Duncan's Multiple Range Test (detransformed data shown).

Table 2. European red mite: adults and nymphs per 10 leaf sample* : 5, 6 and 7 weeks after treatment of 1st applications on treatments 2 and 3; 1, 2 and 3 weeks after treatment of 2nd applications on treatments 4 and 5.

Treatment	Rate g a.i./ 100 L	ERM-Aug. 10 Adults	ERM-Aug. 10 Nymphs	ERM-Aug. 17 Adults	ERM-Aug. 17 Nymphs	ERM-Aug. 23 Adults	ERM-Aug. 23 Nymphs
1.Control	-	293.5a	595.5a	211.9a	396.1a	292.0a	320.0a
2.BAS-300 11 I	7.2	23.0bc	18.3c	1.7c	38.8b	50.1bc	46.6ab
3.BAS-300 11 I	15.0	7.6c	4.3c	0.4c	15.9b	10.7c	14.7b
4.KELTHANE: OMITE;	60.0; 72.0;	45.8b	28.9bc	45.1ab	65.6b	92.3abc	168.4ab
5.OMITE; KELTHANE;	72.0; 60.0;	70.6b	73.3b	22.4bc	83.1b	164.2ab	59.1ab

* In each column, means followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test), data square root transformed before Duncan's Multiple Range Test detransformed data shown).

Table 3. European red mite: adults and nymphs per 10 leaf sample* : effect of the September 1st knock-down treatment of BAS-300 11 I in treatments 4 and 5, and 8 weeks after treatment results in treatments 2 and 3.

Treatment	Rate g a.i./ 100 L	ERM-Aug.31 Adults	ERM-Aug.31 Nymphs	ERM-Sept. 8 Adults	ERM-Sept. 8 Nymphs	% Reduction of Total ERM Life Forms from Aug. 31-Sept.8
1. Control	-	113.8a	86.8a	-	-	-
2. BAS-300 11 I	7.2	45.2a	19.9a	35.5a	33.5a	0.0
3. BAS-300 11 I	15.0	32.7a	6.5a	23.9ab	9.6ab	14.5
4. KELTHANE; OMITE; BAS-300 11 I**	60.0; 72.0; 7.2	109.5a	41.2a	0.9b	0.2b	99.3
5. OMITE; KELTHANE; BAS-300 11 I**	72.0; 60.0; 7.2	139.2a	42.4a	0.0b	0.5b	99.7

* In each column, means followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test), data square root transformed before Duncan's Multiple Range Test (detransformed data shown).

** Knockdown treatments applied September 1, August 31 Count is Pre-Treatment Population, September 8 Count is 1 WAT Population.

#010

ICAR: 91000658

CROP: Apple, cv. McIntosh

PEST: Spotted tentiform leafminer, *Phyllonorycter blancardella* (F.)
European red mite (ERM), *Panonychus ulmi* (Koch)
San Jose scale (SJS), *Aspidiotus perniciosus*

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TITLE: EVALUATION OF ADMIRE (NTN-33893) FOR CONTROL OF EARLY SEASON INSECT PESTS IN APPLES, 1994

MATERIALS: ADMIRE 240 g/L F (NTN-33893)
DECIS 25 g/L EC (Deltamethrin)
GUTHION 50 WP (Azinphos-methyl)

METHODS: Trial was established in a 24-year old block of McIntosh trees on MM-106 rootstock, spaced 1.83 m x 4.45 m, using a R.C.B. design with five-tree plots and four replicates. Applications were made with a diaphragm pump-hand-gun system, operating at 1655 kPa, and were made on a spray to runoff basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis.

TREATMENT DATES: On May 22, with the trees at the full pink stage, the 1st applications were made on treatments 2, 3 and 5. DECIS was the product applied in treatment 5. On June 3, with the trees at calyx, applications were made on treatments 3, 4 and 5. GUTHION was applied in treatment 5. On June 15, 1st Cover applications were made on treatments 3-5. GUTHION was applied in treatment 5.

ASSESSMENTS: All leaves on 120 spurs per plot were examined for the mines of the 1st generation Tentiform Leafminer; 200 fruit per plot were examined for insect injury at harvest.

MAINTENANCE SPRAYS: The entire area received an application of Superior Oil at the pink stage of tree development. Routine sprays of NOVA/DITHANE were used until mid June as the fungicide programme, after which time only Polyram cover sprays were used.

RESULTS: As presented in the table.

DISCUSSION: All treatments provided excellent control of the Spotted Tentiform Leafminer's first generation. All treatments with a calyx application in their schedule had San Jose Scale injury levels that were significantly lower than those in the untreated control. In respect to European Red Mite, no treatments differed significantly from the control; the treatment where GUTHION was involved had the highest population of this pest, and it differed significantly from the treatment where ADMIRE was applied three times.

Treatment	Rate g a.i./ha	TLM MINES /120 SPURS 13/07	ERM MOTILES /LEAF 08/08	SJS INJURY % OF FRUIT 12/09
1. Control	-	54.0a*	1.20ab*	7.52a*
2. ADMIRE;	90	1.3b	0.95ab	4.88ab
3. ADMIRE;	90	1.5b	0.75b	0.74b
ADMIRE;	90			
ADMIRE;	90			
4. ADMIRE;	90	3.3b	1.58ab	1.00b
ADMIRE;	90			
5. DECIS;	12.5	2.8b	2.55a	1.12b
GUTHION;	1125			
GUTHION;	1125			

* Means in same column, followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test).

#011

CROP: Apple, cv. Paulared

PEST: Spotted tentiform leafminer (STLM), *Phyllonorycter blancardella* (Fab)
Foliage inhabiting mites

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TITLE: INTEGRATED PEST MANAGEMENT OF THE TENTIFORM LEAFMINER AND PHYTOPHAGOUS MITES USING CYMBUSH AND PREDATOR RELEASE

MATERIALS: CYMBUSH 12.5 WP (Cypermethrin)
Phytoseiids, *(Amblyseius fallacis*, mass reared)

METHODS: This study aims at establishing a low dose pyrethroid application and field monitoring dependent control strategy for leafminer without destabilizing the mite complex in an apple orchard. The orchard used was a block of 120 trees (approximately 3 m high) consisting of 6 rows of 15-24 trees spaced 10 m between rows and 3 m between trees. The orchard was divided into 12 half row plots of 8-12 trees each. Two plots were sprayed on May 20th, 1994 with CYMBUSH 12.5 WP (800 g/ha, i.e. full recommended dose). Two plots were not treated and served as controls. Four plots received CYMBUSH 12.5 WP at 25% recommended dose (200 g/ha) and four others at 40% recommended dose (320 g/ha) on July 13th 1994. Half of the plots that received 25% or 40% recommended dose were also provided with the release of approximately 2000 specimens of a pyrethroid resistant strain of the predatory mite *Amblyseius fallacis* per plot on July 27th 1994 which were provided by Applied Bionomics of Sydney, British Columbia.

The entire orchard received a spray programme of five applications of MANZATE, and one each of GUTHION, FRUITONE, IMIDAN and Epson salt. CYMBUSH was applied with a hand-gun Rittenhouse sprayer operating at 2700 kPa, all other sprays were applied using a FMC Economist orchard sprayer operating at 2700 kPa. Leaves were sampled biweekly throughout the season (10 leaves per tree), and all mites, leafminer and leafminer parasitoids were counted using a dissecting microscope in the laboratory.

RESULTS: The objective of this experiment was to accept an early season build-up of leafminer during its first generation, and use a low dose application of CYMBUSH against the early second generation to minimize the effect of the pesticide on parasitoids and predatory mites. Any reduction of natural predatory mites would be replaced by the release of industrially reared pyrethroid resistant predatory mites.

The pyrethroid applications were made to coincide with maximal eclosure of the leafminer eggs. This protocol was designed to keep leaf damage to an acceptable level while minimizing the interference in the mite complex.

Tentative results indicate a considerable level of success (see Table 1). The STLM was controlled effectively in all blocks which received CYMBUSH in July, whereas the control plots and those sprayed against the first generation in May resulted in leafminer infestations in the second generations. The natural predatory mites were however severely affected by both the May and July applications of pyrethroid, resulting in a high build up of spider mites (ERM: *Panonychus ulmi* and TSSM: *Tetranychus urticae*) which did not happen in the control plots. The predatory release was only partially successful for two reasons. Firstly the CYMBUSH appeared to have a strong repellent effect, which resulted in most of the mites migrating from the sprayed trees into the control plots. Secondly, the number of released predators was too low to function as an inundative release, and the release was too late in the season to be an effective inoculative release.

CONCLUSIONS:

1. The CYMBUSH recommended dose for control of STLM is too high for second generation control. Adequate control is attained with 25-40% recommended dose.
2. CYMBUSH is much more effective against second generation than first generation STLM.
3. Timing of CYMBUSH application is important and should coincide with maximal egg eclosion.
4. Predatory mites for release should not only be selected for pyrethroid resistance but also to be resistant to the repellent effect of pyrethroids.
5. Further research should use larger blocks to minimize the effect of dispersal.

Table 1. The effect of CYMBUSH application and predator release (P) on the spotted tentiform leafminer (STLM), the predatory mite *A. fallacis,* and the phytophagous mite *P. ulmi*.

Abundance***	Control	Full Dose*	Low Dose** (25%)	Low Dose (25% + P)	Low Dose (40%)	Low Dose (40% + P)
STLM INSTARS 1-3 (July 27)	3.17	3.04	1.00	0.94	1.06	0.98
TOTAL STLM (Sept. 02)	12.26	8.87	8.62	6.59	6.16	4.99
A. fallacis MOTILES (Sept. 02)	3.5	0.87	0.03	0.76	0.02	0.37
P. ulmi (ERM) (Sept. 02)	6.58	11.55	18.3	11.17	20.86	13.25

* Full dose spray - 20 May '94.
** Low dose sprays - 13 July '94.
*** Data represent the number of STLM mines, *A. fallacis* or *P. ulmi* per leaf on the dates indicated.

#012

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. McIntosh

PEST: Winter moth, *Operophtera brumata* (L)

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TITLE: EFFICACY OF CONFIRM 240 F AGAINST WINTER MOTH IN NOVA SCOTIA ORCHARDS

MATERIALS: CONFIRM 240 F, (Tebufenozide)
DIPEL WP, (*Bacillus thuringiensis kurstaki*)
RIPCORD 400 EC, (Cypermethrin)
COMPANION, (spreader/sticker)

METHODS: The test site was a 1.5 ha block of 50-year old apple, cv. McIntosh at Kentville, Nova Scotia. At bud separation (May 18th), blocks of 30 trees each were treated with CONFIRM 240 F at rates of 360, 300, 240 or 180 g a.i./ha, or with DIPEL WP (560 g product) plus RIPCORD 400 EC (12.5 mL product). Pesticides were applied by a Rittenhouse orchard mist sprayer delivering a 5x concentration at a tank pressure of 1380 Kpa. A 0.1% (v/v) COMPANION spreader sticker was tank mixed with each rate of CONFIRM. An additional 30 tree block of the orchard received no insecticide and served as a check.

Pre-treatment counts of winter moth larval abundance were taken by randomly removing four fruit spur clusters from each of four trees in each designated treatment plot. Post-treatment mortality counts from larvae in fruit spur clusters were taken on four occasions, and direct damage to fruit was assessed on June 28th by randomly examining 100 fruit on each of six trees per treatment.

Percent damaged fruit was transformed to arcsin prior to analysis of variance and separation of the means by Tukey's pairwise comparison.

RESULTS: Pre-treatment counts of winter moth larvae ranged from a mean of 1.8 to 4.3 (Table 1) but were not significantly different between treatments. Post-treatment larval survival did not differ between treatments on any of the four sample dates P = 0.05, pooled values are presented in Table 2. Damage to fruit ranged from 0.5% (DIPEL/RIPCORD) to 12.2% (unsprayed control) and all treatments were equally effective in preventing fruit injury. There was no apparent dose response effect of CONFIRM 240 F against winter moth larvae (Tables 2 and 3). We speculate that because of the mode of action for CONFIRM 240 F, larvae remained in spur clusters but ceased to feed on fruit. Cool rainy weather during this period also may have contributed to their persistence.

CONCLUSIONS: A single application of CONFIRM 240 F at rates of 180 - 360 g a.i./ha proved as effective as the current IPM compatible DIPEL/RIPCORD tank mixture and offers an option for product rotation in resistance management in Nova Scotia orchard IPM.

Table 1. Pre-treatment abundance of winter moth larvae in fruit spur clusters.*

Treatment	Rate g a.i./ha	Number of larvae per spur cluster Mean (SE)
Unsprayed check	-	4.3 (1.4)
CONFIRM	360	3.5 (1.2)
CONFIRM	300	3.0 (0.8)
CONFIRM	240	4.3 (0.8)
CONFIRM	180	3.5 (0.7)
DIPEL WP + RIPCORD 400 EC	560 g product 5.2 mL	1.8 (0.9)

* Means are not significantly different P = 0.05, according to Tukey's pairwise comparison.

Table 2. Comparison of post-treatment winter moth survival in plots sprayed with one application of CONFIRM or DIPEL/RIPCORD. Values represent pooled counts for four post-treatment periods.*

Treatment	Rate g a.i./ha	Number of larvae alive per spur cluster Mean (SE)
Unsprayed check	-	10.75 (2.17)
CONFIRM	360	9.50 (2.25)
CONFIRM	300	6.25 (1.31)
CONFIRM	240	7.75 (1.11)
CONFIRM	180	8.00 (0.41)
DIPEL WP +	560 g product	
RIPCORD 400 EC	5.2 mL	4.00 (0.84)

* Means within a column are not significantly different P = 0.05, according to Tukey's pairwise comparison.

Table 3. Comparison of apples protected for winter moth damage by one application of CONFIRM or DIPEL/RIPCORD.*

Treatment	Rate g a.i./ha	Percent fruit damaged
Unsprayed check	-	12.12 (1.25)a
CONFIRM	360	2.67 (0.67)b
CONFIRM	300	2.17 (0.54)b
CONFIRM	240	2.67 (0.61)b
CONFIRM	180	2.00 (0.63)b
DIPEL WP +	560 g product	
RIPCORD 400 EC	5.2 mL	0.50 (0.34)b

* Means within a column sharing a common letter are not significantly different P = 0.05, according to Tukey's pairwise comparison.

#013

CROP: Filbert, cv. Barcelona

PEST: Filbert aphid, *Myzocallis coryli* Goetze

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TITLE: EFFICACY OF DIAZINON FOR CONTROL OF APHIDS ON FILBERTS - 1994

MATERIALS: DIAZINON 500 EC

METHODS: Trial was replicated five times in a randomized complete block design. Each plot consisted of four trees. Diazinon spray was applied on August 30 at 500 g a.i./ha. The sprays were applied with an orchard mist sprayer dilute 1500 L water/ha at a pressure of 690 kPa.

Test 1. Twelve leaves (three per tree) were collected August 26 (pre-spray), August 31 (24 h post-spray), September 1 (48 h post-spray) and September 6 (7 d post-spray). Leaves were placed in sealed containers and frozen. Aphid counts were made October 24-26.

Test 2. Two branches per tree (eight branches per plot) were selected at random. Working from the branch tips the number of leaves out of 25 occupied by aphids was recorded on August 26 (pre-spray), August 31 (24 h post-spray), September 1 (48 h post-spray) and September 6 (7 d post-spray).

RESULTS: As presented in the tables.

CONCLUSIONS: Recording the number of aphids per plot appeared to be the better method for assessment (Table 1). Diazinon reduced aphid populations. Water also reduced aphid populations although not to the same degree as a diazinon spray.

Table 1. Number of aphids per 12 filbert leaves pre- and post-spraying with diazinon or water.

Treatment	Rate a.i./ha	Number of Aphids per Plot			
		Pre-spray	Post-spray		
		Aug. 26	Aug. 31	Sept. 1	Sept. 6
DIAZINON	500 g	813 a	139 c	181 c	404 b
Water	1000 L	754 a	446 b	765 b	790 a
Check	-	753 a	635 a	1076 a	936 a
ANOVA P = <0.05		*	*	*	*

Table 2. Number of filbert leaves occupied by aphids pre-spray and post-spraying with diazinon or water.

Treatment	Rate a.i./ha	Number of Leaves occupied by Aphids/200 Leaves			
		Pre-spray	Post-spray		
		Aug. 26	Aug. 31	Sept. 1	Sept. 6
DIAZINON	500 g	192 a	111 b	52 b	170 a
Water	1000 L	197 a	188 a	185 a	195 a
Check	-	192 a	199 a	197 a	198 a
ANOVA P = <0.05		*	*	*	*

* Figures are the means of five replications. Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05)

#014

STUDY DATA BASE: 390-1252-9201

CROP: Raspberry, *Rubus idaeus* L, cv. Willamette

PEST: Twospotted spider mite, *Tetranychus urticae* (Koch)

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TITLE: EFFICACY OF APOLLO FOR CONTROL OF TWOSPOTTED SPIDER MITE ON RASPBERRY

MATERIALS: APOLLO, (Clofentezine, 454 g/946 mL)

METHODS: The trial was conducted at Abbotsford, British Columbia in an established commercial raspberry farm. There was a natural infestation of twospotted spider mites. Treatment plots were 3 m x 5 m, replicated four times in a randomized complete block design. Each treated row was separated by a barrier row. Treatments were applied on August 4, 1993 using a back-pack sprayer. At that time, the fruit harvest had just been completed and the foliage canopy was dense, with both fruiting canes and primocanes covered in leaves. The spray mixture was applied in 1200 mL water per plot. On November 1, 1993, 20 leaves per plot were collected and mite eggs, nymphs and adults were counted. The data were analyzed by ANOVA followed by Duncan's Multiple Range Test.

RESULTS: The treatment application resulted in a significant decrease in the mean number of nymphs. The numbers of eggs and adults tended to be lower in APOLLO treated plots, but this difference was not significant.

CONCLUSIONS: APOLLO effectively reduced the mean number of mite nymphs in an established raspberry planting.

Table 1. Mean counts per leaf on November 1, 1993.

Treatment	Rate a.i./ha	Eggs*	Nymphs	Adults
Check	---	4.0a	39.1a	4.3a
APOLLO	0.25 kg	1.2a	11.7b	1.2a

* Means are calculated from four replications. Numbers in each column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P = <0.05).

#015

ICAR-ID: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* cv. Pembina, Smoky, Northline, Honeywood

PEST: Woolly elm aphid, *Eriosoma americanum* (Riley)

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TITLE: EVALUATION OF PRODUCTS FOR CONTROL OF WOOLLY ELM APHID ON SASKATOON PLANTS

MATERIALS: BASUDIN 23FM (Diazinon)
BAYGON 18EC (Propoxur)
CYGON 480EC (Dimethoate)
DECIS 5EC (Deltamethrin)
DI-SYSTON 65EC (Disulfoton)
DURSBAN TURF 48EC (Chlorpyrifos)
IVORY LIQUID; SUNLIGHT DISHWASHING LIQUID
MALATHION 50EC (Malathion)
SEVIN XLR PLUS 48LS (Carbaryl)

METHODS: The woolly elm aphid spends part of its life cycle on the roots of saskatoon. Establishment of saskatoon plantings can be difficult due to damage caused by this aphid. In an attempt to control this pest, various products were tested as root drenches on saskatoon plants in three locations in Saskatchewan. The U-pick orchards were located at Saskatoon, Moosomin and D'Arcy. At each location, rows were spaced 2.5 m apart, and plants within the row were 1.0 m apart, except at D'Arcy which had a between plant spacing of 0.75 m. Plants at Saskatoon were four-year old 'Pembina'. At Moosomin 10 replications were two-year old 'Smoky' and five replications were three-year old 'Northline'. At D'Arcy, three-year old 'Honeywood' were used. Nine treatments (Table 2) and a water control were tested at each site in a randomized complete block design with single plant plots. Twelve replications were used at Saskatoon and D'Arcy whereas 15 replications were used at Moosomin. Treatments were applied through a system that duplicated a drip irrigation system. The apparatus consisted of a 20 L pail placed on a 33 cm x 33 cm x 28 cm frame. An emitter in the bottom of the pail allowed the solution to flow at a rate of 10 L/h through a spaghetti line to the base of a single plant. Dikes of soil were formed around each seedling to hold the solution and allow for soil saturation. Treatments were applied after fruit harvest was complete. Treatments at Saskatoon, Moosomin and D'Arcy were applied on August 16, July 26 and August 3, respectively. A visual phytotoxicity rating was conducted using a scale of 0-6 (Table 1). Phytotoxicity damage was assessed by noting the percentage of leaves that showed interveinal yellowing or browning. Phytotoxicity ratings were taken at Saskatoon, Moosomin and D'Arcy on August 16, August 8 and August 15, respectively. Aphid infestation ratings were conducted at Saskatoon, Moosomin and D'Arcy on August 30, August 23 and August 31, respectively. Aphid infestation ratings were conducted by examining half the roots of each plant. A 15 cm deep trench was dug in a semicircle approximately 30 cm away from each plant. The soil around the roots was carefully removed to expose aphid colonies. Only the roots within a 20 cm radius of the main shoots were assessed. An aphid infestation rating scale of 0-5 was used (Table 1). A square root (x + 0.5) transformation was conducted on the phytotoxicity and aphid infestation ratings prior to analysis of variance with means separated by the Student-Newman-Keul test.

RESULTS: Mid and high rates of CYGON caused significant phytotoxic damage to saskatoon at least one site but the low rate of CYGON did not produce significant damage (Table 2). DI-SYSTON and the high rate of MALATHION did cause statistically significant phytotoxic damage at one site, but the level of damage was less than CYGON and probably not economically significant. None of the remaining treatments caused significant phytotoxic damage at any of the sites.

DI-SYSTON caused significant reductions in aphid infestation ratings at all three sites (Table 3). The high rate of CYGON caused significant reductions in the aphid rating at the one site it was tested. The mid rate of CYGON reduced aphid ratings at one of three sites and the low rate of CYGON reduced aphid ratings at the one site it was evaluated. The low rate of MALATHION significantly reduced aphid ratings at the one site it was evaluated. BAYGON, SEVIN, DURSBAN, BASUDIN and the high rate of MALATHION significantly reduced aphid infestation ratings at one of two sites evaluated. DECIS, IVORY LIQUID SOAP, and SUNLIGHT DETERGENT did not cause significant reductions in aphid infestation ratings at any of the sites. Overall treatments showed the most affect on aphid infestation ratings at the Moosomin site and the least affect at the D'Arcy site.

CONCLUSIONS: The mid to high rates of CYGON caused the most phytotoxic damage and should be eliminated as potential woolly elm aphid control products. The low rate of CYGON gave some aphid control and did not cause significant phytotoxic damage and therefore should be evaluated further. DI-SYSTON gave the most consistent and effective control, however slight phytotoxic damage was noted. DI-SYSTON should be evaluated again since the phytotoxic damage was not considered to be economically significant. BASUDIN, BAYGON, DURSBAN TURF, MALATHION and SEVIN XLR PLUS gave inconsistent results in regards to aphid control but should be tested further since most were not phytotoxic and have the advantage of a lower mammalian toxicity than DI-SYSTON. DECIS, IVORY SOAP and SUNLIGHT DETERGENT should be eliminated as control products for woolly elm aphid because of poor control ratings. The reasons for the variation in control between sites is not know, but it may be due to different application dates, plant ages, soil types or cultivars. These variables should be examined in future studies.

Table 1. Phytotoxicity and aphid infestation ratings used for evaluation of products on saskatoon plants.

Phytotoxicity Rating	Phytotoxicity rating* (% of leaves damaged)	Aphid Rating	Aphid rating (cm of aphid infested roots) Saskatoon	Moosomin	D'Arcy
0	0	0	0	0	0
1	1- 5	1	<4	<2	<2
2	6- 10	2	4- 8	2- 4	2- 4
3	11- 30	3	8-12	4- 7	4- 7
4	31- 50	4	12-16	7-10	7-10
5	51- 70	5	>16	>10	>10
6	71-100	-	-	-	-

* Yellowing or browning of the interveinal portion of the leaves used as an indication of phytotoxic damage.

Table 2. Phytotoxicity ratings for products evaluated for control of woolly elm aphid on saskatoon roots at three locations in Saskatchewan.

Treatment	Rate (mL product/L)	Phytotoxicity rating*,** Saskatoon	Moosomin	D'Arcy
BASUDIN 23FM	2.70	0.9a	0.7cde	-
BAYGON 18EC	1.00	0.6ab	-	0.9ab
CYGON 480EC	0.075	1.0a	-	1.1ab
CYGON 480EC	0.125	0.9ab	3.1b	1.4a
CYGON 480EC	0.625	-	5.2a	-
DECIS 5EC	0.15	0.2b	-	0.5b
DI-SYSTON 65EC	0.50	1.0a	0.9cd	0.8ab
DURSBAN TURF 48EC	0.375	0.5ab	-	0.7ab
IVORY LIQUID SOAP	5.00	0.4ab	0.5cde	0.5b
MALATHION 50EC	1.00	-	0.5cde	-
MALATHION 50EC	2.00	-	1.0c	0.5b
SEVIN XLR PLUS 48LS	2.50	0.6ab	0.9cde	-
SUNLIGHT DETERGENT	4.00	-	0.4de	0.5b
WATER CONTROL	-	0.3ab	0.3e	0.3b

* See Table 1 for explanation of phytotoxicity ratings.
** Means in same column followed by same letter not significantly different at 5% level according to the Student-Newman-Keul test.

Table 3. Aphid infestation ratings for products evaluated for control of woolly elm aphid on saskatoon roots at three locations in Saskatchewan.

Treatment	Rate (mL product/L)	Aphid infestation rating*,** Saskatoon	Moosomin	D'Arcy
BASUDIN 23FM	2.70	2.4ab	2.1b	-
BAYGON 18EC	1.00	1.0b	-	2.3ab
CYGON 480EC	0.075	1.1b	-	2.0ab
CYGON 480EC	0.125	1.4ab	0.5de	1.8ab
CYGON 480EC	0.625	-	0.0e	-
DECIS 5EC	0.15	2.4ab	-	3.7a
DI-SYSTON 65EC	0.50	0.5b	0.9cde	1.2b
DURSBAN TURF 48EC	0.375	1.6ab	-	2.9ab
IVORY LIQUID SOAP	5.00	3.3a	3.7a	2.6ab
MALATHION 50EC	1.00	-	2.3b	-
MALATHION 50EC	2.00	-	1.3bcd	2.3ab
SEVIN XLR PLUS 48LS	2.50	2.3ab	1.5bc	-
SUNLIGHT DETERGENT	4.00	-	4.2a	3.3ab
WATER CONTROL	-	3.5a	4.6a	4.3a

* See Table 1 for explanation of aphid infestation ratings. Note: a different scale used for Saskatoon than Moosomin and D'Arcy.
** Means in same column followed by same letter not significantly different at 5% level according to the Student-Newman-Keul test.

#016

STUDY DATA BASE: 390-1252-9201

CROP: Strawberry, *Fragaria x ananassa*, cv. Totem

PEST: Twospotted spider mite, *Tetranychus urticae* (Koch)

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TITLE: EFFICACY OF APOLLO FOR CONTROL OF TWOSPOTTED SPIDER MITE ON STRAWBERRY

MATERIALS: APOLLO, (Clofentezine, 454 g/946 mL)

METHODS: The trial was conducted at the Pacific Agriculture Research Centre, Agassiz, British Columbia, on an established Totem strawberry planting. Treatments were applied to 1 m x 5 m plots replicated four times in a randomized complete block design. There was a small natural infestation of twospotted spider mite which was supplemented by infested leaf pieces being scattered throughout the plots. Treatments were applied July 12, 1994 with a back-pack sprayer using 250 mL of water per plot. The berry harvest was finished and there was a dense canopy of leaves on the plants. Counts were taken from 20 leaves per plot on July 26, 1994 for mite eggs, nymphs and adults. The data were analyzed by ANOVA followed by Duncan's Multiple Range Test.

RESULTS: The treatment application resulted in a significant decrease in the nymph counts. The number of eggs and adults tended to be lower in APOLLO treated plots, but this difference was not significant.

CONCLUSIONS: APOLLO reduced the mean number of twospotted spider mite nymphs in an established strawberry planting.

Table 1. Mean counts per leaf on July 26, 1994.

Treatment	Rate a.i./ha	Eggs*	Nymphs	Adults
Check	---	37.9a	9.2a	7.2a
APOLLO	0.25 kg	1.2a	0.8b	1.2a

* Means are calculated from four replications. Numbers in each column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P = <0.05).

SECTION E

INSECTS OF VEGETABLE AND SPECIAL CROPS /

INSECTES DES LÉGUMES ET CULTURES SPÉCIALES

Section Editors / Réviseurs de section : J.G. Stewart, J.H. Tolman

#017 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR-ID: 61006538

CROP: Bean, white bean (navy)

PEST: Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: VALIDATION OF DAMAGE THRESHOLD FOR POTATO LEAFHOPPERS IN COMMERCIAL WHITE (NAVY) BEAN FIELDS

MATERIALS: CYGON 480E (Dimethoate)

METHODS: The purpose of this study was to test, in commercial fields, a nominal decision threshold of one nymph per trifoliate which was developed at Ridgetown over the last six years using small plots. Seven commercial fields of navy beans, all >4 ha, that growers decided to spray were monitored for potato leafhopper populations and yield in 1994. Growers decided to spray based on nymph counts done by a pest management scout. A minimum counting procedure involved sampling 10 leaflets of similar age from the centre area of the canopy replicated in 10 representative areas in the field. In larger fields we used a simple sequential sampling plan which is available upon request. Fields were sprayed with CYGON 480E at 1.0 L/ha in approximately 95-190 L/ha water with an overhead hydraulic field-sprayer. Field information is detailed in Table 1. A non-treated strip (one sprayer-boom width or 18 m) at least 30 m long was left in the field. Shortly after spraying, nymph populations were estimated in 10 areas of the non-treated strip and 10 corresponding adjacent areas in the treated field. These areas were tagged. Yield samples were taken out of these 10 tagged areas by hand when the beans were mature from plots 2 or 4 rows x 2 m. The samples were threshed in a stationary thresher and yields were corrected to 18% moisture. Yields from each location were compared using a paired t-test.

RESULTS: While six of the seven locations experienced an increase in yield in response to a foliar spray with CYGON 480E, the response was significantly greater at only four locations (P <0.1) (Table 2). A yield increase was obtained with counts as low as 0.5 nymphs per trifoliate (Table 2).

CONCLUSIONS: Application of a nominal threshold of one nymph per trifoliate during vegetative growth appears to adequately protect yield of navy beans.

Table 1. Information for commercial navy bean fields which were sprayed for potato leafhopper control using nymph counts as a decision threshold.

Grower	Location	Cultivar	Spray Date	Crop Stage When Sprayed	Post-Spray Count Date
Walls	Denfield	Stinger	16 July	10 trifoliate	24 July
Miller	Zurich	Vista	5 July	5 trifoliate	20 July
Welsch	Clinton	Stinger	11 July	8 trifoliate	26 July
Trick	Clinton	Stinger	11 July	9 trifoliate	26 July
Eckert	Seaforth	Stinger	18 July	early bloom	26 July
Consitt	Varna	Stinger	16 July	10 trifoliate	20 July
Rau	Zurich	ExRico	4 July	2 trifoliate	21 July

Table 2. Validation of damage threshold for potato leafhoppers in commercial navy bean fields using leaflets as the sampling unit to count nymphs, 1994.

Grower	Location	Pre-spray Counts*	Post-spray Counts (T)**	Post-spray Counts (NT)	Yield (T) (T/ha)	Yield (NT) (T/ha)
Walls	Denfield	1.2	0.0	2.0	3.295	3.272 ns***
Miller	Zurich	3.6	0.4	7.1	1.946	1.800 ns
Welsch	Clinton	0.5	0.0	0.0	2.444	2.122(P=0.09)
Trick	Clinton	1.3	0.0	0.1	2.722	2.860 ns
Eckert	Seaforth	1.1	0.0	0.3	1.788	1.584(P<0.01)
Consitt	Varna	2.0	0.0	1.5	2.235	1.990(P=0.01)
Rau	Zurich	3.2	0.0	3.5	3.147	2.827(P=0.03)
Mean					2.511	2.351(P<0.01)

* Nymphs per trifoliate.
** (T) treated, (NT) non-treated control plot.
*** Paired T-test (P = <0.1).

#018

ICAR-ID: 61002030

CROP: Bean, white, cv. ExRico

PEST: Seedcorn maggot, *Delia platura* (Meigen)
Anthracnose, *Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib.

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TITLE: EFFECT OF DCT SEED TREATMENTS IN COMBINATION WITH INSECTICIDE SEED TREATMENTS ON EMERGENCE OF WHITE BEAN - GREENHOUSE TEST

MATERIALS: AGROX B-3 = (B3) (Diazinon 11% + Lindane 16.6% + Captan 33.5%)
AGROX D-L PLUS = (DLP) (Diazinon 15% + Lindane 25% + Captan 15%)
DCT (Diazinon 6% + Captan 18% + Thiophanate-methyl 14%)

METHODS: DCT is used for seedcorn maggot and anthracnose control. This study was done to determine the phytotoxicity of seed treatments in combination with DCT. DCT was applied 1 d before planting (7 March 1994) as a slurry (52 g/100 mL). Other treatments were applied on the day of planting (8 March 1994) as dry treatments. Seed treatments were applied to 500 g lots of seeds and treatments were mixed in a plastic bag until seeds were thoroughly and evenly covered. Thirty seeds were planted in a 15 cm aluminum pie plate, containing non-pasteurized loam field soil. The plates were watered as required with a fine mist to avoid crusting. There were five replicates for each treatment and these were completely randomized on the greenhouse bench. The greenhouse was kept at 19°C day and 16°C night temperature. On 23 March emergence and vigour were evaluated. Emergence was a count of seedlings emerged from the 30 seeds planted. Vigour of plants was ranked using five categories: 0 - not emerged; 1 - hypocotyl hook showing; 2-hypocotyl and cotyledons emerged but still hooked; 3 - cotyledons open, first leaf showing; 4 - first true leaf expanded. Emergence was adjusted by summing the products of the number of seedlings in each category over the maximum score (4 x 30 or 120). Data were transformed by the arcsine before analysis and de-transformed before reporting results.

RESULTS: As presented in the table.

CONCLUSIONS: No phytotoxicity was evident when DCT was applied in combination with B3. Poor emergence was a result of the lack of fungicide rather than evidence of phytotoxicity.

Table 1. Effect of DCT seed treatments in combination with insecticide seed treatments on emergence of white bean (greenhouse test) at Ridgetown, Ontario, 1993.

Treatment	Rate	Percent Emergence	Adjusted Percent Emergence
Control		40 bc*	24 b
DCT	5.2 g/kg seed	76 ab	66 a
DCT	5.2 g/kg seed	50 abc	39 ab
DLP	2.6 g/kg seed		
DCT	5.2 g/kg seed	75 ab	62 ab
B3	3.2 g/kg seed		
DLP	2.6 g/kg seed	35 c	29 ab
B3	3.2 g/kg seed	79 a	70 a
CV % =		30.8	38.5

* Means followed by the same letter are not significantly different at the 5% level (Duncan's Multiple Range Test).

#019

ICAR-ID: 61002030

CROP: Bean, white, cv. ExRico

PEST: Seedcorn maggot, *Delia platura* (Meigen)

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TITLE: EFFECT OF SEED TREATMENT COMBINATIONS AND DIFFERENT TREATMENT TIMES ON EMERGENCE OF WHITE BEAN

MATERIALS: AGROX B-3 = (B3) (Diazinon 11% + Lindane 16.6% + Captan 33.5%)
AGROX D-L PLUS = (DLP) (Diazinon 15% + Lindane 25% + Captan 15%)
ANCHOR = (ANC) (Carbathiin 66.7 g/L + Thiram 66.7 g/L)
DCT = (Diazinon 6% + Captan 18% + Thiophanate-methyl 14%)
VITAFLO 280 = (VIT) (Carbathiin 14.9% + Thiram 13.2%)
Note, abbreviations are used in the tables.

METHODS: The crop was planted with a John Deere Max-emerge planter which was fitted with a cone seeder, on 20 May, 1994 at Ridgetown, Ontario on a gravelly-loam soil in 8 m rows spaced 0.76 m apart at 100 seeds per plot. Plots were single rows, arranged in a randomized complete block design with four replications. Seeds were treated in 500 g lots and tumbled in a plastic bag until uniformly covered. Slurries were made by adding 52 g product to 100 mL water. Long-term storage of pre-treated seeds was at room temperature in open plastic bags for 10 weeks before planting. Non-stored pre-plant treatment were applied 2 d before planting. Drill box treatments were applied 1 d before planting. Percent emergence was calculated by counting all the plants emerged per plot at the first leaf stage (7 June) and relating that number to the total number of seeds planted. Shortly after emergence was counted, plants were cut at the soil line and total fresh weight was measured for each plot.

RESULTS: As presented in the tables.

CONCLUSIONS: All seed treatments, except for B3 applied 10 months before planting, resulted in significantly higher emergence than the non-treated control (Table 1). Storing seeds treated with DCT alone or in combination with DLP or B3 resulted in similar emergence (Table 2). Long-term storage of seeds treated with DLP or B3 alone tended to result in reduced emergence (Table 2). Long-term storage of seeds treated with DCT in combination with DLP or B3 resulted in larger plants by comparison with the same treatments applied near planting time (Table 2). Emergence and plant size were similar in response to DLP or B3 seed treatments applied as a dry drill box treatment or as a slurry (Table 3).

Table 1. Emergence of white bean with insecticide and fungicide seed treatment combinations, Ridgetown, Ontario, 1994.

Treatment		Application Rate*	Application method and timing**	Percent Plant Emergence***	Fresh weight (g/plot)	Mean fresh weight (g/plant)
1	DCT	5.2	ST PT	68 a-e****	91.3 a-e	1.36 ab
2	DCT + DLP	5.2, 2.6	ST PT, ST PT	75 a-d	106.0 ab	1.42 a
3	DCT + B3	5.2, 3.2	ST PT, ST PT	76 a-d	95.8 a-e	1.26 abc
4	DCT + DLP	5.2, 2.6	ST PT, DB	75 a-d	92.3 a-e	1.22 a-d
5	DCT + B3	5.2, 3.2	ST PT, DB	78 ab	89.3 a-e	1.17 a-d
6	DCT	5.2	NS PT	72 a-e	93.5 a-e	1.32 ab
7	DCT + DLP	5.2, 2.6	NS PT, DB	78 abc	81.3 b-e	1.06 cd
8	DCT + B3	5.2, 3.2	NS PT, DB	76 a-d	80.0 cde	1.06 cd
9	DLP	2.6	ST PT	65 b-e	82.8 a-e	1.28 abc
10	B3	3.2	ST PT	58 ef	83.0 a-e	1.41 a
11	DLP	2.6	DB	75 a-d	100.3 a-d	1.35 ab
12	B3	3.2	DB	78 abc	107.3 a	1.36 ab
13	ANC	6.0	DB	63 cde	82.8 a-e	1.36 ab
14	VIT	2.6	NS PT	62 de	79.8 de	1.36 ab
15	ANC + DLP (DR)	6.0, 2.6	DB , DB	73 a-d	82.5 a-e	1.12 bcd
16	ANC + B3	6.0, 3.2	DB , DB	76 a-d	74.8 ef	0.97 d
17	ANC + DLP (SL)	6.0, 2.6	DB , DB	78 ab	89.8 a-e	1.17 a-d
18	ANC + B3 (SL)	6.0, 3.2	DB , DB	75 a-d	83.3 a-e	1.11 bcd
19	VIT + DLP (DR)	2.6, 2.6	NS PT, DB	75 a-d	89.5 a-e	1.21 a-d
20	VIT + B3 (DR)	2.6, 3.2	NS PT, DB	81 a	105.3 abc	1.29 abc
21	VIT + DLP (SL)	2.6, 2.6	NS PT TOG	75 a-d	96.5 a-e	1.28 abc
22	VIT + B3 (SL)	2.6, 3.2	NS PT TOG	76 a-d	90.3 a-e	1.20 a-d
23	CONTROL			45 f	56.3 f	1.31 abc
CV	% =			9.3	16.6	12.2

* Seed treatments applied at g or mL product/kg seed.

* Pre-treated (PT) = treated ≥2 d before planting, drill box treatments (DB) = applied 1 d before planting, ST = stored treated for 10 weeks, non-stored (NS) = treated 2 d before planting, slurry (SL) = 50 g dry formulation in 100 mL water, dry (DR) = seed tumbled with dry powder formulation, treated together (TOG) = applied at the same time and tumbled together.

*** 100 seeds planted per plot.

**** Means followed by the same letter are not significantly different at the 5% level (Duncan's Multiple Range Test). Emergence data were transformed by ARCSIN(SQR(%)) before ANOVA and mean separation. Plant weights were not transformed and emergence means were un-transformed before reporting.

Table 2. Effect of seed treatment combinations after long-term seed storage on emergence of white bean in the field under cool conditions, Ridgetown, Ontario, 1994.

Treatment	Application Rate*	Application method and timing**	Percent Plant Emergence***	Fresh weight (g/plot)	Mean fresh weight (g/plant)
DCT	5.2	ST PT	68 abc****	91.3 abc	1.36 ab
DCT	5.2	NS PT	72 ab	93.5 abc	1.32 ab
DCT	5.2	ST PT	75 ab	106.0 ab	1.42 a
DLP	2.6	ST PT			
DCT	5.2	NS PT	78 a	81.3 c	1.06 c
DLP	2.6	DB			
DCT	5.2	ST PT	76 ab	95.8 abc	1.26 abc
B3	3.2	ST PT			
DCT	5.2	NS PT	76 ab	80.0 c	1.06 c
B3	3.2	DB			
DCT	5.2	ST PT	75 ab	92.3 abc	1.22 abc
DLP	2.6	DB			
DCT	5.2	ST PT	78 a	89.3 abc	1.17 bc
B3	3.2	DB			
DLP	2.6	ST PT	65 bc	82.8 bc	1.28 ab
DLP	2.6	DB	75 ab	100.3 abc	1.35 ab
B3	3.2	ST PT	58 c	83.0 bc	1.41 a
B3	3.2	DB	78 a	107.3 a	1.36 ab
CV %	=		8.3	15.8	10.5

* Seed treatments applied at g or mL product/kg seed.

** Pre-treated (PT) = treated ≥2 d before planting, drill box treatments (DB) = applied 1 d before planting, ST = stored treated for 10 weeks, non-stored (NS) = treated 2 d before planting.

*** 100 seeds planted per plot.

**** Means followed by the same letter are not significantly different at the 5% level (Duncan's Multiple Range Test). Emergence data were transformed by ARCSIN(SQR(%)) before ANOVA and mean separation. Plant weights were not transformed and emergence means were untransformed before reporting.

Table 3. Effect of applying insecticide seed treatments as a slurry on emergence of white bean in the field under cool conditions. Ridgetown, Ontario, 1994.

Treatment	Application Rate*	Application method and timing**	Percent Plant Emergence***	Fresh weight (g/plot)	Mean fresh weight (g/plant)
ANC	6.0	DB	73 a	82.5 a	1.12 a
DLP (DR)	2.6				
ANC	6.0	DB	78 a	89.8 a	1.17 a
DLP (SL)	2.6				
ANC	6.0	DB	76 a	74.8 a	0.97 a
B3 (DR)	3.2				
ANC	6.0	DB	75 a	83.3 a	1.11 a
B3 (SL)	3.2				
CV % =			8.2	12.1	13.0

* Seed treatments applied at g or mL product/kg seed.
** Drill box treatments (DB) = applied 1 d before planting, slurry (SL) = 50 g dry formulation in 100 mL water, dry (DR) = seed tumbled with dry powder formulation.
*** 100 seeds planted per plot.
**** Means followed by the same letter are not significantly different at the 5% level (Duncan's Multiple Range Test). Emergence data were transformed by ARCSIN(SQR(%)) before ANOVA and mean separation. Plant weights were not transformed and emergence means were untransformed before reporting.

#020

ICAR-ID: 61002030

CROP: Bean, white, cv. ExRico

PEST: Seedcorn maggot, *Delia platura* (Meigen)

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TITLE: INSECTICIDES FOR THE CONTROL OF SEEDCORN MAGGOT (SCM) IN WHITE BEANS

MATERIALS: ADMIRE 240FS (Imadacloprid)
AGROX B-3 (Diazinon 11% + Lindane 16.6% + Captan 33.5%)
AGROX D-L PLUS (Diazinon 15% + Lindane 25% + Captan 15%)
DCT (Diazinon 6% + Captan 18% + Thiophanate-methyl 14%)
DI-SYSTON 8E (Disulfoton)
FORCE 50EC, FORCE 20SC (Tefluthrin)
FURADAN 480F (Carbofuran)
LORSBAN 4E; UBI-2679 ST (Chlorpyrifos)
VITAFLO 280 (Carbathiin 14.9% + Thiram 13.2%)
UBI-2679

METHODS: The crop was planted on 12 May, 1994, at Ridgetown, Ontario using a John Deere Max-emerge planter, which was fitted with a cone seeder, on a sandy-loam soil near a manure pit, in 8 m rows spaced 0.76 m apart at 100 seeds per plot. Plots were single rows, arranged in a randomized complete block design with four replications. Liquid cattle manure was disced in 4 weeks prior to planting. Plots were planted when adults were numerous (monitored by yellow sticky cards). In-furrow applications were sprayed directly into the seed furrow at planting at a rate of 240 L/ha spray solution. Seeds were treated in 500 g lots and tumbled in a plastic bag until uniformly covered. Percent emergence was calculated by counting all the plants emerged per plot at the first leaf stage (30 May) and relating that number to the total number of seeds planted. Percent injury was calculated the following day as the ratio of the number of seedlings showing maggot injury relative to the number of seedlings dug up in a 2 m section of row. Non-emerged seeds per seedlings were included in this calculation.

RESULTS: Results are presented in the table. Emergence data were confounded by the presence of root-rot organisms (*Rhizoctonia\Fusarium*). Therefore plots that were not protected by a fungicide were not included in the analysis of seedcorn maggot injury.

CONCLUSIONS: The best emergence was obtained in the presence of a seed treatment fungicide in combination with seed treatments of diazinon alone or in combination with lindane. When only plots receiving a fungicide seed treatment were considered, DCT applied alone resulted in similar SCM infestation to that obtained with VITAFLO fungicide alone. DCT plus AGROX D-L PLUS seed treatment or ADMIRE 240FS in-furrow spray, and VITAFLO 280 plus AGROX B-3 seed treatments resulted in the lowest infestations of SCM.

Table 1. Emergence of white bean and control of seedcorn maggot with insecticide and fungicide seed treatment combinations, at Ridgetown, Ontario, 1994.

Treatment	Application Rate*	Application Method	% Plant Emergence**	SCM % Plants Infest.***
1 DCT	5.2	ST	60 abc****	43 abc
2 DCT + AGROX D-L PLUS	5.2, 2.2	ST	69 ab	20 d
3 DCT + AGROX B-3	5.2, 3.2	ST	68 ab	30 a-d
4 DCT + LORSBAN 480EC	5.2, 10.0	ST, IFS	46 cd	37 a-d
5 DCT + LORSBAN 480EC	5.2, 20.0	ST, IFS	57 a-d	28 a-d
6 DCT + FURADAN 480F	5.2, 10.0	ST, IFS	56 a-d	38 a-d
7 DCT + FURADAN 480F	5.2, 20.0	ST, IFS	55 a-d	27 a-d
8 DCT + DI-SYSTON 8E (720)	5.2, 5.0	ST, IFS	63 ab	37 a-d
9 DCT + DI-SYSTON 8E (720)	5.2, 10.0	ST, IFS	53 bcd	36 a-d
10 DCT + UBI-2679	5.2, 3.6	ST	65 ab	40 a-d
11 DCT + FORCE ST 20SC	5.2, 3.0	ST	56 a-d	33 a-d
12 DCT + FORCE 50EC	5.2, 22.6	ST, IFS	60 abc	35 a-d
13 DCT + ADMIRE 240FS	5.2, 2.0	ST, IFS	63 ab	20 cd
14 VITAFLO 280	2.6	ST	63 ab	49 a
15 VITAFLO 280 + AGROX DL PLUS	2.6, 2.6	ST	70 a	37 a-d
16 VITAFLO 280 + AGROX B-3	2.6, 3.2	ST	69 ab	23 bcd
17 VITAFLO 280 + UBI-2679	2.6, 3.6	ST	66 ab	43 abc
18 VITAFLO 280 + FORCE ST 20SC	2.6, 3.0	ST	66 ab	39 a-d
19 VITAFLO 280 + ADMIRE 240FS	2.6, 2.0	ST,IFS	57 a-d	46 ab
20 AGROX DL PLUS	2.2	ST	43 d	not included
21 AGROX B-3	3.2	ST	62 abc	30 a-d
22 UBI-2679	3.6	ST	11 f	not included
23 FORCE ST 20SC	3.0	ST	13 f	not included
24 CONTROL			27 e	not included
CV =			12.0	23.6

* Seed treatments (ST) applied as g or mL product/kg seed;
In-furrow sprays (IFS) applied as mL product/100 m row.

** 100 seeds planted per plot.

*** Number of seeds per seedlings infested by seedcorn maggot in one 2 m strip.

**** Means followed by the same letter are not significantly different at the 5% level (Duncan's Multiple Range Test). Data were transformed by ARCSIN(SQR(%)) before ANOVA and mean separation. Reported means were untransformed.

#021

ICAR-ID: 61002030

CROP: Bean, white kidney

PEST: Seedcorn maggot, *Delia platura* (Meigen)
Anthracnose, *Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib.

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TITLE: EFFECT OF DCT SEED TREATMENTS IN COMBINATION WITH INSECTICIDE SEED TREATMENTS ON EMERGENCE OF WHITE KIDNEY BEAN - GREENHOUSE AND FIELD TESTS

MATERIALS: AGROX B-3 (Diazinon 11% + Lindane 16.6% + Captan 33.5%)
AGROX D-L PLUS (Diazinon 15% + Lindane 25% + Captan 15%)
DCT (Diazinon 6% + Captan 18% + Thiophanate-methyl 14%)

METHODS: DCT is mainly applied to control anthracnose and seedcorn maggots. The purpose of these experiments was to determine the safety of seed treatment combinations with DCT to bean seedlings. DCT was applied 1 d before planting as a slurry (52 g/100 mL). Other treatments were applied on the day of planting as dry treatments. Seed treatments were applied to 500 g lots of seeds and were mixed in a plastic bag until seeds were thoroughly and evenly covered. For greenhouse studies, 30 seeds were planted in 15 cm aluminum pie plates, containing non-pasteurized loam field soil. The plates were watered as required with a fine mist to avoid crusting. There were five replicates for each treatment and these were completely randomized on the greenhouse bench. The greenhouse was kept at 19°C day and 16°C night temperature. There were two seedings in the greenhouse (14 and May) of five replicates each. For field studies a similar experiment was planted in a sandy-loam soil with 30 seeds in 1 m plots spaced 0.65 m apart with four replications in a randomized complete block design. Emergence and vigour were evaluated on 24 and 26 May for the greenhouse and on 31 May for the field experiments. Emergence was a count of seedlings emerged from 30 seeds planted expressed as a percentage. Vigour took into account the development of each seedling. Plants were ranked into five categories: 0 - not emerged, 1 - hypocotyl hook showing, 2 - hypocotyl and cotyledons emerged but still hooked, 3 - cotyledons open, first leaf showing, 4 - first true leaf expanded. Emergence was adjusted by summing the products of the number of seedlings in each category over the maximum score (4 x 30 or 120). Data were transformed by the arcsine before analysis and de-transformed before reporting results.

RESULTS: As presented in the table. In the field trial poor emergence in seed not protected by a fungicide was a result of seedling blights (*Fusarium/Rhizoctonia*). There was also some seedcorn maggot injury evident.

CONCLUSIONS: No phytotoxicity was evident in white kidney beans when DCT was applied in combination with B3 or D-L PLUS. Poor emergence was a result of the lack of fungicide or insecticide protection rather than evidence of phytotoxicity.

Table 1. Effect of DCT seed treatments in combination with insecticide seed treatments on emergence of white kidney beans at Ridgetown, Ontario, 1994.

	Rate (g/kg)	Greenhouse Percent Emergence	Greenhouse Adjusted Emergence	Field Percent Emergence	Field Adjusted Emergence
Control		94 a*	80 a	70 c	65 b
DCT	5.2	92 a	79 a	86 b	82 a
DCT + AGROX D-L PLUS	5.2 + 2.2	93 a	63 a	96 a	94 a
DCT + AGROX B-3	5.2 + 3.2	89 a	61 a	88 ab	85 a
CV % =		12.7	15.5	8.3	9.2

* Means followed by the same letter are not significantly different at the 5% level (Duncan's Multiple Range Test).

#022

STUDY DATA BASE: 306-1252-9016

CROP: Cabbage, cv. Stonehead

PEST: Diamondback moth, *Plutella xylostella* (L.)
Cabbage looper, *Trichoplusia ni* (Hub.)
Imported cabbageworm, *Artogeia rapae* (L.)

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TITLE: EFFICACY OF RH-5992 AND LANNATE AGAINST CABBAGE LEPIDOPTERA

MATERIALS: RH-5992 2F, (Tebufenozide)
LANNATE L, (Methomyl)
TRITON B-1956, (Surfactant)

METHODS: The experimental site was a cabbage field at the Agriculture and Agri-Food Canada, Research Centre, Kentville, Nova Scotia. Cabbage plots (6 rows of 14 cabbage plants each, 5 m wide by 5.2 m long) assigned to treatment in a randomized complete block design, were monitored weekly from the time of heading (July 28, 1994) until harvest by counting the number of larvae on 1/3 the leaves of 16 cabbages in the centre 4 rows of each plot. When the mean number of Cabbage Looper Equivalents (CLE; 1 CL = 1 CLE, 1 ICW = 0.75 CLE, 1 DBM = 0.2 CLE) per plant exceeded 0.5, sprays containing TRITON B-1956 (0.1%) were applied using a tractor mounted sprayer with a 12 nozzle side boom calibrated to deliver 1316 L/ha at 1000 kPa. Four sprays were applied based on CLE's, and a fifth spray was indicated based on counts taken on the day of harvest. Control plots were not sprayed. At harvest September 8, 1994, plants from 12 preselected locations were sampled from the centre 4 rows of each plot. For each cabbage plant, injury was rated as none, light, medium, or heavy, and the weight was measured.

RESULTS: Injury ratings are shown in the table. In each injury rating category both insecticide treatments reduced injury compared with the control, but there was no difference in injury rating between RH-5992 and Lannate L. The mean cabbage head weight (control, 1.57, Lannate L, 1.66, RH-5992, 1.70; SEM, 0.128) did not differ among treatments (ANOVA P = <0.05).

CONCLUSIONS: RH-5992 2F and LANNATE L, applied when weekly monitoring indicated CLE exceeded 0.5 per plant, effectively reduced cabbage injury ratings.

Table 1. Injury rating of cabbage, cv. Stonehead, at harvest.

Treatment	Rate (a.i./ha)	No. of Heads with Injury Rating of: None	Light	Medium	Heavy
Control	--	5	19	12	12
RH-5992	0.4 kg	45	2	1	0
Lannate L	0.5 kg	40	7	1	0

#023

STUDY DATA BASE: 303-1452-8703

CROP: Cabbage, cv. Minicole

PEST: Imported cabbageworm, *Artogeia rapae* (L)
Diamondback moth, *Plutella xylostella* (L)

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TITLE: EVALUATION OF INSECTICIDES FOR CONTROL OF IMPORTED CABBAGEWORM AND DIAMONDBACK MOTH ON CABBAGE, 1994

MATERIALS: CONFIRM 240FS (RH-5992)
AC 303,630 (Pyrrole 20%)
RIPCORD 400EC (Cypermethrin)
COMPANION (Octylphenoxypolyethoxyethanol 70%)

METHODS: Cabbage seedlings were transplanted at Harrington, Prince Edward Island, on June 15, 1994. Plants were spaced at 0.5 m within rows and at 0.9 m between rows. Each 4 row plot measured 3.6 m wide by 23 m long. Plots were arranged in a randomized complete block design with seven treatments each replicated four times. Plots were sampled weekly from July 20 to August 17. The numbers of ICW and DBM were recorded from the destructive sampling of six plants systematically selected from the 2 centre rows of each plot. Insecticides were applied on July 28 and again when a threshold of 0.25 Cabbage Loopers Equivalents (CLE) was surpassed. The numbers of ICW and DBM larvae were multiplied by 0.67 and 0.2, respectively to convert them to CLE. Insecticides were applied in a spray mixture equivalent to 320 L/ha and at a pressure of approximately 240 kPa using a CO_2 pressurized precision plot sprayer. The surfactant COMPANION was added to the spray mixtures and the untreated check plots at a rate of 0.25% v/v. Additional sprays were applied to all insecticide-treated plots on August 5 and on August 12. Weeds were controlled by a pre-plant application of trifluralin at a rate of 600 g a.i./ha and by several mechanical cultivations. Ten heads from the centre 2 rows of each plot were harvested on August 24, and weight and marketability were recorded. Heads which were free of insects, frass, and feeding damage were considered marketable. Analyses of variance were performed on the data and Least Squares Differences (LSD) determined. Marketability of heads was transformed to sqrt (arcsine (prop.)) before analysis. Detransformed means are presented.

RESULTS: As presented in the table.

CONCLUSIONS: All insecticides provided good control of larvae at the rates tested. Yield of marketable heads was lower from plots treated with CONFIRM at 70 g a.i./ha than from plots treated with AC 303,630 at 100 g a.i./ha, AC 303,630 plus cypermethrin mixed, or cypermethrin alone. No symptoms of phytotoxicity were noted.

Table 1. Number of larvae per six plants.

	Rate g a.i./ha	ICW Jul27	ICW Aug4	ICW Aug11	ICW Aug17	DBM Jul27	DBM Aug4	DBM Aug11	DBM Aug17	Yield % (Marketable heads)
check	-	21	78a	25a	23a	9	16a	5ab	6a	5c
Confirm	70	21	14b	2b	0b	2	4bc	7a	2b	48b
Confirm	140	15	18b	1b	0b	11	12ab	4abc	2bc	58ab
AC 303,630	50	29	13b	5b	1b	16	2c	2bc	0cd	68ab
AC 303,630	100	27	13b	2b	1b	14	3c	1bc	0d	80a
AC + Cyper	50+17	32	11b	2b	0b	4	1c	0c	0d	78a
Cypermethrin	17	18	19b	3b	0b	10	3c	2bc	0d	75a

* Marketability was transformed to sqrt (arcsine (prop.)) before analysis. Detransformed means presented.

** Means in a column followed by a different letter are significantly different (P = <0.05) using a LSD test.

#024

ICAR NUMBER: 61006535

CROP: Cabbage, cv. Galaxy

PEST: Imported cabbageworm, *Pieris rapae* (L)

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TITLE: INSECT CONTROL IN CABBAGE USING THE INSECTICIDE RH-5992 240F

MATERIALS: MONITOR 480LC (Methamidophos)
RH-5992 240F (experimental)
COMPANION (non-ionic surfactant)

METHODS: Cabbage was transplanted on June 20 in 2 row plots spaced 0.9 m apart. Plots were 7 m long, and replicated four times in a randomized complete block design. Spray applications were made with a back-pack airblast sprayer at 240 L/ha. Insecticides were applied on July 21, August 2, 12, and 22. Insect feeding damage assessments were made by counting the number of feeding sites or clusters across a plot on July 25 and on August 19, and by foliar damage ratings on August 3 and 23. Results were analyzed using the Duncan's Multiple Range Test.

RESULTS: As presented in the table.

CONCLUSIONS: Excellent control of the imported cabbageworm was achieved with all of the candidate insecticides used in this trial. This suggests that under the insect pressures found in this trial, equal control to the standard MONITOR 480LC treatment was achieved at the lowest rate of RH-5992 240F used, 0.3 L product/ha combined with 0.1% v/v COMPANION surfactant.

Table 1.

Treatment	Rate (prod/ha)	No. of Insect Feeding Damage Areas* July 25	No. of Insect Feeding Damage Areas* Aug. 19	Foliar Damage Ratings (0-10)** Aug. 3	Foliar Damage Ratings (0-10)** Aug. 23
MONITOR 480LC + COMPANION	1.1 L 0.1% v/v	17.5a***	20.3b	7.8a	8.3ab
RH-5992 240F + COMPANION	0.3 L 0.1% v/v	16.8a	22.3b	7.8a	8.4ab
RH-5992 240F + COMPANION	0.3 L 0.25% v/v	17.8a	20.0b	8.3a	8.0ab
RH-5992 240F + COMPANION	0.6 L 0.1% v/v	17.8a	22.0b	6.0b	7.3b
RH-5992 240F + COMPANION	0.6 L 0.25% v/v	19.3a	24.3b	7.8a	8.8a
Control		15.8a	36.8a	5.8b	4.8c

* Number of Insect Feeding Damage Areas - the average number of feeding clusters per plot. The lower the number, the more effective the treatment.
** Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.
*** Means followed by the same letter do not differ significantly ($P = <0.05$, Duncan's Multiple Range Test).

#025

ICAR NUMBER: 61006535

CROP: Cabbage, cv. Galaxy

PEST: Imported cabbageworm, *Pieris rapae* (L).

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TITLE: INTEGRATED PEST MANAGEMENT OF CABBAGE INSECTS USING THE INSECTICIDE AC 303,630 240SC

MATERIALS: AC 303,630 240SC (experimental)
CYMBUSH 250EC (Cypermethrin)

METHODS: Cabbage was transplanted on June 20 in 2 row plots spaced 0.9 m apart. Plots were 7 m long, and replicated four times in a randomized complete block design. Spray applications were made with a back-pack airblast sprayer at 240 L/ha. Insecticides were applied on July 21, August 2, 12, and 22. Insect leaf-feeding damage assessments were taken by counting the number of feeding sites or clusters across a plot on July 27 and August 19, and by foliar damage ratings on

August 3 and 23. Results were analyzed using the Duncan's Multiple Range Test.

RESULTS: As presented in the table.

CONCLUSIONS: Under moderate pressure from the imported cabbageworm, all of the insecticide treatments significantly controlled the insect pest by late season. AC 303,630 240SC and CYMBUSH 250EC were effective at the lower rates used alone or in combination.

Table 1.

Treatment	Rate prod/ha	No. of Insect Feeding Damage Areas *		Foliar Damage Ratings (0-10)**	
		July 27	Aug. 19	Aug. 3	Aug. 23
AC 303,630 240SC	208.3 mL	18.0ab***	14.8b	8.5a	7.9b
AC 303,630 240SC	416.7 mL	15.5b	14.0b	7.8a	8.3ab
AC 303,630 240SC + CYMBUSH 250EC	208.3 mL 70.0 mL	13.5b	12.5b	7.8a	8.8ab
AC 303,630 240SC + CYMBUSH 250EC	416.7 mL 70.0 mL	15.3b	14.0b	8.9a	8.9a
AC 303,630 240SC + CYMBUSH 250EC	208.3 mL 140.0 mL	16.8ab	14.0b	8.8a	8.9a
AC 303,630 240SC + CYMBUSH 250EC	416.7 mL 140.0 mL	14.5b	11.8b	8.0a	8.8ab
CYMBUSH 250EC	70.0 mL	18.0ab	12.0b	9.0a	8.3ab
CYMBUSH 250EC	140.0 mL	17.0ab	14.0b	9.0a	8.5ab
Control		23.5a	27.5a	4.3b	4.8c

* Number of Insect Feeding Damage Areas - the average number of feeding clusters per plot. The lower the number, the more effective the treatment.

** Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

*** Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

#026

STUDY DATA BASE: 364-1421-8704

CROP: Canola, var. Excel

PEST: Crucifer flea beetle, *Phyllotreta cruciferae* (Goeze)

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TITLE: CANOLA SEEDLING PROTECTION FROM FLEA BEETLE DAMAGE WITH GRANULAR AND SEED DRESSING INSECTICIDES

MATERIALS: FURADAN 10G (Carbofuran)
CLOAK (Lindane 53.3% + Carbathiin 4.5% + Thiram 9%)
COUNTER 5G (Terbufos)
BIODAC 5G (pesticide carrier)

ROVRAL ST (Lindane 50% + Iprodione 16.7%)
EXP-80534A; EXP-80430B; UBI-2608-1
VITAVAX RS (Lindane 68% + Carbathiin 4.5% + Thiram 9%)

METHODS: Canola was seeded 27 May 1994 to a depth of 2-3 cm in 17.5 cm row spacings at a seeding rate of 5.6 kg/ha with a double disc press drill in field plots at Glenlea, Manitoba. Plots were 1.25 m x 8.0 m and were replicated five times in a randomized complete block design. The seed germination for all treatments was tested by placing 25 seeds per treatment between moistened filter paper in petri dishes, replicating each treatment four times, and then sealing the dishes for 6 d at 25°C. Two plant counts of 0.25 m^2/plot and a visual assessment of flea beetle damage throughout the plot were taken on June 17. Flea beetle damage was rated using a scale based on percent leaf surface area damaged; 0 = no damage; 0.5 = 5%; 1.0 = 10%; 2 = 25%; 3 = 50%; 3.5 = 75%; 4 = 100%. Yields were taken September 9 by straight combining the entire plot and drying the seed samples before weighing.

RESULTS: Rates of the active ingredient in the table refer only to the insecticidal components of the formulation.

CONCLUSIONS: Seed germination was reduced for granular treatments that included CLOAK as a seed dressing and for UBI-2608-1 at the highest rate only. Plant densities in the plots were largely unaffected by differences in seed germination. Plant stands for all treatments were the same as the check plots except for the COUNTER + CLOAK treatment which had fewer plants. No flea beetle feeding injury was observed in any plots during the seedling stage. All treatments had yields that did not differ from either CHECK.

Treatments	Rate (g a.i./ kg seed)	Seed Germination (%)	Plant Damage	Plants /m^2	Canola Yield (g/m^2)
check	-	99a*	0	178bcd	284.6bc
FURADAN	50	98ab	0	167de	278.0bc
FURADAN + CLOAK	50 + 12	81d	0	168de	291.3abc
COUNTER	50	93abc	0	171cde	295.9abc
COUNTER + CLOAK	50 + 12	83cd	0	140e	298.7abc
BIODAC	50	94ab	0	191a-d	296.5abc
BIODAC + CLOAK	50 + 12	88bcd	0	186a-d	302.0abc
ROVRAL ST	12	96ab	0	200a-d	293.4abc
EXP-80534A	12	96ab	0	202a-d	294.0abc
CLOAK	12	92abc	0	214a-d	277.4c
ROVRAL ST	15	99a	0	180bcd	301.5abc
VITAVAX RS	15	89a-d	0	200a-d	324.5a
EXP-80430B	15	95ab	0	192a-d	296.4abc
UBI-2608-1	4	92abc	0	206abc	302.1abc
UBI-2608-1	6	92abc	0	202a-d	322.1a
UBI-2608-1	8	95ab	0	210ab	293.8abc
UBI-2608-1	12	90a-d	0	218a	306.1abc
UBI-2608-1	15	81d	0	195a-d	311.1ab
check	-	-	0	205abc	299.2abc

* Within each column, means followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

#027

STUDY DATA BASE: 352-1252-8501

CROP: Carrot, cv. Six pack

PEST: Carrot weevil, *Listronotus oregonensis* (LeConte)

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TITLE: CHEMICAL CONTROL OF THE CARROT WEEVIL AT THE HOLLAND MARSH, 1994

MATERIALS: IMIDAN 50W (Phosmet)
LORSBAN 4E (Chlorpyrifos)
CYMBUSH 250EC (Cypermethrin)

METHODS: The experiment was conducted on muck soil at the Muck Research Station, Kettleby, Ontario. Each plot consisted of 6 rows x 7.5 m long. There were four replicates. Sprays were applied with a tractor-mounted plot sprayer that delivered approximately 600 L/ha. Treatments were applied at the 2 (June 16) and 4 (June 27) true-leaf stages. On July 27, all carrots in ten 30.5 cm segments of row were harvested from each plot and examined for carrot weevil damage. The number of "dead" carrots (destroyed by carrot weevil feeding) still evident was recorded for each plot, but the total numbers destroyed could not be determined at that time. Damaged carrots were rated subjectively as light, moderate, and severe. In general, carrots rated "moderate" or "severe" were immediately identifiable as unmarketable. Analysis of variance was carried out on the mean number of carrots per plot sample (a total of 3 m of row), and on the transformed (arcsine) overall percent injury (including "dead" carrots), the percent injury at harvest (not including "dead" carrots), and the percent moderate to severe injury (including "dead" carrots).

RESULTS: As presented in the table.

CONCLUSIONS: All treatments provided significant reductions of carrot weevil damage. There were no significant differences between treatments. As one objective of this trial was the assessment of LORSBAN for control of carrot weevil and first-generation carrot rust fly as part of a minor use proposal (URMULE 92-105), it can be concluded that LORSBAN would be a suitable alternative to IMIDAN for carrot weevil control if necessary. Carrot rust fly injury was too light throughout the plots to assess the treatments for control of that insect. The comparison of CYMBUSH applied in water vs. carrot oil was part of a different study; there was no significant difference in control between the two treatments. Differences between treatments in total plants were due, at least in part, to the destruction of plants by early carrot weevil injury, not all of which were detectable at harvest. IMIDAN permitted a significantly better survival of plants than did CYMBUSH or the check. It was also noted that the CYMBUSH-oil treatment, which was applied on a hot day, caused some mortality of plants.

Table 1. Effect of two applications of insecticides on injury to carrots caused by carrot weevil, Holland Marsh, 1994.*

Treatment	Rate (product/ha)	Mean no. carrots** /plot sample	Mean % inf. ***	Mean % inf. at harvest ****	Mean % mod-sev. *****
IMIDAN 50W	2.2 kg	280a	2.4a	0.4a	2.2a
LORSBAN 4E	2.8 L	257ab	5.3a	3.4a	3.6a
CYMBUSH 250EC	280 mL (water)	241 bc	8.7a	6.4a	3.2a
CYMBUSH 250EC	280 mL (oil)	218 c	4.3a	2.2a	2.8a
check		226 bc	25.9 b	20.1 b	16.8 b

* True Means followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P = <0.05) performed or transformed (aresine) data for all percentages.
** Includes harvestable carrots plus "dead"(severely wilted or cadavers) recognizable at harvest. Some carrots killed early were no longer identifiable.
*** Includes carrots infested at harvest plus "dead" carrots.
**** Includes only harvestable carrots.
***** Carrots rated with moderate to severe injury plus "dead" carrots identifiable.

#028

ICAR: 206003

CROP: Onions, yellow cooking

PEST: Onion maggot fly, *Delia antiqua* (Meig.)

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TITLE: EVALUATION OF ONION LINES FOR ONION MAGGOT FLY RESISTANCE

MATERIALS: Nineteen onion breeding lines obtained from Dr. I. Goldman, University of Wisconsin, two commercial cultivars Norstar and Fortress.

METHODS: Twenty-one onion lines were seeded in 288-celled plug trays in the greenhouse on March 17 and 18, 1994. The trial was conducted at the Muck Research Station where onion maggot flies occur naturally. The seedlings were planted out on May 10 and 11, 1994. There were four replicates per line arranged in a randomized complete block design. Each replicate consisted of 2 rows x 3.5 m long. Two commercial cultivars, Norstar and Fortress, were used as checks for the trial. Half of the Norstar and Fortress plugs were treated with LORSBAN 4E at 1.6 mL a.i./500 mL water per tray, 2 d before planting. No other insecticides were applied to any of the lines throughout the trial period. Damage assessments began approximately 1 week after the peaks of first (June 13) and second (August 11) generations of maggot flies. Maggot damage was assessed 3 times a week by counting the number of wilted plants, and once a week these assessments were confirmed by rogueing the onions and looking for symptoms of maggot damage at the base of the plant. All onions were harvested and weighed on October 5, and 6,

1994. Maggot damage and yield data were subjected to analysis of variance (ANOVA) using Statistix version 4.0.

CONCLUSIONS: Significant differences in resistance to onion maggot were found among the lines for both assessments and these differences were also related to yield. Drench applications of Lorsban 4E reduced maggot damage and increased yield. Total damage to Line 1306-91 was equivalent to the insecticide-treated lines. Yields of 116-93 and untreated Fortress were equivalent to insecticide-treated Norstar.

Table 1. Onion maggot damage and yield of transplanted yellow cooking onion breeding lines at Kettleby/Bradford, Ontario, 1994.

	Percent onion maggot damage			
Treatment	1st generation	2nd generation	Total damage	Yield kg/7.5 m
Fortress Drench	0.0 e*	3.1 g	3.1 g	21.30 a
Norstar Drench	0.9 de	3.0 g	3.8 fg	18.53 ab
1306-91	4.3 cde	10.0 f	13.1 efg	12.06 cdefg
15.64-91	9.0 bcde	12.6 cdef	19.9 de	10.62 efghi
Norstar	9.1 bcde	14.7 bcdef	21.8 de	12.66 cdefg
1804-93	9.1 bcde	16.9 bcdef	23.7 de	12.12 cdefg
116-93	9.9 bcde	17.7 bcdef	24.7 de	15.60 bc
Fortress	10.5 bcde	9.7 f	18.5 def	15.35 bcd
1562-91	10.5 bcde	12.3 def	20.0 de	9.47 fghi
123-93	10.9 bcde	10.3 f	19.3 def	13.98 cde
1812-93	10.2 bcde	15.5 bcdef	23.9 de	8.43 ghhi
117-93	12.9 bcde	17.2 bcdef	26.8 cde	11.83 cdefg
1337-91	13.3 bcde	12.7 cdef	23.3 de	9.23 fghi
115-93	14.1 bcd	9.4 f	21.8 de	13.19 cdef
114-93	14.1 bcd	15.4 bcdef	26.1 cde	11.43 defg
118-93	14.4 bcd	16.9 bcdef	27.2 cde	10.82 efgh
126-93	14.4 bcd	19.6 bcde	29.8 cd	11.66 cdefg
1800-93	17.2 bc	31.3 a	40.4 bc	8.87 ghi
125-93	18.2 b	20.0 bcd	31.6 cd	9.46 fghi
124-93	19.3 b	16.3 bcdef	31.0 cd	12.28 cdefg
1399-91	20.4 b	10.9 ef	27.0 cde	6.66 ij
1784-93	38.2 a	22.1 b	47.4 ab	7.26 hij
1014-92	48.4 a	21.5 bc	56.5 a	3.67 j

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, L.S.D. Protected Test.

#029

STUDY DATA BASE: 343-1241-9103

CROP: Evening primrose, cv. EP 10, *Oenothera biennis* L.

PEST: Bud weevil, *Acanthoscelides acephalus* (Say);
Tarnished plant bug (TPB), *Lygus lineolaris* (Palisot);
Microlepidoptera, *Aethes oenotherana* (Riley); Momphidae

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TITLE: EVALUATION OF INSECTICIDES FOR CONTROL OF INSECT PESTS OF EVENING PRIMROSE

MATERIALS: ORTHENE 75SP (Acephate)
RIPCORD 400EC (Cypermethrin)
AMBUSH 500EC (Permethrin)
DECIS 2.5EC (1990) (Deltamethrin)
DECIS 5.0EC (1991-92) (Deltamethrin)

METHODS: Experiments were carried out on Fox loamy sand at the Delhi Research Centre during 1990, 1991, and 1992. Plots measured 3.66 m wide x 7.63 m long and were arranged in a randomized complete block design with four replications. Evening primrose (EP) seedlings were transplanted into field plots in early September each year. Plants were spaced 30.5 cm apart in rows separated by 61 cm. Each plot consisted of 6 rows (25 plants/row) of EP, with the outside rows in each plot serving as guard rows. Insecticides were applied in two passes using a CO_2 pressurized, tractor-mounted sprayer fitted with four LF-3 nozzles delivering either 350 L/ha (Application 1) or 640 L/ha (Applications 2 and 3) at 206 kPa. Timing of insecticide applications each year are shown in Table 1. Applications 1 and 2 were primarily applied for control of bud weevils and TPB; application 3 was targeted against Microlepidoptera. Bud weevils and TPB were counted at regular intervals by moving slowly through each plot, counting the number of adult insects on 1 of the centre 4 rows, ie. the number of insects per 25 plants. Microlepidoptera were counted by randomly harvesting and dissecting samples of 20 EP seed pods from the centre 4 rows of each plot and totalling the number of Microlepidoptera larvae extracted from each sample. Data were analyzed by one-way analysis of variance; significant means were separated using Duncan's Multiple Range Test.

RESULTS: Populations of adult weevils and TPB before and 4-20 d after each of the first two insecticide applications are shown respectively in Table 2 and Table 3. Numbers of Microlepidoptera larvae in EP seed pods before and 6 - 8 d after application three are shown in Table 4.

CONCLUSIONS: Populations of bud weevils were significantly lower in all treated plots than in CONTROL plots following five of six insecticide applications; although bud weevil populations were also lower in treated plots following Treatment 2 in 1990, the difference was not statistically significant. Similar trends were observed for TPB populations. ORTHENE had no effect on numbers of Microlepidoptera larvae dissected from EP seed pods in 1990 and 1992. DECIS provided most reliable control of Microlepidoptera larvae, significantly reducing numbers each year; observed reductions following application of RIPCORD and AMBUSH proved statistically significant only in 1990 and 1991.

RESIDUES: Samples of EP seed from the 1990 crop were analyzed for pesticide residues. No detectable residues of cypermethrin (RIPCORD), permethrin (AMBUSH) or deltamethrin (DECIS) were detected in EP seed combined 47 d after the last insecticide application. Acephate (ORTHENE) residues, in EP seed harvested on the same date, averaged 0.065 ppm.

SUMMARY: Application of RIPCORD, AMBUSH or DECIS provided reliable control of populations of bud weevil, TPB and Microlepidoptera in EP with no accumulation of detectable residues in harvested seed. While ORTHENE application controlled both bud weevils and TPB, control of Microlepidoptera proved unreliable and measurable acephate residues remained in EP seed at harvest.

Table 1. Application dates for insecticides applied for control of insect pests of evening primrose.

Application Number	Year of Application 1990	1991	1992
1	20 June	28 May	18 June
2	05 July	21 June	08 July
3	09 August	09 August	17 August

Table 2. Effect of insecticides on populations of bud weevils in evening primrose - 1990-1992.

	Treatment Applied	Rate (g a.i./ha)	Mean Number Weevils/25 Plants Pre.* No.1	Post** No.1	Pre. No.2	Post No.2
1990:						
	ORTHENE 75SP	1000.0	2.8 a	0.5 b	0.3 a	0.0 a***
	RIPCORD 400EC	70.0	2.3 a	0.3 b	0.3 a	0.0 a
	AMBUSH 500EC	70.0	1.8 a	0.0 b	2.0 a	0.0 a
	DECIS 2.5EC	10.0	0.8 a	0.0 b	0.8 a	0.5 a
	CONTROL	----	1.8 a	3.0 a	2.3 a	1.0 a
1991:						
	ORTHENE 75SP	1000.0	5.0 a	0.0 b	2.5 a	0.5 b
	RIPCORD 400EC	70.0	4.8 a	0.0 b	1.8 a	0.0 b
	AMBUSH 500EC	70.0	3.0 b	0.0 b	3.3 a	0.0 b
	DECIS 2.5EC	10.0	1.5 b	0.3 b	4.5 a	0.0 b
	CONTROL	----	2.5 b	8.3 a	9.0 a	4.5 a
1992:						
	ORTHENE 75SP	1000.0	18.3 a	2.5 b	6.8 a	0.0 b
	RIPCORD 400EC	70.0	15.8 a	4.8 b	5.8 a	0.0 b
	AMBUSH 500EC	70.0	18.0 a	4.0 b	5.0 a	0.5 b
	DECIS 2.5EC	10.0	23.5 a	6.0 b	7.3 a	0.8 b
	CONTROL	----	15.8 a	28.5 a	18.3 a	6.8 a

* Insect numbers before insecticide application.
** Insect numbers after insecticide application.
*** For each year, means within a column followed by the same letter are not significantly different (P = 0.05) as determined by Duncan's Multiple Range Test.

Table 3. Effect of insecticides on populations of tarnished plant bugs in evening primrose - 1990-1992.

Treatment Applied	Rate (g a.i./ha)	Mean No. Plant Bugs/25 Plants Pre.* No.1	Post** No.1	Pre. No.2	Post No.2
1990:					
ORTHENE 75SP	1000.0	0.5 a	0.3 b	5.8 a	0.3 b***
RIPCORD 400EC	70.0	0.5 a	1.5 b	7.0 a	2.5 b
AMBUSH 500EC	70.0	0.8 a	2.3 b	6.5 a	0.3 b
DECIS 2.5EC	10.0	0.5 a	3.0 b	5.8 a	0.3 b
CONTROL	----	0.3 a	17.0 a	8.3 a	14.5 a
1991:					
ORTHENE 75SP	1000.0	0.0 a	0.0 a	3.3 a	1.3 b
RIPCORD 400EC	70.0	0.0 a	0.0 a	5.0 a	0.0 b
AMBUSH 500EC	70.0	0.0 a	0.0 a	8.8 a	0.0 b
DECIS 2.5EC	10.0	0.0 a	0.5 a	6.5 a	0.0 b
CONTROL	----	0.0 a	1.0 a	8.5 a	4.0 a
1992:					
ORTHENE 75SP	1000.0	0.8 a	0.0 b	4.3 a	2.0 bc
RIPCORD 400EC	70.0	0.8 a	0.0 b	2.0 a	1.5 c
AMBUSH 500EC	70.0	1.0 a	0.0 b	1.8 a	4.3 ab
DECIS 2.5EC	10.0	1.0 a	0.0 b	4.3 a	3.0 bc
CONTROL	----	1.3 a	8.3 a	5.0 a	6.0 a

* Insect numbers before insecticide application.
** Insect numbers after insecticide application.
*** For each year, means within a column followed by the same letter are not significantly different (P = 0.05) as determined by Duncan's Multiple Range Test.

Table 4. Effect of insecticides on populations of Microlepidoptera larvae in evening primrose seed pods - 1990-1992.

Treatment Applied	Rate (g a.i./ha)	Mean Number Larvae/20 Seed Pods 1990 Pre.*	1990 Post**	1991 Pre.	1991 Post	1992 Pre.	1992 Post
ORTHENE 75SP	1000.0	7.0 a	10.5 a	5.3 a	1.8 b	9.0 ab	10.8 a***
RIPCORD 400EC	70.0	4.0 a	2.5 b	0.8 a	0.5 b	4.3 c	3.8 ab
AMBUSH 500EC	70.0	6.5 a	3.0 b	1.8 a	1.0 b	6.8 bc	7.8 ab
DECIS 2.5EC	10.0	4.8 a	2.0 b	1.0 a	0.5 b	3.0 c	2.8 b
CONTROL	----	13.0 a	10.5 a	7.5 a	6.8 a	11.3 a	10.8 a

* Insect numbers before insecticide application.
** Insect numbers after insecticide application.
*** For each year, means within a column followed by the same letter are not significantly different (P = 0.05) as determined by Duncan's Multiple Range Test.

#030

ICAR: 84100737

CROP: Onion, cv. Prince

PEST: Onion maggot, *Delia antigua* (Meig.)

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TITLE: INSECTICIDE SEED COATINGS AND GRANULAR INSECTICIDE FOR ONION MAGGOT CONTROL

MATERIALS: DYFONATE 10 G (Fonofos)
LORSBAN 15 G (Chlorpyrifos)
AZTEC 2.1 G (Phosetbupirin + Cyfluthrin)
TRIGARD 75% (Cyromazine)
LORSBAN 480 g/L (Chlorpyrifos)
PRO GRO (Carbathiin 30% + Thiram 50%)

METHODS: The tests were done at the Holland Marsh on muck soil. The experimental plot was arranged in a randomized complete block design with four replicates. Each row was 4 m long with 40 cm between the rows. Commercial film seed coatings (Bejo FILMKOTE) were provided by Bejozaden Ltd., Warmenhuizen, Holland. The granular formulations were applied in-furrow at planting time (May 13, 1994) by adding them with the seed treated with PRO GRO on a V-belt planter. Estimates for the effectiveness of treatments were made as follows: the number of plants in the row were counted for initial stand on June 8 and then examined twice weekly from June 13 to July 18 for onion maggot damage. On each date plants that were wilted from onion maggot were counted and removed. On July 20, the remaining plants were pulled and examined for onion maggots.

RESULTS: As presented in the table.

CONCLUSIONS: With the high infestation (64%) of the onion maggot, the AZTEC furrow treatment alone was highly effective in controlling the onion maggot. TRIGARD seed treatment alone and in combination with furrow treatments of AZTEC, LORSBAN, and DYFONATE were effective. The LORSBAN granular treatment and the LORSBAN seed treatment were not as effective as the TRIGARD seed treatment and the combination of granular and seed treatments.

Table 1. Initial stand, percent maggot damage following the indicated granular and seed treatment at seeding.

Granular treatments	Rate kg a.i./ha	Seed treatments 50 g a.i./kg seed	Initial plant count /4 m row	% maggot damage* /4 m row
LORSBAN 15 G	1.1	LORSBAN	68	18.0c**
LORSBAN 15 G	1.1	TRIGARD	82	4.9cd
AZTEC 2.1 G	0.5	LORSBAN	84	8.7cd
AZTEC 2.1 G	0.5	TRIGARD	76	7.6cd
DYFONATE 10G	1.1	TRIGARD	65	2.3d
	-	LORSBAN	83	40.0b
	-	TRIGARD	70	16.1c
LORSBAN 15 G	1.1	-	81	35.9b
DYFONATE 10 G	1.1	-	73	12.7cd
AZTEC 2.1G	0.5	-	94	9.3cd
check	-	-	86	64.0a

* Accumulative counts June 13, 16, 20, 23, 27, 30, July 4, 7, 11, 14, 18, and 20.

** Means followed by the same letter are not significantly different (P#0.05; LSD test).

#031

ICAR: 84100737

CROP: Onion, cv. Copra, Corona, Prince

PEST: Onion maggot, *Delia antiqua* (Meig.)

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TITLE: INSECTICIDE SEED COATINGS FOR ONION MAGGOT CONTROL

MATERIALS: TRIGARD 75% (Cyromazine)
LORSBAN 480 g/L (Chlorpyrifos)
GAUCHO 70% (Imidacloprid)
PRO GRO (Carbathiin + Thiram)

METHODS: The tests were done at the Holland Marsh on muck soil. The two onion trials were each arranged in a randomized complete block design with four replicates. Trial 1 was to compare the onion maggot efficacy of three insecticide seed treatments at three different rates using one seed variety, Prince. Trial 2 was to compare the onion maggot efficacy with three seed varieties using two insecticide seed treatments. Commercial film seed coatings (Bejo FILMKOTE) were provided by Bejozaden Ltd., Warmenhuizen, Holland. Seed treated with PRO GRO was applied in-furrow at planting time (May 11, 1994) by an Earthway precision garden seeder. Each plot of the onion experiment was 2 rows x 6 m long and 40 cm between the rows. Estimates for the effectiveness of treatments were made as follows: the number of plants in 1 row of each plot was counted for initial stand on June 9 and then examined twice weekly from June 13 to July 18 for onion maggot damage. On each date plants wilting from onion maggot were counted and removed. On July

20, the remaining plants were pulled and examined for onion maggot damage. On August 23 the second row of plants were pulled and examined for onion maggots. The proportion of plants damaged by the onion maggot was used to estimate stand loss.

RESULTS: As presented in the table.

CONCLUSIONS: In Trial 1, the commercial seed treatment of TRIGARD was more effective than LORSBAN and GAUCHO in controlling the first generation of the onion maggot. By the end of the second generation, there was no significant difference in plant loss with the seed treatments of LORSBAN and TRIGARD. In Trial 2, there was no significant difference in onion maggot control in relation to the three seed varieties tested.

Table 1. Initial stand, percent maggot damage, and percent stand loss following the indicated seed treatment.

Seed Treatments	Rate (g a.i./kg seed)	Initial plant count /6 m row	% maggot damage/6 m* Gen. 1	% stand loss Gen. 1 & 2**
Trial 1 var. Prince				
TRIGARD	25	162	12.8cd***	32.8b
TRIGARD	50	122	16.8bc	21.6b
TRIGARD	75	119	6.1d	27.2b
LORSBAN	25	127	32.4bc	27.9b
LORSBAN	50	132	33.0bc	25.7b
LORSBAN	75	126	32.1bc	27.6b
GAUCHO	25	120	50.3ab	59.4a
GAUCHO	35	128	56.4a	64.6a
GAUCHO	50	106	48.0ab	59.0a
check	-	147	48.7ab	59.7a
Trial 2 var. Prince				
LORSBAN	50	132	7.5d	29.0fg
TRIGARD	50	125	10.4d	24.0g
check	-	125	49.6a	53.8ab
.				
var. Copra				
LORSBAN	50	134	12.7cd	38.3def
TRIGARD	50	142	6.9d	33.5efg
check	-	143	33.5ab	58.5a
.				
var. Corona				
LORSBAN	50	104	6.3d	29.1fg
TRIGARD	50	100	4.3d	36.0defg
check	-	112	28.2bc	47.9bcd

* Accumulative counts June 13, 16, 20, 23, 27, 30, July 4, 7, 11, 14, 18, and 20. Based on 6 m, 4 replicates.
** 2nd generation, final count August 23.
*** Means followed by the same letter are not significantly different (P#0.05; LSD test). Trials 1 and 2 were analyzed separately.

#032

ICAR: 84100737

CROP: Onion, cv. Stokes Exporter II

PEST: Onion maggot, *Delia antiqua* (Meig.)

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TITLE: PESTICIDES FOR ONION MAGGOT CONTROL

MATERIALS: DYFONATE 10 G (Fonofos)
LORSBAN 15 G (Chlorpyrifos)
FORCE 15 G (Tefluthrin)
AZTEC 2.1 G (Phosetbupirin 2% + Cyfluthrin 0.1%)
DYFONATE 431 g/L (Fonofos)
FORCE 200 g/L (Tefluthrin)
FIPRONIL 80 WG (Aryl heterocycle)
PRO GRO (Carbathiin 30% + Thiram 50%)

METHODS: The tests were done at the Holland Marsh on muck soil. The experimental plot was arranged in a randomized complete block design with four replicates. Each plot had 2 rows x 6 m long with 40 cm between the rows. In addition to the granular pesticides applied with the seed, all seed was treated by shaking it with a dust formulation of PRO GRO at 25 g/kg seed. The granular formulations were applied in-furrow at planting time (May 10, 1994) by adding them with the seed on a V-belt planter. The LORSBAN, DYFONATE, and FORCE treatments were applied directly onto the seed and then treated with the dust formulation of PRO GRO. Estimates of the effectiveness of treatments were made as follows: the number of plants in 1 row of each plot were counted for initial stand on June 8 and then examined twice weekly from June 13 to July 18. On each date plants that were wilted from onion maggot were counted and removed. On July 20, the remaining plants were pulled and examined for onion maggots. The second row was harvested on October 3 for yield.

RESULTS: As presented in the table.

CONCLUSIONS: The registered insecticides DYFONATE and LORSBAN were moderately effective in controlling the high infestation (73.2%) of the onion maggot. The unregistered granular insecticide AZTEC was more effective in controlling the onion maggot than the registered insecticides. The seed treatment FIPRONIL was more effective than DYFONATE and FORCE. Plants protected with the granular insecticide AZTEC and the seed treatment FIPRONIL had the highest yields.

Table 1. Initial stand, percent maggot damage, and yield following the indicated treatment at seeding.

Treatments	Rate (kg a.i./ha)	Initial plant count /6 m row	Maggot damage* (%)	Yield (kg/ha x 10^3)
LORSBAN 15 G	1.1	211	51.2bcd**	23.5ef
	2.2	198	31.9def	24.2de
DYFONATE 10 G	1.1	194	47.5bc	25.5de
	2.2	147	29.9def	39.2cd
FORCE 1.5 G	0.45	188	46.4bc	17.8efgh
	0.6	203	34.2bcd	40.7bc
AZTEC 2.1 G	0.5	217	4.5g	58.3a
FIPONIL S.T.***	0.0006****	144	27.0cde	56.3a
	0.0013****	157	14.5fg	55.4ab
DYFONATE S.T.***	0.02****	150	61.5ab	21.7efg
	0.025****	137	36.5cde	28.8cde
FORCE S.T.***	0.008****	123	71.5a	8.8fgh
	0.010****	147	80.0a	7.1gh
check	-	185	73.7a	4.2h

* Accumulative counts June 13, 16, 20, 23, 27, 30, July 4, 7, 11, 14, 18, and 20. Based on 6 m, four replicates.
** Means followed by the same letter are not significantly different (P = 0.05; LSD test).
*** ST = seed treated.
**** Kg a.i./kg seed.

#033

ICAR: 84100737

CROP: Onion, cv. Benchmark

PEST: Onion maggot, *Delia antiqua* (Meig.)

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TITLE: PESTICIDES FOR ONION MAGGOT CONTROL - PRECISION SEEDING

MATERIALS: DYFONATE 10 G (Fonofos)
LORSBAN 15 G (Chlorpyrifos)
FORCE 1.5 G (Tefluthrin)
AZTEC 2.1 G (Phosetbupirin 2% + Cyfluthrin 0.1%)
PRO GRO (Carbathiin 30% + Thiram 50%)

METHODS: The tests were done at the Holland Marsh on muck soil. The experimental plot was arranged in a randomized complete block design with four replicates.

Seed was custom-coated PRO GRO-treated seed. The granular formulations were applied by using a Stan-Hay precision seeder in a bed of 4 double rows 24 m long on May 9, 1994. Each bed had three different rates of application of a granular treatment and an untreated row. On June 6 an assessment of initial stand was based on the number of plants in each of two, 2 m lengths in each row. The designated segments for the assessment of the first generation of onion maggot were checked twice weekly from June 13 to July 18, and damaged plants were counted and removed. On July 20, all plants were pulled from the same two, 2 m segments in each row and plants examined for maggot damage. At the end of the second and third generation, all plants were pulled from the designated two, 2 m lengths in each row and plants were examined for maggot damage. On October 3, 5 m of onions of each row were harvested for yield.

RESULTS: As presented in the table.

CONCLUSIONS: The highest rate of the granular insecticide LORSBAN and both rates of DYFONATE were effective in controlling the infestation of the first generation of onion maggot. The unregistered insecticide AZTEC was as effective as the registered insecticides. FORCE did not control the infestation of the onion maggot. By the end of the third generation, the accumulative damage of the onion maggot had increased for all treatments. The treatments with the lower plant loss had the higher yields. AZTEC and highest rate of LORSBAN were the most effective in the control of the onion maggot, as reflected in the yield.

Table 1. Initial onion stand, percent maggot damage, percent stand loss and yield following the indicated treatment at seeding.

Treatments	Rate kg a.i./ha	Initial plant count /4 m row	% Maggot damage Gen 1*	Stand loss Gen 1 & 2**	Stand loss Gen 1,2, & 3***	Yield (kg/ha x 10^3)
check	0	125	41.7a***	44.4abcd	54.4abc	45.3cd
LORSBAN 15G	1.1	114	34.9a	52.7ab	51.2abc	41.2cd
	2.2	137	36.0a	37.1abcde	39.3bcde	42.6cd
	4.5	129	14.7b	16.3e	20.5e	76.0a
check	0	133	42.6a	39.4abcd	48.2abc	51.4cd
DYFONATE 10G	2.2	117	14.1b	40.6abcd	40.8bcde	40.9cd
	4.5	119	8.0b	22.2cde	30.6cde	36.7cd
AZTEC 2.1G	0.5	146	14.6b	14.7e	24.4de	74.6ab
check	0	124	40.3a	30.9bcde	45.3abc	42.4cd
FORCE 1.5G	0.6	126	40.9a	44.1abc	64.2a	32.8cd
	0.75	134	41.2a	53.6a	59.3ab	26.1d

* Accumulative counts June 13, 16, 20, 23, 27, 30, July 4, 7, 11, 14, 18, and 20.

** 1st and 2nd generation final count August 22, 1st, 2nd, and 3rd generations final count September 21.

*** Means followed by the same letter are not significantly different (P#0.05; LSD test).

#034

STUDY DATA BASE: 280-1252-9304

CROP: Onion, cooking, cv. Prince

PEST: Onion maggot, *Delia antiqua* (Meigen)

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TITLE: EVALUATION OF SEED- AND SEED FURROW INSECTICIDES FOR CONTROL OF ONION MAGGOT ATTACKING COOKING ONIONS IN ORGANIC SOIL

MATERIALS: GAUCHO 70WS (Imidacloprid)
UBI-2627 175SD (Imidacloprid)
FORCE 1.5G (Tefluthrin)
LORSBAN 15G (Chlorpyrifos)
TRIGARD 75WP (Cyromazine)
EXP-6043A 83WG (Fipronil)
INSECT STOP (Amorphous diatomaceous earth)
Methyl cellulose; Talc

METHODS: Commercial film seed coatings (Treatments 1, 6-8) were applied by BEJOZADEN Ltd. in Warmenhuizen, Holland. Laboratory-applied seed treatments (Treatments 2-5, 13) were applied 4 May. Cooking onion seed moistened with 1% (w/v) methyl cellulose (Treatment 2), or liquid insecticide (Treatments 3-5) was tumbled with inert talc, until seeds were uniformly coated. Dry cooking onion seed was similarly tumbled with INSECT STOP (Treatment 12) until all seed was uniformly coated. All seed was planted at the London Research Farm on 6 May in 3 row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free organic soil. All treatments were replicated three times in a randomized complete block design. Furrow insecticides were applied after the seed was planted but before the seed furrow was closed. Granular insecticides (Treatments 10, 11) were hand-applied, with a modified salt shaker, in a 2-3 cm band in the bottom of the furrow. Furrow sprays (Treatments 9, 13) were applied in 750 L/ha at 175 kPa in a 2-3 cm band in the bottom of the seed furrow using a single-nozzle (4003 flat fan) Oxford precision sprayer. On 30 May a total of 250 OM eggs were buried 1 cm deep beside 1 onion row in each plot. The infested row length was delineated by stakes and the number of onion plants was counted. Infestations were repeated on 6 and 10 June. Surviving onion plants were counted 4 weeks after each infestation and the percent loss calculated. Data were subjected to arcsin square root transformation prior to statistical analysis by ANOVA; significance of differences among treatments means was determined using Duncan's Multiple Range Test. Untransformed data are presented in Table 1.

RESULTS: As presented in the table.

CONCLUSIONS: Tested rates of application of INSECT STOP had no effect on loss of seedling onions to larvae emerging from introduced OM eggs. All other treatments proved at least as effective as furrow granular application of LORSBAN 15G, the commercial standard, significantly reducing onion seedling loss following Infestations 1 and 2. Weather conditions following Infestation 3 did not favour establishment of larvae emerging from introduced OM eggs.

RESIDUES: Harvest samples of onions for measurement of pesticide residues were collected from microplots for Treatments 5 and 8. Analyses are incomplete.

Results of analyses of samples collected at harvest from microplots established at London in 1993 (1993 PMR Report number 35) are shown in Table 2. No residues of either tefluthrin (detection limit 0.01 ppm) or imidacloprid (detection limit 0.01 ppm) were measured in onions at harvest. Significant quantities of imidacloprid remained at harvest in soil directly beneath onions growing from seed treated with the insecticide. Soil dilution following tillage operations would undoubtedly significantly reduce these residue levels.

Table 1. Effect of seed- and seed furrow treatments on onion stand loss due to onion maggot.

No.	Insecticide Treatment	Rate (g a.i./ kg seed)	Mean % Onion Loss after Indicated Infestation Infestion I	Infestion II	Infestion III
* 1	TRIGARD 75WP	50.0	42.2 c***	25.3 b	9.7 cd
2	TRIGARD 75WP	50.0	52.5 c	24.2 bc	12.6 cd
3	UBI-2627 175SD	25.0	5.9 e	8.5 bcd	5.9 d
4	UBI-2627 175SD	35.0	22.1 cde	7.3 bcd	7.5 cd
5	UBI-2627 175SD	50.0	34.2 cd	2.4 cd	3.0 d
* 6	GAUCHO 70WS	25.0	13.6 de	2.0 d	4.8 cd
* 7	GAUCHO 70WS	35.0	8.7 de	13.3 bcd	9.2 cd
* 8	GAUCHO 70WS	50.0	3.8 e	1.9 d	5.8 cd
9	EXP-6043A 83WG	0.2**	26.0 cde	29.0 b	13.4 cd
10	FORCE 3G	4.5**	8.0 de	17.0 bcd	15.0 cd
11	LORSBAN 15G	4.8**	22.0 cde	12.3 bcd	3.5 d
12	INSECT STOP	200.0	100.0 a	75.4 a	73.4 a
13	INSECT STOP	150.0**	82.6 b	74.3 a	44.2 b
14	CONTROL	---	91.6 ab	75.8 a	23.6 bc

* Commercial application of seed coating.
** Seed furrow treatment applied as g a.i./100 m.
*** Means within a column followed by the same letter are not significantly different (P = 0.05) as determined by Duncan's Multiple Range Test.

Table 2. Pesticide residues measured in soil and onion samples collected from microplots established at London, Ontario in 1993.

No.	Insecticide Treatment	Rate (g a.i./kg)	Measured Residues (ppm) Soil (Harvest '93)	Onion (Harvest '93)
1	FORCE 18WP	40.0	0.41	<0.01
2	UBI-2627 175SD	25.0	1.31	<0.01
3	UBI-2627 175SD	35.0	3.61	<0.01

#035

ICAR: 84100737

CROP: Onion, cv. Benchmark

PEST: Onion thrips, *Thrips tabaci* Lindeman

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TITLE: INSECTICIDE FOLIAR TREATMENT TO CONTROL THRIPS ON ONIONS

MATERIALS: DIAZINON 500 EC (Diazinon)
RIPCORD 400 EC (Cypermethrin)
DECIS 5.0 EC (Deltamethrin)
CYMBUSH 250 EC (Cypermethrin)
ADMIRE 240FS (Imidacloprid)

METHODS: The tests were done at the Holland Marsh on muck soil. Onions were planted with a Stan-Hay precision seeder in a bed of 4 double rows. The experimental plot was arranged in a randomized complete design. The plots were 2 rows x 7 m long, replicated four times. The treatments were applied at 500 L of liquid per ha with a tractor-mounted sprayer at 600 kPa on August 6 and 12, 1994. The thrips population was assessed by examining 10 onions in each plot. Nymphs and adults were counted on each leaf and the leaf was stripped to count thrips in the leaf axil.

RESULTS: As presented in the table.

CONCLUSIONS: After the first application, there was no significant difference among the treatments for the control of the nymphal population of onion thrips. Four days after the second application, CYMBUSH, RIPCORD, and DECIS were more effective than DIAZINON in controlling the nymphal population of onion thrips. ADMIRE was not as effective as CYMBUSH.

Table 1. Mean number of nymphal (N) and adult (A) thrips per plant after insecticide foliar application.

			Mean number of thrips per plant*					
	Rate	Spray dates	Aug. 3		Aug. 8		Aug. 16	
Treatments	g/a.i./ha	August	N	A	N	A	N	A
1 DIAZINON	750	6,12	21a	1.7a	27a	1.4a	20ab	0.8a
2 CYMBUSH	70	6,12	24a	1.1a	15a	0.1b	3d	0.0a
3 ADMIRE;	50	6						
RIPCORD	70	12	15a	1.3a	18a	1.7a	10cd	0.0a
4 ADMIRE	100	6,12	19a	1.0a	19a	1.3a	14abc	2.5a
5 ADMIRE;	50	6						
DECIS	12.5	12	17a	0.9a	23a	1.8a	11bcd	0.3a
6 Control	-	-	20a	1.3a	21a	1.3a	22a	2.5a

* Means followed by the same letter are not significantly different (P#0.05; LSD test).

#036

ICAR NUMBER: 61006535

CROP: Pepper, cv. North Star

PEST: European corn borer, *Ostrinia nubilalis* (L.)

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TITLE: EUROPEAN CORN BORER CONTROL IN PEPPERS

MATERIALS: RH-5992 240F (experimental)
DECIS 2.5EC (Deltamethrin)
COMPANION (surfactant)

METHODS: Peppers were transplanted on June 17, 1994 in 2 row plots spaced 0.9 m apart. Plots were 7 m long, and replicated four times in a randomized complete block design. Spray applications were made with a back-pack airblast sprayer at 240 L/ha. Insecticides were applied on August 2 and 12. Assessments were conducted by counting the number of fruit infested with larvae at harvest on September 29. Results were analyzed using Duncan's Multiple Range Test.

RESULTS: As presented in the table.

CONCLUSIONS: Under significant pressure from the European corn borer, all treatments reduced the incidence of insect damage to the pepper fruit. There was no observable difference among the chemical treatments.

Table 1.

Treatment	Rate (product/ha)	% of fruits infested with European corn borer
RH-5992 240F	0.58 L	1.0b*
RH-5992 240F	1.16 L	0.5b
RH-5992 240F + COMPANION	0.58 L 0.1% v/v	0.3b
RH-5992 240F + COMPANION	1.16 L 0.1% v/v	0.5b
DECIS 2.5EC	0.5 L	0.3b
Control		9.3a

* Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

#037

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

PEST: Buckthorn aphid, *Aphis nasturtii* Kaltenbach
Potato aphid, *Macrosiphum euphorbiae* (Thomas)
Green peach aphid, *Myzus persicae* (Sulzer)

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TITLE: CHEMICAL CONTROL OF THREE APHID SPECIES ON POTATOES

MATERIALS: ADMIRE 240F, ADMIRE 2.5G (Imidacloprid)
THIMET 15G (Phorate)

METHODS: Plots consisted of 4 x 7.3 m long rows spaced 0.9 m apart. The treatments were arranged in a randomized block design with four replicates. Potatoes were planted May 31 and June 1, 1994 at a 41 cm spacing. On June 1, the in-furrow ADMIRE F treatments were applied using a hydraulic tractor-mounted sprayer that operated at 345 kPa and delivered an application volume of 452 L/ha. The tractor speed was 6.1 km/h. There was one extended range nozzle (8006VS) per row on drop lines on the boom. ADMIRE G and THIMET were applied using a conveyor belt fertilizer applicator on May 31. On June 15 linuron (2.5 L product/ha) was applied as a pre-emergence herbicide. Foliar sprays of ADMIRE were applied with the hydraulic sprayer that operated at 1220 kPa and three disc and core nozzles (D4-45) per row, at an application volume of 452 L/ha, and a tractor speed of 6.1 km/h. On July 4 the foliar ADMIRE F treatments were applied. Buckthorn, green peach and potato aphids taken from greenhouse colonies (16L:8D) were reared for two generations on cut leaves in the lab (16L:8D). Newly matured adults, mostly apterae, were used. Five aphids of a species were put into clip cages that measured 3 cm in diameter x 1 cm in height. One cage of each aphid species was placed per plot, on the same plant, when possible. The experiment was set up on July 7. Mortality in the cages was recorded after 7 d. Analyses of variance were carried out on data that were transformed using the Arcsin Transformation.

RESULTS: As presented in the table.

CONCLUSIONS: The dry summer in Fredericton may have resulted in low uptake of soil-applied insecticides which was reflected in the low levels of mortality in the soil-applied insecticides (Table 1). This low uptake resulted in the earlier than usual need for maintenance sprays against Colorado potato beetles, thus only one aphid trial was possible. The similar levels of mortality in the foliar-applied ADMIRE treatments as for the soil-applied ADMIRE treatments likely were due to the proportionate application rates, i.e. 50 g/ha is roughly equivalent to 0.005 g/m. Part of the relatively higher level of mortality of aphids in the THIMET treatment was possibly due to defoliation by Colorado potato beetles. This made the aphids in the THIMET treatment more prone to desiccation than the aphids in the other treatments which were protected from wind and sunlight by potato foliage. The results of this experiment compared to those of experiments in previous years seem to indicate that the level of efficacy of soil-applied ADMIRE in potato plants is related to growing conditions. None of the treatments in this experiment were phytotoxic.

Table 1. Mean buckthorn, green peach and potato aphid percent mortality after 7 days in clip cages set on field grown potato plants.*

Treatment (g a.i./m)	Buckthorn	Green Peach	Potato
ADMIRE F 0.005	46.7ab	51.7abc	75.0ab
ADMIRE F 0.010	58.3abc	71.7ab	56.3abc
ADMIRE F 0.015	91.7cd	31.7bc	72.5abc
ADMIRE G 0.020	100.0d	73.3ab	87.5ab
ADMIRE F 25**	28.3b	6.7c	45.0bc
ADMIRE F 50**	77.8acd	40.0abc	81.7ab
THIMET 3,690**	100.0d	88.8a	100.0a
untreated check	0.0e	6.7c	16.3c

* Figures are the means of four replicates. Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P = <0.05).

** g a.i./ha.

#038

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: COLORADO POTATO BEETLE THRESHOLDS AND ALTERNATIVE CONTROL TECHNIQUES

MATERIALS: NOVODOR FC (*Bacillus thuringiensis* subsp. *tenebrionis*)
Plastic (4 mil black mulching)

METHODS: Plots consisted of 4 x 7.3 m long rows spaced 0.9 m apart. The treatments were arranged in a completely randomized design with four replicates (seven replicates in the Defoliation Threshold treatment). Potatoes were planted May 30, 1994 at a 41 cm spacing. The inner edge of the plastic-lined trench was 90 cm from the plots. All insecticides were applied with a tractor-mounted hydraulic sprayer that operated at 1220 kPa, was equipped with three-disc and core (D4-45) nozzles per row at an application volume of 452 L/ha, and a tractor speed of 6.1 km/h. On June 15 linuron (2.5 L product/ha) was applied as a pre-emergence herbicide. On July 4 azinphos-methyl (1.8 L product/ha) was applied to the defoliation threshold and treated check treatments. On June 29, July 4, 12, and 19 the simulated vacuum treatment was carried out by bending potato plants over drop sheets and gently beating them. The Colorado potato beetle (CPB) adults and larvae that fell on the drop sheet were destroyed. The eight CPB per stem treatment was sprayed when the mean number of CPB adults and larvae exceeded eight per stem. The treated check and defoliation threshold treatments were to be kept within a defoliation rating of 0 and 2, respectively by appropriately timed applications of a foliar insecticide. NOVODOR was applied on July 4, 12, and 19 to NOVODOR treatment and on July 8 and 15 to the Trench/NOVODOR treatment. On July 8, 12, and 15 imidacloprid was sprayed on the defoliation threshold and treated check treatments. On July 8 imidacloprid was sprayed on the eight

CPB/stem treatment. Imidacloprid was used as maintenance sprays for the: Trench treatment on July 12 and 15; Trench/NOVODOR and NOVODOR treatments on July 26; treated check and untreated check on July 29; all treatments except the eight CPB per stem treatment on August 11; and for all treatments on August 24. Mancozeb (2.2 kg product/ha) was applied to all plots to control late-blight on August 24 and September 1. The number of various CPB life stages were counted weekly from June 21 to August 15 on 10 randomly chosen potato plants in the middle 2 rows of each plot. In the eight CPB per stem treatment the number on stems of the 10 potato plants was counted. The defoliation rating for a plot was taken weekly from June 21 to August 29. The plots were top-killed with diquat (2.75 L of product/ha) on September 8 and the 2 middle rows of each plot were harvested on September 21. Analyses of variance and Duncan's Multiple Range Tests were carried out on untransformed parametric data.

RESULTS: As presented in the tables.

CONCLUSIONS: Since the CPB population at the Fredericton Research Centre was resistant to azinphos-methyl and to other registered insecticides available at the Centre, imidacloprid was used. The first spray of insecticides was planned for 30% egg hatch. This was never reached so the insecticides were applied after serious defoliation had occurred, from which the potato plants never recovered. The yield and foliage protection of all treatments was superior to the Untreated Check. The treated check should have had yields superior to the Defoliation Threshold treatment since the foliage protection was planned to be better, but because of the late start of insecticide spraying this was not the case. The eight CPB per stem treatment was sprayed only once, on July 8. This single spray was effective against CPB adults and all larval instars. Yields and defoliation ratings were similar to NOVODOR and Simulated Vacuum treatments (Tables 1 and 2). The Simulated Vacuum treatment had poor efficacy because after each treatment CPB adults moved into these plots from the surrounding plots. If the whole field had been treated, reinfestation would not have occurred at such a high level. The Trench treatment, by physically reducing the movement of CPB into the plots, resulted in yield and foliage ratings similar to the Treated Check. The addition of NOVODOR sprays to plots surrounded by trenches did result in improved yield but not significantly. If NOVODOR had been sprayed earlier its effect may have been greater.

Table 1. The mean number of various Colorado potato beetle life stages per 10 plants and the mean total weight yield in tonnes per ha.*

Treatment	Second Instars 11/07	Third Instars 18/07	Fourth Instars 25/07	Adults 08/08	Total Yield (tonnes/ha)
Trench	144.8a	0.0a	9.8a	12.3a	19.15abc
Trench/NOVODOR**	56.3bc	54.5a	61.3bc	48.0a	22.12a
NOVODOR**	262.3d	153.0b	82.0b	156.3b	13.85c
treated check	0.8c	0.0c	0.0a	18.0a	19.86abc
simulated vacuum	87.8ab	214.8d	87.0bd	41.0a	14.31bc
defoliation threshold	1.3c	0.0c	0.0a	41.4a	21.20ab
8 CPB/stem	2.3c	3.0c	31.5ac	24.5a	14.73bc
untreated check	108.3ab	53.3a	125.0d	68.8a	3.40d

* Figures are the means of four replicates (seven in the Defoliation Threshold). Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P = <0.05).
** 141 mL a.i./ha.

Table 2. The mean defoliation ratings of the treatments plots throughout the sampling period.*

Treatment	June		July					August				
	21	27	4	7	11	18	25	2	8	15	22	29
Trench	1	1	2	2	4	3	2	2	2	2	3	2
Trench/NOVODOR**	1	1.5	1.5	2	3	3	2	2	3	3	4	3
NOVODOR**	1	2	3	3	4	4	5	4	5	6	6	6
treated check	1.5	1.5	2	3	3	2	2	2	2	2	2	1.5
simulated vacuum	1	2	2	2	3	3	4	7	7	7	7	7
defoliation threshold	1	1.5	2	2	2	1.5	2	2	3	3	4	3
8 CPB/stem	1	1.5	2	3	3	2	2	3	5	6	8	8
untreated check	1.5	2	3	3	5	8	8	8	7	8	8	8

* Figures are the means of four replicates (seven in the Defoliation Threshold) rounded to the nearest defoliation rating. Defoliation rating: 0: no defoliation; 1: 2-60% of plants with leaflets lightly damaged; 1.5: >60% of plants with leaflets lightly damaged 2: 2% of plants with one or more compound leaves at least 50% defoliated; 3: 2-9% of plants with one or more stems at least 50% defoliated; 4: 10-24% of plants with one or more stems at least 50% defoliated; 5: 25-49% of plants with one or more stems at least 50% defoliated; 6: 50-74% of plants with one or more stems at least 50% defoliated; 7: 75-99% of plants with one or more stems at least 50% defoliated; 8: stems completely eaten on all plants.

** 141 mL a.i./ha.

#039

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: A COMPARISON OF NOZZLE CONFIGURATION AND NUMBER IN CONTROLLING THE COLORADO POTATO BEETLE

MATERIALS: ADMIRE 2F (Imidacloprid)

METHODS: Plots consisted of 4 x 3.7 m long rows spaced 0.9 m apart. There were two sets of plots. The sets were planted at a 30 cm spacing on May 24, 1994. On June 15 linuron (2.5 L product/ha) was applied as a pre-emergence herbicide. There were different sets to determine if potato plant size had any effect on the relative performance of the six nozzle configuration and number combinations. The first treatment is the Conventional arrangement, which is 3 nozzles per row, spaced at 30 cm on a straight boom. The second treatment is 1 nozzle per row, spaced at 90 cm on a straight boom. The third treatment is the row applicator Kit, which consists of two plastic arms adjustable for length and angle. The arms originate from a point behind the centre nozzle. The arms move sideways from that point and can be adjusted to many crop widths. The centre nozzle and arms are attached to a slot on a clamp that is mounted on the boom. The slot allows for height adjustments of up to 3 cm. Nozzles are attached at the end of each arm. The angles of the nozzles and arms can be used in combination to adjust the spray reaching the crop. All three nozzles on the kit are fed from a single nozzle body on the main boom. In this trial the centre nozzles on the kits were blanks. The fourth treatment is the 3-Drop Line, which consisted of 38 cm long drops lines 90 cm apart. Each pair of drop lines had a nozzle between them on the boom to spray the row from above. This arrangement provides three nozzles per row but brings the outside two nozzles down on the sides of the plants. The drop lines between rows had double swivel nozzles bodies attached to them so that both rows could be sprayed. The fifth treatment is the 2-Drop Line, which is similar to the 3-Drop Line but with the top nozzle shut off with a blank. The sixth and last treatment is the Untreated Check. Half of each plot was sprayed with disc and core hollow cone nozzles (Tee Jet D4-45) and the other half with flat fan extended range nozzles (Tee Jet 11006). The treatments were replicated four times for each type of nozzle. The two sets were sprayed on July 12 or 19, respectively. Treatments were applied using a tractor-mounted sprayer operating at 345 kPa with extended range nozzles and 1220 kPa with the disc and core nozzles. The mean nozzle flow rate was 1.4 L/min for both types of nozzle. Tractor speed was 6.1 km/h. ADMIRE was applied at 0.42 L/ha of product. The application volume was 452.5 L/ha. The number of Colorado potato beetle (CPB) larvae on five randomly chosen plants in the 2 outside rows of each plot were counted the day before the sprays. Sprays were applied in the morning. The efficacy of the treatments was assessed by post-spray counts of the same plants on July 13 (Set 1) and July 20 (Set 2). Analyses of variance and Duncan's Multiple Range Test were carried out on the untransformed data.

RESULTS: As presented in the table.

CONCLUSIONS: The two different types of nozzles resulted in CPB larval control that was not significantly different thus, the replicates of each treatment for the two nozzle types were pooled, making eight replicates per treatment. The mean potato plant heights were significantly different. The trends in both sets were the same, thus a difference of 6 cm in plant height had no effect on the relative performance of the treatments. All treatments resulted in significantly fewer CPB larvae than in the Untreated Check. Treatments with 2 or 3 nozzles per row resulted in similar levels of control of CPB larvae regardless of configuration. The 1 nozzle per row treatment did not control CPB larvae as well as the other nozzle configuration and number combinations.

Table 1. The mean number of Colorado potato beetle larvae per five potato plants pre- and post-spray.*

Nozzle configuration (Number of nozzles per row)	28.7 cm Plants		34.6 cm Plants	
	Pre-spray	Post-spray	Pre-spray	Post-spray
Conventional (3)	62.9a	1.8a	43.9a	10.2a
One (1)	53.8a	13.5b	32.3a	14.3b
Kit (2)	47.4a	0.5a	37.1a	5.9a
2-Drop Line (2)	51.4a	2.6a	37.1a	6.8a
3-Drop Line (3)	51.7a	0.7a	36.9a	6.0a
untreated check	49.6a	45.0c	36.5a	28.2c

* Figures are the means of eight replicates. Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test ($P = <0.05$).

#040

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: CHEMICAL CONTROL OF THE COLORADO POTATO BEETLE

MATERIALS: ADMIRE 2F, 2.5G (Imidacloprid)
THIMET 15G (Phorate)

METHODS: Plots consisted of 4 x 7.3 m long rows spaced 0.9 m apart. The treatments were arranged in a randomized block design with four replicates, except the untreated check which had seven replications. Potatoes were planted May 31 and June 1, 1994 at a 41 cm spacing. On June 1, the in-furrow treatments of ADMIRE F were applied using a hydraulic tractor-mounted sprayer that operated at 345 kPa and delivered an application volume of 452 L/ha. The tractor speed was 6.1 km/h. There was 1 extended range nozzle (8006VS) per row on drop lines on the boom. ADMIRE G and THIMET were applied using a conveyor belt fertilizer applicator on May 31. On June 15 linuron (2.5 L of product/ha) was applied as a pre-emergence herbicide. The foliar sprays of ADMIRE F were applied with the hydraulic sprayer operating at 1220 kPa and three disc and core nozzles (D4-45) per row, at an application volume of 452 L/ha, and a tractor speed of 6.1 km/h. On July 4 and 15, and August 3, the foliar ADMIRE F treatments were applied. On July 28 and August 11, the low rate of foliar ADMIRE F was applied. On July 28, and August 3 and 11 maintenance sprays of ADMIRE F at a rate 50 g a.i./ha was applied to all plots except plots that were to receive the foliar ADMIRE F treatments. On August 18 and September 1, the high rate of the foliar ADMIRE F treatment was applied. Mancozeb (2.2 kg product/ha) was applied to all plots except plots that were to receive the high rate foliar ADMIRE F treatment on August 24, and to all plots on September 1, to control late-blight. The number of various life stages of the Colorado potato beetle (CPB) were counted weekly on 10 randomly chosen plants in the middle 2 rows of each plot from June 21 to August 15. The defoliation rating from a plot was taken weekly from June 21 to August 29. The plots were top-killed with diquat (2.75 L of product/ha) on September 8, and the 2 middle rows in each plot were harvested on September 20. Analyses of variance and Duncan's Multiple Range Tests were carried out on untransformed parametric data.

RESULTS: As presented in the tables.

CONCLUSIONS: The length of effectiveness, from application, against CPB adults was: 7 weeks for ADMIRE F at 0.015 g/m, 6 weeks for ADMIRE F at 0.01 g/m, 5 weeks for ADMIRE F at 0.005 g/m ADMIRE, 6 weeks for ADMIRE G, 5 weeks for THIMET, and 2 weeks for the two foliar ADMIRE F treatments. Thus, ADMIRE F applied in-furrow had at least twice the effective lifetime than foliar applied ADMIRE F against CPB adults. The length of effectiveness, from application, against CPB larvae was 5 weeks for the four soil-applied ADMIRE treatments. The foliar sprays of ADMIRE F were still effective by the time of the next spray, a maximum of 3 weeks. THIMET had lost its effectiveness against CPB larvae by the time they were present (July 4). In terms of protecting foliage from CPB defoliation, 0.015 g/m of ADMIRE F applied in-furrow was the best treatment, followed by 0.01 g/m of ADMIRE F applied in-furrow, then 0.005 g/m of ADMIRE F applied in-furrow, 50 g/ha of ADMIRE F foliar applied, 25 g/ha of ADMIRE F foliar applied, 0.02 g/m of ADMIRE F applied in-furrow, THIMET and then the Untreated Check. All application methods and rates of ADMIRE resulted in similar total yields, all of which were significantly greater than the Untreated Check. The low efficacy of ADMIRE G may have been due to the dry summer in Fredericton. Plots treated with THIMET had a total yield that was not significantly different from that of the Untreated Check, and was roughly half of the yield of the plots treated with ADMIRE. None of the treatments were phytotoxic.

Table 1. The mean number of various Colorado potato beetle life stages per 10 plants and the mean total yield in tonnes per ha.*

Treatment (g a.i./m)	Egg Masses 04/07	Second Instars 12/07	Third Instars 20/07	Fourth Instars 25/07	Adults 08/08	Total Yield (tonnes/ha)
ADMIRE F 0.005	20.8a	36.8ab	138.5a	308.3a	89.0ab	26.20ab
ADMIRE F 0.010	7.0ab	7.0b	23.3bc	159.0bc	27.8ab	28.35ab
ADMIRE F 0.015	2.0b	0.8b	18.8bc	119.0bcd	5.5b	32.00a
ADMIRE G 0.020	7.8ab	21.8ab	33.0bc	38.3cd	30.8ab	24.37ab
ADMIRE F 25**	18.0ab	82.0ac	3.5c	25.3d	82.8ab	29.65a
ADMIRE F 50**	20.5a	19.8ab	1.8c	1.5d	9.8ab	32.22a
THIMET 3,690**	20.5a	79.3ac	130.0a	215.0ab	94.0a	13.06bc
untreated check	10.0ab	104.4c	48.4b	82.1cd	41.0ab	4.91c

* Figures are the means of four replicates (seven in the Untreated Check). Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P = <0.05).
** g a.i./ha.

Table 2. The mean defoliation of the treatments plots throughout the sampling period.*

Treatment (g a.i./ha)	June		July				August				
	21	27	4	12	20	25	2	8	15	22	29
ADMIRE F 0.005	1	1	1	1.5	3	5	7	7	6	6	6
ADMIRE F 0.010	1	1	1	1	2	4	5	4	3	4	3
ADMIRE F 0.015	1	1	1	1	1.5	3	4	3	2	3	2
ADMIRE G 0.020	1	1	1	3	3	4	3	3	3	3	2
ADMIRE F 25**	1	1.5	1.5	2	3	3	3	3	3	4	4
ADMIRE F 50**	1	2	1.5	2	2	2	2	2	2	2	3
THIMET 3,690**	1	1.5	1.5	3	5	7	7	7	6	5	5
untreated check	1	1	1.5	4	7	8	8	8	8	8	8

* Figures are the means of four replicates (seven in the Untreated Check) rounded to the nearest defoliation rating. Defoliation rating, 0: no defoliation; 1: 2-60% of plants with leaflets lightly damaged; 1.5: more than 60% of plants with leaflets lightly damaged; 2: 2% of plants with one or more compound leaves at least 50% defoliated; 3: 2-9% of plants with one or more stems at least 50% defoliated; 4: 10-24% of plants with one or more stems at least 50% defoliated; 5: 25-49% of plants with one or more stems at least 50% defoliated; 6: 50-74% of plants with one or more stems at least 50% defoliated; 7: 75-99% of plants with one or more stems at least 50% defoliated; 8: stems completely eaten on all plants.
** g a.i./ha.

#041

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: CHEMICAL CONTROL OF THE COLORADO POTATO BEETLE WITH TRIGARD AND KRYOCIDE

MATERIALS: KRYOCIDE 96W (Sodium fluoaluminate)
TRIGARD 75WP (Cyromazine)

METHODS: Plots consisted of 4 x 7.3 m long rows spaced 0.9 m apart. The treatments were arranged in a randomized block design with four replicates. Potatoes were planted June 3, 1994, at a 41 cm spacing. On June 15 linuron (2.5 L product/ha) was applied as a pre-emergence herbicide. All insecticide sprays were applied with a tractor-mounted hydraulic sprayer that operated at 1220 kPa and was equipped with three disc and core nozzles (D4-45) per row, at an application volume of 452 L/ha, and a tractor speed of 6.1 km/h. On July 4 azinphos-methyl was applied at a rate of 1.8 L of product/ha to the treated check plots. On July 8, 12, and 15 imidacloprid (50 g a.i./ha) was applied to the treated check plots. The two TRIGARD treatments were sprayed on July 8 and 15. *B.t.* (141 mL a.i./ha) was applied as a maintenance application to the TRIGARD treatment plots on July 22 and 26. The KRYOCIDE treatment was sprayed on July 15, 22 and 26. Maintenance sprays of imidacloprid were applied to all plots on July 29, and on August 11 and 24. On August 24 and September 1 mancozeb (2.2 kg product/ha) was applied to all plots to control late-blight. The number of various life stages of the Colorado potato beetle (CPB) were counted weekly on 10 randomly chosen plants in the middle 2 rows of each plot from June 21 to August 15. The defoliation ratings for plots were taken weekly from June 21 to August 29. The plots were top-killed with diquat (2.75 L product/ha) on September 8 and the 2 middle rows in each plot were harvested on September 19. Analyses of variance and Duncan's Multiple Range Tests were carried out on untransformed parametric data.

RESULTS: As presented in the tables.

CONCLUSIONS: Since the CPB population at the Fredericton Research Centre was resistant to azinphos-methyl and to other registered insecticides available at the Centre, imidacloprid was used in this experiment. The field used in this experiment was in sod in 1993, thus CPBs had to migrate from other fields; resulting in a low and late development of the CPB population. The significantly lower number of egg masses (18) in the treated check plots was due to imidacloprid as it is the only insecticide used in this experiment that is effective against adult CPB (Table 1). In terms of CPB population suppression both TRIGARD treatments and the KRYOCIDE treatment were similar, and none of the insecticide treatments were significantly different but all were significantly different from the untreated check (Table 1). The treated check afforded the best foliage and yield protection. Both application rates of TRIGARD resulted in similar foliage protection, except before the second TRIGARD sprays. The treatment with KRYOCIDE (first applied a week later than TRIGARD) resulted in the least foliage protection (Table 2). The treatments with TRIGARD or KRYOCIDE resulted in yields that were not significantly different from that of the Treated Check. The treatment with the second spray of TRIGARD applied at 0.14 kg a.i./ha was as effective against a low CPB population as the treatment with the second spray of TRIGARD applied at 0.28 kg a.i./ha. Under such CPB pressure TRIGARD appears marginally superior to KRYOCIDE, this difference was not statistically significant. None of the treatments in this experiment were phytotoxic.

Table 1. The mean number of various Colorado potato beetle life stages per 10 plants and the mean total yield in tonnes per ha.*

Treatment and Rates of Application**	Egg Masses 18/07	Second Instars 18/07	Third Instars 25/07	Fourth Instars 25/07	Adults 08/08	Total Yield (tonnes/ha)
TRIGARD 0.28 & 0.14	18.0a	25.3a	40.8a	26.3a	5.0a	26.20ab
TRIGARD 0.28 & 0.28	19.0a	40.8a	24.8a	35.5a	3.5a	27.84a
KRYOCIDE 13.0	14.8a	15.3a	20.3a	36.3a	22.5a	25.86ab
treated check	0.0b	0.0a	0.0a	0.0a	3.0a	32.52a
untreated check	22.3a	113.8b	148.5b	212.3b	123.8b	16.48b

* Figures are the means of four replicates. Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P = <0.05).

** The first number in the TRIGARD treatments is the first rate applied, the second number is the rate applied 7 d later. All treatments are listed in kg a.i./ha.

Table 2. The mean defoliation of the treatments plots throughout the sampling period.*

Treatment and Rates of Application**	June 21	June 27	July 4	July 7	July 11	July 18	July 25	August 2	August 8	August 15	August 22	August 29
TRIGARD 0.28 & 0.14	0	1	1	1.5	1.5	2	2	2	2	2	2	1.5
TRIGARD 0.28 & 0.28	0	1	1	1.5	2	2	2	2	2	2	2	1.5
KRYOCIDE 13.0	0	1	1	1.5	2	3	3	2	2	3	2	1.5
treated check	0	1	1	1.5	1.5	1	1.5	2	1	1	1.5	1.5
untreated check	0	1	1	1.5	1.5	4	6	7	5	5	5	4

* Figures are the means of four replicates rounded to the nearest defoliation rating. Defoliation rating, 0: no defoliation; 1: 2-60% of plants with leaflets lightly damaged; 1.5: >60% of plants with leaflets lightly damaged 2: 2% of plants with one or more compound leaves at least 50% defoliated; 3: 2-9% of plants with one or more stems at least 50% defoliated; 4: 10-24% of plants with one or more stems at least 50% defoliated; 5: 25-49% of plants with one or more stems at least 50% defoliated; 6: 50-74% of plants with one or more stems at least 50% defoliated; 7: 75-99% of plants with one or more stems at least 50% defoliated; 8: stems completely eaten on all plants.

** The first number in the TRIGARD treatments is the first rate applied, the second number is the rate applied 7 d later. All treatments are listed in kg a.i./ha.

#042

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 : ESSAI D'INSECTICIDES CHIMIQUES CONTRE LE DORYPHORE DE LA POMME DE TERRE

PRODUITS : ADMIRE 240 FS (NTN-33893, Imidacloprid)
DECIS 5,0 EC (Deltaméthrine)
KRYOCIDE INSECTICIDE (Cryolite: fluoaluminate de sodium, 96,0%)

MÉTHODES : L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 24 mai 1994, dans un sol de type loam sableux. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués les 24 mai (traitement 1, à la plantation), 4 juillet (traitements 2, 3, 4 et 5), 11 juillet (traitements 2, 4 et 5) ainsi que le 27 juillet (traitements 3, 4 et 5), (dose : g et kg MA/ha, pression : 1641,4 kPa, volume : 800 L/ha). L'évaluation des densités du doryphore a été faite régulièrement sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Le défanage des plants a été effectué les 11 et 18 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 23 août.

RÉSULTATS : Voir le tableau ci-dessous.

CONCLUSIONS : Pour une première année d'essai au Québec, le produit KRYOCIDE a donné de très bons résultats. Avec trois applications, KRYOCIDE a permis de maintenir à un niveau très bas les densités larvaires et le dommage aux plants, qui est demeuré très stable à un indice de 1,0. Les résultats sont dans l'ensemble supérieurs à ceux obtenus avec DECIS et, principalement à partir de la 3e semaine de juillet, les résultats (densités et dommages) sont significativement différents. Aussi, comparativement à ADMIRE, KRYOCIDE a donné une meilleure performance en fin de saison. Toutefois, les résultats obtenus avec ADMIRE demeurent très satisfaisants et sensiblement comparables aux saisons précédentes principalement jusqu'à la mi-juillet. Pendant cette période, les densités et les dommages aux plants ont été maintenus à des niveaux très bas. Cependant, les faibles performances à partir de la mi-juillet sont attribuables à un nombre de traitements plus faibles qu'avec KRYOCIDE. Ainsi trois applications foliaires avec ADMIRE (25,0 g et 50,0 g MA/ha) auraient été nécessaires au lieu de deux applications. Pour ADMIRE à 50,0 g MA/ha l'efficacité a été inférieure à ADMIRE 25,0 g MA/ha parce que la deuxième application a été faite plus tardivement. Pour sa part, ADMIRE à la plantation a procuré une rémanence plus faible que les saisons précédentes car les dommages ont augmenté progressivement du 7 juillet au 1er août. Cette plus faible rémanence s'explique par un type de sol différent en 1994 et aussi par une saison très pluvieuse. Une seconde intervention aurait été nécessaire dès le 18 juillet. Il n'en demeure pas moins que ADMIRE est un produit très performant dont le choix de la dose, du nombre d'interventions et de l'intervalle entre les applications sont très importants.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1994.

Traitement Insecticide	Dose (MA/ha)	Population larvaire juillet 04	11	18	25	Dommage* juillet 07	14	21	août 01	Rendement (t/ha)
1. ADMIRE	0,02 g**	0,0b***	0,4e	3,3bc	10,6b	0,2b	1,0b	1,5c	2,7b	36,49ab
2. ADMIRE	25,00 g	3,3ab	4,2d	0,4d	4,1c	1,0a	1,0b	1,0d	2,0c	38,72ab
3. ADMIRE	50,00 g	2,5ab	1,6ed	4,5b	9,4b	1,0a	1,0b	1,5c	3,0b	34,73b
4. KRYOCIDE	10,56 kg	4,6a	15,7b	1,2cd	2,2c	1,0a	1,0b	1,0d	1,0d	39,99a
5. DECIS	7,5 g	3,8ab	10,9c	4,7b	9,1b	1,0a	1,2b	2,0b	3,0b	37,36ab
6. TÉMOIN	------	4,8a	26,6a	29,9a	14,6a	1,0a	2,5a	4,5a	6,0a	28,21c

* Évaluation visuelle par parcelle : indice de défoliation de 0 à 8 (0 à 100% de défoliation).

** Traitement à la plantation, 0,02 g MA/m de rang.

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

#043

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 : ESSAI DE CYROMAZINE CONTRE LE DORYPHORE DE LA POMME DE TERRE, SAISON 1994

PRODUITS : TRIGARD 75 WP (Cyromazine)
DECIS 5,0 EC (Deltaméthrine)

MÉTHODES : L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 25 mai 1994. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués pour la première intervention les 2 juillet (10-30% d'éclosion des oeufs : traitements 1, 2 et 4. N.B. : Les traitements ont été repris le 4 juillet car une averse importante a délavé le feuillage une heure après l'application), 6 juillet (5 jours après 10-30% d'éclosion des oeufs : traitement 3) et le 12 juillet (traitements 1, 2, 3 et 4) pour la seconde intervention à l'aide d'un pulvérisateur monté sur tracteur (dose : g MA/ha, pression : 1641,4 kPa, volume : 800 L/ha). L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Par ailleurs des masses d'oeufs (10 masses/parcelle) ont été suivies régulièrement afin de pouvoir initier les premiers traitements selon le protocole prévu. Les plants ont été défanés les 11 et 18 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 24 août.

RÉSULTATS : Voir le tableau ci-dessous.

CONCLUSIONS : En regard de l'ensemble des résultats, l'insecticide cyromazine a été relativement efficace à réprimer les densités de doryphores et à assurer la protection du feuillage. À partir du 11 juillet, les résultats (densités larvaires, dommages et rendement) avec le cyromazine sont significativement plus faibles que ceux obtenus avec le témoin (sans traitement). Comparativement à DECIS, les résultats sont comparables ou significativement différents selon les traitements avec cyromazine. Ainsi, le traitement 3, légèrement plus tardif que les traitements 1 et 2, se révèle plus efficace que DECIS avec des densités larvaires et des taux de dommage aux plants significativement plus faibles. Par ailleurs, le traitement 3 semble davantage se démarquer des traitements 1 et 2 avec le cyromazine par un dommage aux plants relativement faible et stable du début juillet jusqu'au 1er août et par des densités larvaires plus faibles à la fin de juillet. Bien que les approches de lutte préconisées (traitement hâtif : 10-30% d'éclosion des oeufs; traitement tardif : cinq jours après le traitement hâtif) n'ont pu être respectés totalement à cause de la pluie, il serait plus avantageux selon les résultats de retarder la première application de quelques jours, sensiblement identique au traitement 3. La performance de cyromazine le permet sans occasionner de risques pour la culture car des indices de dommage inférieurs à 2,0 sont très sécuritaires.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1994.

Traitement		Population larvaire					Dommage*				Rendement
Insecticide	Dose (g MA/ha)	juin 30	juillet 04	juillet 11	juillet 20	juillet 26	juillet 08	juillet 20	juillet 26	août 01	(t/ha)
1. Cyromazine	280 + 140	0,2**	5,7b	15,9c	1,5cd	3,0cb	1,0	1,2c	1,2c	1,7bc	36,18a
2. Cyromazine ***	280 + 280	0,4	4,8b	13,0c	3,7bc	4,3b	1,0	1,5bc	1,7bc	2,0b	36,36a
3. Cyromazine ***	280 + 280	1,2	14,3a	22,9b	0,7d	0,4d	1,0	1,2c	1,2c	1,2c	33,88a
4. DECIS	7,5	1,3	6,4b	22,3b	3,9b	2,4c	1,0	2,0b	2,0b	2,0b	32,49a
5. TÉMOIN	----	0,2	8,0b	45,1a	32,8a	12,6a	1,0	4,7a	6,5a	7,0a	20,14b

* Évaluation visuelle par parcelle : indice de défoliation de 0 à 8 (0 à 100% de défoliation).

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

*** Traitement 2 (1 et 4 semblables), première intervention à 10-30% d'éclosion des oeufs. Traitement 3, première intervention à 5 jours après 10-30% d'éclosion des oeufs.

#044

BASE DE DONNÉES DES ÉTUDES : 87000221

CULTURE : Pomme de terre, cv. Superior

RAVAGEUR : Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say)

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TITRE : ESSAI DE NOVODOR ET DE M-TRAK CONTRE LE DORYPHORE DE LA POMME DE TERRE

PRODUITS : M-TRAK LI (Endotoxine-delta encapsulée de *Bacillus thuringiensis* var. *san diego*, 10%)
NOVODOR FC (Endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3,0%)
DECIS 5,0 EC (Deltaméthrine)
GUTHION 240-EC (Azinphos-méthyl)
RIPCORD 400 EC (Cyperméthrine)

MÉTHODES : L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs aléatoires complets avec 4 répétitions. Les pommes de terre ont été plantées le 6 juin 1994. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides biologiques et chimiques (séquence des produits = GUTHION, RIPCORD, DECIS, DECIS) ont été appliqués les 4, 8, 14 et 27 juillet à l'aide d'un pulvérisateur monté sur tracteur (dose : p.c./ha, pression : 1641,4 kPa, volume : 800 L/ha). L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Le défanage des plants a été effectué les 18 et 22 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 30 août.

RÉSULTATS : Voir le tableau ci-dessous.

CONCLUSIONS : Les insecticides biologiques M-TRAK et NOVODOR ont définitivement été dans l'ensemble beaucoup plus performants que les insecticides chimiques en 1994. Les densités larvaires et les dommages aux plants ont été maintenus à des niveaux très bas et relativement stables à partir de la mi-juillet. Ces résultats ont été significativement plus élevés avec les insecticides chimiques et le témoin. En regard des traitements avec les *Bacillus thuringiensis* et les insecticides chimiques, les rendements ont été significativement plus faibles pour le témoin et très comparables entre NOVODOR (4,6 et 7,0 L/ha) et M-TRAK. Seul le rendement obtenu avec NOVODOR (7,0 L/ha) est significativement plus élevé que le traitement avec les insecticides chimiques, alors que les autres rendements obtenus avec les *Bacillus thuringiensis* sont comparables. Comme en 1993, l'efficacité de NOVODOR, plus spécifiquement à la dose de 7,0 L/ha est semblable à M-TRAK. La saison 1994 se distingue de celle de 1993 par l'abondance des précipitations en juin et en juillet. Dans ces circonstances, les résultats obtenus avec M-TRAK et NOVODOR démontrent hors de tout doute l'efficacité des produits biologiques avec un degré de rémanence et de persistance très acceptable en comparaison des résultats moins performants obtenus avec les insecticides chimiques. Enfin, la performance des *Bacillus thuringiensis* clairement démontrée en 1994 illustre très bien les avantages d'utiliser stratégiquement *Bacillus thuringiensis* en présence de populations de doryphores à Deschambault résistants aux insecticides chimiques.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1994.

Traitement Insecticide	Dose (p.c./ha)	Population larvaire juillet 04	juillet 12	juillet 20	août 01	Dommage* juillet 07	juillet 14	juillet 25	août 08	Rendement (t/ha)
1. M-TRAK	7,5 L	3,5a**	6,1bc	0,2c	1,4c	1,0	1,0b	1,0c	1,2c	42,10ab
2. NOVODOR	4,6 L	4,1a	8,2b	1,4c	2,7c	1,0	1,0b	1,5b	1,7b	40,38ab
3. NOVODOR	7,0 L	1,8a	3,0c	0,4c	1,5c	1,0	1,0b	1,0bc	1,0c	43,88a
4. CHIMIQUES***		4,8a	4,9bc	8,9b	10,8a	1,0	1,0b	2,6a	5,3a	36,37b
5. TÉMOIN	---	1,4a	21,3a	35,1a	5,0b	1,0	2,5a	5,0a	7,2a	24,70c

* Évaluation visuelle par parcelle : indice de défoliation de 0 à 8 (0 à 100% de défoliation).

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

*** Dose : DECIS : 150 mL; GUTHION : 1,70 L; RIPCORD : 125 mL.

#045

BASE DE DONNÉES DES ÉTUDES : 87000221

CULTURE : Pomme de terre, cv. Superior

RAVAGEUR : Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say)

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TITRE : ESSAI DE NOVODOR EN ASSOCIATION AVEC KRYOCIDE

PRODUITS : NOVODOR FC (Endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3,0%)
KRYOCIDE INSECTICIDE (Cryolite : Fluoaluminate de sodium, 96,0%)

MÉTHODES : L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires complets avec 4 répétitions. Les pommes de terre ont été plantées le 6 juin 1994. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués les 4 et 8 juillet (traitements 1, 2, 3, 4 et 5), 14 juillet (traitements 1, 2 et 5), 15 juillet (traitements 3 et 4) et 27 juillet (traitements 1, 2, 3, 4 et 5) avec un pulvérisateur monté sur tracteur (dose : L ou kg p.c./ha, pression : 1641,4 kPa, volume : 800 L/ha). Pour les traitements 3 et 4 NOVODOR a été appliqué les 4 et 8 juillet contre les petites larves (L1 + L2) et KRYOCIDE les 15 et 27 juillet contre les grosses larves (L3 + L4). L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Le défanage des plants a été effectué les 18 et 22 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 30 août.

RÉSULTATS : Voir le tableau ci-dessous.

CONCLUSIONS : L'emploi stratégique de différents moyens de lutte permet de contrer le phénomène de la résistance aux insecticides. Dans cette optique, l'association stratégique NOVODOR et KRYOCIDE dans la lutte au doryphore peut être très intéressante. Ces produits ont des modes d'action très différents et en regard des essais effectués en 1994, les résultats démontrent le potentiel d'utilisation en association dans le temps. Bien que les emplois seuls des produits NOVODOR (4,6 L et 7,0 L/ha) et KRYOCIDE ont donné une très bonne efficacité par une réduction très significative des densités larvaires et du dommage comparativement au témoin, l'association NOVODOR et KRYOCIDE a été plus rentable en fin de saison. L'impact du KRYOCIDE sur les grosses larves semble plus important que celui obtenu avec NOVODOR, produit d'emploi spécifique contre les petites larves. Ainsi, les densités larvaires sont significativement plus faibles le 1er août pour les applications avec KRYOCIDE (traitements 3 et 4) comparativement aux doses correspondantes de NOVODOR (traitements 1 et 2). Par ailleurs, l'indice du dommage est significativement plus faible avec NOVODOR (4,6 L/ha) et KRYOCIDE comparativement à l'emploi seul de NOVODOR à la même dose. Aussi, l'association NOVODOR et KRYOCIDE semble plus rentable avec NOVODOR utilisé à la dose de 4,6 L/ha comparativement à 7,0 L/ha. Les différences aux niveaux des densités larvaires le 1er août et des dommages observés le 25 juillet et le 8 août sont plus marquées que celles obtenues avec la dose de 7,0 L/ha de NOVODOR. En regard des résultats obtenus, l'association NOVODOR et KRYOCIDE est donc possible. De plus, selon les densités de l'insecte, le choix judicieux de la dose de NOVODOR restera toujours très important, aussi bien que le nombre d'intervention avec NOVODOR et KRYOCIDE. Pour cette expérience, il y a eu deux applications pour chacun des produits.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1994.

Traitement Insecticide	Dose (p.c./ha)	Population larvaire juillet 04	juillet 12	juillet 20	août 01	Dommage* juillet 04	juillet 14	juillet 25	août 08	Rendement (t/ha)
1. NOVODOR	4,6 L	4,1ab**	8,2b	1,4b	2,7b	1,0	1,0b	1,5b	1,7b	40,38a
2. NOVODOR	7,0 L	1,8ab	3,0c	0,4b	1,5c	1,0	1,0b	1,0c	1,0c	43,88a
3. NOVODOR*** + KRYOCIDE	4,6 L 11,0 kg	5,2ab	9,3b	0,4b	0,7cd	1,0	1,0b	1,0c	1,0c	43,18a
4. NOVODOR*** + KRYOCIDE	7,0 L 11,0 kg	2,8ab	7,8bc	1,7b	0,5d	1,0	1,0b	1,0c	1,2c	40,45a
5. KRYOCIDE	11,0 kg	5,7a	5,8bc	1,4b	0,7cd	1,0	1,0b	1,0c	1,7b	40,91a
6. TÉMOIN	---	1,4c	21,3a	35,1a	5,0a	1,0	2,5a	5,0a	7,2a	24,70b

* Évaluation visuelle par parcelle : indice de défoliation de 0 à 8 (0 à 100% de défoliation).

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

*** NOVODOR contre les petites larves et KRYOCIDE contre les grosses larves en fin de saison.

#046

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 : INCIDENCE DE TRAITEMENTS INSECTICIDES CONTRE LES ADULTES SUR LA GESTION SAISONNIÈRE DU DORYPHORE DE LA POMME DE TERRE

PRODUITS : ADMIRE 240 FS (NTN-33893, Imidacloprid)
GUTHION 240 EC (Azinphos-méthyl)
RIPCORD 400 EC (Cyperméthrine)
DECIS 5,0 EC (Deltaméthrine)

MÉTHODES : L'essai a été réalisé à Deschambault (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 24 mai 1994. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Afin d'évaluer l'incidence de traitements insecticides contre les adultes et de comparer l'efficacité à celle d'interventions contre les larves, les traitements suivants ont été définis selon le type et le nombre d'applications faites contre les adultes (seuil $ 1 adulte/plant) : 1- ADMIRE à la plantation, dose de 0,02 g MA/ha : 24 mai; 2- une application foliaire : 20 juin; 3- deux applications foliaires : 20 et 24 juin; 4- trois applications foliaires : 20, 24 et 28 juin; 5- témoin : aucune application contre les adultes; traitements seulement contre les larves. Pour tous les traitements, sauf le traitement No 1, des applications ont été effectuées contre les larves (seuil $ 5 larves/plant) aux dates suivantes : 6 juillet (traitements 2, 3 et 5); 8 juillet (traitement 4); 12 juillet (traitements 2, 3, 4 et 5); 25 juillet (traitement 4). Afin d'augmenter les densités d'adultes et d'accroître leur impact sur les plants, des introductions ont été faites le 18 juin (300 adultes/parcelle) et le 22 juin (150 adultes/parcelle) pour l'ensemble du projet. L'évaluation des densités du doryphore a été faite régulièrement sur 10 plants pris au hasard dans les 2 rangées du centre. Le défanage des plants a été fait les 18 et 22 août et la récolte des 2 rangées du centre effectuée le 23 août a servi à déterminer le rendement en tubercules. Tous les insecticides ont été utilisés en rotation, selon les conditions météorologiques, à la dose maximale recommandée sur l'étiquette.

RÉSULTATS : Voir le tableau ci-dessous.

CONCLUSIONS : Les résultats obtenus en 1994 sont dans l'ensemble comparables à 1993 et ce malgré une saison très pluvieuse rendant difficile les interventions. Ainsi l'ajout de traitements insecticides (DECIS, GUTHION, RIPCORD) contre les adultes en début de saison n'a pas amélioré la gestion saisonnière du doryphore. Les rendements sont semblables et le dommage au feuillage est demeuré relativement stable et bas jusqu'à la fin de juillet. En août, le dommage s'est révélé plus important dans l'ensemble des traitements avec les insecticides foliaires, traduisant ainsi l'inefficacité des insecticides à gérer adéquatement le doryphore. De plus, cela démontre qu'une application supplémentaire contre les larves pour tous les traitements, incluant ADMIRE, aurait été nécessaire. L'approche contre les adultes à 1, 2 et 3 traitements se révèle moins économique en nombre de traitements. De 2 à 3 traitements additionnels ont été nécessaires contre les larves, portant le total en saison à 3, 4 et 6 pour les traitements 2, 3 et 4 respectivement comparativement à 2 pour le traitement 5 (stratégie orientée strictement contre les larves). Toutefois, des traitements contre les adultes ont cependant réduit significativement le nombre des masses d'oeufs les 27 et 30 juin (traitements 2 et 4) et les densités larvaires (L1 + L2) le 30 juin (traitement 3) et les 5 et 8 juillet (traitements 3 et 4) par rapport au traitement 5. L'impact de ces traitements n'a pas été suffisant puisqu'un nombre égal et supérieur de traitements contre les larves ont été nécessaires comparativement au traitement 5. L'incidence des traitements contre les adultes n'est donc pas suffisamment positive pour en recommander l'usage de façon régulière. Selon les densités d'adultes présents tôt au printemps et les produits utilisés, des traitements occasionnels peuvent être justifiés. Ainsi, l'emploi de ADMIRE (imidacloprid) à la plantation confirme cette position, puisque un seul traitement a été nécessaire afin de maintenir la rentabilité de la culture. Ces résultats avec ADMIRE démontrent de nouveau la performance du produit avec une rémanence jusqu'à la mi-juillet.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1994.

Traitement	Population larvaire				Dommage*				Rendement
	juin	juillet			juillet			août	(t/ha)
	30	08	18	25	08	15	25	08	
1. ADMIRE à la plantation	0,0b**	0,1c	0,4c	2,7b	0,0b	0,5b	1,0a	1,5b	42,63
2. Adultes (1)*** + larves (2)	0,5ab	15,6a	0,9bc	2,6b	1,0a	1,0ab	1,2a	2,2ab	40,38
3. Adultes (2) + larves (2)	0,1b	13,6a	1,2b	3,1b	1,0a	1,0ab	1,7a	2,5a	40,89
4. Adultes (3) + larves (3)	0,7ab	7,1b	1,9a	6,2a	1,0a	1,0ab	1,2a	3,0a	38,91
5. TÉMOIN, larves (2)	2,3a	18,4a	1,0bc	3,0b	1,0a	1,2a	1,7a	2,5ab	40,00

* Évaluation visuelle par parcelle : indice de défoliation de 0 à 8 (0 à 100% de défoliation).

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

*** La valeur entre parenthèses indique le nombre de traitements contre les adultes ou les larves.

#047

BASE DE DONNÉES DES ÉTUDES : 87000221

CULTURE : Pomme de terre, cv. Superior

RAVAGEUR : Doryphore de la pomme de terre, *Leptinotarsa decemlineata* (Say)

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TITRE : STRATÉGIE D'INTERVENTION BASÉE SUR LE BOUM D'ÉCLOSION DES OEUFS

PRODUITS : M-TRAK LI (Endotoxine-delta encapsulée de *Bacillus thuringiensis* var. *san diego*, 10%)
GUTHION 240-EC (Azinphos-méthyl)

MÉTHODES : L'essai a été réalisé à Deschambault (Québec) selon un plan à blocs aléatoires complets avec 4 répétitions. Les pommes de terre ont été plantées le 4 juin 1994. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués selon deux stratégies de lutte (conventionnelle = première intervention dès l'apparition des petites larves (L1) à 30% d'éclosion des oeufs; boum d'éclosion des oeufs = première intervention 6-9 jours après le boum d'éclosion (30%)) les 4 juillet (traitements 1 et 2), 11 et 16 juillet (traitements 1,2, 3 et 4) à l'aide d'un pulvérisateur monté sur tracteur (dose : L p.c./ha, pression : 1641,4 kPa, volume : 800 L/ha). L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Les dommages aux plants ont été évalués visuellement à l'aide d'un indice de défoliation de 0 à 8. Les masses d'oeufs (10 masses/parcelle) ont été suivies régulièrement afin de pouvoir initier les premiers traitements selon les stratégies utilisées. Les plants ont été défanés les 18 et 22 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 31 août.

RÉSULTATS : Voir le tableau ci-dessous.

CONCLUSIONS : Afin de réduire l'utilisation des insecticides et d'optimiser leur emploi, il est très important d'intervenir au bon moment. Dans le cadre de ce projet de recherche subventionné par le Bureau des nouvelles méthodes de lutte antiparasitaire (BNMLA) et dont les travaux en parcelles expérimentales sont complémentaires de ceux effectués en champs commerciaux, deux stratégies d'intervention ont été évaluées à l'aide d'insecticides chimiques et biologiques. Selon les résultats obtenus, la stratégie associée au «boum d'éclosion des oeufs» s'est révélée plus performante quelque soit l'insecticide utilisé. En effet, l'emploi de M-TRAK et du GUTHION a nécessité deux interventions selon l'approche «boum d'éclosion» comparativement à trois interventions pour l'approche conventionnelle et ce avec des résultats (densités larvaires et dommages) comparables. Avec l'approche «boum d'éclosion» la première intervention a été faite 7 jours après celle établie pour l'approche conventionnelle à un niveau moyen de densités larvaires le 11 juillet de 6,7 larves/plant (91,2% L1 + L2, 8,8% L3 + L4). L'approche «boum d'éclosion» nécessite toutefois l'emploi d'insecticides très performants. Ainsi comparativement à GUTHION, l'insecticide biologique M-TRAK s'est révélé de beaucoup supérieur. Les résultats sur les densités larvaires et les dommages aux plants sont dans tous les cas significativement plus faibles avec M-TRAK pour les deux approches préconisées. Enfin l'applicabilité au Québec en champs commerciaux de l'approche «boum d'éclosion» des oeufs nécessitera de nouvelles évaluations en 1995 et 1996 et ce, en dépit des résultats intéressants obtenus en 1994.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1994.

Traitement Insecticide	Dose (p.c./ha)	Population larvaire juillet 07	juillet 14	juillet 21	août 01	Dommage* juillet 11	juillet 19	juillet 26	août 08	Rendement (t/ha)
1. M-TRAK conventionnelle	7,50 L	0,5	3,6c**	0,5c	3,1b	1,0	1,0c	1,0c	1,5c	38,44
2. GUTHION conventionnelle	1,70 L	1,4	13,1b	13,0b	8,8a	1,0	2,0b	4,2b	5,5b	29,79
3. M-TRAK boum d'éclosion	7,50 L	1,7	5,6c	0,8c	2,7b	1,0	1,0c	1,0c	1,2c	36,57
4. GUTHION boum d'éclosion	1,70 L	1,6	10,6b	13,6b	7,1a	1,0	2,0b	4,0b	5,0b	33,33
5. TÉMOIN	-----	0,5	17,3a	20,5a	7,6a	1,0	2,5a	5,0a	6,2a	27,62

* Évaluation visuelle par parcelle : indice de défoliation de 0 à 8 (0 à 100% de défoliation).

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

#048

ICAR NUMBER: 86000965

CROP: Potato, cv. Chieftan

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EVALUATION OF KARATE FORMULATIONS FOR CONTROL OF POTATO INSECT PESTS

MATERIALS: IMIDAN 50W (Phosmet)
KARATE 50EC (Cyhalothrin-lambda)
KARATE 5WG (Cyhalothrin-lambda)

METHODS: The experiment was conducted on Chieftan potatoes at Copetown, Ontario. Potatoes were planted May 14, 1994 and emergence was recorded on June 7. Plots consisted of single rows each 6 m long and spaced 1 m apart. Each plot was replicated four times in a randomized block design with guard rows on each side of each block. Treatments were applied June 22 and again July 7 with a CO_2 pressurized back-pack sprayer in a volume of 500 L/ha. Plots were assessed several times by counting numbers of adults, small and large larvae per 20 randomly selected leaves per plot. Assessments of insect numbers began 1 d after the first application and ended 6 d after the second application. Visual estimates of percent defoliation were recorded July 6 and 13 and yield per plot was assessed August 25. Tubers were graded according to size with those over 5.5

cm in diameter classified as marketable.

RESULTS: As presented in the table.

CONCLUSIONS: KARATE WG provided control of Colorado potato beetles which was equal to that provided by KARATE EC. Both formulations of KARATE provided better control of larvae following the first application which resulted in less defoliation compared to IMIDAN. IMIDAN provided superior control of large larvae after the second application. All insecticides reduced defoliation and increased yields.

Table 1. Colorado potato beetle counts.

TREATMENT	RATE (g a.i./ha)	SMALL LARVAE 23/06	SMALL LARVAE 27/06	SMALL LARVAE 30/06	SMALL LARVAE 06/07	LARGE LARVAE 30/06	LARGE LARVAE 11/07	LARGE LARVAE 06/07	LARGE LARVAE 13/07
KARATE EC	7.5	15.5 b	33.0a	12.0 b	22.0a	6.0 b	25.8a	15.5 b	23.3ab
KARATE EC	10.0	20.5 b	1.5a	2.0 b	22.8a	2.8 b	14.0a	4.0 b	12.5 bc
KARATE WG	7.5	10.8 b	2.0a	5.8 b	31.5a	3.8 b	24.3a	7.3 b	14.0 b
KARATE WG	10.0	9.3 b	6.3a	0.8 b	28.8a	2.5 b	15.0a	5.3 b	20.5 b
IMIDAN WP	1,625.0	8.3 b	33.8a	28.5ab	36.3a	9.0 b	24.3a	40.0a	3.3 c
UNTREATED		72.3a	35.8a	49.8a	19.8a	28.3a	35.3a	42.8a	32.0a
LSD (.05) =		24.3	42.1	27.9	22.1	7.4	22.2	15.8	10.2
Standard Dev.=		16.1	27.9	18.5	14.7	4.9	14.8	10.5	6.8
CV =		70.9	149.3	112.5	54.7	56.6	63.9	54.9	38.5

Means followed by the same letter do not significantly differ (P = 0.05, Duncan's Multiple Range Test).

Table 2. Percent defoliation and yield.

TREATMENT	RATE (g a.i./ha)	DEFOL % 06/07/94	DEFOL % 13/07/94	TOTAL YIELD 25/08/94	MARKETABLE YIELD 25/08/94	PERCENT MARKETABLE 25/08/94
KARATE EC	7.5	6.5 b	32.8 b	8.33a	5.15 b	60.2 bc
KARATE EC	10.0	6.0 b	10.0 c	12.10a	9.60a	79.5a
KARATE WG	7.5	6.0 b	18.3 bc	10.90a	7.78ab	70.7ab
KARATE WG	10.0	8.3 b	15.5 c	9.18a	5.55 b	60.6 bc
IMIDAN WP	1,625.0	22.8a	13.0 c	8.90a	5.35 b	54.2 bc
UNTREATED		34.8a	79.5a	3.90 b	1.83 c	45.8 c
LSD (.05) =		13.9	15.7	3.70	3.26	15.9
Standard Dev.=		9.19	10.39	2.46	2.16	10.54
CV =		65.47	36.89	27.65	36.84	17.05

Means followed by the same letter do not significantly differ (P = 0.05, Duncan's Multiple Range Test).

#049

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: CONTROL OF COLORADO POTATO BEETLE ON POTATOES WITH PYRROLE AND CYPERMETHRIN, 1994

MATERIALS: AC 303,630
RIPCORD 400 EC (Cypermethrin)
COMPANION (Octylphenoxypolyethoxyethanol 70%)

METHODS: Small, whole seed pieces were planted in Harrington, Prince Edward Island on May 12, 1994. Plants were spaced 40 cm within rows and 90 cm between rows in 4 row plots. Each plot was 7.6 m long and 3.6 m wide and was separated by 1.8 m of cultivated soil. Plots were arranged in a randomized complete block design with five treatments each replicated four times. All treatments were applied as sprays on July 12 at the equivalent of 320 L spray mixture per ha at a pressure of approximately 240 kPa using a CO_2 pressurized precision plot sprayer. A 0.1% (v/v) surfactant was added to all sprays. Additional applications were made on July 20 and August 4 for pyrrole at 0.05 kg a.i./ha, on July 20 and July 26 for pyrrole at 0.1 kg a.i./ha, on July 20 for pyrrole plus cypermethrin, and on July 26 for cypermethrin. Each week from July 4 to August 15, the number of CPB per 10 net sweeps (0.37 m diameter) were counted from the center 2 rows of each plot. Weeds were controlled with an application of metribuzin at 750 g a.i./ha on June 15. Plots received recommended applications of chlorothalonil at 1250 g a.i./ha for blight control. Plants were sprayed with REGLONE (diquat) at 300 g a.i./ha for top desiccation on August 23. Tubers from the center 2 rows of each plot were harvested on September 14, and total and marketable ($ 40 mm) yields were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to ln (x+1) before analysis and percentage defoliation was transformed to sqrt (arcsine (prop)) before analysis. The detransformed means are presented.

RESULTS: The results of CPB counts and percent defoliation are summarized in the tables.

CONCLUSIONS: Relative to the Check, a significant reduction in CPB per 10 net sweeps was achieved with pyrrole plus cypermethrin for the July 25 count (Table 1). The 100 g a.i. rate of pyrrole, the pyrrole plus cypermethrin, and cypermethrin alone significantly reduced CPB populations relative to the check by August 2 and all treatments significantly reduced CPB counts by August 8. The lowest percent defoliation for the July 28 and August 12 counts was observed for plots treated with pyrrole plus cypermethrin and cypermethrin alone (Table 2). Tuber yields, which ranged between 19.5 t/ha and 21.8 t/ha, were not significantly different despite differences in CPB populations and defoliation among plots. An unusually dry summer on Prince Edward Island may have contributed to a limited plant growth and lower yield differences.

Table 1. Colorado potato beetles (CPB) per 10 net sweeps per plot.

			CPB/10 Sweeps				
		No. of	July		August		
Treatment	g a.i./ha	sprays	18	25	2	8	15
check	-	-	25a*	28a	27a	12a	4a
AC 303,630	50	3	15a	8ab	17ab	5b	4a
AC 303,630	100	3	23a	14ab	9bc	6b	3a
AC 303,630 + Cypermethrin	50 17	2	16a	4b	5c	5b	3a
Cypermethrin	17	2	8a	12ab	8c	6b	2a

* Numbers in a column followed by a different letter are significantly different (# P0.05) using a protected LSD means separation test.

Table 2. Plant defoliation.

			Percent Defoliation				
		No. of	July			August	
Treatment	g a.i./ha	sprays	14	21	28	5	12
check	-	-	5a*	15a	25a	23a	37a
AC 303,630	50	3	4a	11a	18ab	26a	28bc
AC 303,630	100	3	5a	15a	18ab	29a	31ab
AC 303,630 + Cypermethrin	50 17	2	3a	11a	12b	16a	18d
Cypermethrin	17	2	3a	11a	14b	16a	21cd

* Numbers in a column followed by a different letter are significantly different (# P0.05) using a protected LSD means separation test.

#050

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: CONTROL OF THE COLORADO POTATO BEETLE WITH NEEM AND/OR A CHEMICAL INSECTICIDE ON POTATOES, 1994

MATERIALS: IMIDAN 50 WP (Phosmet)
ALIGN (Azadirachtin 3%)
ADMIRE 240 FS (Imidacloprid)

METHODS: Small, whole seed pieces were planted in Harrington, Prince Edward Island, on May 12, 1994. Plants were spaced 40 cm within rows and 90 cm between rows in 4 row plots. Each plot was 7.6 m long and 3.6 m wide, and was separated by 1.8 m of cultivated soil. Plots were arranged in a randomized complete block design with seven treatments each replicated a total of four times. The first spray was timed to coincide with a 10% hatch of CPB egg masses (July 12). Additional sprays, which were based on a threshold of 1 CPB per net sweep, were applied on July 26 for IMIDAN at 1100 g a.i./ha, on July 26 for ALIGN at 12 g a.i./ha, on July 26 and August 4 for ALIGN at 24 g a.i./ha, on July 26 and August 4 for ALIGN at 12 g a.i./ha (1st spray ADMIRE at 13 g a.i./ha), on July 20 for ADMIRE at 13 g a.i./ha, and on July 26 and August 4 for ALIGN 24 g a.i./ha (1st spray ADMIRE at 13 g a.i./ha). All sprays were applied in a total volume equivalent to 320 L/ha and at a pressure of approximately 240 kPa using a CO_2 pressurized precision plot sprayer. VYDATE (oxamyl) was applied at a rate of 2 L product/ha on August 16 to control summer adults. Each week from July 4 to August 15, the number of early instars (1st and 2nd), late instars (3rd and 4th), and adults per 10 net sweeps (0.37 m diameter) were counted from the center 2 rows of each plot. Weeds were controlled with an application of SENCOR (metribuzin) at 750 g a.i./ha on June 15. Plots received recommended applications of BRAVO (chlorothalonil) at 1250 g a.i./ha for blight control. Plants were sprayed with REGLONE (diquat) at 300 g a.i./ha for top desiccation on August 23. Tubers from the center 2 rows of each plot were harvested on September 14, and total and marketable ($ 40 mm) yields were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to ln (x+1) before analysis. Percent defoliation was transformed to sqrt (arcsine (prop)) before analysis. Detransformed means are presented.

RESULTS: As presented in the tables.

CONCLUSIONS: There were lower counts of early instar CPB on all treated plots compared to the untreated check on August 15 (Table 1). There were lower counts of late instars on all treated plots, except the ADMIRE 13 g a.i./ha + ALIGN 12 g a.i./ha, compared to the check on August 8 (Table 2). There were no significant differences among treatments for CPB adult counts for most dates (Table 3). Percent defoliation was lower in the treated plots than in the check plots by the end of the season (Table 4), but there were no significant differences in tuber yields which ranged between 22 t/ha and 24 t/ha. The lack of a yield response may have been due to an unusually dry summer on Prince Edward Island which caused less plant growth late in the season. No phytotoxicity symptoms were observed.

Table 1. Colorado Potato Beetle early larvae.

Treatment	Rate	No. of	CPB Early Instars/10 Sweeps					
			July			August		
	g a.i./ha	sprays	11	18	25	2	8	15
check	-	-	1.8ab*	14.5a	14.8a	3.3ab	1.8ab	1.3a
IMIDAN	1100	2	7.0ab	6.3ab	7.3ab	0.3bc	0.5b	0.0b
ALIGN	12	2	0.5b	7.5ab	11.3a	4.5ab	2.3ab	0.0b
ALIGN	24	3	0.8b	7.3ab	14.8a	2.5abc	0.5b	0.0b
ADMIRE	13	2	13.8ab	7.0ab	2.8b	0.0c	0.5b	0.0b
ADMIRE + ALIGN	13+12	1,2	17.3a	4.3ab	18.5a	4.8a	3.0a	0.3b
ADMIRE + ALIGN	13+24	1,2	1.8ab	2.3b	10.0a	2.3ab	2.0ab	0.5ab

* Numbers in a column followed by different letters are significantly different using a protected LSD means separation test (P#0.05).

Table 2. Colorado Potato Beetle late larvae.

Treatment	Rate g a.i./ha	No. of sprays	CPB late instars/10 sweeps July 11	18	25	August 2	8
check	-	-	0.5a*	4.3a	7.5a	7.0ab	1.5a
IMIDAN	1100	2	1.3a	0.8a	5.3a	2.0b	0.0b
ALIGN	12	2	0a	0.5a	16.0a	5.3ab	0.0b
ALIGN	24	3	2.5a	2.3a	14.0a	13.0a	0.3b
ADMIRE	13	2	3.3a	4.8a	1.5a	2.3b	0.3b
ADMIRE + ALIGN	13+12	1,2	2.5a	2.0a	8.0a	15.0a	10.8ab
ADMIRE + ALIGN	13+24	1,2	0.5a	3.3a	3.8a	7.3ab	0.0b

* Numbers in a column followed by different letters are significantly different using a protected LSD mean separation test (P#0.05).

Table 3. Colorado potato beetle adults.

Treatment	Rate g a.i./ha	No. of sprays	CPB Adults/10 Sweeps July 11	18	25	August 2	8	15
check	-	-	0.3b*	0.0a	0.0a	6.8ab	5.5a	3.5a
IMIDAN	1100	2	0.0b	0.0a	0.3a	2.3bc	4.0a	1.5a
ALIGN	12	2	1.5a	0.5a	0.0a	0.0c	2.3a	1.3a
ALIGN	24	3	0.0b	0.3a	0.0a	0.5bc	2.0a	1.0a
ADMIRE	13	2	0.0b	1.0a	0.3a	7.5a	1.3a	3.0a
ADMIRE + ALIGN	13+12	1,2	0.0b	1.0a	0.3a	2.0abc	5.5a	1.8a
ADMIRE + ALIGN	13+24	1,2	0.0b	0.8a	0.0a	1.8bc	2.5a	0.8a

* Numbers in a column followed by different letters are significantly different using a protected LSD mean separation test (P#0.05).

Table 4. Plant defoliation.

Treatment	Rate g a.i./ha	No. of sprays	Percent Defoliation July 28	August 5	12
check	-	-	23a*	24a	38a
IMIDAN	1100	2	16ab	21a	19b
ALIGN	12	2	17ab	22a	21b
ALIGN	24	3	19ab	26a	28ab
ADMIRE	13	2	16ab	26a	28ab
ADMIRE + ALIGN	13+12	1,2	19ab	28a	20b
ADMIRE + ALIGN	13+24	1,2	13b	24a	21b

* Numbers in a column followed by different letters are significantly different using a protected LSD means separation test (P#0.05).

#051

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EVALUATION OF INSECTICIDES FOR CONTROL OF THE COLORADO POTATO BEETLE ON POTATOES, 1994

MATERIALS: NOVODOR 3% (*Bacillus thuringiensis* var. *tenebrionis*)
TRIGARD 75 WP (Cyromazine)
KRYOCIDE 96% (Sodium fluoaluminate)
IMIDAN 50 WP (Phosmet)

METHODS: Small, whole seed pieces were planted in Harrington, Prince Edward Island, on May 12, 1994. Plants were spaced 40 cm within rows and 90 cm between rows in 4 row plots. Each plot was 7.6 m long and 3.6 m wide, and was separated by 1.8 m of cultivated soil. Plots were arranged in a randomized complete block design with eight treatments each replicated a total of four times. Treatments were applied as foliar sprays in a mixture equivalent to 320 L/ha at a pressure of approximately 240 kPa using a CO_2 pressurized precision plot sprayer. First sprays were timed to coincide with a 10-30% hatch of CPB egg masses (July 12). Additional sprays were applied when a threshold of 1 CPB per net sweep was surpassed. In addition, NOVODOR at 2.3 L/ha was applied on July 20 and 26, and August 4. A second spray of NOVODOR at 4.7 L/ha and IMIDAN at 1.1 kg a.i./ha was required on July 20. Two additional sprays of NOVODOR at 7.0 L/ha, TRIGARD at 0.28 + 0.14 kg a.i./ha, and TRIGARD at 0.28 + 0.28 kg a.i./ha were applied on July 20 and August 4. Each week from July 4 to August 8 the number of early instars (L1-L2), late instars (L3-L4), and adults of the CPB from 10 net sweeps (0.37 m diameter) were counted from the center 2 rows per plot. Percent defoliation was recorded weekly from July 14 to August 14. Weeds were controlled with an application of SENCOR (metribuzin) at 750 g a.i./ha on June 15. Plots received recommended applications of BRAVO (chlorothalonil) at 1250 g a.i./ha for control of late blight. Plots were sprayed with DECIS (deltamethrin) at 15 g a.i./ha on August 8 to control adults and with REGLONE (diquat) on August 23 for top desiccation. Tubers from the center 2 rows per plot were harvested on September 14, and total and marketable ($ 40 mm) weights were recorded. Analysis of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to ln (x + 1) before analysis. Percent defoliation was transformed to sqrt (arcsine (prop)) before analysis. The detransformed means are presented.

RESULTS: As presented in the tables.

CONCLUSIONS: A significant reduction in the number of early instars, relative to the Check, was achieved with all applications except the lower rates of NOVODOR as of August 2 (Table 1). Reductions of late instars with the two high rates NOVODOR were not significant when compared to the Check, but there were significant reductions in late instars for plots treated with TRIGARD, KRYOCIDE, and IMIDAN (Table 2). CPB adult populations were lower on plots treated with two higher rates of NOVODOR or KRYOCIDE for the August 8 count (Table 3). Percent defoliation was lower for all treated plots relative to the untreated check plots as of August 5 (Table 4). Tuber yields, which ranged from 21 t/ha to 24 t/ha, were not significantly different between protected and unprotected plots, possibly because of the unusually dry summer on Prince Edward Island which could have limited plant growth. There were no signs of phytotoxicity noted for any of the products tested.

Table 1. Colorado potato beetle early larvae.

Treatment	Product /ha	No. of sprays	CPB Early Instars (L1-L2)/10 Sweeps July 4	11	18	25	August 2	8
check	-	-	10a*	25a	28a	13a	4a	2a
NOVODOR	2.3 L	4	6a	8a	14ab	11ab	2ab	0b
NOVODOR	4.7 L	2	1a	11a	5bc	5abc	1b	1ab
NOVODOR	7.0 L	3	7a	45a	5bc	3abc	0b	0b
TRIGARD	.37,.19,.19 kg	3	8a	27a	7bc	6bc	1b	1ab
TRIGARD	.37,.37,.37 kg	3	10a	18a	27a	7abc	0b	0b
KRYOCIDE	11.2 kg	1	2a	15a	2c	1c	0b	0b
IMIDAN	2.2 kg	2	2a	38a	8bc	4abc	0b	0b

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).

Table 2. Colorado potato beetle late larvae.

Treatment	Product /ha	No. of sprays	CPB Late Instars (L3-L4)/10 Sweeps July 4	11	18	25	August 2	8
check	-	-	0	12a*	25a	12a	6a	1ab
NOVODOR	2.3 L	4	0	7a	13ab	10ab	9a	2a
NOVODOR	4.7 L	2	0	0b	7ab	4abcd	4ab	0ab
NOVODOR	7.0 L	3	0	3ab	13ab	7abc	3ab	0ab
TRIGARD	.37,.19,.19 kg	3	0	8a	5b	0e	3bc	0b
TRIGARD	.37,.37,.37 kg	3	0	5a	14ab	4cde	1bc	1ab
KRYOCIDE	11.2 kg	1	0	5a	4b	1de	0c	0b
IMIDAN	2.2 kg	2	0	2ab	7ab	5bcde	1bc	0b

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).

Table 3. Colorado potato beetle adults.

Treatment	Product /ha	No. of sprays	CPB Adults/10 Sweeps July 4	July 11	July 18	July 25	August 2	August 8
check	-	-	0.75a*	0.25a	0.50a	0.75a	7.00ab	13.00a
NOVODOR	2.3 L	4	0.50a	0.75a	0.00a	0.00b	7.75ab	8.50abc
NOVODOR	4.7 L	2	0.00a	0.25a	0.25a	0.00b	3.00b	5.50bcd
NOVODOR	7.0 L	3	0.50a	0.25a	0.25a	0.00b	8.00a	3.50d
TRIGARD	.37,.19,.19 kg	3	0.00a	0.00a	0.00a	0.00b	10.00a	7.75abc
TRIGARD	.37,.37,.37 kg	3	0.25a	0.75a	0.25a	0.25ab	8.75ab	11.00ab
KRYOCIDE	11.2 kg	1	0.75a	0.25a	0.00a	0.00b	4.50ab	6.25cd
IMIDAN	2.2 kg	2	0.25a	0.75a	0.00a	0.00b	5.00ab	8.50abc

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).

Table 4. Plant defoliation.

Treatment	Product /ha	No. of sprays	Percent Defoliation July 14	July 21	July 28	August 5	August 12
check	-	-	13a*	25a	29a	42a	41a
NOVODOR	2.3 L	4	13a	22a	25ab	30bc	29b
NOVODOR	4.7 L	2	7a	10b	18abc	28bc	26b
NOVODOR	7.0 L	3	12a	18ab	19abc	30bc	25b
TRIGARD	.37,.19,.19 kg	3	12a	17ab	19abc	33b	29b
TRIGARD	.37,.37,.37 kg	3	13a	14ab	19abc	29bc	27b
KRYOCIDE	11.2 kg	1	12a	9b	13c	23c	24b
IMIDAN	2.2 kg	2	10a	14ab	15bc	28bc	25b

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).

#052

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EVALUATION OF INSECTICIDES TANK MIXED WITH FUNGICIDES FOR COLORADO POTATO BEETLE CONTROL ON POTATOES, 1994

MATERIALS: TRIGARD 75 WP (Cyromazine)
RIPCORD 400 EC (Cypermethrin)
RIDOMIL MZ 72 WP (Metalaxyl + Mancozeb)

BRAVO 500 F (Chlorothalonil)

METHODS: Small, whole seed pieces were planted in Harrington, Prince Edward Island on May 12, 1994. Plants were spaced 40 cm within rows and 90 cm between rows in 4 row plots. Each plot was 7.6 m long and 3.6 m wide, and each was separated by 1.8 m of cultivated soil. Plots were arranged in a randomized complete block design with eight treatments each replicated four times. All treatments were applied as a spray mixture equivalent to 320 L/ha at a pressure of approximately 240 kPa using a CO_2-pressurized plot sprayer. Sprays were applied to all insecticide plots on July 7. No fungicides were applied on July 7. Additional sprays were applied to the TRIGARD and TRIGARD plus RIDOMIL on July 13 and July 21, the TRIGARD plus BRAVO treatment on July 13, July 21, and August 4, the RIPCORD treatment on July 21, July 28, August 4, and August 11, and the BRAVO treatment on July 13, July 21, July 28, and August 4. All plots were sprayed with VYDATE (oxamyl) at the equivalent of 2 L product/ha on August 16 to control summer adults. Each week from July 4 to August 15, the number of early instars (1st and 2nd) and late instars (3rd and 4th) as well as adults per 10 net sweeps (0.37 m diameter) were counted from the center 2 rows of each plot. Weeds were controlled with an application of metribuzin at 750 g a.i./ha on June 9. Plots received recommended applications of chlorothalonil at 1250 g a.i./ha for blight control. Plants were sprayed with REGLONE (diquat) at 300 g a.i./ha for top desiccation on August 23. Tubers from the center 2 rows of each plot were harvested on September 14 and total and marketable ($ 40 mm) yields were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to natural log (x + 1) before analysis. Percent defoliation was transformed to sqrt (arcsine (prop)) before analysis. The detransformed means are presented.

RESULTS: As presented in the tables.

CONCLUSIONS: The addition of RIDOMIL or BRAVO did not significantly affect the efficacy of either TRIGARD or RIPCORD (Tables 1, 2, and 3). The percent defoliation was similar on all insecticide-treated plots by August 5 (Table 4). Marketable tuber yields from plots treated with RIPCORD alone were significantly increased over the check plots, but were not significantly better than from other treated plots. Differences in tuber yields may have been suppressed by an unusually dry summer on Prince Edward Island, which caused reduced growth of potato plants. No phytotoxicity was observed on plants in any of the plots.

Table 1. Colorado Potato Beetle early larvae per 10 net sweeps per plot.

			Early Instars/10 Sweeps						
	g	No. of	July				August		
Treatment	a.i./ha	sprays	4	11	18	25	2	8	15
check	-	-	23 a*	38.3a	80.5a	28.5a	8.3a	0.3a	0.3ab
TRIGARD	280	3	10.5a	22.5a	33.8ab	3.8bc	0.3c	0.3a	0.8a
TRIGARD + RIDOMIL MZ	280 1800	3	12.8a	29.8a	20.0bc	3.8bc	0.0c	0.0a	0.0b
TRIGARD + BRAVO	280 1200	4	16.0a	17.3ab	32.5abc	11.5abc	1.8bc	0.0a	0.0b
RIPCORD + RIDOMIL MZ	35 1800	5	11.5a	14.5ab	22.3bc	7.0bc	1.5bc	0.0a	0.3ab
RIPCORD + BRAVO	35 1200	4	9.5a	2.3c	9.3c	2.8c	2.0bc	1.8a	0.0b
RIPCORD	35	5	7.8a	7.3bc	16.3bc	11.5abc	1.5bc	1.3a	0.0b
BRAVO	1200	4	28.5a	42.5a	80.5a	26.5ab	5.0ab	0.3a	0.3ab

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test. (P#0.05).

Table 2. Colorado potato beetle late larvae per 10 net sweeps per plot.

			Late Instars/10 Sweeps						
	g	No. of	July				August		
Treatment	a.i./ha	sprays	4	11	18	25	2	8	15
check	-	-	0	23.5ab*	26.8a	45.5a	10.5a	0.8a	0
TRIGARD	280	3	0	4.0abc	4.5bcd	0.3c	0.3d	0.0a	0
TRIGARD + RIDOMIL MZ	280 1800	3	0	3.5abc	4.0bcd	0.5c	0.0d	0.0a	0
TRIGARD + BRAVO	280 1200	4	0	7.5abc	2.5cd	2.0bc	0.8cd	0.3a	0
RIPCORD + RIDOMIL MZ	35 1800	5	0	4.8abc	5.3bc	3.3bc	2.3bc	1.3a	0
RIPCORD + BRAVO	35 1200	4	0	3.3bc	1.0d	2.3bc	3.8b	0.0a	0
RIPCORD	35	5	0	0.5c	11.0b	6.0bc	4.0b	0.8a	0
BRAVO	1200	4	0	13.8a	41.5a	10.5b	3.0bc	1.0a	0

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test. (P#0.05).

Table 3. Colorado potato beetle adults per 10 net sweeps per plot.

			Adults/10 Sweeps						
	g	No. of	July				August		
Treatment	a.i./ha	sprays	4	11	18	25	2	8	15
check	-	-	1.5a*	1.5a	0.8a	0.8ab	15.0ab	8.8a	2.8b
TRIGARD	280	3	1.0a	1.5a	0.0a	0.8ab	9.0bc	5.8ab	5.3ab
TRIGARD + RIDOMIL MZ	280 1800	3	1.3a	0.5a	0.0a	0.5ab	5.3c	5.3ab	0.3c
TRIGARD + BRAVO	280 1200	4	1.3a	0.3a	0.8a	0.0b	7.0c	8.5ab	2.5b
RIPCORD + RIDOMIL MZ	35 1800	5	2.0a	1.0a	0.0a	0.0b	11.3abc	5.0ab	8.8a
RIPCORD + BRAVO	35 1200	4	1.0a	0.8a	1.0a	0.8ab	10.8abc	2.8b	2.3b
RIPCORD	35	5	0.8a	0.8a	0.8a	0.0b	8.0c	8.3ab	5.8ab
BRAVO	1200	4	1.0a	0.8a	0.0a	1.5a	21.5a	4.0ab	2.5ab

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).

Table 4. Plant defoliation.

	g	No. of	Adults/10 Sweeps						
			July				August		
Treatment	a.i./ha	sprays	4	11	18	25	2	8	15
Check	-	-	1.5a*	1.5a	0.8a	0.8ab	15.0ab	8.8a	2.8b
TRIGARD	280	3	1.0a	1.5a	0.0a	0.8ab	9.0bc	5.8ab	5.3ab
TRIGARD +	280								
RIDOMIL MZ	1800	3	1.3a	0.5a	0.0a	0.5ab	5.3c	5.3ab	0.3c
TRIGARD +	280								
BRAVO	1200	4	1.3a	0.3a	0.8a	0.0b	7.0c	8.5ab	2.5b
RIPCORD +	35								
RIDOMIL MZ	1800	5	2.0a	1.0a	0.0a	0.0b	11.3abc	5.0ab	8.8a
RIPCORD +	35								
BRAVO	1200	4	1.0a	0.8a	1.0a	0.8ab	10.8abc	2.8b	2.3b
RIPCORD	35	5	0.8a	0.8a	0.8a	0.0b	8.0c	8.3ab	5.8ab
BRAVO	1200	4	1.0a	0.8a	0.0a	1.5a	21.5a	4.0ab	2.5ab

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test. (P#0.05).

#053

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, (CPB) *Leptinotarsa decemlineata* (Say)
Potato flea beetle, (PFB) *Epitrix cucumeris* (Harr.)
Potato aphid, (PA) *Macrosiphum euphorbia*e (Thos.)

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TITLE: EVALUATION OF SYNTHETIC INSECTICIDES FOR CONTROL OF INSECT PESTS ON POTATOES, 1994

MATERIALS: ADMIRE 240 FS, 2.5 G (Imidacloprid)
IMIDAN 50 WP (Phosmet)

METHODS: Small, whole seed pieces were planted in Harrington, Prince Edward Island, on May 20, 1994. Plants were spaced at 0.4 m within rows and 0.9 m between rows in 4 row plots. Each plot was 7.6 m long and 3.6 m wide, and was separated by 1.8 m of cultivated soil. Plots were arranged in a randomized complete block design with eight treatments each replicated four times. In-furrow insecticides were applied at planting. Foliar sprays were applied to the IMIDAN plots on July 12 and 20, to the ADMIRE 25 g plots on July 12 and 26, and August 11, and to the ADMIRE 50 g plots on July 12. The equivalent of 320 L of spray mixture per ha was applied, using a precision plot sprayer at 240 kPa pressure, when a threshold of 1 CPB per net sweep was reached or surpassed. Each week from June 27 to August 15, the number of insects (CPB, PFB, and PA) per 10 net sweeps (0.37 m diameter opening) and the number of PBF feeding holes per 10, 4th terminal leaves, were counted from the center 2 rows of each plot. Percent defoliation was also rated weekly from July 14 to August 12. Weeds were controlled with an application of metribuzin at 750 g a.i./ha on June 15. Plots received recommended applications of chlorothalonil at 1.25 kg a.i./ha for blight control. All plots were sprayed with REGLONE (diquat) at 300 g a.i./ha for top desiccation on August 23. Tubers from the center 2 rows of each plot were harvested on September 14, and total and marketable ($ 40 mm) yields were recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated. Insect counts were transformed to ln (x+1) before analysis. Percent defoliation was transformed to sqrt (arcsine (prop)) before analysis. Detransformed means are presented.

RESULTS: The results are summarized in the tables. Potato aphid populations in the imidacloprid and phosmet plots were relatively low and were not significantly different from the check until after July 18.

CONCLUSIONS: The in-furrow applications of ADMIRE 240 FS at 218 or 327 g a.i./ha, or the 2.5 G formulation, effectively provided season-long management of the CPB (Table 1). The lowest rate of the in-furrow applications appeared to lose its efficacy by August 2. A single application of the higher rate of the foliage-applied ADMIRE 240FS kept the population of CPB below the one CPB per sweep threshold from July 18 to August 15.

Control of the CPB with the lower rate of the foliage-applied formulation was inconsistent. Counts of the CPB were significantly lower in the IMIDAN plots compared to the check plots from July 18 to August 8. Some control of PFB adults was achieved with the two higher rates of ADMIRE 240 FS and ADMIRE 2.5G applied in-furrow (Table 2). However, the greatest degree of control was achieved with ADMIRE 240 FS at 218 and 327 g a.i./ha and with ADMIRE 2.5 G at 218 g a.i./ha on June 27, July 4, and August 8 and 15. Neither rate of the foliage-applied ADMIRE 240FS controlled PFB. Except for the July 25 count, IMIDAN did not control PFB adults.

With respect to PFB damage, the two highest rates of the in-furrow applications of both formulations of ADMIRE resulted in little damage to potato foliage from June 27 to July 11 (Table 3). Damage later in the season to these plants could have been due to a loss of activity as a result of dry conditions on Prince Edward Island or from an influx of PFB from the more heavily damaged plots into the relatively undefoliated plants that received the in-furrow applications of ADMIRE.

In general, counts of PA were low in 1994. On July 25, the number of PA per 10 sweeps of all treated plots except the foliar application of ADMIRE at 50 g a.i./ha was significantly lower than the untreated check (Table 4).

Defoliation of plants treated with ADMIRE 240 FS at 218 or 327 g a.i./ha, or with ADMIRE 2.5 G at 218 g a.i./ha, was less than or equal to 15% throughout the season (Table 5). Defoliation of plants treated with the foliar applications of ADMIRE or IMIDAN was significantly less than that of the check plots but often was significantly greater than the defoliation of plots treated with in-furrow applications of ADMIRE. Total tuber yields from plants treated in-furrow with the two higher rates of ADMIRE 240 FS, or ADMIRE 2.5 G were significantly greater than the yields for the Check, IMIDAN, or the foliar treatments of ADMIRE. Although not always statistically significant, this trend was also noted for marketable yields.

Table 1. Colorado potato beetle counts per 10 net sweeps per plot.

Treatment	Rate (g a.i./ha)	Placement	June 27	July 4	July 11	July 18	July 25	August 2	August 8	August 15
check	-	-	1a*	19a	65a	76a	26a	52a	25a	5ab
ADMIRE 240 FS	109	in-furrow	0b	0b	1b	1c	10b	30ab	17ab	7a
ADMIRE 240 FS	218	in-furrow	0b	0b	0b	0b	0c	1f	9ab	5ab
ADMIRE 240 FS	327	in-furrow	0b	0b	0b	0c	0c	2ef	6b	3ab
ADMIRE 240 FS	25	foliar	0b	6a	44a	9b	26a	8cd	16ab	2b
ADMIRE 240 FS	50	foliar	0.8ab	8ab	33a	0c	8b	9bc	9ab	1b
ADMIRE 2.5 G	218	in-furrow	0.3ab	0b	0b	0c	0c	2ef	8b	6a
IMIDAN 50 WP	1100	foliar	0b	8a	33a	15b	8b	8cde	10b	5ab

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).

Table 2. Potato flea beetle (PFB) counts per 10 net sweeps per plot.

Treatment	Rate (g a.i./ha)	Placement	June 27	July 4	July 11	July 18	July 25	August 2	August 8	August 15
check	-	-	40a*	74a	32ab	7c	3c	96abc	331a	110a
ADMIRE 240 FS	109	IF**	17b	57a	56a	28a	11a	95bc	201b	83a
ADMIRE 240 FS	218	IF	6c	18b	40ab	30a	12a	55c	101c	36c
ADMIRE 240 FS	327	IF	6c	11b	21b	19ab	8ab	39c	126c	36c
ADMIRE 240 FS	25	F***	58a	68a	36ab	13abc	5c	236a	281ab	69abc
ADMIRE 240 FS	50	F	56a	75a	37ab	13abc	7ab	113bc	306a	71ab
ADMIRE 2.5 G	218	IF	6c	10b	25b	18ab	12a	68c	121c	39bc
IMIDAN 50 WP	1100	F	55a	63a	44a	10bc	0d	168ab	381a	110a

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).
** In-furrow.
*** Foliar.

Table 3. Potato flea beetle (PFB) feeding per 4th terminal leaf.

Treatment	Rate (g a.i./ha)	Placement	June 27	July 4	July 11	July 18	July 25	August 2	August 8
check	-	-	130a*	122a	88a	58abc	48a	147b	313b
ADMIRE 240 FS	109	in-furrow	13b	54b	58ab	67ab	47a	101ab	481a
ADMIRE 240 FS	218	in-furrow	4c	11c	48bc	70a	49a	116ab	413a
ADMIRE 240 FS	327	in-furrow	3c	6c	37cd	52abc	50a	85ab	520a
ADMIRE 240 FS	25	foliar	125a	113a	67ab	40c	50a	241a	907a
ADMIRE 240 FS	50	foliar	129a	114a	84a	48abc	47a	216ab	836a
ADMIRE 2.5 G	218	in-furrow	5c	15c	27d	64abc	47a	95ab	500a
IMIDAN 50 WP	1100	foliar	151a	143a	82a	43bc	36a	209ab	922a

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).

Table 4. Potato aphids (PA) counts per 10 net sweeps per plot.

Treatment	Rate (g a.i./ha)	Placement	Potato aphids/10 sweeps July 11	July 18	July 25	August 2	August 8	August 15
check	-	-	1.8a*	11.3ab	11.3ab	3.5ab	3.3bc	3.9a
ADMIRE 240 FS	109	in-furrow	1.8a	1.8a	2.8c	3.3bc	0.8bc	1.3a
ADMIRE 240 FS	218	in-furrow	0.0a	2.0b	1.8c	4.0bc	1.8bc	1.2a
ADMIRE 240 FS	327	foliar	0.0a	0.5b	6.8c	1.3bc	2.3c	1.3a
ADMIRE 240 FS	25	foliar	0.8a	3.8ab	1.8c	1.8bc	1.0c	1.2a
ADMIRE 240 FS	50	foliar	1.0a	4.5ab	4.0bc	7.0bc	4.0b	2.6a
ADMIRE 2.5 G	218	in-furrow	0.0a	0.5b	0.8c	4.0c	2.0b	0.9a
IMIDAN 50 WP	1100	foliar	2.0a	14.5ab	16.0a	19.8a	5.0a	7.2a

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).

Table 5. Plant defoliation and tuber yield.

Treatment	Rate (g a.i./ha)	Placement	Percent Defoliation** July 14	July 21	July 28	August 5	August 12	Tuber yield (t/ha) Total	Tuber yield (t/ha) Marketable
check	-	-	18a*	28a	32a	49a	50a	26c	21d
ADMIRE 240 FS	109	in-furrow	3c	4bc	9c	19bc	19bc	29bc	25bc
ADMIRE 240 FS	218	in-furrow	0c	0c	7c	8d	13c	32b	28ab
ADMIRE 240 FS	327	in-furrow	0c	0c	7c	10cd	15c	32b	29ab
ADMIRE 240 FS	25	foliar	11b	10b	18b	22b	27b	28c	24cd
ADMIRE 240 FS	50	foliar	10b	7bc	16b	20b	23bc	28c	24cd
ADMIRE 2.5 G	218	in-furrow	0c	0c	4c	6d	13c	36a	32a
IMIDAN 50 WP	1100	foliar	10b	10b	17b	26b	28b	26c	23cd

* Numbers in a column followed by a different letter are significantly different using a protected LSD means separation test (P#0.05).
** Means transformed to sqrt (arcsine (prop)) before analysis. Detransformed means presented.

#054

ICAR NUMBER: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:
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TITLE: INTEGRATED PEST MANAGEMENT OF CPB WITH AC 303,630 IN POTATOES

MATERIALS: AC 303,630 240SC (experimental)
CYMBUSH 250EC (Cypermethrin)
COMPANION (Surfactant)

METHODS: Potatoes were planted in 2 row plots x 6 m long with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 4, 1994. The foliar applications were applied using a back-pack airblast sprayer using 240 L/ha on June 21, July 2, and 22. The surfactant COMPANION was added to each treatment at a rate of 0.1% v/v. Assessments were taken by counting the number of CPB larvae per plot on June 27, July 2, 5, 22, and 25, by foliage damage ratings caused by leafhopper and CPB feeding damage on July 13 and August 3, and by potato yields on August 16. Results were analyzed using Duncan's Multiple Range Test.

RESULTS: As presented in the tables.

CONCLUSIONS: Both insecticides, AC 303,630 240SC and CYMBUSH 250E effectively controlled Colorado potato beetles and leafhoppers. However, when they were mixed together in a tank mix, a synergistic response was observed with higher levels of insect control achieved than when applied alone.

The higher rates of both insecticides proved more effective in controlling CPB and leafhopper, especially mid to late season. The lower rate of CYMBUSH 240EC began to fail the earliest. Combining the lowest rates of AC 303,630 240SC (208.3 mL product/ha) and CYMBUSH 250EC (70 mL product/ha) gave both statistically and visually the highest level of potato foliar insect control at the lowest applied rates.

Table 1. Colorado potato beetle counts.

Treatment	Rate (product mL/ha)	CPB Larvae/Plot June 27	July 2 (pre-spray)	July 5	July 22 (pre-spray)	July 25
AC 303,630 240SC	208.3	16.3b*	50.5b	22.5b	16.0b	4.5b
AC 303,630 240SC	416.7	10.3b	12.8bc	8.0b	16.0b	1.5b
AC 303,630 240SC + CYMBUSH 250EC	208.3 70.0	4.5b	21.3bc	9.0b	8.3b	1.5b
AC 303,630 240SC + CYMBUSH 250EC	416.7 70.0	5.0b	20.8bc	1.8b	14.0b	1.0b
AC 303,630 240SC + CYMBUSH 250EC	208.3 140.0	.8b	9.0c	4.5b	2.3b	4.0b
AC 303,630 240SC + CYMBUSH 250EC	416.7 140.0	1.8b	5.3c	0.8b	1.8b	3.0b
CYMBUSH 250EC	70.0	18.3b	51.3b	13.0b	54.3a	15.8a
CYMBUSH 250EC	140.0	16.5b	12.0bc	5.8b	23.5b	4.0b
Control		82.8a	105.0a	171.0a	17.5b	12.3a

* Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

Table 2. Foliar damage results.

Treatment	Rate (product mL/ha)	Foliar Ratings (0-10)* Leafhoppers July 13	Leafhoppers Aug. 3	CPB July 13	CPB Aug. 3	Yield (kg/Plot) Aug. 16
AC 303,630 240SC	208.3	8.1b**	5.3d	8.8bc	7.0b	24.8a
AC 303,630 240SC	416.7	8.9a	6.6c	9.4ab	7.0b	29.8a
AC 303,630 240SC + CYMBUSH 250EC	208.3 70.0	9.1a	8.0ab	9.9a	8.0a	28.3a
AC 303,630 250SC + CYMBUSH 250EC	416.7 70.0	9.0a	8.1a	9.9a	7.3b	29.3a
AC 303,630 240SC + CYMBUSH 250EC	208.3 140.0	9.0a	8.0ab	9.9a	8.0a	28.0a
AC 303,630 240SC + CYMBUSH 250EC	416.7 140.0	9.0a	8.0ab	9.8a	8.0a	28.5a
CYMBUSH 250EC	70.0	8.9a	5.0d	8.4c	4.8c	24.8a
CYMBUSH 250EC	140.0	8.9a	7.3bc	8.6c	7.0b	26.0a
Control		4.0c	2.0e	4.5d	2.0d	19.0b

* Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.
** Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

#055

ICAR NUMBER: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: POTATO INSECT CONTROL USING ADMIRE FORMULATIONS

MATERIALS: ADMIRE 240FS, 2.5G (Imidacloprid)

METHODS: Potatoes were planted in 2 row plots x 6 m long with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 5, 1994. In-furrow applications using either the granular or liquid (EC) formulations were applied by hand or sprayed in a 15 cm band just prior to planting. The at cracking treatment was applied by hand in a 15 cm band over the row at the time of potato emergence through the ground on June 7. The foliar insecticides were applied on June 21, July 2, and 22. Assessments were taken by counting the number of Colorado potato beetle (CPB) larvae per plot on June 21, 27, July 2 and 6. Foliar damage ratings caused by leafhoppers and beetle feeding damage were taken on July 13 and August 3. Potatoes were harvested on August 16. Results were analyzed using the Duncan's Multiple Range Test.

RESULTS: As presented in the tables.

CONCLUSIONS: ADMIRE, regardless of formulation and method of application, significantly reduced the high populations of the Colorado potato beetles and damage by potato leafhoppers. In-furrow and foliar applications of ADMIRE provided both early-season control of CPB and season-long control of CPB and reduced damage by leafhoppers. Damage caused by leafhoppers was less with in-furrow applications later on into the season (August 3) with the liquid formulation, while the granular treatment provided extended insect control. Banding ADMIRE 240FS at cracking was the least effective method of application. The foliar application of ADMIRE 240FS gave good control of the CPB within days of application. There was a tendency for higher yields of the two highest rates of the in-furrow treatments relative to the other insecticide treatments.

Table 1. Counts of Colorado potato beetle larvae.

Treatment	Rate (product)	Application	CPB Larvae/plot June 21 (pre-spray)	June 27	July 2	July 6
ADMIRE 240FS	4.17 mL/100 m	In-furrow	0.0b*	1.5b	2.0c	5.8c
ADMIRE 240FS	8.33 mL/100 m	In-furrow	0.0b	1.3b	1.8c	1.5c
ADMIRE 240FS	12.5 mL/100 m	In-furrow	0.0b	1.0b	2.8c	0.3c
ADMIRE 2.5G	80.0 gm/100 m	In-furrow	0.0b	0.0b	3.3c	6.3c
ADMIRE 240FS	12.5 mL/100 m	Band at Cracking	11.5b	42.5b	51.8b	45.3b
ADMIRE 240FS	104.2 mL/ha	Foliar	33.5ab	1.0b	4.0c	0.0c
ADMIRE 240FS	208.3 mL/ha	Foliar	64.0a	0.0b	0.8c	0.0c
Control			46.5ab	100.0a	131.8a	124.3a

* Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

Table 2. Insect damage and yield results.

Treatments	Rate (product)	Application	Foliar Ratings (0-10)** Leafhoppers July 13	Leafhoppers Aug. 3	CPB July 13	CPB Aug. 3	Yield (kg/plot) July 29
ADMIRE 240FS	4.17 mL /100m	In-furrow	8.8a*	4.0c	9.9a	8.0b	19.6ab
ADMIRE 240FS	8.33 mL /100m	In-furrow	8.9a	6.8b	10.0a	8.8a	20.0ab
ADMIRE 240FS	12.50 mL /100m	In-furrow	9.0a	7.0b	10.0a	8.3ab	24.3a
ADMIRE 2.5G	80.0 gm /100m	In-furrow	8.8a	8.0a	9.3a	8.3ab	24.3a
ADMIRE 240FS	12.50 mL /100m	Band at Cracking	7.0b	3.0d	7.3b	8.3ab	16.5bc
ADMIRE 240FS	104.20 mL /ha	Foliar	9.0a	8.4a	9.9a	8.5ab	19.0ab
ADMIRE 240FS	208.30 mL /ha	Foliar	8.9a	8.0a	9.8a	8.8a	19.3ab
Control			4.3c	2.5d	4.8c	2.3c	12.5c

* Means followed by the same letter do not differ significantly (P = 0.05, Duncan's Multiple Range Test).

** Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

#056

ICAR NUMBER: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: EFFICACY OF BROADCAST APPLICATIONS OF FOSTHIAZATE FOR THE CONTROL OF POTATO INSECTS

MATERIALS: FOSTHIAZATE 900EC (Fosthiazate)
VYDATE L (Oxamyl)

METHODS: Potatoes were planted in 2 row plots x 6 m long with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 5, 1994. Treatments were applied just prior to planting using an Oxford precision boom-sprayer, applying 200 L/ha of spray mixture. The treatments were raked into the soil simulating a pre-plant incorporation treatment. Assessments were taken by counting the number of Colorado potato beetle (CPB) larvae per plot on June 21, 27, July 25, and August 16. Foliar damage ratings caused by leafhoppers and beetle feeding damage were taken on July 13 and August 3. Potatoes were harvested on August 16. Results were analyzed using Duncan's Multiple Range Test.

RESULTS: As presented in the tables.

CONCLUSIONS: The pre-plant incorporated broadcast treatment of FOSTHIAZATE 400EC did not reduce the high populations of CPB and leafhopper in this trial. Although not statistically significant, the yield of tubers from the plots treated with FOSTHIAZATE at the highest rate tended to be higher than that of the Control.

Table 1. Colorado potato beetle larval counts and potato yields.

Treatment	Rate (L product/ha)	Application	CPB Larvae/Plot June 21	CPB Larvae/Plot June 27	CPB Larvae/Plot July 25	Yield (kg/plot) Aug. 16
FOSTHIAZATE 900EC	3.75	broadcast-ppi	76.3a*	155.3a	6.0a	13.8ab
FOSTHIAZATE 900EC	5.60	broadcast-ppi	64.3a	118.0a	8.3a	16.5a
FOSTHIAZATE 900EC	7.50	broadcast-ppi	75.0a	116.3a	2.5a	17.0a
VYDATE L	3.00	broadcast-ppi	62.8a	143.8a	6.0a	13.0ab
Control			59.5a	120.3a	3.0a	14.0ab

* Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

Table 2. Foliar damage results.

Treatment	Rate (L product/ha)	Application	Foliar Ratings (0-10)** Leafhoppers July 13	Leafhoppers Aug. 3	CPB July 13	CPB Aug. 3
FOSTHIAZATE 900EC	3.75	broadcast-ppi	6.0c*	2.0a	6.0a	2.8a
FOSTHIAZATE 900EC	5.60	broadcast-ppi	7.3ab	2.0a	6.0a	3.0a
FOSTHIAZATE 900EC	7.50	broadcast-ppi	8.0a	2.0a	5.3a	3.3a
VYDATE L	3.00	broadcast-ppi	6.8bc	2.0a	6.0a	2.5a
Control			4.0d	2.0a	5.0a	3.0a

* Means followed by the same letter do not differ significantly (P = <0.05 Duncan's Multiple Range Test).

** Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

#057

ICAR: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

NAME AND AGENCY:
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TITLE: USE OF KRYOCIDE FOR THE CONTROL OF CPB IN POTATOES

MATERIALS: GUTHION 240SC (Azinphos-methyl)
KRYOCIDE 96WP (Cryolite)

METHODS: Potatoes were planted in 2 row plots x 6 m long with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 10, 1994. Spray applications were made using a back-pack airblast sprayer using 240 L/ha. Insecticides were applied June 22, July 2, and 22. Assessments were taken by counting CPB larvae and adults per plot on June 27, July 2, 6, 22, and 25. Foliar damage ratings caused by leafhoppers and CPB were taken on July 13 and August 3, and potato yields were taken on August 16. Results were analyzed using Duncan's Multiple Range Test.

RESULTS: As presented in the tables.

CONCLUSIONS: Excellent control of both larval and adult populations of the Colorado potato beetle was achieved using the foliar application of KRYOCIDE 96WP. Control was equal to the standard GUTHION 240SC applications. KRYOCIDE 96WP, however, was ineffective in reducing damage by leafhoppers resulting in a loss in potato yields. Yields from KRYOCIDE plots were not significantly different from the yield of the plot treated with GUTHION.

Table 1. Counts of Colorado potato beetle larvae.

Treatment	Rate (product/ha)	CPB Larvae/plot June 27	July 2	July 6	July 22
GUTHION 240SC	1.5 L	7.0b*	35.8b	2.5b	4.0a
KRYOCIDE 96WP	9.0 kg	2.0b	16.5b	0.0b	0.8a
KRYOCIDE 96WP	11.0 kg	3.8b	21.3b	1.3b	1.0a
Control		156.3a	181.8a	213.5a	2.0a

* Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

Table 2. Counts of Colorado potato beetle adult.

Treatment	Rate (product/ha)	CPB Adults/plot July 2	July 6	July 22	July 25
GUTHION 240SC	1.5 L	2.3a*	0.0a	19.5b	1.0b
KRYOCIDE 96WP	9.0 kg	1.0a	0.3a	6.5b	3.3b
KRYOCIDE 96WP	11.0 kg	0.5a	0.3a	26.5b	4.0b
Control		0.5a	0.0a	95.5a	35.3a

* Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

Table 3. Insect damage rating and yield results.

Treatments	Rate (product/ha)	Foliar Ratings (0-10)** CPB July 13	Leafhoppers July 13	Leafhoppers Aug. 3	Yield (kg/plot) Aug. 16
GUTHION 240SC	1.5 L	9.1a*	6.0a	7.5a	21.0a
KRYOCIDE 96WP	9.0 kg	8.5a	6.3a	2.8bc	18.0ab
KRYOCIDE 96WP	11.0 kg	8.5a	6.0a	3.8b	17.8ab
Control		4.0b	5.9a	2.3c	15.8b

* Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).
** Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

#058

ICAR NUMBER: 61006535

CROP: Potato, cv. Norchip

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: EFFECT OF TRIGARD 75WP IN TANK MIXES WITH FUNGICIDES FOR INSECT AND FOLIAR DISEASE CONTROL IN POTATOES

MATERIALS: TRIGARD 75WP (Cyromazine)
RIPCORD 400EC (Cypermethrin)
RIDOMIL MZ 72WP (Metalaxyl + Mancozeb)
BRAVO 500 (Chlorothalonil)

METHODS: Potatoes were planted in 2 row plots x 6 m long with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter om May 5, 1994. Spray applications were made using a back-pack airblast sprayer using 240 L/ha. The first two applications were made early in the season at 10 - 30% egg hatch (June 21) and 7-10 d later (July 1). The last two applications were made on August 2 and 12. Assessments were taken by counting the number of Colorado potato beetle (CPB) larvae per plot before and after sprays, by foliar damage ratings caused by leafhoppers, and CPB on July 13 and August 3, and by potato yields on August. 16. Results were analyzed using Duncan's Multiple Range Test.

RESULTS: As presented in the tables.

CONCLUSIONS: TRIGARD 75WP effectively controlled Colorado potato beetle larvae when applied at 10-30% egg hatch followed by a second application 10 d later. The populations of CPB were high. Two applications were required to reduce the population of CPB larvae to commercially-accepted levels. Due to the high numbers of 1st generation CPB, neither of the early applied TRIGARD nor RIPCORD treatments significantly affected the 2nd generation of adults. TRIGARD 75WP was equal to RIPCORD 400EC in controlling CPB. However, RIPCORD 400EC was more effective in reducing the damage caused by potato leafhoppers.

Part of this experiment was to determine whether tank-mixing of the insecticides with the fungicides had any adverse effects on the efficacy of the fungicides or the insecticides. No difference in the insecticidal effectiveness of TRIGARD 75WP or RIPCORD 400EC when tank mixed with either RIDOMIL MZ 72WP or BRAVO 500 was observed. It was not possible to determine whether either of these insecticides affected the fungicides as the potato foliage was either slightly injured by CPB or severely damaged by leafhoppers. The incidence of foliar disease, therefore, was impossible to rate.

Table 1. Colorado potato beetle counts.

Treatment	Rate (product/ha)	CPB Larvae/Plot June 21 (pre-spray)	June 27	July 1 (pre-spray)	Adults/Plot July 5	July 25
TRIGARD 75WP;	0.373 kg	44.3a*	176.5b	38.8b	14.5b	35.5ab
TRIGARD 75WP;	0.373 kg					
TRIGARD 75WP;	0.373 kg					
TRIGARD 75WP	0.373 kg					
TRIGARD 75WP;	0.373 kg	41.8a	147.5b	36.5b	12.8b	27.8b
TRIGARD 75WP +	0.373 kg					
RIDOMIL MZ 72WP;	2.500 kg					
TRIGARD 75 WP +	0.373 kg					
RIDOMIL MZ 72WP;	2.500 kg					
TRIGARD 75WP +	0.373 kg					
RIDOMIL MZ 72WP	2.500 kg					
TRIGARD 75WP;	0.373 kg	70.0a	138.3b	45.0b	13.5b	35.3ab
TRIGARD 75WP +	0.373 kg					
BRAVO 500;	2.400 L					
TRIGARD 75WP +	0.373 kg					
BRAVO 500;	2.400 L					
TRIGARD 75WP +	0.373 kg					
BRAVO 500	2.400 L					
RIPCORD 400EC;	90 mL	51.8a	105.3b	30.0b	7.0b	32.5ab
RIPCORD 400EC +	90 mL					
RIDOMIL MZ 72WP;	2.5 kg					
RIPCORD 400EC +	90 mL					
RIDOMIL MZ 72WP;	2.5 kg					
RIPCORD 400EC +	90 mL					
RIDOMIL MZ 72WP	2.5 kg					
RIPCORD 400EC;	90 mL	51.0a	135.3b	42.5b	15.0b	39.3ab
RIPCORD 400EC +	90 mL					
BRAVO 500;	2.4 L					
RIPCORD 400EC +	90 mL					
BRAVO 500;	2.4 L					
RIPCORD 400EC +	90 mL					
BRAVO 500	2.4 L					
Control		60.0a	442.0a	447.5a	234.0a	48.3a

* Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

Table 2. Insect damage ratings and yield.

Treatment	Rate (product/ha)	Foliar Ratings (0-10)* CPB July 13	CPB Aug. 3	Leafhopper July 13	Leafhopper Aug. 3	Yield (kg/plot)
TRIGARD 75WP;	0.373 kg	9.6a**	7.0	8.0a	3.3b	26.5a
TRIGARD 75WP;	0.373 kg					
TRIGARD 75WP;	0.373 kg					
TRIGARD 75WP	0.373 kg					
TRIGARD 75WP;	0.373 kg	9.1a	7.0	8.0a	3.3b	26.5a
TRIGARD 75WP +	0.373 kg					
RIDOMIL MZ 72WP;	2.500 kg					
TRIGARD 75 WP +	0.373 kg					
RIDOMIL MZ 72WP;	2.500 kg					
TRIGARD 75WP +	0.373 kg					
RIDOMIL MZ 72WP	2.500 kg					
TRIGARD 75WP;	0.373 kg	9.0a	7.0	8.0a	2.8b	26.0a
TRIGARD 75WP +	0.373 kg					
BRAVO 500;	2.400 L					
TRIGARD 75WP +	0.373 kg					
BRAVO 500;	2.400 L					
TRIGARD 75WP +	0.373 kg					
BRAVO 500	2.400 L					
RIPCORD 400EC;	90 mL	9.6a	6.0	8.0a	6.8a	29.0a
RIPCORD 400EC +	90 mL					
RIDOMIL MZ 72WP;	2.5 kg					
RIPCORD 400EC +	90 mL					
RIDOMIL MZ 72WP;	2.5 kg					
RIPCORD 400EC +	90 mL					
RIDOMIL MZ 72WP	2.5 kg					
RIPCORD 400EC;	90 mL	9.1a	6.0	8.0a	6.8a	28.3a
RIPCORD 400EC +	90 mL					
BRAVO 500;	2.4 L					
RIPCORD 400EC +	90 mL					
BRAVO 500;	2.4 L					
RIPCORD 400EC +	90 mL					
BRAVO 500	2.4 L					
Control		6.0b	1.0	7.5b	1.0c	20.5b

* Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.

** Means followed by the same letter do not differ significantly ($P = <0.05$, Duncan's Multiple Range Test).

#059

ICAR NUMBER: 61006535

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)
Potato leafhopper, *Empoasca fabae* (Harris)

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TITLE: CONTROL OF COLORADO POTATO BEETLES USING TRIGARD 75WP

MATERIALS: TRIGARD 75WP (Cyromazine)
RIDOMIL MZ 72WP (Metalaxyl + Mancozeb)
BRAVO 500 (Chlorothalonil)

METHODS: Potatoes were planted in 2 row plots x 6 m long, with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed-pieces were planted with a commercial planter on May 4, 1994. Spray applications were made using a back-pack airblast sprayer using 240 L/ha. Only two applications were made early in the season at 10-30% egg hatch (June 21) and 7-10 d later (July 1). Assessments were taken by counting the number of Colorado potato beetle (CPB) larvae per plot before and after sprays, by foliar damage ratings caused by leafhoppers, CPB on July 13 and August 3, and by potato yields on August 16. Results were analyzed using the Duncan's Multiple Range Test.

RESULTS: As presented in the tables.

CONCLUSIONS: TRIGARD 75WP, effectively reduced the number of Colorado potato beetle larvae feeding on the foliage of potatoes with two strategically applied foliar applications. Applications at 10-30% egg hatch followed 7-10 d later significantly controlled the 1st generation larvae while significantly reducing the initial CPB adult counts of the second generation. TRIGARD 75WP gave little control of potato leafhoppers. There was no adverse nor positive effects on insect control when RIDOMIL MZ or BRAVO 500 were tank-mixed with TRIGARD 75WP. There was no CPB foliar rating on August 3 as leafhopper damage was so severe at that time.

Table 1. Counts of Colorado potato beetle.

Treatment	Rate (product/ha)	CPB Larvae/Plot June 21 (pre-spray)	June 27	July 1 (pre-spray)	Adults/Plot July 5	July 25
TRIGARD 75WP;	0.373 kg	58.5a*	36.3b	50.3b	9.3b	17.0b
TRIGARD 75WP	0.187 kg					
TRIGARD 75WP;	0.373 kg	75.0a	23.8b	39.3b	10.5b	22.5b
TRIGARD 75WP	0.373 kg					
TRIGARD 75WP;	0.373 kg	41.8a	29.0b	46.5b	12.0b	17.5b
TRIGRAD 75WP +	0.373 kg					
RIDOMIL MZ 72W	2.500 kg					
TRIGARD 75WP;	0.373 kg	39.3a	25.0b	34.5b	6.5b	20.0b
TRIGARD 75WP +	0.373 kg					
BRAVO 500	2.400 L					
Control		46.3a	103.5a	211.5a	154.5a	45.3a

* Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

Table 2. Insect damage ratings and yield.

Treatments	Rate (product/ha)	Foliar Ratings (0-10)* Leafhopper July 13	Aug. 3	CPB July 13	Yield (kg/plot) Aug. 16
TRIGARD 75WP;	0.373 kg	6.3ab**	2.3b	8.5a	18.5a
TRIGARD 75WP	0.187 kg				
TRIGARD 75WP;	0.373 kg	7.0a	2.6ab	9.0a	19.0a
TRIGARD 75WP	0.373 kg				
TRIGARD 75WP;	0.373 kg	6.5ab	3.5a	9.0a	18.3a
TRIGARD 75WP +	0.373 kg				
RIDOMIL MZ 72W	2.500 kg				
TRIGARD 75WP;	0.373 kg	6.8ab	2.3b	8.5a	20.0a
TRIGARD 75WP +	0.373 kg				
BRAVO 500	2.400 L				
Control		6.0b	1.0c	5.8b	14.8a

* Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.
** Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

#060

ICAR NUMBER: 61002036

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: COMPARING IN-FURROW VS. BAND INSECTICIDE TREATMENTS FOR POTATO TRAP CROPS IN FIELD TOMATOES

MATERIALS: THIMET 15G (Phorate)
ADMIRE 240FS, 2.5G (Imidacloprid)

METHODS: Potatoes were planted in single-row plots around the perimeter of a tomato range at Ridgetown College on May 10, 1994. The plots were 6 m long, and replicated two times on each side of the field, totally four replications. One set of treatments was planted on the east side of the tomato field, the other set was on the west side. The granular insecticides were applied in a 15 cm band in-furrow prior to planting. The liquid insecticides were sprayed in a 15 cm band either in-furrow or over the row in a band after planting with a back-pack airblast sprayer using 240 L/ha. Assessments were taken by counting Colorado potato beetle larvae per plot on June 22 and 27. Foliar damage ratings were taken on June 27 and yields were measured on August 17. Results of the two replicated trial were averaged.

RESULTS: As presented in the table.

CONCLUSIONS: The most effective treatments were the in-furrow treatments of ADMIRE 2.5G and 240FS. Delaying the applications as a band over the row was less effective than the in-furrow method. The application of THIMET 15G was ineffective in controlling high populations of Colorado potato beetles.

Table 1. Colorado potato beetle larval counts, foliar damage ratings, and yield on a potato trap crop.

Treatment	Rate (prod/100 m of row)	Application	CPB Larvae/Plot June 22	CPB Larvae/Plot June 27	Foliar Damage Ratings (0-10)* June 27	Yield (kg/plot)
THIMET 15G	224 gm	In-furrow	158.8ab**	185.3a	3.2c	5.7c
ADMIRE 2.5G	80 gm	In-furrow	3.0b	49.5c	9.4a	11.7a
ADMIRE 240FS	9 mL	In-furrow	24.8b	61.3c	9.0a	9.3ab
ADMIRE 240FS	9 mL	Band	94.0ab	91.3bc	6.1b	6.7bc
Control			255.8a	176.5ab	2.1c	3.3c

* Foliar Damage Ratings (0-10): 0, no control, foliage severely damaged; 10, complete control.
** Means followed by the same letter do not differ significantly (P = <0.05, Duncan's Multiple Range Test).

#061

ICAR: 86100104

CROP: Potato, cv. Chieftan

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: EFFECTS OF VARIOUS RATES AND COMBINATIONS OF INSECTICIDES AND ADJUVANTS ON THE CONTROL OF COLORADO POTATO BEETLE (CPB)

MATERIALS: TRIGARD 75 WP (Cyromazine)
AC 303,630
CYMBUSH (Cypermethrin)
KARATE 5 EC and 5 WP (Fenpropathrin)
M-TRAK (*Bacillus thuringiensis san diego*)
SYLGARD (Adjuvant)
GUTHION 50 WP (Azinphos-methyl)
NOVODOR (*Bacillus thuringiensis tenebrionis*)

METHODS: Potatoes were seeded on May 4, 1994, in 4 rows x 13 m long, replicated four times. Rows were spaced at 0.9 m and plots were separated by 3 m spray lanes. Treatments were arranged in a randomized complete block design. Insecticides were applied with a tractor-mounted, 4-row boom sprayer that delivered 800 L/ha at 450 kPa. Two hundred egg masses were tagged on June 15 and checked daily to determine hatch. The proportion of eggs that had hatched was 1% on June 16, 7% on June 17, and 64.5% on June 19. The initial spray of all treatments was applied on June 20. A second and final application against the first generation of CPB was conducted on June 27.

Populations of CPB were monitored 3 d after the initial spray and then weekly to July 15, the end of the generation. Counts were taken by examining five plants in each plot and the numbers of larvae and adults were recorded. The percent defoliation caused by adults and larvae was estimated. Mean defoliation for the period of adult and larval feeding during the first generation was calculated for each treatment. Yield data was obtained at harvest for the center 2 rows of each plot on August 25. The numbers of large larva, the percent defoliation, and the yield for all treatments were compared by Analysis of Variance and means were separated by a Tukey's Studentized Range Test when significant.

RESULTS: As presented in the table.

CONCLUSIONS: The addition of SYLGARD to CYMBUSH or GUTHION did not improve the control of Colorado potato beetle.

All the various combinations of TRIGARD, AC 303,630 and AC 303,630 combined with CYMBUSH provided excellent control of Colorado potato beetle. The lower rates were just as effective as the high rates. CYMBUSH and GUTHION by themselves were not as effective.

Both KARATE formulations, and the treatments of M-TRAK and NOVODOR were effective in controlling the beetle and similarly these treatments out-performed the registered standards, GUTHION and CYMBUSH.

Yields were greatly reduced and not different than the unsprayed checks with

GUTHION and CYMBUSH plus SYLGARD, and with GUTHION alone at 175 g a.i./ha. The yield of all other treatments were significantly greater than the untreated check.

Table 1. Number of CPB large larvae per plant and percent defoliation, 1994.

Insecticide	Rate (a.i./ha)	June 30	July 6	July 13	June 30	July 6	July 13	Yield (t/ha)
		Large larvae*			Percent defoliation			
TRIGARD	280/140	0.0d	0.0d	0.6e	10.5bcd	6.6cd	5.1gh	23.2ab
TRIGARD	280/280	0.0d	0.0d	0.5e	7.9bcde	7.1cd	7.9fgh	21.9abc
AC 303,630	50	0.3d	0.3d	0.8e	5.4cde	6.2cd	3.7gh	22.1abc
AC 303,630	100	0.0d	0.0d	0.8e	5.1cde	3.6d	2.3h	20.4abc
AC 303,630 + CYMBUSH	50 17	0.4d	0.2d	0.5e	7.0cde	3.6d	2.5h	25.5a
AC 303,630 + CYMBUSH	100 17	0.3d	0.0d	2.4de	4.0de	2.9d	7.9fgh	22.1abc
AC 303,630 + CYMBUSH	50 35	0.0d	0.0d	0.5e	3.8de	3.5d	3.1gh	22.6abc
AC 303,630 + CYMBUSH	100 35	0.0d	0.0d	0.0e	4.4de	3.9d	2.1h	25.6a
KARATE 5EC	10	0.0d	0.0d	0.0e	2.8e	3.9d	2.7h	20.5abc
KARATE 5WG	10	0.0d	0.1d	5.6cde	5.0cde	7.5cd	20.2ef	19.2abc
CYMBUSH	17	0.8d	1.2d	19.7a	9.0bcde	9.5cd	31.8de	17.4abcd
CYMBUSH	35	0.5d	0.4d	5.8cde	6.0cde	7.4cd	17.3fg	14.7bcd
M-TRAK + SYLGARD	5 L** 0.15%**	0.5d	0.0d	0.5e	4.0de	3.4d	2.6h	19.8abc
M-TRAK + SYLGARD	5 L 0.25%	0.5d	0.0d	1.9de	5.2cde	4.0d	4.9gh	18.4abcd
GUTHION + SYLGARD	175 0.15%	5.4b	17.4a	13.0ab	15.1b	43.5b	64.0b	5.4e
CYMBUSH + SYLGARD	17 0.15%	0.8d	1.9d	17.8a	7.9cde	11.1cd	39.5cd	14.0cde
GUTHION	175	3.9bc	11.3bc	8.9bcd	11.9bc	41.0b	53.3bc	9.5de
GUTHION	350	1.4cd	8.7c	6.2bcde	9.0bcde	18.6c	36.8d	13.9cde
NOVODOR	5 L	0.0d	0.1d	4.1cde	2.6e	3.8d	5.9fgh	20.8abc
unsprayed check		10.1a	17.1ab	9.5bc	22.4a	57.7a	79.5a	5.9e

* Means in each column followed by the same letter are not significantly different at P#0.05 (Tukey's Studentized Range Test.

** L: L prod/ha, %: v/v.

#062

STUDY DATA BASE: 364-1421-8704

CROP: Potato, cv. Russet Burbank

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: EVALUATION OF TRANSGENIC POTATO CLONES FOR RESISTANCE TO THE COLORADO POTATO BEETLE

MATERIALS: CLONE 1 to CLONE 7 (Russet Burbank potato clones genetically modified to express the delta endotoxin of *Bacillus thuringiensis* var. *tenebrionis*); DECIS 5EC (Deltamethrin).

METHODS: Potatoes were seeded into alternating border and plot rows at the Research Centre in Winnipeg. Border rows were sown with local Russet Burbank seed potatoes on 26 May 1993. Plot rows of 7 experimental clone and 2 nontransgenic potato treatments were seeded 2 d later. All rows were 5 m long and were separated by 1 m between rows and 2 m between blocks. Plots consisted of 1 row, replicated three times in a randomized complete block design. Adult beetles were collected from a nearby commercial field and added to all plots 2 and 4 weeks after potatoes had emerged. Starting 1 week after beetle introduction, all stages of potato beetles on five plants per plot, and a visual assessment of plant defoliation, were taken weekly during July and August. A single application of DECIS 5EC at 7.5 g/L was made July 20 to one treatment of nontransgenic potatoes with a CO_2 pressurized back-pack sprayer equipped with D6-25 nozzles at 400 L/ha and a pressure of 400 kPa. Plots were harvested by hand from September 27 to 29, and tubers were sorted according to marketability and weighed. Potato beetle counts and yields were transformed by the log 10 (x + 1) and then analyzed by Duncan's Multiple Range Test.

RESULTS: Data for potato beetle counts and marketable yields in the tables are the values calculated from the means of the transformed data.

CONCLUSIONS: Adult potato beetles did not show a preference for ovipositing on potatoes in any treatment. Eggs laid on all transgenic clones hatched, but larvae failed to develop and did not feed on these plants (Table 1). Larvae and summer generation adults that were found on transgenic plants later in the season also caused no visible signs of feeding injury (Table 2). Both potato beetle stages likely had migrated from heavily infested border rows. Five of the seven transgenic clones had marketable yields that were significantly higher than untreated nontransgenic potatoes, and were comparable to potatoes that were treated with DECIS 5EC (Table 2). The yields for CLONE 4 and CLONE 6 did not differ from those of either nontransgenic potato treatments despite the absence of feeding injury on these clones.

Table 1. The density per plant of various stages of Colorado potato beetles at various stages on transgenic potato clones.

	Egg Clusters	Larvae				Adults	
Treatments	15/07	20/07	27/07	03/08	10/08	15/07	18/08
CLONE 1	0.59ab*	0.1b	0.2c	0.1c	0.0b	0.5a	0.1c
CLONE 2	0.25abc	0.0b	0.1c	0.1c	0.0b	0.6a	0.1c
CLONE 3	0.17c	1.4ab	0.1c	0.0c	0.1b	0.3a	0.1c
CLONE 4	0.31abc	3.9ab	0.0c	0.4c	0.0b	0.7a	0.3c
CLONE 5	0.19bc	0.7ab	0.1c	0.3c	0.1b	0.4a	0.2c
CLONE 6	0.17c	1.3ab	0.1c	0.1c	0.0b	0.3a	0.2c
CLONE 7	0.65abc	1.3ab	0.2c	0.2c	0.0b	0.4a	0.1c
check	0.90a	4.1ab	10.4a	27.3a	6.1a	0.9a	2.3a
DECIS 5EC	0.85ab	7.8a	2.5b	2.7b	4.7a	0.5a	1.1b

* For each column, means followed by the same letter are not significantly different at the 5% level of Duncan's Multiple Range Test.

Table 2. The effects of feeding by the Colorado potato beetle on plant defoliation and marketable yields of transgenic potato clones.

	Plant defoliation (%)			
Treatments	27/07	03/08	18/08	Yield (g/plant)
CLONE 1	0	0	0	860ab*
CLONE 2	0	0	0	895a
CLONE 3	0	0	0	924a
CLONE 4	0	0	0	807abc
CLONE 5	0	0	0	927a
CLONE 6	0	0	0	764bc
CLONE 7	0	0	0	934a
check	6	12	25	720c
DECIS 5EC	2	1	4	852ab

* For each column, means followed by the same letter are not significantly different at the 5% level of Duncan's Multiple Range Test.

#063

STUDY DATA BASE: 364-1421-8704

CROP: Potato, cv. Russet Burbank

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
WISE I L
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TITLE: RESISTANCE BY TRANSGENIC POTATO CLONES TO FEEDING BY THE COLORADO POTATO BEETLE

MATERIALS: CLONE 1 to CLONE 3, CLONE 5, CLONE 7 (Russet Burbank potato clones genetically modified to express the delta endotoxin of *Bacillus thuringiensis* var. *tenebrionis*); DECIS 5EC (Deltamethrin).

METHODS: The experiment, located in a field at the Research Centre in Winnipeg, was divided into single alternating border and plot rows that were separated by 1 m within blocks and by 2 m between blocks in a randomized complete block design. All rows were sown 17 May 1994. Plots consisted of 1 row x 4 m long, and were replicated four times. Border rows and nontransgenic treatments were seeded with local Russet Burbank seed potatoes. Adult potato beetles were collected from a nearby commercial field and were added to the plots 2 weeks after potatoes had emerged. All stages of the potato beetle were counted from five plants per plot within 1 week of adult beetle introduction, and counts were repeated weekly until the summer generation adults left the plants to overwinter. DECIS 5EC at 7.5 g a.i./ha was applied at 400 L/ha on July 5 to one treatment of nontransgenic potatoes with a CO_2 pressurized back-pack sprayer equipped with D6-25 nozzles at a pressure of 400 kPa. Plant defoliation (percent) in each plot was assessed visually when beetles were counted. Plots were harvested from September 26 to 28 after top growth dieback. Tubers were separated according to their marketability and weighed. All potato beetle counts and yields were transformed by the log 10 (x + 1) before analysis by Tukey's Studentized Range or Duncan's Multiple Range Test.

RESULTS: Data for potato beetle counts and yields listed in the tables are the values that were calculated from the means of the transformed data.

CONCLUSIONS: While adult potato beetles were not deterred from ovipositing on the transgenic clones, fewer egg clusters were laid on these plants than on nontransgenic plants (Table 1). Adult populations of overwintering beetles were found in all plots, but adults of the summer generation confined their feeding to nontransgenic plants before leaving the plots to overwinter (Table 1). A few adults did move to transgenic plots, but did not appear to feed. The larvae from eggs laid on transgenic clones emerged but failed to develop. Few larvae were found on the transgenic clones later in the season (Table 1). These larvae were mostly third and fourth instars that did not appear to feed on the clones (Table 2), and likely had moved from border plots that had become severely defoliated. Although all five clones had marketable yields comparable to treated nontransgenic potatoes and higher than untreated nontransgenic potatoes, the yield increase was not statistically significant (Table 2).

Table 1. Egg clusters, larvae and adults per plant of the Colorado potato beetle on transgenic potato clones.

	Egg clusters	Larvae				Adults		
Treatment	22/06	29/06	05/07	12/07	19/07	22/06	02/08	17/08
CLONE 1	0.4a*	0.2c	0.0b	0.0b	0.1b	0.3a	0.2b	0.1b
CLONE 2	0.6a	1.0bc	0.0b	0.1b	0.1b	0.5a	0.6b	0.1b
CLONE 3	0.5a	0.2c	0.0b	0.2b	0.0b	0.4a	0.2b	0b
CLONE 5	1.0a	0.1c	0.0b	0.1b	0.1b	0.2a	0.7b	0.1b
CLONE 7	0.9a	0.9bc	0.6b	0.0b	0.0b	0.5a	0.3b	0.1b
check	1.2a	10.0ab	21.6a	14.5a	3.9a	0.3a	12.1a	1.5a
DECIS 5EC	1.2a	13.5a	30.3a	1.3b	0.9b	0.4a	4.7a	1.2a

* Within each column, means followed by the same letter are not significantly different at the 5% level of Tukey's Studentized Range test.

Table 2. Crop defoliation and marketable yields of transgenic potato clones exposed to feeding by the Colorado potato beetle.

	Defoliation (%)			Yield
Treatment	12/07	26/07	09/08	(g/plant)
CLONE 1	0	0	0	1447ab*
CLONE 2	0	0	0	1437ab
CLONE 3	0	0	0	1407ab
CLONE 5	0	0	0	1404ab
CLONE 7	0	0	0	1458ab
check	11	20	48	1241b
DECIS 5EC	2	3	8	1490a

* Within each column, means followed by the same letter are not significantly different at the 5% level of Duncan's Multiple Range Test.

#064

CROP: Potato, cv. Kennebec

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: EVALUATION OF TRIGARD 75WP FOR THE CONTROL OF COLORADO POTATO BEETLE- I

MATERIALS: TRIGARD 75WP (Cyromazine)
RIPCORD 400EC (Cypermethrin)
GUTHION 240SC (Azinphos-methyl)
M-TRAK (*Bacillus thuringiensis* var. *san diego*)

METHODS: The test site was located near Cambridge, Ontario. Potato seed pieces were planted on May 11, 1994, into rows spaced 1.0 m apart with a plant spacing of 30 cm. Plots were 6 m long x 3 rows wide. Each treatment was replicated four times in a completely randomized block design. Twenty CPB egg masses from across the site were flagged and monitored. As of June 21, 45% of egg masses had hatched. Treatment applications were made on June 21 and 28 (Treatments 3-6 only), 1994. All treatments were applied using a CO_2 pressurized 3 m hand boom sprayer with XR11002VS flat fan tip nozzles that deliver 400 L/ha at 345 kPa. Counts of CPB were made on June 27, July 5 and 13, 1994. On each date, the total numbers of CPB egg masses, 1st, 2nd, 3rd, and 4th instars, and adults were recorded from 10 plants in the middle row of each plot. First and 2nd instars were grouped as small larvae (SL), 3rd and 4th instars were grouped as large larvae (LL). Percent defoliation due to CPB feeding was visually assessed on July 5, 13 and 19, 1994. The numbers of large larvae and percent defoliation for all treatments were compared by Analysis of Variance. Treatment means were separated by Duncan's Multiple Range Test when significant.

RESULTS: As presented in the table. There were no significant differences among treatments with respect to the numbers of small larvae.

CONCLUSIONS: It is indicated by the results that the population of CPB was partially resistant to RIPCORD and or GUTHION. TRIGARD 75WP provided excellent control of Colorado potato beetles at all rates tested by inhibiting the development of larvae. One application of TRIGARD 75WP gave excellent control of large larvae within 1 week. However, a second application was required to ensure low defoliation ratings beyond 3 weeks after the first application. No symptoms of phytotoxicity were observed.

Table 1. A comparison of counts of 3rd and 4th instars (LL) of the Colorado potato beetle (CPB) and percent defoliation among plots treated with different insecticides.

TREATMENT	RATE g a.i./ha	CPB LARGE LARVAE/10 PLANTS* JUNE 27	JULY 5	JULY 13	% DEFOLIATION* JULY 5	JULY 13	JULY 19
1. CHECK		78.5b	345.8c	87.3a	50.0b	89.5c	83.0c
2. TRIGARD	280	12.5a	89.8ab	83.5a	1.5a	15.8a	13.0a
3. TRIGARD	280,140	4.8a	22.3a	47.0a	1.0a	3.5a	6.5a
4. TRIGARD	280,280	2.5a	11.3a	33.8a	1.0a	2.3a	1.5a
5. RIPCORD; GUTHION	35, 360	26.8ab	162.0b	194.3b	3.3a	42.5b	40.0b
6. M-TRAK	5, 5 L/ha	11.0a	19.5a	89.8a	1.0a	2.3a	4.5a

* Means within a column followed by the same letter are not significantly different (P = 0.05, Duncan's Multiple Range Test).

#065

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EVALUATION OF TRIGARD 75WP FOR THE CONTROL OF COLORADO POTATO BEETLE-II

MATERIALS: TRIGARD 75WP (Cyromazine)
RIPCORD 400EC (Cypermethrin)
GUTHION 240SC (Azinphos-methyl)
M-TRAK (*Bacillus thuringiensis* var. *san diego*)

METHODS: The test site was located near Plattsville, Ontario. Potato seed pieces were planted on May 14, 1994 into rows spaced 1.0 m apart with a plant spacing of 30 cm. Plots were 6 m long x 3 rows wide. Each treatment was replicated four times in a completely randomized block design. Twenty CPB egg masses from across the site were flagged and monitored. As of June 20, 50% of egg masses had hatched. Treatment applications were made on June 20 and 28 (Treatments 3-6 only), 1994. All treatments were applied using a CO_2 pressurized 3 m hand boom sprayer with XR11002VS flat fan nozzles that delivered 400 L/ha at 345 kPa. Counts of CPB were made on June 27, July 4 and 11, 1994. On each date the total numbers of CPB egg masses, 1st, 2nd, 3rd, and 4th instars, and adults were counted from 10 plants in the middle row of each plot. First and 2nd instars were grouped as small larvae (SL), 3rd and 4th instars were grouped as large larvae (LL). Percent defoliation due to CPB feeding was visually assessed on July 4, 11 and 19, 1994.

RESULTS: As presented in the table.

CONCLUSIONS: Multiple applications of TRIGARD 75WP provided excellent control of Colorado potato beetles by inhibiting the development of larvae. Two applications of TRIGARD at 280 g a.i./ha were required for a significant reduction in the numbers of large larvae on July 11. This treatment also resulted in the least defoliation at the July 19 evaluation. The LL counts on July 4 and 11 indicate that there may have been a mixed population of CPB that were susceptible and resistant to RIPCORD and or GUTHION. A Dip Test was not conducted to determine resistance since the test uses adults and the targets were small larvae. The LL counts for the M-TRAK were higher than for the two applications of TRIGARD at 280 g. This may indicate that timing of application is more critical for M-TRAK in that an earlier hatch threshold is necessary to target even smaller instar larvae. However, defoliation ratings indicate that the larger number of LL did not significantly increase defoliation. No symptoms of phytotoxicity were observed.

Table 1. A comparison of counts of 3rd and 4th instars (LL) of the Colorado potato beetle (CPB) and percent defoliation of potato plants treated with different insecticides.

TREATMENT	RATE g a.i./ha	NO. CPB LARGE LARVAE/10 PLANTS* JUNE 27	JULY 4	JULY 11	% DEFOLIATION* JULY 4	JULY 11	JULY 19
1 CHECK		89.0b	466.8c	132.5bc	42.5b	82.5c	61.3b
2 TRIGARD	280	1.0a	50.8ab	167.3cd	2.3a	12.0a	9.5a
3 TRIGARD	280,140	7.5a	10.5a	95.3ab	1.3a	2.5a	6.5a
4 TRIGARD	280,280	2.5a	3.5a	54.5a	1.3a	1.3a	4.3a
5 RIPCORD 35, GUTHION	360	13.0a	114.5b	203.8d	4.3a	33.8b	15.0a
6 M-TRAK	5,5 L/ha	87.8b	72.8ab	118.8bc	3.5a	7.8a	5.5a

* Means within a column followed by the same letter are not significantly different (P = 0.05, Duncan's Multiple Range Test).

#066

CROP: Potato, cv. Kennebec

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: TRIGARD 75WP IN TANK MIXTURES WITH FUNGICIDES FOR THE CONTROL OF COLORADO POTATO BEETLE - I

MATERIALS: TRIGARD 75WP (Cyromazine)
RIDOMIL MZ 72WP (Metalaxyl + Mancozeb)
BRAVO 500 (Chlorothalonil)

METHODS: The test site was located near Cambridge, Ontario. Potato seed pieces were planted on May 11, 1994, into rows spaced 1.0 m apart with a plant spacing of 30 cm. Plots were 6 m long x 3 rows wide. Each treatment was replicated four times in a completely randomized block design. Twenty CPB egg masses from across the site were flagged and monitored. As of June 21, 45% of egg masses had hatched. Treatment applications were made on June 21 and 28, 1994. All treatments were applied using a CO_2 pressurized 3 m hand boom sprayer with XR11002VS flat fan tip nozzles that delivered 400 L/ha at 345 kPa. Counts of CPB were made on June 27, July 5 and 13, 1994. On each date, the total numbers of CPB egg masses, 1st, 2nd, 3rd, and 4th instars, and adults were counted from 10 plants in the middle row of each plot. First and 2nd instars were grouped as small larvae (SL), 3rd and 4th instars were grouped as large larvae (LL). Percent defoliation due to CPB feeding was visually assessed on July 5, 13 and 19, 1994. The numbers of large larvae and percent defoliation for all treatments were compared by Analysis of Variance. Treatment means were separated by Duncan's Multiple Range Test when significant.

RESULTS: As presented in the table. There were no significant differences among treatments with respect to the numbers of small larvae.

CONCLUSIONS: All treatments provided control of the CPB by inhibiting the development of larvae, resulting in little defoliation in the treated plots. There were no significant differences in efficacy among treatments of TRIGARD 75WP alone or in a tank mixture with a fungicide. Late blight pressure was too light to allow for assessments of disease control. No symptoms of phytotoxicity were observed.

Table 1. A comparison of counts of 3rd and 4th instars (LL) of the Colorado potato beetle (CPB) and percent defoliation among plots treated with different insecticides.

TREATMENT	RATE kg a.i./ha	CPB LARGE LARVAE/10 PLANTS* JUNE 27	JULY 5	JULY 13	% DEFOLIATION* JULY 5	JULY 13	JULY 19
1. CHECK		78.5b	345.8b	87.3b	50.0b	89.5b	83.0b
2. TRIGARD TRIGARD	0.28, 0.28	2.5a	11.3a	33.8a	1.0a	2.3a	1.5a
3. TRIGARD TRIGARD + RIDOMIL	0.28, 0.28 1.80	13.5a	21.5a	58.8ab	1.5a	2.5a	5.0a
4. TRIGARD TRIGARD + BRAVO	0.28, 0.28 1.20	2.0a	16.3a	41.8ab	1.0a	1.5a	3.0a

* Means within a column followed by the same letter are not significantly different (P = 0.05, Duncan's Multiple Range Test).

#067

CROP: Potato, cv. Superior

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: TRIGARD 75WP IN TANK MIXTURES WITH FUNGICIDES FOR THE CONTROL OF COLORADO POTATO BEETLE - II

MATERIALS: TRIGARD 75WP (Cyromazine)
RIDOMIL MZ 72WP (Metalaxyl + Mancozeb)
BRAVO 500 (Chlorothalonil)

METHODS: The test site was located near Plattsville, Ontario. Potato seed pieces were planted on May 14, 1994 into rows spaced 1.0 m apart with a plant spacing of

30 cm. Plots were 6 m long x 3 rows wide. Each treatment was replicated four times in a completely randomized block design. Twenty CPB egg masses from across the site were flagged and monitored. As of June 20, 50% of egg masses had hatched. Treatment applications were made on June 20 and 28, 1994. All treatments were applied using a CO_2 pressurized 3 m hand boom sprayer with XR11002VS flat fan nozzles that delivered 400 L/ha at 345 kPa. Counts of CPB were made on June 27, July 4 and 11, 1994. On each date, the total numbers of CPB egg masses, 1st, 2nd, 3rd, and 4th instars, and adults were counted from 10 plants in the middle row of each plot. First and 2nd instars were grouped as small larvae (SL), 3rd and 4th instars were grouped as large larvae (LL). Percent defoliation due to CPB feeding was visually assessed on July 4, 11 and 19, 1994.

RESULTS: As presented in the table below.

CONCLUSIONS: All treatments provided control of CPB by inhibiting the development of larvae, resulting in little defoliation in the treated plots. There were no significant differences in efficacy among treatments of TRIGARD 75WP alone or in a tank mixture with a fungicide. Late blight pressure was extremely light and did not give rise to observable disease symptoms. No symptoms of phytotoxicity were observed.

Table 1. A comparison of counts of 3rd and 4th instars (LL) of the Colorado potato beetle (CPB) and percent defoliation of potato plants treated with different insecticides.

TREATMENT No.	RATE kg a.i./ha	CPB LARGE LARVAE/10 PLANTS*			% DEFOLIATION*		
		JUNE 27	JULY 4	JULY 11	JULY 4	JULY 11	JULY 19
1. CHECK		89.0b	466.8b	132.5b	42.5b	82.5b	61.3b
2. TRIGARD TRIGARD	0.28, 0.28	2.0a	3.5a	54.5a	1.3a	1.3a	4.3a
3. TRIGARD TRIGARD + RIDOMIL	0.28, 0.28 1.80	1.3a	12.3a	70.3a	1.8a	7.8a	4.5a
4. TRIGARD TRIGARD + BRAVO	0.28, 0.28 1.20	2.0a	8.8a	81.0a	1.0a	3.0a	6.8a

* Means within a column followed by the same letter are not significantly different (P = 0.05, Duncan's Multiple Range Test).

#068

ICAR: 86100104

CROP: Potato, cv. Chieftan

PEST: Potato leafhopper, *Empoasca fabae* (Harris)
Green peach aphid, *Myzus persicae* (Sulz)

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TITLE: CONTROL OF POTATO LEAFHOPPER AND GREEN PEACH APHID

MATERIALS: ADMIRE FS, ADMIRE 2.5G (Imidacloprid)
MONITOR EC (Methamidophos)
NOVODOR (*Bacillus thuringiensis tenebrionis*)

METHODS: Potatoes were seeded May 20, 1994, in open furrows in 4 row plots, 13 m long, replicated four times. Rows were spaced at 0.9 m and plots were separated by 3 m spray lanes. Treatments were arranged in a randomized complete block design. The in-furrow liquid treatments were applied using a back-pack sprayer that delivered 450 L/ha at 200 kPa pressure. The granular treatment was applied by using a 'salt-shaker' container and sprinkling the granules evenly over the rows. The foliar insecticides were applied with a tractor-mounted, 4-row boom sprayer that delivered 800 L/ha at 450 kPa. A single treatment of NOVODOR was applied to all plots on June 27 to control Colorado potato beetle (CPB) larvae. The foliar treatments were applied July 14, 22, 29, and August 4. These sprays were initiated at this time because the leafhopper population had exceeded the threshold of one leafhopper per sweep in the counts taken the previous day.

Populations of leafhoppers and aphids were monitored weekly by examining five plants from the centre rows of each plot and the numbers of CPB adults, eggs, and larvae, leafhopper adults and nymphs, and aphids were recorded. In addition, 25 sweeps per plot were taken each week from June 30 to August 23, using a 37.5 cm dia. sweep-net and the number of leafhopper adults and nymphs, and aphids were recorded. A leafhopper damage index was estimated by scoring the plots using the scale: 0 = no damage ; 1 = tip burn; 2 = margin and tip burn; 3 = a combination of margin and tip burn, leaf curl, and/or vein clearing; 4 = severe burn and curl: 5 = totally dead foliage.

Yield data was obtained at harvest for the center 2 rows of each plot on September 1. The leafhopper data obtained from the sweeps was subjected to analysis. Yield and damage data for all treatments were also analyzed using Analysis of Variance and means were separated by a Tukey's Studentized Range Test.

RESULTS: As presented in the table.

CONCLUSIONS: The two in-furrow treatments of ADMIRE at 33 and 22 g a.i./ha were the result of a calculation error. They should have been applied at 330 and 220 g a.i./ha, respectively. Results from similar treatments indicate that these treatments, if applied at the specified rate, would have been effective in controlling leafhopper and aphid populations.

Damage due to leafhopper feeding was reduced by ADMIRE at 220 g a.i./ha in-furrow, and at 25 and 50 g a.i./ha foliar. This control was equal to that attained by the standard, MONITOR. Yield was significantly increased by ADMIRE 220 in-furrow, ADMIRE 50 foliar and MONITOR.

ADMIRE applied at 220 g a.i./ha in-furrow or at 25 g a.i./ha foliarly gave adequate control of leafhoppers and aphids. The 50 g a.i./ha foliar rate of ADMIRE provided excellent control of leafhoppers and aphids and was comparable to the control given by the standard, MONITOR.

Table 1. Number of potato leafhopper adults (PLHA), nymphs (PLHN), and aphids (APH) per 25 sweeps on potatoes, cv. Chieftan, 1994.

Insecticide	Application method*	Rate (a.i./ha)	Aug. 3** PLHA	Aug. 3** APH	Aug. 12 DAM***	Aug. 23 PLNA	Aug. 23 PLHN	Sept. 1 YLD (t/ha)
Admire FS	IF	110 g	105.8abc	4.3ab	2.0ab	30.8ab	7.8ab	29.5ab
Admire FS	IF	220 g	81.8bcd	1.3ab	1.5bc	24.8b	3.3ab	33.1a
Admire FS	IF	33 g	114.0abc	2.5ab	2.3ab	46.8ab	12.8ab	28.2ab
Admire G	G	22 g	164.8a	4.5ab	2.5a	63.0a	24.0ab	27.2ab
Admire FS	F	25 g	66.5cd	0.8ab	1.5bc	12.5b	1.3b	30.0ab
Admire FS	F	50 g	59.0cd	0.0b	1.0c	17.0b	0.3b	31.7a
Monitor	F	960 g	15.75d	0.8ab	1.0c	18.3b	3.3ab	31.6a
check			140.8ab	6.0a	2.5a	65.0a	32.3a	24.5b

* IF: in-furrow, G: granular, F: foliar.
** Means in each column followed by the same letter are not significantly different at P#0.05 (Tukey's Studentized Range Test).
*** DAM: damage index. See METHODS for explanation.

#069

ICAR NUMBER: 61002036

CROP: Tomato, field, cv. Heinz 9478

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

NAME AND AGENCY:
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TITLE: DETERMINING THE EFFICACY OF BROADCAST APPLICATIONS OF FOSTHIAZATE FOR THE CONTROL OF THE CPB ON TOMATO

MATERIALS: FOSTHIAZATE 900EC (Fosthiazate)
VYDATE L (Oxamyl)

METHODS: Tomatoes were planted on May 30, 1994, in single, 2 row plots spaced 1.65 m apart in a co-operative trial with H.J. Heinz, Leamington, Ontario. Plots were 8 m long, and replicated four times in a randomized complete block design. The broadcast treatments were sprayed onto the plots using an Oxford precision-boom sprayer, applying 200 L/ha of spray mixture prior to transplanting. Assessments of foliar injury caused by the chemical treatments (June 9), insect feeding damage and CPB larval counts (June 23) were taken. Results were analyzed using the Duncan's Multiple Range Test.

RESULTS: As presented in the table.

CONCLUSIONS: The insecticide FOSTHIAZATE 900EC applied as a pre-plant incorporated broadcast treatment did not cause any injury to the tomato transplants. However, control of the CPB was not achieved. Severe leaf damage and high counts of CPB larvae were recorded. VYDATE L was ineffective in this manner of application under high beetle pressures.

Table 1.

Treatment	Rate (product/ha)	Application	Phytotoxicity Ratings (0-10)* June 9	Insect Feeding Sites** June 23	CPB Larvae/ Plot June 23
FOSTHIAZATE 900EC	3.75 L	Broadcast-ppi	10.0a***	26.5a	29.3a
FOSTHIAZATE 900EC	5.60 L	Broadcast-ppi	10.0a	27.5a	30.8a
FOSTHIAZATE 900EC	7.50 L	Broadcast-ppi	10.0a	31.3a	35.8a
VYDATE L	3.00 L	Broadcast-ppi	10.0a	19.8a	34.5a
Control			10.0a	18.5a	30.3a

* Phytotoxicity Ratings (0-10): 0, severe injury; 10, no injury, healthy plant growth.
** Insect Feeding Sites - the average number of feeding sites or clusters per plot. The lower the number, the more effective the treatment.
*** Means followed by the same letter do not differ significantly (P = 0.05), Duncan's Multiple Range Test).

#070

ICAR NUMBER: 61002036

CROP: Tomato, field, cv. Heinz 9478

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: FIELD EVALUATION OF TRANSPLANT WATER TREATMENTS FOR THE CONTROL OF CPB IN FIELD TOMATOES

MATERIALS: ORTHENE 75SP (Acephate)
ADMIRE 240FS (Imidacloprid)

METHODS: Tomatoes were transplanted on May 30, 1994, in single, 2 row plots spaced 1.65 m apart in a co-operative trial with H.J. Heinz, Leamington, Ontario. Plots were 8 m long, and replicated four times in a randomized complete block design. Treatments were applied either in the transplant water or to the tomato seedlings in their 288 cell trays in the greenhouse prior to field setting. The insecticides were sprayed on the tomatoes using an Oxford precision-boom sprayer or in the transplant water. Assessments were taken by recording foliar injury caused by the chemical treatments on June 9 and 23, insect feeding damage on June 23, the number of dead CPB adults found beneath the tomato foliage on July 14, and yields on September 19. Results were analyzed using Duncan's Multiple Range Test.

RESULTS: As presented in the table.

CONCLUSIONS: There was noticeable chlorosis on leaf edges observed early in the season (June 9), 9 d after transplanting with the ORTHENE 75SP as a transplant water treatment. ORTHENE 75SP, when applied as a foliar spray onto the tomato transplants in the greenhouse, did not cause any foliar damage. ADMIRE 240FS did not cause any foliar damage at any time during the season. The only visual observation, of phytotoxicity to the ADMIRE 240FS transplant water treatment was a slight whitening at the tips of a few tomato leaves. Foliar feeding was significantly reduced with both of the insecticides tested regardless of the method of application. By July 14, high numbers of dead CPB adults were noticed underneath the tomato foliage in plots treated with ADMIRE as a transplant water treatment. The systemic effect of ADMIRE 240FS applied to the roots at time of transplanting, effectively controlled CPB adults feeding on the foliage 6 weeks after transplanting. Yields of all plots were similar.

Table 1.

Treatment	Rate Product	Applic.***	Phytotoxicity Ratings (0-10)* June 9	June 23	No. of Insect Feeding Sites** June 23	No. of Dead CPB Adults Underneath Plants July 14	Yield (T/ha) Sept. 19
ORTHENE 75SP	0.085 g/ plant	TWT	6.0b****	10.0a	0.3b	0.0b	62.4a
ORTHENE 75SP	0.170 g/ plant	TWT	6.0b	10.0a	0.0b	1.0b	64.2a
ADMIRE 240FS	0.085 mL/ plant	TWT	10.0a	10.0a	3.3b	59.3a	64.2a
ADMIRE 240FS	0.170 mL/ plant	TWT	10.0a	10.0a	3.5b	62.0a	67.2a
ORTHENE 75SP	0.2 g/ tray	PLUG TRT	10.0a	10.0a	0.0b	0.3b	61.2a
ADMIRE 240FS	1.04 mL/ tray	PLUG TRT	10.0a	10.0a	2.8b	1.0b	63.6a
ORTHENE 75SP	0.2 g/ tray	PLUG TRT	6.0b	10.0a	1.3b	0.3b	63.9a
ORTHENE 75SP	0.085 g/ plant	TWT					
ADMIRE 240FS	1.04 mL/ tray	PLUG TRT	10.0a	10.0a	2.8b	57.3a	66.9a
ADMIRE 240FS	0.085 mL/ plant	TWT					
Control			10.0a	10.0a	14.5a	0.0b	60.0a

* Phytotoxicity Ratings (0-10): 0, severe foliage damage; 10, no foliar damage.

** Number of Insect Feeding Sites - the average number of CPB feeding clusters per plot. The lower the number, the more effective the treatment.

*** Application: TWT - Transplant Water Treatment - 100 mL of water/transplant, continuous flow-PLUG TRT-Insecticides applied onto the tomato transplants in the greenhouse in plug plant trays.

**** Means followed by the same letter do not differ significantly (P = 0.05) Duncan's Multiple Range Test).

#071

STUDY DATA BASE: 280-1252-9304

CROP: Tomato, cv. Mountain Pride

PEST: Colorado potato beetle, *Leptinotarsa decemlineata* (Say)

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TITLE: EVALUATION OF PLANTING WATER TREATMENTS FOR CONTROL OF COLORADO POTATO BEETLE ATTACKING TOMATOES ON MINERAL SOIL

MATERIALS: ADMIRE 240FS (Imidacloprid)
ORTHENE 75SP (Acephate)

METHODS: Tomato seedlings were grown singly in plastic propagation-plug trays each containing 8 rows of 14 plugs. On 7 June, 24 h prior to planting, treatment 6 and 7 (Table 1.) were applied at 175 kPa in 8.0 mL per plug using a single-nozzle (4003 flat fan) Oxford precision sprayer. Treated plants (15 - 17 cm high) were immediately flushed with well water to rinse the insecticide from the foliage and down into the planting medium of individual plugs. All treatments (10 plants per treatment) were planted at the London Research Farm on 8 June in 2 row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated four times in a randomized complete block design. Treatments 6,7, and 9 received only 150 mL starter fertilizer (soluble 10-52-10 [N-P-K] at 2.5 g/L) in the planting hole. The desired rate of insecticide was added to starter solution for treatments 1-5, 8. Individual seedlings were established in planting holes as soon as possible after adding planting water. Within 0.5 h after planting treatments 6, 7 and 9, a total of three leaves were harvested from each plot of each treatment (12 leaves per treatment) and returned to the laboratory for bioassay. A total of five bioassays, each containing two leaves and five adult insecticide-susceptible Colorado potato beetle (CPB) adults was established for each treatment. Bioassays were held at 25°C, 55% RH, and 16:8 L:D photoperiod. Mortality and leaf damage were recorded after 24, 48, and 72 h. Leaves were thereafter collected from all treatments at regular intervals for further bioassay (Table 1).

RESULTS: As presented in the table. For the sake of brevity, only percent reduction in damage to leaves by feeding adults is shown. Significant phytotoxicity was observed following pre-plant drench application of ADMIRE to tomato seedlings. No phytotoxicity was noted following any planting water treatment.

CONCLUSIONS: Residues of imidacloprid in leaves of tomato seedlings subjected to drench application 24 h prior to planting provided virtually complete control of CPB feeding damage to leaves harvested within 0.5 h of planting. The higher rate of drench application of ADMIRE reduced CPB feeding damage by at least 50% for 27 d after planting. Reduced CPB feeding damage correlated with the rate of application of ADMIRE, ie. the higher the rate of application, the longer the duration of leaf protection. Damage reduction >90% was recorded for at least 5 d at 1.0 mg a.i./plant and persisted for at least 84 d following application of 20 mg a.i./plant. Although ORTHENE, the commercial standard, was generally more rapidly absorbed than ADMIRE from the soil following application in planting, damage reduction fell below 60% within 5 d of planting. By day five all rates of application of ADMIRE were much more toxic to feeding CPB than ORTHENE. Economic effectiveness of ORTHENE at the label rate of application would appear to be fewer than 5 d.

RESIDUES: On day 92 and day 106 samples of ripe fruit were collected from Treatments 2 to 5 for measurement of imidacloprid residues. Soil samples for similar analysis were collected from directly beneath treated plants for treatments 2 to 5 on day 105 and again at random from the same plots on day 131 after plots were turned over. Analyses are incomplete.

Table 1. Duration of foliage protection by pre-plant and planting water application of insecticides to tomato seedlings.

No	Treatment	Rate (mg a.i./ plant)	Method	% Damage Reduction on Indicated Day**** Day 0	Day 1	Day 5	Day 13	Day 20	Day 27	Day 34
1	ADMIRE 240FS	1.0	PW*	--***	68.3	95.5	69.9	47.9	7.0	0.0
2	ADMIRE 240FS	2.5	PW	--	62.2	94.7	90.5	84.7	56.3	15.1
3	ADMIRE 240FS	5.0	PW	--	77.1	98.1	99.4	78.4	67.4	25.3
4	ADMIRE 240FS	10.0	PW	--	85.5	98.8	97.3	91.2	86.8	63.2
5	ADMIRE 240FS	20.0	PW	--	99.3	99.0	99.8	97.6	93.8	96.1
6	ADMIRE 240FS	2.5	DR**	98.6	94.0	99.4	71.7	55.4	28.9	3.7
7	ADMIRE 240FS	5.0	DR	98.4	99.6	99.5	91.2	60.0	54.0	21.1
8	ORTHENE 75SP	65.0	PW	--	99.6	56.3	13.3	6.3	0.0	6.0
9	CONTROL	----	PW	10.0	10.0	9.9	9.8	8.6	7.7	7.7

No	Treatment	Rate (mg a.i./ plant)	Method	% Damage Reduction on Indicated Day Day 41	Day 48	Day 56	Day 62	Day 69	Day 76	Day 84
1	ADMIRE 240FS	1.0	PW	12.2	47.6	1.8	5.3	4.3	--	--
2	ADMIRE 240FS	2.5	PW	18.2	0.0	10.8	5.3	13.6	--	--
3	ADMIRE 240FS	5.0	PW	43.9	63.7	60.9	50.8	38.4	68.3	55.9
4	ADMIRE 240FS	10.0	PW	66.1	63.2	96.6	75.5	57.7	85.4	86.3
5	ADMIRE 240FS	20.0	PW	92.6	97.8	96.2	96.8	95.7	95.5	93.8
6	ADMIRE 240FS	2.5	DR	18.2	12.9	2.5	1.4	--	--	--
7	ADMIRE 240FS	5.0	DR	20.6	11.0	17.5	0.0	--	--	--
8	ORTHENE 75SP	65.0	PW	20.8	0.0	0.0	15.1	--	--	--
9	CONTROL	----	PW	8.7	8.2	8.9	8.7	9.3	7.6	6.4

* Planting water treatment.
** Drench application 24 h prior tp planting.
*** Bioassay not undertaken.
**** Relative to feeding damage in leaves from CONTROL plots (Treatment 9) rated on a 0-10 scale where 0 represents no feeding damage, 5 represents 50% loss of leaf area, 10 represents 100% consumption of the leaf.

#072

ICAR-ID: 61002030

CROP: Soybean, cv. Brock

PEST: Seedcorn maggot, *Delia platura* (Meigen)

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TITLE: INSECTICIDES FOR THE CONTROL OF SEEDCORN MAGGOT (SCM) IN SOYBEANS

MATERIALS: AGROX B-3 (Diazinon 11% + Lindane 16.6% + Captan 33.5%)
AGROX D-L PLUS = (DLP) (Diazinon 15% + Lindane 25% + Captan 15%)
ANCHOR (Carbathiin 66.7 g/L + Thiram 66.7 g/L)
FORCE 20SC (Tefluthrin)
UBI-2679 ST (Chlorpyrifos)
VITAFLO 280 (Carbathiin 14.9% + Thiram 13.2%)

METHODS: The crop was planted on 12 May 1994, at Ridgetown, Ontario on a sandy-loam soil near a manure pit, in 8 m rows spaced 0.76 m apart at 100 seeds per plot, using a John Deere Max-emerge planter which was fitted with a cone seeder. Plots were single rows, arranged in a randomized complete block design with four replicates. Liquid cattle manure was disced-in 4 weeks prior to planting. Plots were planted when adults (SCM) were numerous (monitored by yellow sticky cards). Seeds were treated in 500 g lots and rolled in plastic bags until thoroughly covered. Slurries were made with 50 g dry material in 100 mL water. On 30 May, percent emergence was calculated by counting all the plants emerged per plot at the first leaf stage and relating that to the total number of seeds planted. On the next day, percent infestation was calculated as the proportion of seedlings showing maggot injury relative to the number of seedlings dug up in a 2 m section of row. Non-emerged seeds per seedlings were included in the evaluation.

RESULTS: As presented in the table.

CONCLUSIONS: AGROX B-3 alone or with carbathiin, and AGROX D-L PLUS with carbathiin (ANCHOR or VITAFLO) provided the best control of seedcorn maggot. These products remain the standards for seedcorn maggot control, however the level of control was 85% at best. Applying the AGROX B-3 or AGROX D-L PLUS, as a slurry in a batch treatment prior to seeding, did not significantly change the performance of the seed treatments, or cause any there significant adverse effects on emergence.

Table 1. Control of seedcorn maggot in soybeans with seed treatments with insecticides at Ridgetown, Ontario, 1994.

Treatment		Product Rate/kg seed	Application Method	05/30 % Emergence	05/30 % Infestation
1	VITAFLO 280	2.6 mL	batch ST	67 de	19 ab
2	ANCHOR	6.0 mL	liquid drill box	72 cd	16 abc
3	AGROX DLP	2.2 g	dry drill box	82 a-d	25 a
4	AGROX B-3	3.2 g	dry drill box	90 a	5 cd
5	VITAFLO 280 +	2.6 mL	batch ST	82 abc	11 a-d
	AGROX DLP	2.2 g	dry drill box		
6	VITAFLO 280 +	2.6 mL	batch ST	90 a	5 cd
	AGROX B-3	3.2 g	dry drill box		
7	VITAFLO 280 +	2.6 mL	batch ST	81 a-d	4 cd
	AGROX DLP	2.2 g	slurry batch ST		
8	VITAFLO 280 +	2.6 mL	batch ST	78 a-d	3 d
	AGROX B-3	3.2 g	slurry batch ST		
9	ANCHOR +	6.0 mL	liquid drill box	81 a-d	6 bcd
	AGROX DLP	2.2 g	dry drill box		
10	ANCHOR +	6.0 mL	liquid drill box	87 ab	5 cd
	AGROX B-3	3.2 g	dry drill box		
11	VITAFLO 280 +	2.6 mL	batch ST	43 f	19 ab
	UBI-2679	3.6 mL	batch ST		
12	VITAFLO 280 +	2.6 mL	batch ST	81 a-d	6 bcd
	FORCE ST 20SC	4.0 mL	batch ST		
13	VITAFLO 280 +	2.6 mL	batch ST	76 bcd	19 ab
	FORCE ST 20SC	5.0 mL	batch ST		
14	CONTROL			56 ef	20 ab
CV %	=			10.0	39.8

* Means followed by the same letter are not significantly different at the 5% level (Duncan's Multiple Range Test). Data were transformed by ARCSIN(SQR(%)) before ANOVA and the mean separation test. Reported means were untransformed.

SECTION F

INSECTS OF CEREAL AND FORAGE CROPS /

INSECTES DES CÉRÉALES ET CULTURES FOURRAGÈRES

Section Editor / Réviseur du section : N.D. Westcott

#073 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 387-1231-8507

CROP: Alfalfa leafcutting bee, *Megachile rotundata* (Fab.)

PEST: Chalkbrood, *Ascosphaera aggregata*

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TITLE: EFFICACY OF FUMIGATION WITH PARAFORMALDEHYDE FOR CONTROL OF CHALKBROOD IN ALFALFA LEAFCUTTING BEES

MATERIALS: PARAFORMALDEHYDE

METHODS: Leafcutting bees with a high incidence of chalkbrood were obtained from Utah, United States. Bee cells were x-rayed to identify those containing sporulating cadavers. The fumigation chamber consisted of a 4 L glass jar with a single 10 mm hole drilled through the bottom for fumigant introduction and two 7 mm holes drilled through the lid for purging with moist air. Materials to be fumigated were placed into the chamber and humidified at 80% RH for 48 h. Paraformaldehyde (Sigma, St. Louis, MO) was then introduced via a glass tube by heating the compound in a 14 mL serum vial on a hot plate, directly below the fumigation chamber until it completely vapourized. Each fumigation included the following; loose spores on a depression slide, spores sealed within three nested glass containers and a plastic bag (control), sporulating bee cadavers (whole, broken and intact within bee cell), and intact cells containing healthy prepupae. Fumigations were conducted according to label recommendations (*i.e.* 20 g paraformaldehyde per m cubed for 24 h). Concentrations and exposure times were also increased up to 10 times the recommended concentration and 5 times the exposure time. After fumigation, the materials were ventilated in a fume hood for 12-16 h. Whole intact cadavers, removed from their cells, and broken cadavers were placed into glass test tubes and crushed with a glass rod. Germination and viability of spores were determined using methods previously developed. Briefly, spores were placed into a glass tube containing Sabouraud dextrose broth with 2% yeast extract. The tube was purged with carbon dioxide from a pressurized gas cylinder, sealed and incubated at 30°C for 24 h. Germination rates were determined by counting numbers of germinated and nongerminated spores until a total of at least 500 spores were counted.

RESULTS: Fumigation of bee cells with paraformaldehyde completely killed loose spores of *A. aggregata* at all treatments tested. However, fumigation at the presently recommended rate did not decontaminate broken cadavers, intact cadavers or intact cadavers within bee cells (Table 1). Complete decontamination of broken and intact cadavers could be achieved at twice the recommended concentration and 5 times the recommended exposure period. Complete decontamination of cadavers within completed cells could be achieved at 10 times the recommended concentration after a 5 d exposure. However, at this rate, the viability of the bees was also affected (data not presented).

CONCLUSIONS: Fumigation of bee cells at the presently registered rate can be used to decontaminate *A. aggregata* from the surface of bee cells. However, fumigation at the presently recommended rate will not kill spores within broken cadavers, intact cadavers or in cadavers within bee cells. Therefore, decontamination of cells should be undertaken only after cell tumbling has been completed. Tumbling after decontamination would only serve to coat the cells with viable spores contained within the cadavers. Furthermore, care should be exercised in the manipulation of cells post-fumigation to minimize subsequent recontamination of cell surfaces.

Table 1. Effect of paraformaldehyde fumigation on the viability of *Ascosphaera aggregata* ascospores.

Exposure (days)	Conc*	% spore germination post-treatment**			
		Control	Broken cadaver	Intact cadaver	Intact cell
1	1X	60	11-49	7-50	3-42
1	1X	69	8-61	4-71	55-80
2	1X	92	0	0	1-52
2	1X	89	7-23	4-55	8-92
2	1X	67	0	0	31-84
5	1X	52	6-19	51-75	33-68
5	1X	77	35-44	33-54	41-83
5	2X	65	0	0	75
5	2X	72	0	0	7-84
5	3X	56	0	0	1-6
5	3X	76	0	0	1-69
5	4X	79	0	0	18-48
5	4X	62	0	0	2-34
5	5X	71	0	0	0
5	5X	64	0	0	3-67
5	8X	68	0	0	1-67
5	8X	63	0	0	0
5	10X	68	0	0	0
5	10X	68	0	0	0

* Times recommended concentration of 20 g/m cubed.
** Five to 10 cadavers per treatment. Range of germination of spores per cadaver.

#074

ICAR: 86000965

CROP: Corn, field cv. CO-OP 220

PEST: Northern corn rootworm, *Diabrotica barberi* Smith & Lawrence
Western corn rootworm, *Diabrotica virgifera virgifera* LeConte

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TITLE: EVALUATION OF FORCE 1.5G CLAY VERSUS FORCE 3.0G FORMULATIONS FOR CONTROL OF CORN ROOTWORM IN FIELD CORN

MATERIALS: FORCE 1.5G (Tefluthrin granular 1.5%)
FORCE 3.0G (Tefluthrin granular 3%)

METHODS: Location: Harrington, Ontario. Field corn was planted on May 31, 1994 using a John Deere Max-Emerge two row planter. The field had been planted with corn in 1993 and had high numbers of corn rootworm beetles recorded late in the season. Granular insecticides were applied at planting in a 15 cm band dispensed in front of the packer wheel covering the row or in-furrow. Each plot consisted of 2 rows x 15 m long. Each treatment was replicated four times in a randomized complete block design. Plots were assessed for crop emergence, stand, rootworm feeding damage, root weights and lodging. The roots were washed and rated using the Iowa State University 1-6 rating scale where 1 = no damage and 6 = severe damage. Data was analyzed using an analysis of variance and Duncan's Multiple Range Test at the 0.05 level of significance.

RESULTS: As presented in the table.

CONCLUSIONS: Seedling emergence and stand counts were not significantly affected by any of the insecticide treatments. Root ratings did not indicate any significant amount of rootworm feeding in the untreated plots. No significant differences in root ratings were observed except with FORCE 1.5G in-furrow which had a significantly higher root rating than the untreated. Root weights were not significantly affected by any treatment. Lodging was significantly reduced by all FORCE treatments. FORCE 3.0G performed equal to FORCE 1.5G both in-furrow and banded.

TREATMENT	RATE (g a.i./100 m)	EMERGENCE 23/06/94	STAND CO 03/08/94	ROOT RATING (1-6) 14/08/94	ROOT WEIGHT 14/08/94	LODGING (NO./PLOT) 03/08/94
UNTREATED		69.8 a	68.5 a	2.38 b	63.57 a	15.0a
FORCE 1.5G B	1.13	66.3 a	69.5 a	2.94 ab	52.02 a	0.5 b
FORCE 1.5G IF	1.13	78.0 a	75.8 a	3.54 a	49.45 a	2.0 b
FORCE 3.0G B	1.13	64.3 a	73.0 a	2.46 b	56.97 a	2.3 b
FORCE 3.0G IF	1.13	76.5 a	78.3 a	2.54 ab	58.68 a	2.8 b
LSD (.05) =		25.4	29.6	0.98	23.54	5.8
Standard Dev.=		16.49	19.19	0.63	15.28	3.75
CV =		23.25	26.29	22.87	27.21	83.32

Means followed by same letter do not significantly differ (P = 0.05, Duncan's Multiple Range Test).

#075

ICAR-ID: 61002030

CROP: Corn, field, cv. C0220

PEST: Western corn rootworm (75%), *Diabrotica virgifera virgifera* LeConte
Northern corn rootworm (25%), *Diabrotica barberi* Smith & Lawrence

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TITLE: CANDIDATE INSECTICIDES FOR THE CONTROL OF CORN ROOTWORMS, 1994

MATERIALS: COUNTER 15G (Terbufos)
DYFONATE II 20G (Fonofos)
FORCE 1.5G and 3.0G (Tefluthrin)
LORSBAN 15G (Chlorpyrifos)
THIMET 15G (Phorate)

METHODS: The crop was planted on 11 May, 1994, at Ridgetown, Ontario, using a John Deere Max-emerge planter at 64,000 seeds per ha with a 0.76 m row spacing. Plots were single rows 10 m long placed in a randomized complete block design with four replicates. The plots were fertilized and maintained using commercially acceptable practices. The granular materials were applied using plot-scale Noble applicators. T-band applications were placed in a 15 cm band over the open seed furrow. In-furrow applications were placed directly into the open seed furrow. Rootworm damage assessments were made on 25 July. For each plot, the number of lodged plants per plot were counted. Six roots per plot were dug, washed and scored for root injury using the Iowa 1-6 root injury scale (1 = no feeding scars; 6 = 3 or more root nodes severely damaged). Data for percent lodging, and root injury were transformed to the arcsine and square root, respectively, before analysis of variance and then detransformed before reporting.

RESULTS: As presented in the table.

CONCLUSIONS: Rootworm feeding pressure was low in the test plots. FORCE 1.5G or 3.0G at 37.5 or 75 g product/100 m row in T-band applications provided the best control of corn rootworms.

Table 1. Corn rootworm insecticide efficacy tests at Ridgetown (RCAT), Ontario, 1994.

Treatment	Rate*	Method	Percent Lodging 25 July	Root injury Iowa 1-6 25 July
FORCE 1.5G	75	T-BAND	4.5 a**	1.1 b
FORCE 1.5G	75	IN-FURROW	5.9 a	1.6 ab
FORCE 3.0G	37.5	T-BAND	2.3 a	1.1 b
FORCE 3.0G	37.5	IN-FURROW	5.0 a	2.0 a
COUNTER 15G	75	T-BAND	3.7 a	1.5 ab
COUNTER 15G	75	IN-FURROW	6.9 a	1.9 ab
DYFONATE II 20G	55	T-BAND	2.4 a	1.5 ab
LORSBAN 15G	75	T-BAND	5.7 a	1.5 ab
THIMET 15G	75	T-BAND	5.3 a	1.4 ab
CONTROL			5.9 a	2.0 a
CV (%) =			93.6	29.9

* Rates are in g product/100 m row.

** Means followed by the same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test).

SECTION G

MEDICAL AND VETERINARY / MÉDICAL ET VÉTÉRINAIRE

Section Editor / Réviseur de section : D. Colwell

#076 REPORT NUMBER / NUMÉRO DU RAPPORT

HOST: Beef cattle, mixed breed

PEST: Horn fly, *Haematobia irritans* (L.)
Face fly, *Musca autumnalis* L.

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TITLE: PERFORMANCE OF THE PRAIRIE PHOENIX CATTLE CARE STATION FOR APPLICATION OF MALATHION TO RANGE CATTLE FOR PROTECTION AGAINST HORN AND FACE FLIES

MATERIALS: PRAIRIE PHOENIX CATTLE CARE STATION, (equipped with mineral feeder)
VET TEK MALATHION BACKRUBBER CONCENTRATE, (50% Malathion)
CLEAN CROP SUPERIOR 70 Oil, (Horticultural dormant oil)

METHODS: The self-treatment PRAIRIE PHOENIX CATTLE CARE STATION was assembled and placed with a herd of 74 cross-bred beef cows with calves 16 km east of Vernon, British Columbia. The station was kept with the herd which was rotated between six partially-treed irrigated pastures during the study period June 30 to September 27, 1994. A herd of 45 cross-bred beef cows with calves in a 101 ha non-irrigated forested pasture across the road from the treated herd was used as an untreated control herd. Mineral supplement was provided *ad libitum* from the mineral feeder suspended from the frame of the cattle station. A 2% malathion solution was prepared using the SUPERIOR 70 OIL as the carrier. The solution was poured into the reservoir except for 3 L which was poured onto the manila rope wicks prior to exposing the cattle. The release valves were adjusted as necessary to ensure the ropes remained saturated with solution but solution was not wasted out the bottom of the wicks. Horn and face fly counts were taken using binoculars every 1 to 2 weeks by recording the number of horn flies on one side and face flies on each face of 15 randomly selected cows in each herd.

RESULTS: Horn fly and face fly counts are presented in Table 1. A significant reduction in horn fly numbers in the treated herd did not occur until 2 weeks (July 15) after introduction of the cattle station. This probably reflects a period of familiarization by the cattle which had never been exposed to a self-treatment backrubber. From July 15 to the end of the trial, horn fly abundance in the treated herd was reduced on average 78% (range 63-92%) from that of the untreated herd. A reduction in face fly numbers on the treated cattle was not detected until 3 weeks after introduction. From July 22 to the end of the trial period, face fly abundance was reduced on average 48% (range 27-80%) from that of the untreated herd. The herd and station was moved at least six times during the trial period and the mineral feeder was sometimes empty for 1-2 d. The valves were closed when the station was moved in mid August to a pasture 2 km away which was adjacent to a heavily infested untreated cattle herd. One valve was left closed accidentally until September 2. This resulted in a doubling of the average number of horn flies in the treated herd (August 29 and September 2). After the valve was opened on September 2, horn fly numbers decreased 65% over the next 10 d. Also, the placement of the treated herd adjacent to the untreated beef herd would have resulted in some horn and face flies transferring to the treated herd and thus raising the average number of flies per animal. The station performed very well. The mineral feeder detached once at the beginning of the trial. The wheels were easy to install and the station was easily moved between pastures. Once sited, shallow holes were dug in which to park the wheels so the station rested on the ground. This negated the need to remove the wheels and saved time when the station had to be moved. A total of 8.8 L of the 2% malathion solution was dispensed over the trial period (1.3 mL/animal/d: 0.026 g a.i./ animal/d).

CONCLUSIONS: Under the conditions of this field trial, the PRAIRIE PHOENIX CATTLE CARE STATION provided reliable and effective protection of range cattle from horn flies when charged with a 2% malathion solution. Suppression of face flies was also achieved. For the station to be most effective, mineral or salt should be provided with the station if it is not placed where cattle water. The valves should be checked regularly to ensure the malathion solution is being released at the proper rate.

Table 1. Average number of horn flies/one side and face flies/face per animal (+/- SD) in the treated (T) and untreated (UT) herds, June 30-September 27, 1994.

	Horn Flies			Face Flies		
Sample Date	T	UT	Percent Reduction	T	UT	Percent Reduction
June 30*	24.3(14.6)	27.7(11.8)	-	2.0(1.3)	5.8(2.7)	-
July 8	14.6(10.8)	16.4(11.7)	11	10.0(6.6)	11.5(5.6)	0
July 15	9.1(7.2)	10.3(5.5)	12	13.2(5.1)	8.1(4.0)	0
July 22	13.9((7.2)	43.7(26.8)	68	6.2(1.9)	9.6((5.1)	35
July 29	17.0(7.3)	72.7(32.5)	77	8.1(4.6)	11.2(6.0)	27
Aug. 9	19.3(8.0)	133.3(58.0)	86	5.8(3.6)	16.4(11.0)	66
Aug. 16	16.3(10.6)	200.0(50.0)	92	12.1(8.1)	16.2(5.8)	25
Aug. 29**	32.5(32.7)	140.0(50.7)	77	4.1(1.7)	9.5(4.3)	57
Sept. 2**	44.0(39.5)	120.0(52.8)	63	5.7(3.5)	9.8(3.5)	43
Sept. 12	15.6(8.8)	51.7(26.3)	70	1.8(1.5)	8.9(3.3)	80
Sept. 19	5.1(4.1)	35.0(15.2)	85	1.5(1.1)	6.9(3.1)	80
Sept. 27	3.2(2.4)	20.1(9.7)	84	1.4(1.5)	4.1(2.3)	68

* Pre-treatment count.
** One valve left closed accidentally.

#077

ICAR: 86100101

HOST: Beef cattle (mixed cross breeds)

PEST: Horn fly, *Haematobia irritans* (L.)

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TITLE: EVALUATION OF HORN FLY RESISTANCE TO FENVALERATE-IMPREGNATED EAR TAGS NEAR GLENCOE, ONTARIO

MATERIALS: Glass tubes (27 mL) treated with
Fenvalerate (0.000305-0.512 :g/cm^2)

METHODS: Horn flies were collected with a sweep net over cattle near Glencoe, Ontario, where >150 horn flies were observed on animals tagged with fenvalerate-impregnated ear tags. Collections took place on 2 and 9 September, 1994. Captured horn flies were transferred to a 20 x 20 x 20 cm sleeve cage, provided with water, and transported to the laboratory within 3 h of capture. Two assays were performed on horn flies to evaluate fenvalerate resistance, each assay comprising two different concentration ranges. In the first assay concentrations ranged from 0.000305 to 0.001953 :g/cm^2). Susceptible horn flies were exposed to the same batch of glass tubes at Agriculture and Agri-Food Canada, Lethbridge, Alberta. In the second assay concentrations ranged from 0.0156 to 0.512 :g/cm^2. Susceptible horn flies provided by Agriculture and Agri-Food Canada, Lethbridge, Alberta were exposed to the same batch of glass tubes as the Glencoe flies. Methodology for both assays was identical. Twenty flies were placed in each glass tube and mortality was assessed after 30 s and 2 h. Flies which were not moving or were lying on their backs were considered dead. Concentrations were replicated twice (two tubes per concentration) while two untreated tubes served as control. Evaluations were carried out at 22°C.

RESULTS: Horn flies collected near Glencoe, Ontario exhibited substantial resistance to fenvalerate. In the first assay (range of concentrations 0.000305 to 0.001953 :g/cm^2) there was no mortality of horn flies in glass tubes treated with fenvalerate. In the second assay (range of concentrations 0.0156 to 0.512 :g/cm^2) differential mortality was observed. The results of the second assay are summarized in the table.

CONCLUSIONS: The LD 50 of resistant horn flies collected near Glencoe, Ontario was approximately 0.04 :g/cm^2 versus 0.00015 :g/cm^2 for susceptible flies assayed at Agriculture and Agri-Food Canada, Lethbridge, Alberta. The resistance ratio of horn flies (LD 50 of test strain:LD 50 susceptible strain) collected near Glencoe, Ontario was 267. The LD 50 and resistance ratio of these flies was comparable to levels of resistance in horn fly populations observed in western Canada.

Table 1. Per cent mortality of horn flies, collected near Glencoe, Ontario, exposed to different concentrations of fenvalerate for 2 h.*

Concentration of fenvalerate (:g/cm^2)	Per cent mortality after 2 h	
	Glencoe flies	Susceptible flies
0	0	0
0.512	100	100
0.256	100	100
0.128	100	100
0.064	71.8	100
0.032	41.6	100
0.0156	18.2	100

* Based on 20 horn flies per glass tube, two replications per concentration.

#078

ICAR: 86100101

HOST: Beef cattle (mixed cross breeds)

PEST: Horn fly, *Haematobia irritans* (L.)
Face fly, *Musca autumnalis* (DeGeer)

NAME AND AGENCY:
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TITLE: CONTROL OF HORN FLIES AND FACE FLIES ON CATTLE USING TWO EAR TAGS CONTAINING 20% DIAZINON

MATERIALS: OPTIMIZER PVC ear tags containing 20% diazinon. Y-Tex Corporation, P O Box 1450, 1825 Big Horn Avenue, Cody, Wyoming 82414-1450

METHODS: Two separate herds of beef cattle of mixed breeds (ca. 25 animals per herd) within 2 km of each other were used in this trial. Both herds were located within 3 km of Elora, Ontario. During the first week of June, 1994 one herd was tagged with two tags per animal, one tag per ear. A second herd was non-treated and served as a control. At approximately weekly intervals numbers of horn flies per one side and face flies per face were counted on 10 randomly selected animals in each herd. Fly counts on each herd were performed on the same day between 1300 h and 1630 h. Wind speed, temperature and cloud conditions were recorded prior to each counting period. Animals were examined at each visit for tag loss or ill effects due to tags. Fly counts were not performed on animals that had lost one or both tags. Differences in weekly means were analyzed using a Student's t-test. Seasonal per cent control was calculated from seasonal means of fly numbers.

RESULTS: As presented in the table.

CONCLUSIONS: Ear tags containing 20% diazinon provided 99.6% control of horn flies and 49.3% control of face flies over the entire season. Control of horn flies was significant 12 out of 13 weeks of the trial. Control of face flies was significant 8 out of 13 weeks of the trial. Tag loss was first noted on 4 July. In total, eight animals lost one tag and one animal lost both tags. The observed degree of tag loss was expected for the treated herd which was pastured on land which included rough terrain, trees and shrubs. There were no ill effects noted in tagged animals.

Table 1. Mean number of horn flies per one side and face flies per face (n= 10 animals, +/- one standard deviation) on cattle wearing two ear tags containing 20% diazinon, Elora, Ontario, 1994.

	Horn flies (+\-)		Face flies (+\-)	
Sampling date	Non-treated	20% diazinon	Non-treated	20% diazinon
June 9	2.1 +/- 3.0	0.0 +/- 0.0*	4.9 +/- 1.3	1.9 +/- 1.3*
14	3.2 +/- 3.3	1.2 +/- 1.7	3.1 +/- 1.2	4.2 +/- 2.9
20	8.6 +/- 4.9	0.1 +/- 0.3*	20.1 +/- 9.9	6.4 +/- 4.9*
28	12.6 +/- 7.5	0.0 +/- 0.0*	8.1 +/- 5.5	2.9 +/- 1.4*
July 4	19.7 +/- 7.2	0.1 +/- 0.3*	13.7 +/- 7.7	1.2 +/- 0.8*
11	15.9 +/- 9.7	0.0 +/- 0.0*	12.8 +/- 7.5	12.0 +/- 6.3
18	24.8 +/- 12.5	0.0 +/- 0.0*	18.6 +/- 11.7	6.1 +/- 3.2*
25	43.0 +/- 27.3	0.0 +/- 0.0*	24.0 +/- 13.3	5.8 +/- 3.6*
August 2	24.7 +/- 12.3	0.0 +/- 0.0*	25.0 +/- 8.8	10.1 +/- 4.9*
8	28.6 +/- 17.4	0.0 +/- 0.0*	25.2 +/- 10.8	6.5 +/- 4.5*
15	38.3 +/- 17.1	0.0 +/- 0.0*	16.6 +/- 9.4	10.0 +/- 4.2
22	52.0 +/- 24.6	0.0 +/- 0.0*	14.2 +/- 5.4	22.2 +/- 11.8
29	39.8 +/- 21.2	0.0 +/- 0.0*	3.4 +/- 3.1	6.4 +/- 4.1
Seasonal Mean	24.1 +/- 20.9	0.1 +/- 0.6*	14.6 +/- 11.0	7.4 +/- 7.1*
Seasonal % control	99.6%		49.3%	

* Number of flies on treated animals significantly lower than on non-treated animals (p<0.05; t-test).

SECTION I

BASIC STUDIES / ÉTUDES DE BASE

Section Editor / Réviseur de section : S.A. Hilton

#079 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 280-1452-9405

CROP: Horticultural crops

PEST: Weeds in horticultural crops

NAME AND AGENCY:
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Tel: (519) 645-4452 **Fax:** (519) 645-5476

TITLE: EFFECTS OF HERBICIDES ON ENZYMATIC ACTIVITIES IN LOAMY SAND

MATERIALS: Technical (>99% purity):
ALLIDOCHLOR
BENTAZON
CHLORBROMURON
DICLOFOP
DIURON
EPTC
IOXYNIL (89.5%)
MONOLINURON
NITROFEN (85%)
PROPAZINE

METHODS: The soil was a loamy sand, which was collected randomly to a depth of 15 cm. The bulk sample was passed through a 2 mm sieve and analyzed for chemical and physical characteristics. The soil had 3.2% organic matter, 0.29% Kjeldahl-N and pH value of 7.6. Herbicides were applied to the soil at 10 :g a.i./g of soil using a carrier sand. Untreated controls were included. Activities of soil enzymes were determined at 1 and 3 d for amylase and 7 and 21 d for dehydrogenase. Triplicate samples of 2 g soil for each herbicide treatment were allowed to stand with 0.6 mL toluene for 15 min before incubating with 4 mL acetone-phosphate buffer at pH 5.5 and 5 mL solution of 2% starch. After shaking, the samples were placed in an incubator at 28°C. Controls without added substrate were included. Amylase activities were determined for the reducing sugar using the Prussian blue method. Soil dehydrogenase activity was measured by incubating the soil at 28°C with 2,3,5-triphenyltetrazolium chloride for the formation of formazan (2,3,5-triphenyltetrazolium formazan).

RESULTS: All treatments inhibited amylase activities for 1 day. Amylase activity recovered to equal to that of control after 3 d. Diclofop and ioxynil had stimulatory effects on dehydrogenase. Allidochlor was inhibitory for 7 and 21 d and nitrofen for 7 d respectively.

CONCLUSIONS: None of the herbicides inhibited activities of soil amylase after 3 d. Except for allidochlor, dehydrogenase was not affected.

Treatment	Amylase :g glucose/g soil		Dehydrogenase mg Formazan/g soil	
	Incubation period (days)			
	1	3	7	21
Control	36	32	25	56
Allidochlor	25*	26	21*	42*
Bentazon	19*	29	25	53
Chlorbromuron	23*	29	27	57
Diclofop	26*	31	28*	56
Diuron	26*	27	26	58
EPTC	27*	29	26	54
Ioxynil	28*	32	29*	56
Monolinuron	29*	31	27	56
Nitrofen	30*	27	23*	50
Propazine	25*	30	25	55

* Significantly different (P = <0.05) from control.

#080

STUDY DATA BASE: 280-1452-9405

CROP: Horticultural crops

PEST: Weeds of horticultural crops

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TITLE: EFFECTS OF HERBICIDES ON SOIL NITRIFICATION AND DENITRIFICATION

MATERIALS: Technical (>95% purity):
2,4-D
DICAMBA
GLYPHOSATE
PARAQUAT
PICLORAM
SIMAZINE

METHODS: Herbicides were applied to the soil at a rate of 10 :g a.i./g of soil. Samples were incubated at 28°C and 60% moisture-holding capacity. Soil nitrification was determined by phenol disulfonic acid method for nitrate at 410 nm in a spectrophotometer. Nitrite was determined by the diazotization method with sulfanilic acid, "-naphthylamine hydrochloride and sodium acetate buffer at 525 nm. Portions (20 g) of soil samples were weighed into 100 mL serum bottles containing KNO_3 equipped with gas tight butyl-rubber serum stoppers and sealed with an aluminum seal. The activity of the soil to denitrify nitrate and nitrite was studied by determining the amounts of N_2O-N evolved. Denitrification activity is reflected by gaseous nitrogen loss from NO_3-N in soil. The activity of soil denitrification was determined by measuring formation of N_2O using a gas-chromatograph equipped with dual thermal conductivity detectors and Porapak Q columns. Untreated controls were included with all tests. All results are expressed on an oven-dry basis and are means of triplicate determinations.

RESULTS: Most treatments inhibited nitrification after 2 weeks. However, the inhibitory effect disappeared after 3 weeks. No inhibitory effect was observed on denitrification.

CONCLUSIONS: None of the herbicide treatments inhibited activities of soil nitrification after 3 weeks or soil denitrification. Microbial denitrification, the reduction of NO_3^- and NO_2^- into nitrous oxide (N_2O) or nitrogen gas (N_2) which is lost from soil into the atmosphere, represents a net loss of nitrogen to microorganisms and plants. The process is influenced by soil aeration, moisture, organic matter, acidity and temperature. Denitrification is known to take place under anaerobic conditions. The N_2O evolution from the soil anaerobic assay system indicated that the herbicides used in the experiment are non-toxic to denitrifying microorganisms.

Treatment	Nitrification :g(NO_2^- + NO_3^--)N		Denitrification :g N_2O-N/g	
	Incubation period (weeks)			
	2	3	1	2
Control	131	132	55	71
2,4-D	50*	118	67	98*
Dicamba	78*	103	65	84
Glyphosate	80*	121	49	71
Paraquat	122	128	64	70
Picloram	49*	111	66	89
Simazine	45*	115	49	68

* Significantly different from control at 5% level.

#081

STUDY DATA BASE: 280-1452-9405

CROP: Horticultural crops

PEST: Weeds of horticultural crops

NAME AND AGENCY:
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TITLE: EFFECTS OF HERBICIDES ON SULFUR OXIDATION AND NITRIFICATION IN SANDY SOIL

MATERIALS: Technical (>99% purity):
ALLIDOCHLOR
BENTAZON
CHLORBROMURON
DICLOFOP
DIURON
EPTC
IOXYNIL (89.5%)
MONOLINURON

NITROFEN (85%)
PROPAZINE

METHODS: Herbicides were applied to the soil at a rate of 10 :g a.i./g of soil. Samples were incubated at 28°C and 60% moisture-holding capacity. The level of sulfur oxidation was determined turbidimetrically in the soil extracts at 429 nm for sulfate. Soil nitrification was determined by phenol disulfonic acid method for nitrate at 410 nm in a spectrophotometer. Nitrite was determined by the diazotization method with sulphanilic acid, "-naphtylamine hydrochloride and sodium acetate buffer read at 525 nm. Untreated controls were included with all tests. All results are expressed in terms of oven-dried soil, and results are means of triplicate determinations. Analysis of variance was employed for statistical analyses of results.

RESULTS: Stimulatory effect was observed with treatment of ioxynil after 8 weeks and no effects were shown with all treatments on sulfur oxidation. Stimulatory effects were observed with most treatments after 1 week on nitrification while with exception of allidochlor and diuron, no inhibitory effects were observed in soil nitrification tests.

CONCLUSIONS: None of the herbicide treatments inhibited soil sulfur oxidation or nitrification after incubation which is important to soil fertility.

Treatment	Rate (:g/g)	S-oxidation :g ($SO_4^{=}$-S)/g		Nitrification :g(NO_2^- + NO_3^-)-N/g	
		Incubation period (wk)			
		4	8	1	2
Control	0	58	51	12	80
Allidochlor	10	47	80	89*	95*
Bentazon	10	58	39	140*	84
Chlobromuron	10	54	65	77*	71
Dichlofop	10	52	61	61*	68
Diuron	10	75	74	66*	91*
EPTC	10	51	83	58*	80
Ioxynil	10	55	88*	106*	75
Monolinuron	10	45	78	9	82
Nitrofen	10	37	87	12	74
Propazine	10	82	60	10	72

* Significantly different from control at 5% level.

#082

STUDY DATA BASE: 280-1452-9405

CROP: Horticultural crops

PEST: Weeds of horticultural crops

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TITLE: EFFECTS OF TEN HERBICIDES ON MICROBIAL POPULATIONS IN LOAMY SAND

MATERIALS: Technical (>99% purity):
ALLIDOCHLOR
BENTAZON
CHLORBROMURON
DICLOFOP
DIURON
EPTC
IOXYNIL (89.5%)
MONOLINURON
NITROFEN (85%)
PROPAZINE

METHODS: Ten micrograms active ingredient of herbicide were dissolved in 1 mL petroleum ether:acetone (1:1) mixture and incorporated with carrier sand. After the solvent had evaporated, the sand-herbicide mixture was incorporated with loamy sand by tumbling for 30 min. Changes in the soil microflora numbers were determined by soil dilution plate technique using sodium albuminate agar for bacteria and actinomycetes and rose-bengal streptomycin agar for fungi. Soil moisture was maintained at 60% moisture-holding capacity. Samples were incubated at 28°C for periods of 1 and 2 weeks after treatment. Analysis of variance was used in statistical analysis of results. All data are expressed on an oven-dry basis and are averages of triplicate determinations.

RESULTS: Plate counts indicated that bacterial numbers were reduced with most treatments after 1 week incubation while nitrofen stimulated bacterial number after 2 weeks. Similar effect was observed on fungal populations with nitrofen treatment.

CONCLUSIONS: Microbial populations were equal to or greater than the control after 2 weeks. Results indicated that no inhibitory effects of the herbicides on populations of microorganisms occurred.

Treatment	Bacteria ($x10^{-5}$)		Fungi ($x10^{-3}$)	
	Incubation period (weeks)			
	1	2	1	2
Control	199	87	56	19
Allidochlor	152*	94	44	19
Bentazon	128*	82	17*	13
Chlorbromuron	105*	56	17*	16
Diclofop	157	80	27*	19
Diuron	144*	78	24*	16
EPTC	152*	85	33*	7
Ioxynil	166	72	47	22
Monolonuron	121*	90	23*	21
Nitrofen	161	163*	38*	38*
Propazine	147*	94	29*	26

* Significantly different from control at 5% level.

#083

STUDY DATA BASE: 280-1452-9405

CROP: Horticultural crops

PEST: Insects of horticultural crops

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TITLE: EFFECTS OF INSECTICIDES ON MICROBIAL ACTIVITIES IN SANDY LOAM

MATERIALS: Technical (>93% purity):
DOWCO 429X
DPX-43898 (78%)
TEFLUTHRIN
TRIMETHACARB

METHODS: The soil used was a sandy loam from southwestern Ontario. Random samples were collected in late fall to a depth of 15 cm and sifted (<2 mm). The insecticides were applied to the soil at 10 :g/g a.i. using a carrier sand. An autoclaved soil and untreated controls were included with all tests. Data are expressed on an ovendry basis and are averages of triplicate determinations. Samples were incubated at 28°C for appropriate periods after treatment. Soil moisture was maintained at 60% moisture-holding capacity. Nitrogenase activity was determined by acetylene reducing capacity using a gas chromatography. Treated or untreated soil was incubated and ATP (adenosine 5'-triphosphate) content was analyzed after 1 and 2 d with a Luminometer model 1070.

RESULTS: The capacity of soil samples to reduce C_2H_2 to C_2H_4 provided evidence for potential N_2 fixation. The effect of insecticides on C_2H_2 reduction to C_2H_4 by nitrogenase was measured after 2 and 7 d. None of the treatments affected C_2H_2 reduction. Autoclaving caused a significant increase in C_2H_2 reduction in the soil. Heating of soil and remoistening results in liberation of soluble organic matter, reducing substances and minerals which apparently contain the substances necessary for C_2H_2 reduction. ATP is an extremely labile cell constituent but is a useful indicator of life in soil. ATP concentrations were depressed by autoclaving after 2 d incubation.

CONCLUSIONS: None of the chemicals at the levels tested drastically reduced the activities of nitrogenase or the level of ATP and none had a pronounced effect on soil fertility.

Treatment	Nitrogenase :g (C_2H_2 6 C_2H_4)/g soil		ATP :g ATP/g soil	
	Incubation time (days)			
	2	7	1	2
Control	2.8	5.4	13.3	14.3
Autoclaving	4.4*	8.1*	0.1*	0.4*
DOWCO 429X	2.1	5.3	11.0	18.1
DPX-43898	2.3	4.6	9.4	14.2
Tefluthrin	2.3	4.4	12.6	17.3
Trimethacarb	2.1	4.0	7.7	19.4

* Significantly different from control at 5% level.

SECTION J

PLANT PATHOLOGY / PHYTOPATHOLOGIE

DISEASES OF FRUIT CROPS / MALADIES DES FRUITS

Section Editor / Réviseur de section : R.W. Delbridge

#084 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apple, cv. Spy

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: CONTROL OF APPLE SCAB USING FLUAZINAM 500F AND BRAVO 500, 1994

MATERIALS: FLUAZINAM 500 F
BRAVO 500 SC (Chlorothalonil 500 g/L)
NOVA 40 W (Myclobutanil)
POLYRAM 80 DF (Metiram)
FLUAZINAM 75 SDG (75%)
NU-FILM

METHODS: A recently abandoned apple orchard in St. George, Ontario was used as the trial site. Treatments were assigned to single tree plots, replicated three times and arranged according to a randomized complete block design. Various combinations of fluazinam, fluazinam/NOVA, BRAVO 500 and BRAVO 500/NOVA tank mixes were applied for the control of apple scab disease. Treatments and applications schedules are outlined in Table 1. Applications to all treatments were dilute with a hand-gun sprayer at 3000 L/ha (runoff). Spray pressure was 2760 kPa. Maintenance treatments of fenvalerate (0.100 kg a.i./ha) were applied for control of insect pests. Ratings were conducted on the apple leaves on July 8, and the leaves and fruit on September 23. The percent apple scab on leaves and fruit was calculated by randomly choosing 200 leaves or fruit from each tree and counting the number that were infected. The weight of 100 fruit per plot was measured on September 23. These fruit were collected at random containing marketable and unmarketable (scab symptoms present) fruit. Data were analyzed using an analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

RESULTS: As presented in the table.

CONCLUSIONS: All treatments reduced the amount of scab present on the leaves on July 8 and September 23 when compared to the untreated control. Similarly all treatments reduced the amount of apple scab found on apple fruit compared to the untreated control. Treatment 10 which consisted of wider application intervals during the primary infection season had significantly more apple scab on fruit at harvest than those treatments where the interval remained at or below 10 d during the early part of the season. The addition of NU-FILM did not improve scab control compared to the same rate of fluazinam alone. Fluazinam 75 SDG provided equal control when compared to the liquid formulation. The addition of myclobutanil did not improve control of apple scab when compared to fluazinam alone. Treatments applied using OMAF forecasting methods (application code C) during the primary infection period provided equal control compared to preventative treatments while receiving two fewer applications during May and

June. Not all treatments provided significantly better yields than the untreated control when including unmarketable or diseased fruit in the calculation of yield. The yield in all treated plots was visually better in quality than untreated plots.

Table 1. Treatment list, application timings, and number of applications applied during the season for control of apple scab, 1994.

Treatment	Formulation	Rate (Product)	Appl. Code	No. of Appl.
1. fluazinam	500 g/L SC	100 mL/100 L	A*	8
1. fluazinam	500 g/L SC	75 mL/100 L	D	
2. fluazinam	500 g/L SC	75 mL/100 L	B	8
3. fluazinam +	500 g/L SC	75 mL/100 L	B	8
NU-FILM	999 v/v	62.5 mL/100 L	B	
4. fluazinam	75 % SDG	66.7 gm/100 L	B	8
5. fluazinam +	500 g/L SC	75 mL/100 L	A	8
myclobutanil	40 % WP	0.35 kg/ha	A	
5. fluazinam	500 g/L SC	75 mL/100 L	D	
6. fluazinam +	500 g/L SC	75 mL/100 L	C	6
myclobutanil	40 % WP	0.35 kg/ha	C	
6. fluazinam	500 g/L SC	75 mL/100 L	D	
7. POLYRAM	80% DF	200 gm/100 L	B	8
8. untreated control	------	------------		
9. chlorothalonil +	500 g/L SC	200 mL/100 L	C	6
myclobutanil	40 % WP	0.35 kg/ha	C	
9. chlorothalonil	500 g/L SC	66.7 mL/100 L	D	
10. chlorothalonil	500 g/L SC	1000 mL/100 L	E	8
10. chlorothalonil	500 g/L SC	66.7 mL/100 L	D	

*A Applied from green tip to petal fall at 7-10 d intervals.
B Applied from green tip to pink bloom at 7 intervals. Interval extended to 10 d until late June.
C OMAF Forecasting recommendations. Applied 48 to 96 h after primary infection periods. Seven to 10 minimum interval between applications.
D Cover sprays applied at a 14 interval until 30-45 d pre-harvest.
E Applied at budbreak, and at green tip.

Table 2. Mean percent apple scab and yield on Spy apples treated with fluazinam and chlorothalonil, 1994.

Treatment	Rate (product)		%Disease leaf 08-July	%Disease leaf 23-Sept	%Disease fruit 23-Sept	Weight kg/100fruit 23-Sept
1. fluazinam	100	mL/100 L	10.0 b	5.3 cd	2.7 d	11.5 a
1. fluazinam	75	mL/100 L				
2. fluazinam	75	mL/100 L	13.8 b	5.3 cd	8.0 cd	11.7 a
3. fluazinam +	75	mL/100 L	17.0 b	13.0 bcd	8.7 c	10.6 a
NU-FILM	62.5	mL/100 L				
4. fluazinam	66.7	gm/100 L	7.7 b	5.7 cd	2.7 d	11.8 a
5. fluazinam +	75	mL/100 L	11.7 b	3.8 d	3.7 cd	10.2 ab
myclobutanil	0.35	kg/ha				
5. fluazinam	75	mL/100 L				
6. fluazinam +	75	mL/100 L	15.3 b	6.2 cd	5.3 cd	11.6 a
myclobutanil	0.35	kg/ha				
6. fluazinam	75	mL/100 L				
7. POLYRAM	200	gm/100 L	11.8 b	24.5 b	3.7 cd	11.1 a
8. untreated control	------------		41.0 a	90.5 a	99.7 a	7.8 b
9. chlorothalonil +	200	mL/100 L	16.8 b	6.0 cd	4.0 cd	10.2 ab
myclobutanil	0.35	kg/ha				
9. chlorothalonil	66.7	mL/100 L				
10. chlorothalonil	1000	mL/100 L	18.3 b	16.5 bc	17.7 b	11.6 a
10. chlorothalonil	66.7	mL/100 L				

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's Multipe Range Test)

#085

CROP: Apple, cv. Spy

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: CONTROL OF APPLE SCAB USING BAS-490 02 F

MATERIALS: BAS-490 F (50%)
POLYRAM 8 DF (Metiram)
N0VA 40 W (Myclobutanil)

METHODS: An abandoned apple orchard in St. George, Ontario was used as the trial site. Treatments were assigned to single tree plots, replicated four times and arranged according to a randomized complete block design. Polyram cover sprays were made to treatments 2, 3, 4, 5 and 6 starting at green tip and again 12 d later. The first significant infection period after the first two cover sprays occurred on May 15, 1994. Experimental treatments were applied on the following scheduled intervals after this infection period. Treatments 2 and 3 were applied on May 19, 1994, 96 h after infection. Treatment 4 was applied on May 20, 1994, 120 h after infection. Treatments 5 and 6 were applied on June 8, 1994, after visible symptoms appeared on the leaves. Following experimental treatments, POLYRAM cover sprays were applied for the duration of the season (treatments 2-6). Applications to all treatments were dilute with a commercial orchard sprayer and hand-gun spayer at 3000 L/ha (runoff). Sprayer pressure was 2760 kPa. Maintenance treatments of cypermethrin (0.100 kg a.i./ha) were applied for control of insect pests. Leaf efficacy ratings were conducted on July 5, 1994, and fruit efficacy ratings on August 31, 1994. Percent disease was calculated by randomly choosing 200 leaves or fruit from each tree and counting those that were infected. Counts were converted to percent disease on the leaves and percent disease on the fruit.

RESULTS: As presented in the table.

CONCLUSIONS: All treatments significantly reduced the number of fruit infected with apple scab when compared to the untreated check. Treatments two, three and four significantly reduced the number of leaves infected with apple scab when compared to the untreated check. There was no significant difference in fruit symptoms between BAS-490 applied at 96 and 120 h after infection and after symptoms were first present on the leaves. There was no significant difference between myclobutanil applied at 96 h after infection and BAS-490 treatments. Myclobutanil applied after symptoms became evident had significantly more fruit scab at harvest than BAS-490 treatments applied at 96 and 120 h after infection. There was no visual phytotoxicity or reduction in fruit quality caused by any of the treatments tested.

Table 1. Mean percent apple scab on Spy apples, 1994.

Treatment	Formulation	Rate (g a.i./100 L H_2O)	% Disease (leaves)	% Disease (fruit)
1. Untreated control	----	----	34.9 a*	89.1 a
2. BAS-490 02 F	50% WDG	4.0	8.1 bc	4.6 c
3. myclobutanil	40% WP	4.52	12.1 bc	6.3 bc
4. BAS-490 02 F	50% WDG	4.0	4.3 c	2.3 c
5. BAS-490 02 F	50% WDG	4.0	22.8 ab	10.1 bc
6. myclobutanil	40% WP	4.52	24.4 ab	18.6 b

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's Multiple Range Test).

#086

STUDY DATA BASE: 348-1261-4801

CROP: Apple, cv. Jerseymac

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: EVALUATION OF FUNGICIDES FOR THE CONTROL OF APPLE SCAB

MATERIALS: DITHANE 75 DG (Mancozeb)
NOVA 40 W (Myclobutanil)
RH-0611 F (2-3% Myclobutanil and 60-63% Mancozeb by weight)

METHODS: Apple scab control was evaluated in a 12-year old orchard on M.26 rootstock. Treatments were assigned to 3-tree plots and replicated four times using a randomized complete block design. The fungicides were sprayed to runoff (9-15 L/plot) using a hydraulic hand-gun attached to a truck-mounted Rittenhouse sprayer operating at 2700 kPa. Unsprayed guard trees were left between plots to reduce spray drift. A 2.4 x 3.7 m plastic tarp supported by two 3.0 m x 4 x 9 cm boards, was placed around plots being sprayed, when necessary, in a further attempt to reduce spray drift. Treatment two was sprayed following a protectant programme on May 4, 12, 20, 27, June 6, 13, 21, 27. Treatments 3, 4, and 5 were sprayed at 10 d intervals on May 10, 20, 30 and June 9. They were followed by applications of DITHANE (200 g product/100 L) on June 13, 21 and 27. Mill's primary apple scab infection periods occurred on May 8, 15-17, 25-27, 28-29, 31-June 1, June 11-12, 13-14, 24-25, 27-28; 29, 30-July 1. The incidence of scab was assessed on July 13 by examining all the leaves and fruit on 20 fruiting clusters and all the leaves on 10 randomly selected shoots per plot. On August 23, scab was assessed on all the leaves of 20 randomly selected shoots and on 100 fruit per plot.

RESULTS: As presented in the table.

CONCLUSIONS: All fungicide treatments provided significant season long scab control on both the leaves and fruit as compared to the unsprayed check. The NOVA + DITHANE treatment provided better early season scab control on the cluster leaves than did the DITHANE treatment. There was no significant difference in scab control between the two rates of RH-0611.

Table 1. Percent with Scab

Treatment	Rate of product/ 100 L	July 13 cluster leaves	July 13 shoot leaves	July 13 fruit	August 23 shoot leaves	August 23 fruit
1. check	---	26.1 a*	25.6 a	56.0 a	49.0 a	83.0 a
2. DITHANE 75 DG	200.0 g	1.5 b	1.2 b	0.0 b	1.8 b	0.5 b
3. NOVA 40 W + DITHANE 75 DG	11.3 g 100.0 g	0.0 c	0.9 b	1.1 b	0.7 b	0.0 b
4. RH-0611	133.3 g	0.8 bc	1.1 b	0.0 b	1.6 b	0.0 b
5. RH-0611	100.0 g	0.8 bc	2.3 b	4.5 b	1.3 b	1.0 b

* Means followed by the same letter in each column are not significantly different using Duncan's Multiple Range Test (P = 0.05). The data were analyzed following arcsin transformation.

#087

STUDY DATA BASE: 402-1461-8605

CROP: Apple, cv. McIntosh

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: BAS-490 02F AS A CURATIVE FUNGICIDE

MATERIALS: BAS-490 02F (Strobilurine analogue)
NOVA 40 WP (Myclobutanil)
MAESTRO 75 DF (Captan)

METHODS: The experiment was conducted at Kelowna, British Columbia in a four-year old McIntosh orchard owned by the Research Centre. The experimental design was a randomized complete block with six replicates. Each single tree replicate was separated by a barrier tree. The six treatments were applied with a back-pack sprayer until runoff, except for the control which was untreated. All treatments received a captan treatment (1.3 g/L) at tight cluster on April 12, 1994. Curative applications of BAS-490F were initiated on May 2 (full bloom) 27 h after the first significant infection period. Curative applications followed on May 3, 4 and 5, 51, 72 and 98 h, respectively after the first infection period. A curative application of NOVA 40W was also made after 98 h. Captan (1.3 g/L) was applied as a cover spray on May 12, 24 and June 9. No further cover sprays were made. Foliage scab was evaluated on June 9 on 10 randomly selected shoots from each single tree replicate. Fifteen leaves on each shoot were individually examined for lesions and number of lesions per leaf were counted. The number of lesions per leaf were estimated when more than 10 occurred on a single leaf. Apple foliage was also examined for signs of phytotoxicity such as leaf curling or burning. Apples (15 per single tree replicate) were harvested on August 23 and brought back to the laboratory for examination. Number of fruit with lesions and number of lesions on each fruit were recorded.

RESULTS: BAS-490 was as effective as NOVA after 27, 51, 72 and 98 h in preventing apple scab lesions on fruit (Table 1). On leaves BAS-490 significantly reduced the number of leaves with apple scab from 30.0 to 16.6% when applied 98 h after a moderate infection period. NOVA reduced the number of leaves with apple scab lesions from 30 to 1% when applied at the same time.

CONCLUSIONS: BAS-490 and NOVA are equally effective in eradicating apple scab lesions from fruit however NOVA is better in eradicating lesions from apple leaves.

Table 1. Curative action of BAS-490 compared to NOVA.

Treatment	Rate (product 100 L)	Infected Leaves (%)	Lesions/ Leaf	Infected Fruit (%)	Lesions/ Fruit
Control		30.0 A*	3.8 A	62.2 A	3.5 A
BAS-490 27 h	8.0g	4.9 CD	0.3 BC	2.2 B	0.0 B
BAS-490 51 h	8.0g	14.7 B	1.5 BC	1.1 B	0.0 B
BAS-490 72 h	8.0g	9.7 BC	0.9 BC	0.0 B	0.0 B
BAS-490 98 h	8.0g	16.6 B	1.7 B	1.1 B	0.0 B
NOVA 98 h	10.0g	1.0 D	0.1 C	2.2 B	0.0 B

* Means within the same column followed by the same letter are not significantly different at P = 0.05 as determined by the Waller-Duncan K-ratio t-test.

#088

ICAR: 91000658

CROP: Apple, cv. Jerseymac

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: EVALUATION OF BAS-490 02 F ON A 10-14 DAY APPLICATION SCHEDULE FOR THE CONTROL OF APPLE SCAB, 1994

MATERIALS: BAS-490 02 F-50 DF
NOVA 40 WP (Myclobutanil)
POLYRAM 80 DF (Metiram)

METHODS: Trial was established in an 11-year old plantation of Jerseymac trees on EM7 rootstock, spaced 3.7 m x 5.5 m, using a R.C.B. design with two-tree plots and four replicates. Applications were made with a diaphragm pump-hand-gun system, operating at 1655 kPa, and were made on a spray to run-off basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis.

INFECTION PERIODS: 16/05 (heavy), 25/05 (moderate), 29/05 (moderate), 02/06 (moderate), 06/06 (moderate), 13/06 (moderate), 18/06 (light).

APPLICATIONS: Treatments were on a 10-14 d schedule for the period of primary scab infections. Up until bloom, BAS-490 02 F and NOVA were applied on their own; from bloom to the end of the primary infection season these products were tank mixed with POLYRAM.

TREATMENT DATES: BAS-490 02 F and NOVA alone: 06/05 and 20/05, tank mixes with POLYRAM: 31/05, 10/05 and 20/05.

ASSESSMENTS: All leaves on 20 clusters and 20 terminals per plot were examined for primary scab lesions; 100 fruit (at mid-season) and 200 fruit (at harvest) per plot were examined for scab lesions.

RESULTS: As presented in the table.

CONCLUSIONS: The season had seven primary infections. Under the resulting moderate disease pressure, all treatments provided highly significant control of fruit and leaf scab. With the near perfect disease control obtained with all treatments, it was not possible to detect a rate response with the BAS-490 product. All treatments based around this product provided results that were comparable to those found with the NOVA based commercial standard. All treatments received summer maintenance applications of mancozeb and captan using an airblast sprayer.

Treatment	Rate g a.i./ha	% Fruit Scab 26/07	% Fruit Scab 18/08	% Terminal Leaf Scab - 26/07	% Cluster Leaf Scab - 26/07
1. Control	-	60.5a*	69.0a*	64.6a*	60.8a*
2. BAS-490 02 F; BAS-490 02 F + POLYRAM	90; 90 3600	0.3b	0.1b	0.1b	0.0b
3. BAS-490 02 F; BAS-490 02 F + POLYRAM	120; 120 3600	0.0b	0.0b	0.1b	0.0b
4. BAS-490 02 F; BAS-490 02 F + POLYRAM	150; 150 3600	0.0b	0.3b	0.6b	0.0b
5. NOVA; NOVA + POLYRAM	136; 136 3600	0.8b	0.0b	0.1b	0.0b

* Means in same column, followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test).

#089

ICAR: 91000658

CROP: Apple, cv. Jerseymac

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: EVALUATION OF BAS-490 02 F FOR ERADICANT ACTIVITY AGAINST APPLE SCAB; POST-INFECTION "KICK-BACK" AND "POST-SYMPTOM" APPLICATIONS, 1994

MATERIALS: BAS-490 02 F-50 DF
NOVA 40 WP (Myclobutanil)
POLYRAM 80 DF (Metiram)

METHODS: Trial was established in an 11-year old plantation of Jerseymac trees on EM7 rootstock, spaced 3.7 m x 5.5 m, using a R.C.B. design with two-tree plots and four replicates. Applications were made with a diaphragm pump-hand-gun system, operating at 1655 kPa, and were made on a spray to run-off basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis.

TREATMENT SCHEDULE: The objective of the application scheduling was to evaluate the post-infection activity of BAS-490 02 F. To do this, treatments were focused against a single, major infection period; this infection period was chosen only after the foliage had fully leafed out. Treatments 2-6 were to be applied at different "kick-back" intervals following the chosen infection period. The intended intervals in hours for treatments 2-5 were 48, 72, 96, and 120, respectively, and 96 h for treatment 6. Treatments 7 and 8 were to be applied "post-symptom", with two applications to be made at a 7 d interval.

MAINTENANCE FUNGICIDE AND INFECTION INFORMATION: To prevent any early season scab from establishing itself within the plots prior to the start of the experimental applications, treatments 2-8 all received a protectant application of POLYRAM (4.5 kg/ha) on May 7. On May 16, with the trees at the early tight cluster stage, the heavy infection, against which the treatments would be timed, occurred. On May 27, treatments 2-8 again received a POLYRAM protectant; with 11 d having elapsed since the targeted infection period, it was assumed that this application would provide cover protection against subsequent infections without affecting the disease development from the May 16 infection. Scab lesions first appeared in treatments 7 and 8 on June 3, and the post-symptom applications were made on June 4 and June 10. Two additional POLYRAM protectant cover sprays were made on treatments 2-6, one June 4 and June 13, ensuring protection through until the end of the primary infection season. All treatments received summer maintenance applications of mancozeb, chlorothalonil, and captan.

TARGETED INFECTION PERIOD: Began on May 16 at 00:00 and continued through until 12:00 on May 17; a duration of 36 h at a mean temperature of 9.3°C.

APPLICATIONS: Treatment 2-May 18, 05:30; Treatment 3-May 19, 05:30; Treatments 4 and 6-May 20, 05:15; Treatment 5-May 21, 05:10; Treatments 7 and 8-June 4, 05:05 and June 10, 21:05.

ASSESSMENTS: All leaves on 20 clusters and 20 terminals per plot were examined for primary scab lesions; 100 fruit (at mid-season) and 200 fruit (at harvest) per plot were examined for scab lesions.

RESULTS: As presented in the table.

DISCUSSION: BAS-490 02 F provided excellent post-infection control of apple scab in all treatments. It gave outstanding "kick-back" for up to 125 h and gave equally good eradication of established apple scab, with a two application programme, when applied at the first appearance of the lesions.

Treatment	Rate g a.i./ha	Timing (hours post-infection, or date)	% Fruit Scab 20/07	% Fruit Scab 19/08	% Terminal Leaf Scab 26/07	% Cluster Leaf Scab 26/07
1. Control	-	-	53.3a*	68.2a*	50.6a*	44.9a
2. BAS-490 02 F	120	53.5	0.7b	1.6b	0.8b	1.2b
3. BAS-490 02 F	120	77.5	0.8b	0.1b	0.4b	0.6b
4. BAS-490 02 F	120	101.3	0.8b	0.8b	1.0b	1.4b
5. BAS-490 02 F	120	125.3	0.5b	1.3b	1.7b	0.8b
6. NOVA	136	101.3	1.3b	0.8b	0.8b	0.0b
7. BAS-490 02 F; BAS-490 02 F	120; 120	June 4; June 10	1.3b	0.3b	0.9b	1.1b
8. NOVA; NOVA	136; 136	June 4; June 10	1.9b	0.6b	0.1b	0.7b

* Means in same column, followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test).

#090

ICAR: 91000658

CROP: Apple, cv. Spartan

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.
European red mite, *Panonychus ulmi* (Koch)
Twospotted spider mite, *Tetranychus urticae* (Koch)

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TITLE: EVALUATION OF DIFFERENT FUNGICIDE PROGRAMMES FOR THE CONTROL OF APPLE SCAB AND THEIR EFFECTS ON MITE POPULATIONS, 1994

MATERIALS: FLUAZINAM 500 F
BRAVO 500 F (Chlorothalonil)
NOVA 40 WP (Myclobutanil)
DITHANE 75 DG (Mancozeb)
RH-0611 62.25WP (Myclobutanil-2.25% + Mancozeb-60%)

METHODS: Trial was established in an 11-year old plantation of Spartan trees on EM7 rootstock, spaced 3.7 m x 5.5 m, using a R.C.B. design with two-tree plots and four replicates. Applications were made with a diaphragm pump-hand-gun system, operating at 1655 kPa, and were made on a spray to runoff basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis.

INFECTION PERIODS: Primary: 16/05 (heavy), 25/05 (moderate), 29/05 (moderate), 02/06 (moderate), 06/06 (moderate), 13/06 (moderate), 18/06 (light); Secondary: 27/06, 02/07, 05/07, 08/07, 10/07, 19/07, 21/07, 30/07, 02/08, 04/08.

APPLICATION SCHEDULES: Treatments 1, 4 and 6: the first portion of the programme was to start at green tip, and be applied at 10 d intervals up until ascospore exhaustion; the second portion was to be a 10-14 d cover spray programme. Treatments 2 and 3: the programme was to start at green tip, and have applications made at 7 d intervals up until ascospore exhaustion, and were then to be made at 10 d intervals. Treatment 5: the first portion of the programme was to start at tight cluster, and be applied at 10 d intervals up until ascospore exhaustion; the second portion was to be a 10-14 d cover spray programme. Treatment 7: the first portion of the programme was to start at green tip, with two applications to be made at a 14-21 d interval; the second portion was to be a 7-10 d cover spray programme. Treatments 8-10: the first portion of the programme was to be applied once at green tip; the second portion was to have applications made at Tight Cluster, Pink, Bloom-Calyx and 1st Cover; the third portion was to be a 10-14 d cover spray programme. APPLICATION DATES: detailed in Table 1.

ASSESSMENTS: Apple Scab: All leaves on 20 clusters and 20 terminals per plot were examined for primary scab lesions; 100 fruit (at mid-season) and 200 fruit (at harvest) per plot were examined for scab lesions. Mites: 10 leaves per plot were sampled for both the twospotted spider mite and European red mite.

RESULTS: As presented in the tables.

CONCLUSIONS: Despite some good primary infection periods, and a wetter than usual summer, disease pressure was light. Nonetheless, all treatments had significantly lower levels of both leaf and fruit scab than was found in the untreated control.

The control attained was excellent in all treatments. The mite populations in the fluazinam based treatments were consistently lower than the other fungicide programmes where it was not used. This trend was seen in both the European red mite and twospotted spider mite data. With the European red mite, the fluazinam based programmes' mite populations were significantly lower than the BRAVO/NOVA and control treatments, but not from the NOVA/DITHANE and BRAVO treatments. With the twospotted spider mite, all of the fluazinam based programmes had infestation levels that were significantly lower than the NOVA/DITHANE, BRAVO/NOVA, and BRAVO treatments; they did not differ significantly from the control.

Table 1. Treatments and application dates.

Treatment	Rate kg a.i./ha	Dates applied
1. Fluazinam;	1.5;	May 5, 18, 27, June 6 and 16;
Fluazinam	1.125	June 27, July 4, 14, 28 and August 11
2. Fluazinam	1.125	May 5, 14, 21, 27, June 4, 10, 16, 27, July 4, 14, 28 and August 11
3. Fluazinam + Nu-Film*	1.125 + 3.75 L/ha	May 5, 14, 21, 27, June 4, 10, 16, 27, July 4, 14, 28 and August 11
4. Fluazinam + NOVA;	1.125 + 0.136;	May 5, 18, 27, June 6 and 16;
Fluazinam	1.125	June 27, July 4, 14, 28 and August 11
5. NOVA + DITHANE;	0.136 + 2.25;	May 10, 20, 31, June 10 and 24;
DITHANE	4.5	July 4, 14, 28 and August 11
6. BRAVO + NOVA;	3.0 + 0.136;	May 5, 18, 27, June 6 and 16;
BRAVO	1.0	June 27, July 4, 14, 28 and August 11
7. BRAVO; **	15.0;	May 5, 27;
BRAVO	1.0	June 8, 16, June 27, July 4, 14, 28 and August 11
8. DITHANE;	3.75;	May 5;
8. NOVA + DITHANE;	0.136 + 2.25;	May 15, 21, June 4 and 14;
8. DITHANE	3.375	June 24, July 4, 14, 28 and August 11
9. DITHANE;	3.75;	May 5;
9. RH-0611;	0.090 + 2.4;	May 15, 21, June 4 and 14;
9. DITHANE	3.375	June 24, July 4, 14, 28 and August 11
10. DITHANE;	3.75;	May 5;
10. RH-0611;	0.068 + 1.8;	May 15, 21, June 4, 14;
10. DITHANE	3.375	June 24, July 4, 14, 28 and August 11
11. Control	-	

* NU-FILM was not present in the applications of May 5, 27 and June 4.

** On May 18, fluazinam at 1.5 kg a.i./ha was mistakenly sprayed on this treatment; the next BRAVO application was delayed until May 27.

Table 2. Scab control.

Treatment	Rate kg a.i./ha	% Fruit Scab 03/08	% Fruit Scab 16/09	% Terminal Leaf Scab- 03/08	% Cluster Leaf Scab - 03/08
1. Fluazinam; Fluazinam	1.5; 1.125	0.0b*	0.0b*	0.7b*	0.3b*
2. Fluazinam	1.125	0.0b	0.0b	0.7b	0.0b
3. Fluazinam + Nu-Film **	1.125 3.75 L/ha	0.0b	0.0b	0.6b	0.0b
4. Fluazinam + NOVA; Fluazinam	1.125 + 0.136; 1.125	0.0b	0.0b	0.1b	0.0b
5. NOVA + DITHANE; DITHANE	0.136 + 2.25; 4.5	0.0b	0.0b	0.4b	0.0b
6. BRAVO + NOVA; BRAVO	3.0 + 0.136; 1.0	0.0b	0.0b	0.2b	0.0b
7. BRAVO; BRAVO	15.0; 1.0	0.0b	0.0b	0.0b	0.0b
8. DITHANE;	3.75;				
8. NOVA + DITHANE;	0.136 + 2.25;	0.0b	0.0b	0.6b	0.0b
8. DITHANE	3.375				
9. DITHANE;	3.75;				
9. RH-0611;	0.090 + 2.4;	0.0b	0.0b	0.1b	0.4b
9. DITHANE	3.375				
10. DITHANE;	3.75;				
10. RH-0611;	0.068 + 2.4;	0.0b	0.0b	0.5b	0.4b
10. DITHANE	3.375				
11. Control	-	4.3a	7.5a	14.6a	16.8a

* In the same column, means followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test), data arcsin square root transformed before DMRT (detransformed data shown).

** NU-FILM was not present in the applications of May 5, 27 and June 4.

Table 3. Fungicide programme effects on mite populations.

Treatment	Rate** g a.i./ha	ERM (motile) 15/08	TSSM (motile) 15/08
1. Fluazinam; Fluazinam	1.5; 1.125	0.0c*	1.4e*
2. Fluazinam	1.125	0.2c	0.0e
3. Fluazinam + NU-FILM **	1.125 + 3.75 L/ha	1.4c	3.2de
4. Fluazinam + NOVA; Fluazinam	1.125 + 0.136; 1.125	0.4c	6.2de
5. NOVA + DITHANE; DITHANE	0.136 + 2.25; 4.5	7.3bc	36.7bc
6. BRAVO + NOVA; BRAVO	3.0 + 0.136; 1.0	51.2a	61.9ab
7. BRAVO; BRAVO	15.0; 1.0	6.5bc	96.4a
8. DITHANE;	3.75;		
8. NOVA + DITHANE;	0.136 + 2.25;	-	-
8. DITHANE	3.375		
9. DITHANE;	3.75;		
9. RH-0611;	0.090 + 2.4;	-	-
9. DITHANE	3.375		
10. DITHANE;	3.75;		
10. RH-0611;	0.068 + 2.4;	-	-
10. DITHANE	3.375		
11. Control	-	24.7ab	20.5d

* In the same column, means followed by same letter are not significantly different (P = <0.05, Duncan's Multiple Range Test), data square root transformed before Duncan's Multiple Range Test (detransformed data shown).

** NU-FILM was not present in the applications of May 5, 27 and June 4.

#091

STUDY DATA BASE: 344-1261-7211

CROP: Apple, cv. Mutsu (Crispin)

PEST: Blister spot, *Pseudomonas syringae* pv. *papulans* (Rose 1917) Dhanvantari 1977

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TITLE: CONTROL OF BLISTER SPOT OF APPLES USING COPPER FUNGICIDES, 1994

MATERIALS: BORDEAUX MIXTURE (Copper sulphate and lime)
COPPER SPRAY WP (Copper oxychloride)
COPPER 50W (Tribasic copper sulphate)
KOCIDE 101 (Cupric hydroxide)
CALCIUM CHLORIDE

METHODS: The trial was conducted in a commercial orchard of cv. Mutsu apples located near Harrow, Ontario. cv. Mutsu trees on M106 apple rootstock had been established in 1974 on a sandy loam soil site. Tree rows were spaced 6.7 m apart with a spacing between trees of 4.6 m. Treatments consisting of copper fungicides and calcium chloride (Table 1) were applied to single tree plots. Treated trees were separated by guard trees within the same row. A complete randomized block design with 4 blocks was used. Treatments were applied to runoff using a hand-held nozzle (1034 kPa). Copper fungicides were applied at two rates, the calcium chloride at one rate. Spraying was done only under conditions of light winds (10 km/h or less) on June 7, 20 and July 4. Prior to harvest, 20 fruit samples were removed from each of the treated trees and the blister spot lesions were counted. Fruit phytotoxicity (rating scale: 0-3) was also recorded. The disease counts along with the phytotoxicity ratings were subjected to statistical analysis using SAS.

RESULTS: No significant differences were detected among the fungicide treatments and rates. Both calcium chloride and the water check treatments had significantly higher levels of fruit spotting than the copper fungicides (Table 1). Some phytotoxicity was observed, notably when Bordeaux was used at the 2-6-1000 rate. Higher rates of fungicides resulted in greater levels of phytotoxicity, however they were not high.

CONCLUSIONS: Copper fungicides were effective in reducing fruit lesions caused by *P. syringae* pv. *papulans* on cv. Mutsu. Phytotoxicity would not appear to be a significant problem when using copper materials on growing tissues during the growing season.

Table 1. Comparison of disease incidence and phytotoxicity following the application of copper fungicides to cv. Mutsu trees at Harrow, Ontario in 1994.

Treatment	Rate (product/1000 L)	Lesions/apple*	Phytotoxicity**
Kocide 101 + lime	1.1 kg + 6 kg	0.4c	0.10ab
Copper 50W + lime	1.0 kg + 6 kg	0.6c	0.04cd
Copper spray WP + lime	1.0 kg + 6 kg	0.9c	0.06bc
Copper sulphate + lime	2.0 kg + 6 kg	1.2c	0.14a
Copper 50W + lime	0.5 kg + 6 kg	1.3c	0.00d
Kocide 101 + lime	0.5 kg + 6 kg	1.4c	0.04cd
Copper spray WP + lime	0.5 kg + 6 kg	2.3c	0.03cd
Copper sulphate + lime	1.0 kg + 6 kg	2.7c	0.00d
Calcium chloride	10 L	14.0b	0.00d
check	-	20.5a***	0.00d

* Figures represent the means of four replications.
** Phytotoxic reaction was assessed on a scale of 0 to 3 where 0 = no reaction and 3 = high.
*** Figures with the same letter are not significantly different (P = 0.05).

#092

CROP: Blueberry, cv. Bluecrop

PEST: Fruit rot, *Botrytis cinerea* Pers. ex Fr.
Anthracnose, *Colletotrichum gloeosporioides (Penz.) Sacc.*

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TITLE: EFFICACY OF EIGHT FUNGICIDE TREATMENTS AGAINST FRUIT ROT ON BLUEBERRIES, 1994

MATERIALS: BRAVO 500 0500F (Chlorothalonil)
BRAVO ULTREX 0825 SDG
FUNGINEX 190 EC (Triforine)
ROVRAL 50% WP (Iprodione)
MAESTRO 75 DF (Captan)
FLUAZINAM 50% F

METHODS: The trial was located at a farm in Matsqui, British Columbia with a history of fruit rot. Plots consisting of one bush each were replicated six times in a randomized complete block design. Each treatment (Table 1) was repeated every 7-10 d with first sprays beginning March 31 (Treatment 1). The number of applications for each treatment was dependent upon stage of bloom or fruiting (Table 1). The sprays were applied with a CO^2 back-pack sprayer, single cone nozzle at 690 kPa and volume of 1000 L/ha. Berry samples were hand-picked on July 20, 27, and August 12 for incubation experiments. A total of 3,240 berries were collected. The samples from each treatment were individually separated, with 20 berries per container. Care was taken to ensure no berry touched another. Containers were held at approximately 100% R.H. at room temperature (27°C). Readings were made in 7 d. The number of infected berries was recorded for each fungus. Berries were harvested July 13, 27, August 10 and 24.

RESULTS: Bravo and fluazinam gave good control of post-harvest fruit rot (Table 1). This may have been partly due to the shorter pre-harvest spray interval. The Rovral treatment had the same timing but gave no control, although this may be due to its lack of persistence. The Maestro treatment did not provide control of overall post-harvest rot, although it did reduce anthracnose levels. All treatments except Rovral reduce anthracnose levels. There were differences in the level of fruit rot at each picking. Fruit rot levels were lowest on July 27, and highest on August 3 (Table 2). When all treatments were combined, *Botrytis* caused the highest level of infection 21.1%, (Table 3).

Residues were observed on berries and leaves from treatments 1 and 2. Berries from treatments of Funginex had russetting, but this was not quantified. Fluazinam caused a significant increase in total yield (Table 3). There were no other differences between treatments for yield.

CONCLUSIONS: The more persistent fungicides Bravo and fluazinam offered post-harvest fruit rot protection, but that the protectant fungicides Rovral and Maestro were not effective when applied during bloom. Further work is required to determine the most effective application times for Maestro. Anthracnose was present on 5% of untreated fruit. We do not know the importance of anthracnose on blueberries in British Columbia.

Table 1. Comparison of total average numbers of berries per 60 infected with *Botrytis, Glomerella* and total fruit rot following various fungicide sprays during the season - 1994.

Treatment	Rate a.i./ha	Time Sprays Applied*	*Botrytis* Number/60 Berries	*Glomerella* Number/60 Berries	Total Fruit rot Number/60 Berries
Bravo 500	7.5 kg	A	3.2 E	0.0 B	3.8 C
Bravo Ultrex	4.5 kg	A	5.7 DE	0.0 B	6.3 C
Funginex	2.8 L	B	13.8 ABC	0.2 B	15.3 AB
Funginex	2.8 L	C	14.7 ABC	0.3 B	15.3 AB
Rovral	2.0 kg	D	13.3 BCD	1.2 AB	15.3 AB
Maestro	2.4 kg	E	21.3 A	0.2 B	22.0 A
Maestro	1.2 kg	F	17.5 AB	0.0 B	18.7 A
Fluazinam	1.0 kg	D	7.7 CDE	0.0 B	7.8 BC
check	-	-	16.8 AB	3.3 A	20.7 A
ANOVA P = <0.05			**	**	**

* Timing: A - Applied before bud break repeated at bud break then every 7-10 d to fruit maturity.
B - Begun at bud break and continued to the end of bloom.
C - Begun at bud break and stopped before mid-bloom.
D - Applied at bud break and then every 7-10 d to fruit maturity.
E - Begun at bloom and continued until bloom complete. Applied every 7 d.
F - Begun at bloom and continued until bloom complete. Applied every 3-4 d.

** Figures are the means of six replications. Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05).

Table 2. Percent of total rot per treatment for three dates, and days since last treatment.

Treatment	Days Since Last Treatment	% Total Rot July 27		Days Since Last Treatment	% Total Rot Aug 3		Days Since Last Treatment	% Total Rot Aug 19	
Bravo 500 (A)	21	3.4	A	28	4.2	E	14	9.2	C
Bravo Ultrex (A)	21	0.0	A	28	12.5	DE	14	20.0	BC
Funginex (B)	67	0.9	A	74	44.2	ABC	90	30.9	ABC
Funginex (C)	67	5.0	A	74	40.1	BCD	90	30.9	ABC
Rovral (D)	21	1.7	A	28	46.7	ABC	14	26.7	BC
Maestro (E)	64	6.7	A	71	73.4	A	86	30.9	ABC
Maestro (F)	64	4.2	A	71	60.9	CDE	86	35.9	AB
Fluazinam (D)	21	0.9	A	28	20.9	CDE	14	12.5	C
check	-	5.0	A	-	45.0	ABC	-	50.0	D
ANOVA P = <0.05	**	**		**	**		**	**	

** Figures are the means of six replications. Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05).

Table 3. A comparison of total yields per bush of blueberries sprayed with various fungicides.

Treatment	Yield (Kg/bush)
Bravo 500 (A)	13.7 BCD*
Bravo Ultrex (A)	15.8 ABCD
Funginex (B)	12.4 D
Funginex (C)	13.4 CD
Rovral (D)	13.9 BCD
Maestro (E)	16.6 ABC
Maestro (F)	17.4 AB
Fluazinam (D)	18.0 A
check	14.0 BCD
ANOVA P = <0.05	*

* Figures are the means of six replications. Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05).

#093

CROP: Blueberry, cv. Bluecrop

PEST: Mummy berry, *Monilinia vaccinii-corymbosi* (Reade Honey)

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TITLE: EFFICACY OF FIVE FUNGICIDE TREATMENTS AGAINST PRIMARY AND SECONDARY MUMMY BERRY INFECTIONS ON BLUEBERRIES, 1994

MATERIALS: BRAVO 500 0500 F (Clorothalonil)
BRAVO ULTREX 0825 SDG
FUNGINEX 190 EC (Triforine)
ROVRAL 50% WP (Iprodione)

METHODS: The trial was located at a farm in Matsqui with a history of mummy berry. Plots consisting of one bush each were replicated six times in a randomized complete block design. Each treatment (Table 1) was repeated every 7-10 d with first sprays beginning March 31 (Treatment 1). The number of applications (up to 15 applications) for each treatment was dependent upon stage of bloom or fruiting (Table 1). The sprays were applied with a CO_2 back-pack sprayer, single cone nozzle at 690 kPa and volume of 1000 L/ha. Primary infection was recorded on April 26. Mummy berries were collected from all bushes on four dates, July 13, 27, August 10 and 24.

RESULTS: As presented in the table.

CONCLUSIONS: All treatments resulted in a significant reduction of primary and secondary mummy berry infections although Funginex gave the best results. Funginex caused some russetting on the berries, but this was not quantified.

Yields were taken. There was no significant difference in yield between the treatments.

Table 1. Comparison of total numbers of primary and secondary mummy berries and following various fungicide treatments during the season - 1994.

Treatment	Rate a.i./ha	Time Sprays Applied*	Primary Infections Mummy Berry Number/Bush	Secondary Infections Mummy Berry Number/Bush
Bravo 500	7.5 kg	A	19.8 B	55.8 B
Bravo Ultrex	4.5 kg	A	27.5 B	62.0 B
Funginex	2.8 L	B	0.0 C	9.8 C
Funginex	2.8 L	C	0.0 C	15.3 C
Rovral	2.0 kg	D	14.8 B	58.2 B
check	-	-	51.8 A	135.0 A
ANOVA P = <0.05			**	**

* Timing: A - Applied before bud break repeat at bud break then every 7-10 d until fruit maturity.
B - Begun at bud break (when apothecia open) and continued until the end of bloom.
C - Begun at bud break (when apothecia open) and stopped before mid-bloom.
D - Applied at bud break and then every 7-10 d until fruit maturity.

** Figures are the means of six replications. Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05).

#094

STUDY DATA BASE: 402-1461-8605

CROP: Cherry, cv. Montmorency

PEST: Powdery mildew, *Podosphaera clandestina* (Wallr.:Fr.) Lév.

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TITLE: CHERRY POWDERY MILDEW CONTROL WITH NOVA, 1994

MATERIALS: KUMULUS S 80 WDG (sulfur)
NOVA 40 WP (myclobutanil)

METHODS: The experiment was conducted at the Summerland Research Centre on mature cherry. Nine trees in 2 rows were separated into 3 blocks of 3 random single tree replicates per block. The three treatments, except the control, were applied until runoff with a hand-gun operated at 700 kPa. They were applied on April 22 (full bloom), May 3 (petal fall), May 17 (first cover) and May 31 (second cover).

Secondary powdery mildew was evaluated on leaves on June 14, 1994 by randomly selecting 10 shoots on each single tree replicate and counting the number of leaves with mildew and the area of mildew on each infected leaf.

RESULTS: NOVA and KUMULUS S both provided effective disease control.

CONCLUSIONS: NOVA is an effective alternative to KUMULUS S for the control of powdery mildew on cherries.

Table 1. Percent leaves and leaf area with powdery mildew.

Treatment	Rate (product 100 L)	Leaves (%)	Leaf Area (%)
NOVA 40 WP	11.3g	2.7 B*	0.2 B
KUMULUS S	200.0g	14.0 B	1.3 B
Control	---	60.3A	22.0A

* Means within the same column followed by the same letter are not significantly different at P = 0.05 as determined by the Waller-Duncan K-ratio t-test.

#095

CROP: Cranberry, cv. Bergman

PEST: Upright dieback, *Diaporthe vaccinii* Shear

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TITLE: EFFICACY OF NINE FUNGICIDE TREATMENTS AGAINST UPRIGHT DIEBACK ON CRANBERRIES, 1994

MATERIALS: BRAVO 500 0500F (Clorothalonil)
BRAVO ULTREX 0825 SDG
COPPER OXYCHLORIDE 50 WP

METHODS: Plots were 2.25 m^2, replicated eight times in a randomized complete block design. Treatments were applied according to a schedule outline in Table 1. The sprays were applied with a CO_2 back-pack sprayer, single cone nozzle at 690 kPa and volume of 2000 L/ha. Upright dieback infection was recorded on September 27.

RESULTS: As presented in the table.

CONCLUSIONS: Bravo 500 applied from the bud break stage to early berry development gave the best control of upright dieback. The next best control was obtained with copper oxychloride and Bravo 500 applied at varying schedules from bud break to early berry development. All of these effective treatments covered the early bloom period. Control from the "D" schedule did not include coverage during the early bloom period and was less than satisfactory. There were no significant differences between fungicide rates in this trial which suggests that growers could use the lower rates of Bravo 500. Phytotoxicity was not observed on the plants from any treatment, even though temperatures reached highs of 29°C.

Table 1. Comparison of amount of upright dieback infections on cranberries following various fungicide sprays during the season - 1994.

Treatment	Rate kg a.i./ha	Time Sprays Applied*	Number of Uprights Infected with Dieback/30 cm^2
Bravo 500	5.88	D	31.5 BC
Bravo Ultrex	5.88	D	39.3 AB
Bravo 500	5.88	B	20.6 D
Bravo 500	4.6	B	15.9 DE
Bravo 500	3.36	B	22.3 CD
Copper oxychloride	2.0	A	12.0 DE
Copper oxychloride	2.0	B	21.5 CD
Bravo 500	3.36	C	7.5 E
Copper oxychloride	2.0	C	16.3 DE
check			48.1 A
ANOVA P = <0.05			**

* Timing: A - 1/4 inch bud growth (bud break) + 2 weeks later + 2 weeks later (early bloom)
B - Early bloom (5%) + 2 weeks later (late bloom) + 2 weeks later (early berry development).
C - 1/4 inch bud growth (bud break) + 2 weeks later + 2 weeks later (10 - 50% flower in bloom) + 2 weeks later (late bloom) + 2 weeks later (early berry development)
D - Late bloom + 10 d later + 10 d later.
Not Applied after August 1.

** Figures are the means of 8 replications. Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05).

#096

CROP: Filbert, cv. Barcelona

PEST: Bacterial blight, *Xanthomonas campestris pv. corylina* (Miller et al.) Dye

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TITLE: EFFICACY OF COPPER OXYCHLORIDE AGAINST BACTERIAL BLIGHT ON FILBERTS

MATERIALS: COPPER OXYCHLORIDE 50% WP

METHODS: Trials were conducted on three different sites. Plots were one-eighth, one-sixth and one-quarter ha replicated three times in randomized complete block design. Copper oxychloride was applied 3 times in each trial i.e., September 2, 1993 (trees in full leaf), December 15-18, 1993 (90-95% leaf drop) and March 25, 1994 (bud break). The sprays were applied with an air blast sprayer at 552 kPa. Sprays were applied at 1.5-4.5 kg a.i./ha depending on size of trees. Efficacy ratings were made July 13, 1994. Samples of nuts were collected per site on

September 3, 1993 for residue analysis.

RESULTS: As presented in the table.
Trial site 1. Consisted of a mature orchard with moderate levels of bacterial blight. The trees did not have crown infections and the shoots had not been pruned out. This provided a large area for new infections to occur as young wood is most susceptible to infection. The one- and two-year old suckers were examined for infections during July and were considered infected if there were any lesions present. The bark was removed from cankers to confirm that the tissue beneath was necrotic. Isolations were made from several cankers to confirm the bacterium did cause these infections.

Trial site 2. This site had a serious disease problem for over four years. The bacterium was spread around the orchard by pruners from sucker pruning. This resulted in crown infections. It became apparent that although the disease was severe at this site, it was not possible to evaluate the effect of the copper treatment. The copper treatment is only a protectant and not an eradicant so it has no effect on old infections. Most of the new growth (which was protected) was so severely affected by the crown infections that it was not possible to evaluate the new infections that would have entered the branch through wounds and leaf scars. The trees had also had the suckers removed so these could not be evaluated.

Trial site 3. This site had no active disease.

CONCLUSIONS: Copper oxychloride reduced the percent of filbert shoots infected with bacterial blight.

Table 1. Comparison of percent of shoots infected with bacterial blight following copper oxychloride sprays.

Treatment	Rate a.i./ha	Percent Infected Shoots Site 1	Site 2	Site 3
1. Control	-	50.0 A	N/A	0.0
2. Copper oxychloride	1.5-4.5 KG	15.0 B	N/A	0.0
ANOVA P = <0.05		*		

* Figures are the means of three replications. Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05).

#097

CROP: Grape, cv. Riesling

PEST: Bunch rot, *Botrytis cinerea* Pers.,
Downy mildew, *Plasmopara viticola* (Berk. and Curt.) Berl. and deToni
Black rot, *Guignardia bidwellii* (Ell.) Viala and Ravaz

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TITLE: CROP TOLERANCE AND EFFICACY OF FLUAZINAM IN GRAPES

MATERIALS: FLUAZINAM 500 F, FLUAZINAM 75 SDG
ROVRAL 50 WP (Iprodione)
NU-FILM

METHODS: The test was conducted in Vineland, Ontario. Treatments were assigned to single row, 8 m plots, replicated three times and arranged according to a randomized complete block design. Applications were made with a Solo back-pack airblast sprayer, in 1100 L/ha of water, on 09-06-94 (shoot elongation), 21-06-94, 06-07-94 (late bloom), 20-07-94, 29-07-94 (bunch closure), 25-08-94 (veraision), and 16-09-94 (14 d pre-harvest). Each treatment received a total of seven applications. The shoot elongation application was applied at 550 L/ha. Downy mildew was rated by collecting 20 leaves at random and counting the number showing disease symptoms. Black rot and *Botrytis* bunch rot were rated by counting the number of diseased bunches in 20 randomly selected bunches. Severity was rated visually on a scale of 0 to 5, where 0 = no effect, and 5 = 100% infection. Data were analyzed using an analysis of variance and Duncan's Multiple Range Test at the P = 0.05 significance level.

RESULTS: Efficacy data are presented in the tables. There was no visual injury to the crop caused by any of the treatments tested.

CONCLUSIONS: Plots treated with fluazinam had significantly fewer leaves infected with downy mildew and the severity of infection was significantly less than plots treated with ROVRAL or left untreated. Black rot and *Botrytis* bunch rot incidence was significantly less in the fluazinam and ROVRAL treated plots when compared to the untreated plots. The two fluazinam formulations were equally safe and effective for controlling the three diseases. The addition of NU-FILM sticker showed no advantage in terms of disease control when compared to fluazinam alone. Berries treated with NU-FILM showed a loss, or alteration in the thin waxy layer on the skin, called bloom, which prevents water loss. This was replaced by an oily, shiny appearance. It is not known whether this had any impact on fruit quality or sugar content.

Table 1. Mean downy mildew incidence (number of infected leaves per 20) and severity (rated on a scale of 0-5) on Riesling grapes, 1994.

Treatment	Rate (product/ha)	Incidence No./20 leaves 08-Aug-94	Incidence No./20 leaves 23-Aug-94	Severity (0-5) 23-Aug-94
1. fluazinam 500F	1.00 L	0.3 b*	6.0 b	1.0 b
2. fluazinam 500F	1.50 L	0.0 b	5.7 b	1.0 b
3. fluazinam 500F + NU-FILM	1.00 L 5.00 L	0.0 b	6.7 b	1.3 b
4. fluazinam 75SDG	0.90 kg	0.0 b	7.7 b	1.0 b
5. ROVRAL 50 WP	1.50 kg	10.0a	16.7 a	4.7 a
6. Untreated	----	13.7a	17.0 a	4.7 a

* Means followed by the same letter are not significantly different P = 0.05, Duncan's Multiple Range Test).

Table 2. Mean number of bunches infected with black rot and *Botrytis* bunch rot and black rot severity on Riesling grapes, 1994.

Treatment	Rate (product/ha)	Black Rot #/20 bunches 08-Aug-94	Black Rot Severity(0-5) 08-Aug-94	Black Rot #/40 bunches 26-Sep-94	Bunch Rot #/40 bunches 26-Sep-94
1. fluazinam 500F	1.00 L	1.0 b*	0.3 b	3.0 b	0.0 b
2. fluazinam 500F	1.50 L	1.0 b	0.7 ab	4.3 b	0.0 b
3. fluazinam 500F + NU-FILM	1.00 L 5.00 L	0.7 b	0.7 ab	2.7 b	0.3 ab
4. fluazinam 75SDG	0.90 kg	1.0 b	0.7 ab	5.0 b	0.0 b
5. ROVRAL 50 WP	1.50 kg	3.0 a	1.3 ab	5.3 b	0.0 b
6. Untreated	----	7.0 a	1.7 a	16.0 a	1.0 a

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's Multiple Range Test).

#098

STUDY DATA BASE: 402-1461-8605

CROP: Peach, cv. Glohaven

PEST: Brown rot, *Monilinia fructicola* (Wint.) Honey

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TITLE: USE OF IPRODIONE FOR CONTROL OF BROWN ROT IN 1994

MATERIALS: CAPTAN 80 WP
EXP-10295A 50 WG (Iprodione)
ROVRAL 50 WP (Iprodione)

METHODS: The experiment was conducted at the Summerland Research Centre on mature Glohaven peach trees. Twelve trees in 2 rows were separated into 4 blocks of 3 random single tree replicates per block. The treatments were applied until runoff with a hand-gun operated at 700 kPa. Treatments were applied on April 15 (5% bloom), April 22 (full bloom), August 2 (ripening fruit) and August 15 (2 d before harvest).

Blossom blight was evaluated by visually counting the number of withered blossoms on each tree. Fruit rot was evaluated by picking 40 fruit from each tree and placing in cardboard trays with separate cups for each fruit. The fruit was placed in a 20°C temperature controlled room and covered with polyethylene liners in order to keep high humidity around the peaches. Number of fruit with brown rot decay was counted 5 d after harvest.

RESULTS: Blossom infection did not occur. ROVRAL and EXP10295A provided effective control of fruit brown rot (Table 1). Symptoms of phytotoxicity were not observed at any time during this experiment.

CONCLUSIONS: EXP10295A was as effective as Rovral and Captan for control of brown rot.

Table 1. Percent fruit brown rot on peaches 5 d after harvest.

Treatment	Rate (product/100 L)	Fruit Brown Rot (%)
Control	----	31.2 A*
CAPTAN 75 WG	133.0 g	10.8 B
EXP10295A 50 WG	50.0 g	8.3 BC
ROVRAL 50 WP	50.0 g	6.7 C

* Mean values followed by the same letter are not significantly different at the 5% level according to Duncan's Multiple Range Test.

#099

CROP: Strawberry, cv. Redcoat

PEST: Gray mold, *Botrytis cinerea* Pers.

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TITLE: ROVRAL FORMULATIONS FOR CONTROL OF GRAY MOLD IN STRAWBERRIES

MATERIALS: ROVRAL 50 WP (Iprodione 50%)
EXP-10370A 50 WG (Iprodione 50%)
MAESTRO 75 DF (Captan 75%)

METHODS: A third year picking field of strawberries in Lynden, Ontario was used as the trial site. Treatments were assigned to 2 m x 10 m plots, replicated four times and arranged according to a randomized complete block design. Plots were sprayed on May 30, 1994 and June 9, 1994 using a 2 m hand boom with a CO_2 powered sprayer at a water volume of 350 L/ha. Sprayer pressure at the source was 206 kPa. A maintenance treatment of cypermethrin applied at a rate of 0.070 kg a.i./ha was made for the control of insect pests. Efficacy ratings on June 28 consisted of a harvest of 100 berries per plot. Diseased berries from the 100 harvested were counted and a percent disease was calculated. Percent disease was calculated after 24 h storage at 21 degrees Celcius using the same method. Data were analyzed using analysis of variance and Duncan's Multiple Range Test at the 5% significance level.

RESULTS: Efficacy data are presented in the table. There was no visual injury to the crop caused by any of the treatments tested.

CONCLUSIONS: All three treatments provided effective control of gray mold without causing any phytotoxicity to the crop. It is believed that a final application prior to harvest would have reduced the amount of disease that developed post-harvest. There was rain on 3 of the 5 d leading up to harvest that likely led to this quick deterioration.

Table 1. Mean percent gray mold disease at harvest (June 28) and post-harvest (June 29) on Redcoat strawberries, 1994.

Treatment	Rate (kg a.i./ha)	% Disease 28-June-94	% Disease 29-June-94
1. Untreated control	----	9.5 a*	41.3 a
2. ROVRAL 50 WP	1.00	3.8 b	21.3 b
3. EXP-10370	1.00	4.3 b	20.0 b
4. MAESTRO 75 DF	3.00	4.8 b	19.5 b

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's Multiple Range Test).

SECTION K

DISEASES OF VEGETABLE AND SPECIAL CROPS / MALADIES DES LÉGUMES ET CULTURES SPÉCIALES

Section Editor / Réviseur de section : P.D. Hildebrand

#100 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 20902309

CROP: Bean, dry, (*Phaseolis vulgaris* L.), cv. Othello (pinto type)

PEST: Halo blight, *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young et al.
Seed- and soil-borne fungi, *Fusarium* spp., *Penicillium* spp., *Trichoderma* sp., *Rhizopus* sp., *Rhizoctonia solani* Kühn

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TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF HALO BLIGHT AND SEED DECAY OF DRY EDIBLE BEANS: I. GREENHOUSE AND LABORATORY TRIALS IN SOUTHERN ALBERTA IN 1994

MATERIALS: AGRICULTURAL STREPTOMYCIN (Streptomycin Sulphate 62.6% WP; equivalent to 50% Streptomycin base)
CAPTAN 30-DD (Captan 28.7% SU)

METHODS: Separate 500 g lots of dry bean seed naturally infested with *Pseudomonas syringae* pv. *phaseolicola* and various fungi were treated with three rates of AGRICULTURAL STREPTOMYCIN, three rates of AGRICULTURAL STREPTOMYCIN + CAPTAN 30-DD, and one rate of CAPTAN 30-DD as specified in Table 1. The required amounts of STREPTOMYCIN were each mixed in 2.5 mL of water and applied to the 500 g lots of seed as a slurry. The CAPTAN suspension was supplemented with 1.75 mL of tapwater to facilitate even coverage of the seed. An additional lot of bean seed was treated with tapwater as a control. The seed treatments were applied with a Gustafson Batch Lab Treater. Before each test lot was treated, 500 g of seed was run through the treater to pre-coat the drum with the respective fungicide in order to minimize adhesion losses.

On February 3, two separate greenhouse experiments were started. In one, medium-grade horticultural vermiculite was used as the growing medium, while in the other it was non-pasteurized soil. The treatments and environmental conditions assigned to each experiment were identical. Each treatment consisted of eight 15 cm diameter pots (replicates) with 25 seeds per pot. Air temperatures were maintained at ca. 22°C, supplementary light was provided for 12 h/d, and the pots were watered as required. Emergence counts were taken on March 8 and the data were tabulated and subjected to ANOVA. After the emergence data had been taken, the plants were thinned to 5 per pot and both experiments were covered with plastic sheeting to provide a humid microclimate favourable for halo blight development. After 2 weeks, the plastic was removed and blight incidence and severity were rated.

Due to poor emergence, the experiment with soil as the growing medium was repeated on May 26 using six pots per treatment and 50 seeds per pot. Environmental conditions were the same as before, except that air temperatures were 22-25°C and no supplemental lighting was provided. This trial was terminated on June 10, and the data were processed as for the earlier trial.

Two separate assays for seed-borne bacteria and fungi were conducted in the laboratory. In the first, 50 seeds from each treatment (see Table 2) were placed onto petri dishes of potato dextrose agar (5 seeds per plate). The plates were incubated at room temperature (ca. 20-23°C) for 5-7 d, then observed for the presence and type of microbial growth. Following the conclusion of this experiment, a second trial was run using seed that was: a) not surface-sterilized prior to the application of STREPTOMYCIN and/or CAPTAN, b) surface-sterilized for 1.5 minutes in 1% sodium hypochlorite and rinsed with sterile water prior to treatment, or c) surface-sterilized for 3 minutes and rinsed prior to treatment (see Table 3). These seeds were plated as described above and checked for fungal and bacterial growth after 5-7 d of incubation.

RESULTS: No significant differences in percent emergence between treatments were observed either in soil or vermiculite for the experiments planted on February 3 (Table 1). Germination of the seed and plant vigour were generally poor, and no bacterial blight developed on the plants incubated under humid conditions. In the trial seeded May 26, some differences in stands were noted between treatments, but none was significantly better or worse than the check.

Treated and untreated seeds plated onto PDA without prior surface sterilization were rapidly colonized by *Penicillium*, *Rhizopus* and/or *Trichoderma* (Table 2) to the extent that no bacterial colonies were observed on the plates. Seed treatments containing CAPTAN generally controlled *Penicillium* and *Rhizopus* significantly better than those with STREPTOMYCIN alone, and they also reduced percent colonization by these two fungi relative to the untreated check. None of the treatments significantly reduced the levels of seed-borne *Trichoderma* compared to the check.

On seeds with no prior surface sterilization, STREPTOMYCIN + CAPTAN and CAPTAN alone almost always controlled *Penicillium* and *Trichoderma* significantly better than the treatments containing only STREPTOMYCIN, which were similar to the check. No significant differences between treatments were detected where seed was surface sterilized for 1.5 minutes; however, where 3.0 minutes of surface sterilization was employed, CAPTAN-containing treatments only succeeded in reducing the levels of *Penicillium* and not the other two genera.

CONCLUSIONS: Efforts to demonstrate efficacy against seed-borne bacteria in these trials were inconclusive, and none of the products tested significantly improved percent emergence relative to the check (Table 3). Seed treatments containing CAPTAN, alone or in combination with STREPTOMYCIN, generally gave better control of seed-borne fungi than those containing STREPTOMYCIN alone. Increasing the rates of application for the various seed treatment products did not necessarily improve their performance.

Table 1. Percent emergence of Othello pinto dry beans treated with various rates of STREPTOMYCIN, CAPTAN, and STREPTOMYCIN + CAPTAN and planted into soil and vermiculite under greenhouse conditions.

Treatment	Rate of product/ kg seed	Emergence (%) Seeded February 3* Soil***	Emergence (%) Seeded February 3* Vermiculite	Emergence (%) Seeded May 26** Soil
Untreated check	--	4.2	48.0	43.0 abc
STREPTOMYCIN	0.2 g	3.3	52.0	31.7 c
STREPTOMYCIN	0.4 g	9.7	47.0	33.3 bc
STREPTOMYCIN	1.0 g	8.5	44.0	37.3 abc
STREPTOMYCIN + CAPTAN	0.2 g + 1.5 mL	7.5	51.5	36.3 abc
STREPTOMYCIN + CAPTAN	0.4 g + 1.5 mL	12.9	40.2	47.3 a
STREPTOMYCIN + CAPTAN	1.0 g + 1.5 mL	9.5	48.0	31.7 c
CAPTAN	1.5 mL	4.6	46.0	46.3 ab
ANOVA P#0.05		ns	ns	s
Coefficient of Variation (%)		24.4	201.8	100.8

* These values are the means of eight replications (pots), with 25 seeds planted per pot.
** These values are the means of six replications (pots), with 50 seeds planted per pot. Numbers followed by the same small letter are not significantly different according to Duncan's Multiple Range Test (P#0.05).
*** These data were square-root-transformed prior to ANOVA and the detransformed means are presented here.

Table 2. Incidence of three genera of fungi on treated and untreated seed of Othello pinto dry beans plated onto potato dextrose agar.*

Treatment	Rate of product/ kg seed	% seeds colonized *Penicillium*	% seeds colonized *Trichoderma*	% seeds colonized *Rhizopus*
Untreated check	--	98.7 a	2.4 b	84.6 a
STREPTOMYCIN	0.2 g	100.0 a	0.0 b	20.7 bc
STREPTOMYCIN	0.4 g	100.0 a	65.5 a	65.5 ab
STREPTOMYCIN	1.0 g	100.0 a	9.6 b	97.5 a
STREPTOMYCIN + CAPTAN	0.2 g + 1.5 mL	17.8 bc	0.2 b	0.0 c
STREPTOMYCIN + CAPTAN	0.4 g + 1.5 mL	34.4 b	0.9 b	0.5 c
STREPTOMYCIN + CAPTAN	1.0 g + 1.5 mL	7.4 c	1.2 b	0.8 c
CAPTAN	1.5 mL	13.0 c	0.0 b	2.4 c
ANOVA P#0.05		s	s	s
Coefficient of Variation (%)		24.4	201.8	100.8

* The values in this table are the means of 10 replications (plates), with 5 seeds per plate. Some seeds were colonized by more than one type of organism and, if so, each occurrence was recorded separately. Percentage data were arcsin-transformed prior to ANOVA and the detransformed means are presented here.

Table 3. Incidence of three genera of fungi on treated and untreated seed of Othello pinto dry beans, with and without prior surface sterilization, plated onto potato dextrose agar.*

Treatment	Rate of product/ kg seed	% seeds colonized *Penicillium*	*Trichoderma*	*Rhizopus*
No surface sterilization**				
Untreated check	--	100.0 a	100.0 a	100.0 a
STREPTOMYCIN	0.2 g	100.0 a	100.0 a	0.0 b
STREPTOMYCIN	0.4 g	100.0 a	100.0 a	0.9 b
STREPTOMYCIN	1.0 g	100.0 a	100.0 a	0.0 b
STREPTOMYCIN + CAPTAN	0.2 g + 1.5 mL	3.4 b	7.3 b	0.0 b
STREPTOMYCIN + CAPTAN	0.4 g + 1.5 mL	7.1 b	0.9 b	13.1 b
STREPTOMYCIN + CAPTAN	1.0 g + 1.5 mL	90.4 a	77.7 c	77.7 b
CAPTAN	1.5 mL	15.9 b	19.6 b	13.1 b
ANOVA P#0.05		s	s	s
Coefficient of Variation (%)		24.1	28.7	62.9
1.5 minutes of surface sterilization**				
Untreated check	--	12.3	0.0	3.4
STREPTOMYCIN	0.2 g	72.0	4.8	3.4
TREPTOMYCIN	0.4 g	76.9	3.1	13.1
STREPTOMYCIN	1.0 g	34.5	0.9	0.6
STREPTOMYCIN + CAPTAN	0.2 g + 1.5 mL	0.7	0.0	0.9
STREPTOMYCIN + CAPTAN	0.4 g + 1.5 mL	5.2	0.0	7.6
STREPTOMYCIN + CAPTAN	1.0 g + 1.5 mL	27.2	0.0	13.1
CAPTAN	1.5 mL	15.7	0.0	3.4
ANOVA P#0.05		ns	ns	ns
Coefficient of Variation (%)		365.1	90.0	104.5
3.0 minutes of surface sterilization**				
Untreated check	--	92.4 a	9.5 b	0.9 b
STREPTOMYCIN	0.2 g	94.8 a	4.8 b	0.9 b
STREPTOMYCIN	0.4 g	100.0 a	0.0 b	0.9 b
STREPTOMYCIN	1.0 g	100.0 a	100.0 a	20.0 a
STREPTOMYCIN + CAPTAN	0.2 g + 1.5 mL	15.5 b	3.4 b	0.9 b
STREPTOMYCIN + CAPTAN	0.4 g + 1.5 mL	5.1 b	5.1 b	0.9 b
STREPTOMYCIN + CAPTAN	1.0 g + 1.5 mL	12.1 b	9.5 b	3.4 b
CAPTAN	1.5 mL	1.8 b	12.8 b	13.1 b
ANOVA P#0.05		s	s	s
Coefficient of Variation (%)		38.4	91.8	104.6

* The values in this table are the means of five replications (plates), with five seeds per plate. Some seeds were colonized by more than one type of organism and, if so, each occurrence was recorded separately.

** Bean seeds were surface-sterilized for 0.0, 1.5 or 3.0 minutes in 1% sodium hypochlorite, rinsed in sterile water, air dried, treated with STREPTOMYCIN, STREPTOMYCIN + CAPTAN or CAPTAN, and plated onto potato dextrose agar.

#101

ICAR: 20902309

CROP: Bean, dry, (*Phaseolus vulgaris* L.), cv. Othello (pinto type)

PEST: Halo blight, *Pseudomonas syringae* pv. *phaseolicola* (Burkh.) Young et al.
Seed- and soil-borne fungi, *Fusarium* spp., *Penicillium* spp., *Trichoderma* sp., *Rhizopus* sp., *Rhizoctonia solani* Kühn

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TITLE: EFFICACY OF SEED TREATMENTS FOR THE CONTROL OF HALO BLIGHT AND SEED DECAY OF DRY EDIBLE BEANS: II. FIELD TRIALS IN SOUTHERN ALBERTA IN 1994

MATERIALS: AGRICULTURAL STREPTOMYCIN (Streptomycin Sulphate 62.6% WP; equivalent to 50% streptomycin base)
CAPTAN 30-DD (Captan 28.7% SU)

METHODS: Separate 500 g lots of dry bean seed naturally infested with *Pseudomonas syringae* pv. *phaseolicola* and various fungi were treated with three rates of AGRICULTURAL STREPTOMYCIN, three rates of AGRICULTURAL STREPTOMYCIN + CAPTAN 30-DD, and one rate of CAPTAN 30-DD as specified in Table 1. The required amounts of STREPTOMYCIN were each mixed in 2.5 mL of water and applied to the 500 g lots of seed as a slurry. The CAPTAN suspension was supplemented with 1.75 mL of tapwater to insure even coverage of the seed. An additional lot of bean seed was treated with tapwater as a control. The seed treatments were applied with a Gustafson Batch Lab Treater. Before each test lot was treated, 500 g of seed was run through the treater to pre-coat the drum with the respective fungicides in order to minimize adhesion losses. The treated and untreated seed was planted by hand in a field at the ASCHRC, Brooks, on May 24. A randomized block design with four replications was used. Each subplot consisted of 1 x 5 m row. The row spacing in the trial was 60 cm and individual seeds were spaced approximately 1.3 cm apart. The total number of bean seeds in a 5 m row was 384.

Emergence was determined on June 23 by counting all of the plants in each row. Halo blight severity was rated on June 28 and July 22, and blight incidence (percent infected plants per row) was measured on June 28. The June 28 severity rating was done on a randomly selected sample of 20 diseased leaves per row using the visual assessment key for common bacterial blight of beans developed by James (1971), i.e. 0 = no disease, 1 = slight (1-10% leaf area blighted), 2 = moderate (11-25% blighted), 3 = severe (26-50% blighted), and 4 = severe (>50% blighted). The severity rating on July 22 was done differently than on June 28 because the disease had advanced to the point where many of the plants were dead or defoliated. The July 22 assessment was made by counting the total number of infected leaves on 10 plants per row. Another incidence rating was not done on this date because virtually all of the plants in the trial were affected.

RESULTS: As presented in the table. Emergence was generally poor, with no significant differences showing between any of the treatments. Halo blight incidence was lower in plants grown from treated seed, but none of the treatments was significantly better than the check. On June 28, halo blight severity across the trial was rated as slight to moderate, and disease levels in the rows grown from treated seed were generally lower; however, no significant differences were detected between any of the treatments. By July 22, the disease had become much more serious, but once again blight severity ratings in the treated subplots did not differ significantly from the check.

CONCLUSIONS: Though all of the seed treatments tested generally reduced the incidence and severity of halo blight, none proved to be significantly better than the check at the 5% level of statistical probability.

REFERENCE: James, C. 1971. A Manual of assessment keys for plant diseases. Can. Dept. Agric. Publ. 1458. Amer. Phytopath. Soc., St. Paul, MN.

Table 1. Percent emergence and incidence and severity of halo blight on Othello dry bean plants derived from seed treated with a bactericide (AGRICULTURAL STREPTOMYCIN) and a fungicide (CAPTAN), alone and in various combinations, in a field trial at the ASCHRC, Brooks, in 1994.*

Treatment	Rate of product/ kg seed	Emergence (%)	Halo blight: Incidence (% infected plants) June 28	Halo blight: Severity (0-4 rating) June 28	Halo blight: Severity (% leaves affected) July 22
Untreated check	--	32.6	15.3	1.4	73.5
STREPTOMYCIN	0.2 g	32.1	9.7	1.3	70.1
STREPTOMYCIN	0.4 g	35.1	8.4	1.2	70.0
STREPTOMYCIN	1.0 g	32.6	6.3	1.2	60.0
STREPTOMYCIN + CAPTAN	0.2 g/1.5 mL	35.5	6.8	1.1	63.8
STREPTOMYCIN + CAPTAN	0.4 g/1.5 mL	34.9	8.4	1.4	70.5
STREPTOMYCIN + CAPTAN	1.0 g/1.5 mL	31.1	3.8	1.2	58.9
CAPTAN	1.5 mL	32.5	12.1	1.3	70.5
ANOVA P#0.05		ns	ns	ns	ns
Coefficient of Variation (%)		15.0	36.7	27.9	9.5

* The values in this table are means of four replications. Blight incidence data were square-root-transformed before ANOVA. The detransformed means are presented here. Disease severity ratings on July 22 were arcsin-transformed prior to analysis and the detransformed means are listed here.

#102

ICAR NUMBER: 306001

CROP: Canola, spring, *Brassica napus* L., cv. Westar

PEST: Blackleg, *Leptosphaeria maculans* (Desm.) Ces. et de Not.

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TITLE: EVALUATION OF SEED TREATMENTS FOR CONTROL OF BLACKLEG OF CANOLA

MATERIALS: UBI-2390-3 (Carboxin + Thiram; 118 and 235 g a.i./L), @ 8.5 and 17.0 mL/kg
UBI-2369-1 (Carboxin + Thiram + Lindane; 45, 92 and 671 g a.i./L), @ 22.5 mL/kg
UBI-2576 (Thiabendazole + Thiram + Lindane; 20, 60 & 512 g .i./L), @ 28.0 mL/kg

METHODS: Seed was infested with the fungus at the rate of 4 g seed/10 mL spore suspension (10^7 spores/mL). The treatments were uninfested untreated seed, infested untreated seed, and infested seed treated with chemical product. A randomized complete block design with five replicates was established May 19. Plots were 5 m long and contained 15 rows 8 cm apart. Treated seed was sown in the centre row of the plot at 20 seeds/m and the remaining rows received uninfested untreated seed. Plots were separated by 1 guard row.

On August 23-25, the centre rows were evaluated for disease incidence (percentage of plants with symptoms) at the crown and for severity on a cross section of the crown using a scale of 0-4 (0 = healthy, 1 = 1-25%, 2 = 26-50%, 3 = 51-75%, 4 = 76-100% of crown cross section discolored). The remaining rows were rated for incidence of disease at the crown September 7-29. The incidence of disease per row was regressed against distance on either side of the centre row.

RESULTS: As presented in the table.

CONCLUSIONS: Blackleg occurred in the centre row of the uninfested check treatment, indicating that inoculum other than that added to the seed was present in the trial. Incidence and severity of blackleg were significantly higher in the centre row of the infested check treatment than in the uninfested check, a result attributed to the inoculum added to the seed. Every chemical treatment significantly reduced the severity and incidence of blackleg in the centre row compared to the infested untreated check and to levels not significantly different from those in the uninfested untreated check. This indicates that the chemicals were highly effective in preventing transmission of the pathogen from seed to the plant. Slopes (b) that were negative and coefficients of determination (r^2) with P values of 0.003 and 0.06 for the regressions of disease against distance on either side of the infested untreated row provided evidence of disease spread from the infested seed in the absence of chemical treatment. In all other cases, the coefficient of determination was not significant (P$0.05) or the slope of the regression line was positive. This provides evidence that chemical treatment of the seed suppressed spread of the disease from the infested row to adjacent rows. The values for measured incidence of blackleg in the centre row and the Y intercepts (a) of the regression equations agree in indicating that the background incidence of disease was near 20%, that addition of inoculum to seed doubled disease incidence in rows sown with infested seed without fungicide, and that addition of fungicide to infested seed reduced disease incidence to background levels.

Table 1. Effect of canola seed treatment on severity and incidence of blackleg in the centre row of plots and on parameters of regression equations relating blackleg incidence to distance from centre row.

Treatment	Rate mL/kg	Blackleg centre row August 23-25* Severity	Incidence	Regression equation parameters** Side	r^2	P	a	b
UBI-2390-3	8.5	0.5a	26a	west	0.02	0.73	28.9	0.03
				east	0.02	0.72	27.6	-0.02
UBI-2390-3	17.0	0.3a	19a	west	0.00	0.95	21.9	0.00
				east	0.54	0.04	18.4	0.09
UBI-2369-1	22.5	0.5a	23a	west	0.42	0.08	20.0	0.09
				east	0.41	0.09	22.8	0.06
UBI-2576	28.0	0.4a	22a	west	0.31	0.15	17.4	0.08
				east	0.05	0.58	17.0	0.03
Infested check	----	1.2b	49b	west	0.79	0.003	41.3	-0.19
				east	0.48	0.06	41.4	-0.10
Uninfested check	----	0.3a	23a	west	0.20	0.27	22.9	-0.04
				east	0.02	0.76	20.5	0.01

* Means in a column followed by the same letter are not significantly different at P#0.05 (LSD test).

** Disease incidence (Y %) was measured in rows on the west and east sides of the centre row and regressed against distance (X cm) from the centre row according to the equation Y = a + bX.

#103

STUDY DATA BASE: 375-1221-8177

CROP: Canola, *Brassica napus* L., cv Excel

PEST: Blackleg, *Leptosphaeria maculans* (Desmaz.) Ces. & De Not.

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TITLE: EFFICACY OF ICIA-5504 AS A FOLIAR FUNGICIDE FOR CONTROL OF BLACKLEG IN CANOLA, 1993-94

MATERIALS: ICIA-5504 (Azoxystrobin 80 WG)
PREMIERE (Thiabendazole 1.6%, Thiram 4.8%, Lindane 40%)
TILT 250 EC (Propiconazole 25%)
SUPERIOR OIL CONCENTRATE (Surfactant)
ATPLUS 463 (Surfactant)

METHODS: Tests were located at the Saskatoon Research Farm in 1993 and 1994, and in a grower's field near Waldhiem, Saskatchewan. The test sites were located on land which had abundant two-year old Leptosphaeria - infected canola stubble. The tests were arranged in a RCB design with four replicates. Each plot consisted of 9 x 6 m rows with 250 seeds per row; all plots were separated by 6 rows of barley to reduce interplot pycnidiospore spread. All plots, except the untreated check plots were planted with seeds treated with PREMIERE @ 28.0 ml product/kg. The foliar application treatments included single applications at 2 weeks after seeding (2 WAS) and dual applications at 2 and 4 weeks after seeding (2 + 4 WAS). An R and D plot sprayer was used at 276 kPa and 350 L solution per ha. In 1993, the surfactant ATPLUS 463 (AT) @ 0.5% spray volume was used with all foliar applications, and in 1994, the surfactant Superior Oil Concentrate (SOC) @ 1% spray volume was used in some treatments. At the Saskatoon location the test areas were irrigated to provide a minimum equivalent of 2 cm rain per week to promote disease spread during dry periods. At crop growth stage 5.1, all plants in row 2 of each plot were assessed for disease severity; a disease rating (% DRAT) was then calculated for each plot (see Pesticide Research Report, 1982, p. 233). Analysis of variance for percent DRAT and percent of plants infected, and orthogonal comparisons on treatment means, were done. Treatments were compared to the ?PREMIERE SD only" treatment rather than the "No Treatment" since all plots receiving a foliar fungicide treatment were planted with PREMIERE-treated seed.

RESULTS: As presented in the table.

CONCLUSIONS: The results of the two preliminary tests done in 1993 indicated that ICIA-5504 was effective in controlling blackleg. Both the single and dual application at both rates significantly reduced incidence and severity of infection. In the Saskatoon test the PREMIERE seed treatment did not reduce severity or incidence of blackleg. Analysis also showed a trend for dual applications to significantly reduce incidence, but not severity, of blackleg more than single applications.

For the 1994 test, orthogonal comparisons of rates at single application and with surfactant showed a significant linear decrease in severity, but not incidence, with increasing rate. The same analysis of rates at single and at dual application without surfactant indicated there was no significant decrease in severity or incidence with increasing rate of ICIA-5504. Comparison of individual means to the PREMIERE ONLY treatment indicated single applications of ICIA-5504 at 125 g a.i./ha with surfactant and at 250 g a.i./ha without surfactant were effective in reducing both incidence and severity of blackleg. The single application of ICIA-5504 at 125 g a.i./ha without surfactant did not reduce Blackleg which again shows that the surfactant is needed for efficacy. The dual application of ICIA-5504 at 125 g a.i./ha did significantly reduce severity but not incidence of the disease. All treatments with rates <125 g a.i./ha, with and without surfactant, were ineffective. Treatment with PREMIERE seed dressing only does not significantly reduce severity or incidence of infection.

Fungicide	Foliar Application Rate (g a.i./ha)	Application Time (WAS)	Disease Severity (% DRAT)	Disease Incidence (% Infection)
A. Saskatoon 1993				
No Treatment	0	0	21.0	44.3
Premiere SD only	0	0	16.3	35.5
ICIA-5504	125 + AT	2	6.0 a	14.9 a
ICIA-5504	125 + AT	2 + 4	2.1 a	4.5 a
ICIA-5504	250 + AT	2	4.8 a	11.6 a
ICIA-5504	250 + AT	2 + 4	1.2 a	3.4 a
Error Mean Square			12.6	64.7
B. Waldhiem 1993				
Premiere SD only	0	0	37.8	73.6
ICIA-5504	250 + AT	2 + 4	14.9 a	37.7 a
Error Mean Square			41.9	205.3
C. Saskatoon 1994				
No Treatment	0	0	17.7	36.0
Tilt	250.0	2	16.6	37.4
Premiere SD only	0	0	15.2	33.0
ICIA-5504	31.25	2	12.0	28.8
ICIA-5504	31.25 + SOC	2	13.1	28.8
ICIA-5504	31.25	2 + 4	13.8	30.1
ICIA-5504	62.5	2	12.9	29.0
ICIA-5504	62.5 + SOC	2	12.9	29.0
ICIA-5504	62.5	2 + 4	12.8	29.1
ICIA-5504	125.0	2	12.4	28.4
ICIA-5504	125.0 + SOC	2	6.7 a	18.8 a
ICIA-5504	125.0	2 + 4	9.0 a	22.2
ICIA-5504	250.0	2	7.0 a	17.1 a
Error Mean Square			13.8	58.9

* Within a column and test, only the values followed by the letter "a" are significantly different from the value of the treatment "Premiere SD only" according to orthogonal comparison analysis, P = 0.05.

#104

CROP: Canola, *Brassica rapa*, cv. Reward

PEST: Sclerotinia stem rot, *Sclerotinia sclerotiorum* (Lib.) de Bary

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TITLE: CONTROL OF SCLEROTINIA STEM ROT WITH PROCHLORAZ, 1994

MATERIALS: PROCHLORAZ 450 g/L EC
BENOMYL 50% WP

ENHANCE surfactant

METHODS: The trial was conducted in a commercial field of *B. rapa*, cv. Reward at Spruceview, Alberta. The trial was designed as a randomized complete block design, replicated four times, with individual plots covering 12 m^2. Treatments 2-4 were applied at 25% bloom at the rates indicated in Table 1. Treatments 5-7 were applied at 100% bloom or the beginning stages of petal drop, while treatment 8 was split applied with the first application applied at 25% bloom and the second application made at 100% bloom, or petal drop. All prochloraz treatments were applied with ENHANCE at 0.5% v/v. These treatments were compared to a standard treatment of benomyl applied at 25% bloom stage. All applications were made with a CO_2 propelled hand-held spray boom with four Tee Jet 80015 flat fan nozzles calibrated to deliver 110 L/ha spray solution at 240 kPa. Applications were made with the boom held approximately 30 cm over the canopy. All 25% bloom applications were made on July 13 while 100% bloom applications were made on July 20. Visual crop phytotoxicity assessments were made on July 20 and July 27 using a 0-100 scale. On September 1, disease control was rated by counting infected stems in 4.5 m^2, and then conducting an ANOVA. On September 9, yield samples were taken by combining the middle 8.4 m^2 and subjecting the untransformed data to ANOVA to test for significant differences. A Duncan's Multiple Range Test was utilized as the mean separation test. All results are reported in Table 1.

RESULTS: Crop phytotoxicity associated with prochloraz treatments was mild, while benomyl resulted in no visible injury. All prochloraz and benomyl treatments resulted in significant reductions in the number of *S. sclerotiorum* infected *B. rapa* plants per unit area. Although control data was variable, generally, prochloraz applied at 600 g a.i./ha, whether applied at 25% bloom, at 100% bloom or in a split application with two 300 g a.i./ha applications, provided control of sclerotinia stem rot which did not differ significantly from that provided by benomyl. Yield data suggested that the most effective treatments were 500 or 600 g a.i./ha of prochloraz applied at 100% bloom or the split application of two 300 g a.i./ha prochloraz treatments. These three treatments significantly outyielded the untreated check and the benomyl standard.

CONCLUSIONS: Prochloraz applied at 600 g a.i./ha offered control of *Sclerotinia sclerotiorum* that did not differ statistically from that provided by the standard benomyl. Prochloraz treatments applied at 100% bloom at 500-600 g a.i./ha significantly outyielded the standard treatment, benomyl, and the untreated check.

Table 1. The effect of prochloraz treatment on crop phytotoxicity, sclerotinia stem rot control and crop yield as compared to benomyl at Spruceview, Alberta in 1994.

Treatment	Rate (g a.i./ha)	Injury 7-20-94 (%)	Injury 7-27-94 (%)	Infected Stems 9-1-94 (no./4.5 m^2)	Yield 9-8-94 (g/m^2)
1. Check	---	0	0	13.0a	148.9cd
2. Prochloraz	400	0	5.8	5.0bcd	164.3abc
3. Prochloraz	500	0	6.5	8.3b	160.7abc
4. Prochloraz	600	0	5.8	6.3bcd	152.9bcd
5. Prochloraz	400		4.0	6.7bc	160.3abc
6. Prochloraz	500		6.0	7.7b	166.4ab
7. Prochloraz	600		6.5	3.0cd	167.6ab
8. Prochloraz	300	0	8.0	3.3cd	173.5a
Prochloraz	300				
9. Benomyl	753	0	0	2.7d	141.3d
ANOVA P = <0.05		---	---	P = 0.0002	P = 0.0034

Means followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05).

#105

ICAR: 206003

CROP: Carrot, cv. Six Pak

PEST: Sclerotinia rot, *Sclerotinia sclerotiorum* (Lib.) de Bary

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TITLE: EVALUATION OF FUNGICIDES FOR THE CONTROL OF SCLEROTINIA ON CARROTS IN STORAGE

MATERIALS: BRAVO 500 (Chlorothalonil)
RONILAN DF (Oxazolidinedione)
BENLATE 50 WP (Benomyl)
BOTRAN 75W (Dichloran)
CALCIUM NITRATE 15.5% (Calcium 19%)

METHODS: On May 27, 1993 carrots were seeded in naturally infested soil at the Muck Research Station. Plots were 4 rows wide and 5 m long, and replicated four times in a randomized complete block design. Treatments RONILAN and BENLATE were applied on October 7 and 18 approximately 20 and 10 d before harvest. BRAVO 500 was applied on October 13, 20 and 27, approximately 15, 8, and 1 d before harvest. All treatments were applied using solid cone nozzles with 65 p.s.i. in 500 L of water/ha. Approximately 10 kg of carrots from each plot were harvested on October 28, 1993. Dip samples were placed in plastic containers and put in a Filacell storage where temperature and relative humidity were kept at approximately 1°C and 90%, respectively. The number of carrots with and without visible white mold were counted and those with mold were assessed for degree of disease on January 26, and April 26, 1994. A number was assigned to the degree of disease, 5 represented no disease, 3.7 represented moderate disease and 1.0

represented severe disease such that the carrot was in a liquified state.

RESULTS: As presented in the table.

CONCLUSIONS: The calcium dip significantly increased the percent disease at both evaluation dates. None of the treatments reduced disease incidence or severity.

Table 1. Control of sclerotinia on carrots in storage in 1993-94.

Treatment	Field application kg/ha product)	Post-harvest dip (prod. per L water)	January 26 Percent disease	January 26 Degree of disease	April 26 Percent disease	April 26 Degree of disease
RONILAN	1.68	---	0.1 b*	4.5 a	20.5 cd	4.7a
BENLATE	2.0	---	0.4 b	4.0 a	23.6 bc	4.6a
BRAVO	3.2 L	---	0.3 b	4.25 a	13.3 de	4.3a
check unwashed	---	---	1.4 b	3.5 ab	26.2 bc	4.4a
CALCIUM dip		1.67 g	73.9 a	2.0 b	100.0 a	1.5b
check washed	---	---	0.4 b	3.25 ab	27.0 bc	4.6a
BOTRAN dip	---	3.70 g	1.5 b	4.5 a	31.1 b	4.7a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#106

ICAR: 2090230C

CROP: Corn, sweet, (*Zea mays* L.), cvs. Crisp 'n Sweet, Honey 'n Pearl and Ultimate

PEST: Seedling blight, *Pythium* spp., *Rhizoctonia solani* Kühn, *Penicillium* spp., *Fusarium* spp., *Trichoderma* spp., *Rhizopus* sp.

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TITLE: EFFICACY OF TWELVE SEED TREATMENT FUNGICIDES USED SINGLY OR IN MULTIPLE COMBINATIONS AGAINST SEEDLING BLIGHT ON SUPER SWEET CORN: I. GREENHOUSE TRIALS IN SOUTHERN ALBERTA IN 1994

MATERIALS: THIRAM 42-S (Thiram 42% SU)
APRON-FL (Metalaxyl 28.35% SU)
ANCHOR FLOWABLE (Oxadixyl 31% SU)
NU-ZONE 10ME (Imazalil 10.4% SN)
TOPSIN-M 4.5F (Thiophanate-methyl 46.2% SU)
FLO-PRO IMZ (Imazalil 31% SN)
MAXIM 4FS (Fludioxonil 42% SU)
CAPTAN 400 (Captan 37.4% SU)
VITAVAX-34 (Carbathiin 34% SN)

VITAFLO-280 (Carbathiin 14.9% + Thiram 13.2% SU)
THIRAM 75 WP (Thiram 75% WP)
CAPTAN 30-DD (Captan 28.7% SU)

METHODS: This cooperative study consisted of three separate trials.
MAXIM TRIAL: Six treatments, with MAXIM 4FS (treatment M65) as the standard against which all other treatments were compared (see Table 1). The test fungicides were applied to the cultivar CNS 710 (Crisp 'n Sweet), which is moderately susceptible to seedling blight.

GUSTAFSON TRIAL: Nine treatments, with CAPTAN 400 + THIRAM 42-S (treatment G41) as the standard (see Table 1), were applied to the cultivar Honey 'n Pearl. It is susceptible to seedling blight.

NSCBA (National Sweet Corn Breeders Association) TRIAL: Nine treatments, with THIRAM 42-S + APRON-FL (treatment NS97) as the standard (see Table 1). Ultimate, which is moderately susceptible to seedling blight, was the cultivar used.

The three sweet corn cultivars used in these trials were analyzed for seed-borne fungi before the fungicides were applied. These assays revealed the following levels of contamination (% seeds infested): Honey 'n Pearl-*Fusarium* spp. (96) and *Penicillium* spp. (94); Ultimate-*Fusarium* spp. (90) and *Penicillium* spp. (43), and CNS 710 (percentages were similar to Ultimate). The fungicides were applied in measured amounts onto seed that was tumbled in a rotating drum. Water was added to the test products to create a slurry that was comparable to a commercial treating rate of 888 mL of mixture per 45 kg of seed (30 U.S. fl. oz./cwt.). Most of the seed was treated by the Crookham Co., packaged and sent to ASCHRC. Seed treated with THIRAM 75 WP, VITAFLO-280 and CAPTAN 30-DD (NSCBA Trial, see Table 1) was prepared at the ASCHRC.

Naturally infested soil taken from a commercial corn field in southern Alberta was dispensed into 15 cm diameter plastic pots, each of which held ca. 1500 mL. Individual treatments in each of the three trials were planted into four pots (replicates) using 25 corn seeds per pot. Seeding occurred on August 10 and the pots were arranged in a randomized complete block design in a growth chamber set at 10°C for one month, then at 20°C for the remaining 2 weeks of the experiment. The trials were terminated on September 27. Data taken included emergence (no. plants per pot), and vigour and uniformity, which were subjectively rated on a scale from 1 (poor) to 5 (very good). All data values were subjected to analysis of variance (ANOVA).

RESULTS: As presented in the table.
MAXIM TRIAL: Seedling growth in this trial was poor and no significant differences in percent emergence, vigour or uniformity were observed.

GUSTAFSON TRIAL: Despite the poor growth of plants in this trial, significant differences between some treatments were noted. In general, treatments G45, G46 and G47 outperformed G41, the standard.

NSCBA TRIAL: None of the fungicides evaluated significantly outperformed the standard treatment, NS97. Emergence, vigour and uniformity of seedlings in treatments NS98, NS99, NS100 and NS101 were not significantly different from NS97 in all but one case, i.e. vigour of NS101. VITAFLO-280, THIRAM 75 WP and CAPTAN 30-DD were all significantly poorer than the standard and, in fact, grew no better than the untreated check.

CONCLUSIONS: The overall growth of the plants in these trials was poor, possibly due to the low ambient temperature (10°C) that was used for the first 4 weeks after seeding. Nevertheless, it was clear that many of the new, multiple combination treatments under test performed much better on super sweet corn cultivars than some of the single or dual component seed treatments currently being used in Canada.

Table 1. Emergence, vigour and uniformity ratings for three cultivars of super sweet corn grown from seed treated with various fungicides, either singly or in combination, in three different growth chamber trials at the ASCHRC, Brooks, Alberta, 1994.*

Treatment	Rate product (mL/kg seed)	Emergence** (%)	Vigour (0-5)	Uniformity (0-5)
MAXIM TRIAL				
(M66) MAXIM	0.10	21.1	2.0	3.0
(M67) CAPTAN	2.62	25.5	3.5	3.8
THIRAM	2.62			
IMAZALIL	0.99			
(M71) MAXIM	0.21	9.8	2.3	3.0
APRON	0.49			
(M72) CAPTAN	2.62	32.9	3.0	3.0
THIRAM	2.62			
IMAZALIL	0.99			
APRON	0.49			
(M73) CAPTAN	2.62	13.2	2.5	2.5
THIRAM	2.62			
IMAZALIL	0.32			
APRON	0.49			
VITAVAX	1.31			
(M74) MAXIM	0.10	6.6	2.8	2.7
APRON	0.49			
VITAVAX	1.31			
ANOVA P#0.05		ns	ns	ns
Coefficient of Variation (%)		47.9	41.4	31.1

GUSTAFSON TRIAL

(G41)	CAPTAN	1.97	0.0 c	0.0 c	0.0 b
	THIRAM	1.31			
(G42)	CAPTAN	1.97	0.0 c	0.0 c	0.0 b
	THIRAM	1.31			
	FLO-PRO IMZ.	0.32			
(G43)	CAPTAN	1.97	2.3 bc	2.8 a	2.3 a
	THIRAM	1.31			
	APRON	0.66			
(G44)	CAPTAN	1.97	6.5 ab	1.0 bc	1.5 ab
	THIRAM	1.31			
	APRON	0.32			
(G45)	CAPTAN	1.97	12.8 a	2.0 ab	2.8 a
	THIRAM	1.31			
	ANCHOR	0.49			
(G46)	THIRAM	1.31	3.7 ab	1.5 abc	1.8 a
	APRON	0.49			
	IMAZALIL	0.32			
(G47)	CAPTAN	1.97	6.6 ab	2.0 ab	2.5 a
	APRON	0.49			
	IMAZALIL	0.32			
(G51)	THIRAM	1.31	0.0 c	0.0 c	0.0 b
	IMAZALIL	0.32			
	ANCHOR	0.49			
(G52)	THIRAM	1.31	2.5 bc	1.2 bc	1.3 ab
	IMAZALIL	0.32			
	ANCHOR	0.99			
ANOVA P#0.05			s	s	s
Coefficient of Variation (%)			72.8	79.4	70.2

NSCBA TRIAL					
(NS97)	THIRAM	3.29	15.7 a	2.8 a	2.8 a
	APRON	0.99			
(NS98)	THIRAM	3.29	8.1 ab	2.0 ab	2.5 a
	APRON	0.99			
	FLO-PRO IMZ	0.32			
(NS99)	THIRAM	3.29	18.7 a	2.8 a	3.3 a
	APRON	0.99			
	TOPSIN-M	1.97			
(NS100)	THIRAM	3.29	2.9 bc	1.5 abc	2.0 ab
	ANCHOR	0.99			
	IMAZALIL	1.97			
(NS101)	THIRAM	3.29	9.1 ab	1.3 bcd	1.8 ab
	ANCHOR	0.99			
	TOPSIN-M	1.97			
VITAFLO-280		2.80	0.0 c	0.0 d	0.0 c
THIRAM 75 WP		2.20	0.0 c	0.0 d	0.0 c
CAPTAN 30-DD		2.10	0.0 c	0.0 d	0.0 c
Untreated check		-	0.4 c	0.2 cd	0.8 bc
ANOVA P#0.05			s	s	s
Coefficient of Variation (%)			70.9	77.1	72.1

* The values in this table are means of four replications. Numbers followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P#0.05).

** Emergence data were arcsin-transformed prior to ANOVA and the detransformed means are presented here.

#107

ICAR: 2090230C

CROP: Corn, sweet, (*Zea mays* L.), cvs. Crisp n' Sweet, Honey 'n Pearl and Ultimate

PEST: Seedling blight, *Pythium* spp., *Rhizoctonia solani*, *Penicillium* spp., *Fusarium* spp., *Trichoderma* spp.

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TITLE: EFFICACY OF TWELVE SEED TREATMENT FUNGICIDES USED SINGLY OR IN MULTIPLE COMBINATIONS AGAINST SEEDLING BLIGHT ON SUPER SWEET CORN: II. FIELD TRIALS IN SOUTHERN ALBERTA IN 1994

MATERIALS: THIRAM 42-S (Thiram 42% SU)
APRON-FL (Metalaxyl 28.35% SU)
ANCHOR FLOWABLE (Oxadixyl 31% SU)
NU-ZONE 10ME (Imazalil 10.4% SN)
TOPSIN-M 4.5F (Thiophanate-methyl 46.2% SU)

FLO-PRO IMZ (Imazalil 31% SN)
MAXIM 4FS (Fludioxonil 42% SU)
CAPTAN 400 (Captan 37.4% SU)
CAPTAN 30-DD (Captan 28.7% SU)
VITAVAX-34 (Carbathiin 34% SN)
VITAFLO-280 (Carbathiin 14.9% + Thiram 13.2% SU)
THIRAM 75 WP (Thiram 75% WP)

METHODS: This cooperative study consisted of three separate trials.
MAXIM TRIAL: Six treatments, with MAXIM 4FS (treatment M65) as the standard against which all other treatments were compared (see Table 1). The test fungicides were applied to the cultivar CNS 710 (Crisp 'n Sweet), which is moderately susceptible to seedling blight.

GUSTAFSON TRIAL: Nine treatments, with CAPTAN 400 + THIRAM 42-S (treatment G41) as the standard (see Table 1), were applied to the cultivar Honey 'n Pearl. It is susceptible to seedling blight.

NSCBA (National Sweet Corn Breeders Association) TRIAL: Nine treatments, with THIRAM 42-S + APRON-FL as the standard (see Table 1). Ultimate, which is moderately susceptible to seedling blight, was the cultivar used.

The three sweet corn cultivars used in these trials were analyzed for seed-borne fungi before the fungicides were applied. These assays revealed the following levels of contamination (% seeds infested): Honey 'n Pearl-*Fusarium* spp. (96) and *Penicillium* spp. (94); Ultimate-*Fusarium* spp. (90) and *Penicillium* spp. (43), and CNS 710 (percentages were similar to Ultimate). The fungicides were applied in measured amounts onto seed that was tumbled in a rotating drum. Water was added to the test products to create a slurry that was comparable to a commercial treating rate of 888 mL of mixture per 45 kg of seed (30 U.S. fl. oz./cwt.). Most of the seed was treated by the Crookham Co., packaged and sent to ASCHRC. Seed treated with THIRAM 75 WP, VITAFLO-280 and CAPTAN 30-DD (NSCBA Trial, see Table 1) was prepared at the ASCHRC.

The treatments within each trial were arranged in a random complete block design with four replications. Each subplot consisted of 1 x 6 m row, the spacing between rows was 30 cm, and the seeding rate was 33 seeds per row. All three trials were planted by hand on May 9 in a commercial corn field near Taber in southern Alberta. Data collected from the trials included emergence (number of plants in a 2 m section of the center of each row), and vigour and uniformity, which were subjectively rated on a scale from 1 (poor) to 5 (very good). Each trial was assessed twice, once on June 6 when the corn was at the 3 leaf stage and again on June 15 when it was at the 4 to 5 leaf stage. The emergence counts were converted to percentages, and all of the data were subjected to analysis of variance (ANOVA).

RESULTS: As presented in the table.

MAXIM TRIAL: Overall, the emergence, vigour and uniformity of stands were fair to satisfactory. No significant differences in percent emergence and uniformity were noted between any of the treatments for either date when ratings were taken. A similar trend was seen for vigour measurements done on June 6. On June 15, however, the vigour of plants in treatments M71 and M74 were significantly poorer than in the standard treatment M66.

GUSTAFSON TRIAL: The condition of plants in this trial was generally poor and no significant differences between treatments were observed for any of the data variables measured.

NSCBA TRIAL: Although the condition of the seedlings in this trial was generally poor, some significant differences were detected between treatments. Treatments NS99 and NS101 generally performed the best in promoting emergence, vigour and uniformity, even though they were often not significantly better than the standard NS97. VITAFLO-280, THIRAM 75 WP AND CAPTAN 30-DD were the poorest-performing treatments and, in most cases, were no better than the untreated check.

CONCLUSIONS: Unfavourable growing conditions may have affected the results of these trials. Warm, dry weather following seeding, the inability to irrigate the part of the field where the plots were seeded, and prolific germination of red root pigweed and millet were confounding factors. Most of the seed treatments registered in Canada for use on sweet corn contain older fungicides, such as CAPTAN, THIRAM, CARBATHIIN, MANEB and MANCOZEB. There is evidence that these products may not adequately protect the new "Super Sweet" cultivars of sweet corn against seedling blight, hence the need to continue trials such as these in order to identify newer, more effective treatments.

Table 1. Emergence, vigour and uniformity ratings for seedlings of three cultivars of super sweet corn grown from seed treated with various fungicides, either singly or in combination, in three different trials in southern Alberta, 1994.*

Treatment	Rate product (mL/kg seed)	Emergence** (%)		Vigor (0-5)		Uniformity (0-5)	
		June 6	June 15	June 6	June 15	June 6	June 15
			MAXIM TRIAL				
(M66) MAXIM	0.10	80.3	78.3	2.5	3.5 a	2.8	2.8
(M67) CAPTAN	2.62	69.6	71.1	2.5	3.0 ab	2.5	2.5
THIRAM	2.62						
IMAZALIL	0.99						
(M71) MAXIM	0.21	52.3	56.9	2.0	2.0 c	2.0	2.3
APRON	0.49						
(M72) CAPTAN	2.62	79.0	87.7	2.0	3.0 ab	2.0	2.8
THIRAM	2.62						
IMAZALIL	0.99						
APRON	0.49						
(M73) CAPTAN	2.62	91.3	93.2	2.3	2.8 abc	2.5	2.8
THIRAM	2.62						
IMAZALIL	0.32						
APRON	0.49						
VITAVAX	1.31						
(M74) MAXIM	0.10	71.8	84.4	1.8	2.3 bc	2.0	2.5
APRON	0.49						
VITAVAX	1.31						
ANOVA P#0.05		ns	ns	ns	s	ns	ns
Coefficient of Variation (%)		24.0	22.6	23.3	18.0	24.2	20.4

		GUSTAFSON TRIAL					
(G41)	CAPTAN THIRAM	1.97 1.31	44.3	23.6	1.5	2.0	1.3	1.8
(G42)	CAPTAN THIRAM FLO-PRO IMZ	1.97 1.31 0.32	67.5	32.2	2.3	2.5	2.3	2.5
(G43)	CAPTAN THIRAM APRON FA-12	1.97 1.31 0.66	40.3	24.1	1.8	1.8	1.5	1.8
(G44)	CAPTAN THIRAM APRON	1.97 1.31 0.32	54.3	45.4	1.3	1.8	1.5	2.0
(G45)	CAPTAN THIRAM ANCHOR	1.97 1.31 0.49	40.6	33.5	1.8	1.5	1.8	1.3
(G46)	THIRAM APRON IMAZALIL	1.31 0.49 0.32	69.1	66.4	2.5	2.3	2.0	2.0
(G47)	CAPTAN APRON IMAZALIL	1.97 0.49 0.32	77.7	65.8	2.5	2.3	2.0	2.5
(G51)	THIRAM IMAZALIL ANCHOR	1.31 0.32 0.49	78.8	59.3	2.0	2.0	2.0	2.5
(G52)	THIRAM IMAZALIL ANCHOR	1.31 0.32 0.99	40.3	45.4	1.8	2.0	1.5	1.8
ANOVA P#0.05			ns	ns	ns	ns	ns	ns
Coefficient of Variation (%)			29.8	36.9	35.5	37.7	40.9	44.6

NSCBA TRIAL							
(NS97) THIRAM	3.29	64.3 abc	48.5 bcd	2.5 a	2.8 abc	2.3	2.8 ab
APRON	0.99						
(NS98) THIRAM	3.29	63.9 abc	57.1 abc	1.8 ab	2.8 abc	2.3	2.5 ab
APRON	0.99						
FLO-PRO IMZ	0.32						
(NS99) THIRAM	3.29	82.3 ab	80.7 a	2.3 a	3.0 ab	2.3	2.5 ab
APRON	0.99						
TOPSIN-M	1.97						
(NS100) THIRAM	3.29	71.3 abc	68.4 abc	2.5 a	3.0 b	2.5	3.0 a
ANCHOR	0.99						
IMAZALIL	0.32						
(NS101) THIRAM	3.29	90.0 a	75.0 ab	2.3 a	3.5 a	2.3	3.3 a
ANCHOR	0.99						
TOPSIN-M	1.97						
VITAFLO-280	2.80	52.4 bcd	37.9 cd	1.5 ab	2.0 cd	1.8	2.0 bc
THIRAM 75 WP	2.20	42.7 cd	43.0 cd	1.5 ab	2.5 bc	2.3	2.5 ab
CAPTAN 30-DD	2.10	29.2 d	21.8 d	1.5 ab	1.5 d	2.0	1.5 c
Untreated check	-	23.6 d	19.8 d	1.3 b	1.5 d	1.3	1.5 c
ANOVA P#0.05		s	s	s	s	ns	s
Coeff. of Variation (%)		24.0	24.5	31.8	21.5	31.2	21.2

* The values in this table are means of four replications. Numbers followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P#0.05).

** Emergence data were arcsin-transformed prior to ANOVA. The detransformed means are presented here.

#108

STUDY DATA BASE: 390-1252-9201

CROP: Lettuce, head, cv. Target

PEST: Gray mold, *Botrytis cinerea* Pers.

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TITLE: EFFICACY OF FUNGICIDES AGAINST BOTRYTIS CINEREA ON LETTUCE

MATERIALS: ROVRAL WDG 500 g/kg (Iprodione)
TRITON XR (Non-ionic surfactant)
CANPLUS 411 (surfactant)
RONILAN 50 WP (Vinclozolin)

METHODS: The trial was conducted at Pacific Agricultural Research Centre, Agassiz, British Columbia. Target lettuce plants were transplanted on July 8, 1994. Plants were space 25 cm apart. Treatment plots were 5 m x 0.4 m and were replicated four times in a randomized complete block design. The fungicide treatments were applied four times, August 3, 9, 17 and 25, 1994. Plots were irrigated with 6 cm of water on July 15 and again on August 16. *Botrytis cinerea* inoculum was sprayed on all plots except for the uninoculated check plots, on August 10. At maturity lettuce plants were harvested and graded. Head diameter and weight was recorded and disease symptoms rated. Data were statistically analyzed.

RESULTS: The fungicide treatments affected the percentage of lettuce heads culled due to rot with ROVRAL alone or combined with a surfactant having significantly less decay than both checks.

CONCLUSIONS: ROVRAL can reduce the amount of rot in lettuce due to *Botrytis cinerea*.

Table 1. Yield results from field lettuce trial.

Treatments	Rate a.i./ha	Average Head Wt* grams	Percentage of Diseased Heads
Uninoculated check	---	931 ab	36.6 a
Inoculated check	---	864 b	41.7 a
ROVRAL	0.75 kg	834 b	12.0 b
ROVRAL + non-ionic surfactant	0.75 kg 0.25% v/v	1028 a	11.6 b
ROVRAL + CANPLUS 411	0.75 kg 2.0% v/v	931 ab	5.6 b
RONILAN	1.1 kg	1039	17.1 ab

* Means calculated from four replications. Numbers in each column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05).

#109

ICAR: 206003

CROP: Lettuce, cv. Ithaca

PEST: Lettuce drop, *Sclerotinia sclerotiorum* (Lib.) de Bary and *Sclerotinia minor* Jagger

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TITLE: EFFICACY OF CALCIUM NITRATE FOR THE CONTROL OF SCLEROTINIA DROP OF DIRECT SEEDED LETTUCE

MATERIALS: DITHANE M-22 (Maneb 80%)
CALCIUM NITRATE (Ca 19%)

METHODS: Lettuce was direct seeded into naturally-infested soil at the Muck Research Station on July 25, 1994. A randomized complete block arrangement with 6 blocks per treatment was used. Each replicate consisted of 4 rows x 5 m long. DITHANE M-22 was used as a standard treatment for comparison with three calcium nitrate solutions, as well as an untreated control. DITHANE M-22 was applied at the rate of 2.25 kg a.i./ha. The three calcium nitrate solutions evaluated were 0.005% Ca, 0.05% Ca, and 0.5% Ca. Treatments were applied as foliar sprays at 60 p.s.i. in 550 L/ha of water on August 18 and 25, September 2, 8, 15, 22, 29 and October 6. The trial was harvested and evaluated on October 13, 1994. The number of lettuce heads infected with sclerotinia was assessed at harvest.

RESULTS: As presented in the table.

CONCLUSIONS: There were no significant differences among treatments for percent marketable, marketable weight or percent disease.

Table 1. Evaluation of calcium nitrate and DITHANE M-22 for the control of lettuce drop.

Treatment	Percent marketable	Marketable weight (kg)	Percent disease
Untreated control	53.9 a*	8.4 a	34.7 a
DITHANE M-22	50.1 a	10.1 a	43.9 a
0.005% CALCIUM	50.5 a	8.3 a	37.8 a
0.05% CALCIUM	54.4 a	9.2 a	34.0 a
0.5% CALCIUM	54.5 a	10.0 a	37.8 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#110

ICAR: 206003

CROP: Lettuce, cv. Ithaca

PEST: Lettuce drop, *Sclerotinia sclerotiorum* (Lib.), de Bary and *Sclerotinia minor* Jagger

NAME AND AGENCY:
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TITLE: EFFICACY OF CALCIUM NITRATE FOR THE CONTROL OF SCLEROTINIA DROP OF TRANSPLANTED LETTUCE

MATERIALS: DITHANE M-22 (Maneb 80%)
CALCIUM NITRATE (Ca 19%)

METHODS: Lettuce was seeded into 128 plugs on April 13, 1994. Lettuce plugs were transplanted on May 20, 1994 into naturally-infested soil at the Muck Research Station. A randomized complete block arrangement with 6 blocks per treatment was used. Each replicate consisted of 4 rows x 5 m long. DITHANE M-22 was used as a standard treatment for comparison with three calcium nitrate solutions, as well as an untreated control. DITHANE M-22 was applied at the rate of 2.25 kg product per ha. The three calcium nitrate solutions evaluated were 0.1% Ca., 1% Ca., and 10% calcium. Treatments were applied as foliar sprays at 60 p.s.i. in 550 L/ha of water at 7 d intervals starting on June 9, 16, 23 and 30 and July 7. The trial was harvested and evaluated on July 13, 1994. The number of lettuce heads infected with sclerotinia was assessed at harvest.

RESULTS: As presented in Table 1. Lettuce treated with the 10% calcium solution showed severe phytotoxicity symptoms (browning, shrivelling) after the second spray application. The 10% Ca solution was not applied after the symptoms of phytotoxicity were noticed. The lettuce treated with 1% calcium also showed slight tip burn damage around the outer leaves on most marketable heads at harvest.

CONCLUSIONS: Significant differences in the control of sclerotinia drop of lettuce were found. Applications of DITHANE M-22 resulted in the highest percent marketable, highest marketable weight and second lowest percent disease. Applications of 10% calcium resulted in the lowest percent marketable, lowest marketable weight and lowest percent disease due to severe phytotoxicity.

Table 1. Evaluation of calcium nitrate and DITHANE M-22 for the control of lettuce drop.

Treatment	Percent marketable	Marketable weight (kg)	Percent disease
Untreated control	40.6 b*	17.7 b	55.4 a
DITHANE M-22	65.4 a	31.4 a	34.9 b
0.1% Calcium	44.0 b	20.7 b	53.8 a
1.0% Calcium	40.0 b	15.8 b	57.5 a
10% Calcium	3.1 c	1.2 c	22.6 b

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#111

ICAR: 2090230B

CROP: Monarda, *Monarda fistulosa* L., cv. Morden-3

PEST: Powdery mildew, *Erysiphe cichoracearum* DC.:Mérat;
Rust, *Puccinia calcitrapae* DC. var. *centaureae* (DC.) Cummins

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TITLE: EFFICACY OF SIX FUNGICIDES AGAINST POWDERY MILDEW AND RUST ON MONARDA IN SOUTHERN ALBERTA, 1994

MATERIALS: MICRO-NIASUL W (Sulphur 92% WP)
TILT 250E (Propiconazole 250 g/L EC)
NOVA 40W (Myclobutanil 40% WP)
LIME SULPHUR SOLUTION (Sulphide Sulphur 22% SN)
SULCHEM 92 (Sulphur 95% WG)
COMPANION AGRICULTURAL ADJUVANT
(octylphenoxypolyethoxy-(9)-ethanol 70% SN)

METHODS: This trial was conducted in an experimental plot of monarda at the ASCHRC, Brooks. The rows were spaced 1.0 m apart and the spacing between plants within rows was 0.5 m. Each treatment (see Table 1) was applied to four, 20 m^2 subplots, each containing approximately 40 plants. A similar set of subplots was sprayed with tapwater as a check. The non-ionic adjuvant COMPANION was added to the spray mixture containing NOVA 40W at a rate of 1.0 mL/L. The treatments were arranged in a randomized complete block design. The sprays were applied with a CO_2 propelled, hand-held boom sprayer equipped with four, Tee Jet 8002 nozzles. The spray was directed onto the top and exposed sides of each row. The plants were 30-40 cm and had flower buds on June 20 when the sprays were applied. The equivalent of 200 L/ha of spray mixture was applied to each subplot using a boom pressure of 250 kPa. Powdery mildew was just beginning to appear on the bottom leaves of the plants at this time, but no rust symptoms were seen. From July 20 to 21, visual ratings of mildew and rust severity were made by collecting 25 stems from each subplot and counting the number of leaves with mildew and/or rust per stem. These counts were converted to percentages, arcsin-transformed, and subjected to analysis of variance (ANOVA).

At full bloom (July 25), which is the optimum time for harvesting this crop, 2 kg of plant material was cut from each subplot. A 500 g subsample from each harvested lot was oven dried at 40°C for 48 h and the dry weight was determined. The rest of the material was frozen at -20°C immediately after cutting. Two weeks later, a 500 g subsample of frozen plants from each subplot was chopped and placed in a hydrodistillation flask where the essential oils were extracted, condensed and the volume measured. A small amount of each oil sample was subjected to gas-liquid chromatography to determine the percent geraniol, the principal essential oil in monarda. The oil yields were also statistically analyzed.

RESULTS: See Table 1. The levels and uniformity of powdery mildew and rust infection in the trial were high. NOVA 40W provided the best control of powdery mildew on both the upper and lower surfaces of leaves, but the disease incidence in this treatment was still relatively high. SULCHEM 92 and MICRO-NIASUL W also significantly reduced the amount of powdery mildew relative to the check, but only on the upper surface of the leaves. None of the fungicides adequately controlled rust. Oil yields from the subplots treated with NOVA 40W and LIME SULPHUR were significantly higher than the check. NOVA 40W-treated plants also had significantly more oil than those sprayed with TILT 250E and MICRO-NIASUL W, but did not out yield those treated with SULCHEM 92 or LIME SULPHUR SOLUTION. NOVA 40W was the only fungicide to significantly increase the percent geraniol compared to the check and to the other products under test.

CONCLUSIONS: NOVA 40W provided the best control of powdery mildew under the conditions of this trial and it also significantly improved the yield and quality of oil extracted from the foliage. Additional trials to evaluate rates, timing and frequency of application are necessary to further improve mildew and rust control on monarda.

Table 1. Powdery mildew and rust incidence, oil yield and percent geraniol in monarda sprayed with five fungicides at Brooks, Alberta, in 1994.*

Treatment	Rate (product/ha)	Mildewed leaves (%)** Upper surface	Mildewed leaves (%)** Lower surface	Rust (%)**	Oil yield (mL/100 g oven dry wt.)	Geraniol (%)
MICRO-NIASUL W	5.0 kg	76.6 bc	81.9 a	91.5	2.43 bc	94.00 a
TILT 250E	0.5 L	92.2 ab	77.7 a	91.9	2.47 bc	94.17 a
NOVA 40W	0.25 kg	54.3 c	21.0 b	82.2	3.00 a	94.54 b
LIME SULPHUR	9.4 L	87.9 ab	83.4 a	86.3	2.84 ab	94.00 a
SULCHEM 92	4.0 kg	69.2 bc	76.5 a	85.0	2.72 abc	94.14 a
Untreated check	-	100.0 a	85.6 a	90.9	2.27 c	93.84 a
ANOVA P#0.05		s	s	ns	s	s
Coefficient of Variation (%)		20.4	27.0	16.8	11.3	0.2

* The values in this table are the means of four replications. Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P#0.05).

** These data were arcsin-transformed prior to ANOVA and the detransformed means are presented here.

#112

ICAR: 206003

CROP: Onions, yellow cooking, cv. Benchmark

PEST: Botrytis leaf blight, *Botrytis squamosa* J.C. Walker

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TITLE: EFFICACY OF FUNGICIDES FOR THE CONTROL OF BOTRYTIS LEAF BLIGHT OF ONIONS

MATERIALS: BRAVO 500 (Chlorothalonil)
BRAVO ULTREX (Chlorothalonil)
ASC-67098Z
FLUAZINAM 500
ZINEB 80W (Zineb)
DITHANE DG (Mancozeb)
ROVRAL (Iprodione)
DACOBRE DG
BRAVO ZN

METHODS: Onions, cv. Benchmark, were seeded at the Muck Research Station on May 7, 1994. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of 8 rows x 5 m long. The treatments consisted of 1) BRAVO 500 at 2.0 L product/ha, 2) BRAVO ULTREX at 1.2 kg product/ha, 3) ASC-67098Z at 1.2 kg product/ha 4) FLUAZINAM 500F at 1.0 L product/ha, 5) Standard fungicide treatment programme as recommended in Publication 363, 6) DACOBRE DG at 4 kg product/ha, 7) BRAVO ZN at 2.0 L product/ha and 8) untreated control. All fungicides were applied as foliar sprays using solid cone nozzles at 90 p.s.i.

and 500 L/ha water. Treatments were applied on July 21 and 27, August 3, 10 and 23. A preliminary assessment of botrytis leaf blight was done on August 17. Ten plants per replicate were sampled and the three oldest leaves with a minimum of 80% green leaf tissue per plant were rated for total number of blight lesions. The total number of green and dead leaves per plant was also recorded. A final assessment of botrytis leaf blight was done on September 20 with 25 plants per replicate. The three oldest leaves per plant, with a minimum of 80% green leaf tissue, were rated for percent of leaf blight using the Manual of Assessment Keys for Plant Diseases by Clive James, Key No. 1.6.1. The number of green and dead leaves per plant were also recorded.

RESULTS: As presented in the table.

CONCLUSIONS: The fungicide applications did not significantly reduce the total number of botrytis lesions or the percentage of botrytis blight at harvest compared to the untreated check.

Table 1. Efficacy of fungicides on number of blight lesions, percent of botrytis leaf blight and number of green and dead leaves.

Treatment	Rate (product /ha)	Preliminary Assessment: Total No. of lesions	Preliminary Assessment: No. of dead leaves /plant	Preliminary Assessment: No. of green leaves /plant	Final Assessment: Percent blight	Final Assessment: No. of dead leaves /plant	Final Assessment: No. of green leaves /plant
BRAVO 500	2.0 L	15.4 a**	1.5 a	7.9 a	5.75 a	4.6 a	7.2 a
BRAVO ULTREX	1.2 kg	20.8 a	1.6 a	8.5 a	3.75 a	4.2 a	7.5 a
ASC-67098Z	1.2 kg	34.2 a	1.6 a	8.3 a	8.25 a	5.2 a	5.7 a
FLUAZINANM 500F	1.0 L	20.5 a	1.2 a	7.9 a	5.50 a	4.3 a	7.0 a
Standard Fungicide*	---	35.8 a	1.8 a	8.1 a	6.00 a	4.9 a	6.8 a
DACOBRE	4.0 kg	29.6 a	1.3 a	7.5 a	9.75 a	4.3 a	7.0 a
BRAVO ZN	2.0 L	16.3 a	1.5 a	8.5 a	6.00 a	3.7 a	7.6 a
Untreated Control	---	35.2 a	1.7 a	7.7 a	6.25 a	5.0 a	6.9 a

* Standard fungicide programme as recommended in Publication 363, Vegetable Production Recommendations, page 70.

** Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#113

ICAR: 206003

CROP: Onions, yellow cooking, cv. Benchmark

PEST: Botrytis leaf blight, *Botrytis squamosa* J.C. Walker

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TITLE: EFFICACY OF TWO FORMULATIONS OF PENNCOZEB FOR THE CONTROL OF BOTRYTIS LEAF BLIGHT

MATERIALS: PENNCOZEB 75DF, PENNCOZEB 80WP (ethylenebisdithiocarbamate)

METHODS: Onions were seeded into organic soil at the Muck Research Station on May 7, 1994. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of 8 rows x 5 m long. PENNCOZEB 75DF AND PENNCOZEB 80WP were applied singly at 3.25 kg product/ha. An untreated check was also included. Treatments were applied on July 26, August 3, 16, and 24, 1994 as foliar sprays at 50 p.s.i., in 500 L of water. Ten plants per replicate were harvested on August 19, 1994. The three lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for number of blight lesions. The number of green and dead leaves on each plant was also recorded. Twenty-five plants per replicate were harvested on September 6 and 7, 1994. The three lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for percent green leaf area using the Manual of Assessment Keys for Plant Disease by Clive James, Key No. 1.6.1. The number of green and dead leaves on each plant was also recorded.

RESULTS: As presented in the tables.

CONCLUSIONS: The fungicide applications did not reduce the level of botrytis leaf blight compared to the untreated check, although by September 7 the untreated onions tended to have more dead and fewer green leaves.

Table 1. Evaluation of PENNCOZEB 75DF and 80WP for the control of botrytis leaf blight lesions on the three oldest green leaves, August 19, 1994.

Treatment	Rate (kg product/ha)	Total No. of lesions/3 leaves	No. of dead leaves/plant	No. of green leaves/plant
PENNCOZEB 75DF	3.25	53.6 a*	3.2 a	7.1 a
PENNCOZEB 80WP	3.25	41.4 a	2.4 a	7.3 a
Check	---	45.5 a	2.9 a	7.0 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

Table 2. Evaluation of PENNCOZEB 75DF and 80WP for the control of Botrytis leaf blight of onions, September 7, 1994.

Treatment	Rate (kg product/ha)	Percent green tissue	No. of dead leaves/plant	No. of green leaves/plant
PENNCOZEB 75DF	3.25	82.5 a*	4.53 a	6.45a
PENNCOZEB 80WP	3.25	87.5 a	4.55 a	6.78a
Check	---	80.0 a	5.43 a	5.45a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#114

ICAR: 206003

CROP: Onions, yellow cooking, cv. Benchmark

PEST: Botrytis leaf blight, *Botrytis squamosa* J.C. Walker

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TITLE: EFFICACY OF TWO FORMULATIONS OF IPRODIONE AND DITHANE DG FOR THE CONTROL OF BOTRYTIS LEAF BLIGHT

MATERIALS: ROVRAL 50WP (Iprodione)
DITHANE DG (Mancozeb 75%)
EXP-10370A 50 WG (Iprodione)
BRAVO 500 (Chlorothalonil)

METHODS: Onions were seeded into organic soil at the Muck Research Station on May 7, 1994. A randomized complete block arrangement with 4 blocks per treatment was used. Each replicate consisted of 8 rows x 5 m long. ROVRAL 50 WP and EXP-10370A were applied singly at 0.75 kg product/ha and at a rate of 0.75 kg product/ha in combination with DITHANE DG at 2.0 kg product/ha. BRAVO 500 was applied singly at a rate of 2.0 L product/ha. An untreated check was also included. Treatments were applied on July 26, August 3, 10, and 24, 1994, as foliar sprays at 50 p.s.i. in 500 L of water. Ten plants per replicate were harvested on August 19, 1994. The three lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for number of blight lesions. The number of green and dead leaves on each plant was also recorded. Twenty-five plants per replicate were harvested on September 6 and 7, 1994. The three lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for percent green leaf area using the Manual of Assessment Keys for Plant Disease by Clive James, Key No. 1.6.1. The number of green and dead leaves on each plant was also recorded.

RESULTS: As presented in the tables.

CONCLUSIONS: During the first evaluation for number of Botrytis lesions no significant differences were found. For the final evaluation of percent green tissue, all treatments except ROVRAL and EXP-10370A alone were significantly better than the untreated check.

Table 1. Evaluation of iprodione, DITHANE DG and BRAVO 500 for the control of botrytis leaf blight lesions on the three oldest green leaves, August 19, 1994

Treatment	Rate (kg product/ha)	Total No. of lesions/3 leaves	No. of dead leaves/plant	No. of green leaves/plant
ROVRAL 50 WP	0.75	56.2	2.9	7.0
ROVRAL 50 WP	0.375	54.7	2.7	7.6
+ DITHANE DG PLUS	2.0			
EXP-10370A 50 WG	0.75	61.0	2.6	7.6
EXP-10370A 50 WG	0.375	39.3	2.3	7.3
+ DITHANE DG PLUS	2.0			
BRAVO 500	2.0 L	33.9	2.1	7.6
Check	---	45.5	2.9	7.0

Note: There were no significant differences between treatments for any of the 3 parameters measured (P = 0.05), Protected L.S.D. Test.

Table 2. Evaluation of Iprodione, DITHANE DG and BRAVO 500 for the control of Botrytis leaf blight of onions, September 7, 1994.

Treatment	Rate (kg product/ha)	Percent green tissue	No. of dead leaves/plant	No. of green leaves/plant
ROVRAL 50 WP	0.75	84.0 abc*	4.33 b	6.41 a
ROVRAL 50 WP	0.375	91.5 bc	4.07 b	6.89 a
+ DITHANE DG PLUS	2.0			
EXP-10370A 50 WG	0.75	82.5 ab	4.12 b	6.62 a
EXP-10370A 50 WG	0.375	94.8 c	3.86 b	7.08 a
+ DITHANE DG PLUS	2.0			
BRAVO 500	2.0 L	94.3 c	3.72 b	6.53 a
Check	---	80.0 a	5.43 a	5.45 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#115

ICAR: 206003

CROP: Onions, yellow cooking

PEST: Botrytis leaf blight, *Botrytis squamosa* J.C. Walker

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TITLE: EVALUATION OF BOTRYTIS LEAF BLIGHT RESISTANCE IN ONION BREEDING LINES

MATERIALS: Nine onion cultivars were obtained from Dr. I. Goldman, University of Wisconsin, Madison, WI. Three onion cultivars were obtained from T. Walters, Cornell, University, Ithaca, NY. Two commercial onion cultivars, Norstar and

Benchmark were also used.

METHODS: The trial was seeded on May 17, 1994 at the Muck Research Station. A randomized complete block arrangement with 4 blocks per cultivar was used. Cultivars 1590-91, 1598-91, 1608-91, 1610-91 and 93A-78NY each had 1 row x 3 m long, per replicate. Cultivars 902-90, 912-92, 914-93, 921-91, 926-87, Bench mark, Norstar, 93A-74NY and 93A-77NY each had 2 rows per replicate x 3 m long, due to seed availability. The onion seed was planted 1.5 cm deep with 43 cm row spacing using a V-belt push seeder. The controls, Benchmark and Norstar were sprayed on a 7-10 d schedule with fungicides as recommended in Publication 363, *Vegetable Production Recommendations*. The rest of the cultivars in the trial received no fungicide sprays. The onions were evaluated on September 29, 1994 by sampling 25 plants per replicate. The three oldest leaves per plant, with a minimum of 80% green leaf tissue, were rated for percent leaf blight using the *Manual of Assessment Keys for Plant Diseases*, by Clive James, Key No. 1.6.1. The number of green and dead leaves per plant were also recorded.

RESULTS: As presented in the table.

CONCLUSIONS: Line 93A-74NY had the least leaf blight and highest number of green leaves, however this onion does not produce bulbs. Lines 93A-77NY and 93A-78NY also had low levels of blight and high numbers of green leaves. All of the lines had less blight than Benchmark.

Table 1. A comparison of percent of leaf area with disease, number of green leaves per plant and number of dead leaves per plant on yellow cooking onion breeding lines.

Cultivar	Percent disease	No. of green leaves/plant	No. of dead leaves/plant
Benchmark	7.8 a **	6.59 bc	5.07 bcd
1608-91	3.5 b	4.12 f	6.17 ab
1610-91	3.5 b	4.68 ef	5.44 abcd
926-87	3.5 b	5.94 bcde	4.44 d
1590-91	3.3 bc	4.98 ef	6.04 abc
914-93	3.3 bc	4.72 ef	6.05 abc
902-90	3.1 bc	6.59 bc	5.05 bcd
93A-78NY	2.7 bcd	7.23 ab	6.43 a
Norstar	2.3 bcd	5.47 cdef	4.88 cd
1598-91	2.3 bcd	5.37 cdef	5.40 abcd
912-92	2.3 bcd	5.11 def	5.04 bcd
921-91	2.0 bcd	5.38 cde	4.97 bcd
93A-77NY	1.0 cd	6.42 bcd	5.80 abc
93A-74NY*	0.6 d	8.09 a	1.79 e

* 93A-74NY is a bunching-type onion, not yellow cooking onion.
** Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#116

ICAR: 206003

CROP: Onions, yellow cooking, cv. Fortress and Taurus

PEST: Onion smut, *Urocystis cepulae* Frost

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TITLE: EVALUATION OF FORMULATIONS AND METHODS OF APPLYING PRO GRO TO RAW ONION SEED FOR SMUT CONTROL

MATERIALS: PRO GRO (Carbathiin 30% + Thiram 50%)
Methyl cellulose

METHODS: Raw onion seed was treated with either 25, 50 or 75 g of PRO GRO/kg of seed. Other raw seed treatments were 25, 50, 75 g of PRO GRO/kg of seed applied with 1% solution of methyl cellulose as a sticker. An untreated check was also included. The trial was seeded at the Muck Research Station in naturally infested soil. A randomized complete block arrangement with 4 blocks per replicate was used. Each replicate consisted of 2 rows of cv. Fortress and 2 rows of cv. Taurus, 5 m long. The treatments were seeded on May 5, 1994 using a push V-belt seeder delivering a random spacing and a depth of 1.0 - 1.5 cm. Germination counts were taken every second day starting on May 27 and ending on June 13 from a 1 m section of each row. When the onions were at 1 true leaf, a sample of 1 m was harvested, washed and rated for percent smut on June 16. Other samples were taken on July 8 when the onions had three true leaves. A final evaluation of smut was made at harvest on September 14, and 15. The harvest weight was the sum of cv. Fortress and Taurus, taken from the remaining 16 m of onions on October 17.

RESULTS: As presented in the tables.

CONCLUSIONS: Significant differences were found between treatments on cv. Fortress only for the first sampling date of June 16. The check had the highest percent smut, and PRO GRO and methyl cellulose at 75 g/kg had the lowest. Treatment of onion seed with PRO GRO and methyl cellulose significantly increased yields.

Table 1. Evaluation of PRO GRO and METHYL CELLULOSE for control of onion smut on cv. Fortress.

Treatments	Percent infected with smut		
Fortres s	June 16	July 8	Sept. 14
Check	94.5 a*	44.3 a	0.0 a
PRO GRO 25 g/kg	65.0 bc	42.3 a	8.3 a
PRO GRO 50 g/kg	66.8 bc	29.2 a	0.0 a
PRO GRO 75 g/kg	75.2 ab	37.0 a	1.9 a
PRO GRO 25 g/kg + methyl cellulose	67.8 bc	26.6 a	1.4 a
PRO GRO 50 g/kg + methyl cellulose	43.7 cd	35.1 a	1.6 a
PRO GRO 75 g/kg + methyl cellulose	38.1 d	12.5 a	0.0 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

Table 2. Evaluation of PRO GRO and methyl cellulose on onion smut on cv, Taurus

Treatments	Percent infected with smut		
Taurus	June 16	July 8	Sept. 15
Check	76.3	49.5	0.0
PRO GRO 25 g/kg	73.2	32.6	0.0
PRO GRO 50 g/kg	55.6	33.7	0.0
PRO GRO 75 g/kg	65.0	35.0	3.1
PRO GRO 25 g/kg + methyl cellulose	62.2	21.7	2.1
PRO GRO 50 g/kg + 2 methyl cellulose	38.3	30.7	0.0
PRO GRO 75 g/kg + methyl cellulose	61.8	34.8	2.1

Note. There were no statistical differences between treatments for percent infected with smut.

Table 3. Yield data in bushels per acre of Fortress and Taurus together.

Treatments	Rate g/kg seed	Yield B/A
Check	---	139 e*
PRO GRO	25	249 cd
PRO GRO	50	223 de
PRO GRO	75	323 bcd
PRO GRO + methyl cellulose	25	351 abc
PRO GRO + methyl cellulose	50	442 a
PRO GRO + methyl cellulose	75	359 ab

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected L.S.D. Test.

#117

ICAR: 206003

CROP: Onions, yellow cooking

PEST: White rot, *Sclerotium cepivorum* Berk.

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TITLE: EVALUATION OF ONION LINES FOR WHITE ROT RESISTANCE

MATERIALS: Onion breeding lines obtained from Dr. Irwin Goldman, University of Wisconsin, two commercial cultivars Norstar and Fortress.

METHODS: Plots were established on each of three farms, with known histories of white rot, located in the Holland Marsh. The plot size at all sites was 1 m x 4 rows. Seeds from each resistant line were seeded on April 19 in the greenhouse in plug trays. Two commercial cultivars, Norstar and Fortress, were also seeded at the same time. Resistant cultivars were also grown in a plot artificially infested with white rot sclerotia at the Muck Research Station (MRS). Plot size was 7 m x 4 rows. Plug plants were transplanted on June 13 at site 1 and site 2, June 14 at the MRS site and June 15 at site 3. Each line was replicated four times and arranged in a randomized complete block design. The total number of onions and the number of infected onion bulbs were counted at the time of harvest.

RESULTS: As presented in the tables.

CONCLUSIONS: The levels of white rot infection were lower in 1994 than in previous years due to a hot and dry growing season. Levels of white rot infection were consistently low at each of the sites and none of the breeding lines were significantly more resistant to white rot than the commercial cultivars.

Table 1. White rot resistant variety trial 1994.

Line Site 1	Percent Infection	Line Site 2	Percent Infection
1804-93	2.63 a*	1804-93	1.923 a
1800-93	2.505 a	116-93	1.885 a
FORTRESS	2.313 a	1812-93	1.250 a
NORSTAR	1.135 a	123-93	0.892 a
1399-91	1.135 a	FORTRESS	0.805 a
1564-91	1.050 a	NORSTAR	0 a
119-93	0.925 a	1784-93	0 a
105-93	0.862 a	106-93	0 a
125-93	0.757 a	1800-93	0 a
1784-93	0 a	1399-91	0 a
115-93	0 a	1790-93	0 a
1812-93	0 a	1306-91	0 a
1306-91	0 a	1562-91	0 a
1562-91	0 a	1564-91	0 a
1295-91	0 a		

White rot variety trial 1994

Line Site 3	Percent Infection	Line Site 3	Percent Infection
107-93	2.083 a*	1399-91	0 a
NORSTAR	2.00 a	1800-93	0 a
1804-93	0.805 a	102-93	0 a
FORTRESS	0 a	1812-93	0 a
114-93	0 a	1306-91	0 a
117-93	0 a	1564-91	0 a
124-93	0 a	1017-89-90	0 a
1784-93	0 a		

* Numbers in a column followed by the same letter are not significantly different at the P = 0.05 Protected LSD Test.

Table 2. Evaluation of onion lines for resistance to white rot

Muck Research Station site:

Line	Percent Infection
FORTRESS	1.43 a*
FORSTAR	0.65 a
1014-92	0 a
118-93	0 a
1292-91	0 a

* Numbers in a column followed by the same letter are not significantly different at P = 0.05, Protected LSD Test.

#118

ICAR: 206003

CROP: Onions, yellow cooking

PEST: White rot, *Sclerotium cepivorum* Berk.

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TITLE: THE EFFECT OF ARTIFICIAL AND NATURAL CURING ON WHITE ROT DEVELOPMENT IN STORAGE

MATERIALS: Onions naturally infected with white rot.

METHODS: Onions were harvested early and late August and early September from five established plots in commercial onion fields known to be infested with white rot. The initial percentage of white rot was established at this time. Replications 4, 5 and 6 from the untreated check from site 1, 2, 3 and 4 were artificially cured, while replications 1 and 6 were artificially cured from site 5 and replicates 2, 3, 4 and 5 were naturally cured. The onions were placed in pallet boxes and left outside to cure naturally. Artificial curing took place at the Muck Research Station. During the weeks of October 12 and October 19, the onion storage was heated to between 24°C and 25°C, this temperature was gradually reduced over the following 10 weeks. The week of October 25, the temperature was 20°C, November 1, 16°C, November 9, 10°C and then gradually reduced to between 1°C and 0°C.

RESULTS: As presented in the table.

CONCLUSIONS: White rot infection was low at all sites. There were no differences in the percent of white rot between the two treatments.

Table 1. The effect of artificial and natural curing on white rot development in storage.

Site	Percent white rot artificially cured	Percent white rot naturally cured
1	6.04 a*	4.30 a
2	5.60 a	5.13 a
3	9.11 a	6.92 a
4	0.54 a	0.52 a
5	0.55 a	1.0 a

* Numbers in a row followed by the same letter are not significantly different at the P = 0.05 Protected L.S.D. test.

#119

ICAR: 61009653

CROP: Pea, field, cv. Patriot

PEST: Ascochyta blight, *Mycosphaerella pinodes* (Berk. and Blox.)

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TITLE: EFFECT OF SPRAY SCHEDULING OF BRAVO FOR CONTROL OF ASCOCHYTA BLIGHT OF FIELD PEA

MATERIALS: BRAVO 500 F (Chlorothlonil 50%)

METHODS: A field plot experiment was conducted at a site with a high inoculum of *Mycosphaerella pinodes* at Morinville, Alberta in the spring of 1994. A pre-emergence herbicide, Edge F (ethalfluralin 50%), was incorporated into the soil at a rate of 1.6 kg/ha along with 60 kg/ha fertilizer (8-36-15-5, N-P-K-S). Field pea (*Pisum sativum* L.) cv. Patriot was planted 4 cm deep on 11 May with a grain drill at 80 g seeds/row and a peat-based inoculant (Enfix-P™) at 30 mL/row was used as a source of root-nodule bacteria. Each plot consisted of 4 x 6 m rows, with 30 cm row spacing. Adjacent plots were separated by 1 m and replicate plots by 2 m. The experiment was arranged in a randomized complete block with four replicates.

Application of Bravo was made at three different growth stages: prior to flowering (early spray, June 27), mid-flowering (mid-spray, July 13), and late flowering (late spray, July 29). Bravo was sprayed either once, twice or three times depending on the spray schedule. There were eight treatments: early spray, mid-spray, late spray, early plus mid sprays, early plus late sprays, mid plus late sprays, early plus mid plus late sprays, and an untreated control. Bravo was applied at a recommended rate of 1000 g a.i./ha for each spray. Plots were assessed for symptoms of *M. pinodes* infection 3 weeks after the final application. Symptoms were visually estimated as the percent of foliage area infected using a 0-10 scale where 0 = no infection, 1 #10%, 2 = 11-20%, 3 = 21-30%, 4 = 31-40%, 5 = 41-50%, 6 = 51-60%, 7 = 61 - 70, 8 = 71 - 80%, 9 = 81-90%, and 10 = 91-100% of leaf area affected. At maturity, plants from each plot (2 m^2) were swathed and combined. Seeds were dried to 16% moisture content and weighed.

RESULTS: Results of scheduled spraying of Bravo on the control of ascochyta blight of field pea in 1994 are summarized in Table 1. All Bravo treatments significantly reduced the severity of ascochyta blight and some also significantly increased seed yield relative to the control. Application of Bravo twice or three times resulted in the least disease, with severity ratings from 1.5 to 1.9. The disease severity of a single application of Bravo ranged from 2.3 to 3.2. No significant differences in disease severity occurred for a single application at any flowering stage, but greatest seed yield was observed when Bravo was applied at the early flowering stage.

CONCLUSIONS: Based on results obtained at one location in Alberta, Bravo was effective in reducing the severity of ascochyta blight and increasing the yield of field pea. Disease severity with two or three sprays was significantly lower than a single late spray or the control. No difference in seed yield was observed between various spray schedules with Bravo; however, early spraying appeared to be more beneficial. This experiment should be repeated in 1995.

Table 1. Effect of spraying time of Bravo on severity of ascochyta blight and seed yield of pea.

Treatment	Rate/ha	No. of applications	Disease severity**	Yield (kg a.i.)
Control	0	-	4.5 a*	2495 b
Early spray	1	1	3.2 b	3620 a
Mid-spray	1	1	2.9 b	3010 ab
Late spray	1	1	2.3 bc	3060 ab
Early plus mid-spray	2	2	1.5 c	3520 a
Early plus late spray	2	2	1.5 c	2830 ab
Mid plus late spray	2	2	1.9 c	3015 ab
Early plus mid plus late spray	3	3	1.5 c	3045 ab

* Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test.

** Severity rating scale: 0 = clean, 1 # 10%, 2 = 11-20%, 3 = 21-30%, 4 = 31-40%, 5 = 41-50%, 6 = 51-60%, 7 = 61-70%, 8 = 71-80%, 9 = 81-90%, and 10 = 91-100% of leaf area infected.

#120

STUDY DATA BASE: 362-1221-8801

CROP: Pea, field, cv AC Tamor and Radley

PEST: Ascochyta blight, *Ascochyta spp*.

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TITLE: EFFECT OF SEED TREATMENT ON SEEDBORNE ASCOCHYTA IN FIELD PEA

MATERIALS: CAPTAN 50% WP
ROVRAL 4F (Iprodione 50%)
THIRAM 75% WP (Thiram)
ALIETTE 40% WP (Fosetyle-Al 40%)
CROWN (Carbathiin + Thiabendazole 15%)

METHODS: This experiment was conducted at the Research Centre at Morden, Manitoba in 1994. Two seedlots each of the field pea (*Pisum sativum* L.) cultivars AC Tamor and Radley were used; one had high and the other had low level of seedborne infection. A split-plot experimental design was used with four replicates. Seedlots were used as main plots and seed treatments as sub-plots. Plots consisted of 4 rows x 3 m long with 0.30 m spacing between rows and 1.2 m between plots. Fifty seeds were planted in each row.

The seedlots were treated 2 d prior to seeding. Fungicide treatments with rates of g or mL a.i./kg of seed were as follows:
1 = Control,

2 = ROVRAL (1.24),
3 = THIRAM (1.0),
4 = THIRAM + ROVRAL (ratio 1.0:1.24),
5 = THIRAM + ROVRAL (ratio 1.0:0.62),
6 = THIRAM + ROVRAL (ratio 1.0:1.86),
7 = ALIETTE (2.5),
8 = ALIETTE + ROVRAL (ratio 2.5:1.24),
9 = CROWN (6.0)
10 = CAPTAN (2.5)

Seeding was done on May 13 and harvesting was completed on September 15, 1994. Plant emergence was recorded from individual rows of each plot. Plants were dug out from 1 row of each plot after emergence, and roots were assessed for signs of infection on a scale of 1-5; 1 = healthy, 2 = very small lesions or light browning, 3 = 2-3 mm lesions on stems or moderate browning, 4 = 3-5 mm long lesions or dark browning, and 5 = lesions girdling stems or dead seedling. Plants were dug out from the second row of each plot before flowering and were assessed for root infections. The remaining 2 rows were harvested for seed yield at the end of the season.

RESULTS: The results are summarized in Table 1. All seed treatments except for Treatment 2 in the heavy-infested seedlot of Radley, significantly improved seedling emergence. All treatments significantly reduced disease index in the light-infested seedlots of AC Tamor, and all except Treatment 2 significantly reduced disease index in the heavy-infested seedlot of AC Tamor. Treatments 2, 3, 4, 5, 6, and 10 significantly reduced the disease index in the heavy-infested seedlot of Radley, while Treatments 2, 4, 5, 6, and 8 significantly reduced the disease index in the light-infested seedlot of Radley. All treatments except Treatment 2, significantly increased the yield in the heavy-infested seedlots of AC Tamor and Radley. All Treatments except 5 and 10, produced significant yield increase in the light-infested seedlot of Radley; all Treatments except 4, 6 and 10, produced significant yield increase in light-infested seedlot of AC Tamor.

CONCLUSIONS: The treatments with Thiram/Rovral + Captan were the most effective in improving emergence in all seedlots, while in general all treatments were equally effective in reducing the disease index. Generally all seed treatments improved the yield except for Rovral alone in heavy-infested seedlots of both cultivars.

Table 1. The effects of seed treatment with several fungicides on emergence, diseased roots and yield of field pea in Morden, Manitoba in 1994.

Treatment	Emergence %				Early disease index				Yield (g/plot)			
Number	RH	RL	TH	TL	RH	RL	TH	TL	RH	RL	TH	TL
1	29	62	31	42	1.5	1.3	1.9	2.3	938	1060	859	989
2	31	72	38	55	1.3	1.1	2.0	1.3	878	1204	897	1183
3	58	85	68	76	1.3	1.2	1.6	1.3	1080	1189	1180	1110
4	64	89	72	76	1.3	1.1	1.2	1.1	1244	1290	1079	1062
5	60	87	74	82	1.2	1.1	1.3	1.2	1190	1140	1101	1146
6	63	85	69	79	1.2	1.1	1.3	1.3	1210	1227	1049	1098
7	51	84	61	62	1.6	1.2	1.3	1.3	1150	1261	1148	1355
8	47	81	59	60	1.5	1.1	1.3	1.3	1148	1225	1066	1158
9	47	78	51	54	1.5	1.2	1.7	1.4	1083	1196	1079	1146
10	69	86	73	76	1.3	1.2	1.3	1.5	1217	1135	1141	1004
LSD (0.05)	4	4	4		0.2	0.2	0.2	0.2	120	120	120	120

RH = Radley high-infested seedlot; RL = Radley low-infested seedlot;
TH = AC Tamor high-infested seedlot; TL = AC Tamor low-infested seedlot.

#121

STUDY DATA BASE: 362-1241-9301

CROP: Pea, field, cv Radley and AC Tamor

PEST: Ascochyta blight, *Mycosphaerella pinodes* (Berk. and Blox.)

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TITLE: CONTROL OF ASCOCHYTA BLIGHT OF FIELD PEA BY FUNGICIDE APPLICATIONS-1994

MATERIALS: BENLATE (Benomyl 50%)
ROVRAL 4F (Iprodione 41.6%)
BRAVO (Chlorothalonil 50%)
TILT (Propiconazole 25%)

METHODS: Experiments were conducted at Morden and Darlingford, Manitoba in 1994. Field pea (*Pisum sativum* L.) was planted in 4 row plots with a row length of 3 m, 0.3 m spacing between rows, and 1.2 m between plots. Seeding rate was 75 seeds/m^2. The experiment was arranged in a split plot design with four replicates; the two cultivars AC Tamor and Radley were the main plots, and fungicide treatments were subplots. AC Tamor and Radley were the two cultivars used. Dates of seeding were 10 May at Morden and 16 May at Darlingford; harvest dates were 2 September at Morden and 7 September at Darlingford.

Fungicides rates (kg a.i./ha) were as follows: BENLATE, 0.763; BRAVO, 2.00; ROVRAL 4F, 0.600; and TILT, 0.125. The fungicide treatments were applied either once, twice or three times during the growing season. The initial application was made just prior to flowering; the second application at mid-flowering; the third application at late flowering. The fungicides were applied in a water volume of 300 L/ha at 276 kPa using a hand-held boom. Plots were assessed for *Mycosphaerella* blight symptoms at each spray date and 2 weeks after the final application. Symptoms were visually estimated using a 0-9 scale, where 0 = no infection and 9 = all of the foliage area infected.

RESULTS: This was the second year of this study; 1993 results were previously published (Pest Management Research Report-1993). The effect of four fungicides on the control of Ascochyta blight of field pea in 1994 is summarized in Table 1. The interaction between cultivar and fungicide treatment on yield was not significant at either location, so results for the two cultivars were combined. The interaction was significant for disease severity rating at Darlingford, so data for individual cultivars is presented for this location. All treatments except single applications of TILT, or ROVRAL 4F significantly reduced the severity of Ascochyta blight at Morden compared to the untreated control. At Darlingford, disease severity was significantly reduced on Radley by all treatments except a single application of ROVRAL 4F. On AC Tamor, disease severity was significantly reduced by all treatments except single applications of BRAVO, two or three applications of ROVRAL 4F, and one or two applications of TILT.

At Morden, all BRAVO and BENLATE treatments, as well as two applications of TILT, significantly increased yields compared to the untreated control. At Darlingford, only the triple application of BRAVO produced a significant yield increase. Triple application of BRAVO provided the greatest yield increases over the controls at Morden (14%) and Darlingford (34%).

CONCLUSIONS: These results support those obtained in 1993. In both years, BRAVO and BENLATE were effective in controlling ascochyta blight of field pea, whereas TILT and ROVRAL 4F were relatively ineffective. Ascochyta disease pressure was greater in 1993 than in 1994 due to the wetter conditions. As a result, the benefits of BRAVO or BENLATE applications were greater in 1993.

Table 1. Effect of four fungicides on the control of Ascochyta blight on field pea in 1994 in Manitoba.

Treatment	No. of applications	Disease severity* D** AC	Disease severity* D** Ra	Disease severity* M	Yield (kg/ha) D	Yield (kg/ha) M
CONTROL	-	4.8	4.0	3.9	3414	6767
BENLATE	1	4.5	3.7	3.7	3553	7320
BENLATE	2	4.7	3.5	3.8	3184	7267
BENLATE	3	4.5	3.4	3.6	3381	7359
BRAVO	1	4.9	3.7	3.7	3417	7370
BRAVO	2	4.5	3.3	3.6	3970	7312
BRAVO	3	4.0	3.3	3.5	4573	7717
ROVRAL 4F	1	4.7	4.0	3.9	2670	6712
ROVRAL 4F	2	4.8	3.7	3.7	3125	7006
ROVRAL 4F	3	4.8	3.8	3.8	3481	6864
TILT	1	4.8	3.9	3.9	3384	6795
TILT	2	4.9	3.6	3.8	3217	7242
TILT	3	4.7	3.8	3.7	3336	6909
C.V.		4.3	4.3	2.8	18.9	6.7
L.S.D. (0.05)		0.1	0.1	0.1	628	397

* Disease severity, is the mean of the four disease assessments made during the season.
** D = Darlingford site, M = Morden site, AC = AC Tamor, Ra = Radley.

#122

STUDY DATA BASE: 362-1241-9301

CROP: Pea, field, cv Radley and AC Tamor

PEST: Powdery mildew, *Erysiphe polygoni* DC.

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TITLE: CONTROL OF POWDERY MILDEW OF FIELD PEA BY FUNGICIDE APPLICATIONS - 1994

MATERIALS: KUMULUS S (Sulfur 80%)
NOVA 40W (Myclobutanil 40%)

METHODS: Experiments were conducted at Morden and Darlingford, Manitoba in 1994. Field pea (*Pisum sativum* L.) was planted in 4 row plots with a row length of 3 m, 0.3 m spacing between rows, and 1.2 m between plots. Seeding rate was 75 seeds/m^2. The experiment was arranged in a split plot design with four replicates; cultivar as main plot and fungicide treatment as subplot. The cultivar AC Tamor, which contains a single gene for resistance to powdery mildew, and the susceptible cultivar Radley were used in this study. Dates of seeding were 2 June at Morden and 16 May at Darlingford; harvest dates were 22 September at Morden and 17 September at Darlingford.

Fungicides rates (kg a.i./ha) were as follows: KUMULUS S, 0.800; NOVA 40W, 0.056. Powdery mildew symptoms first appeared on 29 July at Morden and on 28 July at Darlingford. Pea plants were setting pods at these dates. KUMULUS S treatments were applied either once, 2 or 3 times at weekly intervals; NOVA 40W was applied either once or twice at a 2 week interval. Initial applications of both fungicides began at the first sign of powdery mildew symptoms. Fungicides were applied in a water volume of 300 L/ha at 276 kPa using a hand-held boom. Plots were assessed for powdery mildew severity at each spray date and 2 weeks after the final application. Disease severity was visually estimated using a 0-9 scale, where 0 = no disease, and 9 = all of the foliage severely infected.

RESULTS: Powdery mildew disease pressure on field pea was intense at Morden and mild at Darlingford in 1994. The effect of two fungicides on the control of powdery mildew is summarized (Table 1). Since there was a significant interaction between cultivar and fungicide treatment at Morden and at Darlingford, the fungicide effects on each cultivar are presented separately. Fungicide treatments did not have a significant effect on powdery mildew severity on the resistant cultivar AC Tamor at either location. However, all fungicide treatments significantly reduced powdery mildew severity on Radley at both locations. Two applications of NOVA 40W reduced the disease to the greatest extent at both Morden and Darlingford.

All fungicide treatments significantly increased the yield of Radley at Morden. In addition, plots treated with two applications of NOVA 40W had significantly greater yield than that of any other fungicide treated plots. This treatment also increased the yield of AC Tamor at Morden. This yield increase may have been due to a beneficial effect of NOVA 40W on the control of diseases other than powdery mildew, since powdery mildew severity was unaffected. There were no significant differences in seed yield for either variety at Darlingford.

CONCLUSIONS: Both KUMULUS S and NOVA 40W reduced powdery mildew severity and enhanced seed yield of a susceptible cultivar under conditions of intense powdery mildew infection. A single application of KUMULUS S to the variety Radley at Morden resulted in a 28% yield increase; a single application of NOVA 40W produced a 41% yield increase, and two applications of NOVA 40W produced a 58% yield increase.

Table 1. Effect of Kumulus S and Nova 40W on the control of powdery mildew on Radley field pea in 1994 in Manitoba.

	No. of	Disease severity*				Yield (kg/ha)			
	applications	Radley		AC	Tamor	Radley		AC	Tamor
Treatment		D**	M	D	M	D	M	D	M
CONTROL	-	2.3	5.7	1.2	1.2	3325	3304	1512	4830
KUMULUS S	1	1.5	4.1	1.2	1.1	2475	4213	1658	5166
KUMULUS S	2	1.6	3.7	1.2	1.1	3587	4323	1536	5189
KUMULUS S	3	1.4	3.8	1.2	1.1	3023	4372	1558	5265
NOVA 40W	1	1.5	3.4	1.2	1.2	3382	4645	1803	4927
NOVA 40W	2	1.2	2.5	1.2	1.1	3092	5235	1553	5623
C.V.		17.0	5.5	17.0	5.5	18.6	8.2	18.6	8.2
L.S.D. (0.05)		0.3	0.2	ns	ns	ns	469	ns	469

* Disease severity is the mean of the four disease assessments made during the season.
** D = Darlingford site, M = Morden site.

#123

STUDY DATA BASE: 390-1252-9201

CROP: Pepper, field, cv. Galaxy

PEST: Gray mold, *Botrytis cinerea* Pers.

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TITLE: EFFICACY OF FUNGICIDES AGAINST BOTRYTIS CINEREA ON FIELD PEPPERS

MATERIALS: MAESTRO 75DF (Captan)
BENLATE 50WP (Benomyl)
ROVRAL 500 g/kg (Iprodione)
CANPLUS 411 (surfactant)

METHODS: The trial was conducted at the PARC-Vancouver substation in Abbotsford, British Columbia. Galaxy pepper plants were transplanted into plastic mulch covered raised beds on May 30 1994. Each plot consisted of 8 plants spaced 45 cm apart. Treatment plots were 1.0 m x 1.8 m and were replicated four times in a randomized complete block design. The Captan + Benomyl treatment was applied six times starting at bloom stage and repeated every 7-10 d until 2 d prior to harvest. The Iprodione treatments were applied four times starting at bloom stage and repeated every 3 weeks until 14 d prior to harvest. Treatments were applied in 180 m water/plot with a back-pack sprayer. Peppers were harvested from four plants in each plot and sorted into marketable number and weight, undersize number and weight, sunscald number and weight and rot number and weight. Yield data were statistically analyzed.

RESULTS: All fungicide treatments reduced the number and weight of rotten pepper fruit.

CONCLUSIONS: MAESTRO + BENLATE, ROVRAL and ROVRAL + CANPLUS 411 were all effective at reducing botrytis cinerea in field peppers.

Table 1. Mean yield of four field pepper plants. Weight in kg/ha.

Treatment	Rate a.i./ha	Mkt no*	Mkt wt	Under no	Under wt	Rot no	Rot wt
Check	---	14.8a	2.56a	2.8a	0.20a	4.5a	0.43a
MAESTRO + BENLATE	2.25kg 2.25kg	15.8a	2.72a	4.0a	0.25a	1.8b	0.13b
ROVRAL	0.75kg	19.5a	3.56a	5.8a	0.27a	0.5b	0.07b
ROVRAL + CANPLUS 411	0.75kg 2%v/v	16.3a	2.84a	6.0a	0.32a	1.0b	0.11b

* Means calculated from four replications. Numbers in each column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = <0.05).

#124

ICAR: 61002036

CROP: Tomato, field cv. Heinz 9478

PEST: Bacterial canker, *Corynebacterium michiganensis* subsp. *michiganensis* (Smith) David et al.
Early blight, *Alternaria solani* (Ell. and Mart.) L.R. Jones and Grout
Septoria leaf spot, *Septoria lycopersici* Speg.
Anthracnose, *Colletotrichum coccodes* (Wallr.) Hughes

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TITLE: EVALUATION OF DACOBRE DG AND BRAVO COMBINATIONS FOR THE CONTROL OF FOLIAR DISEASES OF TOMATOES

MATERIALS: BRAVO 500 (Chlorothalonil)
BRAVO C/M (27% Chlorothalonil + 27% Copper + 5.4% Maneb)
DACOBRE SDG (27% Chlorothalonil + 27% Copper)
BRAVO ZN 500F (Chlorothalonil + Zinc)
MANCOZEB 80WP (Mancozeb)
CU SULFATE 63WP (Copper Sulfate)

METHODS: Tomatoes were transplanted on June 10 in single, 2 row plots spaced 1.65 m apart in Ridgetown. Plots were 6 m long, replicated four times in a randomized complete block design. Spray applications were made with a back-pack airblast sprayer at 240 L/ha of water. Fungicides were applied either on a 7 d spray schedule on June 23, July 2, 8, 15, 22, 29, August 8, 12, 19, 26 and September 2 or based on TOM-CAST on July 5, 20, August 5 and 22. Foliar disease was assessed on September 7, 28 and October 11. Yields and fruit rot assessments were taken on October 11.

RESULTS: As presented in the table.

CONCLUSIONS: Eleven fungicide spray applications were used following the 7 d spray programme versus four for the TOM-CAST weather-timed system. Equal foliar disease ratings were recorded throughout the summer using either of these spray schedules, all providing excellent control compared to the nonsprayed plot. There was considerable variation in fruit rots within the trial resulting in an inconsistent pattern. Yields were not significantly different.

Treatments	Rate prod/ha	Application	Foliar Disease Rating (0-10)** Oct. 11	% Anthracnose	Fruit Rot T/ha	Yield T/ha
DACOBRE SDG	4.50 kg	7 days	7.9a*	6.5ab	0.6cd	49.2a
DACOBRE SDG	6.75 kg	7 days	7.8a	7.5ab	0.4d	49.5a
BRAVO 500	2.80 L	7 days	8.4a	8.5ab	0.9bcd	48.6a
BRAVO ZN 500F	2.80 L	7 days	8.1a	10.3a	1.0a-d	54.6a
MANCOZEB 80WP + CU SULFATE 63WP	3.40 kg 4.70 L	7 days	7.9a	10.3a	0.9bcd	49.5a
BRAVO CM	6.75 kg	7 days	8.2a	1.5b	0.4d	48.9a
DACOBRE SDG	4.50 kg	TOM-CAST	8.1a	12.0a	1.2abc	48.9a
DACOBRE SDG	6.75 kg	TOM-CAST	8.6a	9.0ab	1.0a-d	56.1a
BRAVO 500	2.80 L	TOM-CAST	8.5a	13.0a	1.7a	47.7a
BRAVO ZN 500F	2.80 L	TOM-CAST	8.1a	11.8a	1.3ab	46.2a
Control			3.8b	8.0ab	1.1a-d	51.9a

* Means followed by the same letter do not significantly differ (P = 0.05), Duncan's Multiple Range Test).

** Foliar Damage Ratings (0-10)-0, no control, foliage severely damaged; 10, complete control.

#125

ICAR: 61002036

CROP: Tomato, field cv. Sunrise

PEST: Bacterial canker, *Corynebacterium michiganensis* subsp. *michiganensis* (Smith) Davis et al.
Bacterial spot, *Xanthomonas campestris pv. vesicatoria*, Dye
Early blight, *Alternaria solani* (Ell. and Mart.) L.R. Jones and Grout
Septoria leaf spot, *Septoria lycopersici* Speg.
Anthracnose fruit rot, *Colletotrichum coccodes* (Wallr.) Hughes

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TITLE: TIMING OF BACTERIAL CONTROL MATERIALS IN FIELD TOMATOES

MATERIALS: BRAVO 82.5DF (Chlorothalonil)
DITHANE 75DG (Mancozeb)
KOCIDE 40DF (Copper)
DACOBRE DG (Chlorothalonil 27% + Copper 27%)

METHODS: Tomatoes were transplanted on June 3 in single, 2 row plots spaced 1.65 m apart. The transplants had been chosen as they were infected with bacterial spot observed in the greenhouse. Plots were 6 m long, replicated four times in a randomized complete block design. Spray applications were made with a back-pack airblast sprayer at 240 L/ha of water. Fungicides were applied on a 7 d spray schedule on June 23, July 8, 15, 22, 29, August 8, 12, 19, 26 and September 3 versus a TOM-CAST scheduled spray programme of July 8, 22, August 5 and 22. Foliar visual ratings on a whole plot basis regardless of type of disease, bacterial or fungal, were assessed on August 23 and September 7. Yields and fruit anthracnose counts were taken on October 6.

RESULTS: As presented in the table.

CONCLUSIONS: The 7 d spray programme consisted of 10 foliar sprays versus four applications on the weather-timed TOM-CAST schedule. Even though more than twice the number of spray applications were made there was no significant difference in foliar disease ratings, fruit anthracnose nor total yields between the two spray programmes. There were differences, however, late in the season amongst spray materials. These plants had been chosen for this trial as they had been identified as being infected with Bacterial Spot. In the field they were further infected with bacterial canker and severe foliar fungal diseases. The most effective materials for the reduction of foliar symptoms were products containing copper, eg., DACOBRE DG and the combination KOCIDE 40DF + DITHANE 75DG. These copper containing products, however, did not significantly increase yields or reduce fruit anthracnose. The one exception was that multiple applications of copper combinations were more effective for controlling anthracnose than DITHANE 75DG applied by itself.

Table 1.

Treatments	Rate (product kg/ha)	Application	Foliar Visual Ratings (0-10)** Aug. 23	Foliar Visual Ratings (0-10)** Sept. 7	% Anthracnose	Yield T/ha
BRAVO 82.5DF	1.8	7 days	6.8bc*	7.0abc	14.0abc	48.0a
DITHANE 75DG	3.2	7 days	5.8c	5.5bcd	16.8a	47.4a
KOCIDE 40DF +	2.25	7 days	8.0ab	7.4ab	9.5bc	51.3a
DITHANE 75DG	2.25					
DACOBRE DG	4.0	7 days	8.4a	8.3a	7.5c	47.7a
BRAVO 82.5DF	1.8	TOM-CAST	5.8c	5.3cd	12.5abc	41.7a
DITHANE 75DG	3.2	TOM-CAST	5.6c	4.5d	14.3ab	46.5a
KOCIDE 40DF +	2.25	TOM-CAST	8.4a	7.6a	10.8abc	52.2a
DITHANE 75DG	2.25	TOM-CAST				
DACOBRE DG	4.0	TOM-CAST	8.8a	8.0a	11.0abc	58.8a
Control			5.3c	4.5d	13.3abc	43.2a

* Means followed by the same letter do not significantly differ (P = 0.05) Duncan's Multiple Range Test).

** Foliar Visual Ratings (0-10)-0, no control, foliage severely damaged; 10, complete control

#126

ICAR: 61002036

CROP: Tomato, field, cv. Heinz 9230

PEST: Early blight, *Alternaria solani* (Ell. and Mart.) L.R. Jones and Grout
Septoria leaf spot, *Septoria lycopersici,* Speg.
Anthracnose, *Colletotrichum coccodes* (Wallr.) Hughes

NAME AND AGENCY:
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TITLE: EVALUATION OF TOMATO FUNGICIDES

MATERIALS: BRAVO 82.5SDG (Chlorothalonil)
DITHANE 75DG (Mancozeb)
DEMON 40WP (experimental)
PENNCOZEB 75DF, 80WP (Mancozeb)
MAESTRO 75DF (Captan)

METHODS: Tomatoes were transplanted on June 3 in single, 2 row plots spaced 1.65 m apart. Plots were 6 m long, replicated four times in a randomized complete block design. Spray applications were made with a back-pack airblast sprayer at 240 L/ha of water. Fungicides were applied every 10 d on June 23, July 5, 15, 25, August 4, 16 and 25. The treatment DEMON 40WP was not available until the 15th of July application. Foliar disease assessments were made on August 23, September 7 and 25. Plots were harvested September 30.

RESULTS: As presented in the table.

CONCLUSIONS: The most effective fungicide treatments for the control of foliar and fruit rot diseases of field tomatoes were MAESTRO 75DF and BRAVO 82.5SDG followed by PENNCOZEB 75DF, DITHANE 75DG and PENNCOZEB 80WP. There was little difference between any of these five candidate fungicides, all performed well against the target foliar and fruit fungal diseases of tomatoes. The level of disease control was significantly lower with the fungicide DEMON 40WP. However, it must be noted that two fewer sprays were applied early in the season due to its late arrival.

Treatments	Rate kg prod/ha	Foliar Disease Ratings (0-10) ** Aug.23	Sept.7	Sept.28	% Anthracnose	Yield T/ha	Fruit Rots T/ha
BRAVO 82.5SDG	1.5	8.6a*	8.3a	8.0abc	5.6c	84.6a	1.8a
DITHANE 75DG	3.25	8.0ab	7.9ab	7.1cd	8.0bc	92.3a	2.3a
DEMON 40WP	0.313	7.8ab	7.8ab	4.8e	15.6b	79.6ab	4.3a
PENNCOZEB 75DF	3.25	8.6a	8.4a	7.3bcd	5.0c	87.6c	2.3a
PENNCOZEB 80WP	3.25	7.6ab	8.2a	7.0d	6.6c	99.7a	3.8a
MAESTRO 75DF	3.0	8.0ab	8.4a	8.3ab	3.6c	82.4a	3.5a
MAESTRO 75DF	4.0	8.9a	9.0a	8.5a	5.0c	90.0a	1.4a
Control		6.5b	6.5b	3.5f	24.6a	79.5ab	3.4a

* Means followed by the same letter do not significantly differ (P = 0.05) Duncan's Multiple Range Test).
** Foliar Damage Ratings (0-10)-0, no control, foliage severely damaged; 10, complete control.

SECTION L

DISEASES OF POTATOES / MALADIES DES POMMES DE TERRE

Section Editor / Réviseur de section : R.P. Singh

#127 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Norchip

PEST: *Alternaria solani* (Ell. and Martin) Sor.

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TITLE: EFFICACY OF CHEMICAL CONTROL OF POTATO EARLY BLIGHT, 1993

MATERIALS: BRAVO 500, 40% F at 1.6 or 2.4 L/ha (Chlorothalonial)
BRAVO 825, 82.5% DG at 1.0 or 1.5 kg/ha (Chlorothalonil)
BRAVO Zn, 40% F at 1.6 or 2.4 L/ha plus Zn (Chlorothalonil + Zinc)
ASC-66897 60% DG at 1.4 kg/ha)
GAOZHIMO (Masbrane, coconut extract, 1 L in 200 L water)
MANCOZEB (Dithane M45, 80% WP at 2.3 kg/ha)

METHODS: For each treatment, four replicate plots consisting of 5 rows (7.5 m long, spaced 0.9 m apart) were established in a randomized complete block design in 1993. All 5 row plots were separated by 2 buffer rows for tractor operations. Whole (35 - 55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20 SN, 2.25 L/ha).

Plant emergence counts on the center row of each 5 row plot were made 40 - 50 d post-planting. To the foliage of plants in the two outer rows of each five-row plot, a conidial suspension (pathogen, *Alternaria solani* cultured on potato dextrose agar) of approximately 5 x 10^3 spores/mL was applied 2 - 3 d after the first fungicide application and 2 - 3 weeks later as required. Disease severity ratings (0 = no symptoms, 1 = slight leaf spotting, 2 = moderate and 3 = severe with 25% or more of the foliage having many lesions) of plants in the center row of each 5 row plot were made throughout August and September.

Fungicide applications (tractor-mounted sprayer modified to spray only the center 3 rows with three hollow-cone nozzles per row, 450 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top desiccant was applied mid-September, 2 weeks prior to plot harvest.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see Table). All plots had 100% emergence and foliar disease damage increased during the course of the season. May and June were exceptionally wet while August was exceptionally dry. Early blight levels were only slight (severity indices 0-1.5), and no significant differences in early blight severities were observed among the various treatments.

CONCLUSIONS: While early blight severity was not significantly reduced with the application of the various fungicides tested, early blight occurrences were limited. Further studies are required to confirm these results prior to development of recommendations for registration and use of these materials.

Table 1. Effects of foliar fungicide treatment on potato early blight development - 1993.

Treatment Rate/ Spray Interval	Foliar Early Blight Severity (0-3) (day/month) 10/8	18/8	20/8	24/8	07/9
Non-treated control	0.0	1.5	1.6	1.6	1.6
BRAVO 500 1.6F/7 d	0.0	0.3	0.6	0.9	0.9
BRAVO 500 1.6F/14 d	0.0	0.8	0.8	0.9	1.0
BRAVO 500 2.4F/7 d	0.0	0.5	0.5	0.6	0.6
BRAVO 500 2.4F/10 d	0.0	0.6	0.8	1.0	1.1
BRAVO 500 1.6F + Zn/7 d	0.0	0.5	0.5	0.5	1.1
BRAVO 500 2.4F + Zn/7 d	0.0	0.5	0.5	0.8	0.9
BRAVO 825 1.0G/7 d	0.0	0.6	0.6	1.1	1.4
BRAVO 825 1.5G/7 d	0.0	0.4	0.4	0.9	1.1
BRAVO 825 1.5G/10 d	0.0	0.6	0.6	0.8	0.9
ASC-66897 1.4G/7 d	0.1	0.9	1.0	1.0	1.0
MASBRANE 1 L/200 L water + BRAVO 500 1.6F/7 d	0.0	0.1	0.5	0.5	0.8
MASBRANE 1 L/200 L water + BRAVO 500 1.6F/14 d	0.0	O.9	1.1	1.1	1.2
MASBRANE 1 L/200 L water + BRAVO 500 1.6F/21 d	0.0	0.8	0.8	1.0	1.0
MANCOZEB 2.3P/7 d	0.0	0.5	0.5	1.1	1.1
MASBRANE 1 L/200 L water + MANCOZEB 2.3P/7 d	0.0	0.0	0.2	0.4	0.8
LSD (P = 0.05)	ns	ns	ns	ns	ns

ns Not significantly different.

#128

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Green Mountain

PEST: *Alternaria solani* (Ell. and Martin) Sor.
Botrytis cinerea Pers.

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TITLE: POTATO EARLY BLIGHT AND GRAY MOLD CHEMICAL CONTROL EFFICACIES, 1993

MATERIALS: BRAVO 825, 82.5% DG at 1.0 and 1.5 kg/ha (Chorothalonil)
FLUAZINAM, 42.4% F, at 0.4 and 1.0 L/ha
ASC-67098Z 0.4 L/ha
ASCE-RCT60 2.0 kg/ha
RH-7281 0.44 and 1.33 L/ha
ZENECA1 4.0 kg/ha
MANCOZEB (Dithane 75 DG, 75% DG at 2.3 kg/ha)

METHODS: For each treatment, four replicate plots consisting of 5 rows (7.5 m long, spaced 0.9 m apart) were established in a randomized complete block design in 1993. All 5 row plots were separated by 2 buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20 SN, 2.25 L/ha).

Plant emergence counts on the center row of each 5 row plot were made 40 - 50 d post-planting. Naturally occurring inoculum of *Alternaria solani* and *Botrytis cinerea* were relied upon as sources of early blight and gray mold disease, respectively. Plots were mist irrigated (3 - 5 mm/h for 2 - 4 h) during August to maintain the disease in the inoculated rows. Disease incidence (amount of diseased foliar tissue as a percent of total plant foliage) or disease severity (0 = no symptoms, 1 = slight leaf spotting, 2 = moderate, and 3 = severe with 25% or more of the foliage having many lesions) ratings of plants in the center row of each 5 row plot were made during August and September.

Fungicide applications (tractor-mounted sprayer modified to spray only the center 3 rows with three hollow-cone nozzles per row, 450 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top desiccant was applied mid-September, 2 weeks prior to plot harvest when tuber yields and late blight tuber rot occurrence (percent by tuber weight) were determined.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see Table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Early blight and gray mold incidences were low this season due to the weather and plant growth conditions but disease combination assessments were made. Severity levels were generally in the trace to slight range and no significant treatment differences were found. Defoliation estimates were not possible for the non-treated plots due to the rapid development of potato late blight. Incidence of these diseases was less with ASC-67098Z and BRAVO 825 on the later assessment dates but only BRAVO 825 1.0/7d, RH-7281 1.33/7d had significantly less damage due to early blight and gray mold on 24 August than many of the other treatments.

CONCLUSIONS: Early blight and gray mold severity was minimal this year but incidence assessments demonstrated acceptable efficacies against these foliar diseases for some of the fungicides tested. Further studies are required to confirm these results and to accurately establish recommendations for fungicide registration and usage.

Table 1. Effects of foliar fungicide treatment on potato early blight and gray mold development - 1993.

TREATMENT RATE/ SPRAY INTERVAL	Early Blight and Gray Mold (day/month) Severity (0-3) 13/8	17/8	Incidence (%) 24/8	27/8	01/9	07/9
Non-treated control	1.0	1.0	na	na	na	na
FLUAZINAM 0.4/7 d	0.3	0.3	11.7	16.7	21.7	38.3
FLUAZINAM 1.0/28 d	0.7	2.7	11.7	18.3	20.0	23.3
ASC-67098Z 1.4/7 d	0.3	0.5	11.7	15.0	18.3	16.7
ASCE-RCT60 2.0/14 d	0.7	1.3	8.7	11.7	11.7	20.0
ASCE-RCT60 2 sprays (bloom and bloom + 14 d) + ALL OTHER DATES WITH BRAVO 825 1.0/7 d	0.7	1.3	8.3	11.7	16.7	18.3
BRAVO 825 1.0/7 d	0.7	1.0	3.7	9.0	11.7	15.0
BRAVO 825 1.5/7 d	1.3	1.3	6.7	13.3	16.7	21.7
DITHANE 75DG 2.3/7 d	0.7	0.7	16.7	21.7	21.7	21.7
DITHANE 75DG 2.3/F*	1.3	2.0	15.0	18.3	25.0	30.0
RH-7281** 0.44/7 d	0.7	1.0	18.3	20.0	30.0	31.7
RH-7281** 1.33/7 d	0.5	2.3	20.0	25.0	28.3	31.7
RH-7281 1.33/7 d	0.3	0.8	4.0	10.0	15.0	26.7
ZENECA1 4/7 d	0.7	0.8	6.7	10.0	10.0	15.0
.						
LSD (P = 0.05)	ns	ns	7.20	ns	ns	ns
with water at 6.7%	7.04	8.65	11.8	(15.12)***		

na Data not available.
* F = sprays timed to an automated spray forecast system.
** RH-7281 tank mixed with DITHANE 75DG 2.3/7d.
** P = 0.08

#129

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Green Mountain

PEST: *Alternaria solani* (Ell. and Martin) Sor.
Botrytis cinerea Pers.
Phytophthora infestans (Mont.) de Bary

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TITLE: FOLIAR DISEASE CONTROL EFFECTS ON POTATO YIELDS AND TUBER ROT, 1993

MATERIALS: BRAVO 825, 82.5% DG at 1.0 and 1.5 kg/ha (Chlorothalonil)
FLUAZINAM 42.4% F, at 0.4 and 1.0 L/ha
ASC-67098Z 0.4 L/ha
ASCE-RCT60 2.0 kg/ha
RH-7281 0.44 and 1.33 L/ha
ZENECA1, 4.0 kg/ha)
MANCOZEB (DITHANE 75 DG, 75% DG at 2.3 kg/ha)

METHODS: For each treatment, four replicate plots consisting of 5 rows (7.5 m long, spaced 0.9 m apart) were established in a randomized complete block design in 1993. All 5 row plots were separated by 2 buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20 SN, 2.25 L/ha).

Plant emergence counts on the center row of each 5 row plot were made 40 - 50 d post-planting. To the foliage of plants in the 2 outer rows of each 5 row plot, a sporangial suspension (pathogen, *Phytophthora infestans* (races 1,4) cultured on leaves of Green Mountain) of approximately 5 x 10^3 spores/mL was applied 2 - 3 d after the first fungicide application and then 2 - 3 weeks later as required. Naturally occurring inoculum of *Alternaria solani* and *Botrytis cinerea* were relied upon as sources of early blight and gray mold disease, respectively. Plots were mist irrigated (3 - 5 mm/h for 2 - 4 h) during August to maintain the disease in the inoculated rows. Disease damage (amount of disease foliar tissue as a percent of total plant foliage) or disease severity (0 = no symptoms, 1 = slight leaf spotting, 2 = moderate, and 3 = severe with 25% or more of the foliage having many lesions) ratings of plants in the center row of each 5 row plot were made during August and September.

Fungicide applications (tractor-mounted sprayer modified to spray only the center 3 rows with three hollow-cone nozzles per row, 450 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top desiccant was applied mid-September, 2 weeks prior to plot harvest when tuber yields and late blight tuber rot occurrence (percent by tuber weight) were determined.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see Table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Tuber yields were significantly improved with the use of fungicides. Non-treated plots had significantly lower tuber yields than fungicide treated plots. ASC-67098Z had the greatest total yields. Several other treatments had similar total yields but marketable tuber (>55 mm) yields were less and small tuber (<55 mm) yields were greater for FLUAZINAM 1.0 L every 4 weeks. Yield benefits are likely due mainly to the reduction in foliar disease as a result of fungicide efficacy. Late blight tuber rot incidences were sporadic, and except for one treatment were low. This was probably due to the dry weather conditions after topkill and until tuber harvest and grading operations were complete.

CONCLUSIONS: All fungicide treatments increased yields as compared to the non-treated control due to efficacy against foliar diseases. Further studies are required to confirm these results and to accurately establish recommendations for fungicide registration and usage.

Table 1. Effects of foliar fungicide treatment on potato yields and late blight tuber rot - 1993.

Treatment Rate/ Spray Interval	Tuber Yields (t/ha) 0-55 mm	>55 mm	all	Late Blight Tuber Rot (%) 0-55 mm	>55 mm	all
Non-treated control	11.7	13.8	25.5	0	0	0
FLUAZINAM 0.4/7 d	9.7	21.4	31.1	1.0	1.5	1.3
FLUAZINAM 1.0/28 d	11.2	18.6	29.8	0	0	0
ASC-67098Z 1.4/7 d	8.2	27.1	35.3	0	0	0
ASCE-RCT60 2.0/14 d	8.1	21.7	29.8	0	0.7	0.5
ASCE-RCT60 2 sprays (bloom and bloom + 14 d) + all other dates with BRAVO 825 1.0/7 d	9.1	24.5	33.5	0	0	0
BRAVO 825 1.0/7 d	7.6	25.2	32.8	0	1.2	0.9
BRAVO 825 1.5/7 d	8.5	25.1	33.6	7.2	10.7	9.8
DITHANE 75DG 2.3/7 d	7.4	27.2	34.6	1.4	1.9	1.8
DITHANE 75DG 2.3/F*	7.3	25.9	33.2	0	0	0
RH-7281** 0.44/7 d	8.5	25.9	34.4	0.9	1.7	1.6
RH-7281** 1.33/7 d	8.7	25.3	33.9	0	0.9	0.6
RH-7281 1.33/7 d	7.7	26.7	34.4	0.7	0	0.1
ZENECA1 4/7 d	6.1	27.7	33.8	0	1.3	1.1
LSD (P = 0.05)	2.25	4.10	3.68	ns	ns	ns

* F = sprays timed to an automated spray forecast system.
** RH-7281 tank mixed with DITHANE 75DG 2.3/7d.

#130

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Norchip

PEST: *Alternaria solani* (Ell. and Martin) Sor.
Phytophthora infestans (Mont.) de Bary

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TITLE: EFFECTS OF CHEMICAL CONTROL OF FOLIAR POTATO DISEASES ON TUBER YIELDS AND ROTS, 1993

MATERIALS: BRAVO 500, 40% F at 1.6 or 2.4 L/ha (Chlorothalonil)
BRAVO 825, 82.5% DG at 1.0 or 1.5 kg/ha (Chlorothalonil)
BRAVO Zn, 40% F at 1.6 or 2.4 L/ha plus Zn (Chlorothalonil + Zinc)
ASC-66897 60% DG at 1.4 kg/ha
GAOZHIMO (MASBRANE 1 L in 200 L water)
MANCOZEB (DITHANE M45, 80% WP at 2.3 kg/ha)

METHODS: For each treatment, four replicate plots consisting of 5 rows (7.5 m long, spaced 0.9 m apart) were established in a randomized complete block design in 1993. All 5 row plots were separated by 2 buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20 SN, 2.25 L/ha).

Plant emergence counts on the center row of each 5 row plot were made 40 - 50 d post-planting. To the foliage of plants in the 2 outer rows of each 5 row plot, a conidial suspension (pathogen, *Alternaria solani* cultured on potato dextrose agar) of approximately 5 x 10^3 spores/mL was applied 2 - 3 d after the first fungicide application and 2 - 3 weeks later as required. Early blight disease severity ratings (0 = no symptoms, 1 = slight leaf spotting, 2 = moderate, and 3 = severe with 25% or more of the foliage having many lesions) of plants in the center row of each 5 row plot were made throughout August and September. Naturally occurring inoculum of *Phytophthora infestans* was relied upon for disease establishment. Late blight disease damage ratings (portion of potato foliage with late blight symptoms as percent of total foliage) of plants in the center row of each 5 row plot were made throughout August and September.

Fungicide applications (tractor-mounted sprayer modified to spray only the center 3 rows with three hollow-cone nozzles per row, 450 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top desiccant was applied mid-September, 2 weeks prior to plot harvest.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see Table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Late blight tuber rot occurred infrequently and at very low levels in the various treated plots (data not presented). Tuber yields (>55 mm and total) were affected by foliar fungicide treatment. Almost all fungicide treatments had greater yields than the non-treated plots. Treatments which demonstrated good efficacy levels against the foliar diseases had the higher total yields (e.g. BRAVO 500 1.6 L/7d, BRAVO 825 1.0 and 1.5 kg/7d, and ASC-66897 1.4 L/7d). However, for some fungicide treatments total yields were greater due to less marketable tuber yields (>55 mm) but more small (<55 mm) tubers (e.g. BRAVO 500 1.6 L/14 d and BRAVO 500 2.4 L/7d plus Zn).

CONCLUSIONS: Several treatments were found to have yield improvements as compared to the non-treated control. These increases were generally related to fungicides with good efficacies against late blight. Further studies are required to confirm these results prior to development of recommendations for registration and use of these materials.

Table 1. Effects of foliar fungicide treatment on potato tuber yields - 1993.

Treatment Rate/ Spray Interval	Tuber Yields (T/ha) <55 mm	>55 mm	all
Non-treated control	9.5	12.4	21.9
BRAVO 500 1.6F/7 d	7.7	22.4	30.0
BRAVO 500 1.6F/14 d	8.4	17.5	25.9
BRAVO 500 2.4F/7 d	7.2	21.0	28.3
BRAVO 500 2.4F/10 d	7.8	22.3	30.1
BRAVO 500 1.6F + Zn/7 d	7.5	21.5	29.1
BRAVO 500 2.4F + Zn/7 d	8.2	20.8	29.0
BRAVO 825 1.0G/7 d	7.3	22.9	30.2
BRAVO 825 1.5G/7 d	7.5	24.9	32.4
BRAVO 825 1.5G/10 d	7.4	21.3	28.7
ASC-66897 1.4G/7 d	7.8	24.4	32.2
MASBRANE 1 L/200 L water + BRAVO 500 1.6F/7 d	7.7	22.8	30.4
MASBRANE 1 L/200 L water + BRAVO 500 1.6F/14 d	9.3	17.8	27.1
MASBRANE 1 L/200 L water + BRAVO 500 1.6F/21 d	9.3	13.8	23.2
MANCOZEB 2.3P/7 d	7.2	26.0	33.2
MASBRANE 1 L/200 L water + MANCOZEB 2.3P/7 d	7.7	21.0	28.7
LSD (P = 0.05)	ns	3.95	3.24

ns Not significantly different.

#131

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Norchip

PEST: Late blight, *Phytophthora infestans* (Mont.) de Bary

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TITLE: EFFICACY OF CHEMICAL CONTROL OF POTATO LATE BLIGHT, 1993

MATERIALS: BRAVO 500, 40% F at 1.6 or 2.4 L/ha (Chlorothalonil)
BRAVO 825, 82.5% DG at 1.0 or 1.5 kg/ha (Chlorothalonil)
BRAVO Zn, 40% F at 1.6 or 2.4 L/ha plus Zn (Chlorothalonil + Zinc)
ASC-66897 60% DG at 1.4 kg/ha)
GAOZHIMO (MASBRANE 1 L in 200 L water)
MANCOZEB (DITHANE M45, 80% WP at 2.3 kg/ha)

METHODS: For each treatment, four replicate plots consisting of 5 rows (7.5 m long, spaced 0.9 m apart) were established in a randomized complete block design in 1993. All 5 row plots were separated by 2 buffer rows for tractor operations. Whole (35 - 55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha;

insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20 SN, 2.25 L/ha).

Plant emergence counts on the center row of each 5 row plot were made 40 - 50 d post-planting. Naturally occurring inoculum of *Phytophthora infestans* was relied upon for disease establishment. Disease damage ratings (portion of potato foliage with late blight symptoms as percent of total foliage) of plants in the center row of each 5 row plot were made throughout August and September.

Fungicide applications (tractor-mounted sprayer modified to spray only the center 3 rows with three hollow-cone nozzles per row, 450 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top desiccant was applied mid-September, 2 weeks prior to plot harvest.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see Table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Warm, moist weather in August aided development of the late blight epidemic. Weekly applications of BRAVO 500 (1.6 L and 2.4 L), BRAVO 500 (1.6 L and 2.4 L plus Zn), BRAVO 825 (1.0 kg and 1.5 kg), and ASC-66897 (1.4 L) had similar and successful late blight control efficacies. Similar results were obtained with BRAVO 500 (1.6 L/7d) applied alone or in combination with MASBRANE. The extended spray schedules of BRAVO 500 (1.6 L), BRAVO 500 (2.4 L), BRAVO (1.5 kg), and BRAVO (1.6 L + MASBRANE) did not control late blight to the same extent.

CONCLUSIONS: Several treatments were found to have good efficacies against late blight. Further studies are required to confirm these results prior to development of recommendations for registration and use of these materials.

Table 1. Effects of foliar fungicide treatment on potato late blight development - 1993.

Treatment Rate/ Spray Interval	Foliar Late Blight Damage (%) (day/month) 10/8	18/8	20/8	24/8	07/9
Non-treated control	0	45	70	100	100
BRAVO 500 1.6 F/7 d	0	3	4	19	26
BRAVO 500 1.6 F/14 d	0	6	10	33	66
BRAVO 500 2.4 F/7 d	0	2	2	17	30
BRAVO 500 2.4 F/10 d	0	2	3	20	53
BRAVO 500 1.6 F + Zn/7 d	0	2	2	9	23
BRAVO 500 2.4 F + Zn/7 d	0	1	2	5	25
BRAVO 825 1.0 G/7 d	0	1	2	10	21
BRAVO 825 1.5 G/7 d	0	2	2	5	20
BRAVO 825 1.5 G/10 d	0	1	3	23	50
ASC-66897 1.4 G/7 d	0	2	3	6	14
MASBRANE 1 L/200 L water + BRAVO 500 1.6 F/7 d	0	1	2	8	15
MASBRANE 1 L/200 L water + BRAVO 500 1.6 F/14 d	0	8	10	39	86
MASBRANE 1 L/200 L water + BRAVO 500 1.6 F/21 d	0	8	20	55	96
MANCOZEB 2.3 P/7 d	0	1	1	1	4
MASBRANE 1 L/200 L water + MANCOZEB 2.3 P/7 d	0	1	2	4	5
LSD (P = 0.05)	ns	8.7	7.5	14.2	26.8

ns Not significantly different.

#132

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Green Mountain

PEST: Late blight, *Phytophthora infestans* (Mont) de Bary

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TITLE: POTATO LATE BLIGHT CHEMICAL CONTROL EFFICACY, 1993

MATERIALS: BRAVO 825, 82.5% DG at 1.0 and 1.5 kg/ha (Chlorothalonil)
FLUAZINAM 42.4% F, at 0.4 and 1.0 L/ha
ASC-67098Z 0.4 L/ha
ASCE-RCT60 2.0 kg/ha
RH-7281 0.44 and 1.33 L/ha
ZENECA1 4.0 kg/ha
MANCOZEB (DITHANE 75 DG, 75% DG at 2.3 kg/ha)

METHODS: For each treatment, four replicate plots consisting of 5 rows (7.5 m long, spaced 0.9 m apart) were established in a randomized complete block design in 1993. All 5 row plots were separated by 2 buffer rows for tractor operations. Whole (35 - 55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20 SN, 2.25 L/ha). Plant emergence counts on the center row of each 5 row plot were made 40 - 50 d post-planting. To the foliage of plants in the 2 outer rows of each 5 row plot, a sporangial suspension (pathogen, *Phytophthora infestans* (races 1,4) cultured on leaves of Green Mountain) of approximately 5 x 10^3 spores/mL was applied 2 - 3 d after the first fungicide application and then 2 - 3 weeks later as required. Plots were mist irrigated (3 - 5 mm/h for 2 - 4 h) during August to maintain the disease in the inoculated rows. Disease damage (amount of disease foliar tissue as a percent of total plant foliage) in plants in the center row of each 5 row plot were made throughout August and September.

Fungicide applications (tractor-mounted sprayer modified to spray only the center 3 rows with three hollow-cone nozzles per row, 450 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top desiccant was applied mid-September, 2 weeks prior to plot harvest when tuber yields and late blight tuber rot occurrence (percent by tuber weight) were determined.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see Table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Late blight tuber rot incidences were minimal probably due to the dry weather conditions after top desiccation (data not presented). Late blight foliar damage was first seen in early August and in non-treated plots disease development progressed steadily until all plants were defoliated. All fungicide treatments significantly reduced the amount of late blight as compared to the non-treated plots except FLUAZINAM applied at 1.0 L every 4 weeks which had the same amount of defoliation as the non-treated plots by 7 September. While ASC-67098Z at 1.4 L/7d and RH-7281 (with DITHANE 75DG) 1.33 L/7d are examples of treatments with the limited late blight damage, several others also had significantly better efficacy against late blight than was obtained with FLUAZINAM 1.0 L/28d. No significant differences in late blight occurrence were found between the weekly and "forecasted" application schedules for DITHANE 75 DG as the "forecasted" schedule called for weekly application during the warm, moist conditions of the study. RH-7281 (1.33) with DITHANE 75 DG had significantly better late blight control than RH-7281 (1.33) alone.

CONCLUSIONS: Several fungicides were found to be efficacious in controlling foliar late blight. However, further studies are required to confirm these results and to accurately establish recommendations for fungicide registration and usage.

Table 1. Effects of foliar fungicide treatment on potato late blight development - 1993.

Treatment Rate/ Spray Interval	Foliar Disease Damage (%) (day/month) 10/8	13/8	17/8	20/8	24/8	27/8	01/9	07/9
Non-treated control	12	30	58	72	82	87	93	99
FLUAZINAM 0.4/7 d	0	1	2	2	7	15	28	37
FLUAZINAM 1.0/28 d	1	3	10	25	50	68	78	85
ASC-67098Z 1.4/7 d	0	0	1	1	4	12	20	29
ASCE-RCT60 2.0/14 d	3	4	6	10	20	30	42	52
ASCE-RCT60 2 sprays (bloom and bloom + 14 d) + ALL OTHER DATES WITH BRAVO 825 1.0/7 d	2	3	8	12	23	35	48	62
BRAVO 825 1.0/7 d	1	2	4	6	17	27	40	55
BRAVO 825 1.5/7 d	1	1	3	5	12	21	33	45
DITHANE 75DG 2.3/7 d	0	1	1	3	5	13	32	45
DITHANE 75DG 2.3/F*	1	2	4	8	11	21	28	36
RH-7281** 0.44/7 d	1	1	1	2	7	17	23	31
RH-7281** 1.33/7 d	0	0	1	1	2	7	13	25
RH-7281 1.33/7 d	1	2	5	4	8	16	30	43
ZENECA1 4/7 d	2	2	4	8	15	25	33	43
LSD (P = 0.05)	2.9	8.6	6.8	8.2	10.3	10.8	15.1	17.0

* F = sprays timed to an automated spray forecast system.
** RH-7281 tank mixed with DITHANE 75DG 2.3/7 d.

#133

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Kennebec

PEST: *Rhizoctonia solani* Kuhn (AG 3)
Verticillium spp.
Colletotrichum coccodes (Wallr.) Hughes

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TITLE: EFFICACY OF CHEMICAL CONTROL OF POTATO DISEASES CAUSED BY SOIL-BORNE FUNGAL PATHOGENS, 1993

MATERIALS: EASOUT 10 D 5 g/kg seed (Thiophanate-methyl)

ZENECA1 - 7.5 D: 10 gm/kg seed)
GAOZHIMO (MASBRANE - 1 L/200 L water)

METHODS: Elite 3 seed was used that had received no "fall" fungicide treatment prior to storage except for the seed dipped in Masbrane. Immediately after cutting and just before planting, the seed was treated with fungicides. Fungicide treatments were applied by shaking in a plastic bag for 3-5 min. the seed and fungicide treatment. As controls, some seed were not treated with fungicides. Immediately after treating, the seed was hand-planted in 3.0 m rows with 30 cm in-row and 0.9 m between-row spacings in a randomized complete block design with four replicate blocks in 1993 with the cultivar Kennebec. After planting, Masbrane was applied (5 L) to the soil surface of the potato row with a 6 L hand-held pesticide sprayer. Sufficient Masbrane was applied to moisten the soil surface. This treatment was repeated for some plots at flowering and 2 weeks after flowering. Recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 WP, 0.73 kg/ha; fungicides-chlorothalonil 40 F, 2.1 L/ha; insecticides-endosulfan 400EC 1.5 L/ha; top desiccant-diquat 20 SN, 2.25 L/ha). Plant emergence, vigour, and disease determinations were made throughout the season. Top desiccant was applied mid-September and plots were harvested 2 weeks later.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see Tables). Planting was delayed slightly due to wet weather. Plant emergence was rapid but early vigour was reduced with the ZENECA1 seed treatment. The number of "healthy" and "weak" plants were not significantly affected by any of the treatments at the 5% probability level but ZENECA1 plots had fewer "healthy" plants based on a probability level of approximately 7% than EASOUT and MASBRANE. Similar results were obtained for total plant stand and seed rot assessments. No significant differences in plant wilt and pre-mature senescence were obtained during the very dry conditions of August which caused "drought-wilt" on many occasions. No significant yield differences were found among the various treatments.

CONCLUSIONS: No major differences were obtained among the treatments studied. However, a few seed-pieces treated with ZENECA1 may have not sprouted due to phytotoxicity. Further investigations are recommended prior to development of recommendations for the treatments studied.

Table 1. Effects of tuber and soil treatments on potato growth - 1993.

Treatment	Plant vigour 30/6	Healthy plants 12/7	Weak plants 12/7	Plant stand 12/7	Seed rots 12/7
Non-inoculated	91.7	90.0	10.0	100.0	0.0
EASOUT	75.0	85.0	6.7	91.7	8.3
ZENECA1	45.0	65.0	15.0	80.0	20.0*
MASBRANE P	80.0	91.7	8.3	100.0	0.0
MASBRANE P&F	86.7	93.3	6.7	100.0	0.0
MASBRANE P&F&2F	73.3	86.7	13.3	100.0	0.0
.					
LSD (P = 0.05)	24.03	[19.18]	NS	[14.89]	[14.89]

* 3.3% had no sprouting possibly due to phytotoxicity.
Note For Masbrane treatments P = planting, F = flowering, 2F = 2 weeks post-flowering. All values record percentage data. NS = not significantly different. Values in brackets [] are significantly different at P = 0.08.

Table 2. Effects of tuber and soil treatments on potato diseases - 1993.

Treatment	Plant wilt (%) 09/8	13/8	18/8	Pre-mature senescence 30/8
Non-inoculated	5.0	1.7	8.3	28.3
EASOUT	0.0	6.7	23.3	40.0
ZENECA1	1.7	3.3	3.3	16.7
MASBRANE P	0.0	3.3	15.0	36.7
MASBRANE P&F	6.7	15.0	31.7	58.3
MASBRANE P&F&2F	3.3	11.7	16.7	33.3
LSD (P = 0.05)	NS	NS	NS	NS

Note For MASBRANE treatments P = planting, F = flowering, 2F = 2 weeks post-flowering. All values record percentage data. NS = not significantly different.

Table 3. Effects of tuber and soil treatments on potato maturity and yield - 1993.

Treatment	Tuber Yield (t/ha) <55mm	>55mm	Total
Non-inoculated	11.8	16.5	28.3
EASOUT	10.0	16.6	26.6
ZENECA1	8.3	10.9	19.1
MASBRANE P	11.7	13.1	24.7
MASBRANE P&F	12.9	12.6	25.5
MASBRANE P&F&2F	12.1	16.4	28.5
LSD (P = 0.05)	NS	NS	NS

Note For MASBRANE treatments P = planting, F = flowering, 2F = 2 weeks post-flowering. NS = not significantly different.

#134

STUDY DATA BASE: 309-1251-9315

CROP: Potato

PEST: Common scab, *Streptomyces scabies* (Thaxt.) Lambert and Loria

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TITLE: TRANSMISSION OF RESISTANCE TO COMMON SCAB FROM THE DIPLOID TO THE TETRAPLOID LEVEL VIA 4X-2X CROSSES IN POTATOES, 1994

MATERIALS: Potato families were produced with the same scab-susceptible, tetraploid (4x) female parent (cv. Shepody) crossed with either scab-resistant or scab-susceptible diploid (2x) selections and with resistant or scab-susceptible (4x) parents. All 4 cross parents are cultivars from *S. tuberosum* L. and the diploid parents are hybrids from haploids of tetraploid cvs. x primitive cultivated diploids such as *S. phureja* or *S. stenotomum*.

METHODS: Thirty genotypes from each family were planted in five hill-plots in a naturally-infested field in 1992 and 1993. The spacing between adjacent plots was 92 cm and that between adjacent plants in a plot was 26 cm. The field was divided into 3 blocks where 10 genotypes from each family were assigned to each of 3 blocks. In addition, the parents of each family and standard control cultivars with known reactions to scab (Hindenburg, Avon and Green Mountain which are highly resistant, moderately resistant and susceptible, respectively) were planted in each block. The amount of surface area covered by scab was estimated for each tuber from each plot and a scab index was calculated for each plot based on the number of tubers in each of six categories ranging from 0 to 51-100% surface coverage. The scab index data of all individual clones were subjected to three separate analyses of variance (ANOVA). The first one compared the difference between families and their interactions with years, respectively. The second ANOVA compared performances of parents and cultivars tested in the experiments, and the third ANOVA compared mean performances between parents and cultivars and families.

RESULTS: The mean family scab index was similar for the two years of the trial. Analyses of variance indicated highly significant differences between parents and families. Neither parents nor families showed significant interactions between years. Except for Family 5, there did not seem to be major differences in progeny performance between diploid and tetraploid parents. F58089, which was used as a resistant tetraploid parent, produced a progeny which was similar to progenies of resistant diploid parents. Likewise, the susceptible tetraploid male parent, GoldRus produced a progeny which was similar to the progenies of the susceptible diploid. The association between mid-parent values and those of the families was demonstrated by a simple correlation coefficient, r = .765. This moderately high correlation suggested that scab reaction information for parents can be used to assist in determining cross combinations in a potato breeding programme.

CONCLUSIONS: The results of this study show that resistance to common scab can be effectively transmitted from the diploid to the tetraploid level via 4-2 crosses. This provides access to a broader base of resistance to scab which is desirable since resistance in tetraploid cultivars can often be traced to two old German cvs., Jubel and Hindenburg.

Table 1. Frequency distribution of tubers per scab index category and means and standard deviations for each of 10 families.

Fam. no.	Female parent	Scab index	Male parent	Ploidy level	Scab index	Percent tubers per scab index category* <1	1-1.9	2.0-3.5	3.6-4.9	5.0-7.5	7.6-17.0	Mean±SD
1	Shepody	4.6	75-10	2x	0.2	31.0	24.1	31.0	10.3	0.0	3.4	2.1±2.4
2	Shepody	4.6	8664-06	2x	1.2	8.0	48.0	40.0	0.0	4.0	0.0	2.1±1.8
3	Shepody	4.6	9121-18	2x	1.2	11.1	40.7	40.7	7.4	0.0	0.0	2.1±1.3
4	Shepody	4.6	9121-23	2x	1.3	3.7	59.3	25.9	3.7	7.4	0.0	2.2±1.6
5	Shepody	4.6	9136-03	2x	1.4	0.0	25.0	33.3	12.5	20.8	8.3	4.2±4.2
6	Shepody	4.6	8979-07	2x	2.3	3.3	13.3	26.7	33.0	23.3	0.0	3.8±2.9
7	Shepody	4.6	9751-03	2x	1.2	11.1	40.7	40.7	7.4	0.0	0.0	2.0±1.3
8	Shepody	4.6	BPH32-40	2x	3.3	0.0	9.1	31.8	13.6	31.8	13.6	5.1±3.7
9	Shepody	4.6	F58089	4x	1.0	0.0	72.0	20.0	4.0	4.0	0.0	1.9±1.6
10	Shepody	4.6	GoldRus	4x	1.7	8.3	8.3	25.0	20.8	25.0	12.5	4.7±3.9

* Scab Index = $\frac{0 \times a + 2.5 \times b + 7.5 \times c + 15 \times d + 35 \times e + 57 \times f}{a + b + c + d + e + f}$

where a = number of tubers with no scab
b = number of tubers with 1-5% of surface covered
c = number of tubers with 6-10% of surface covered
d = number of tubers with 11-20% of surface covered
e = number of tubers with 21-50% of surface covered
f = number of tubers with 51-100% of surface covered
(Schöber, B. 1987. *In*: Potato Disease Assessment Keys EAPR)

SECTION M

DISEASES OF CEREAL AND FORAGE CROPS / MALADIES DES CÉRÉALES ET CULTURES FOURRAGÈRES

Section Editors / Réviseurs de section : R.A. Martin, H.W. Johnston, P. Thomas

#135 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 375-1431-7631

CROP: Alfalfa, cvs. Vernal and Algonquin

PEST: Damping-off, *Botrytis cinerea* Pers.
Phoma medicaginis Malbr. & Roum. in Roum.
others

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TITLE: EFFECT OF FUNGICIDE SEED TREATMENTS ON ESTABLISHMENT OF ALFALFA IN 1994

MATERIALS: THIRAM 75 (Thiram)
VITAFLO-280 (Carbathiin + Thiram)
UBI-2521-1 (Carbathiin + Thiabendazole)

METHODS: The effect of four seed treatments on germination and establishment of two batches of alfalfa seed was evaluated in a growth cabinet study and a field trial. The seed treatments were: Thiram at 2.7 g a.i./kg, Vitaflo-280 at 1.7 g a.i./kg seed, UBI-2521-1 (Crown) at 0.9 g a.i./kg, surface sterilization for 5 min in 0.6% NaOCl, and a control. The treatments were applied to 20 gm batches of seed in pre-treated 125 mL Erlenmeyer flasks. The seed was cv. Vernal alfalfa (lot no.1) and cv. Algonquin (lot no.2) from Manitoba. Both lots were hand harvested in October 1993 from fields where yield losses caused by botrytis blossom blight [1] were so severe that the fields were not harvested commercially. Seed was stored at -7°C until required. The populations of pathogens and saprophytes on and in the seed were assessed by either: 1) washing seed in running water for 30 min or 2) surface sterilizing seed in 0.6% NaOCl for 2 min followed by two rinses in sterile water, then plating 10 seeds per plate onto PDA supplemented with streptomycin. In the growth cabinet trial, seed was planted in flats of soilless mix. Each lot x treatment combination consisted of 1 row per flat, with 10 seeds per row. The tests were run at 4°C and 12°C, with 10 flats per temperature. Seedling emergence was assessed when most of the seedlings had developed a true leaf. At 12°C, seedlings were rated at 3 weeks after seeding, and again 1 week later. At 3 weeks after seeding, there was almost no emergence at 4°C, so the flats were moved to the incubator at 12°C and emergence was assessed 17 d later. In the field trial seeded at Saskatoon, the impact of soil temperature was evaluated by seeding at three dates; May 13, May 26 and June 6 1994. Each plot consisted of a single row, 1 m long, with 25 seeds per row. The test was arranged in a split plot design with four replicates. Seeding date was the main plot factor and seed treatments were assigned to the subplots. Emergence was rated on June 17, June 28 and July 7. Statistical analysis was based on ANOVA and Duncan's Multiple Range Test.

RESULTS: The seed samples were heavily infected with saprophytic fungi and with *Phoma medicaginis*, a seed-borne pathogen, but *Botrytis cinerea* was not isolated (Table 1). In a related study that examined samples from many fields in Manitoba where blossom blight was severe in 1993, the incidence of *B. cinerea* was consistently low and generally <1% (unpublished). In the greenhouse trial, seedling establishment was not enhanced with any of the seed treatments (mean of 54%, range 52%-55%), but was slightly higher (P = 0.05) at 12°C (57%) than at 4°C (51%). (Note that the temperatures were not repeated among growth cabinets, so analysis using ANOVA is only an approximation.) Also, seedling establishment was higher (P = 0.01) from lot no. 1 (59%) than from lot no. 2 (49%). The same pattern was observed in the field trial; seed treatment did not enhance establishment (mean of 22%, range of 20 to 24%). However, later seeding improved (P = 0.05) establishment (Table 2). There was no difference in seedling establishment between the two seed lots in the field study, with a mean of only 29% establishment for the best (late-seeded) treatments on the final evaluation date. There was no evidence of damping-off of alfalfa seedlings caused by *B. cinerea* in either trial.

CONCLUSIONS: The primary objective of this study was to determine if seed-to-seedling transmission of *Botrytis cinerea* occurred from alfalfa seed harvested from fields affected by botrytis blossom blight (as is the case in lentil) and to assess the pathogen's impact on seed quality, especially germination and establishment. *Botrytis cinerea* was not carried at high levels in or on seed and there was no evidence of seed-to-seedling transmission. However, there was a high incidence of other pathogens and saprophytes associated with the seed. These seed samples also exhibited poor germination and establishment, as did much of the alfalfa seed produced in the prairie region in 1993. We postulated that establishment might be improved in this heavily contaminated seed via fungicidal seed treatments, but the treatments did not improve establishment in either the growth cabinet or the field study. Planting into warm soil hastened germination and increased establishment in this poor quality seed. Other measures that speed seed germination, such as shallow seeding depth and good seed-soil contact, are likely to maximize establishment where better seed is not available.

ACKNOWLEDGEMENT: Thanks to the Canadian Seed Growers Association for financial assistance, to Mr. G. Huebner and Dr. S.R. Smith for supplying the seed samples and to K. Bassendowski and K. Anderson for technical assistance.

REFERENCE:

1. Gossen, B.D., Smith, S.R. and Platford, R.G. 1994. *Botrytis cinerea* blossom blight of alfalfa on the Canadian prairies. Plant Dis. In press

Table 1. Fungal genera isolated from alfalfa seed harvested from two fields affected with botrytis blossom blight in 1993.

Source	Treatment	*Botrytis*	*Phoma*	*Cladosporium*	*Fusarium*	Other
Lot 1	Washing	0	1	31	14	34
	2 min NaOCl	0	1	0	1	6
Lot 2	Washing	0	6	34	64	0
	2 min NaOCl	0	21	6	11	11

Table 2. The effect of seeding date on establishment of alfalfa seedlings from two lots of poor-quality seed, Agriculture and Agri-Food Canada, Research Centre, Saskatoon, Saskatchewan, 1994.

Seeding date	Establishment (%)			
	June 17	June 28	July 07	Mean
May 13	15 b*	16 c	17 c	16
May 26	17 b	20 b	22 b	20
June 06	22 a	27 a	29 a	26
Mean	18	21	23	

* Values within a column followed by the same letter are not different, based on Duncan's Multiple Range Test at P # 0.05.

#136

STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Morrison

PEST: Net blotch, *Pyrenophora teres* Drechs.

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TITLE: EFFECTS OF FUNGICIDE SEED TREATMENTS ON DISEASE AND YIELD OF BARLEY, 1994

MATERIALS: UBI-2454-1 (RH-3866 50 g/L)
VITAFLO 280 (Carbathiin 14.9%, Thiram 13.2% ww)
ANCHOR (Carbathiin 66.7 g/L, Thiram 66.7 g/L)
UBI-2383 (Baytan 30, Triadimenol 317 g/L)
UBI-2568 (Baytan, Triadimenol 60 g/L)
AGSCO DB-GREEN L (Maneb 323 g/L, Lindane 108 g/L)
TF-3770A (Hexaconazole 5.0 g/L)
TF-3794 2ME (Paclobutrazol 2.0 g /L)
UBI-2584 (Tebuconazole 8.33 g/L)

METHODS: Morrison barley seed was treated in a small plot seed treater with the above materials at the rates listed in the following table. The seed was planted on May 4, 1994 at a seeding rate of 300 viable seeds per m^2. Each plot was 8 rows wide x 5 m long with 17.8 cm between each row, and plots were separated by 2 rows of Belvedere wheat guards. Treatments were replicated four times in a complete randomized block design. Emergence counts were taken on 2 x 1 m row per plot. Disease ratings were taken on the second and third leaf from the head at ZGS (Zadok's Growth Stage) 56, using the Horsfall-Barratt Rating System. Yield and thousand kernel weights were determined from the harvest of 7 rows, using a small plot combine.

RESULTS: None of the treatments had any significant effect on emergence. While there was a tendency for some treatments to reduce net blotch only UBI-2454-1 had a significant effect on the penultimate leaf and two of the UBI-2383-1 rates on the third leaf down. While there were no significant effects on yield, yields were greater than the untreated control by a maximum of 11%.

CONCLUSIONS: Weather conditions in July and August were not highly conducive to net blotch development. In general, moisture levels were very low without extensive periods of leaf moisture which would enhance epidemiological disease spread. Early to mid-season periods were sufficiently moist for good crop development and this appears to have had a positive effect of not decreasing yields even though moisture in the later growth stages were very dry.

Table 1. Influence of seed treatments on disease and yield in barley

Treatment	Rate*	Emergence (plants/m^2)	Net Blotch 2nd Leaf ZGS 56	Net Blotch 3rd Leaf ZGS 56	Yield (kg/ha)	Thousand Kernel Wt (g)
Untreated	0	221	15.7	43.3	4507	39.6
UBI-2454-1	2.4	217	9.8	38.8	4794	42.2
Vitaflo 280	2.3	256	11.2	35.2	4785	42.0
Vitaflo 280	3.3	233	12.1	41.8	4954	41.4
Anchor	8.0	237	12.2	34.7	4778	40.2
UBI-2383-1	0.5	245	15.9	39.0	4803	42.9
UBI-2383-1	1.0	246	11.2	32.3	4661	40.7
UBI-2383-1	1.5	227	11.1	29.7	4933	41.4
UBI-2383-1	2.0	202	13.9	40.6	5007	43.3
UBI-2568	5.0	244	13.9	36.3	4957	42.1
AGSCO DB-Green L	3.12	262	15.7	45.0	4884	40.8
TF-3770A	3.0	233	18.3	44.7	4777	41.7
TF-3770A	6.0	222	13.6	35.5	4743	40.0
TF-3794 2ME	5.0	220	19.6	45.5	4534	40.8
UBI-2584	2.4	239	19.7	51.2	4862	41.8
UBI-2584	3.6	221	13.4	40.9	4640	41.6
SEM**		15.3	1.81	3.51	142.2	0.68
LSD (P = 0.05)		NS	5.2	10.0	NS	1.9

* Rate - mL product per kg seed.
** SEM - Standard Error of Mean.
NS Not significant at 0.05 level of probability.

#137

STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Morrison

PEST: Net blotch, *Pyrenophora teres* Drechs.

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TITLE: INFLUENCE OF FOLIAR FUNGICIDE APPLICATION FREQUENCY ON DISEASE AND YIELD OF BARLEY

MATERIALS: TILT (Propiconazole 250 EC)
BAYLETON 50WP (Triadimefon 50 WP)
FOLICUR 144EC (Hexaconazole)
FOLICUR 45DF (Hexaconazole)

METHODS: Barley plots, cv. Morrison, were established May 4, 1994 at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide x 5.0 m long with 17.8 cm between rows. Foliar fungicides were applied in single and double applications. Treatments were replicated four times in a complete randomized block design. At Zadok's Growth Stage (ZGS) 30, the single sprays and the first of the double sprays were applied. At ZGS 49, the second of the double sprays was applied. Treatments were applied at the rates listed in the table using a CO_2 back-pack sprayer. Disease ratings for net blotch were taken on the second and third leaf at ZGS 58 using the Horsfall Barrett Rating System. Yield and thousand kernel weights were determined from the harvest of the centre 7 rows of each plot, using a small plot combine.

RESULTS: Net blotch developed late in the season and may not have had as dramatic an effect on the yields observed as has often been observed in this region. Of the fungicides tested, BAYLETON was ineffectual at net blotch control or in providing a positive yield benefit, from either single or double applications. Maximum benefit was obtained with FOLICUR 45DF formulation with no significant difference between the single and double application. There were no differences between FOLICUR 144EC and TILT treatments. The second application had no effect on disease control or yield enhancement, for any of the treatment materials.

CONCLUSIONS: FOLICUR formulations were effective for disease control and yield benefits and there was limited evidence to indicate that there are formulation differences. FOLICUR 45DF was more effective than FOLICUR 144EC in disease control and, while not significantly different, appeared to result in a higher yield. In this particular trial, a late spray added nothing that the early single spray did not provide in disease control or yield benefit.

Table 1. Influence of single and double foliar fungicide sprays on net blotch and yield of barley

Treatment	Number of Sprays*	Rate (g a.i./ha)	Net Blotch (%) 2nd Leaf	Net Blotch (%) 3rd Leaf	Yield (kg/ha)	1000 Kernel Weight (g)
Untreated control	0		27.2	59.1	4651	36.8
Tilt	1	125	16.3	31.8	5298	40.0
Tilt	2	125	3.5	9.5	5521	41.3
Bayleton 50WP	1	250	24.4	55.4	4575	37.2
Bayleton 50WP	2	250	20.8	44.3	4690	39.3
Folicur 144EC	1	125	21.6	40.2	5224	41.1
Folicur 144EC	2	125	2.9	7.3	5537	41.4
Folicur 45DF	1	125	4.0	9.9	5743	42.4
Folicur 45DF	2	125	1.1	3.9	5801	43.6
SEM*			3.2	4.47	183.6	0.826
LSD (P = 0.05)**			9.3	13.1	535.9	2.41

* First spray at ZGS 30, second spray at ZGS 45-59.
** SEM Standard Error of Mean.

#138

STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Morrison

PEST: Net blotch, *Pyrenophora teres* Drechs.

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TITLE: INFLUENCE OF FOLIAR FUNGICIDES ON DISEASE AND YIELD OF BARLEY, 1994

MATERIALS: TILT (Propiconazole 250 EC)
BAYLETON 50WP (Triadimefon 50 WP)
FOLICUR 144EC (Hexaconazole)
FOLICUR 45DF (Hexaconazole)
ICIA-5504 (80 Wbm 200 g a.i./ha)

METHODS: Barley plots, cv. Morrison, were established May 11, 1994 at a seeding rate of 300 viable seeds per m^2. Each plot was 10 rows wide x 5.0 m long with 17.8 cm between each row. Foliar fungicide treatments were replicated four times in a complete randomized block design. At Zadok's Growth Stage (ZGS) 45, treatments were applied at the rates listed in the table, using a CO_2 back-pack sprayer. Disease ratings for net blotch were taken on the second and third leaves from the head at ZGS 71 using the Horsfall-Barrett Rating System. Yield and thousand kernel weights were determined from the harvest of the centre 7 rows of each plot, using a small plot combine.

RESULTS: Net blotch developed late in the season and as a result, yields did not appear to be severely affected. With the exception of both BAYLETON and a late application of TILT. BAYLETON treatments were the only ones which did not result in a significant yield increase.

CONCLUSIONS: BAYLETON was ineffectual at net blotch control or at increasing yield. TILT was effective at net blotch control and resulted in a yield benefit of approximately 12% over the untreated control. FOLICUR 45DF was the most effective material tested resulting in a yield increase of 1035 kg/ha, 26%, over the untreated control. There was evidence of formulation differences with FOLICUR, where the 144EC formulation yielded significantly less than the 45DF formulation.

Table 1. Effect of foliar applied fungicide on disease control and yield in barley.

Treatment	Rate (g a.i./ha)	Net Blotch (%) 2nd Leaf	Net Blotch (%) 3rd Leaf	Yield (kg/ha)	1000 Kernel Weight (g)
Untreated control		7.85	47.2	3937	37.80
TILT	125	2.22	18.9	4412	38.70
BAYLETON 50WP	125	6.27	46.4	4042	38.35
BAYLETON 50WP	250	7.50	39.0	4176	38.75
FOLICUR 144EC	125	2.46	15.1	4338	39.35
FOLICUR 45DF	125	1.52	2.6	4972	42.90
ICIA-5504	200	2.22	10.4	4578	40.80
TILT**	125	2.75	33.8	4454	39.65
SEM*		0.969	5.55	98.9	0.729
LSD (P = 0.05)		2.85	16.33	290.9	2.14

* SEM Standard Error or Mean.
** Applied after heading at ZGS 50.

#139

STUDY DATA BASE: 303-1212-8907

CROP: Barley, various cvs.

PEST: Scald, *Rhynchosporium secalis* (Oudem.) J.J. Davis
Net blotch, *Pyrenophora teres* Drechs.

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TITLE: BARLEY CULTIVAR RESPONSE TO FOLIAR DISEASE CONTROL WITH PROPICONAZOLE (TILT) APPLICATION

MATERIALS: TILT (Propiconazole 250 EC)

METHODS: Various 2 and 6-row barley cultivars were established in separate evaluation trials on May 13, 1993. Each plot was 10 rows wide x 5 m long with 17.8 cm between rows. Treatments were replicated four times in a randomized complete block design with cultivar as the main plot and TILT treatment as sub plot. TILT treatments were applied at a rate of 125 g a.i./ha, using a CO_2 back-pack sprayer, when foliar disease symptoms were at 10% leaf area on the fourth leaf from the head or at Zadoks Growth Stage (ZGS) 45-49. With the 2-row cultivar trial, the 10% disease spray timing was applied on July 15 at ZGS 44 while the other TILT treatment was applied on July 26 at ZGS 48. In the 6-row cultivar trial, the 10% disease spray timing also at ZGS 44 on July 15, however, the alternate treatment was applied at ZGS 47, July 19, for Leger and Chapais and July 26, ZGS 48, for the remaining cultivars. Foliar disease severity was rated using the Horsfall-Barratt Rating System on 10 randomly selected tillers per plot. Yield and thousand kernel weights were determined from the harvest of the centre 7 rows of each plot using a small plot combine.

RESULTS: Both scald and net blotch were present with scald, the predominate disease representing approximately 70-80% of the area of disease symptom. The 6-row cultivars tended to have higher scald levels than 2-row cultivars relative to net blotch levels.

With the 2-row cultivar trial, TILT was effective at reducing foliar disease. At the first disease rating date, there were significant cultivar treatment interactions. However, these were of degree only, TILT application at 10% disease on the 4th leaf resulting in a significant lowering of disease severity on all cultivars. As a result, only the main effects are presented in Table 1. TILT, at 10%, effectively reduced disease at early and late ratings. The growth stage timed application was not effective at the first rating but was the most effective at the later rating. Both treatments were effective at significantly reducing lodging although the effect was only minor. Yield and 1000-kernel weights were also positively influenced across all cultivars, with a mean yield increase in yield of 23 to 28%.

Disease control in the 6-row cultivar trial indicated no differences between the two TILT treatments at the later rating (Table 2). There were differences between TILT treatments on lodging, kernel weight or yield means. There were significant interactions between cultivars and treatments for yield (Table 3). Chapais, Leger and OAC Kippen exhibited no significant yield benefit from TILT application, while Mascot's response was split.

CONCLUSIONS: Benefits derived by TILT application appeared more consistent across the 2-row cultivars than with the 6-row cultivars, in the trials presented. However, cultivar selection still has a major role in maximizing yield. In the 2-row cultivars, the lowest susceptibility to disease, Morrison and Lester, also resulted in the maximum yields. It would appear that with 6-row cultivars, there may be a requirement to gear application more closely to cultivar selection although further work is required to determine season variability and influence. However, 6-row cultivars can still be significantly influenced by over 20% by a TILT application.

Table 1. Two-row barley cultivar responses to Tilt.

	Foliar Disease Severity (%) ZGS 49 July 30 2nd*	3rd	ZGS 71 Aug 11 2nd	Lodging** (1-45) Aug 11	Aug 30	Yield (kg/ha)	1000 Kernel Weight (g)
Cultivar							
Albany	39.3	65.3	80.3	21.4	29.2	3307	34.61
Morrison	28.0	52.5	76.9	25.0	29.8	3892	35.10
Helena	35.5	64.5	90.6	21.5	30.8	3135	29.32
Iona	29.3	56.7	85.0	23.9	34.6	3328	32.35
Micmac	34.8	66.0	84.5	24.9	40.1	2635	27.35
Winthrop	45.6	70.8	88.5	27.4	39.8	2766	26.98
Lester	28.1	51.8	77.4	23.4	28.5	4397	37.21
.							
SEM	1.645	2.847	1.849	1.601	1.323	153.8	0.462
LSD (0.05)	4.89	8.46	5.49	NS	3.93	456.9	1.373
.							
Treatment***							
Control	44.2	69.5	98.4	28.7	35.4	2859	28.83
TILT (10%)	16.9	45.8	82.3	17.8	31.4	3671	33.20
TILT (ZGS 45-49)	42.0	68.0	69.2	25.4	32.9	3524	33.51
SEM	1.411	1.369	1.309	0.814	0.663	63.7	0.300
LSD (0.05)	4.03	3.91	3.74	2.32	1.89	181.9	0.857

* Leaf location from the head.
** Belgium scale.
*** Application when 10% leaf area diseased on 4th leaf or at ZGS 45-49.

Table 2. Six-row barley cultivar response to TILT.

	Foliar Disease Severity (%) ZGS 49 07/28		ZGS 71 08/09		Lodging** 08/30 (1-45)	1000 Kernel Weight (g)
	2nd*	3rd	2nd	3rd		
Cultivar						
Chapais	0.3	2.1	11.8	25.5	12.2	41.82
Duke	1.0	2.8	5.3	14.6	1.8	35.59
Leger	0.5	2.1	36.4	58.5	18.6	33.34
Mascot	1.9	4.1	10.7	23.1	4.5	37.32
Sabina	3.3	8.3	25.1	45.0	11.3	35.32
OAC Kippen	0.4	2.5	13.5	28.0	26.3	35.92
.						
SEM	0.483	0.402	2.554	4.24	2.09	0.730
LSD (0.05)	1.46	1.21	7.70	12.78	6.30	2.20
.						
Treatment***						
Control	1.5	4.3	26.2	45.4	14.0	35.2
TILT (10%)	0.8	2.8	11.8	26.2	11.1	37.0
TILT (ZGS 45-49)	1.4	3.9	13.4	25.7	12.2	37.4
SEM	0.203	0.253	1.376	2.17	0.724	0.439
LSD (0.05)	0.58	0.73	3.95	6.23	2.08	1.260

* Leaf location from the head.
** Belgium scale.
*** Application when 10% leaf area diseased on 4th leaf or at ZGS 45-49.

Table 3. Yield (kg/ha) response of 6-row barley cultivars to TILT application.

Cultivar	Control	TILT (10%)*	TILT (ZGS 45-49)*
Chapais	5437	5455	5395
Duke	5337	5688	5999
Leger	4095	4222	4205
Mascot	4637	5223	4499
Sabina	4037	4915	5112
OAC Kippen	4541	4648	4557

.
SEM 175.8; LSD (0.05) 505

* Application when 10% leaf area diseased on 4th leaf from the head or at ZGS 45-49.

#140

STUDY DATA BASE: 385-1412-8203

CROP: Barley

PEST: Scald, *Rhynchosporium secalis* (Oudem.) J.J. Davis

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TITLE: THE EFFECT OF SCALD INOCULUM AND TILT ON SIX BARLEY CULTIVARS, LACOMBE, 1994

MATERIALS: TILT (250 g a.i./L Propiconazole)

METHODS: AC Lacombe, Brier, Harrington, Jackson, Leduc and Manley cultivars were selected for their varying resistance to scald. Harrington, Jackson and Manley are rated susceptible, AC Lacombe and Brier rate intermediate, and Leduc rates resistant (Varieties of Cereal and Oilseed Crops for Alberta - 1994. Agdex 100/32 Alberta Agriculture). A split-split plot was set up with either artificial or natural inoculum as the main plot and the application of TILT as the sub-plot. The cultivars were randomized within each chemical treatment. Plots were seeded May 3 into barley silage stubble and were 4 rows x 5.5 m long with 23 cm spacing between rows. Two rows of wheat were seeded between plots to limit disease spread. Straw infected with scald was chopped and applied to artificial plots on June 17. Scald inoculum was prepared by growing isolates of *R. secalis* on potato sucrose peptone agar (PSPA) at 17°C and 14 h daylight. After a 21 d incubation, the spores were scraped off and a suspension of mixed isolates was prepared to give 10^5 spores/mL. TWEEN 20 was added as a surfactant. Spores were applied to run off using compressed air sprayers during the evening of June 21. TILT was applied at 125 g a.i./ha using a CO_2 back-pack sprayer on June 30. An early disease score was made June 29 using a 0-9 scale with 9 rating >50% disease on each of the lower, middle and upper leaf canopies. Prior to maturity, 20 flag and 20 penultimate leaves from each plot were collected and rated for percent leaf area diseased (PLAD). At maturity, plots were harvested and grain yields and 1000 kernel weights taken. Data was subjected to analysis of variance and treatment means were compared using least significant difference.

RESULTS: As presented in the table. Scald was the more prevalent disease, although plots sprayed with TILT exhibited more net blotch (*Pyrenophora teres*). The hot and dry weather during the summer resulted in low disease levels. There were no significant differences between natural and artificial inoculum for any data variable, although PLAD for both flag and penultimate leaf was higher and yields and 1000 kernel weights were lower for artificially infected plots. There were significant cultivar differences for the early scald score (LSD .05 = 0.5) with Leduc rating <1 and Harrington, Manley and Jackson rating >2. TILT application gave significantly lower PLAD for both the flag (6% vs. 9%) and penultimate (8% vs. 16%) leaves. There were significant differences for cultivar with Jackson followed by Harrington and Manley having higher PLAD on both leaves than Brier, Leduc and AC Lacombe. There was also a significant interaction between TILT application and cultivar for PLAD for both the flag and penultimate. Both yields and 1000 kernel weights showed significant increases with the application of TILT. As well, there were significant differences between cultivars for both yields and 1000 kernel weights, as would be expected from such diverse material.

CONCLUSIONS: There were no significant differences between artificial or natural inoculum for any data variable. The application of TILT reduced PLAD for both the flag and penultimate leaves while increasing yields and 1000 kernel weights. The magnitude of the change was cultivar dependent.

Table 1. The effect of artificial or natural scald inoculum and TILT on six barley cultivars, Lacombe 1994.*

Inoculum	Chemical	Cultivar	Jun 29 Scald Score**	Flag PLAD	Penu PLAD	Kg/ha	1000 Kernel Wt (g)
Artificial	No	AC Lacombe	2	6	11	3276	38.4
		Brier	2	6	11	3500	37.9
		Harrington	2	10	25	3075	41.8
		Jackson	3	22	31	2761	36.6
		Leduc	1	6	7	3499	41.6
		Manley	2	8	16	2889	38.8
Artificial	TILT	AC Lacombe	2	5	6	3256	38.7
		Brier	2	5	7	3332	40.4
		Harrington	2	6	12	3257	45.1
		Jackson	3	7	10	2663	38.6
		Leduc	0	5	7	3478	42.2
		Manley	3	6	8	2954	39.8
Natural	No	AC Lacombe	1	6	6	3338	38.6
		Brier	2	6	10	3285	37.9
		Harrington	3	11	26	2729	42.6
		Jackson	3	14	26	2694	37.1
		Leduc	1	6	6	3276	42.2
		Manley	2	8	17	3034	40.8
Natural	TILT	AC Lacombe	1	5	6	3225	38.1
		Brier	2	6	7	3632	39.2
		Harrington	3	8	10	3438	44.2
		Jackson	2	7	13	3218	38.2
		Leduc	0	5	6	3607	42.1
		Manley	2	7	7	3632	39.9
LSD .05							
Chemical			ns	.9	1.5	165	.8
Cultivar			.5	1.5	2.7	285	1.4
Chemical x Cultivar			ns	2.1	3.8	ns	ns
Inoculum x Chem x Cultivar			ns	ns	ns	ns	ns

* Mean of four replications.
** 0-9 scale where 9 rates >50 PLAD on the upper, middle and lower leaf canopy.

#141

STUDY DATA BASE: 385-1412-8203

CROP: Barley, cv. Galt

PEST: Loose smut, *Ustilago nuda*

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TITLE: THE EFFECT OF SEED DRESSINGS ON LOOSE SMUT OF GALT BARLEY, LACOMBE 1994

MATERIALS: UBI-2092-1 (VITAFLOW 250)
UBI-2454-1 (50 g a.i./L Myclobutanil)
UBI-2568 (60 g a.i./L Triadimenol)
UBI-2584-1 (8.33 g a.i./L Tebuconazole)

METHODS: Galt barley artificially infected with loose smut was treated in a small batch laboratory treater with the chemicals and rates listed in Table 1. The seed was air dried and seeded May 3 into 4 row plots x 5.5 m long, and replicated four times in a randomized complete block design. Emergence was counted in two 1 m lengths from the center rows and averaged for each plot. Smut was recorded as the number of smutted heads in the 2 center rows. The total number of heads was determined and a figure for percent control calculated. At maturity, the 2 center rows were harvested and grain yield and 1000 kernel weights were taken. Data was subjected to analysis of variance and treatment means were compared using least significant difference.

RESULTS: As presented in the table. There were no significant differences in emergence counts although all treatments except UBI-2092-1 had lower counts than the untreated check. The level of smut infection was approximately 1% in the untreated check. All treatments except UBI-2584-1 at the higher rate had significantly higher percent control of loose smut. Yields were lower than the untreated check for every treatment except UBI-2568 and thousand kernel weights were higher except for UBI-2584-1 at the lower rate and UBI-2454-1.

CONCLUSIONS: While all treatments increased the percentage of smut controlled, only UBI-2568 also increased yield and thousand kernel weight.

Table 1. A comparison of emergence, percent control of smutted heads, seed yield and 1000 kernel weights on Galt barley treated with fungicide seed treatments at Lacombe, 1994.*

Treatment	Rate g a.i./kg	Emergence (number/m)	% Control Smut	Kg/ha	1000 Kernel Wt.
UBI-2092-1	.56	50	39	2803	34.4
UBI-2568	.15	40	82	2899	34.5
UBI-2584-1	.015	41	36	2761	33.7
UBI-2584-1	.02	44	21	2743	34.4
UBI-2454-1	.12	40	61	2804	33.6
Untreated	--	47	0	2808	33.9
LSD.05		ns	31	ns	ns

* Figures are the means of four replications.

#142

ICAR-ID: 91000144

CROP: Corn, field, cv. Pioneer 3737, Pioneer 3790

PEST: *Fusarium graminearum* Schwabe

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TITLE: FOLIAR FUNGICIDES FOR CONTROL OF FUSARIUM EAR ROT IN CORN

MATERIALS: A5504 80DG
EXP-10068 200F

METHODS: Plots were rows, 1 x 4.5 m long and spaced at 0.76 m apart. The plots were seeded on 3 May, 1994 and thinned to 25 plants per plot. Plot design was a 2 x 7 x 2 split plot arranged in a randomized complete block design with four replicates. Main plots were two hybrids (Pioneer 3737 and Pioneer 3790) and seven fungicide treatments arranged as a factorial. There were three rates for each fungicide and one non-treated control. The fungicides were applied on 27 June at the late whorl stage (V7-V9) and the spray was directed into the whorl at 1 mL spray per plant. This rate was equivalent to 240 L/ha of spray. The main plots were split into two methods of inoculation with *F. graminearum* (silk channel and pin block wounding). A mistline was placed overhead across the centre of the plots. Ten plants were inoculated on either side of the mistline with either the silk channel (1 mL of spores at 10^6 spores/mL injected into silk channel 1 week after silking) or pin block (centre area of ear wounded with 1 x 2 cm pin block and wound flooded with 1 mL of spores at 10^6 spores/mL 3 weeks after silking) inoculation method. Plots were misted to keep the ear zone wet to encourage mould. Plots were rated for mould on 18 October, when the crop was mature and dry to 25% moisture, using a rating scale of 1-7 where 1 was no visible mould and 7 was >75% of the ear covered with visible mould.

RESULTS: Main effects for fungicide treatments were not significant (P = 0.05). Main effects for hybrid and inoculation method were significant (P = 0.05). Hybrid P3737 was more susceptible to infection than P3790. There were no interactions between corn hybrid and inoculation method (P = 0.05). The results for mould severity ratings in response to fungicide treatments are summarized by inoculation method and fungicide in Table 1.

CONCLUSIONS: The fungicides tested did not control Fusarium ear rot in corn.

Table 1. Effect of fungicide sprays applied into the whorl at the late whorl stage on Fusarium ear rot severity in corn, 1994.

Fungicide	Formulation	Rate (g a.i./ha)	Mould Severity (1-7) Silk channel	Pin Block
RP EXP-10068	200F	200	2.9*	3.5
RP EXP-10068	200F	300	2.8	3.2
RP EXP-10068	200F	400	3.1	3.5
CONTROL			3.0	3.5
.				
ICIA-5504	80DG	100	3.0	3.6
ICIA-5504	80DG	200	3.0	3.7
ICIA-5504	80DG	300	3.0	3.3
CONTROL			3.0	3.5

* Means are not significantly different (P = 0.05, Duncan's Multiple Range Test).

#143

STUDY DATA BASE: 303-1212-9301

CROP: Oats, cv. Capital

PEST: Speckled leaf blotch, *Phaeosphaeria avenaria* (G.F. Weber) O. Eriksson
Naturally occurring seedling blights

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TITLE: EFFICACY OF SPRAYS AND FUNGICIDE SEED TREATMENTS ON CONTROL OF FOLIAR DISEASE OF OATS, 1994

MATERIALS: Seed treatments:
VITAFLO 280 (Carbathiin, 167 g a.i./L + Thiram 148 g a.i./L)
BAYTAN (Ttriademenol, 317 g a.i./L
TF-377OA (Hexaconazole FL, 5.0 g a.i./L)
TF-3794 (Paclobutrazol, 2 g a.i./L)
DB GREEN (Maneb 323 g a.i./L + Lindane 108 g a.i./L)
UBI-2454 (RH-3866, 50 g a.i./L)
UBI-12584 (Tebuconazole 8.33 g a.i./L)
Foliar treatments: TILT (Propiconazole, 250 EC)
BRAVO (Chlorothalonil, 500 g a.i./L)
SEAWEED EXTRACT (unknown)

METHODS: The trial was established at the Harrington Research Farm, Harrington, Prince Edward Island on 16 May. Treatments were replicated four times in a randomized complete block design with separate blocks for seed treatments and foliar evaluations. The plots, 2 x 5 m, in the foliar trial were separated by equal sized guard plots of barley while seed treatment plots were separated by 2 barley guard rows. Emergence was determined by counting the number of seedlings in 2 m of the 2 centre rows of each seed treatment plot. Foliar sprays were applied once at Zadoks Growth Stage (ZGS) 37 using a tractor driver direct injection sprayer delivering the treatments at 1000 kps in 640 L/ha water. The seed treatment trial was rated for severity of leaf lesioning on a whole plot basis once at ZGS 50 while foliar treatment trial was rated at ZGS 70 utilizing a 0-9 scale. The trials were harvested at crop maturity using a Hege small plot combine. All yield data was recorded on a 14% moisture basis.

RESULTS: Fungicide seed treatments did not improve the stand of oats (Table 1). Treatments excepting TF-377OA and TF-3794 at the lower application rates decreased severity of *P. avenarae* lesioning at ZGS 50. However seed weights and total grain yields were not increased by materials evaluated. Foliar sprays of BRAVO and TILT alone or in combination decreased severity of leaf disease but no changes in either seed weight or total grain yield were evident.

CONCLUSIONS: Disease severity in 1994 was less than normally experienced on Prince Edward Island due to dry warm weather in mid to late summer. This may have resulted in a general lack of host response to the treatments even when several foliar sprays reduced foliar disease severity.

Table 1. Influence of seed treatments of seed treatments on emergence, foliar disease severity, and yield of oats.

Treatment	Rate*	Emergence plants/m^2	Disease (0-9)	1000-K wt. (g)	Grain yield (kg/ha)
Check	Nil	252	4.5	31.0	3821
VITAFLO	1.4	235	3.0	30.2	3887
BAYTAN	0.15	221	3.5	30.5	3888
TF-3770A	0.005	243	4.0	30.5	3933
TF-3794	0.01	247	4.0	31.0	4059
TF-3794	0.02	209	3.5	30.1	4150
DB GREEN	1.35	270	3.5	30.4	4193
DB GREEN	2.7	266	3.5	30.4	4071
UBI-2454	0.24	232	3.5	30.1	4316
UBI-2454	0.36	245	3.5	29.9	3993
UBI-2585	0.02	240	2.3	30.9	3721
UBI-2584	0.25	260	3.8	30.6	3880
LSD (0.05)		ns	0.72	ns	ns

* g a.i./kg seed

Table 2. Influence of sprays on severity of foliar disease and yield of oats.

Treatment	Rate*	Disease (0-9)	1000-K wt. (g)	Grain yield (kg/ha)
Check	Nil	4.8	30.49	4208
TILT	125	3.7	30.64	4176
BRAVO	1000	3.5	30.67	4232
SEAWEED	500	4.0	30.68	3832
SEAWEED	1000	5.0	30.98	4042
SEAWEED	1500	4.5	30.18	3893
SEAWEED	2000	4.3	30.77	4230
BRAVO + TILT	1000 + 125	3.1	31.40	4603
BRAVO + TILT	2000 + 125	3.0	31.50	4484
LSD (0.05)		1.10	ns	ns

* g a.i./ha for fungicides, g product/ha for seaweed extract.

#144

STUDY DATA BASE: 303-1212-8907

CROP: Wheat, cv. Celtic

PEST: Fusarium head blight, *Fusarium graminearum* Schwabe

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TITLE: THE EFFECTS OF WHEAT SEED TREATMENTS ON FUSARIUM HEAD BLIGHT AND YIELD, 1994

MATERIALS: UBI-2454-1 (RH-3866 + Sistane + Mycloloutanil, 50 g/L)

VITAFLO 280 (Carbathiin 14.9% + Thiram 13.2% ww)
ANCHOR (Carbathiin 66.7 g/L)
UBI-2568 (Baytan + Triadimenol 60 g/L)
AGSCO DB-GREEN L (Maneb 323 g/L + Lindane 108 g/L)
TF-3770A (Hexaconazole 5.0 g/L)
TF-3794 2 ME (Paclobutrazol 2.0 g/L)
UBI-2584 (Tebuconazole 8.33 g/L)

METHODS: Celtic spring wheat was treated in a small batch seed treater with the above materials at the rates listed in the table. Plots were established on May 12, 1994, at a seeding rate of 400 viable seeds per m^2. Each plot was 8 rows wide x 4 m long, separated by 2 guard rows of Belvedere wheat. Treatments were replicated four times in a randomized complete block design. Emergence was taken on June 1/94, June 3/94 and June 6/94, on the same two, 1 m sections of row in each plot. On August 3/94, fusarium head blight ratings were taken on 20 randomly selected heads per plot using a severity rating of 0-9, where 0 = no disease symptoms and 9 = head completely covered with symptoms. Yield and thousand kernel weight were determined from the harvest of 7 rows, using a small plot combine.

RESULTS: While several treatments initially may have delayed emergence, by the final date there were no significant differences (P = 0.05). UBI-2568 appeared to slow emergence down early on, while there is evidence of increased emergence when compared to the untreated control for some treatments, inparticular VITAFLO 280 and AGSCO DB-GREEN. Only TF-3770A had a significant affect on yield, compared to the untreated control, and this was a negative effect.

CONCLUSIONS: Although the Celtic wheat used in this test had a high incidence of infection by fusarium species (65%) it appeared that treatments, in general, had little effect on emergence or yield. Weather conditions from heading through to harvest were very dry and not conducive to infection by *Fusarium graminearum* or the development of fusarium head blight symptoms, thus the very low severity levels. The prolonged dry period probably had an effect of evening out any potential yield effects between treatments.

Table 1. Influence of seed treatments on emergence, disease and yield in Celtic wheat

Treatment	Rate*	Emergence ($Plants/m^2$) 06/01	06/03	06/06	Fusarium Head Blight Severity (0-9)	Incidence (%)	Yield (kg/ha)	TKW (g)
Untreated	0	296	315	375	0.8	21.3	2948	29.6
UBI-2454-1	2.4	298	328	398	0.7	11.3	2954	28.5
Vitaflo 280	2.3	326	334	432	0.5	13.8	2877	28.1
Vitaflo 280	3.3	312	352	395	0.6	18.8	2876	28.7
Anchor	8.0	295	323	394	0.5	18.8	2942	30.3
UBI-2383-1	1.0	281	321	386	1.1	18.8	3059	30.2
UBI-2568	5.0	256	286	378	0.9	23.8	3001	28.7
AGSCO DB-Green L	3.12	324	356	401	0.9	18.8	2861	29.5
TF-3770A	3.0	276	295	362	0.5	25.0	2631	29.9
TF-3794 2ME	5.0	286	302	346	1.0	18.8	2800	27.6
UBI-2584	2.4	297	312	378	1.0	20.0	2886	30.2
SEM**		13.3	11.4	21.6	0.20	4.70	60.3	0.68
LSD (P = 0.05)		38.4	33.2	NS	NS	NS	174.1	NS

* Rate - mL product/kg seed.
** SEM - Standard Error of Mean.
NS Not significant at 0.05 level of probability.

#145

STUDY DATA BASE: 303-1212-9301

CROP: Wheat, cv. Belvedere and Roblin

PEST: Powdery mildew, *Erysiphe graminis* DC. f.sp. *tritici* Ém. Marchal
Glume and leaf blotch, *Phaeosphaeria nodorum* (E. Müller) Hedjaroude

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TITLE: EFFICACY OF SPRAYS AND FUNGICIDE SEED TREATMENTS FOR CONTROL OF FOLIAR DISEASES OF SPRING WHEAT, 1994

MATERIALS: Seed treatments:
VITAFLO 280 (Carbathiin, 167 g a.i./L + Thiram 148 g a.i./L)
BAYTAN (Triademenol, 317 g a.i./L
TF-377OA (Hexaconazole FL, 5.0 g a.i./L)
TF-3794 (Paclobutrazol, 2 g a.i./L)
DB GREEN (Maneb 323 g a.i./L + Lindane 108 g a.i./L)
UBI-2454 (RH-3866, 50 g a.i./L)
UBI-2584 (Tebuconazole 8.33 g a.i./L)
Foliar treatments: TILT (Propiconazole, 250 EC)
BRAVO (Chlorothalonil, 500 g a.i./L)
SEAWEED EXTRACT (unknown)

METHODS: The trials were established with Belvedere and Roblin spring wheat on May 16 at the Harrington Research Farm, Harrington, Prince Edward Island. Roblin is more susceptible to scab (*F. graminearum*) and powdery mildew (*E. graminis* f.sp. *tritici*) than Belvedere but are equally susceptible to leaf blotch (*P. nodorum*). The plots, 4 x 5 m, were replicated four times and planted in a split-plot randomized complete block design with seed treatments or foliar sprays as main plots and cultivars sub-plots. Separate blocks were used for seed and foliar treatments with seed plots separated by 2 guard rows of barley and spray plots by an equal sized barley plot. Emergence was determined as plants/m^2 at Zadoks Growth Stage (ZGS) 10 by counting the number of seedlings in 2 m of the centre 2 rows of each seed treatment plot. Foliar treatments were applied at ZGS 39 using a tractor driven direct line injection sprayer with all materials delivered at 1000 kPa in 640 L/ha water. All plots were rated for severity of leaf lesioning on a 0-9 scale, at ZGS 60 and 70 for seed treatments and at ZGS 65 and 75 for foliar sprays. The trials were harvested by sub-plots at crop maturity using a Hege small plot combine. All yield data was determined on a 14% moisture basis.

RESULTS: Seed treatments resulted in increased yield of Belvedere wheat but while emergence was improved, no yield improvements resulted with Roblin wheat. Disease severity was not altered by use of seed treatments (Table 1). Seed treatments did not improve emergence of Belvedere wheat but VITAFLO 280 and DB GREEN at the low rate improved emergence of Roblin wheat. Yields of Belvedere were improved by UBI-2584 at the higher application rate. Roblin wheat had the highest yields at 3471 kg/ha also with UBI-2485 at the 0.02 g ai rate (significant at P = 0.06). No product evaluated significantly decreased seed weight or grain yield. Foliar sprays did not result in significant differences in total leaf lesioning or grain yields for either cultivar (Table 2). BRAVO and TILT applied alone and in combination resulted in increased seed weights with Roblin wheat.

CONCLUSIONS: Weather conditions in mid to late summer were generally dry and unfavourable for the development of foliar diseases of wheat. In seed treatment evaluation plots, increases in grain yield of both cultivars were significantly correlated with increased stand and vigor and negatively related to foliar disease severity (P = 0.01). Grain yield improvements for Belvedere and Roblin in the foliar spray trial were correlated with decreased foliar disease severity (P = 0.01).

The lack of yield improvement with foliar sprays was attributed to the low disease severity in 1994 compared to most years. Seed treatments may have improved the emergence of Roblin more than Belvedere due to the higher susceptibility of Roblin to *Fusarium* or poor seed quality due to scab in the harvest year. The reported yield increase with UBI-2584 should be further evaluated.

Table 1. Influence of fungicide seed treatments on emergence, disease severity, and yield of Belvedere and Roblin spring wheat.

Treatment	Rate*	Emergence**	AUDPC***	Yield	Emergence	AUDPC	Yield
Check	Nil	610	7.5	3806	378	13.5	3065
VITAFLO	1.4	694	9.0	3704	474	12.5	3199
BAYTAN	0.15	598	8.3	3758	326	13.3	3294
TF-3770A	0.005	581	9.0	3627	345	13.8	3111
TF-3770A	0.01	542	7.5	3794	424	13.3	3168
TF-3770A	0.015	618	8.3	3766	341	13.0	3066
TF-3794	0.01	619	8.5	3482	406	13.3	3235
TF-3794	0.02	528	8.8	3633	419	12.5	3143
DB GREEN	1.35	598	8.5	3746	487	13.8	3315
DB GREEN	2.7	595	9.3	3556	455	14.0	3331
UBI-2454	0.24	642	8.0	3730	361	12.5	3281
UBI-2554	0.36	671	8.0	3928	443	12.8	3391
UBI-2584	0.02	574	8.3	3831	421	13.3	3471
UBI-2584	0.25	567	9.2	4179	450	13.0	3160
LSD (0.05)		ns	ns	332.6	92.2	ns	ns

* Total g a.i./kg seed.
** Plants/square meter.
*** Area under disease progression curve.

Table 2. Influence of foliar sprays on disease severity and grain yield of Belvedere and Roblin spring wheat.

Treatment	Rate*	Foliar disease (AUDPC)		1000-K (g)		Grain yield (kg/ha)	
		Bel'ere**	Roblin	Bel'ere	Roblin	Bel'ere	Roblin
Check	Nil	6.8	13.0	35.5	33.6	3744	3052
TILT	125	7.5	12.5	36.8	34.7	3840	3182
BRAVO	1000	6.5	11.0	35.6	35.4	3978	3414
SEAWEED	500	8.3	13.5	37.1	34.4	3767	3208
SEAWEED	1000	7.8	13.3	35.8	34.3	3669	3222
SEAWEED	1500	8.0	14.3	36.9	34.4	3587	2917
SEAWEED	2000	8.0	13.0	36.5	34.2	3879	2932
TILT + BRAVO	125 1000	6.8	12.8	36.7	35.4	3694	3190
TILT + BRAVO	125 2000	7.8	13.3	37.2	34.6	4107	3004
LSD (0.05)		ns	ns	ns	0.97	ns	ns

* Total g a.i./ha for fungicides, g product/ha seaweed extract.
** Belvedere.

#146

STUDY DATA BASE: 375-1411-8719

CROP: Spring wheat, cv. Leader
6 row Barley, cv. Brier

PEST: Common root rot, *Cochliobolus sativus* (Ito & Kuribayashi) Drechs. ex Dastur

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TITLE: EFFECT OF SEED TREATMENT FUNGICIDES ON EMERGENCE, COMMON ROOT ROT AND YIELD OF LEADER SPRING WHEAT AND BRIER BARLEY, 1994

MATERIALS: DIVIDEND (Difenoconazole 360 g/L)
UBI-2100-4 (Carbathiin 230 g/L)
UBI-2454-1 (Sisthane 50 g/L)
UBI-2568 (Triadimenol 30 g/L)
UBI-2584-1 (Tebuconazole 8 g/L)
AGROX FLOWABLE (Maneb 300 g/L)
WF-2228 (Hexaconazole 5 g/L)
TF-3794 (Paclobutrazol 2 g/L)

METHODS: The test was established at Saskatoon, Saskatchewan in 1994. Naturally occurring inoculum of *C. sativus* was relied upon for infection. Seed was treated in 1000 mL glass jars. Chemical treatments were dispersed over the glass surface, then for wheat 275 g of seed was added and shaken, and for barley 350 g of seed was added and shaken. To ensure uniform coverage of the seed, the first treated lot of seed was discarded and a second lot was packaged for seeding. Seed was treated with products from Gustafson on April 22. Ciba-Geigy and Zeneca treated seed from the same seed lot. Wheat and barley were in separate tests. Each test was a randomized complete block design with six replicates. Plots had 4 rows x 6 m long. Rows were 23 cm apart with 350 seeds planted in each row. Seeding and fertilizing (40 kg/ha with 11-55-0) took place May 9; emergence was recorded on May 31 on 2 m of one of the center rows. Common root rot was recorded twice during the growing season for barley, at flowering to watery ripe (D.R. Tottman and H. Broad. *Ann. Appl. Biol.* 10:441-454, 1987) on July 21, and at firm dough on August 9 by rating 40 plants randomly selected from 1 row. Common root rot on wheat was measured on July 21 at flowering, and at hard dough on August 24. Common root rot was determined by counting the number of plants with lesions covering >50% of the subcrown internode. Percent common root rot was calculated by multiplying the field score by 2.5. Harvesting (3 rows x 5 m long) of barley was done August 31 and wheat on September 5 with yield recorded as kg/ha of dry grain.

RESULTS: As presented in the tables.

CONCLUSIONS: For wheat, UBI-2568, WF-2228 plus TF-3794, WF-2228, and UBI-2454-1 had significantly (P = 0.05) lower yields than the control, while DIVIDEND-1 (12 g a.i.) and UBI-2100-4 had higher yields, they were not significantly higher than the control (Table 1). Disease rating at flowering and at firm dough stage was significantly (P = 0.05) lower for all treatments except Agrox Flowable, UBI-2100-4, and TF-3794. Emergence was significantly (P = 0.05) lower than the control for WF-2228, WF-2228 plus TF-3794, UBI-2454-1, and DIVIDEND-1 (12 g a.i.). Treatment with UBI-2568, WF-2228 plus TF-3794, UBI-2484-1, UBI-2454-1, and WF-2228 shortened and thickened subcrown internodes. For barley there was no significant difference from the control for yield (Table 2). UBI-2454-1 had a significantly (P = 0.05) lower disease rating than the control at flowering. Disease rating at hard dough was lower than the control, but not significantly, for all treatments except UBI-2100-4 and UBI-2584-1. Emergence was significantly (P = 0.05) lower than the control for UBI-2454-1.

Table 1. The effect of seed treatment fungicides on emergence, common root rot and yield of Leader spring wheat.

PRODUCT	RATE (g a.i./kg seed)	EMERGENCE (plants/^{2}m)	CRR July 21	CRR August 24	YIELD (kg/ha)
Control	----	104a*	9.2a*	26a*	4304a*
AGROX-FLOWABLE	0.450	95abc	11.7a	24a	4099abc
DIVIDEND-1	0.120	85 bc	1.7 b	10 bc	4359a
DIVIDEND-2	0.240	89abc	1.7 b	9 c	4152ab
DIVIDEND-3	0.400	97abc	0.4 b	7 c	4284a
TF-3794	0.006	95abc	8.3a	20ab	4163ab
UBI-2100-4	0.550	101ab	10.4a	20ab	4317a
UBI-2454-1	0.060	82 c	0.4 b	5 c	3492 e
UBI-2568	0.150	88abc	1.7 b	9 c	3785 bcde
UBI-2584-1	0.020	94abc	3.3 b	12 bc	3985abcd
WF-2228	0.015	82 c	0.8 b	6 c	3603 de
WF-2228 + TF-3794	0.015 0.006	79 c	0.4 b	6 c	3711 cde

* Values in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

Table 2. The effect of seed treatment fungicides on emergence, common root rot and yield of Brier 6 row spring barley.

PRODUCT	RATE (g a.i./kg seed)	EMERGENCE (plants/^{2}m)	CRR July 21	CRR August 9	YIELD (kg/ha)
Control	----	98a*	22ab*	46ab*	6303a*
AGROX-FLOWABLE	0.450	99a	17 bc	43ab	6272a
UBI-2100-4	0.550	97a	27a	50a	6111a
UBI-2454-1	0.060	80 b	13 c	31 b	5856a
UBI-2568	0.150	89ab	15 bc	33ab	5987a
UBI-2584-1	0.020	94ab	20abc	46ab	6238a
WF-2228	0.015	88ab	15 bc	38ab	6082a

* Values in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

#147

STUDY DATA BASE: 375-1411-8719

CROP: Canadian Western Red Spring Wheat, cv. Katepwa
Canada Prairie Spring Wheat, cv. Biggar
Canadian Western Amber Durum, cv. Sceptre
Soft White Spring Wheat, cv. Fielder

PEST: Naturally occurring foliar diseases

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TITLE: EFFECT OF APPLICATION OF TILT ON FOLIAR DISEASE AND YIELD OF SEVERAL CLASSES OF SPRING WHEAT, 1994

MATERIALS: TILT (Propiconazole 250 g/L)

METHODS: The test was performed at the Agriculture and Agri-Food Research Centre farms located at Saskatoon and Melfort, Saskatchewan. A split-plot design was used with cultivars as main plots and treatments as subplots. Each subplot was made up of 8 rows. Two rows of wheat were planted between subplots. Seeding and seed placement with 50 kg/ha of 11-55-0 fertilizer took place in Melfort on May 24, and in Saskatoon on May 27. Treatments were sprayed using a hand-held, CO_2 pressurized, 4 nozzle boom sprayer (nozzle size 0.01) that delivered 225 L/ha at 240 kPa. The foliage of 8 rows was sprayed with Tilt at a rate of 125 g a.i./ha. Control subplots were sprayed with water on July 27 in Melfort and July 28 in Saskatoon. Spraying took place four times in Melfort on July 13 (G.S. 43-59 boots swollen to inflorescence emergence), July 20 (G.S. 55-66 one half of inflorescence emerged to anthesis one half way), July 27 (G.S. 67-71 anthesis half way to water ripe), August 4 (G.S. 72-79 early milk to late milk) (D.R. Tottman and H. Broad. *Ann. Appl. Biol.* 10:441-454, 1987). Spraying in Saskatoon took place on July 14 (G.S. 41-45 flag leaf sheath extending to boots swollen), July 21 (G.S. 45-61 boots swollen to beginning of anthesis), July 28 (G.S. 61-69 beginning of anthesis to anthesis complete) and August 4 (G.S. 69-73 anthesis complete to early milk). Ten penultimate leaves were collected in Melfort (flag leaves for Katepwa) on August 15 and flag leaves were collected in Saskatoon on August 24 from randomly selected plants in the center 2 rows of each subplot and were stored at 5°C until actual percent disease coverage was rated. Leaves from the control subplots were pressed and dried. They were scanned to determine the presence of obligate pathogens. Dried leaf pieces (4-6 cm) containing lesions were prepared and plated on water agar containing antibiotics. Sporulation was observed after approximately 1 week. Harvesting of 5 rows x 5 m long occurred in Melfort on September 12 and in Saskatoon on September 14 with yield recorded as kg per ha.

RESULTS: Results are summarized in the tables. Cultivars grown at Saskatoon were significantly (P = 0.05) different for yield with Fielder averaging 5292 kg/ha, Biggar 5216, Sceptre 4789, and Katepwa 3822. The cultivar x treatment interaction was not significant for foliar disease or yield. Timing of spray application was significantly (P = 0.05) different than the control for yield and percent disease. Yield was increased from 8% over the control at the July 14 spray date to 5% for the August 4 spray date. Foliar disease was reduced from the control by 22 to 34% for all spray dates. Assessment of pathogens for Saskatoon trials showed that in Sceptre, 100% of the leaf disease was caused by *Pyrenophora tritici-repentis* (tan spot) and for Katepwa, 100% was caused by *Septoria tritici.* The major cause of leaf disease in Biggar was *S. tritici* at 60% while *P. tritici-repentis* caused 40%. In Fielder 90% of the leaf disease was caused by *P. tritici-repentis* and 10% by *S. tritici*. Pathogen assessment of Melfort trials showed that in Sceptre 90% of foliar disease was caused by *P. tritici-repentis* and 10% by *S. tritici*, for Katepwa 90% was caused by *S. tritici*, and 10% by *S. nodorum*. The major cause of leaf disease for Biggar was *S. tritici* at 100%, while for Fielder *P. tritici-repentis* caused 90% and *S. tritici*, 10%. In Melfort, foliar disease was significantly (P = 0.05) lower than the control for all treatments, but there was no significant difference from the control for yield. Yield for Biggar was 4249 kg/ha, Fielder 4236, Katepwa 3471, and Sceptre 3384. The cultivar X treatment interaction was significant (P = 0.05) for percent disease, but not for yield. Foliar disease levels for Katepwa, Sceptre, Fielder and Biggar were 19%, 18%, 11% and 8% respectively.

CONCLUSIONS: Saskatoon trials with Tilt significantly (P = 0.05) increased yield and decreased percent foliar disease from the control at all spray dates. Trials at Melfort with Tilt significantly (P = 0.05) decreased foliar disease for all spray dates. Yield was not significantly different for the spray dates, but was higher than the control for August 4, July 20, and July 13.

Table 1. The effect of application of Tilt on foliar disease and yield on several classes of spring wheat in Saskatoon.

SPRAY DATE	GROWTH STAGE	FOLIAR DISEASE (%)	YIELD (kg/ha)
Control		41a*	4562 b*
July 14	41-45	32 b	4915a
July 21	45-61	30 b	4825a
July 28	61-69	29 b	4807a
August 04	69-73	27 b	4788a

* Values for each variable in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

Table 2. The effect of application of Tilt on foliar disease and yield on several classes of spring wheat in Melfort.

SPRAY DATE	GROWTH STAGE	FOLIAR DISEASE (%)	YIELD (kg/ha)
Control		30a*	3803a*
July 13	43-59	7 c	3834a
July 20	55-66	6 c	3871a
July 27	67-71	10 c	3744a
August 04	72-79	18 b	3921a

* Values for each variable in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

#148

CROP: Winter wheat, cv. Norstar/Readymade

PEST: Dwarf bunt, *Tilletia controversa* Kühn in Rabenh.

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TITLE: EFFECT OF SEED TREATMENT FUNGICIDES ON CONTROL OF SOIL-BORNE DWARF BUNT AND EMERGENCE OF WINTER WHEAT, 1994

MATERIALS: MERTECT FLOWABLE (Thiabendazole 450 g/L)
DIVIDEND 3FS (Difenconazole 360 g/L)
ICIA-0523 (Hexaconazole 5 g/L)

METHODS: Seed was treated with MERTECT and ICIA-0523 in 200 mL glass jars on September 22, 1993. Seed was treated with DIVIDEND by Ciba Geigy during the week of September 20. Plots were seeded using a one-row cone seeder on October 1, 1993 at Armstrong, British Columbia, in soil naturally infested with dwarf bunt. There were seven chemical treatments plus a control for each variety, for a total of 16 treatments. Each treatment was replicated four times in a randomized complete block design. Each plot consisted of 2-6 m rows, 23 cm apart. Each row was seeded with 18 g seed. Plots were separated by a row of untreated winter barley. Emergence was assessed on November 8, 1993 in three replicates. The fourth replicate was not assessed due to heavy germination of wild oats. Supplemental inoculum was applied on November 23, 1993. Inoculum was prepared by grinding dwarf bunt infected wheat heads, which were collected at Armstrong BC in July 1993. The ground wheat heads were mixed with sand, which was sprinkled by hand over the plot area. Five metres of each plot was harvested on July 21, 1994 using a 2-row binder. Percent bunt infection was determined by counting the number of healthy and bunted wheat spikes per plot.

RESULTS: Percent bunt infection and emergence are summarized in Table 1. The cultivars were significantly different (P = 0.01) in percent bunt infection (Norwin-5.1%, Readymade-1.9%). The cultivar cross treatment interaction was significant (P = 0.01), therefore data are presented separately for each cultivar. There were no significant differences in emergence between treatments.

CONCLUSIONS: DIVIDEND provided almost complete suppression of dwarf bunt. MERTECT at 2 and 4 g a.i./kg seed also provided significant control compared to the check. ICIA-0523 did not provide adequate control at the rates tested.

Table 1. Percent dwarf bunt infection and emergence counts by treatment.

Fungicide	Rate (g a.i./kg seed)	% Bunt Norwin	% Bunt Readymade	Emergence (plants/m)
Check	-	9.0 ab*	4.4 a*	67
MERTECT	1.0	7.8 b	1.8 b	65
MERTECT	2.0	1.7 c	1.0 bc	63
MERTECT	4.0	0.35 c	0.53 bc	62
DIVIDEND	0.12	0.15 c	0.0 c	60
DIVIDEND	0.18	0.0 c	0.18 bc	61
ICIA-0523	0.03	13.6 a	3.9 a	61
ICIA-0523	0.06	8.2 b	3.8 a	57

* Numbers followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P = 0.05).

#149

ICAR-ID: 61006537

CROP: Wheat, winter, cv. unknown

PEST: Loose smut, *Ustilago tritici* (Pers.) Rostr.

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TITLE: CONTROL OF LOOSE SMUT IN WINTER WHEAT WITH SEED TREATMENTS

MATERIALS: VITAFLO 280 (Carbathiin + Thiram, 167 & 148 g/L a.i., respectively)
UBI-2092-1 (Carbathiin 282 g/L a.i.)
UBI-2568 (Triadimenol 60 g/L a.i.)
UBI-2454-1 (RH-3866 50 g/L a.i.)
UBI-2584-1 (Tebuconazole 8 g/L a.i.)

METHODS: Seed known to be infected was treated on 9 September 1993 with a mini rotostat seed treater in lots of 1 kg. The crop was planted on 7 October, 1993 at Ridgetown using a 6 row cone seeder at 2,070 seeds per plot. Plots were 6 rows at a row spacing of 15 cm and 5 m long placed in a randomized complete block design with four replications. The plots were fertilized and maintained using provincial recommendations. Emergence was evaluated on 23 November by counting the number of plants in 1 m^2 in the centre of the plot. Winter survival was assessed by counting the number of wheat heads in the same area of the plot where emergence was counted. The total number of heads showing smut infection was counted for each plot and then expressed as a percentage of the total heads per plot, which was estimated by the head counts obtained in 1 m^2.

RESULTS: As presented in the table.

CONCLUSIONS: All the materials, except for UBI-2092-1, provided better control of loose smut than the standard, VITAFLO 280. All materials resulted in significantly less loose smut than observed in non-treated controls. None of the seed treatments resulted in poorer emergence or reduced winter survival by comparison with non-treated controls.

Table 1. Control of loose smut with seed treatment fungicides in winter wheat at Ridgetown, Ontario, 1994.

Treatment	Rate mL/kg seed	Emergence plants/m^2 Nov. 11	Heads /m^2 June 20	Loose smut % heads infected June 17
1. VITAFLO 280	3.30	429 a*	782 a	0.3 b
2. UBI-2092-1	1.95	423 a	708 a	0.2 b
3. UBI-2568	2.50	392 a	747 a	0.0 c
4. UBI-2092-1 +	1.95			
UBI-2454-1	1.20	403 a	635 a	0.0 c
5. UBI-2584-1	2.40	438 a	819 a	0.0 c
6. UBI-2568	5.00	413 a	882 a	0.0 c
CONTROL		383 a	832 a	1.6 a
CV =		15.3	19.8	44.4

* Means followed by the same letter are not significantly different (P = 0.05, Duncan's Multiple Range Test).

SECTION N

DISEASES OF ORNAMENTALS AND GREENHOUSE CROPS / MALADIES DES PLANTES ORNEMENTALES ET DE SERRE

Section Editor / Réviseur de section : Dr. G. Platford

#150 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 20902307

CROP: Kentucky bluegrass, (*Poa pratensis* L.), cvs. Nugget and Chateau

PEST: Powdery mildew, *Erysiphe graminis* DC.
Rust, *Puccinia brachypodii* G. Otth var. *poae-nemoralis* (G. Otth) Cummins and H.C. Greene

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TITLE: EFFICACY OF NINE FUNGICIDES AGAINST POWDERY MILDEW AND RUST IN KENTUCKY BLUEGRASS SEED FIELDS IN SOUTHERN ALBERTA, 1994

MATERIALS: LIME SULPHUR SOLUTION (Sulphide Sulphur 22% SN)
SULCHEM 92 (Sulphur 95% WG)
EASOUT (Thiophanate-methyl 70% WP)
DITHANE DG (Mancozeb 75% WG)
TILT 250E (Propiconazole 250 g/L EC)
NOVA 40W (Myclobutanil 40% WP)
COMPANION AGRICULTURAL ADJUVANT (octylphenoxypolyethoxy-(9)-ethanol 70% SN)

METHODS: Fungicide efficacy trials were conducted in two commercial bluegrass seed fields near Hays and Taber in southern Alberta. Each treatment was applied to four, 10 m^2 subplots (see Tables 1 and 2). A similar set of subplots was sprayed with tap water as an untreated check. The non-ionic adjuvant COMPANION was added to the spray mixes containing NOVA 40W and DITHANE DG at the rate of 1.0 mL/L of mixture. The treatments were arranged in a randomized complete block design with four replications. The sprays were applied with a CO_2-propelled, hand-held boom sprayer equipped with four, Tee Jet 8002 nozzles. The spray was directed over the top of the plant canopy. The grass was 20-25 cm tall and not yet headed out on May 17 when all of the treatments containing sulphur (Treatments 1, 2, 7, 8, 9), as well as the check, were sprayed for the first time. The equivalent of 200 L/ha of spray mixture was applied to each subplot using a boom pressure of 250 kPa. A trace amount of mildew was noticed in the Hays plot at the time of spraying, but none was evident at Taber, and no rust was seen at either location. On June 1, a second round of spraying was done at Hays in which LIME SULPHUR SOLUTION (treatment 1) and SULCHEM 92 (treatment 2) were applied for the second time, and EASOUT (treatments 3, 9), TILT 250E (treatments 4, 7), DITHANE DG (treatment 5) and NOVA 40W (treatment 6 and 8) were put on for the first time. At the time these fungicides were applied, approximately 90% of the grass plants were in head, with some mildew showing on the lower leaves and stems; no rust was observed. On June 9, the second set of sprays were applied at Taber, as per the Hays trial. Approximately 50% of the plants were in head, but their distribution over the plot was uneven. Trace levels of mildew were observed on the bottom leaves, but no rust was seen.

From July 13 to 14, random samples of 100 leaves were collected from each subplot at both locations and visually rated for mildew and rust severity. The ratings were based on the percentage of leaf area covered, i.e. clean (0) = no mildew/rust; slight (1) = 1-5%, moderate (2) = 6-25%, and severe (3) = >25%. Grass heads (100/subplot) were harvested from the Hays plot, dried, threshed and cleaned to obtain seed yields. Yields were not taken at the Taber plot because of non-uniform production of heads. Disease incidence and severity data and seed weights were subjected to analysis of variance (ANOVA). The percent disease incidence figures were arcsin-transformed prior to ANOVA.

RESULTS: At Hays, powdery mildew and rust occurred at moderate to high incidence levels. Plots treated with TILT 250E, NOVA 40W, LIME SULPHUR SOLUTION plus NOVA 40W and LIME SULPHUR SOLUTION plus TILT 250E had a much lower incidence of powdery mildew compared to the untreated check (see Table 1), but these differences were not statistically significant, probably because of the high coefficient of variation (67%) in the experiment. There were no significant differences in the incidence of rust, in the severity of mildew and rust, or in seed yields between any of the treatments.

Mildew incidence at Taber was higher than at Hays, whereas rust incidence was much lower (see Table 2). Subplots treated with TILT 250E, NOVA 40W, LIME SULPHUR SOLUTION plus NOVA 40W and LIME SULPHUR SOLUTION plus TILT 250E all had a significantly lower incidence and severity of powdery mildew than the other fungicide treatments and the check. No statistically significant differences in rust incidence or severity were observed between any of the treatments. The coefficients of variation for these 2 parameters were very high.

CONCLUSIONS: Treatments containing NOVA 40W and TILT 250E provided the best control of powdery mildew under the conditions of these trials. Even though the severity of rust at both sites was low, none of the fungicides tested adequately controlled this disease.

Table 1. Incidence and severity of powdery mildew and rust on Nugget bluegrass treated with nine fungicides in field plots at Hays, Alberta, in 1994.*

Treatment	Rate product/ha	Dis. incid.(%)** Mildew	Dis. incid.(%)** Rust	Dis. sev. (0-3) Mildew	Dis. sev. (0-3) Rust	Seed yield (g/100 heads)
1. LIME SULPHUR	9.4 L	29.8 ab	79.8	0.46	0.98	5.2
2. SULCHEM	4.0 kg	33.5 ab	86.8	0.41	1.03	6.5
3. EASOUT	2.5 kg	57.0 a	90.0	0.78	1.28	6.1
4. TILT	0.5 L	7.3 b	69.5	0.09	0.80	7.0
5. DITHANE	2.25 kg	55.0 a	81.5	0.78	1.00	6.0
6. NOVA	0.25 kg	8.0 b	72.3	0.08	0.83	6.1
7. LIME S. +	9.4 L					
TILT	0.5 L	4.5 b	80.3	0.04	0.93	6.0
8. LIME S. +	9.4 L					
NOVA	0.25 kg	2.5 b	72.5	0.03	0.88	5.9
9. LIME S. +	9.4 L					
EASOUT	2.5 kg	23.5 ab	82.5	0.28	1.18	6.0
10. Untreated check	--	35.3 ab	72.5	0.60	0.98	5.6
ANOVA P#0.05		s	ns	ns	ns	ns
Coefficient of Variation (%)		67.0	15.0	121.6	31.0	18.8

* The values in this table are means of four replications. Numbers followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P#0.05).

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

Table 2. Incidence and severity of powdery mildew and rust on Chateau bluegrass treated with nine fungicides in field plots at Taber, Alberta, in 1994.*

Treatment	Rate product/ha	Dis. incid. (%)**		Dis. severity (0-3)	
		Mildew	Rust	Mildew	Rust
1. LIME SULPHUR	9.4 L	49.5 a	1.3	0.58 a	0.01
2. SULCHEM	4.0 kg	48.3 a	1.0	0.53 a	0.01
3. EASOUT	2.5 kg	58.5 a	1.8	0.75 a	0.02
4. TILT	0.5 L	1.0 b	0.5	0.01 b	0.01
5. DITHANE	2.25 kg	67.8 a	2.5	0.98 a	0.03
6. NOVA	0.25 kg	1.5 b	0.3	0.02 b	0.00
7. LIME S. + TILT	9.4 L 0.5 L	0.8 b	0.0	0.01 b	0.00
8. LIME S. + NOVA	9.4 L 0.25 kg	2.5 b	0.5	0.03 b	0.01
9. LIME S. + EASOUT	9.4 L 2.5 kg	65.5 a	4.0	0.90 a	0.04
10. Untreated check	--	67.3 a	1.8	0.90 a	0.02
ANOVA P#0.05		s	ns	s	ns
Coefficient of Variation (%)		33.1	108.5	64.4	148.1

* The figures in this table are means of four replications. Numbers followed by the same small letter are not significantly different according to a Duncan's Multiple Range Test (P = 0.05).

** Disease incidence data were arcsin-transformed prior to analysis of variance and the detransformed means are presented here.

SECTION P

RESIDUE STUDIES / ÉTUDES SUR LES RÉSIDUS

Section Editor / Réviseur de section : B.D. Ripley

#151 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 387-1431-8312

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TITLE: HERBICIDES DETECTED IN CENTRAL ALBERTA GROUNDWATER

MATERIALS: 2,4-D
DICAMBA
BROMOXYNIL
MCPA
DICLOFOP-METHYL
FENOXAPROP-ETHYL

METHODS: The study was conducted on a 1-ha field (four 50 x 50 m blocks) at the Lacombe Research Centre. Herbicides had not been applied to the field for several years (field had been in a barley silage/summerfallow rotation, i.e., a 'virgin site'). The field was seeded to wheat in the spring of 1994. The soil is a sandy loam with 9% organic matter. Mean annual precipitation is 450 mm; the water table is at 1.5 - 2.5 m depth. On June 23, tank mixes of 2,4-D + dicamba, bromoxynil + MCPA, diclofop-methyl + fenoxaprop-ethyl were applied at recommended rates to the 4 - 5 leaf stage wheat. The next day, 2 of the 4 blocks were irrigated with 57 mm of water to simulate a heavy rainfall. There was 13 mm and 36.5 mm of actual rainfall during the 3 - 6 d and 8 - 13 d periods after spraying, respectively. The groundwater (pH 6.9) was sampled from a grid of 9 to 13 sites per block using 4.4 m stainless steel wells at each site. Samples (0.6-0.8 L) were collected on June 15, 27, 29; July 04, 06; and August 02 (i.e., 8 d before, and 4, 6, 11, 13, 39 d after spraying). Samples were held in glass bottles at 4°C until analysis 3 - 7 d later by Enviro-Test Labs, Edmonton, Alberta, using a MSD-GC with selected ion monitoring. The minimum quantifiable limits were 0.05 - 0.1 ppb with 86 - 117% method recovery.

RESULTS: To date, herbicides have not been detected in the groundwater on the 2 blocks not receiving the 1 d heavy 'rainfall'. The herbicides on these blocks were gently set into the soil by the 13 mm of rainfall over 3-6 d after spraying. This 'residue setting' would have enhanced adsorption by the soil organic matter and clay, and allowed residue degradation to begin. All detections (see Table) are from the 2 blocks which received the 57 mm of simulated rain 1 d after herbicide application. This heavy 'rainfall' would have flushed the herbicides down into the soil macropores. Five of the six herbicides were detected in the groundwater, but not until 6 d after application. The herbicides appeared to move into the groundwater in one 'band', then dissipate (move away, become diluted and adsorbed) quickly. There were no detections past 11 d after herbicide application. Except for one 2,4-D detection (4.8 ppb), all herbicide levels were below the Environment Canada aquatic life (2.6-6.1 ppb) and drinking water (5.0-100 ppb) guidelines.

CONCLUSIONS: Herbicide contamination of the groundwater can occur on a 'virgin' site, with 'high' organic-matter soil, if the first moisture event after a herbicide application is a heavy rainfall.

Date, after spraying)	Detections, No. & levels**	Herbicides* in groundwater (irrigated blocks) (days dicamba	MCPA	2,4-D	bromoxynil	diclofop	fenoxaprop
June 15 (08)	No.	0/26	0/26	0/26	0/26	0/26	0/26
	ppb	nd	nd	nd	nd	nd	nd
June 27 (04)	No.	0/26	0/26	0/26	0/26	0/26	0/26
	ppb	nd	nd	nd	nd	nd	nd
June 29 (06)	No.	9/26	17/26	17/26	4/26	6/26	0/26
	ppb	0.1-0.3	0.1-0.9	0.1-4.8	0.1-0.2	0.1-0.6	nd
July 04 (11)	No.	0/26	4/26	8/26	0/26	0/26	0/26
	ppb	nd	0.1-0.2	0.1-0.4	nd	nd	nd
June 06 (13)	No.	0/26	0/26	0/26	0/26	0/26	0/26
	ppb	nd	nd	nd	nd	nd	nd
Aug 02 (39)	No.	0/26	0/26	0/26	0/26	0/26	0/26
	ppb	nd	nd	nd	nd	nd	nd --

* Diclofop-methyl and fenoxaprop-ethyl detected in the acid forms, diclofop and fenoxaprop, respectively.

** Number of detections expressed as number of sites with herbicide detected/total number of sites sampled; ppb = ug/L.

#152

ICAR: 84100737

CROP: Chinese broccoli, cv. Guy Lon
Thick mustard cabbage, cv. Pak-Choi
Chinese cabbage, cv. Kasumi

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TITLE: INSECTICIDE RESIDUE IN CHINESE BROCCOLI, PAK-CHOI AND CHINESE CABBAGE

MATERIALS: BELMARK 300 EC (Fenvalerate)

METHODS: Chinese broccoli, pak choi and chinese cabbage were transplanted at the Holland Marsh on muck soil. Each plot consisted of 3 rows x 6 m long, replicated four times. The treatments were applied at the rate of 500 L of water per ha with a tractor-mounted sprayer. BELMARK was applied four times at weekly intervals at the rate of 97.5 g a.i./ha. The crop was treated prior to harvest and sampled at various intervals when the crop was mature. Samples were analyzed for residue (methods of analyses available on request).

RESULTS: As presented in the table.

CONCLUSIONS: Residue of fenvalerate decreased significantly from day of application to day 14 in the three crops. The residue was not below 0.1 mg/kg ("negligible") residue limit by day 14.

Table 1. Residue of fenvalerate in chinese broccoli, pak choi and chinese cabbage when the insecticide was applied four times at weekly intervals prior to harvest.*

Days after 4th application	Residue (mg/kg)** Chinese broccoli	pak choi	Chinese cabbage
0	3.53a***	3.4a	2.1a
3	1.40b	2.18b	1.36b
5	0.96bc	1.18c	0.82c
7	0.69cd	0.72d	0.77cd
10	0.41de	0.71d	0.71cd
14	0.13e	0.34e	0.28d

* Treated July 23, 29, August 5 and 12, 1994.
** Mean of 4 replicates.
*** Means followed by the same letter are not significantly different (P#0.05; LSD test).

#153

ICAR: 84100737

CROP: Chinese cabbage, cv. Kasumi
Fuzzy squash, cv. Mao Gwa

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TITLE: FUNGICIDE RESIDUE IN CHINESE CABBAGE

MATERIALS: DITHANE DG 75% (Mancozeb)

METHODS: Chinese cabbage and fuzzy squash were transplanted at the Holland Marsh on muck soil. The plot consisted of 3 rows (chinese cabbage) and 1 row (fuzzy squash), 8 m long, replicated four times. The treatments were applied at the rate of 500 L of water per ha with a tractor-mounted sprayer. DITHANE was applied three times at 2 week intervals at the rate of 2.4 kg a.i./ha. The crop was treated prior to harvest and sampled at various intervals when the crop was mature. Samples were analyzed for residue (methods of analyses available on request).

RESULTS: As presented in the table.

CONCLUSIONS: The residue of mancozeb (zineb equivalent EBDC) in chinese cabbage decreased significantly by day 19 from the high residue deposit. By day 14, the EBDC residue was <7 mg/kg maximum residue limit (MRL). On day 19, the residue of mancozeb had not decreased below 0.1 mg/kg ("negligible") residue limit. The residue of mancozeb in fuzzy squash decreased by day 14 to below 0.1 mg/kg ("negligible") residue limit.

Table 1. Residue of mancozeb (zineb equivalent EBDC) in chinese cabbage and fuzzy squash when the fungicide was applied three times at 2 week intervals prior to harvest.*

Days after 3rd application	Residue (mg/kg)** chinese cabbage zineb eq EBDC	Days after 3rd application	Residue (mg/kg) fuzzy squash zineb eq EBDC
0	25.5a***	1	0.95a
2	18.0b	3	0.20b
9	7.7c	7	0.28b
14	3.1cd	9	0.65a
19	0.5d	14	ND****
-	-	20	ND

* Treated July 29, August 12, 3rd application August 24 (chinese cabbage) and August 30 (fuzzy squash), 1994.
** Mean of four replicates.
*** Means followed by the same letter are not significantly different (P#0.05; LSD test).
**** ND = not detected.

#154

ICAR: 84100737

CROP: Thick mustard cabbage, cv. Pak-Choi

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TITLE: INSECTICIDE RESIDUE IN PAK-CHOI

MATERIALS: LORSBAN 4 E (Chlorpyrifos)

METHODS: The tests were done at the Holland Marsh on muck soil. Pak-choi was planted in 2 row plots x 6 m long, replicated four times. The drench was applied August 4, 1992, at the rate of 210 mL LORSBAN in 130 L water/1,000 m of row with a Backpak sprayer. The crop was treated prior to harvest and sampled at various intervals when the harvest was mature. Samples were analyzed for residue (method of analyses available on request).

RESULTS: As presented in the table.

CONCLUSIONS: The residue of chlorpyrifos decreased significantly and was below 0.1 mg/kg ("negligible") residue limit by the post-harvest interval (PHI) of 15 d. The metabolite chlorpyrifos oxon was not detected.

Table 1. Residue of chlorpyrifos in pak choi when the insecticide was applied as a drench prior to harvest.

Days after drench	Residue in pak choi (mg/kg)* chlorpyrifos	chlorpyrifos oxon
2	1.22a**	ND***
9	0.283b	ND
15	0.042c	ND
21	0.020c	ND

* Mean of four replicates.
** Means followed by the same letter are not significantly different (P#0.05; LSD test).
*** ND = not detected.

#155

ICAR: 84100737

CROP: Carrot, cv. Six Pak

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TITLE: INSECTICIDE RESIDUE IN CARROTS

MATERIALS: ORTHO DIBROM 864 g/L (Naled)
LORSBAN 4 EC (Chlorpyrifos)

METHODS: The tests were done at the Muck Research Station on muck soil. For each site, carrots were planted with a Stan-Hay precision seeder in a bed of 2 triple rows, 15 m long, replicated four times. The treatments were applied at the rate of 500 L of water per ha with a tractor-mounted sprayer. DIBROM and LORSBAN were applied five times at weekly intervals at the rate of 864 g and 400 g a.i./ha, respectively. The crop was treated prior to harvest and sampled at various intervals during harvest maturity by pulling 14 carrots, per replicate, topping and sending the roots for analysis. Samples were analyzed for residue (method of analysis available on request).

RESULTS: As presented in the table.

CONCLUSIONS: No residue of naled and chlorpyrifos (1992 and 1993) were detected in the roots of carrots following foliar application (detection limit 0.005 mg/kg). The residue of chlorpyrifos in 1994 was below 0.1 mg/kg ("negligible") residue limit. The metabolites chlorpyrifos oxon and chlorpyrifos pyridinol were not detected.

Table 1. Residue of naled and chlorpyrifos in carrots when the insecticide was applied to foliage five times prior to harvest.*

Days after 5th application		Residue in carrots (mg/kg)** naled	chlorpyrifos	chlorpyrifos oxon	chlorpyrifos pyridinol
1992	3	ND***	-	-	-
	7	ND	-	-	-
	15	-	ND	-	-
1993	2	ND	-	-	-
	7	ND	ND	ND	ND
	15	-	ND	ND	ND
1994	Site 1				
	3	ND		-	-
	7	ND	0.046	ND	ND
	15	-	0.020	ND	ND
	Site 2				
	3	ND	-	-	-
	7	ND	0.052	ND	ND
	15	-	0.030	ND	ND

* Treated August 10, 17, 31, September 9 and 14, 1992; August 17, 24, 30, September 7 and 15, 1993; August 12, 18, 30, September 7 and 12, 1994.
** Mean of 4 replicates.
*** ND = not detected.

#156

ICAR: 84100737

CROP: Cauliflower, cv. Andes

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TITLE: FUNGICIDE RESIDUE IN CAULIFLOWER

MATERIALS: ROVRAL 50 WP (Iprodione)

METHODS: Cauliflower was transplanted in 4 row plots x 10 m long, replicated four times. The treatment was applied at the rate of 800 L of water per ha with a tractor-mounted sprayer. ROVRAL was applied on tied cauliflower three times at weekly intervals at the rate of 0.75 kg a.i./ha. The crop was treated prior to harvest and sampled at various intervals during harvest maturity. Samples were analyzed for residue (methods of analyses available on request).

RESULTS: As presented in the table.

CONCLUSIONS: In 1992 and 1994, the residue of iprodione decreased below 0.1 mg/kg ("negligible") residue limit by day 7 and 1, respectively. In 1993, residue of iprodione did not decrease below 0.1 mg/kg by day 9. The metabolites 32490-RP and 30288-RP were not detected.

Table 1. Residue of iprodione in cauliflower when the fungicide were applied three times at weekly intervals prior to harvest.*

Days after 3rd application	1992 iprodione	1992 32490-RP	1993 iprodione	1993 32490-RP	1994 iprodione	1994 32490-RP	1994 30228-RP
	Residue (mg/kg)**						
0	-	-	0.14b	ND	-	-	-
1	0.14a***	ND****	0.4a	ND	0.058a	ND	ND
5	0.14a	ND	0.11b	ND	0.039a	ND	ND
7	0.07a	ND	0.18b	ND	0.052a	ND	ND
9	0.07a	ND	0.20b	ND	0.035a	ND	ND

* Treated September 2, 10 and 16, 1992; September 15, 22 and 29, 1993; September 14, 20 and 28, 1994.
** Mean of four replicates.
*** Means followed by the same letter are not significantly different (P#0.05; LSD test).
**** ND = not detected.

#157

ICAR: 61006457

CROP: Onions, cv. Northstar

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TITLE: INSECTICIDE RESIDUE IN SOIL

MATERIALS: LORSBAN 4E (Chlorpyrifos)

METHODS: Onions were transplanted on muck soil at the Holland Marsh on May 17, 1993 and May 18, 1994. Each plot had 2 rows x 5 m long with 40 cm between the rows. The plants were treated 3 d prior to transplanting at the rate of 16 mL of LORSBAN in 4.7 L of water per 10 trays. The second drench was applied on June 10, 1993 and June 14, 1994 at the rate of 210 mL of Lorsban in 130 L of water per 1,000 m of row with a Backpak sprayer. Soil was sampled with a core sampler 2 cm in diameter at 5 times after the drench treatment. For each sample date, eight samples were taken in two depths, 0-3 cm and 3-6 m, replicated four times. Samples were analyzed for residue (method of analysis on request).

RESULTS: As presented in the table.

CONCLUSIONS: In 1993, there was a decrease in the residue of chlorpyrifos in the soil at 0-3 cm by day 49, at 3-6 cm an increase by day 34 and then a decrease by day 49. In 1994, there was higher initial residue of chlorpyrifos in the soil with a decrease in residue at 0-3 cm by day 35 and 49. There was a variation in residue at 3-6 cm with a decrease by day 49.

Table 1. Residue of chlorpyrifos in soil when the insecticide was applied as a drench treatment.

	Residue in soil (mg/kg)*				
	1993 depth (cm)			1994 depth (cm)	
Days after 2nd drench	0-3	3-6	Days after 2nd drench	0-3	3-6
0	92a**	43b	2	237a	133ab
7	89ab	37b	7	266a	122bc
14	68ab	32b	14	289a	170a
20	61ab	35b	23	208ab	175a
34	90ab	78a	35	120bc	136ab
49	57b	5c	49	96c	74c

* Mean of four replicates.
** Means followed by the same letter are not significantly different (P#0.05; LSD test).

#158

ICAR: 84100737

CROP: Onions, cv. Benchmark

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TITLE: FUNGICIDE RESIDUE IN ONIONS

MATERIALS: RIDOMIL MZ 72W (Metalaxyl + Mancozeb)

METHODS: The tests were done at the Holland Marsh on muck soil. For each site onions were planted with a Stan-Hay precision seeder in a bed of 4 double rows, 10 m long, replicated four times. The treatments were applied at the rate of 500 L of water per ha with a tractor-mounted sprayer. RIDOMIL MZ was applied three times at weekly intervals at the rate of 0.156 and 1.24 kg a.i./ha, respectively. The crop was treated prior to harvest and sampled at various intervals during harvest maturity. Samples were analyzed for residue (method of analyses available on request).

RESULTS: As presented in the table.

CONCLUSIONS: The residue of metalaxyl was below 0.1 mg/kg ("negligible") residue limit by day 2 in 1993 and day 1 in 1994. The residue of mancozeb (zineb equivalent EBDC) did not decrease below 0.1 mg/kg ("negligible") residue limit by day 14, except for Site 1 in 1994 which did decrease below 0.1 mg/kg by day 7.

Table 1. Residue of metalaxyl and mancozeb (zineb equivalent EBDC) in onions when the fungicide were applied three times at weekly intervals prior to harvest.*

Days after 3rd application	Residue in onions (mg/kg)**			
	Site 1		Site 2	
	metalaxyl	zineb eq EBDC	metalaxyl	zineb eq EBDC
1993				
2	0.059ab***	0.218a	0.066	0.33a
5	0.083a	0.175ab	ND****	ND
7	0.055ab	0.165ab	ND	ND
9	0.073ab	0.098c	ND	ND
14	0.018b	0.138bc	ND	0.12a
1994				
1	ND	0.625a	ND	0.075a
5	ND	0.225b	ND	0.150a
7	ND	ND	ND	0.250a
9	ND	0.089b	ND	ND
14	ND	ND	ND	0.213a

* Treated August 25, 30 and September 8, 1993 and August 22, 30 and September 7, 1994.
** Mean of four replicates.
*** Means followed by the same letter are not significantly different (P = #0.05; LSD test).
**** ND = not detected.

PESTICIDE AND CHEMICAL DEFINITION /
PESTICIDES ET DÉFINITIONS DES PRODUITS CHIMIQUES

PESTICIDE	ALTERNATIVE DESIGNATION(S)
1,2-dichloropropane	1,2-DICHLOROPROPANE
1,3-dichloropropene	TELONE; TELONE II-B
2,4-D	2,4-D ACID; 2,4-D ACIDE; 2,4-D-ACID; 2,4-DICHLOROPHENOXYACETIC ACID; DESORMONE; DRIAMINE; FORMULA 40; UBI-2323
2,4-D dimethylamine	2,4-D DIMETHYLAMINE
2,4-D ester	2,4-D ESTER
ABAMECTIN	avermectin b1
ABG-6263	*B. thuringiensis tenebrionis*
ABG-6271	*B. thuringiensis tenebrionis*
ABG-6275	*B. thuringiensis tenebrionis*
AC 303,630	confidential
AC 301,467	terbufos
ACECAP	acephate
acephate	ACECAP; ORTHENE; ORTHO-12-420
ACR-3675	pyrifenox
ACR-3815	mancozeb + pyrifenox
acrinathrin	RU-38702; RUFAST
ADMIRE	imidacloprid
AFUGAN	pyrazophos
AGRAL 90	nonylphenolethylene oxide
AGRI-MYCIN	streptomycin
AGRICULTURAL STEPTOMYCIN	streptomycin
AGRIDYNE	azadirachtin
AGRIKELP	seaweed
AGRISTREP	streptomycin
AGROSOL	captan + thiabendazole
AGROSOL POUR-ON	thiram + thiabendazole; AGROSOL T
AGROSOL T	thiram + thiabendazole
AGROX	maneb
AGROX B-3	B-3; captan + diazinon + lindane
AGROX D-L PLUS	captan + diazinon + lindane; AGROX DL PLUS
AGROX DB	maneb
AGROX DL PLUS	captan + diazinon + lindane
AGROX FLOWABLE	maneb
aldicarb	TEMIK
ALDRIN	HHDN
ALIETTE	fosetyl-al
ALIGN	azadirachtin
allidochlor	RANDOX
ALPHA-CYPERMETHRIN	cypermethrin-alpha
AMAZE	isofenphos
AMBUSH	permethrin
amitraz	MITAC
ANCHOR	carbathiin + thiram; UBI-2359-2
anilazine	DYRENE
ANVIL	hexaconazole
APM	azinphos-methyl
APOLLO	clofentezine
APRON	metalaxyl
APRON-T	APRON-T 69
APRON-T 69	metalaxyl + thiabendazole; APRON-T
ARREST	carbathiin + oxycarboxin + thiram
ASC-66518	confidential
ASC-66792	confidential
ASC-66824	FOSTHIAZATE
ASC-66825	experimental

ASC-66884	unknown
ASC-66895	biocontrol bacteria
ASC-66897	experimental
ASC-67089	experimental
ASC-67090	experimental
ASC-67091	experimental
ASC-67092	experimental
ASC-67093	experimental
ASC-67098	experimental
ASC-67098Z	unknown
ASCE-RCT60	unknown
Ascophyllum nodosum extract	MICRO-MIST
ASIMICIN	Paw Paw bark extract
Asimina triloba extract	Paw Paw bark extract
ASSIST	adjuvant; ASSIST OIL; ASSIST OIL CONCENTRATE
ASSIST OIL	adjuvant
ASSIST OIL CONCENTRATE	adjuvant
ATPLUS 463	surfactant
atrazine	AATREX; ATRAMIX
ATROBAN	permethrin
ATROBAN DELICE POUR-ON	permethrin
avermectin b1	ABAMECTIN; AVID
AVID	avermectin b1
AVON-SKIN-SO-SOFT	AVON-SKIN-SO-SOFT (repellant)
Azadirachta indica extract	azadirachtin
azadirachtin	AGRIDYNE; ALIGN; *Azadirachta indica* extract; AZADIRACHTIN SOLUTION 1; AZADIRACHTIN SOLUTION 2; MARGOSAN-O; NEEM; NEEM SOLUTION 1; NEEM SOLUTION 2; NEEMIX; SAFERS NEEM INSECTICIDE; SNI OIL
AZADIRACHTIN SOLUTION 1	azadirachtin
AZADIRACHTIN SOLUTION 2	azadirachtin
azinphos-methyl	APM; GUTHION
azoxystoboin	ICIA-5504
AZTEC	cyfluthrin + phostebupirim
B-3	captan + diazinon + lindane; AGROX B-3; CHIPMAN B-3
B. thuringiensis Berliner	*BACILLUS THURINGIENSIS*
B. thuringiensis israelensis	VECTOBAC
B. thuringiensis kurstaki	*BACILLUS THURINGIENSIS KURSTAKI*; BACTOSPEINE; CGA-237218; CONDOR; CUTLASS; DIPEL; EG-2371; FORAY; FUTURA; FUTURA XLV; JAVELIN; MYX-2284; ORGANIC INSECT KILLER LIQUID; THURICIDE; THURICIDE-HPC
B. thuringiensis san diego	M-ONE; M-ONE MYD; M-TRAK; MYX-9858
B. thuringiensis tenebrionis	ABG-6263; ABG-6271; ABG-6275; DITERA; NOVODOR; SAN-418; TRIDENT; TRIDENT II
BACILLUS THURINGIENSIS	*B. thuringiensis* Berliner
BACILLUS THURINGIENSIS KURSTAKI	*B. thuringiensis kurstaki*
BACTOSPEINE	*B. thuringiensis kurstaki*
BANISECT	chlorpyrifos
BANNER	propiconazole
BANVEL	dicamba
BAS-152	dimethoate
BAS-152-47	dimethoate
BAS-300	unknown
BAS-490	a strobilurine analogue
BAS-9078	confidential

BAS-9082	fenpropathrin
BAS-9102	benfuracarb
BASIC COPPER SULPHATE	tribasic copper sulphate
BASIC H	unknown
BASF-152	dimethoate
BASUDIN	diazinon
BAY-HWG-1608	tebuconazole
BAY-MAT-7484	phostebupirim
BAY-NTN-19701	MONCEREN; PENCYCURON
BAY-NTN-33893	imidacloprid
BAYCOR	bitertanol
BAYGON	propoxur
BAYLETON	triadimefon
BAYTAN	triadimenol
BAYTHROID	cyfluthrin
BELMARK	fenvalerate
benalaxyl	GALBEN; TF-3651; TF-3772; TF-3773
bendiocarb	TRUMPET
benfuracarb	BAS-9102; ONCOL
BENLATE	benomyl
benodanil	CALIRUS
BENOLIN R	benomyl + lindane + thiram
benomyl	BENLATE
bentazon	BAS-501-06; BASAGRAN; LADDOCK
BERET	CGA-142705
BERET MLX	CGA-142705 + metalaxyl
BHC	lindane
bifenthrin	BRIGADE; CAPTURE; TALSTAR
binderdispersion V-406	BINDERDISPERSION
BIODAC	adjuvant
BIOLURE CONSEP MEMBRANE LURE	pheromone
BIRLANE	chlorfenvinphos
bitertanol	BAYCOR
BL-1104	experimental bactericide
BOND	adjuvant
BORDEAUX MIXTURE	calcium hydroxide + copper sulphate
BOTRAN	dichloran
BOVAID	fenvalerate
BOVITECT	permethrin
BRAVO	chlorothalonil
BRAVO 500	chlorothalonil
BRAVO 90DG	chlorothalonil
BRAVO C/M	chlorothalonil + copper oxychloride + maneb
BRIGADE	bifenthrin
brodifacoum	VOLID
BROMINAL M	bromoxynil + MCPA; BUCTRIL M
bromoxynil	PARDNER
BUCTRIL M	bromoxynil + MCPA
BUTACIDE	piperonyl butoxide
butylate	SUTAN
calcium carbonate	lime
calcium chloride	CALCIUM CHLORIDE
calcium hydroxide	CALCIUM HYDROXIDE
calcium nitrate	CALCIUM NITRATE
calcium sulfate	GYPSUM
CALIRUS	benodanil
CANPLUS	CANPLUS 411; adjuvant
captafol	DIFOLATAN; SPRILLS; SULFONIMIDE
captan	MAESTRO; ORTHOCIDE; ZENECA1

CAPTURE	bifenthrin
carbaryl	SEVIMOL; SEVIN; SEVIN XLR; SEVIN XLR PLUS
carbathiin	CARBOXIN; UBI-2092; UBI-2092-1; UBI-2100; UBI-2100-2; UBI-2100-4; VITAFLO 250; VITAVAX; VITAVAX SINGLE SOLUTION; VITAVAX SOLUTION
carbendazim	BAS-3460; BAVISTIN; BCM; DELSENE; DEROSAL; DPX-10; DPX-965; GRANANIT; HOE-17411; LIGNASAN-P; MBC; MCAB
carbofuran	FURADAN; FURADAN CR-10; UBI-2501
CARBOXIN	carbathiin
CARPOVIRUSINE	granulosis virus
CARZOL	formetanate
CASCADE	flufenoxuron; WL-115110
CATALYST	citric acid + fertilizers + molasses
CC-16238B	diniconazole
CC-16239	diniconazole
CC-16239A	diniconazole
CC-16348	diniconazole
CC-16359	diniconazole
CC-16378	diniconazole
CC-16394	diniconazole
CC-16395	diniconazole
CC-16461	diniconazole
CC-16462	diniconazole
CC-16464	diniconazole
CC-16481	diniconazole
CC-16488	diniconazole
CC-16553	diniconazole
CC-16555	diniconazole
CC-16557	diniconazole
CC-16558	diniconazole
CC-16681	diniconazole
CC-16683	diniconazole
CC-16685	diniconazole
CC-16687	diniconazole
CC-16688	diniconazole
CC-16696	diniconazole
CC-16697	diniconazole
CC-16698	diniconazole
CC-16699	diniconazole
CC-16700	diniconazole
CC-16859	diniconazole
CC-16860	diniconazole
CC-16862	diniconazole
CC-16864	diniconazole
CC-16865	diniconazole
CC-16866	diniconazole
CC-16867	diniconazole
CC-16882	diniconazole
CC-16896	diniconazole
CERONE	ethephon
CGA-12223	isazofos
CGA-142705	BERET
CGA-169374	difenoconazole; DRAGAN
CGA-173506	fludioxonil; MAXIM
CGA-237218	*B. thuringiensis kurstaki*
CGA-453	A-7924-B
CGF-4280	flutolanil; NNF-136
CHARGE	cyhalothrin-lambda
chinomethionat	MORESTAN
CHIPMAN B-3	B-3; captan + diazinon + lindane

chitine	CHITINE
CHITOSAN	poly-d-glucosamine
chloranil	SPERGON
chlorbromuron	CHLOROBROMURON; MALORAN
chlordane	ASPON; BELT; CHLORDAN
chlorethoxyfos	DPX-42989; FORTRESS
chlorfenvinphos	BIRLANE
chlormequat	CYCOCEL
chloroneb	DEMOSAN; DPX-1823; PROTURF FII; SCOTTS PROTURF; TERSAN; TERSAN SP
chlorophacinone	ROZOL
chlorothalonil	BRAVO; BRAVO 500; BRAVO 90DG; DACONIL; DACONIL 2787
chlorpyrifos	BANISECT; DURSBAN; DURBAN TURF; LORSBAN UBI-2679
chromium yeast	CHROMIUM YEAST
CITOWETT	CITOWETT PLUS; adjuvant
citric acid	CITRIC ACID
clay	CLAY
CLEARWING BORER LURE	pheromone
cloak	carbathiin + lindane + thiram
cloethocarb	LANCE; UBI-2559; UBI-2562
clofentezine	APOLLO
COAX	organic insecticide
COCONUT MILK EXTRACT	masbrane
codlemone	CODLING MOTH PHEROMONES
CODLING MOTH GRANULOSIS VIRUS	granulosis virus
CODLING MOTH PHEROMONES	codlemone
COMPANION	octylphenoxypolyethoxyethanol n-butanol
CONDOR	*B. thuringiensis kurstaki*
CONFIRM	tebufenozide
copper	COPAC
copper oxides	PERECOT
copper oxychloride	NIAGARA FIXED COPPER
copper salts of rosin & fatty acids	TENN-COP
COPPER SPRAY	tribasic copper sulphate
copper sulphate	COPPER SULFATE; tribasic copper sulphate
CORBEL	fenpropimorph
COUNTER	terbufos
CPGV	granulosis virus
cresol	M-CRESOL; META-CRESOL
CROWN	carbathiin + thiabendazole
CRYOLITE	KRYOCIDE; sodium aluminum fluoride
CUB	tribasic copper sulphate
CULTAR	paclobutrazol
cupric hydroxide	COPPER HYDROXIDE; KOCIDE
CUPRIC SULFATE TRIBASIC	tribasic copper sulphate
CUTLASS	*B. thuringiensis kurstaki*
CYCOCEL	chlormequat
cyfluthrin	BAYTHROID
CYGON	dimethoate
CYGUARD	phorate + terbufos; CYGARD
cyhalothrin	GRENADE; PP-563
cyhalothrin-lambda	CHARGE; ICIA-0321; KARATE; LAMBDA-CYHALOTHRIN; PP-321
CYMBUSH	cypermethrin
cypermethrin	CYMBUSH; DEMON; RIPCORD
cypermethrin-alpha	ALPHA-CYPERMETHRIN; FASTAC
CYPREX	dodine
cyproconazole	SAN-619; UBI-2565; UBI-2575
cyromazine	TRIGARD
CYTHION	malathion

D-D	1,2-dichloropropane + 1,3-dichloropropene
DACOBRE	chlorothalonil
DACONIL	chlorothalonil
DACONIL 2787	chlorothalonil
DANITOL	fenpropathrin
DASANIT	fensulfothion
DB GREEN	lindane + maneb
DCT	captan + diazinon + thiophanate-methyl
DDT	ZEIDANE
DECIS	deltamethrin
deet	NERO INSECT REPELLENT SOLUTION; SKINTASTIK; ULTRATHON
delta-endotoxin of *B.t. kurstaki*	M-CAP; MVP BIOINSECTICIDE
delta-endotoxin of *B.t. kurstaki-tenebrionis*	FOIL
delta-endotoxin of *B.t. san diego*	M-ONE PLUS; MYX-1806; SPUD-CAP
deltamethrin	DECIS
DEMON	cypermethrin
DERITOX	rotenone
DEVRINOL	napropamide
DEXON	fenaminosulf
DI-SYSTON	disulfoton
diatomaceous earth	INSECT STOP; INSECTAGON; INSECTAWAY; SHELLSHOCK
diazinon	BASUDIN; UBI-2291
DIBROM	naled
dicamba	BANVEL
dicamba-dimethylamine	DICAMBA-DIMETHYLAMINE
dichlone	PHYGON
dichloran	BOTRAN
dichlorprop	dichlorprop
dichlorvos	VAPO
diclofop-methyl	CHOE-190Q; DICHLOFOP METH; DICLOFOP; HOE-GRASS; HOELON; ILLOXAN
dicofol	KELTHANE
dieldrin	HEOD
dienochlor	PENTAC AQUAFLOW
difenoconazole	CGA-169374; DIVIDEND; DRAGON
diflubenzuron	DIMILIN
DIKAR	dinocap + mancozeb
dimethoate	BAS-152; BAS-152-47; BASF-152; CYGON; HOPPER-STOPPER; LAGON; SYSTEM
DIMILIN	diflubenzuron
diniconazole	CC-16238B; CC-16239; CC-16239A; CC-16348; CC-16359; CC-16378; CC-16394; CC-16395; CC-16461; CC-16462; CC-16464; CC-16481; CC-16488; CC-16553; CC-16555; CC-16557; CC-16558; CC-16681; CC-16683; CC-16685; CC-16687; CC-16688; CC-16696; CC-16697; CC-16698; CC-16699; CC-16700; CC-16859; CC-16860; CC-16862; CC-16864; CC-16865; CC-16866; CC-16867; CC-16882; CC-16896; SPOTLESS; XE-779
DINITRO	dinoseb
dinocap	KARATHANE
dinoseb	DINITRO
DIPEL	*B. thuringiensis kurstaki*
diphacinone	RAMIK BRUN
diquat	REGLONE
disulfoton	DI-SYSTON
DITERA	*B. thuringiensis tenebrionis*

DITHANE 480F	mancozeb
DITHANE DF	mancozeb
DITHANE DG	mancozeb
DITHANE F-45	mancozeb
DITHANE M-22	maneb
DITHANE M-45	mancozeb; DITHANE M45
diuron	DMU; KARMEX
difenoconazole	CGA-169374
DIVIDEND	difenoconazole; CGA-169374
dodine	CYPREX; EQUAL
DOGWOOD BORER LURE	pheromone
DOWCO-429	DOWCO-429X; unknown
DOWCO-473	unknown; XRD-473
DPX-43898	SD-208304
DPX-H6573	flusilazole
DRAGAN	CGA-169374
DUAL	metolachlor
DURSBAN	chlorpyrifos
DURSBAN TURF	chlorpyrifos
DYFONATE	fonofos
DYFONATE II	fonofos
DYFONATE ST	fonofos
DYLOX	trichlorfon
DYRENE	anilazine
DYVEL	herbicide

EASOUT	thiophanate-methyl
ECTIBAN	permethrin
EG-2371	*B. thuringiensis kurstaki*
EL-228	nuarimol
ELITE	tebuconazole
EMBARK	mefluidide
emulsifiable spray oil	SUNSPRAY
endosulfan	THIODAN
ENHANCE	surfactant
ENTICE	organic insecticide
ESTAPROP	diclorprop + 2,4-D ester
EPIC	furmecyclox
EPTC	EPTAM
EQUAL	dodine
esfenvalerate	HALMARK
estraprop	2,4-D ester + dichlorprop
ethalfluralin	EDGE; EL-161; SONALAN
ethephon	CERONE
ethion	DIETHION; NIALATE
ETHOPROP	ethoprophos
ethoprophos	ETHOPROP
ETHYLTRIANOL	tebuconazole
etridiazole	TRUBAN
EVISECT	thiocyclam-hydrogenoxalate
EXP-2022C	copper oxychloride + fosetyl-al
EXP-2164B	iprodione
EXP-6003A	unknown
EXP-6043A	organic insecticide; FIPRONIL
EXP-10295A	unknown
EXP-10370A	iprodione
EXP-60145A	confidential
EXP-60655A	confidential
EXP-80240A	organic fungicide
EXP-80287A	organic fungicide
EXP-80290A	organic fungicide

EXP-80318A	triticonazole
EXP-80362A	organic fungicide
EXP-80363A	organic fungicide
EXP-80364A	organic fungicide
EXP-80365A	organic fungicide
EXP-80366A	organic fungicide
EXP-80367A	organic fungicide
EXP-80430B	unknown
EXP-80511A	unknown
F020	Paw Paw bark extract
FASTAC	cypermethrin-alpha
fenaminosulf	DEXON; LESAN
fenamiphos	NEMACUR
fenapanil	SISTHANE
fenbutatin oxide	TORQUE; VENDEX
fenitrothion	SUMITHION
fenpropathrin	BAS-9082; DANITOL; S-3206
fenpropimorph	CORBEL; MISTRAL
fensulfothion	DASANIT
fenthion	PVC EAR TAG
fenvalerate	BELMARK; BOVAID
ferbam	FERMATE
fertilizers	SUSTANE
FIPRONIL	EXP-6043A
FLO-PRO-IMZ	imazalil
fluazinam	B-1216; IKF-1216
fludioxonil	CGA-173506; MAXIM
flucythrinate	GUARDIAN
flufenoxuron	CASCADE; WL-115110
flusilazole	DPX-H6573; NUSTAR
flutolanil	CGF-4280; MONCUT; NNF-136
flutriafol	ICIA-0450; MINTECH; TF-3673; TF-3675; TF-3753; TF-3765; TF-3775
FOIL	delta-endotoxin of *B.t. kurstaki-tenebrionis*
FOLICOTE	tebuconazole
FOLICUR	tebuconazole
FOLPAN	folpet
folpet	PHALTAN; FOLPAN
fonofos	DYFONATE; DYFONATE II; DYFONATE ST
FORAY	*B. thuringiensis kurstaki*
FORCE	tefluthrin
FORE	mancozeb
formetanate	CARZOL
fosetyl-al	ALIETTE
FOSTHIAZATE	ASC-66824
FRANIXQUERRA	sodium dioctyl sulfosuccinate
FRIGATE	mineral oil
FUNGAFLOR	imazalil
FUNGINEX	triforine
FURADAN	carbofuran
FURADAN CR-10	carbofuran
furathiocarb	PROMET
furmecyclox	EPIC
FUTURA	*B. thuringiensis kurstaki*
FUTURA XLV	*B. thuringiensis kurstaki*
G-696	UBI-2563
GALBEN	benalaxyl

GALLEX	2,4-xylenol + cresol
GAMMA-BHC	lindane
GAOZHIMO	masbrane
GAUCHO	imidacloprid
glyphosate	ROUNDUP
granulosis virus	CARPOVIRUSINE; CODLING MOTH GRANULOSIS VIRUS; CPGV; UCB-87
GREATER PEACH TREE BORER LURE	pheromone
GSX-8743	GXS-8743
GUARDIAN	flucythrinate
GUARDSMAN SURFACE TENSION REDUCER	surfactant
GUTHION	azinphos-methyl
GX SOAP	soap
GXS-8743	GSX-8743
GYPSUM	calcium sulfate
HALMARK	esfenvalerate
hexaconazole	ANVIL; ICIA-0523; JF-9480; TF-3770; TF-9480; WF-2228
hexythiazox	SAVEY
HHDN	ALDRIN
HOE-000522	teflubenzuron
HOE-00522	teflubenzuron
HOLLYSUL MICRO-SULPHUR	sulphur
HOPPER-STOPPER	dimethoate
HWG-1608	tebuconazole
hymexazol	TACHIGAREN; UBI-2631
ICIA-0321	cyhalothrin-lambda
ICIA-0450	flutriafol
ICIA-0523	hexaconazole
ICIA-0993	tefluthrin
ICIA-5504	azoxystroboin
imazalil	FLO-PRO IMZ; FUNGAFLOR; NU-ZONE; UBI-2420
imazethapyr	AC 263,499; AC-263499; PURSUIT
imidacloprid	BAY-NTN-33893; GAUCHO; NTN-33893; UBI-2627
IMIDAN	phosmet
INCITE	piperonyl butoxide
INSECOLO	silicon dioxide
INSECT STOP	diatomaceous earth
INSECTAGON	diatomaceous earth
INSECTAWAY	diatomaceous earth
INSEGAR	RO-13-5223
iodine	IODINE
ioxynil	ACTRIL; CERTOL; CERTROL; TORTRIL; TOTRIL
iprodione	EXP-10370A; EXP-2164B; ROVRAL; ROVRAL FLO; ROVRAL GREEN
isazofos	CGA-12223; TRIUMPH
ISK-66824	unknown
ISK-66895	unknown
ISOBUTYLIDENE DIUREA	fertilizer
isofenphos	AMAZE
ISOMATE C	pheromone
ivermectin	IVOMEC
IVOMEC	ivermectin
IVORY LIQUID	soap
JAVELIN	*B. thuringiensis kurstaki*

JAVEX	sodium hypochlorite
JF-9480	hexaconazole
KARATE	cyhalothrin-lambda
KARATHANE	dinocap
KELTHANE	dicofol
KILLEX TURF HERBICIDE	2,4-D dimethylamine + dicamba-dimethylamine + mecoprop dimethylamine; KILMOR
KILMOR	KILLEX TURF HERBICIDE
KOCIDE 101	copper + cupric hydroxide
KORN OIL CONCENTRATE	korn oil
KORNTROL OIL	mineral oil
KRYOCIDE	CRYOLITE; sodium aluminum fluoride
KUMULUS	sulphur; KUMULUS S
LAGON	dimethoate
LAMBDA-CYHALOTHRIN	cyhalothrin-lambda
LANCE	cloethocarb
LANNATE	methomyl
LATRON	adjuvant; LATRON B-1956
LATRON B-1956	adjuvant; LATRON
leptophos	ABAR; PHOSVEL
LESAN	fenaminosulf
lime sulphur	SULPHIDE SULPHUR
lindane	BHC; GAMMA-BHC; UBI-2599
linuron	AFALON; AFOLAN; LOROX
LI700	buffer
LIQUIDUSTER	permethrin
LORSBAN	chlorpyrifos
M-CAP	delta-endotoxin of *B.t. kurstaki*
M-ONE	*B. thuringiensis san diego*
M-ONE MYD	*B. thuringiensis san diego*
M-ONE PLUS	delta-endotoxin of *B.t. san diego*
M-TRAK	*B. thuringiensis san diego*
MAESTRO	captan
MAINTAIN	maleic hydrazide
malathion	CYTHION
maleic hydrazide	MAINTAIN; ROYAL MH
mancozeb	DITHANE 480F; DITHANE DF; DITHANE DG; DITHANE F-45; DITHANE M-45; DITHANE M45; MANZATE 200; MANZATE DF; PENNCOZEB; TF-3710
maneb	AGROX; AGROX DB; AGROX FLOWABLE; DITHANE M-22; MANZATE; POOL NM; TF-3767; TF-3767B
MANZATE	maneb
MANZATE 75	mancozeb
MANZATE 200	mancozeb
MANZATE DF	mancozeb
MARGOSAN-O	azadirachtin
masbrane	COCONUT MILK EXTRACT; GAOZHIMO
MAT-7484	phostebupirim
MAXIM	fludioxonil
MCPA	AGRITOX; AGROXONE; CORNOX M; MCP
mecoprop dimethlamine	MECOPROP DIMETHLAMINE
mefluidide	EMBARK
MERCURIC BICHLORIDE	mercuric chloride

mercuric chloride	MERCURIC BICHLORIDE
MERGAMMA FL	TF-3769
MERGAMMA NM	lindane + maneb
MERSIL	mercuric chloride + mercurous chloride
MERTECT	thiabendazole
MESUROL	methiocarb
metalaxyl	APRON; RIDOMIL; SUBDUE; UBI-2379
METASYSTOX-R	oxydemeton-methyl
methamidophos	MONITOR
methidathion	SUPRACIDE
methiocarb	MESUROL
methomyl	LANNATE
methoxychlor	MARLATE; METHOXY-DDT
methyl cellulose	CANOCOTE COMMERCIAL COAT; CANOCOTE MICROPELLET; HILLESHOG COMMERCIAL COAT; HILLESHOG MICROPELLET; METHOCEL A 15LV
methyl isothiocyanate	METHYL ISOTHIOCYANATE
metiram	POLYRAM
metolachlor	DUAL
metribuzin	LEXONE; SENCOR; SENCOR 500; SENCOR 75DF
MICRO-MIST	*Ascophyllum nodosum* extract
MICRO-NIASUL	sulphur
MICROSCOPIC SULPHUR	sulphur
MICROTHIOL SPECIAL	sulphur
mineral oil	FRIGATE; KORNTROL OIL; MINERAL SEAL OIL
MINERAL SEAL OIL	mineral oil
MINTECH	flutriafol
MISTRAL	fenpropimorph
MITAC	amitraz
MO-BAIT	molasses
MON-24004	unknown fungicide
MON-24015	unknown fungicide
MON-24039	unknown fungicide
MONCEREN	BAY-NTN-19701; pencycuron
MONCUT	flutolanil; NNF-136
MONITOR	methamidophos
monolinuron	AFESIN; ARESIN
MORESTAN	chinomethionat
MVP BIOINSECTICIDE	delta-endotoxin of *B.t. kurstaki*
myclobutanil	NOVA; RALLY; RH-3866; UBI-2454; UBI-2454-1; UBI-2454-2; UBI-2561
MYX-1806	delta-endotoxin of *B.t. san diego*
MYX-2284	*B. thuringiensis kurstaki*
MYX-9858	*B. thuringiensis san diego*
nabam	DITHANE D-14; PARZATE LIQUID
naled	DIBROM
napropamide	DEVRINOL
NEEM	azadirachtin
NEEM FORMULATED	azadirachtin + pyrethrum
NEEM SOLUTION 1	azadirachtin
NEEM SOLUTION 2	azadirachtin
NEEMIX	azadirachtin
NEMACUR	fenamiphos
NERO INSECT REPELLENT SOLUTION	deet
NIAGARA FIXED COPPER	copper oxychloride
NITROFEN	herbicide
nitrapyrin	DOWCO-163; N-SERVE
NNF-136	CGF-4280; flutolanil; MONCUT
nonylphenolethylene oxide	AGRAL 90

NOVA	myclobutanil
NOVODOR	*B. thuringiensis tenebrionis*
NTN-33893	imidacloprid
NU-FILM	surfactant
NU-ZONE	imazalil
nuarimol	EL-228
NUSTAR	flusilazole
octylphenoxypolyethoxyethanol n-butanol	COMPANION
ofurace	RE-20615; VAMIN
OKANAGAN DORMANT OIL	okanagan oil
okanagan oil	OKANAGAN DORMANT OIL
OMITE	propargite
ONCOL	benfuracarb
ORBIT	propiconazole
ORGANIC INSECT KILLER LIQUID	*B. thuringiensis kurstaki*
ORTHENE	acephate
ORTHO-12-420	acephate
oxadixyl	GUS-371; GUS-4551; OXYDICIL; SAN-371; SANOFAN
oxamyl	VYDATE
oxycarboxin	HRC; PLANTVAX; UB-I2125; UB-I2216
oxydemeton-methyl	METASYSTOX-R
paclobutrazol	CULTAR; PP-333
paraformaldehyde	PARAFORM F POWDERED FUMIGANT
paraquat	GRAMOXONE; WEEDOL
parathion	AQUA; FOLIDOL; NIRAN; PENCAP E
PARDNER	bromoxynil
Paw Paw bark extract	ASIMICIN; *Asimina triloba* BARK EXTRACT; F020
PBO	piperonyl butoxide
PCNB	quintozene
penconazole	TOPAS
pencycuron	BAY-NTN-19701; MONCEREN
PENNCOZEB	mancozeb
PENTAC AQUAFLOW	dienochlor
PENTACHLORONITROBENZENE	quintozene
PERECOT	copper oxides
permethrin	AMBUSH; ATROBAN; ATROBAN DELICE POUR-ON; BOVITECT; ECTIBAN; LIQUIDUSTER; POUNCE; SANBAR
PETRO-CANADA SUPERIOR 70 SPRAY OIL	petroleum oil
petroleum oil	PETRO-CANADA SUPERIOR 70 SPRAY OIL; SAF-T-SIDE; SAFERS ULTRAFINE SPRAY OIL; SMOTHER-OIL; SUNSPRAY OIL; SUPERIOR OIL; SUPERIOR OIL 70; SUPERIOR OIL CONCENTRATE; VOLCK DORMANT OIL; VOLCK OIL; VOLCK SUPREME OIL
phagostimulant	PHEAST
PHALTAN	folpet
PHEAST	phagostimulant
PHEROCON 1CP	pheromone
PHEROCON AM	pheromone
phorate	THIMET
phosalone	ZOLONE
phosmet	IMIDAN
phosphoric acid	PHOSPHORIC ACID
phostebupirim	BAY-MAT-7484; MAT-7484

PHYGON	dichlone
PHYTOSOL	trichloronat
picloram	ACIDE PICLORAM; AMDON; PICLORAM ACID; TORDON; TORDON 10K
piperonyl butoxide	BUTACIDE; INCITE; PBO
pirimicarb	PIRIMOR
PIRIMOR	pirimicarb
potassium salts of fatty acids	POTASSIUM SALTS OF FATTY ACIDS
potassium silicate	POTASSIUM SILICATE
poly-d-glucosamine	CHITOSAN
POLYON	polymer coated urea
POLYRAM	metiram
POOL NM	maneb
potassium oleate	SAFERS INSECTICIDAL SOAP; SAFERS SOAP
POUNCE	permethrin
PP-321	cyhalothrin-lambda
PP-333	paclobutrazol
PREMIERE	lindane + thiabendazole + thiram
PREMIERE PLUS	lindane + thiabendazole + thiram
PRO GRO	PRO GRO SYSTEMIC SEED PROTECTANT
PRO GRO SYSTEMIC SEED PROTECTANT	carbathiin + thiram; PRO GRO
prochloraz	SPORTAK
PROMET	furathiocarb
PRO-MIX BX	adjuvant
propargite	OMITE
propazine	PROPAZINE
propiconazole	BANNER; ORBIT; TILT
propoxur	BAYGON
PVC EAR TAG	fenthion
pyrazophos	AFUGAN
pyrethrins	PYRETHRINS
pyrethum	PYRETHRUM
pyrifenox	ACR-3675
quintozene	PCNB; PENTACHLORONITROBENZENE; SCOTTS LAWN DISEASE PREVENTER; TERRACHLOR
RALLY	myclobutanil
RAMIK BRUN	diphacinone
RAPCOL TZ	furathiocarb + metalaxyl + thiabendazole
RAXIL	tebuconazole
RE-20615	ofurace
REGLONE	diquat
RENEX	adjuvant; RENEX 36
RH-0611	myclobutanil + mancozeb
RH-3866	myclobutanil
RH-5598	confidential
RH-5849	1,2-DIBENZOYL-1-TERT-BUTYLHYDRAZINE; TERT-BUTYLBENZOHYDRAZIDE
RH-5992	CONFIRM; tebufenozide
RH-7281	unknown
RH-7592	unknown
RH-7988	unknown
RHC-378	surfactant
RHC-387	unknown
RIDOMIL	metalaxyl
RIDOMIL MZ	mancozeb + metalaxyl
RIPCORD	cypermethrin
RIZOLEX	tolclofos-methyl
RO-13-5223	INSEGAR

RONILAN	vinclozolin
ROTACIDE	rotenone
rotenone	DERITOX; ROTACIDE
ROUNDUP	glyphosate
ROVRAL	iprodione
ROVRAL FLO	iprodione
ROVRAL GREEN	iprodione
ROVRAL ST	iprodione + lindane
ROYAL MH	maleic hydrazide
ROZOL	chlorophacinone
RP EXP-10068	unknown
RU-38702	acrinathrin
S-3206	fenpropathrin
SAF-T-SIDE	petroleum oil
SAFERS INSECTICIDAL SOAP	potassium oleate
SAFERS NEEM INSECTICIDE	azadirachtin
SAFERS SOAP	potassium oleate
SAFERS ULTRAFINE SPRAY OIL	petroleum oil
SAN-371	oxadixyl
SAN-418	*B. thuringiensis tenebrionis*
SAN-619	cyproconazole
SAN-658	captan + cyproconazole
SAN-683	cyproconazole + mancozeb
SANBAR	permethrin
SAVEY	hexythiazox
SCOTTS LAWN DISEASE PREVENTER	quintozene; SCOTTS FFII
SCOTTS PROTURF	chloroneb
SD-208304	DPX-43898
SEVIMOL	carbaryl
SEVIN	carbaryl
SEVIN XLR	carbaryl
SEVIN XLR PLUS	carbaryl
SHELLSHOCK	diatomaceous earth
silicon dioxide	INSECOLO
silicone polyether	SYLGARD; adjuvant
simazine	GESATOP; PRIMATOL S; PRINCEP; PRINCEP NINE-T
SISTHANE	fenapanil
skim milk powder	POWDERED SKIM MILK
SKINTASTIK	deet
SMOTHER-OIL	petroleum oil
SNI OIL	azadirachtin
soap	IVORY LIQUID; SUNLIGHT DISHWASHING LIQUID
sodium aluminum fluoride	KRYOCIDE
sodium bicarbonate	SODIUM BICARBONATE
sodium dioctyl sulfosuccinate	FRANIXQUERRA
sodium hypochlorite	JAVEX
sodium selenite	SODIUM SELENITE
SOLACOL	validamycin a
SPORTAK	prochloraz
SPOTLESS	diniconazole
SPUD-CAP	delta-endotoxin of *B.t. san diego*
streptomycin	AGRI-MYCIN; AGRICULTURAL STEPTOMYCIN; AGRISTREP; STREPTOMYCIN SULPHATE
STREPTOMYCIN SULPHATE	streptomycin
SUBDUE	metalaxyl
SULCHEM 92	sulphur
SULFUR	SULCHEM 92; sulphur
SULPHIDE SULPHUR	lime sulphur
sulphur	HOLLYSUL MICRO-SULPHUR; KUMULUS;

	KUMULUS S; MICRO-NIASUL; MICROTHIOL SPECIAL; SULCHEM 92; SULFUR COATED UREA
SUMITHION	fenitrothion
SUNLIGHT DISHWASHING LIQUID	soap
SUNSPRAY	emulsifiable spray oil
SUNSPRAY OIL	petroleum oil
SUPER-CU	tribasic copper sulphate
SUPERIOR OIL	petroleum oil
SUPERIOR OIL 70	petroleum oil
SUPERIOR OIL CONCENTRATE	petroleum oil
SUPRACIDE	methidathion
SUSTANE	fertilizers
SYLGARD	adjuvant; silicone polyether
SYSTEM	dimethoate
TACHIGAREN	hymexazol; UBI-2631
TALSTAR	bifenthrin
tebuconazole	BAY-HWG-1608; ELITE; ETHYLTRIANOL; FOLICOTE; FOLICUR; HWG-1608; RAXIL; UBI-2584; UBI-2584-1; UBI-2611
tebufenozide	CONFIRM; RH-5992
teflubenzuron	HOE-000522; HOE-00522
tefluthrin	FORCE; ICIA-0993; TF-3754; TF-3755
TELONE	1,3-dichloropropene
TELONE II-B	1,3-dichloropropene
TEMIK	aldicarb
TENN-COP	copper salts of rosin and fatty acids
terbufos	AC-301467; COUNTER
TERRACHLOR	quintozene
TERSAN 1991	benomyl
TF-3480	triadimenol
TF-3607	lindane + thiabendazole + thiram
TF-3651	benalaxyl
TF-3656	imazalil + triadimenol
TF-3673	flutriafol
TF-3675	flutriafol
TF-3710	mancozeb
TF-3720	flutriafol + lindane
TF-3753	flutriafol
TF-3754	tefluthrin
TF-3755	tefluthrin
TF-3765	flutriafol
TF-3767	maneb
TF-3767B	maneb
TF-3769	lindane + maneb; MERGAMMA FL
TF-3770	hexaconazole; TF-3770A
TF-3772	benalaxyl
TF-3773	benalaxyl
TF-3775	flutriafol
TF-3785	unknown
TF-3787	unknown
TF-3790	hexaconazole + tefluthrin
TF-3791	tefluthrin + thiabendazole + thiram
TF-3794	paclobutrazol
TF-9480	hexaconazole
thiabendazole	MERTECT; UBI-2395-1; UBI-2531
THIMET	phorate
thiocyclam-hydrogenoxalate	EVISECT
THIODAN	endosulfan
thiodicarb	GUS-80502; LARVIN

thionazin	NEMAFOS; ZINOPHOS
thiophanate-methyl	EASOUT; TOPSIN-M
thiram	UBI-2215; UBI-2233
THURICIDE	*B. thuringiensis kurstaki*
THURICIDE-HPC	*B. thuringiensis kurstaki*
TILT	propiconazole
TILT MZ	mancozeb + propiconazole
tolclofos-methyl	RIZOLEX
TOPSIN-M	thiophanate-methyl
TOPAS MZ	mancozeb + penconazole
TORQUE	fenbutatin oxide
TRI-COP	tribasic copper sulphate
triadimefon	BAYLETON
triadimenol	BAYTAN; TF-3480; UBI-2383; UBI-2383-1; UBI-2541; UBI-2556; UBI-2568
TRIBASIC COPPER	tribasic copper sulphate
tribasic copper sulphate	BASIC COPPER SULPHATE; COPPER SPRAY; CUB; CUPRIC SULPHATE TRIBASIC; SUPER-CU; TRI-COP; TRIBASIC COPPER
trichlorfon	DYLOX
trichloronat	PHYTOSOL
TRIDENT	*B. thuringiensis tenebrionis*; TRIDENT II
triflumizole	UBI-2342
trifluralin	HERITAGE; HOE-FLURAN; JF-8679; RIVAL; TREFLAN; UBI-2309; UBI-2340
triforine	FUNGINEX
TRIGARD	cyromazine
trimethacarb	BROOT; LANDRIN; SD-8530; SD-8736; TF-3627; UC27-BF-32
triticonazole	EXP-80318A
TRITON	adjuvant
TRITON B-1956	adjuvant; TRITON B 1956
TRITON XR	adjuvant
TRIUMPH	isazofos
TROUNCE	potassium salts of fatty acids + pyrethrins
TRUBAN	etridiazole
TRUMPET	bendiocarb
UAN	urea ammonium nitrate
UBI-2051	VITAFLO 280
UBI-2051-1	carbathiin + thiram
UBI-2092	carbathiin
UBI-2092-1	carbathiin
UBI-2100	carbathiin
UBI-2100-2	carbathiin
UBI-2100-4	carbathiin
UBI-2106-1	carbathiin + lindane
UBI-2155	carbathiin + thiram
UBI-2215	thiram
UBI-2233	thiram
UBI-2236	carbathiin + lindane + thiram
UBI-2291	diazinon
UBI-2342	triflumizole
UBI-2359	carbathiin + thiram
UBI-2359-2	ANCHOR; carbathiin + thiram
UBI-2369-1	VITAVAX RS; carbathiin + lindane + thiram
UBI-2379	metalaxyl
UBI-2383	triadimenol
UBI-2383-1	triadimenol
UBI-2389	carbathiin + isofenphos

UBI-2390	carbathiin + thiram; UBI-2390-1
UBI-2390-1	UBI-2390
UBI-2390-3	UBI-2390
UBI-2393	carbathiin + thiabendazole; UBI-2393-2
UBI-2393-2	UBI-2393
UBI-2394	carbathiin + imazalil + thiabendazole; UBI-2394-2
UBI-2394-2	UBI-2394
UBI-2395-1	thiabendazole
UBI-2401	carbathiin + imazalil
UBI-2402	carbathiin + lindane + thiabendazole; UBI-2402-1
UBI-2402-1	UBI-2402
UBI-2413	carbathiin + isofenphos + thiram; UBI-2413-1
UBI-2413-1	UBI-2413
UBI-2417	carbathiin + lindane + metalaxyl; UBI-2417-1
UBI-2417-1	UBI-2417
UBI-2420	imazalil
UBI-2424	carbathiin + imazalil; UBI-2424-1
UBI-2424-1	UBI-2424
UBI-2450	metalaxyl + thiabendazole
UBI-2454	myclobutanil
UBI-2454-1	myclobutanil
UBI-2454-2	myclobutanil
UBI-2457	metalaxyl + thiabendazole
UBI-2484	tebuconazole
UBI-2501	carbofuran
UBI-2509	UBI-2509-1
UBI-2509-1	metalaxyl + thiram; UBI-2509
UBI-2511	carbathiin + cloethocarb + thiram; UBI-2511-1
UBI-2511-1	UBI-2511
UBI-2521	UBI-2521-1
UBI-2521-1	carbathiin + thiabendazole; UBI-2521
UBI-2529	carbathiin + cloethocarb
UBI-2530	carbathiin + isofenphos
UBI-2531	thiabendazole
UBI-2541	triadimenol
UBI-2550	G-696 + lindane + thiram
UBI-2554	carbathiin + cloethocarb + thiram; UBI-2554-1
UBI-2554-1	UBI-2554
UBI-2555	carbathiin + cloethocarb + thiram; UBI-2555-1
UBI-2555-1	UBI-2555
UBI-2556	triadimenol
UBI-2557	carbathiin + cloethocarb + thiram
UBI-2559	cloethocarb
UBI-2561	myclobutanil
UBI-2562	cloethocarb
UBI-2563	G-696
UBI-2564	carbathiin + G-696
UBI-2565	cyproconazole
UBI-2568	triadimenol
UBI-2573	G-696 + thiram
UBI-2575	cyproconazole
UBI-2576	lindane + thiabendazole + thiram
UBI-2584	tebuconazole
UBI-2584-1	tebuconazole
UBI-2599	lindane

UBI-2599-2	carbathiin + lindane + thiram
UBI-2608-1	carbathiin + imidacloprid + thiram
UBI-2611	tebuconazole
UBI-2617	carbathiin + lindane + thiram
UBI-2627	imidacloprid
UBI-2631	hymexazol; TACHIGAREN
UBI-2679	chlorpyrifos
UCB-87	granulosis virus
ULTRA-T	iodine + phosphoric acid
ULTRATHON	deet
UNITRAPS	pheromone
UREA	fertilizer
urea ammonium nitrate	UAN
validamycin a	SOLACOL
VAMIN	ofurace
VAPO	dichlorvos
VECTOBAC	*B. thuringiensis israelensis*
VENDEX	fenbutatin oxide
VIGORO	isobutylidene diurea + quintozene + urea
vinclozolin	RONILAN
VITAFLO 250	carbathiin
VITAFLO 280	carbathiin + thiram; UBI-2051
VITAVAX	carbathiin
VITAVAX 200	carbathiin + thiram
VITAVAX DUAL SOLUTION	carbathiin + lindane
VITAVAX RS	carbathiin + lindane + thiram; UBI-2369-1
VITAVAX SINGLE SOLUTION	carbathiin
VITAVAX SOLUTION	carbathiin
VOLCK DORMANT OIL	petroleum oil
VOLCK OIL	petroleum oil
VOLCK SUPREME OIL	petroleum oil
VOLID	brodifacoum
VORLEX	1,3-dichloropropene + methyl isothio-cyanate
VYDATE	oxamyl
WL-115110	CASCADE; flufenoxuron
WF-2228	hexaconazole
XE-779	diniconazole
XRD-473	DOWCO-473
ZENECA1	captan
zinc	ZINC SULPHATE
zineb	DITHANE Z-78; PARZATE; PARZATE C; PARZATE-C
ziram	ZERLATE
ZOLONE	phosalone

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