Agriculture and Agri Food Canada | Agriculture et Agroalimentaire Canada

2003 Pest Management Research Report (PMRR)
2003 Growing Season

2003 Rapport de recherches sur la lutte dirigée (RRLD)
pour le saison 2003

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

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

February, 2004 / Février, 2004

Canada

English

2003 PEST MANAGEMENT RESEARCH REPORT

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

Chairperson: **Michel Letendre**

Prepared by: **Research Branch, Agriculture and Agri-Food Canada**
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The Official Title of the Report
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[1] This is the fourth year that the Report has been issued a volume number. It is based on the number of years that it has been published. See history on page iii.

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

This year there were 107 reports. The Expert Committee on Integrated Pest Management is indebted to the researchers from provincial and federal departments, universities, and industry who submitted reports, for without their involvement there would be no report. Special thanks is also extended to the section editors for reviewing the scientific content and merit of each report, and to Andrea Labaj for editorial and computer compilation services.

Suggestions for improving this publication are always welcome.

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Procedures for the 2004 Annual PMR Report will be sent in Fall, 2004. They will also be published on the web site, or contact PMRR EDITOR, Andrea Labaj.

Pest Management Research Report History.

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

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

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

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

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

The publication of the Report for the growing season 2003 has been assigned a Volume number for the fourth year. Although there was a name change since it was first published, the purpose and format of the publication remains the same. Therefore based on the first year of publication of this document, the Volume Number will be Volume 42.

An individual report will be cited as follows:
Author(s). 2004. Title. 2003 Pest Management Research Report - 2003 Growing Season. Expert Committee on Integrated Pest Management. February, 2004. Report No. x. Vol. 42: pp-pp.

Français

Rapport de recherches sur la lutte dirigée - 2003

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

Président: **Michel Letendre**

Préparé par: **Agriculture et Agroalimentaire Canada**
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Titre officiel du document

2003 Rapport de recherches sur la lutte dirigée - pour le saison 2003. Compilé par le Comité d'experts sur la lutte intégrée, par Agriculture et Agroalimentaire Canada, London (Ontario) Canada N5V 4T3.
Février, 2004. 271 pp.
Publié sur l'Internet à http://www.carc-crac.ca/french/ECIPM/ecipmf.htm

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

Cette année, nous avons donc reçu 107 rapports. Les membres du Comité d'experts sur la lutte intégrée tiennent à remercier chaleureusement les chercheurs des ministères provinciaux et fédéraux, des universités et du secteur privé sans oublier les rédacteurs, qui ont fait la révision scientifique de chacun des rapports et en ont assuré la qualité, et Andrea Labaj qui ont fourni les services d'édition et de compilation sur ordinateur. Vos suggestions en vue de l'amélioration de cette publication sont toujours très appréciées.

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

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

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

Il y a deux ans, on a commencé à attribuer un numéro de volume au rapport annuel. Même si ce dernier a changé de titre depuis sa création, sa vocation et son format demeurent les mêmes. Ainsi, si l'on se reporte à la première année de publication, le rapport portant sur la saison de croissance de 2002 correspond au volume 42.

Modèle de référence :
[Nom de l'auteur ou des auteurs. Année de parution 2004. Titre (*2003 Rapport de recherche sur la lutte antiparasitaire*). Comité d'experts de la lutte antiparasitaire intégrée. Fev. 2004. Rapport n^{o} x. 42:** pp-pp.]

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[1] enregistrement
[2] numéro de page

2003 PMR REPORT # 1 **SECTION A: FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

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

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TITLE: CONTROL OF ORIENTAL FRUIT MOTH (SECOND GENERATION) ON APPLE WITH INSECTICIDES, 2003.

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

METHODS: The trial was conducted in an eight-year-old orchard in the Jordan Station, Ontario area; trees cv. Empire were spaced 4.6 m by 2.4 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. ASSAIL was compared to three rates of INTREPID, a DECIS standard, and an unsprayed control. Applications were timed for egg hatch of the second generation of Oriental fruit moth (OFM), determined from pheromone trap catches of male moths. Treatments were applied 16 July, 666 degree days (DD) (base 7.2 C) after first male moth catch (May 5). Insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-10 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled for OFM post-treatment 31 July; all infested terminals and fruit were removed and counted. Damaged twigs and fruit were dissected; all larvae found were examined under a stereomicroscope and identified. Data were transformed (log(x+1)) and analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

RESULTS: Data are presented in Table 1; laboratory identification revealed that 88% of larvae recovered were OFM, while the remainder were codling moth (*Cydia pomonella* (L.)). No phytotoxic effects were observed in any of the treated plots.

CONCLUSIONS: In the 31 July sample of fruit for OFM damage, all treatments except the 120 g a.i./ha rate of INTREPID had significantly less damaged fruit than the control (Table 1); however, the plots treated with ASSAIL showed significantly less fruit damage than all other treatments. The DECIS treatment was not different from any of the INTREPID treatments, but the plots treated with the 360 g a.i./ha rate of INTREPID had less fruit damage than those treated with the 120 g a.i./ha rate of INTREPID.

Table 1. OFM damage per plot.

Treatment[1]	Rate (a.i./ha)	Damaged Fruit per Plot 1 August
ASSAIL 70 WP	168 g	1.5 D[2]
INTREPID 2F	360 g	4.5 C
DECIS 5 EC	12.5 g	6.0 BC
INTREPID 2F	240 g	6.0 BC
INTREPID 2F	120 g	12.5 AB
CONTROL	-	24.0 A

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

2003 PMR REPORT # 2 SECTION A : BERRY CROPS - Insect Pests
STUDY DATA BASE: 160.3

CROP: Blueberry (*Vaccinium corymbosum*), cv. Blue Crop (Site 1), Blue Gold (Site 2)
PEST: "White Grubs" - European Chafer, *Rhizotrogus majalis* (Razoumowsky)
June beetles, *Phyllophaga* spp.

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TITLE: SMALL PLOT FIELD EVALUATION OF ADMIRE® 240 F FOR CONTROL OF "WHITE GRUBS" IN HIGHBUSH BLUEBERRIES, 2003.

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

METHODS: Trials were established on 01 July at Site 1 (42° 46' 45.81" N; 81°30' 49.33" W) and on 02 July at Site 2 (43° 01' 37.42" N; 80° 28' 14.77" W) in established plantations of highbush blueberries. Soil at both sites was a sandy loam. At both sites blueberry bushes were growing in the centre of a strip of bare ground approximately 1 m wide; alleyways between rows of blueberry plants consisted of established, mown perennial grass. Plots were established down the length of 2 rows of blueberries. Individual plots measured 5 m long separated by a 1 m buffer between plots. The treated area measured 1.7 m from each side of the blueberry row. All treatments were replicated 4x in a Randomized Complete Block Design with 6 plots in each experimental row. Treatments were applied in 250 L/ha at 220 kPa using a hand-held, CO_2-pressurized R&D field-plot sprayer fitted with a 1.1 m boom equipped with four XR8002VS flat spray tips. Approximately 10 mm of water was applied either by hand (Site 2) or by overhead sprinkler irrigation (Site 1) within 6 hours of application. On 25 (Site 1) and 29 (Site 2) September, numbers of grubs were counted in quadrats measuring 1.0 m x 0.25 m established in the grass at the edge of the strip of bare ground containing the blueberry plants; 1 quadrat was randomly located on each side of the blueberry row in each plot. Grass and thatch were removed from each quadrat and inspected for the presence of white grubs. Soil was then excavated to a depth of 15 cm, sifted through a 5 mm screen and all "white grubs' counted and identified. For the purposes of statistical analysis raw data was transformed to Log (x+10). Significance of observed differences among treatments was determined using ANOVA and a Least Significant Difference Test. Untransformed data are presented in Table 1.

OBSERVATIONS: A mixed population of "white grubs" was identified at Site 1; both European chafer and June beetle were identified. All "white grubs" collected at Site 2 were European chafer. The population of "white grubs" was more variable at Site 2 than at Site 1. At Site 2 no "white grubs" were found in 1 quadrat in 1 plot that was not treated with insecticide.

RESULTS: Experimental results are outlined in Table 1. At both Site 1 and Site 2 significantly fewer European chafer grubs were collected from plots treated with the higher rate of ADMIRE 240 F. At Site 1, while fewer chafer were collected from plots treated with the lower rate of ADMIRE 240 F than from untreated plots, the difference was not statistically significant; application of the lower rate of ADMIRE 240 F significantly reduced numbers of chafer at Site 2. Populations of June beetle grubs at Site 1 were much lower and more variable than populations of chafer at the same site. While fewer June beetle gubs were collected from plots treated with both rates of ADMIRE 240 F, reductions were significant at only $P < 0.10$.

CONCLUSIONS: Application of ADMIRE 240 F to turf and bare ground in blueberry plantations significantly reduced populations of grubs of European chafer in those plantations nearly 3 months after application. Where present, populations of June beetle grubs were also lower in treated plots but the statistical significance of those reductions was slightly lower.

Table 1. Impact of application of ADMIRE 240 F on numbers of "white grubs" in plantations of highbush blueberries in southwestern Ontario, 2003.

Tmt. No.	Treatment Applied	Rate Applied	Mean Number of "Grubs"/Plot at Indicated Site		
			Site 1		Site 2
			June beetle	European chafer	European chafer
1	ADMIRE 240 F	1.4 L/ha	0.0 b[1]	0.8 b	1.3 b
2	ADMIRE 240 F	1.2 L/ha	0.1 b	2.4 ab	0.3 b
3	No Insecticide	---	1.4 a	4.0 a	7.8 a

[1] - within each column, numbers followed by the same letter are not significantly different ($P \leq 0.1$ - Site 1-June beetle; $P \leq 0.05$ - European chafer - both sites) as determined by ANOVA and a Least Significant Difference range test.

2003 PMR REPORT #3 **SECTION A: FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

CROP: Grapes cv. Riesling
PEST: Multicoloured Asian Lady Beetle, *Harmonia axyridis* (Pallas)

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TITLE: CONTROL OF MULTICOLOURED ASIAN LADY BEETLE ON GRAPE, 2003.

MATERIALS: ASSAIL 70 WP (acetamiprid), CYMBUSH 250 EC (cypermethrin), MALATHION 500 E (malathion)

METHODS: The trial was conducted in a mature vineyard in the Vineland, Ontario area; vines cv. Riesling were spaced 2.5 m by 1.5 m. Treatments were replicated four times, assigned to five-vine plots, and arranged according to a randomised complete block design. On 23 October insecticides were diluted to a rate comparable to 3000 L per ha and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 8-9 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled 1 day (24 October) and 7 days (30 October) after treatment; total numbers of multicoloured Asian lady beetle (MALB) in bunches and on leaves were recorded for each plot. Data were transformed (log(x+1)), analysed using analysis of variance, and means separated with a Tukey test at the 0.05 significance level.

RESULTS: Data are presented in Table 1. Examination of beetles in the laboratory identified 95% of beetles to be MALB, the remainder were other subspecies of lady beetle. No phytotoxic effects were observed.

CONCLUSIONS: In the 1-day sample, plots treated with MALATHION and CYMBUSH had fewer MALB than the control (Table 1), and significantly fewer MALB than those treated with ASSAIL, which were not different from the control. In the 7-day sample, there were no differences between insecticide treatments, but plots treated with CYMBUSH contained fewer MALB than the control.

Table 1. Number of MALB per plot.

Treatment[1]	Rate a.i./ha	Days After Treatment: 1 day after application (24 October)	Days After Treatment: 7 days after application (30 October)
CYMBUSH 250 EC	60 g	0.0 B	7.0 B[2]
MALATHION 500 E	900 g	0.3 B	11.0 AB
ASSAIL 70 WP	56 g	11.8 A	27.0 AB
CONTROL	-	25.8 A	38.8 A

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

2003 PMR REPORT #4 **SECTION A: FRUIT - Insect Pests**
STUDY DATA BASE #: 280-1261-9341

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

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TITLE: CONTROL OF SECOND-GENERATION ORIENTAL FRUIT MOTH ON PEACH, 2003.

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

METHODS: The trial was conducted in a seven-year-old peach orchard in the Jordan Station, Ontario area; trees cv. Loring were spaced 4.6 m by 5.5 m. Treatments were replicated four times, assigned to two-tree plots, and arranged according to a randomised complete block design. Application was timed for egg hatch of the second generation, determined from pheromone trap catches of male moths. Treatments were applied 16 July, 666 DD (base 7.2 C) after first male moth catch (May 5). Insecticides were diluted to a rate comparable to 3000 L per ha, and sprayed to runoff with a Rittenhouse truck-mounted sprayer equipped with a Spraying Systems handgun fitted with a D-6 orifice plate. Approximately 12-13 L of spray mix were used per plot; pressure was set at 2000 kPa. Plots were sampled for Oriental fruit moth (OFM) post-treatment 29 July; all infested terminals and fruit were removed and counted. Data were analysed using analysis of variance and means separated with a Tukey Test at the 0.05 significance level.

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

CONCLUSIONS: In the 29 July OFM sample, all treatments showed significantly fewer infested terminals and less total damage than the control (Table 1); the ASSAIL treatment showed significantly less damage than all rates of INTREPID, but was not different from DECIS; damage was significantly lower in the plots treated with DECIS than the 120 g a.i./ha rate of INTREPID; no differences were observed between rates of INTREPID. Only the plots treated with the 120 g a.i./ha rate of INTREPID did not have less fruit damage than the CONTROL; no difference in fruit damage was observed between the three rates of INTREPID and DECIS; plots treated with ASSAIL contained less damaged fruit than the low rate of INTREPID.

Table 1. OFM damage per plot.

Treatment[1]	Rate (a.i./ha)	Infested Terminals per Plot 29 July	Damaged Fruit per Plot 29 July	Total OFM Damage 29 July
ASSAIL 70 WP	168 g	3.75 D	0.75 C	4.50 D[2]
DECIS 5 EC	10 g	7.50 CD	1.25 BC	8.75 CD
INTREPID 2 F	360 g	15.25 BC	2.75 BC	18.00 BC
INTREPID 2 F	240 g	19.50 BC	3.50 BC	23.00 BC
INTREPID 2 F	120 g	25.25 B	4.25 AB	29.50 B
CONTROL	-	85.25 A	11.00 A	96.25 A

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

2003 PMR REPORT #5 **SECTION A: BERRY CROPS - Insect Pests.**
ICAR:

CROP: Strawberry, *Fragaria* x *ananassa* Duchesne
PEST: Cyclamen mite, *Pytonemus (=Stenotarsonemus) pallida* (Banks)

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TITLE: EFFICACY OF VARIOUS INSECTICIDES FOR POST-HARVEST RENOVATION CONTROL OF CYCLAMEN MITE ON COMMERCIAL STRAWBERRIES, 2003

MATERIALS: AGRI-MEK 1.9% EC (abamectin, 19 g ai/L); PYRAMITE 75 WP (pyridaben, 75% w/w); THIODAN 4 EC (endosulfan, 50% w/w).

METHODS: A 1.5 ha commercial strawberry field with a history of cyclamen-mite infestation was identified near Barrie, ON. The western edge of the field bordered a hedgerow, which appeared to serve as the reservoir for the mite population. The trial was designed as randomised complete block with six replications with blocks extending eastward from the hedgerow. The individual plot dimensions were 3 rows (at a row spacing of 1 m) by 3 m long or 9 m^2. After berry harvest was complete, the grower mowed the field to remove top-growth. After adequate vegetative regrowth (ca. 10 cm in height), the treatments (Table 1) were applied on 18 August 2003 as a single foliar application. All treatments, excluding the untreated-check plot, (UTC), were applied using a hand-pumped plot sprayer with single-row boom fitted with a hollow-cone nozzle. The sprayer was calibrated to deliver a water volume equivalent to ca. 2300 L/ha. Product efficacy was evaluated by sampling 10 immature (i.e., unfurled) trifoliate leaves from the center row only (and avoiding the border plants at each end of the plot) at 21 and 42 days after treatment (DAT). The leaves were placed in re-sealable bags and brought in a cooler with 'blue ice' to the laboratory for counting. The number of mites per leaflet were counted, to a maximum of 30 mites, using a binocular dissecting microscope (ca. 10X amplification). At the first sampling, adult and immature mites were counted together. At the second sampling; the adults and immature mites were counted separately due to a bias of contact kill over ingested toxin, i.e., the immature had to begin feeding to receive a lethal dose of AGRI-MEK 1.9% EC and PYRAMITE. Beneficial mites (phytoseiidae), immature thrips, and a few immature minute pirate bugs were observed and counted as beneficial. Raw count data approximated a normal distribution and was subjected to an Analysis of Variance. If the treatment effect was deemed significant ($\alpha = 0.05$), then a Fisher's Least Significant Difference value was calculated and used to separate the individual treatment means.

RESULTS: The results are summarized in Table 1. All miticide treatments significantly reduced mite populations up to 21 DAT relative to the UTC. Numerically, THIODAN 4EC provided the greatest level of control at 83%; whereas, the high rates of PYRAMITE and AGRI-MEK 1.9% EC afforded levels of control >75%. At 42 DAT, no treatment effects were significant ($\alpha = 0.05$); the overall decrease in populations was likely due to the rapidly cooling ambient temperature and the shorter daylength. However, there was significant treatment effect on beneficial populations: Populations of beneficials were significantly lower in plots treated with THIODAN 4EC or the lower rate of AGRI-MEK 1.9% EC. THIODAN 4EC and the 1X rate of AGRI-MEK 1.9% EC reduced beneficial insects, whereas, both PYRAMITE rates had numerically higher populations relative to the UTC.

CONCLUSIONS: THIODAN 4EC is registered currently for the post-harvest control of cyclamen mite on strawberries. AGRI-MEK 1.9% EC and PYRAMITE are registered for post-harvest control of mites, but cyclamen mite is not a currently labelled species. From these data, AGRI-MEK 1.9% EC and

PYRAMITE are viable options for cyclamen mite control. These products could provide alternatives to THIODAN in a resistance management program.

Table 1. Mite and beneficial mite/insect population counts on strawberry leaflets 21 and 42 days after receiving a single, foliar application of a miticide.

	Application rate	21 DAT	42 DAT		
Miticide treatment	Formulation (unit per ha)	Total Mites per leaflet[1]	Adult +immature mites per leaflet[1]	Eggs per leaflet[1]	Beneficials per leaflet[1]
Untreated control	-	10.5 a	2.6	2.9	0.9 ab
THIODAN 4EC	5 L	1.8 c	1.5	1.4	0.2 c
PYRAMITE 75 WP	450 g	3.2 bc	2.4	3.0	1.5 a
PYRAMITE 75 WP	600 g	2.5 bc	2.3	2.5	1.0 ab
AGRI-MEK 1.9% EC	0.75 L	3.8 b	2.9	2.8	0.7 bc
AGRI-MEK 1.9% EC	1.00 L	2.9 bc	2.1	1.9	0.1 c
	LSD (95%)	1.9	NS	NS	0.6

[1] raw data were subjected to Analysis of Variance and subsequent Fisher's Least Significant Difference [LSD] test.

2003 PMR REPORTS #6 SECTION B: VEGETABLES and SPECIAL CROPS- Insect Pests
ICAR: 30601

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

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TITLE: COMPARATIVE EFFICACY OF INSECTICIDES FOR CONTROL OF SWEDE MIDGE ON BROCCOLI AND CABBAGE, 2003

MATERIALS: ASSAIL 70 WP (acetamiprid 70.35%), RIMON 10 EC (novaluron 100 g/L), MATADOR 120 EC (lambda cyhalothrin 120 g/L), WARRIOR T (lambda cyhalothrin 114 g/L), GUTHION 50 WP (azinphos-methyl 50%), ADMIRE 240 F (imidacloprid 240 g/L), TRACER 480 SC (spinosad 480 g/L), SYLGARD 309 (siloxylated polyether 76% + surfactant mixture 24%).

METHODS: Broccoli seedlings cv. Eureka and cabbage seedlings cv. Blue Dynasty were grown in plug trays and then machine-planted (mechanical cell transplanter) at a farm near Markham, ON (Site 1; clay soil), on 18 June, in 4 row plots, 5 m in length, with a row spacing of 90 cm and in-row plant spacing of 45 cm. Within each plot, two adjacent rows were planted with broccoli plants and the remaining two adjacent rows with cabbage plants. The position of broccoli and cabbage within each plot was randomized throughout the field. Plots were separated by a 3 m spray lane (N-S) and a 3 m alley (E-W). Thirteen treatments were replicated 5 times in a randomized complete block design. The same experiment, was repeated at a farm near Stouffville, ON (Site 2; sandy soil) where plants were machine-planted (mechanical cell transplanter) on 16 June. To control cabbage maggot, GUTHION (100 g/100 L water) was added to the planting water for all treatments. Five control agents were evaluated for efficacy against the swede midge, each at two application rates, with the exception of lamba cyhalothrin, tested as two different formulations (MATADOR and WARRIOR). TRACER was also tested alone or in combination with the surfactant SYLGARD. All applications were made as foliar sprays with the exception of Treatment 8, which consisted of a single drench (200 ml) application of ADMIRE at the base of each plant immediately after transplanting. All foliar treatments were applied using a CO_2-pressurized precision plot sprayer at 275 kPa in water equivalent to 200 L/ha. Applications took place on 25 June at Site 1 and 27 June at Site 2, and at both sites on 14 and 29 July. Swede midge damage was rated weekly starting June 27. Swede midge damage was rated on 6 plants per plot on a scale of 0 to 3 (0 = no damage; 1 = mild crumpling of leaves; 2 = severe crumpling of leaves with plant deformities; 3 = blind plant, i.e. no head formation). A damage index for each block was calculated from plant damage ratings. Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Treatment differences in damage indices were determined by analyses of all post-treatment dates both individually and pooled using analysis of variance and Duncan's multiple range test.

RESULTS: The results are summarized in Tables 1, 2, and 3. Only results from the final damage rating are presented. Treatment differences were not consistent between sites. For broccoli at Site 1, plots treated with the two lambda cyhalothrin formulations (MATADOR and WARRIOR) had significantly lower damage indices than the untreated control and the low application rate of TRACER without surfactant (Table 1). However at Site 2, application of no product caused significantly lower damage indices than those of the untreated control. For cabbage at Site 1, WARRIOR and the low rate of TRACER (with surfactant) had significantly lower damage indices than the untreated control (Table 2). At Site 2, however, only plots receiving the low rate of ASSAIL had significantly lower damage indices than did the control. Differences among treatment damage indices were not reflected in cabbage yield data, although yields for the low rate of ASSAIL were significantly higher than the control at Site 1. At Site 2, plots treated with the two rates of TRACER plus surfactant and the high rate of RIMON had significantly higher yields than the control.

CONCLUSIONS: Differences in results between the two sites may have been related to differences in swede midge population levels. This was especially apparent on the last sampling date. For broccoli, under moderate swede midge population levels (Site 1), application of MATADOR and WARRIOR effectively reduced damage levels. However, at high population levels (Site 2), no product significantly reduced damage levels relative to control plots. Similarly for cabbage, application of WARRIOR and the low rate of SUCCESS (with surfactant) effectively reduced damage under moderate population; while under high population levels, these products were not effective. At high population levels, the lower rate of ASSAIL was the only treatment with significantly lower damage levels than in control plots.
Crop phenology and application timings are factors that need to be examined more fully in order to determine how to most effectively control the swede midge. More products were effective in reducing swede midge damage on cabbage than were effective on broccoli. In 2003, swede midge damage on cabbage increased until mid-July and then decreased substantially in late July. Damage to cabbage is severe until heading, but then decreases once plants have successfully initiated a head. In broccoli, however, swede midge damage continues to increase throughout the season, with substantial increases in damage severity occurring from mid to late July. As indicated by emergence and sticky trap data, the first spray applications (June 25 & 27) were made during a peak of adult emergence, the second applications (July 14) were made 2 to 3 days after a peak of emergence, and the third applications (July 29) were made at the beginning of a very high peak of adult emergence. Timing of insecticide applications needs to be studied in detail to determine the optimum timing of each insecticide application. Insecticides that mainly target adult swede midge (e.g. MATADOR and WARRIOR) should be made during peaks of adult emergence. Insecticides active against swede midge larvae might be most effective if applied at the end of a peak emergence period.

Table 1. Mean damage indices (± standard error) of broccoli after treatment with various insecticides, near Markham (Site 1) and Stouffville (Site 2), ON, 13 August, 2003.

Treatment No.	Insecticide	Rate (mL/ha)[1]	Mean damage indices[2,3]	
			Site 1	Site 2
1	ASSAIL	56 g	37.8 ± 5.7 ab	71.1 ± 4.4 ab
2	ASSAIL	86 g	48.9 ± 13.4 ab	67.3 ± 6.4 ab
3	TRACER (- surfactant)	182	55.8 ± 10.5 b	61.1 ± 11.8 ab
4	TRACER (+ surfactant)	182	42.2 ± 10.6 ab	60.7 ± 13.5 ab
5	TRACER (- surfactant)	300	38.9 ± 10.7 ab	68.1 ± 2.7 ab
6	TRACER (+ surfactant)	300	42.2 ± 4.5 ab	52.8 ± 9.2 a
7	WARRIOR	88	22.2 ± 7.7 a	65.6 ± 4.4 ab
8	ADMIRE (drench)	875	28.9 ± 4.8 ab	84.8 ± 2.3 b
9	ADMIRE (foliar)	200	41.1 ± 10.3 ab	75.6 ± 7.2 ab
10	RIMON	250	52.2 ± 14.1 ab	75.6 ± 3.3 ab
11	RIMON	500	47.8 ± 10.8 ab	74.4 ± 10.3 ab
12	MATADOR	83.3	21.1 ± 6.9 a	72.2 ± 3.9 ab
13	Control	--	55.6 ± 7.9 b	58.3 ± 8.6 a

[1] Unless otherwise stated.
[2] Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Damage rating classes were 0= no damage, 1 = mild crumpling of leaves, 2=severe crumpling of leaves with plant deformities, 3=blind plant, i.e. no head formation.
[3] Values followed by the same letter, within the same column for each site, are not significantly different (P>0.05); Duncan's multiple range test.

Table 2. Mean damage indices (± standard error) of cabbage after treatment with various insecticides, near Markham (Site 1) and Stouffville (Site 2), ON, 13 August, 2003.

Treatment No.	Insecticide	Rate (mL/ha)[1]	Mean damage indices[2,3]	
			Site 1	Site 2
1	ASSAIL	56 g	5.6 ± 1.8 ab	0.0 ± 0.0 a
2	ASSAIL	86 g	5.6 ± 2.5 ab	7.8 ± 3.8 ab
3	TRACER (- surfactant)	182	11.1 ± 3.9 ab	4.4 ± 3.2 ab
4	TRACER (+ surfactant)	182	2.2 ± 1.4 a	13.3 ± 4.8 ab
5	TRACER (- surfactant)	300	10.0 ± 5.4 ab	7.8 ± 4.2 ab
6	TRACER (+ surfactant)	300	6.7 ± 2.1 ab	8.9 ± 4.5 ab
7	WARRIOR	88	2.2 ± 1.4 a	7.8 ± 4.2 ab
8	ADMIRE (drench)	875	8.9 ± 3.8 ab	8.3 ± 3.6 ab
9	ADMIRE (foliar)	200	11.1 ± 4.6 ab	11.6 ± 8.9 ab
10	RIMON	250	6.7 ± 2.1 ab	9.7 ± 8.0 ab
11	RIMON	500	6.7 ± 2.1 ab	5.6 ± 1.8 ab
12	MATADOR	83.3	4.4 ± 1.1 ab	18.1 ± 6.9 ab
13	Control	--	14.4 ± 5.2 b	22.4 ± 8.2 b

[1] Unless otherwise stated.
[2] Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Damage rating classes were 0= no damage, 1 = mild crumpling of leaves, 2=severe crumpling of leaves with plant deformities, 3=blind plant, i.e. no head formation.
[3]Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.

Table 3. Mean yield (± standard error) of cabbage treated with various insecticides, near Markham (Site 1) and Stouffville (Site 2), ON, 2003.

Treatment No.	Insecticide	Rate (mL/ha)[1]	Mean yield (t/ha)[2]	
			Site 1	Site 2
1	ASSAIL	56 g	16.8 ± 1.9 a	11.4 ± 2.5 ab
2	ASSAIL	86 g	14.5 ± 2.2 ab	9.2 ± 1.0 ab
3	TRACER (- surfactant)	182	12.8 ± 0.8 ab	15.9 ± 3.5 a
4	TRACER (+ surfactant)	182	14.3 ± 1.9 ab	10.2 ± 0.7 ab
5	TRACER (- surfactant)	300	15.7 ± 1.0 ab	15.8 ± 2.9 a
6	TRACER (+ surfactant)	300	11.7 ± 1.9 ab	11.2 ± 1.1 ab
7	WARRIOR	88	14.8 ± 1.3 ab	10.0 ± 1.4 ab
8	ADMIRE (drench)	875	13.9 ± 2.3 ab	9.7 ± 2.8 ab
9	ADMIRE (foliar)	200	12.2 ± 0.7 ab	8.8 ± 1.5 ab
10	RIMON	250	15.0 ± 1.4 ab	7.5 ± 1.9 b
11	RIMON	500	13.8 ± 1.8 ab	12.2 ± 3.0 a
12	MATADOR	83.3	13.6 ± 2.0 ab	4.9 ± 0.6 b
13	Control	--	10.5 ± 1.0 b	7.3 ± 2.3 b

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

2003 PMR REPORT #7 **SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests**
STUDY DATA BASE:

CROP: Broccoli cv. Paragon
PEST: Swede midge (SM), *Contarinia nasturtii* (Kieffer)

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TITLE: CONTROL OF SWEDE MIDGE IN GREENHOUSE GROWN BROCCOLI TRANSPLANTS, SEEDED MAY 26 2003

MATERIALS: TRISTAR 70 WP (acetamiprid 70%), INTERCEPT 60 WP (imidacloprid 60%), TRACER 480 SC (spinosad 480 g/L), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), WARRIOR (lambda-cyhalothrin 122 g/L), RIMON 10 EC (novaluron 100 g/L), ENDEAVOUR 50 WG (pymetrozine 50%), GAUCHO (imidacloprid 600 g/L)

METHODS: Broccoli was seeded into 200 cell plastic seedling trays in a commercial greenhouse on May 26. Broccoli seed was treated in the laboratory at Ridgetown College by tumbling the seed and sticker in a clean bag for 5 minutes until all seed was uniformly coated. The seed was then dried. Drench treatments were applied 1 week after seeding at a rate of 200 ml per tray using a modified spray bottle with a fine mist. All other treatments were applied to the foliage using a specialized, small plot research CO_2 sprayer with a two-nozzled, hand-held boom applying 200 L/ha (100 ml per tray) of spray mixture on the transplants on July 15, just prior to shipment. The trays were set out in a commercial field with known SM populations near Stouffville, north of Toronto. All treatments were replicated 4 times in a randomized complete block design. Treated broccoli transplants were left in the field for 48 hours exposed to the existing SM pressures (natural infestation period) and then placed into a greenhouse away from the insect pressure for assessment on July 24 and July 28, 7 and 11 days after plants were removed from the field. Assessments were taken by counting the total number of plants per tray and calculating the percentage of plants in each SM Damage Rating on each assessment date. Results were analyzed using ANOVA and Duncan's Multiple Range Test (P£ 0.05).

RESULTS: Data are presented in Tables 1 and 2. None of the insecticides tested in this trial caused any damage to broccoli transplants.

CONCLUSIONS: At the first rating, 7 days after removal from the field, while trays treated in the greenhouse with RIMON, MATADOR or WARRIOR had the highest numbers of symptom-free broccoli seedlings, numbers for no treatment were significantly different from CONTROL trays. Also at the first rating, while less than 2% of plants showed severe SM damage in all treatments only trays treated with ENDEAVOUR contained more severely affected plants than control trays. When trays were again rated 4 days later, the number of symptom-free plants had declined in all treatments. While there was no significant difference among treatments in the percentage of undamaged plants, at least 10.5% of plants remained free of symptoms in trays treated with GAUCHO as a seed treatment or RIMON or TRISTAR as foliar treatments.

Table 1. Control of swede midge in broccoli with greenhouse applied control agents – Seeded, May 26; Assessed – July 24.

Treatments	Rate Product/ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts 0	1	2	3
TRISTAR 70 WP	86 g	Foliar	73.3ab[2]	38.6abc	60.8abc	0.3a	0.3ab
TRISTAR 70 WP	86 g	Drench	67.8b	37.9abc	61.4abc	0.7a	0.0b
INTERCEPT 60 WP	80 g	Foliar	72.8ab	42.6abc	56.3abc	0.3a	0.7ab
INTERCEPT 60 WP	80 g	Drench	73.3ab	39.3abc	60.3abc	0.4a	0.0b
TRACER 480 SC	182 ml	Foliar	69.0ab	41.6abc	56.9abc	0.0a	1.5ab
MATADOR 120 EC	83 ml	Foliar	74.0ab	50.0ab	49.7bc	0.3a	0.0b
WARRIOR 122 EC	88 ml	Foliar	69.0ab	47.6ab	52.0abc	0.0a	0.4ab
RIMON 10 EC	500 ml	Foliar	76.8a	51.7a	47.7c	0.0a	0.7ab
ENDEAVOUR 50 WG	193 g	Foliar	71.0ab	27.6c	70.0a	0.7a	1.7a
GAUCHO 600	7500 ml / 100kg	Seed Trt	73.5ab	32.9bc	66.4ab	0.4a	0.3ab
CONTROL	---[3]	---	73.8ab	36.7abc	62.6abc	0.7a	0.0b
ANOVA P £ 0.05			s	s	s	ns	s
Coefficient of Variation (%)			6.4	27.2	18.9		173.7

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

Table 2. Control of swede midge in broccoli with greenhouse applied control agents - Seeded, May 26; Assessed, July 28.

Treatments	Rate Product/ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts 0	1	2	3
TRISTAR 70 WP	86 g	Foliar	71.0ab[2]	10.5a	87.4a	1.0a	0.8a
TRISTAR 70 WP	86 g	Drench	69.5ab	8.1a	90.1a	1.0a	0.7a
INTERCEPT 60 WP	80 g	Foliar	71.5ab	1.5a	95.1a	2.7a	0.7a
INTERCEPT 60 WP	80 g	Drench	73.5a	8.9a	90.8a	0.4a	0.0a
TRACER 480 SC	182 ml	Foliar	62.8a	2.2a	95.7a	1.1a	0.9a
MATADOR 120 EC	83 ml	Foliar	73.5a	6.3a	92.1a	1.6a	0.0a
WARRIOR 122 EC	88 ml	Foliar	68.3ab	6.1a	93.2a	0.4a	0.4a
RIMON 10 EC	500 ml	Foliar	71.8ab	11.9a	86.0a	1.8a	0.4a
ENDEAVOUR 50 WG	193 g	Foliar	69.0ab	6.5a	91.7a	1.1a	0.7a
GAUCHO 600	7500 ml / 100kg	Seed Trt	70.5ab	12.6a	85.3a	1.4a	0.7a
CONTROL	---[3]	---	76.5a	2.3a	96.1a	1.6a	0.0a
ANOVA P £ 0.05			s	ns	ns	ns	ns
Coefficient of Variation (%)			8.6				

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

2003 PMR REPORT #8 **SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests**
STUDY DATA BASE:

CROP: Broccoli cv. Paragon
PEST: Swede midge (SM), *Contarinia nasturtii* (Kieffer)

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TITLE: CONTROL OF SWEDE MIDGE IN GREENHOUSE GROWN BROCCOLI TRANSPLANTS, SEEDED MAY 26 2003

MATERIALS: TRISTAR 70 WP (acetamiprid 70%), INTERCEPT 60 WP (imidacloprid 60%), TRACER 480 SC (spinosad 480 g/L), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), WARRIOR (lambda-cyhalothrin 122 g/L), RIMON 10 EC (novaluron 100 g/L), ENDEAVOUR 50 WG (pymetrozine 50%), GAUCHO (imidacloprid 600 g/L)

METHODS: Broccoli was seeded into 200 cell plastic seedling trays in a commercial greenhouse on May 26. Broccoli seed was treated in the laboratory at Ridgetown College by tumbling the seed and sticker in a clean bag for 5 minutes until all seed was uniformly coated. The seed was then dried. Drench treatments were applied 1 week after seeding at a rate of 200 ml per tray using a modified spray bottle with a fine mist. All other treatments were applied to the foliage using a specialized, small plot research CO_2 sprayer with a two-nozzled, hand-held boom applying 200 L/ha (100 ml per tray) of spray mixture on the transplants on July 15, just prior to shipment. The trays were set out in a commercial field with known SM populations near Stouffville, north of Toronto. All treatments were replicated 4 times in a randomized complete block design. Treated broccoli transplants were left in the field for 48 hours exposed to the existing SM pressures (natural infestation period) and then placed into a greenhouse away from the insect pressure for assessment on July 24 and July 28, 7 and 11 days after plants were removed from the field. Assessments were taken by counting the total number of plants per tray and calculating the percentage of plants in each SM Damage Rating on each assessment date. Results were analyzed using ANOVA and Duncan's Multiple Range Test (P£ 0.05).

RESULTS: Data are presented in Tables 1 and 2. None of the insecticides tested in this trial caused any damage to broccoli transplants.

CONCLUSIONS: At the first rating, 7 days after removal from the field, while trays treated in the greenhouse with RIMON, MATADOR or WARRIOR had the highest numbers of symptom-free broccoli seedlings, numbers for no treatment were significantly different from CONTROL trays. Also at the first rating, while less than 2% of plants showed severe SM damage in all treatments only trays treated with ENDEAVOUR contained more severely affected plants than control trays. When trays were again rated 4 days later, the number of symptom-free plants had declined in all treatments. While there was no significant difference among treatments in the percentage of undamaged plants, at least 10.5% of plants remained free of symptoms in trays treated with GAUCHO as a seed treatment or RIMON or TRISTAR as foliar treatments.

Table 1. Control of swede midge in broccoli with greenhouse applied control agents – Seeded, May 26; Assessed – July 24.

Treatments	Rate Product/ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts 0	1	2	3
TRISTAR 70 WP	86 g	Foliar	73.3ab[2]	38.6abc	60.8abc	0.3a	0.3ab
TRISTAR 70 WP	86 g	Drench	67.8b	37.9abc	61.4abc	0.7a	0.0b
INTERCEPT 60 WP	80 g	Foliar	72.8ab	42.6abc	56.3abc	0.3a	0.7ab
INTERCEPT 60 WP	80 g	Drench	73.3ab	39.3abc	60.3abc	0.4a	0.0b
TRACER 480 SC	182 ml	Foliar	69.0ab	41.6abc	56.9abc	0.0a	1.5ab
MATADOR 120 EC	83 ml	Foliar	74.0ab	50.0ab	49.7bc	0.3a	0.0b
WARRIOR 122 EC	88 ml	Foliar	69.0ab	47.6ab	52.0abc	0.0a	0.4ab
RIMON 10 EC	500 ml	Foliar	76.8a	51.7a	47.7c	0.0a	0.7ab
ENDEAVOUR 50 WG	193 g	Foliar	71.0ab	27.6c	70.0a	0.7a	1.7a
GAUCHO 600	7500 ml / 100kg	Seed Trt	73.5ab	32.9bc	66.4ab	0.4a	0.3ab
CONTROL	---[3]	---	73.8ab	36.7abc	62.6abc	0.7a	0.0b
ANOVA P £ 0.05			s	s	s	ns	s
Coefficient of Variation (%)			6.4	27.2	18.9		173.7

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

Table 2. Control of swede midge in broccoli with greenhouse applied control agents - Seeded, May 26; Assessed, July 28.

Treatments	Rate Product/ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts 0	1	2	3
TRISTAR 70 WP	86 g	Foliar	71.0ab[2]	10.5a	87.4a	1.0a	0.8a
TRISTAR 70 WP	86 g	Drench	69.5ab	8.1a	90.1a	1.0a	0.7a
INTERCEPT 60 WP	80 g	Foliar	71.5ab	1.5a	95.1a	2.7a	0.7a
INTERCEPT 60 WP	80 g	Drench	73.5a	8.9a	90.8a	0.4a	0.0a
TRACER 480 SC	182 ml	Foliar	62.8a	2.2a	95.7a	1.1a	0.9a
MATADOR 120 EC	83 ml	Foliar	73.5a	6.3a	92.1a	1.6a	0.0a
WARRIOR 122 EC	88 ml	Foliar	68.3ab	6.1a	93.2a	0.4a	0.4a
RIMON 10 EC	500 ml	Foliar	71.8ab	11.9a	86.0a	1.8a	0.4a
ENDEAVOUR 50 WG	193 g	Foliar	69.0ab	6.5a	91.7a	1.1a	0.7a
GAUCHO 600	7500 ml / 100kg	Seed Trt	70.5ab	12.6a	85.3a	1.4a	0.7a
CONTROL	---[3]	---	76.5a	2.3a	96.1a	1.6a	0.0a
ANOVA P £ 0.05			s	ns	ns	ns	ns
Coefficient of Variation (%)			8.6				

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

2003 PMR REPORT #9 **SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests STUDY DATA BASE:**

CROP: Broccoli cv. Paragon
PEST: Swede midge (SM), *Contarinia nasturtii* (Kieffer)

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TITLE: CONTROL OF SWEDE MIDGE IN GREENHOUSE GROWN BROCCOLI TRANSPLANTS, SEEDED JUNE 26 2003

MATERIALS: TRISTAR 70 WP (acetamiprid 70%), INTERCEPT 60 WP (imidacloprid 60%), TRACER 480 SC (spinosad 480 g/L), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), WARRIOR (lambda-cyhalothrin 122 G/l), RIMON 10 EC (novaluron 100 g/L), ENDEAVOUR 50 WG (pymetrozine 50%)

METHODS: Broccoli was seeded into 200 cell plastic seedling trays in a commercial greenhouse on June 26, 2003. Broccoli seed was treated in the laboratory at Ridgetown College by tumbling the seed and sticker in a clean bag for 5 minutes until all seed was uniformly coated. The seed was then dried. Drench treatments were applied 1 week after seeding at a rate of 200 ml per tray using a modified spray bottle with a fine mist. All other treatments were applied to the foliage using a specialized, small plot research CO_2 sprayer with a two-nozzled, hand-held boom applying 200 L/ha (100 ml per tray) of spray mixture on the transplants on August 12, just prior to shipment. The trays were set out in a commercial field with known SM populations near Stouffville, north of Toronto. All treatments were replicated 4 times in a randomized complete block design. Treated broccoli transplants were left in the field for 48 hours exposed to the existing SM pressures (natural infestation period) and then placed into a greenhouse away from the insect pressure for assessment on August 21 and 25, 8 and 11 days after plants were removed from the field. Assessments were taken by counting the total number of plants per tray and calculating the percentage of plants in each SM Damage Rating on each assessment date. Results were analyzed using ANOVA and Duncan's Multiple Range Test (P £ 0.05).

RESULTS: Data are presented in Tables 1 and 2. None of the insecticides tested in this trial caused any damage to broccoli transplants.

CONCLUSIONS: None of the control agents applied as a greenhouse transplant treatment significantly reduced SM damage to broccoli seedlings. Under the warmer temperatures in August, application of MATADOR provided the lowest level of SM control. At the first rating trays treated with MATADOR had the lowest numbers of damage free broccoli transplants and the highest numbers of plants with a SM Damage Rating of 1.

Table 1. Control of swede midge in broccoli with greenhouse applied control agents - Seeded, June 26; Assessed, August 21.

Treatments	Rate Product/ ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts			
				0	1	2	3
TRISTAR 70 WP	86 g	Foliar	70.8a[2]	40.9ab	59.1bc	0.0a	0.0a
TRISTAR 70 WP	86 g	Drench	72.8a	37.9ab	62.1bc	0.0a	0.0a
INTERCEPT 60 WP	80 g	Foliar	62.0a	41.8ab	57.0bc	0.0a	1.3a
INTERCEPT 60 WP	80 g	Drench	70.5a	38.6ab	61.4bc	0.0a	0.0a
TRACER 480 SC	182 ml	Foliar	65.3a	45.8ab	54.2bc	0.0a	0.0a
MATADOR 12 0EC	83 ml	Foliar	66.8a	15.5c	83.8a	0.0a	0.7a
WARRIOR 122 EC	88 ml	Foliar	67.0a	41.8ab	57.0bc	0.0a	1.2a
RIMON 10 EC	500 ml	Foliar	70.3a	34.8b	65.2b	0.0a	0.0a
ENDEAVOUR 50 WG	193 g	Foliar	62.8a	45.4ab	54.6bc	0.0a	0.0a
CONTROL	---[3]	---	68.0a	55.9a	43.6c	0.0a	0.5a
ANOVA P £ 0.05 Coefficient of Variation (%)			ns	s 31.1	s 20.5	ns	ns

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

Table 2. Control of swede midge in broccoli with greenhouse applied control agents - Seeded, June 26; Assessed, August 25.

Treatments	Rate Product/ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts 0	1	2	3
TRISTAR 70 WP	86 g	Foliar	69.8a[2]	27.1a	72.9a	0.0a	0.0a
TRISTAR 70 WP	86 g	Drench	71.5a	17.5a	82.5a	0.0a	0.0a
INTERCEPT 60 WP	80 g	Foliar	60.5a	21.2a	77.0a	0.0a	1.8a
INTERCEPT 60 WP	80 g	Drench	71.5a	17.5a	82.6a	0.0a	0.0a
TRACER 480 SC	182 ml	Foliar	64.3a	25.1a	74.9a	0.0a	0.0a
MATADOR 120 EC	83 ml	Foliar	64.5a	11.7a	87.5a	0.0a	0.8a
WARRIOR 122 EC	88 ml	Foliar	66.5a	22.8a	76.0a	0.0a	1.2a
RIMON 10 EC	500 ml	Foliar	69.8a	18.1a	81.9a	0.0a	0.0a
ENDEAVOUR 50 WG	193 g	Foliar	60.8a	25.6a	73.4a	0.0a	1.0a
CONTROL	— [3]	---	68.3a	25.6a	73.3a	0.0a	1.1a
ANOVA P £ 0.05 Coefficient of Variation (%)			ns	ns	ns	ns	ns

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

2003 PMR REPORT #10 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE:

CROP: Cabbage cv. Megaton
PEST: Swede midge (SM), *Contarinia nasturtii* (Kieffer)

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TITLE:CONTROL OF SWEDE MIDGE IN GREENHOUSE GROWN CABBAGE TRANSPLANTS, SEEDED MAY 16 2003

MATERIALS: TRISTAR 70 WP (acetamiprid 70%), INTERCEPT 60 WP (imidacloprid 60%), TRACER 480 SC (spinosad 480 g/L), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), WARRIOR (lambda-cyhalothrin 122 g/L), RIMON 10 EC (novaluron 100 g/L), ENDEAVOUR 50 WG (pymetrozine 50%), GAUCHO (imidacloprid 600 g/L)

METHODS: Cabbage was seeded into 200 cell plastic seedling trays in a commercial greenhouse on May 26. Cabbage seed was treated in the laboratory at Ridgetown College by tumbling the seed and sticker in a clean bag for 5 minutes until all seed was uniformly coated. The seed was then dried. Drench treatments were applied 1 week after seeding at a rate of 200 ml per tray using a modified spray bottle with a fine mist. All other treatments were applied to the foliage using a specialized, small plot research CO_2 sprayer with a two-nozzled, hand-held boom applying 200 L/ha (100 ml per tray) of spray mixture on the transplants on July 15, just prior to shipment. The trays were set out in a commercial field with known SM populations near Stouffville, north of Toronto. All treatments were replicated 4 times in a randomized complete block design. Treated cabbage transplants were left in the field for 48 hours exposed to the existing SM pressures (natural infestation period) and then placed into a greenhouse away from the insect pressure for assessment on July 24 and July 28, 7 and 11 days after plants were removed from the field. Assessments were taken by counting the total number of plants per tray and calculating the percentage of plants in each SM Damage Rating on each assessment date. Results were analyzed using ANOVA and Duncan's Multiple Range Test (P£ 0.05).

RESULTS: Data are presented in Tables 1 and 2. None of the insecticides tested in this trial caused any damage to broccoli transplants.

CONCLUSIONS: Early season SM plant damage was most effectively controlled with foliar applications of INTERCEPT and TRACER in the greenhouse. The drench application of INTERCEPT was also effective as was TRISTAR applied either as a foliar spray or as a drench application. Foliar application of MATADOR, WARRIOR, RIMON or ENDEAVOUR or application of GAUCHO as a seed treatment did not effectively reduce SM damage to cabbage in this trial. When trays were again rated after a further 4 days, there was no significant difference in SM damage among any treatment, including the CONTROL. On that date at least 88.9% of cabbage seedlings in all treatments had only slight SM damage and trays for no treatment showed more than 0.5% plants with severe SM damage.

The number of transplants in the GAUCHO treatment on May 16 were higher due to the use of a 288 cell tray versus the normal 200 cell trays used for all other treatments.

Table 1. Control of swede midge in cabbage with greenhouse applied control agents – Seeded, May 16; Assessed – July 24.

Treatments	Rate Product/ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts 0	1	2	3
TRISTAR 70 WP	86 g	Foliar	90.3b[2]	33.5ab	64.8bc	1.8a	0.0a
TRISTAR 70 WP	86 g	Drench	88.5b	32.0ab	67.5abc	0.5a	0.0a
INTERCEPT 60 WP	80 g	Foliar	89.0b	38.0a	62.0c	0.0a	0.0a
INTERCEPT 60 WP	80 g	Drench	88.8b	32.0ab	67.8abc	0.3a	0.0a
TRACER 480 SC	182 ml	Foliar	90.0b	36.5a	63.0bc	0.0a	0.3a
MATADOR 120 EC	83 ml	Foliar	84.5b	25.5abc	73.8abc	0.8a	0.0a
WARRIOR 122 EC	88 ml	Foliar	92.5b	23.8abc	75.0abc	1.0a	0.0a
RIMON 10 EC	500 ml	Foliar	91.0b	26.8abc	73.3abc	0.0a	0.0a
ENDEAVOUR 50 WG	193 g	Foliar	88.8b	19.3bc	80.8a	0.0a	0.0a
GAUCHO 600	7500 ml / 100kg	Seed Trt	115.8a	20.8bc	78.0ab	1.3a	0.3a
CONTROL	—[3]	---	89.3b	15.8c	83.0a	1.3a	0.0a
ANOVA P £ 0.05			s	s	s	ns	ns
Coefficient of Variation (%)			5.9	33.9	13.1		

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

Table 2. Control of swede midge in cabbage with greenhouse applied control agents - Seeded, May 16; Assessed, July 28.

Treatments	Rate Product/ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts 0	1	2	3
TRISTAR 70 WP	86 g	Foliar	88.8a[2]	4.3a	92.7ab	2.4a	0.5a
TRISTAR 70 WP	86 g	Drench	91.0a	5.9a	93.6ab	0.5ab	0.0a
INTERCEPT 60 WP	80 g	Foliar	90.5a	7.2a	92.0ab	0.8ab	0.0a
INTERCEPT 60 WP	80 g	Drench	91.8a	4.2a	95.3ab	0.5ab	0.0a
TRACER 480 SC	182 ml	Foliar	92.3a	8.7a	88.9b	2.4a	0.0a
MATADOR 120 EC	83 ml	Foliar	94.3a	2.5a	97.0ab	0.6ab	0.0a
WARRIOR 122 EC	88 ml	Foliar	90.5a	1.1a	98.3ab	0.6ab	0.0a
RIMON 10 EC	500 ml	Foliar	88.8a	4.4a	95.3ab	0.3b	0.0a
ENDEAVOUR 50 WG	193 g	Foliar	87.3a	1.1a	98.9a	0.0b	0.0a
GAUCHO 600	7500 ml / 100kg	Seed Trt	90.5a	1.1a	97.8ab	0.7ab	0.4a
CONTROL	— [3]	---	90.3a	1.4a	96.6ab	2.0ab	0.0a
ANOVA P £ 0.05			ns	ns	s	s	ns
Coefficient of Variation (%)					6.1	129.7	

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

2003 PMR REPORT #11 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE:

CROP: Cabbage cv. Megaton
PEST: Swede midge (SM), *Contarinia nasturtii* (Kieffer)

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TITLE: CONTROL OF SWEDE MIDGE IN GREENHOUSE GROWN CABBAGE TRANSPLANTS, SEEDED JUNE 30 2003

MATERIALS: TRISTAR 70 WP (acetamiprid 70%), INTERCEPT 60 WP (imidacloprid 60%), TRACER 480 SC (spinosad 480 g/L), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), WARRIOR (lambda-cyhalothrin 122 g/L), RIMON 10 EC (novaluron 100 g/L), ENDEAVOUR 50 WG (pymetrozine 50%), GAUCHO (imidacloprid 600 g/L)

METHODS: Cabbage was seeded into 200 cell plastic seedling trays in a commercial greenhouse on May 26. Cabbage seed was treated in the laboratory at Ridgetown College by tumbling the seed and sticker in a clean bag for 5 minutes until all seed was uniformly coated. The seed was then dried. Drench treatments were applied 1 week after seeding at a rate of 200 ml per tray using a modified spray bottle with a fine mist. All other treatments were applied to the foliage using a specialized, small plot research CO_2 sprayer with a two-nozzled, hand-held boom applying 200 L/ha (100 ml per tray) of spray mixture on the transplants on August 13, just prior to shipment. The trays were set out in a commercial field with known SM populations near Stouffville, north of Toronto. All treatments were replicated 4 times in a randomized complete block design. Treated cabbage transplants were left in the field for 48 hours exposed to the existing SM pressures (natural infestation period) and then placed into a greenhouse away from the insect pressure for assessment on August 22 and 26, 7 and 11 days after plants were removed from the field. Assessments were taken by counting the total number of plants per tray and calculating the percentage of plants in each SM Damage Rating on each assessment date. Results were analyzed using ANOVA and Duncan's Multiple Range Test (P£ 0.05).

RESULTS: Data are presented in Tables 1 and 2. None of the insecticides tested in this trial caused any damage to broccoli transplants.

CONCLUSIONS: At the second rating, 11 days after removal from the field, while the percentage of undamaged cabbage seedlings was significantly lower in trays in which GAUCHO was applied to the seed, the remainder of plants in trays planted with GAUCHO-treated seed showed only slight symptoms of SM damage. Indeed, treatment of seed with GAUCHO was the only treatment to significantly increase the percentage of seedlings with slight SM damage relative to CONTROL trays.

Table 1. Control of swede midge in cabbage with greenhouse applied control agents – Seeded, June 30; Assessed – August 22.

Treatments	Rate Product/ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts 0	1	2	3
TRISTAR 70 WP	86 g	Foliar	80.5a[2]	16.1a	83.6a	0.4a	0.0a
TRISTAR 70 WP	86 g	Drench	72.3ab	21.4a	78.2a	0.4a	0.0a
INTERCEPT 60 WP	80 g	Foliar	73.8ab	23.2a	76.8a	0.0a	0.0a
TRACER 480 SC	182 ml	Foliar	69.8ab	21.5a	78.5a	0.0a	0.0a
MATADOR 120 EC	83 ml	Foliar	77.5ab	21.1a	78.6a	0.3a	0.0a
WARRIOR 122 EC	88 ml	Foliar	74.1ab	21.2a	78.8a	0.0a	0.1a
RIMON 10 EC	500 ml	Foliar	67.3b	16.9a	83.1a	0.0a	0.0a
ENDEAVOUR 50 WG	193 g	Foliar	74.8ab	23.1a	76.9a	0.0a	0.0a
GAUCHO 600	7500 ml / 100kg	Seed Trt	65.3b	12.6a	87.4a	0.0a	0.3a
CONTROL	— [3]	---	54.0c	22.8a	76.7a	0.0a	0.5a
ANOVA P £ 0.05			s	ns	ns	ns	ns
Coefficient of Variation (%)			10.8				

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

Table 2. Control of swede midge in cabbage with greenhouse applied control agents – Seeded, June 30; Assessed – August 26.

Treatments	Rate Product/ha	Method	Total # plants / rep.	Insect Damage Ratings (0-3) [1] % counts 0	1	2	3
TRISTAR 70 WP	86 g	Foliar	79.5a[2]	4.8ab	95.2ab	0.0b	0.0a
TRISTAR 70 WP	86 g	Drench	72.8ab	4.9ab	94.4ab	0.7a	0.0a
INTERCEPT 60 WP	80 g	Foliar	73.0ab	5.6ab	94.4ab	0.0b	0.0a
TRACER 480 SC	182 ml	Foliar	69.3ab	4.2ab	95.8ab	0.0b	0.0a
MATADOR 120 EC	83 ml	Foliar	75.5ab	7.4b	92.6b	0.0b	0.0a
WARRIOR 122 EC	88 ml	Foliar	69.6ab	2.8ab	93.0ab	0.0b	0.7a
RIMON 10 EC	500 ml	Foliar	67.0ab	6.9ab	92.8ab	0.0b	0.4a
ENDEAVOUR 50 WG	193 g	Foliar	75.3ab	7.4ab	92.6ab	0.0b	0.0a
GAUCHO 600	7500 ml / 100kg	Seed Trt	65.5b	0.5a	99.5a	0.0b	0.0a
CONTROL	---[3]	---	52.8c	8.5b	90.4b	0.0b	1.1a
ANOVA P £ 0.05			s	s	s	s	ns
Coefficient of Variation (%)			10.8	5.4	4.6	385.6	

[1] Insect Damage Ratings (0-3); 0- no insect damage; 3 - severe insect damage.
[2] Numbers within a column followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P £ 0.05).
[3] No insecticide applied.

2003 PMR REPORTS #12 SECTION B: VEGETABLES and SPECIAL CROPS – Insect Pests
ICAR: 30601

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

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TITLE: RELATIVE EFFICACY OF SYNTHETIC INSECTICIDES AND NEMATODES FOR CONTROL OF PEA LEAFMINER ON CELERY, 2003

MATERIALS: AGRI-MEK 0.15 EC (abamectin 1.9%), CITATION 75 WP (75%), NEMASYS F (live nematodes, 50 million per pack), TRACER 480 SC (spinosad 480 g/L), SYLGARD 309 (siloxylated polyether 76% + surfactant mixture 24%)

METHODS: Celery seedlings cv. Florida 683 were grown in plug trays and then hand-transplanted at the Muck Research Station near Kettleby, ON, on 4 July, in 3 row plots, 5 m in length, with a row spacing of 55 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Seven treatments were replicated 4 times in a randomized complete block design. All treatments were applied using a CO_2-pressurized precision plot sprayer at 275 kPa in water equivalent to 200 L/ha. Where necessary, the surfactant SYLGARD was added to the spray solution at a concentration of 2.5 ml/L water. Applications took place on 20 and 28 August and 10 September. Plots were monitored for PLM-leaf mining (caused by larvae) approximately once each week. Both sides of the youngest, most fully expanded four leaves per plant on seven randomly chosen plants per plot were examined. PLM-mining damage was rated on a scale of 0 to 4 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards stalk; 4 = mines present on stalk). Plots were monitored for PLM-leaf stippling damage (caused by ovipositing adult females) at harvest. PLM-leaf stippling damage was rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples). Damage indices for mining and stippling were calculated for each block from plant damage ratings. Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Celery was harvested on 3 October. Mining damage per bunch was determined before and after trimming and rated on a scale of 0 to 4 (0 = all stalks undamaged; 1 = 1-25% of stalks damaged; 2 = 26-50% of stalks damaged; 3 = 51-75% of stalks damaged; 4 = 76-100% of stalks damaged). Differences in ratings among treatments were determined using analysis of variance and Duncan's multiple range test.

RESULTS : Results of mining and stippling damage assessments at harvest are summarized in Table 1. All treatments tested, except NEMASYS and the low rate of AGRI-MEK had significantly lower mine damage indices than did the Control. All treatments had significantly lower stipple damage indices than the Control. Stipple damage indices were lowest in plots treated with CITATION, the high rate of AGRI-MEK or the high rate of TRACER, and were significantly lower on these treatments than in plots treated with the low rate of AGRI-MEK or NEMASYS. All treatments, except the low rate of TRACER had significantly lower mining damage indices on stalks than did the Control in both pre-trim and post-trim ratings.

CONCLUSIONS: Application of CITATION or the high rates of AGRI-MEK or TRACER give the best control of PLM damage both in terms of mining and stippling damage. At harvest, application of all treatments, except the low rate of TRACER, produced significantly higher quality celery bunches than were harvested in the Control plots.

Table 1. Mean (± standard error) pea leafminer mining damage for 4 pooled post-treatment dates and stippling damage at harvest on celery treated with control agents, Kettleby, ON, 2003.

Tmt No.	Insecticide	Rate (g a.i./ha) [1]	Mean damage indices[2]		Bunch Damage Indices[5]	
			Mines[3]	Stipples[4]	Pre-trimming	Post-trimming
1	AGRI-MEK	578.9	7.3 ± 1.2 abc	29.6 ± 4.4 b	20.6 ± 2.1 bc	23.8 ± 2.2 bc
2	AGRI-MEK	1052.6	6.2 ± 0.9 bc	16.1 ± 3.2 c	16.9 ± 2.4 bc	21.3 ± 2.2 bc
3	TRACER (+ surfactant)	182	6.7 ± 1.0 bc	26.2 ± 5.6 bc	27.5 ± 4.8 ab	32.5 ± 2.5 ab
4	TRACER (+ surfactant)	300	5.5 ± 0.8 bc	16.7 ± 4.2 c	16.3 ± 2.2 c	18.8 ± 3.9 c
5	CITATION	187.5	4.0 ± 0.7 c	14.3 ± 2.8 c	14.4 ± 3.4 c	20.0 ± 1.0 c
6	NEMASYS (+ surfactant)	2.5 billion/ha	8.3 ± 1.4 ab	36.9 ± 5.7 b	23.8 ± 6.5 bc	23.1 ± 6.8 bc
7	Control	---	10.3 ± 1.7 a	63.1 ± 3.1 a	36.3 ± 3.1 a	39.4 ± 4.5 a

[1] Unless otherwise stated.
[2] Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.
[3] Rated on a scale of 0 to 4 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards stalk; 4 = mines present on stalk).= least, 4 = greatest degree of damage).
[4] Rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples).
[5] Rated on a scale of 0 to 4 (0 = all stalks undamaged; 1 = 1-25% of stalks damaged; 2 = 26-50% of stalks damaged; 3 = 51-75% of stalks damaged; 4 = 76-100% of stalks damaged).

2003 PMR REPORTS #13 SECTION B: VEGETABLES and SPECIAL CROPS – Insect Pests
ICAR: 30601

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

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TITLE: EFFICACY OF INSECTICIDES FOR CONTROL OF PEA LEAFMINER ON CELERY, 2003

MATERIALS: ASSAIL 70 WP (acetamiprid 70.35%), RIMON 10 EC (novaluron 100 g/L), CITATION 75 WP (cyromazine 75%).

METHODS: Celery seedlings cv. Florida 683 were grown in plug trays and then hand-transplanted at the Muck Research Station near Kettleby, ON, on 4 July, in 3 row plots, 5 m in length, with a row spacing of 55 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Six treatments were replicated 4 times in a randomized complete block design. All treatments were applied using a CO_2-pressurized precision plot sprayer at 275 kPa in water equivalent to 200 L/ha. Applications took place on 20 and 28 August and 10 September. Plots were monitored for PLM-leaf mining (caused by larvae) approximately once each week. Both sides of the youngest, most fully expanded four leaves per plant on seven randomly chosen plants per plot were examined. PLM-mining damage was rated on a scale of 0 to 4 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards stalk; 4 = mines present on stalk). Plots were monitored for PLM-leaf stippling damage (caused by ovipositing adult females) at harvest. PLM-leaf stippling damage was rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples). Both mining and stippling damage ratings were converted to damage indices for each block. Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Celery was harvested on 2 and 3 October. Ten plants from each plot were graded according to damage. Mining damage per bunch was determined before trimming and rated on a scale of 0 to 4 (0 = all stalks undamaged; 1 = 1-25% of stalks damaged; 2 = 26-50% of stalks damaged; 3 = 51-75% of stalks damaged; 4 = 76-100% of stalks damaged). Differences in ratings among treatments were determined using analysis of variance and Duncan's multiple range test. All post-treatment rating dates were pooled for analyses of mining damage indices.

RESULTS: The results are summarized in Table 1. While no treatment significantly reduced mining damage indices relative to the Control, application of either rate of ASSAIL or the high rate of RIMON significantly reduced stippling damage indices relative to the Control. Application of the high rate of ASSAIL was the only treatment to significantly lower mining damage per bunch relative to the Control.

CONCLUSIONS: Based on the lower mining damage indices per bunch and lower stippling damage indices, application of the high rate of ASSAIL most effectively reduced PLM damage to celery.

Table 1. Mean (± standard error) damage indices for pea leafminer mining damage for pooled post-treatment dates and stippling damage and mining damage per bunch at harvest on celery treated with insecticides, Kettleby, ON, 2003.

Treatment No.	Insecticide	Rate (g a.i./ha)	Mean damage indices[1]		
			Mines[2]	Stipples[3]	Bunch[4]
1	ASSAIL	39.2	15.1 ± 1.6 a	31.0 ± 5.2 b	41.3 ± 4.7 a
2	ASSAIL	60.2	14.2 ± 1.7 a	26.2 ± 4.6 b	23.1 ± 0.6 c
3	RIMON	25	11.5 ± 1.5 a	38.1 ± 7.0 ab	31.3 ± 3.3 abc
4	RIMON	50	12.8 ± 1.6 a	27.4 ± 6.3 b	26.3 ± 2.6 bc
5	CITATION	187.5	11.8 ± 1.5 a	38.7 ± 6.9 ab	25.0 ± 1.8 bc
6	Control	---	15.4 ± 1.8 a	53.0 ± 6.5 a	35.6 ± 5.3 ab

[1] Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.
[2] Rated on a scale of 0 to 4 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards stalk; 4 = mines present on stalk).= least, 4 = greatest degree of damage).
[3] Rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples).
[4] Rated on a scale of 0 to 4 (0 = all leaves undamaged; 1 = 1-25% of leaves damaged; 2 = 26-50% of leaves damaged; 3 = 51-75% of leaves damaged; 4 = 76-100% of leaves damaged).

2003 PMR REPORT # 14 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE:

CROP: Various cole crops
PEST: Swede midge (SM), *Contarinia nasturtii* (Kieffer)

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TITLE: DETERMINING THE EFFICIENCY OF BLACK LIGHT TRAPS FOR MONITORING MALE AND FEMALE ADULT SWEDE MIDGE POPULATIONS IN COLE CROP FIELDS, TROY AND STOUFFVILLE, ONTARIO, 2003

MATERIALS: Two hand made black light traps, white fax paper coated with Tanglefoot™, yellow sticky cards, black mesh screening, weather monitoring equipment (Campbell Scientific weather station supplied by the Ontario Weather Network, Hobo Units), high magnification microscope

METHODS: Both the sticky card traps and black light traps were erected along field margins of commercial cole crop fields in early May, 2003. All traps were monitored and serviced two to three times per week, throughout the season, until the middle of September (Troy) and the middle of October (Stouffville). Traps were removed by cutting the fax paper above the application of Tanglefoot. Each sheet was then protected with Saran™ wrap. Initially, two sticky cards were placed near the black light trap to ensure SM adults were able to make it through the mesh screening (to eliminate larger insects). Both male and female SM adults were counted and recorded from each trap. Results were analyzed using ANOVA.

RESULTS: Data is presented in Graphs 1, 2, 3 and 4.

CONCLUSIONS: The black light trap caught significantly more (95% level) SM adults than the yellow sticky cards at both sites. There was no significant difference between the number of SM females versus males caught by either the black light trap or the yellow sticky cards.

2003 PMR REPORT #15 SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests
ICAR: 30601

CROP: Romaine Lettuce, cv. Parris Island 318 M.I.
PEST: Pea Leafminer (PLM), *Liriomyza huidobrensis* (Blanchard)

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TITLE: EFFICACY OF INSECTICIDES FOR CONTROL OF PEA LEAFMINER ON ROMAINE LETTUCE, 2003

MATERIALS: ASSAIL 70 WP (acetamiprid 70.35%), RIMON 10 EC (novaluron 100 g/L), CITATION 75 WP (cyromazine 75%).

METHODS: Romaine Lettuce cv. Parris Island 318 M.I. was grown in plug-trays and hand-transplanted at the Muck Research Station near Kettleby, ON, on 18 August, in 4 row plots, 5 m in length, with a row spacing of 30 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Six treatments were replicated 4 times in a randomized complete block design. All treatments were applied using a CO_2-pressurized precision plot sprayer at 275 kPa in water equivalent to 200 L/ha. Applications took place on 20 and 28 August and 10 September. Plots were monitored for PLM-leaf mining (caused by larvae) approximately once each week. Both sides of the youngest, most fully expanded two leaves per plant on seven randomly chosen plants per plot were examined. PLM-mining damage was rated on a scale of 0 to 3 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards base). Plots were monitored for PLM-leaf stippling damage (caused by ovipositing adult females) 3 days after harvest. PLM-leaf stippling damage was rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples). Both mining and stippling damage ratings were converted to damage indices for each block. Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Lettuce was harvested on 30 September. Ten plants from each plot were graded according to damage. Mining damage per bunch was determined and rated on a scale of 0 to 4 (0 = all leaves undamaged; 1 = 1-25% of leaves damaged; 2 = 26-50% of leaves damaged; 3 = 51-75% of leaves damaged; 4 = 76-100% of leaves damaged). Differences in ratings among treatments were determined using analysis of variance and Duncan's multiple range test. Only the last three (of five) post-treatment rating dates were pooled for analyses of mining damage indices as no mining damage was recorded on the first two dates.

RESULTS: The results are summarized in Table 1. While all treatments except the low rate of ASSAIL significantly reduced mining damage indices relative to the Control, no treatment had a lower stippling damage index than the Control. Harvest bunch damage indices were significantly lower in plots treated with the high rates of ASSAIL, RIMON or CITATION than in the Control.

CONCLUSIONS: Application of the high rates of ASSAIL, RIMON or the registered rate of CITATION were the best treatments of those evaluated for control of PLM damage on romaine lettuce.

Table 1. Mean (± standard error) damage indices for pea leafminer mining damage for pooled post-treatment dates, stippling damage three days post-harvest, and mining damage per bunch at harvest on romaine lettuce treated with insecticides, Kettleby, ON, 2003.

Treatment No.	Insecticide	Rate (g a.i./ha)	Mean damage indices[1]		
			Mines[2]	Stipples[3]	Bunch[4]
1	ASSAIL	39.2	1.8 ± 0.7 ab	92.9 ± 1.4 ab	55.3 ± 3.7 a
2	ASSAIL	60.2	0.6 ± 0.3 b	97.6 ± 1.4 a	45.6 ± 5.4 b
3	RIMON	25	1.0 ± 0.4 b	90.5 ± 1.9 b	57.5 ± 3.1 a
4	RIMON	50	0.4 ± 0.3 b	94.0 ± 2.3 ab	43.1 ± 1.6 b
5	CITATION	187.5	0.8 ± 0.6 b	91.7 ± 1.2 b	35.6 ± 4.0 b
6	Control	---	3.2 ± 1.1 a	91.7 ± 2.3 b	56.9 ± 1.2 a

[1] Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.
[2]Rated on a scale of 0 to 3 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards stalk).
[3]Rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples).
[4]Rated on a scale of 0 to 4 (0 = all leaves undamaged; 1 = 1-25% of leaves damaged; 2 = 26-50% of leaves damaged; 3 = 51-75% of leaves damaged; 4 = 76-100% of leaves damaged).

2003 PMR REPORT # 16 SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests
ICAR: 30601

CROP: Mustard Greens, cv. Savanna Hybrid
PEST: Pea Leafminer (PLM), *Liriomyza huidobrensis* (Blanchard)

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TITLE: EFFICACY OF INSECTICIDES FOR CONTROL OF PEA LEAFMINER ON MUSTARD GREENS, 2003

MATERIALS: ASSAIL 70 WP (acetamiprid 70.35%), RIMON 10 EC (novaluron 100 g/L), CITATION 75 WP (cyromazine 75%).

METHODS: Mustard greens cv. Savanna Hybrid was machine-seeded at the Muck Research Station near Kettleby, ON, on 1 August, in 4 row plots, 5 m in length, with a row spacing of 30 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Six treatments were replicated 4 times in a randomized complete block design. All treatments were applied using a CO_2-pressurized precision plot sprayer at 275 kPa in water equivalent to 200 L/ha. Applications took place on 20 and 28 August and 10 September. Plots were monitored for PLM-leaf mining (caused by larvae) approximately once each week. Both sides of the youngest, most fully expanded two leaves per plant on seven randomly chosen plants per plot were examined. PLM-mining damage was rated on a scale of 0 to 3 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards base). Plots were monitored for PLM-leaf stippling damage (caused by ovipositing adult females) 6 days prior to harvest. PLM-leaf stippling damage was rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples). Both mining and stippling damage ratings were converted to damage indices for each block. Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Mustard greens were harvested on 26 September. Ten plants from each plot were graded according to damage. Mining damage per bunch was determined and rated on a scale of 0 to 4 (0 = all leaves undamaged; 1 = 1-25% of leaves damaged; 2 = 26-50% of leaves damaged; 3 = 51-75% of leaves damaged; 4 = 76-100% of leaves damaged). Differences in ratings among treatments were determined using analysis of variance and Duncan's multiple range test. All post-treatment rating dates were pooled for analyses of mining damage indices.

RESULTS: The results are summarized in Table 1. No treatment significantly reduced mining damage indices or stippling damage indices relative to the Control. Mining damage per bunch was significantly lower in all insecticide treatments than in the Control; damage indices were lowest in plots treated with CITATION or the high rate of ASSAIL.

CONCLUSIONS: Stippling damage on mustard greens is more economically damaging than mining damage, but no insecticides evaluated reduced stippling damage. However, as the indices for proportion of leaves per bunch with mining damage at harvest were significantly lower following application of the registered rate of CITATION and the high rate of ASSAIL, these treatments most effectively controlled PLM on mustard greens.

Table 1. Mean (± standard error) damage indices for pea leafminer mining damage for pooled post-treatment dates, stippling damage six days before harvest, and mining damage per bunch at harvest on mustard greens treated with insecticides, Kettleby, ON, 2003.

Treatment No.	Insecticide	Rate (g a.i./ha)	Mean damage indices[1]		
			Mines[2]	Stipples[3]	Bunch[4]
1	ASSAIL	39.2	3.0 ± 0.9 a	92.3 ± 2.8 a	50.0 ± 3.1 bc
2	ASSAIL	60.2	5.8 ± 1.8 a	87.5 ± 2.8 a	40.6 ± 3.7 cd
3	RIMON	25	3.0 ± 1.0 a	83.9 ± 4.4 a	56.9 ± 4.9 b
4	RIMON	50	4.2 ± 1.2 a	86.3 ± 6.1 a	45.0 ± 6.2 bcd
5	CITATION	187.5	3.8 ± 1.1 a	81.5 ± 3.9 a	33.1 ± 3.7 d
6	Control	---	5.4 ± 1.4 a	82.1 ± 5.7 a	71.3 ± 5.3 a

[1] Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.
[2] Rated on a scale of 0 to 3 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards stalk).
[3] Rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples).
[4] Rated on a scale of 0 to 4 (0 = all leaves undamaged; 1 = 1-25% of leaves damaged; 2 = 26-50% of leaves damaged; 3 = 51-75% of leaves damaged; 4 = 76-100% of leaves damaged).

2003 PMR REPORT # 17 SECTION B : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 160.3

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

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TITLE: EVALUATION OF FOLIAR TREATMENTS FOR THE CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL, LONDON, 2003

MATERIALS: RIMON 0.83 EC (novaluron 100 g/L), DIBROM (864 g/L), SUCCESS 480 SC (spinosad 480 g/L), ASSAIL 70 WP (acetamiprid 70%), ORTHENE 75 SP (acephate 75%), KNACK 0.86 EC (pyriproxifen 103.1 g/L), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), SYLGARD 309 (siloxylated polyether 76% + surfactant mixture 24%)

METHODS: On 09 May, dry yellow seed cooking onion seeds were planted (135 seeds/row) on the SCPFRC-London Research Farm in 3-row microplots (2.25 m long x 0.9 m wide) filled with insecticide-residue free organic soil. Nine treatments (Table 1) were replicated 4x in a randomized complete block design. On 10 July, prior to first treatment, three shallot plants infested with OT from an untreated onion block were transplanted into each microplot to ensure buildup of OT populations. On 18 July, 01 and 07 August all treatments were applied in 600 L/ha 0.375% SYLGARD , at 200 kPa, using a hand-held, CO_2 pressurized R&D field-plot sprayer fitted with a 0.6 m boom equipped with 1 central XR11002VS and 2 XR8002VS flat spray tips. On 17, 21, 31 July (4 plants/plot), 24 July and 04, 07, 11 August (5 plants/plot), OT were counted by destructive sampling. Raw data was transformed using square root (Y + 0.5). Significance of observed differences among treatment means was determined using ANOVA and Dunnett's Test. Untransformed data are presented in the table.

RESULTS: Experimental results are outlined in Table 1. During the course of this study, OT populations on untreated onions did not exceed the OMAF-recommended threshold of 3.0 OT/leaf for dry yellow seed cooking onions on any date. On 21 July, 3 days after treatment (DAT), RIMON and the low rate of KNACK were the only treatments that did not significantly reduce OT populations compared to the CONTROL plots. On this date, the lowest OT numbers were recorded in plots treated with ORTHENE or MATADOR; in these plots OT populations were respectively 87% and 79% lower than in CONTROL plots. On 04 August, 3 days after the second application of all treatments, only application of SUCCESS significantly reduced OT populations. Three days after the last treatment, OT populations were significantly lower in plots treated with SUCCESS, ASSAIL, ORTHENE and RIMON. While OT populations were usually lower in plots treated with the higher rate of KNACK than in CONTROL plots, the difference was significant only on 21 July. While OT populations in plots treated with the lower rate of KNACK were also significantly lower than those in CONTROL plots on 31 July, on most sampling dates populations were higher in these plots than in CONTROL plots. By 11 August, 4 days after the last treatment, OT numbers were significantly higher in plots treated with the lower rate of KNACK than in CONTROL plots.

CONCLUSIONS: Application of SUCCESS was the only treatment which consistently reduced OT populations after each spray during the course of this study. OT populations were also significantly reduced within 4 DAT following two of three applications of ASSAIL and ORTHENE. Application of DIBROM significantly reduced OT numbers in treated plots only after the first application. A significant reduction in OT numbers following application of the growth regulator RIMON was not observed until

13 DAT. With one exception, OT numbers remained significantly lower in plots treated with RIMON than in CONTROL plots until the end of the trial. The relatively slow response of OT numbers to application of RIMON suggests that this growth regulator should be applied earlier in the season while OT populations are low. The growth regulator KNACK did not exert a consistent impact on OT populations in this trial.

Table 1. Impact of foliar treatments on populations of onion thrips on dry yellow seed cooking onion, London, ON, 2003.

Tmt. No.	Treatment Applied	Rate/ha	Mean Number of OT/Plant on Indicated Date						
			17 Jul	21 Jul	24 Jul	31 Jul	04 Aug	07 Aug	11 Aug
1	RIMON	1500.0 ml	3.1 b[1]	4.4 b	3.8 b	2.4 a	6.6 b	5.7 a	4.2 a
2	DIBROM	550.0 ml	2.9 b	1.6 a	2.8 b	2.4 a	7.9 b	13.0 b	7.3 b
3	SUCCESS	350.0 ml	3.6 b	1.4 a	3.4 b	2.2 a	2.7 a	6.7 a	2.8 a
4	ASSAIL	150.0 g	3.2 b	1.2 a	1.0 a	2.7 a	7.7 b	10.9 b	2.3 a
5	ORTHENE	1000.0 g	2.4 a	0.5 a	1.1 a	3.9 b	4.6 b	12.7 b	4.7 a
6	KNACK	600.0 ml	3.6 b	4.7 b	4.8 b	2.2 a	7.8 b	8.8 b	13.7 c
7	KNACK	750.0 ml	3.1 b	1.9 a	5.0 b	2.9 b	5.8 b	8.8 b	6.3 b
8	MATADOR	188.0 ml	2.7 a	0.8 a	0.7 a	1.3 a	3.9 b	6.2 a	6.3 b
9	CONTROL	---[2]	2.4 a	3.9 b	4.3 b	5.4 b	5.8 b	11.4 b	8.1 b
Mean No. Leaves/Plant			5	5	6	7	7	8	9
Mean No. OT/Leaf [3]			0.5	0.8	0.7	0.8	0.8	1.4	0.9

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

2003 PMR REPORT # 18 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 160.3

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

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TITLE: EVALUATION OF FOLIAR TREATMENTS FOR THE CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL, THEDFORD - GRAND BEND MARSH, 2003

MATERIALS: RIMON 0.83 EC (novaluron 100 g/L), SUCCESS 480 SC (spinosad 480 g/L), ASSAIL 70 WP (acetamiprid 70%), ORTHENE 75 SP (acephate 75%), KNACK 0.86 EC (pyriproxifen 103.1 g/L), MATADOR 120 EC (lambda-cyhalothrin 120 g/L), SYLGARD 309 (siloxylated polyether 76% + surfactant mixture 24%)

METHODS: Onion seeds were planted 25 April in a commercial onion field in the Thedford-Grand Bend Marsh (Lot 21, B Concession, Bosanquet Township, Lambton County). Eight treatments (Table 1) were replicated 5x in a randomized complete block design. Each replicate block was established down the length of a single bed of onions containing four double rows of precision-seeded dry yellow seed cooking onions. Experimental plots consisted of one bed of onions (4 x 2 rows) x 5 m, separated by 1 m cultivated walkways. Treatment beds were separated by one untreated bed that served as an infestation source of OT. On 07 July and 11 August, RIMON and the two rates of KNACK were applied in 600L/ha 0.375% SYLGARD at 235 kPa using a hand-held, CO_2 pressurized R&D field-plot sprayer fitted with a 1.1 m boom equipped with four XR11002VS flat spray tips. On 30 July and 13 August, all treatments were applied in 0.375% SYLGARD as described above. On 04, 09, 16, 22, 29 July (4 plants/plot), 01, 05, 13, 17 August (5 plants/plot), OT were counted by destructive sampling. Raw data was transformed using square root (Y + 0.5). Significance of observed differences among treatment means was determined using ANOVA and Dunnett's Test. Untransformed data are presented in the table.

RESULTS: Experimental results are outlined in Table 1. During the course of this study, OT populations on untreated onions did not exceed the OMAF-recommended threshold of 3.0 OT/leaf for dry yellow seed cooking onions until 13 August. Not until 29 July, 22 days after treatment (DAT), were OT populations significantly lower in plots treated with RIMON and the higher rate of KNACK than in untreated CONTROL plots. By that date average OT populations had increased 6.2x in CONTROL plots, 1.9x in plots treated with the higher rate of KNACK and 1.3x in plots treated with RIMON. OT populations remained significantly lower in plots treated with RIMON and the higher rate of KNACK than in CONTROL plots until 13 August and 05 August, 14 and 6 days respectively after the second application. Only on 01 August, 2 days after the second application, were OT populations significantly lower in plots treated with the lower rate of KNACK than in CONTROL plots. In fact, on average, more OT were counted in plots that received the lower rate of KNACK than in CONTROL plots. On 01 August, 2 DAT, OT populations were lowest in plots that had been treated with ORTHENE, 79% lower than in CONTROL plots. By 05 August, 6 DAT, OT populations had increased in plots treated with ORTHENE, ASSAIL and MATADOR, and were no longer significantly lower than in CONTROL plots. OT populations increased 2.1x from 05 August - 13 August when all treatments were applied. On 17 August, 4 DAT, OT populations were 72%, 62% and 61% lower in plots treated with SUCCESS, ORTHENE and ASSAIL respectively than in CONTROL plots. The final application of RIMON and

KNACK had no significant impact on OT populations. On 01 August, 2 days after initial application, populations were significantly lower in plots treated with MATADOR than in CONTROL plots. The second application of MATADOR had no significant impact on OT numbers.

CONCLUSIONS: While slow to act, the growth regulators RIMON and KNACK (higher rate only) significantly delayed the buildup of OT populations in treated plots. Once OT populations exceeded the OMAF recommended action threshold of 3 OT/leaf, further application of RIMON and KNACK had no significant impact on OT numbers. While application of ORTHENE, SUCCESS or ASSAIL significantly reduced OT populations relative to those recorded in CONTROL plots, OT numbers did recover within 6 days. Although the first application of MATADOR did significantly reduce OT populations in treated plots, the total lack of efficacy following the second application indicated the likely presence of high levels of resistance to MATADOR in the resident OT population.

Table 1. Impact of foliar treatments on populations of onion thrips on dry yellow seed cooking onion, Thedford-Grand Bend Marsh, ON, 2003.

Tmt. No.	Treatment Applied	Rate/ha	Mean Number of OT/Plant on Indicated Date							
			04 Jul	09 Jul	22 Jul	29 Jul	01 Aug	05 Aug	13 Aug	17 Aug
1	RIMON	1500.0 ml	1.6 a[1]	0.7 a	0.7 a	2.0 a	2.6 a	7.8 a	25.2 a	31.8 b
2	KNACK	600.0 ml	2.8 b	1.9 b	3.2 b	6.8 b	5.8 a	21.8 c	36.6 c	34.4 b
3	KNACK	750.0 ml	1.6 a	1.0 b	0.3 a	3.1 a	2.7 a	5.2 a	27.3 b	22.0 b
4	SUCCESS	350.0 ml	1.2 a	2.1 b	2.1 a	3.8 a	3.2 a	12.9 b	28.3 b	9.2 a
5	ASSAIL	150.0 g	0.6 a	2.9 c	2.2 a	5.5 a	2.4 a	18.3 b	31.4 b	12.8 a
6	ORTHENE	1000.0 g	1.0 a	2.0 b	0.4 a	3.4 a	1.9 a	11.1 b	22.6 a	12.4 a
7	MATADOR	188.0 ml	1.0 a	0.6 a	1.3 a	5.1 a	2.3 a	13.1 b	28.4 b	31.3 b
8	CONTROL	---[2]	1.3 a	1.7 b	1.4 a	8.1 b	9.1 b	14.9 b	31.3 b	32.8 b
Mean No. Leaves/Plant			4	5	6	3*	6	7	3*	3*
Mean No. OT/Leaf [3]			0.3	0.3	0.2	2.7	1.5	2.1	10.4	10.9

[1] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined by One-way ANOVA and Dunnett's Test.
[2] No insecticide applied.
[3] Calculated by dividing the mean number OT/plant in untreated CONTROL plots for each date by the mean number of leaves/plant on that date.
* OT only counted on 3 inner leaves on this date.

2003 PMR REPORT # 19 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 160.3

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

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TITLE: EVALUATION OF SEED TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL, 2003

MATERIALS: GAUCHO 480 FL (imidacloprid 480 g/L), PRO-GRO 80 WP (carbathiin 30% + thiram 80%), PYRIFOS 15 G (chlorpyrifos 15%), sticker (HP-9 Acrylic Emulsion Polymer)

METHODS: On 07 May onion seed was treated in the laboratory at SCPFRC-London by tumbling seed and sticker together in a clean 375 ml glass jar for 3-4 minutes until all seed was uniformly coated. A glass marble was tumbled with the mixture to separate clumped seed. To control onion smut, *Urocystis magica*, PRO GRO (25.0 g/kg seed) was then added to all treated batches and seed again tumbled for 1 minute. On 14 May, seeds were planted (180 seeds/4 m row) using a Vee-belt seeder in 3 commercial fields in Thedford-Grand Bend Marsh. Experimental plots consisted of 4 grower-planted double rows in which the 2 inner rows were replaced by single rows of treated seed (160 seeds/4 m row). All treatments were replicated 5 times in a randomized complete block design. PYRIFOS G was applied in-furrow at planting to control onion maggot, *Delia antiqua*, in all experimental rows. On 09, 16, 29 July, (4 plants/plot), 05 and 13 August (5 plants/plot), OT were counted by destructive sampling. Raw data was transformed using square root (Y + 0.5) and significance of observed differences among treatment means was determined using ANOVA and a Least Significant Difference test. Untransformed data are presented in the table.

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

RESULTS: Experimental results are outlined in Table 1. OT populations on untreated onions did not exceed the OMAF-recommended threshold of 3.0 OT/leaf for dry yellow seed cooking onions until 05 August (Site 1 and 3). At Site 2, the economic threshold was not exceeded during the course of this study. Although no statistically significant differences were observed, trends were evident. At Site 1, fewer OT were counted onions grown from seed treated with the lower rate of GAUCHO until the end of the 13-week monitoring period. At Site 2 (4 of 6 sample dates) and Site 3 (5 of 6 sample dates), fewer OT were counted on plants treated with the higher rate of GAUCHO.

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

Table 1. Impact of GAUCHO 480 FL seed treatments on populations of onion thrips on dry yellow seed cooking onions in organic soil on the Thedford-Grand Bend Marsh, 2003.

Tmt. No.	Treatment Applied	Rate/Unit[1] Seed	Mean Number of OT /Plant on Indicated Date					
			09 Jul	16 Jul	22 Jul	29 Jul	05 Aug	13 Aug
Site 1:								
1	GAUCHO	55.0 ml	0.0 a[2]	0.3 a	0.2 a	3.0 a	10.4 a	19.3 a
2	GAUCHO	80.0 ml	0.0 a	0.3 a	0.3 a	6.7 a	25.8 a	25.4 a
3	CONTROL	---[3]	0.4 a	1.0 a	0.6 a	7.7 a	28.0 a	26.8 a
Mean No. Leaves/Plant			4	5	5	6	7	7
Mean No. OT/Leaf [4]			0.1	0.2	0.1	1.3	4	3.8
Site 2:								
1	GAUCHO	55.0 ml	0.0 a	0.3 a	0.2 a	2.2 a	8.9 a	15.0 a
2	GAUCHO	80.0 ml	0.1 a	0.1 a	0.0 a	0.9 a	1.2 a	13.2 a
3	CONTROL	---	0.1 a	0.0 a	0.4 a	1.3 a	5.3 a	19.8 a
Mean No. Leaves/Plant			4	5	5	6	6	7
Mean No. OT/Leaf			0	0	0.1	0.2	0.9	2.8
Site 3:								
1	GAUCHO	55.0 ml	0.1 a	0.5 a	0.7 a	1.4 a	21.1 a	64.1 b
2	GAUCHO	80.0 ml	0.1 a	0.1 a	0.2 a	0.9 a	15.5 a	40.0 a
3	CONTROL	---[3]	0.1 a	0.0 a	0.8 a	1.5 a	19.5 a	63.0 ab
Mean No. Leaves/Plant			3	4	5	5	6	6
Mean No. OT/Leaf			0	0.1	0.3	0.3	3.3	10.5

[1] 1 unit contains 250,000 seeds.
[2] For each site, means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined by ANOVA and a Least Significant Differences Test.
[3] No seed treatment applied.
[4] Calculated by dividing the mean number OT/plant in CONTROL plots on each date by the mean number leaves/plant on that date.

2003 PMR REPORT # 20 SECTION B : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 280-2126-9904

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

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TITLE: COMPARISON OF SEED AND TRAY DRENCH TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING SPANISH ONION ON MINERAL SOIL, LONDON, 2003

MATERIALS: ADMIRE 240 F (imidacloprid 240 g/L), GAUCHO 480 FL (imidacloprid 480 g/L), PRO-GRO 80 WP (carbathiin 30% + thiram 80%), sticker (HP-9 Acrylic Emulsion Polymer)

METHODS: On 21 April, Spanish onion seeds were treated in the laboratory at SCPFRC-London. by tumbling seed and sticker together in a clean 375 ml glass jar for 3-4 minutes until all seed was uniformly coated. A glass marble was tumbled with the mixture to separate clumped seed. To control onion smut, *Urocystis magica*, PRO GRO (25.0 g/kg seed) was then added to all treated batches and seed again tumbled for 1 minute. On 22-23 April, Spanish onion seeds, including both treated and untreated seeds, were individually seeded into each cell of 288-plug plastic propagation trays at SCPFRC-London. On 25 April, labelled, seeded trays were transferred to SCPFRC-Vineland greenhouses until 18 June, when seedlings were returned to SCPFRC-London for planting. Prior to treatment or planting, all seedlings were clipped to a height of 15 cm. The trial consisted of two treatment rows bordered on each side by one row of untreated plants. All treatments (Table 1) were planted on the SCPFRC-London Research Farm in 2-row plots (3 m long with 15 cm between plants in rows separated by 1 m) on mineral soil. All treatments were replicated 5 times in a randomized complete block design. Transplanting occurred in two stages. Seed (SD) treatments (Tmt. 1, 2), untreated CONTROL (Tmt. 5) and border rows were transplanted on 18 June. Tray drench (TD) treatments (Tmt. 3, 4) were applied on 18 June using a hand-held, CO_2-pressurized, R&D precision sprayer fitted with a single 8004EVS flat spray tip. Following TD treatment, all plants were flushed with 0.5 ml/plug of clear water using the same sprayer. All treatments planted on 18 June received 30 ml clear transplant-water/plant. Due to rainfall during the morning of 19 June no water was added during planting of TD treatments. Four plants/plot were destructively sampled and OT were counted on each sampling date. Raw data was transformed using square root (Y + 0.5) and significance of observed differences among treatment means was determined using ANOVA and a Least Significant Difference test. Untransformed data are presented in the table.

RESULTS: Experimental results are outlined in Table 1. OT populations exceeded the OMAF-recommended threshold of 1.0 OT/leaf for Spanish onions by 14 July and remained above 1.0 OT/leaf for the remainder of the study. Two weeks post-transplant, 8 weeks post-seeding, fewer OT were counted in plots receiving both SD treatments or the higher TD treatment than in CONTROL plots. OT numbers in SD treated plots were significantly lower than in CONTROL plots on 5 of 7 sampling dates; as long as 15 weeks after initial seeding, OT populations were significantly lower in plots treated with the higher rate of GAUCHO SD. OT populations in plots receiving the higher TD application of ADMIRE were significantly lower than OT numbers in CONTROL plots until just over 5 weeks after treatment. Increase of OT-populations above the recommended threshold of 1 OT/leaf was delayed for 1 week in plots receiving either SD or TD treatments.

CONCLUSIONS: Both SD application of GAUCHO and TD application of ADMIRE delayed the development of OT populations on treated plants. Further research is warranted to verify plant safety and quantify economic benefits of both SD and TD treatments.

Table 1. Comparison of impact of seed and tray-drench treatments on populations of onion thrips on Spanish onion on mineral soil, London, ON, 2003.

Tmt. No.	Treatment Applied	Treatment[1]	Rate Applied	Mean Number of OT/Plant on Indicated Date						
				30 Jun	07 Jul	14 Jul	21 Jul	28 Jul	04 Aug	11 Aug
1	GAUCHO	SD	55.0 ml	0.0 a[2]	0.2 a	7.8 a	2.8 a	6.4 a	22.8 ab	90.4 a
2	GAUCHO	SD	80.0 ml	0.0 a	0.1 a	10.9 ab	1.7 a	6.4 a	18.6 a	87.4 a
3	ADMIRE	TD	4.0 ml	0.2 ab	0.3 a	10.2 ab	4.6 a	10.2 ab	21.8 ab	91.2 a
4	ADMIRE	TD	6.0 ml	0.0 a	0.0 a	9.7 ab	5.6 a	8.8 a	24.8 ab	78.8 a
5	CONTROL	---[3]	---[3]	0.8 b	2.2 b	17.9 b	19.1 b	17.4 b	32.9 b	85.8 a
Mean No. Leaves/Plant				3	4	4	5	6	7	8
Mean No. OT/Leaf [4]				0.3	0.6	4.5	3.8	2.9	4.7	10.7

[1] SD - Seed treatment; TD - tray drench
[2] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined by One-way ANOVA and a Least Significant Difference Range Test.
[2] No insecticide applied.
[4] Calculated by dividing the mean number OT/plant in untreated CONTROL plots for each date by the mean number of leaves/plant on that date.

2003 PMR REPORT # 21 SECTION B: VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 160.3

CROP: Spanish onion (*Allium cepa*), cv. T-439
PEST: Onion thrips (OT), *Thrips tabaci* Lindeman

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TITLE: EVALUATION OF TRAY-DRENCH TREATMENTS FOR CONTROL OF ONION THRIPS ATTACKING SPANISH ONION ON MINERAL SOIL, 2003

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

METHODS: Commercially produced Spanish onion seedlings were grown singly in plastic propagation-plug trays each containing 12 rows of 24 plugs. On 20 May, all seedlings were clipped to a height of 15 cm. Tray-drench (TD) treatments were then applied in 1.0 ml/plug at 200 kPa using a hand-held CO_2 pressurized, R&D field-plot sprayer fitted with a single 8004EVS flat spray tip. Following treatment, all plants were flushed with 0.5 ml/plug of clear water using the same sprayer. On 21 May, onions were transplanted into a research field at SCPFRC-London (Site 1) and into a commercial onion field in Thedford-Grand Bend Marsh (TGBM) (Lot 20, B concession, Bosanquet Township, Lambton County - Site 2). All treatments (Table 1) were replicated 4x (SCPFRC-London) or 5x (TGBM) in a randomized complete block design. Experimental plots at Site 1 consisted of one bed of two treated rows (40 plants/4 m row); plots were separated by 1 m walkways. At Site 2, the two inner rows of 4 row beds were replaced with treated transplants (40 plants/4 m row). Prior to transplanting, all seedlings were clipped to a height of 15 cm. At transplanting, all treatments received 80 ml clear transplant-water/plant. OT were counted by destructive sampling. Counts were made at Site 1 on 16, 23 June (4 plants/plot), 30 June, 07, 14, 21, 28 July and 04 August (5 plants/plot). Counts were made at Site 2 on 17, 25 June (4 plants/plot), 30 June, 09, 16, 22, 29 July and 05 August (5 plants/plot). Raw data was transformed using square root (Y + 0.5) and significance of observed differences among treatment means was determined using ANOVA and a Least Significant Difference test. Untransformed data are presented in the table.

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

RESULTS: Experimental results are outlined in Table 1. OT populations in CONTROL plots exceeded the OMAF-recommended threshold of 1.0 OT/leaf for Spanish onions by 23 June (Site 1) and 09 July (Site 2). At both sites TD application of at least 1 rate of ADMIRE significantly reduced OT populations in treated plots for as long as 10 weeks after treatment. At Site 2 the OT populations in plots receiving TD application of the higher rate of ADMIRE did not reach the threshold level until 2 weeks after the threshold was passed in CONTROL plots. While the benefit was not as significant at Site 1 where OT populations were higher than at Site 2, TD application of ADMIRE did delay buildup up high OT numbers on treated plants.

CONCLUSIONS: Tray drench application of ADMIRE to Spanish onion seedlings significantly delayed the development of OT populations at two sites in 2003.

Table 1. Impact of ADMIRE 240 F, applied as a tray-drench treatment, on populations of onion thrips on Spanish onion in mineral soil, 2003.

Tmt. No.	Treatment Applied	Rate/1000 Plants	Mean Number of OT/Plant on Indicated Date							
			16 Jun	23 Jun	30 Jun	07 Jul	14 Jul	21 Jul	28 Jul	04 Aug
Site 1:										
1	ADMIRE	4.0 ml	0.2 a[1]	1.9 a	1.4 a	9.1 a	15.4 a	7.4 a	15.9 a	4.8 a
2	ADMIRE	6.0 ml	0.4 ab	0.5 a	2.2 a	10.0 a	17.5 a	9.2 a	21.0 ab	3.8 a
3	CONTROL	---[2]	1.9 b	6.2 b	3.6 a	59.1 b	65.3 b	11.4 a	36.1 b	3.2 a
Mean No. Leaves/Plant			4	5	6	6	7	3*	3*	3*
Mean No. OT/Leaf[3]			0.5	1.2	0.6	9.8	9.3	3.8	12	1.1
Site 2:			17 Jun	25 Jun	30 Jun	09 Jul	16 Jul	22 Jul	29 Jul	05 Aug
1	ADMIRE	4.0 ml	0.1 a	0.0 a	0.1 a	3.1 b	19.2 a	20.9 a	30.6 b	43.8 a
2	ADMIRE	6.0 ml	0.0 a	0.1 a	0.0 a	0.3 a	5.2 a	7.2 a	19.2 a	44.2 a
3	CONTROL	---	0.6 a	0.7 b	2.9 b	12.8 c	43.7 b	47.9 b	61.5 b	35.2 a
Mean No. Leaves/Plant			3	4	4	5	6	3*	3*	3*
Mean No. OT/Leaf [3]			0.2	0.2	0.7	2.6	7.3	15.9	20.5	11.7

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

2003 PMR REPORT # 22 SECTION B : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 160.3

CROP: Dry yellow seed cooking onion (*Allium cepa*), cv. Prince
PEST: Onion maggot (OM), *Delia antiqua* (Meigen)

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TITLE: EVALUATION OF PLANTING-TREATMENTS FOR CONTROL OF DAMAGE BY ONION MAGGOT TO DRY YELLOW SEED COOKING ONION ON ORGANIC SOIL, 2003

MATERIALS: ICON 6.2 FS (fipronil 755 g/L), TRACER 480 SC (spinosad 480 g/L), ENTRUST 80 WP (spinosad 80%), GAUCHO 480 FL (imidacloprid 480 g/L), TI-435 600 F (clothianidin 600 g/L), PRO-GRO 80 WP (carbathiin 30% + thiram 80%), PYRIFOS 15 G (chlorpyrifos 15%), sticker (HP-9 Acrylic Emulsion Polymer)

METHODS: On 09 May onion seed was treated in the laboratory at SCPFRC-London by tumbling seed and sticker together in a clean 375 ml glass jar for 3-4 minutes until all seed was uniformly coated. A glass marble was tumbled with the mixture to separate clumped seed. To control onion smut, *Urocystis magica*, PRO GRO (25.0 g/kg seed) was then added to all treated batches and seed again tumbled for 1 minute. All seed (Table 1) was planted at the SCPFRC-London Research Farm on 14 May in 3-row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free organic soil. Granular insecticide (Tmt. 7) was hand-applied in a 2-3 cm band in the bottom of the furrow after the seed was planted but before the seed furrow was closed. All treatments were replicated three times in a randomized complete block design. On 16 June a total of 250 OM eggs from an insecticide-susceptible strain, originally collected on the Thedford Marsh, were buried 1 cm deep beside one onion row in each plot. The infested row length was delineated by stakes and the number of onion plants was counted. The second infestation was completed as described above on 20 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 analysis of variance; significance of differences among treatments means was determined using Least Significant Difference Test. Untransformed data are presented.

RESULTS: Experimental results are outlined in Table 1. Under the conditions of this trial, all treatments significantly reduced OM damage following the first infestation; only application of the lower rate of TRACER to the seed failed to significantly reduce seedling loss due to OM following the second infestation. For both infestations, application to seed of ICON, the higher rate of TRACER, GAUCHO or TI-435 proved as effective as IFG application of PYRIFOS, the current commercial standard treatment. For both infestations, application of the higher rate of TRACER provided significantly better protection of onion seedlings than the lower rate of TRACER.

CONCLUSIONS: Application to onion seed of ICON, TRACER, GAUCHO or TI-435 effectively reduced OM damage to onion seedlings. Further research is warranted to determine the optimum rate of application and generate data to support a petition to either register (ICON, TI-435) or expand current registrations (TRACER, GAUCHO) to include OM control on dry yellow seed cooking onions.

Table 1. Effect of planting treatments on loss of stand due to onion maggot attacking dry yellow seed cooking onions on organic soil, London, ON, 2003.

Tmt. No.	Treatment Applied		Rate Applied (a.i./kg seed)	Method[1]	Mean % Onion Loss after Indicated Infestation	
	Insecticide	Formulation			I -16 Jun	II - 20 Jun
1	fipronil	ICON 6.2 FS	26.4 g	SD	13.2 bc[2]	15.0 bc
2	spinosad	TRACER 480 SC	24.0 g	SD	23.9 b	33.7 ab
3	spinosad	TRACER 480 SC	36.0 g	SD	3.4 d	9.3 c
4	spinosad	ENTRUST 80 WP	25.0 g	SD	30.9 b	11.0 c
5	clothianidin	TI-435 600 F	39.0 g	SD	1.4 d	7.5 c
6	imidacloprid	GAUCHO 480 FL	38.4 g	SD	5.6 cd	6.9 c
7	chlorpyrifos	PYRIFOS 15 G	9.6 g[3]	IFG	0.0 d	7.8 c
8	no insecticide	---[4]	---	---	60.2 a	48.4 a

[1] - Method of Application: SD - Seed Dressing; IFG -In Furrow Granular Application
[2] - For each infestation, means followed by the same letter are not significantly different ($P \leq 0.05$ [Infestation I] or $P \leq 0.10$ [Infestation II]) as determined by ANOVA and a Least Significant Difference Test.
[3] - g a.i./100 m row.
[4] - No insecticide applied.

2003 PMR REPORT #23 SECTION C : VEGETABLE and SPECIAL CROPS - Insect Pests
STUDY DATA BASE: 160.3

CROP: Radish (*Rhaphanus sativus*), cv. Comet
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: EVALUATION OF PLANTING-TREATMENTS FOR CONTROL OF DAMAGE BY CABBAGE MAGGOT TO RADISH ON MINERAL SOIL, 2003

MATERIALS: TRACER 480 SC (spinosad 480 g/L), TI-435 600 F (clothianidin 600 G/L), PYRINEX 480 EC (chlorpyrifos 480 g/L), sticker (HP-9 Acrylic Emulsion Polymer)

METHODS: On 12 May radish seed was treated in the laboratory at SCPFRC-London by tumbling seed and sticker together in a clean 375 ml glass jar for 3-4 minutes until all seed was uniformly coated. A glass marble was tumbled with the mixture to separate clumped seed. All seed (Table 1) was planted at the SCPFRC-London Research Farm on 22 May in 1-row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. In-furrow drench (IFD) treatments (Tmt. 4, 5) were applied in a 3-5 cm band at 225 kPa in 20 L/100 m row, using a hand-held, CO_2-pressurized, single-nozzled R&D plot sprayer fitted with a 4006E flat fan nozzle, centred over the seed in the open seed furrow. All treatments were replicated three times in a randomized complete block design. On 10 and 16 June a total of 250 CM eggs from an insecticide-susceptible strain were buried 1 cm deep beside separate 1 m lengths of the row in each plot. After infestation, plots were lightly watered to improve egg survival and hatch. On each date the infested row length was delineated by stakes and the number of radish plants was counted. All radishes from both infestations were harvested on 24 June. Roots were washed, counted, inspected for CM damage and the percent roots showing any feeding damage calculated. Data were subjected to arcsin square root transformation prior to statistical analysis by analysis of variance (ANOVA); significance of differences among treatments means was determined using Student-Neuman-Koyle's (SNK) Multiple Range Test. Untransformed data are presented.

RESULTS: Experimental results are outlined in Table 1. Both infestations of CM eggs resulted in high CM damage to radish. For both infestations, SD application of TI-435 was the most effective treatment, significantly reducing CM damage to radish by 73.2% (Infestation I) and 63.4% (Infestation II). While the IFD-application of PYRINEX, the current commercial recommendation, resulted in significantly less CM damage to radish for both CM infestations, the treatment provided much better control of the first infestation, 19 days after treatment (DAT) than of the second CM infestation, 25 DAT. Tested rates of application of TRACER either to seed or in-furrow significantly reduced CM damage only following the CM infestation; the limited reduction, however, was not commercially acceptable.

CONCLUSIONS: Treatment of radish seed with TI-435 significantly reduced CM damage to radish. Further study is warranted to confirm rates of application.

Table 1. Effect of planting treatments on damage due to cabbage maggot attacking radishes on mineral soil, London, ON, 2003.

Tmt. No.	Treatment Applied		Rate Applied (a.i.)	Method[3]	Mean % Damaged Radish after Indicated Infestation	
	Insecticide	Formulation			I -10 Jun	II - 16 Jun
1	clothianidin	TI-435 600 F	39.0 g[1]	SD	17.5 c[4]	26.4 c

2	spinosad	TRACER 480 SC	24.0 g[1]	SD	41.8 ab	44.8 b
3	spinosad	TRACER 480 SC	36.0 g[1]	SD	49.9 ab	56.2 b
4	spinosad	TRACER 480 SC	1.4 g[2]	IFD	53.6 a	51.2 b
5	chlorpyrifos	PYRINEX 480 EC	4.1 g[2]	IFD	25.5 b	56.2 b
6	no insecticide	---	---	---	65.4 a	72.2 a

[1] - amount applied/kg seed.
[2] - amount applied/100 row.
[3] - Method of Application: SD - Seed Dressing; IFD - In-Furrow Drench Application.
[4] - For each infestation, means followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and an SNK Multiple Range Test.

2003 PMR Report #23A **SECTION C: POTATOES - Insect Pests**
STUDY DATA BASE: 303-1251-9601

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

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TITLE: EFFICACY OF SEED-PIECE OR IN-FURROW INSECTICIDE TREATMENTS AGAINST INSECT PESTS OF POTATOES, 2003

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

METHODS: Cut seed-potato pieces were planted at Harrington, PE, on 5 June, 2003, in four-row plots with plant spacing of 0.4 m within rows and 0.9 m between rows. Plots were arranged in a randomized complete block design with five treatments, and four replicates per treatment. The plots measured 7.6 m in length and 3.7 m in width, and were separated from each other by two buffer rows of potatoes. All treatments consisted of either a pre-plant seed-piece application or an in-furrow application at planting, and were as follows: 1) Check - SENATOR 10% seed-piece treatment at 50.0 g AI/100 kg seed; 2) L1210-A1 at 6.3 g AI/100 kg seed; 3) L1216-A1 at 333g product*/100 kg seed; 4) L1210-A1 at 9.4 g AI/100 kg seed; and 5) ADMIRE 240 F in-furrow at 1.8 g AI/100 m row at planting after SENATOR 10% seed-piece treatment at 50.0 g AI/100 kg seed. Beginning with the first appearance of Colorado potato beetle (CPB) adults in the plots on 9 July, weekly counts of the numbers of CPB adults, egg masses, early-instars (L1-L2), and late-instars (L3-L4) on five whole plants per plot were done until 9 September. On the same schedule, potato flea beetle (PFB) population levels were determined by counting the number of holes in a fourth terminal leaf of each of the five plants, and aphids were counted on a top, middle, and bottom leaf of the same plant. Percent defoliation by the CPB in each plot was estimated weekly throughout the growing season. After planting, a pre-emergence application of metribuzin at 1.1 kg AI/ha was applied to plots for weed control. Throughout the summer, plots received recommended applications of chlorothalonil at 1.25 kg AI/ha for late blight control. On 16 September, the top desiccant Diquat was applied at the rate of 370 g AI/ha. Tubers from the centre two rows of each plot were harvested on 30 September, and total and marketable (wt.>41.5 g, <510 g) yields were recorded. Fifty tubers per plot from all treatments were examined for wireworm damage, as determined by the number of wireworm holes per tuber. Analyses of variance (ANOVA) were performed on the data and Least Significant Differences (LSD, P=0.05) were calculated. Insect counts were transformed to Ln(x+1) before analysis. Percent defoliation was transformed to sqrt (arcsine(prop)) before analysis. Untransformed means are presented. Only periods of high activity are represented in the tables.
* AI concentration confidential

RESULTS: L1210-A1 at 6.3 and 9.4 g AI/100 kg seed, L1216-A1 at 333 g product*/100 kg seed, and ADMIRE 240 F in-furrow at 1.8 g AI/100 m row, were equally effective at reducing numbers of CPB adults on 13 and 19 August, 9 September, and on a seasonally-averaged basis, compared to the SENATOR-treated Check (Table 1). On both 26 August and 2 September, all treatments except L1210-A1 at 9.4 g AI gave effective control of CPB adults in comparison with the Check, but L1210-A1 at 6.3 g
AI and ADMIRE gave the best adult control on 26 August (Table 1). All treatments equally controlled

numbers of CPB egg masses on 9 and 16 July, but not later in the summer (Table 2). All products gave similar levels of control of L1-L2 larvae from 9 July through 30 July (Table 3), L3-L4 larvae from 23 July through 13 August (Table 4), and of both stages when seasonally averaged. As indicated by the average number of PFB holes per fourth terminal leaf, all treatments gave significant control of the PFB in comparison with the non-treated Check from 9 July through 23 July (Table 5). On 9 July, L1210-A1 at both rates, and L1216-A1, gave superior control of PFB compared to ADMIRE. After 23 July, no consistent effect of any treatment was observed, and after 7 August, due to high CPB defoliation levels on the Check plots, there were no fourth terminal leaves available for comparison with the treated plots. Although aphid populations were very low throughout the entire summer, all treatments effectively controlled the total number of aphids per plant on 19 August and 9 September, and on a seasonally-averaged basis (Table 6). All treatments were equally effective at reducing wireworm damage, as indicated by number of holes per tuber compared to the non-treated Check (Table 7). Similar levels of reduction of defoliation by the CPB were achieved by all treatments from 14 July through 16 September, and on a seasonally averaged basis (Table 7). All treatments were equally effective at producing significantly greater total and marketable tuber yields in comparison with the not-treated Check (Table 7).

CONCLUSIONS: When compared to the check, L1210-A , L1216-A1 and admire effectively controlled CPB egg masses early in the season and adults and larvae over the entire summer. All treatments equally reduced potato flea beetles damage early in the season, but no consistent effects were observed after 7 August . Although aphid pressure was low, all treatments controlled the total number of aphids per plant when averaged over the season. There was significantly less wireworm damage in the treatment plots when compared to the check. Defoliation as a result of insect feeding was significantly reduced by all treatments. Total and marketable yield was significantly higher at all treatment levels. Overall the products L1210-A1 both concentrations, and L1216-A1 and Admire effectively reduced damage caused by potato pests such as CPB,.PFB, wireworm, and aphids, reduced defoliation and increased tuber yield.

* AI concentration confidential

Table 1. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) adults on potatoes planted at Harrington, PE, in 2003.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB Adults/Plant					
		August 13	August 19	August 26	Sept. 02	Sept. 09	Seas. Avg.[4]
SENATOR 10%	50	10.0 a[1]	11.0 a	3.4 a	1.7 a	1.6 a	2.8 a
L1210-A1 1.25%	6.3	2.3 b	2.3 b	0.4 c	0.1 b	0.0 b	0.5 b
L1216-A1[3]	cc [2]	2.9 b	2.3 b	1.1 bc	0.5 b	0.2 b	0.7 b
L1210-A1 1.25%	9.4	1.5 b	2.9 b	1.9 ab	0.7 ab	0.6 b	0.7 b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[3]	3.1 b	2.0 b	0.5 c	0.3 b	0.1 b	0.6 b
ANOVA P≤ 0.05		s	s	s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected, Least Significant Differences Test).
[2] concentration is confidential
[3] g AI/100 m row
[4] from 9 July to 9 September

Table 2. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) egg masses on potatoes planted at Harrington, PE, in 2003.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB Egg Masses/Plant					
		July 09	July 16	July 23	August 13	August 19	Seas. Avg.[4]
SENATOR 10%	50	2.5 a[1]	1.5 a	0.3 a	0.4 a	0.6 a	0.5 a
L1210-A1 1.25%	6.3	0.0 b	0.0 b	0.0 a	0.8 a	2.1 a	0.3 a
L1216-A1[3]	cc [2]	0.1 b	0.0 b	0.0 a	0.5 a	1.9 a	0.3 a
L1210-A1 1.25%	9.4	0.0 b	0.1 b	0.1 a	0.1 a	0.6 a	0.1 a
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[3]	0.1 b	0.2 b	0.0 a	0.3 a	1.1 a	0.2 a
ANOVA P≤ 0.05		s	s	ns	ns	ns	ns

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected, Least Significant Differences Test).
[2] concentration is confidential
[3] g AI/100 m row
[4] from 9 July to 9 September

Table 3. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) L1-L2 instars on potatoes planted at Harrington, PE, in 2003.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB L1-L2 Instars/Plant					
		July 09	July 16	July 23	July 30	Aug. 07	Seas. Avg.[4]
SENATOR 10%	50	21.0 a[1]	39.0 a	20.0 a	5.0 a	1.7 a	8.6 a
L1210-A1 1.25%	6.3	0.0 b	0.0 b	0.0 b	0.0 b	0.0 a	1.2 b
L1216-A1[3]	cc [2]	0.2 b	0.0 b	0.0 b	0.0 b	0.0 a	1.0 b
L1210-A1 1.25%	9.4	0.0 b	0.0 b	0.0 b	0.1 b	0.0 a	0.8 b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[3]	1.5 b	0.0 b	0.0 b	0.0 b	0.0 a	0.8 b
ANOVA P≤ 0.05		s	s	s	s	ns	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected, Least Significant Differences Test).
[2] concentration is confidential
[3] g AI/100 m row
[4] from 9 July to 9 September

Table 4. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against Colorado potato beetle (CPB) L3-L4 instars on potatoes planted at Harrington, PE, in 2003.

Treatment	Rate (g AI/100 kg seed)	Mean No. CPB L3-L4 Instars/Plant					
		July 23	July 30	August 07	August 13	August 19	Seas. Avg.[4]
SENATOR 10%	50	16.0 a[1]	14.0 a	4.3 a	0.9 a	0.2 a	3.7 a
L1210-A1 1.25%	6.3	0.0 b	0.0 b	0.0 b	0.0 b	0.0 a	0.7 b
L1216-A1[3]	cc [2]	0.0 b	0.0 b	0.2 b	0.1 b	0.0 a	0.4 b
L1210-A1 1.25%	9.4	0.0 b	0.0 b	0.0 b	0.0 b	0.0 a	0.2 b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[3]	0.0 b	0.0 b	0.0 b	0.0 b	0.0 a	0.2 b
ANOVA P≤ 0.05		s	s	s	s	ns	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected, Least Significant Differences Test).
[2] concentration is confidential
[3] g AI/100 m row
[4] from 9 July to 9 September

Table 5. Effect of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, on potato flea beetle (PFB) damage on potatoes planted at Harrington, PE, in 2003.

Treatment	Rate (g AI/100 kg seed)	Mean No. of PFB Holes/4th Terminal Leaf					
		July 09	July 16	July 23	July 30	August 07	Seas. Avg.[4]
SENATOR 10%	50	11.0 a[1]	9.5 a	17.0 a	4.2 a	8.8 a	10.8 a
L1210-A1 1.25%	6.3	0.2 c	0.7 b	1.5 b	1.2 ab	5.2 a	11.4 a
L1216-A1[3]	cc [2]	0.1 c	0.1 b	1.6 b	2.5 a	1.3 c	11.7 a
L1210-A1 1.25%	9.4	0.1 c	0.3 b	1.2 b	0.1 b	5.5 ab	9.4 a
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[3]	1.3 b	1.1 b	2.6 b	0.5 b	1.5 bc	9.8 a
ANOVA P≤ 0.05		s	s	s	s	s	ns

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected, Least Significant Differences Test).
[2] concentration is confidential
[3] g AI/100 m row
[4] from 9 July to 9 September

Table 6. Efficacy of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, against aphids on potatoes planted at Harrington, PE, in 2003.

Treatment	Rate (g AI/100 kg seed)	Mean No. of Aphids/Plant					
		August 19	August 26	Sept. 02	Sept. 09	Sept. 16	Seas. Avg.[4]
SENATOR 10%	50	2.3 a[1]	0.1 a	3.6 a	1.9 a	0.7 a	0.8 a
L1210-A1 1.25%	6.3	0.3 b	0.6 a	1.1 a	0.0 b	0.1 a	0.2 b
L1216-A1[3]	cc [2]	0.1 b	0.4 a	0.1 a	0.0 b	0.0 a	0.1 b
L1210-A1 1.25%	9.4	0.1 b	0.5 a	0.5 a	0.1 b	0.1 a	0.1 b
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[3]	0.3 b	0.2 a	0.2 a	0.1 b	0.0 a	0.1 b
ANOVA P≤ 0.05		s	ns	ns	s	ns	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected, Least Significant Differences Test).
[2] concentration is confidential
[3] g AI/100 m row
[4] from 9 July to 9 September

Table 7. Effect of two rates of L1210-A1 seed-piece treatment, one rate of L1216-A1 seed-piece treatment, and one in-furrow treatment of ADMIRE 240 F, on wireworm damage, CPB defoliation, and total and marketable tuber yield of potatoes planted at Harrington, PE, in 2003.

Treatment	Rate (g AI/100 kg seed)	Wireworm Damage	% Defoliation	Tuber Yield t/ha	
		Mean no. holes/ tuber	Seas. Avg.[4]	Total	Market.
SENATOR 10%	50	0.3 a[1]	47.2 a	14.2 b	13.6 b
L1210-A1 1.25%	6.3	0.1 b	4.9 b	29.0 a	26.0 a
L1216-A1[3]	cc [2]	0.1 b	6.5 b	28.6 a	24.5 a
L1210-A1 1.25%	9.4	0.1 b	5.1 b	30.2 a	26.2 a
SENATOR 10% + ADMIRE 240 F	50.0 + 1.8[3]	0.1 b	5.0 b	29.0 a	25.5 a
ANOVA P≤ 0.05		s	s	s	s

[1] Numbers in a column followed by the same letter are not statistically different (P ≤ 0.05, Protected, Least Significant Differences Test).
[2] concentration is confidential
[3] g AI/100 m row
[4] from 14 July to 16 September

2003 PMR REPORT #24 **SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests**
ICAR: 30601

CROP: Spinach, cv. Unipack 151
PEST: Pea Leafminer (PLM), *Liriomyza huidobrensis* (Blanchard)

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TITLE: EFFICACY OF INSECTICIDES FOR CONTROL OF PEA LEAFMINER ON SPINACH, 2003

MATERIALS: ASSAIL 70 WP (acetamiprid 70.35%), RIMON 10 EC (novaluron 100 g/L), CITATION 75 WP (cyromazine 75%).

METHODS: Spinach cv. Unipack 151 was machine-seeded at the Muck Research Station near Kettleby, ON, on 1 August, in 4 row plots, 5 m in length, with a row spacing of 30 cm. Plots were separated by a 3 m spray lane (N-S) and a 1.5 m alley (E-W). Six treatments were replicated 4 times in a randomized complete block design. All treatments were applied using a CO_2-pressurized precision plot sprayer at 275 kPa in water equivalent to 200 L/ha. Applications took place on 20 and 28 August and 10 September. Plots were monitored for PLM-leaf mining (caused by larvae) approximately once each week. Both sides of the youngest, most fully expanded two leaves per plant on seven randomly chosen plants per plot were examined. PLM-mining damage was rated on a scale of 0 to 3 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards base). Plots were monitored for PLM-leaf stippling damage (caused by ovipositing adult females) 3 days prior to harvest. PLM-leaf stippling damage was rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples). Both mining and stippling damage ratings were converted to damage indices for each block. Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Spinach was harvested on 23 September. Ten plants from each plot were graded according to damage. Mining damage per bunch was determined and rated on a scale of 0 to 4 (0 = all leaves undamaged; 1 = 1-25% of leaves damaged; 2 = 26-50% of leaves damaged; 3 = 51-75% of leaves damaged; 4 = 76-100% of leaves damaged). Differences in ratings among treatments were determined using analysis of variance and Duncan's multiple range test. Only mining damage data from the last two rating periods (9 & 20 September) was used in pooled analyses, as previous dates had extremely low levels of damage.

RESULTS: The results are summarized in Table 1. While mining damage indices were very low in all treatments, only plots treated with the high rate of RIMON had a significantly lower mining damage index than the Control. All treatments had significantly lower stippling damage indices than the Control. At harvest, all treatments except the low rate of RIMON had significantly lower bunch damage indices than did the Control.

CONCLUSIONS: Stippling damage on spinach is more economically damaging than mining damage; all insecticides examined effectively reduced stippling damage levels. However in this trial, the high rate of RIMON was the best treatment as mining and stippling damage to leaves and damaged leaves per bunch were all lower in plants in this treatment than in the Control.

Table 1. Mean (± standard error) damage indices for pea leafminer mining damage for pooled post-treatment dates, stippling damage three days before harvest, and mining damage per bunch at harvest on spinach treated with insecticides, Kettleby, ON, 2003.

Treatment No.	Insecticide	Rate (g a.i./ha)	Mean damage indices[1]		
			Mines[2]	Stipples[3]	Bunch[4]
1	ASSAIL	39.2	5.7 ± 1.2 ab	43.1 ± 5.1 b	26.9 ± 4.1 b
2	ASSAIL	60.2	4.8 ± 1.1 ab	46.4 ± 2.3 b	21.9 ± 4.7 b
3	RIMON	25	4.8 ± 1.2 ab	44.1 ± 6.3 b	38.1 ± 7.3 ab
4	RIMON	50	3.9 ± 1.3 b	39.3 ± 3.6 b	26.9 ± 4.3 b
5	CITATION	187.5	4.5 ± 1.4 ab	41.7 ± 3.0 b	21.3 ± 5.5 b
6	Control	---	7.7 ± 1.2 a	65.5 ± 1.2 a	50.0 ± 6.8 a

[1] Damage indices were calculated using the following formula: DI = ([(0xA) + (1xB) + (2xC) + (3xD)] / [(A+B+C+D)x3]) x 100, where numbers are damage classes and letters are number of plants in each class. Values followed by the same letter, within the same column, are not significantly different (P>0.05); Duncan's multiple range test.
[2] Rated on a scale of 0 to 3 (0 = no mines; 1 = small mines (early instars); 2 = more extensive mines with mines coalescing into patches; 3 = mines extend down petiole of leaf towards stalk).
[3] Rated on a scale of 0 to 3 (0 = no stipples, 1 = 1-10 stipples, 2 = 11-100 stipples, and 3 = greater than 100 stipples).
[4] Rated on a scale of 0 to 4 (0 = all leaves undamaged; 1 = 1-25% of leaves damaged; 2 = 26-50% of leaves damaged; 3 = 51-75% of leaves damaged; 4 = 76-100% of leaves damaged).

2003 PMR REPORT # 25 **SECTION B: VEGETABLES and SPECIAL CROPS - Insect Pests**
ICAR:

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

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TITLE: **RELATIVE EFFICACY OF SUCCESS 480 SC, ATTRIBUTE™, RIMON 10 SC, FURADAN 480 F AND MATADOR 120 EC FOR THE CONTROL OF EUROPEAN CORN BORER, *Ostrinia nubilalis* (Hübner), ON SWEET CORN GROWN ON SANDY SOIL (Delhi Research Farm, 2003)**

MATERIALS: SUCCESS 480 SC (spinosad 480 g/L), RIMON 10 EC (novaluron 100 g/L), FURADAN 480 F (carbofuran 480 g/L), MATADOR 120 EC (lambda cyhalothrin 120 g/L), ATTRIBUTE™ (Bt corn cv., BC 0801)

METHODS: Conventional sweet corn (cvs. Precious Gem, Seneca Dancer) was seeded at the Agriculture and Agri-Food Canada (AAFC) Delhi Research Farm, Delhi, ON, in 4 row blocks, 15.0 m long. Rows were 0.75 m apart with 20.0-22.0 cm plant spacing. Four treatments were replicated four times in a randomized complete block design. A separate field of Bt-sweet corn (ATTRIBUTE) was seeded using the same planting parameters. Bt-sweet corn and untreated control plots (cvs. Precious Gem, Seneca Dancer) were planted in 4 row blocks, with 4 buffer rows separating each block. The Bt-sweet corn was isolated from the conventional sweet corn by 100 m to comply with government regulation (CFIA, 2001). Peak ECB flights were monitored using pheromone traps (univoltine Iowa strain lures). Foliar insecticides were applied to all four rows of each block, using a Hahn Hi-Boy™ (Hahn Corp.) that delivered 750 L/ha at 450 kPa (Teejet 8008VS). The first application took place when sweet corn reached late whorl. Efficacy of treatments for ECB-control was determined at harvest by examining 25 ears from the centre two rows of each plot for tunnelling on the husk and the ear, damaged kernels, yield, and assessing marketability of each ear. Marketability was determined using a standard processor's 1-9 scale (Warnock and Davis, 1998), where only ratings of ≤ 3 were considered of marketable quality. Data were analyzed using analysis of variance (ANOVA) and a Fisher's protected LSD test ($P < 0.05$).

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

CONCLUSIONS: SUCCESS, RIMON, FURADAN or MATADOR applied to Precious Gem sweet corn significantly reduced the mean number of ECB damage to kernels (Table 2). The number of ECB tunnels on husks and ears at harvest was also significantly reduced compared to the untreated control (Table 2). Sweet corn treated with SUCCESS (70 g a.i./ha) had a significantly higher yield than all other treatments (Table 2). Mean marketability ratings in all treatments were significantly improved compared to the untreated control (Table 2). Sweet corn harvested from all treatments, including the untreated control, was of marketable quality. SUCCESS, RIMON, FURADAN or MATADOR applied to Seneca Dancer sweet corn significantly reduced the mean number of ECB damaged kernels (Table 3). The number of ECB tunnels on husks and ears at harvest was also significantly reduced compared to the untreated control (Table 3). No significant difference in yield was found between treatments and the untreated control. Marketability of SUCCESS, RIMON, FURADAN and MATADOR treated sweet corn was significantly improved compared to the untreated control. With the exception of the untreated control, all sweet corn harvested from the treatments was of marketable quality (Table 3). Significantly fewer ECB damaged kernels were

counted in ATTRIBUTE sweet corn compared to untreated Seneca Dancer (Table 4). There were no significant differences in mean number of ECB damage kernels on ATTRIBUTE and untreated Precious Gem sweet corn (Table 4). The number of ECB tunnels on husks was significantly lower in ATTRIBUTE sweet corn compared to untreated Precious Gem or Seneca Dancer sweet corn (Table 4). The mean number of ECB tunnels per ear were significantly lower in ATTRIBUTE compared to Precious Gem but not compared to Seneca Dancer. Marketability of ATTRIBUTE sweet corn was significantly improved compared Seneca Dancer and Precious Gem. The marketability of Seneca Dancer was significantly better than Precious Gem. However, all sweet corn varieties were marketable quality (Table 4). SUCCESS, RIMON and ATTRIBUTE were comparable in efficacy to the industry standards FURADAN and MATADOR for control of ECB in sweet corn. In addition, sweet corn harvested from plots treated with SUCCESS or RIMON or planted with ATTRIBUTE was of equal or superior quality to sweet corn treated with either FURADAN or MATADOR.

Table 1. Management parameters for the sweet corn field trial, Delhi Research Farm, 2003.

Cultivar	Maturity (days)	Planting Date	Application dates			Harvest date
			First	Second	Third	
Precious Gem	78	38132	12 Jul	27 Jul	2 Aug*	15 Aug
Seneca Dancer	89	38132	28 Jul	2 Aug	11 Aug*	25 Aug
Bt corn, BC 0801	73	38132	---	---	---	15 Aug

* Third application for SUCCESS (70 g a.i./ha) and MATADOR only.

Table 2. Relative efficacy of SUCCESS 480 SC, RIMON 10 EC, FURADAN 4 F, and MATADOR 120 EC for control of European corn borer on sweet corn var. Precious Gem grown on sandy soil at the Delhi Research Farm, 2003.

Treatments	Rate (g a.i./ha)	Tunnels/ husk	Kernel damage/ear	Tunnels/ ear	Yield (kg)	Marketability (0-9 scale)**
Untreated	--	1.36 a*	0.68 a	0.22 a	5.09 b	2.27 a
SUCCESS	40	0.09 c	0.01 b	0.00 b	5.11 b	1.07 b
SUCCESS	70	0.06 c	0.01 b	0.00 b	5.41 a	1.07 b
RIMON	50	0.62 b	0.02 b	0.02 b	4.97 b	1.33 b
FURADAN	530	0.15 bc	0.20 b	0.02 b	4.98 b	1.36 b
MATADOR	10	0.03 c	0.00 b	0.00 b	5.26 ab	1.02 b

* Treatment means in a column followed by the same letter are not significantly different ($P < 0.05$, LSD).
** Ratings of ≤ 3 indicate acceptable market quality (Warnock and Davis, 1998).

Table 3. Relative efficacy of SUCCESS 480 SC, RIMON 10 EC, FURADAN 4 F, and MATADOR 120 EC for control of European corn borer on sweet corn var. Seneca Dancer grown on sandy loam soil at the Delhi Research Farm, 2003.

Treatments	Rate (g a.i./ha)	Tunnels/ husk	Kernel damage/ear	Tunnels/ ear	Yield (kg)	Marketabilit y (0-9 scale)**
Untreated	--	1.05 a*	2.75 a	0.17 a	5.71 a	3.30 a
SUCCESS	40	0.14 b	0.53 b	0.00 c	5.91 a	1.41 bc
SUCCESS	70	0.04 b	0.14 b	0.00 c	5.86 a	1.07 c
RIMON	50	0.14 b	0.79 b	0.06 b	5.62 a	1.77 b
FURADAN	530	0.14 b	0.32 b	0.03 bc	5.71 b	1.44 bc
MATADOR	10	0.20 b	0.12 b	0.01 bc	5.91 a	1.26 c

* Treatment means in a column followed by the same letter are not significantly different ($P < 0.05$, LSD).
** Ratings of ≤ 3 indicate acceptable market quality (Warnock and Davis, 1998).

Table 4. Relative efficacy of Bt sweet corn var. BC 0801 ATTRIBUTE™ for control of European corn borer on sweet corn grown on sandy loam soil at the Delhi Research Farm, 2003.

Treatments	Tunnels/ husk	Kernel damage/ear	Tunnels/ ear	Yield (kg**)	Marketability (1-9 scale)***
Untreated - Precious Gem	0.99 a*	0.72 b	0.12 a	4.91	2.03 a
Untreated - Seneca Dancer	0.93 a	1.64 a	0.06 ab	5.62	2.62 b
ATTRIBUTE	0.05 b	0.03 b	0.01 b	5.29	1.10 c

* Treatment means in a column followed by the same letter are not significantly different ($P < 0.05$, LSD).
** Three separate varieties included, therefore statistical comparison for yield could not be conducted.
*** Ratings of ≤ 3 indicate acceptable market quality (Warnock and Davis, 1998).

REFERENCES:

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

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

2003 PMR REPORT # 26 **SECTION B: VEGETABLES and SPECIAL CROPS – Insect pests**
ICAR:

CROP: Sweet corn (*Zea mays* L.), cvs. Precious Gem, Seneca Dancer
PEST: Corn flea beetle (CFB), *Chaetocnema pulicaria* Melsheimer

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TITLE: **RELATIVE EFFICACY OF PONCHO™ 250 F AND GAUCHO®480 FS AS SEED TREATMENTS FOR CONTROL OF CORN FLEA BEETLE (*Chaetocnema pulicaria* Melsheimer) ON SWEET CORN GROWN ON SANDY SOIL (Delhi Research Farm, 2003).**

MATERIALS: GAUCHO® 480 FS (imidacloprid 480 g/L), PONCHO™ 250 F (clothianidin 250 g/L)

METHODS: Sweet corn (cvs. Precious Gem, Seneca Dancer) was seeded on May 26 at the Agriculture and Agri-Food Canada (AAFC) Delhi Research Farm, Delhi, ON, in 4 row blocks, 15.0 m long. Rows were spaced on 0.75 cm centers with 20-22 cm plant spacing. Treatments consisted of an untreated control or sweet corn seed treated with either GAUCHO (2.5 g a.i./kg of seed) or PONCHO (1.25 mg a.i./kernel). Treatments were replicated 4 times in a randomized complete block design. CFB populations were monitored using yellow sticky cards placed on 0.6 m stakes positioned 5 and 10 m into each plot. The number of CFB feeding damage marks/plant were counted on 15 plants from the middle two rows of each plot. Both the sticky cards and the number of feeding damage marks/plant were monitored weekly over 3 weeks from spike emergence to the six-leaf stage. Data were analyzed using analysis of variance (ANOVA) and a Fisher's protected LSD test ($P < 0.05$).

RESULTS: Results of sticky card captures and efficacy trials are illustrated in Tables 1 and 2.

CONCLUSIONS: There was no significant difference in the mean number of CFB captured on yellow sticky cards between any of the treatments in either variety (Table 1).
For both Precious Gem and Seneca dancer sweet corn varieties application of GAUCHO and PONCHO to the seed significantly reduced the mean number of CFB feeding damage marks compared to the untreated control (Table 2). For Precious gem sweet corn there were no significant difference in CFB feeding damage marks between plants grown from seed treated with GAUCHO or PONCHO (Table 2). For Seneca Dancer sweet corn significantly fewer CFB feeding marks/plant were counted on plants grown from seed treated with PONCHO than on plants from seed treated with GAUCHO (Table 2).
Results from this study indicated that the seed treatment insecticides, PONCHO and GAUCHO, were effective for control of CFB in sweet corn. In addition, PONCHO provided equal or superior control of CFB compared to GAUCHO.

Table 1. Mean number of corn flea beetle (CFB) per yellow sticky card in sweet corn (cvs. Precious Gem and Seneca Dancer) grown from untreated seed or seed treated with imidacloprid (GAUCHO® 480 FS) and clothianidin (PONCHO™ 250 F), AAFC Delhi Research Farm, 2003.

Treatment	Rate	Mean No. (SD) CFB/Yellow Sticky Card for Indicated cv.	
		Precious Gem	Seneca Dancer
GAUCHO	2.50 g a.i./kg seed	0.28 (0.27) a[1]	0.31 (0.07) a
PONCHO	1.25 mg a.i./seed	0.43 (0.26) a	0.28 (0.15) a
Untreated Control	--	0.25 (0.00) a	0.31 (0.07) a[1]

[1] - Treatment means in a column followed by the same letter are not significantly different ($P < 0.05$, LSD).

Table 2. Relative efficacy of imidacloprid (GAUCHO® 480F) and clothianidin (PONCHO™ 250F) applied as seed treatments for control of corn flea beetle (CFB) on sweet corn (cvs. Precious Gem and Seneca Dancer), AAFC Delhi Research Station, 2003.

Treatment	Rate	Mean No. CFB Damage Marks/Plant for Indicated cv.	
		Precious Gem	Seneca Dancer
GAUCHO	2.50 g a.i./kg seed	4.8 a[1]	5.7 a
PONCHO	1.25 mg a.i./seed	3.5 a	3.4 b
Untreated Control	--	11.7 b	12.2 c

[1] - Treatment means in a column followed by the same letter are not significantly different ($P < 0.05$, LSD).

2003 PMR Report #26A **SECTION B: VEGETABLES AND SPECIAL CROPS - Insect Pests**
ICAR:

CROP: Potato, (*Solanum tuberosum* L.) cv. Kennebec.
PEST: Colorado potato beetle, (*Leptinotarsa decemlineata* (Say))

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TITLE: **RELATIVE EFFICACY OF RIMON® 10EC COMPARED TO ADMIRE® 240F FOR CONTROL OF COLORADO POTATO BEETLE, *Leptinotarsa decemlineata* (Say), ON POTATO GROWN ON SANDY SOIL (Simcoe Research Station, 2003)**

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

METHODS: Potato seed pieces were planted at the University of Guelph – Simcoe Research Farm (Simcoe, Ontario) on 22 May in 4 row plots, 14.0 m in length, with a row spacing of 1.0 m and a planting space of 240 cm. Plots were separated by 3.0 m spray lanes. Eight treatments were replicated four times in a randomized complete block design (RCBD). The foliar treatments were applied using a tractor mounted, four-row boom sprayer delivering 807.53 L/ha at 276 kPa (Colorjet nozzles # 80-28, 12 nozzles at 0.31 m average nozzle spacing). Monitoring for Colorado Potato Beetle (CPB) began on 23 June and continued at an interval of twice per week until treatment application. On the 23 and 24 June, all plots were inoculated with CPB collected from a nearby field (approximately 50 m away) at a rate of 18-20 adults per plot. Four plots per block were treated on 25 June, when eggs were first observed. These treatments consisted of RIMON 10EC at 12.5, 25.0 and 50.0 g a.i./ha, and ADMIRE 240F at 50.0 g a.i./ha. Three other plots per block were treated on 4 July, when late 2nd instar larvae were observed. These treatments consisted of RIMON 10EC at 12.5, 25.0 and 50.0 g a.i./ha.

Treatment efficacy was determined by recording CPB populations on 10 randomly selected potato plants per plot. On each plant the number of CPB egg masses, small CPB larvae (1st and 2nd instars), large CPB larvae (3rd and 4th instars) and CPB adults was determined. Plots that received treatment based on the presence of CPB egg masses were monitored on June 23 (Day -2 (2 days before treatment)), 26 (1 Day After Treatment (DAT)), 28 (3 DAT), July 2 (7 DAT), 10 (15 DAT), 17 (22 DAT), 24 (29 DAT) and 31 (36 DAT). Plots that received treatment based on the presence of 2nd instar larvae were scouted on June 23 (Day -11), 26 (Day -8), 30 (Day -4), July 3 (Day -1), 5 (1 DAT), 7 (3 DAT), 10 (5 DAT), 17 (13 DAT), 24 (20 DAT) and 31 (27 DAT). Untreated control plots were scouted on all dates listed above for both application times.

Differences in mean CPB abundance per plant were determined by Analysis of the Variance (ANOVA). Multiple comparisons were conducted with the Tukey test. JMP Statistical Software was used in all analyses (SAS Institute).

RESULTS: See Tables 1-4.

CONCLUSIONS: RIMON had no significant effect on overwintered adult CPB mortality (Table 1). This was expected as it is selectively toxic against insect larval stages during molting. In contrast, applications of ADMIRE, a known adulticide, resulted in significant adult mortality CPB mortality after treatment. As expected for a foliar treatment, adult CPB migrated into the ADMIRE treated plots 7 days after treatment (Table 1). Significant differences in adult counts for DAT 36-27

resulted from the smaller number of summer adults emerging from ADMIRE and RIMON treated plots.

RIMON applications had no effect on the mean number of egg masses, suggesting the compound has little on CPB adult fecundity (Table 2). Mortality of CPB adults in the ADMIRE plots resulted in fewer CPB egg masses.

RIMON applications did not have a significant impact on the number of small (1^{st}- 2^{nd} instar) CPB larvae observed (Table 3). This result was unexpected. Laboratory studies, however, have shown that RIMON does exhibit potent insecticidal activity against 1^{st} and 2^{nd} instar CPB.

There were significantly lower mean numbers of CPB large larvae (3^{rd} and 4^{th} instar) in the second application of RIMON at 25 g a.i./ha and 50 g a.i./ha (Table 4: 12-3 DAT, 15-5 DAT, 22-13 DAT, 29-20 DAT) and the first application of RIMON at 50 g a.i./ha (Table 4: 15-5 DAT, 22-13 DAT) as compared to the untreated control. The effect of RIMON on 3^{rd} and 4^{th} instar larvae is of particular importance as these larvae cause the largest amount of damage. Although comparable efficacy to ADMIRE was achieved with all three RIMON treatments (Table 4: 12-3 DAT, 15-5 DAT, 22-13 DAT), by the end of this experiment the second application treatments of RIMON 25g a.i./ha and 50 g a.i./ha had significantly fewer 3^{rd} and 4^{th} instar larvae when compared to both the untreated control and ADMIRE treatments (29-20 DAT). This suggests that the application of RIMON when 2^{nd} instar larvae become present is more effective than RIMON or ADMIRE applied when egg masses become present.

Table 1. Relative efficacy of RIMON 10EC and ADMIRE 240F for control of adult Colorado potato beetle (CPB) on potato (cv. Kennebec). RIMON 10EC treatments occurred when CPB egg masses (EM) or 2nd instar larvae (L2) were first observed. ADMIRE 240F was applied when CPB egg masses were first observed. Values within columns with different letters are significantly different from each other (Tukey-Kramer test, $P < 0.05$).

Treatment	Mean Number of Adult CPB/Plant (±SEM) at Indicated Days After Treatment*										
	1-0	3-0	5-0	7-0	8-0	10-1	12-3	15-5	22-13	29-20	36-27
Untreated control	0.60 (0.16)ab	0.70 (0.15)a	0.10 (0.06)a	0.25 (0.08)a	0.30 (0.09)a	0.05 (0.05)a	0.08 (0.08)a	0.06 (0.03)a	0.03 (0.03)ab	0.20 (0.10)a	4.68 (0.65)a
ADMIRE, 50 g a.i./ha	0.00 (0.0)b	0.08 (0.04)b	0.0	0.30 (0.26)a	0.0	0.0	0.0	0.15 (0.07)a	0.18 (0.07)b	0.00 (0.00)a	0.30 (0.07)c
RIMON, 12.5 g a.i./ha (EM)	0.60 (0.15)ab	0.60 (0.17)a	0.0	0.20 (0.09)a	0.0	0.0	0.0	0.10 (0.07)a	0.00 (0.00)a	0.03 (0.03)a	2.33 (0.43)b
RIMON, 12.5 g a.i./ha (L2)	0.50 (0.14)ab	0.0	0.18 (0.06)a	0.0	0.20 (0.08)a	0.03 (0.03)a	0.08 (0.04)a	0.15 (0.06)a	0.05 (0.03)ab	0.05 (0.03)a	0.75 (0.24)c
RIMON, 25 g a.i./ha (EM)	0.50 (0.10)ab	0.20 (0.10)ab	0.0	0.10 (0.05)a	0.0	0.0	0.0	0.10 (0.05)a	0.03 (0.03)ab	0.03 (0.03)a	1.33 (0.27)bc
RIMON, 25 g a.i./ha (L2)	0.30 (0.12)ab	0.0	0.15 (0.06)a	0.0	0.30 (0.10)a	0.10 (0.06)a	0.13 (0.06)a	0.10 (0.06)a	0.05 (0.03)ab	0.15 (0.08)a	0.48 (0.28)c
RIMON, 50 g a.i./ha (EM)	1.00 (0.22)a	0.50 (0.15)ab	0.0	0.10 (0.05)a	0.0	0.0	0.0	0.10 (0.06)a	0.08 (0.04)ab	0.00 (0.00)a	1.00 (0.22)bc
RIMON, 50 g a.i./ha (L2)	0.80 (0.18)a	0.0	0.35 (0.11)a	0.0	0.40 (0.11)a	0.05 (0.03)a	0.28 (0.12)a	0.08 (0.06)a	0.08 (0.04)ab	0.13 (0.05)a	0.10 (0.05)c

* Number before the hyphen refers to the number of days after the first RIMON treatment. Number after the hyphen refers to the number of days after the second RIMON treatment.

Table 2. Relative efficacy of RIMON 10EC and ADMIRE 240F for control of Colorado potato beetle (CPB) egg masses on potato (cv. Kennebec). RIMON 10EC treatments occurred when CPB egg masses (EM) or 2nd instar larvae (L2) were first observed. ADMIRE 240F was applied when CPB egg masses were first observed. Values within columns with different letters are significantly different from each other (Tukey-Kramer test, $P < 0.05$).

Treatment	Mean Number of CPB Egg Masses/Plant (±SEM) at Indicated Days After Treatment*										
	1-0	3-0	5-0	7-0	8-0	10-1	12-3	15-5	22-13	29-20	36-27
Untreated control	1.78 (032)a	1.40 (0.31)a	1.30 (0.24)a	0.80 (0.14)ab	0.48 (0.13)a	0.38 (0.11)a	0.42 (0.15)a	0.10 (0.04)a	0.00 (0.00)a	0.00 (0.00)a	0.05 (0.03)a
ADMIRE, 50 g a.i./ha	0.55 (0.15)b	0.50 (0.15)a	0.0	0.18 (0.07)b	0.0	0.0	0.0	0.28 (0.08)a	0.15 (0.07)a	0.20 (0.09)a	0.00 (0.00)a
RIMON, 12.5 g a.i./ha (EM)	0.83 (0.20)ab	1.35 (0.31)a	0.0	1.00 (0.25)ab	0.0	0.0	0.0	0.15 (0.10)a	0.03 (0.03)a	0.10 (0.05)a	0.00 (0.00)a
RIMON, 12.5 g a.i./ha (L2)	0.98 (0.24)ab	0.0	1.10 (0.25)a	0.0	0.58 (0.10)a	0.48 (0.16)a	0.60 (0.31)a	0.15 (0.07)a	0.18 (0.07)a	0.13 (0.07)a	0.03 (0.03)a
RIMON, 25 g a.i./ha (EM)	1.11 (0.31)ab	0.83 (0.21)a	0.0	1.18 (0.45)a	0.0	0.0	0.0	0.08 (0.04)a	0.00 (0.00)a	0.05 (0.03)a	0.03 (0.03)a
RIMON, 25 g a.i./ha (L2)	0.80 (0.17)ab	0.0	1.05 (0.23)a	0.0	0.80 (0.27)a	0.53 (0.12)a	0.23 (0.14)a	0.20 (0.10)a	0.08 (0.04)a	0.03 (0.03)a	0.13 (0.05)a
RIMON, 50 g a.i./ha (EM)	1.30 (0.23)ab	1.30 (0.23)a	0.0	1.03 (0.18)ab	0.0	0.0	0.0	0.13 (0.05)a	0.15 (0.06)a	0.03 (0.03)a	0.03 (0.03)a
RIMON, 50 g a.i./ha (L2)	0.80 (0.21)ab	0.0	1.35 (0.25)a	0.0	0.78 (0.18)a	0.35 (0.10)a	0.20 (0.08)a	0.08 (0.04)a	0.18 (0.09)a	0.05 (0.03)a	0.05 (0.03)a

* Number before the hyphen refers to the number of days after the first RIMON treatment. Number after the hyphen refers to the number of days after the second RIMON treatment.

Table 3. Relative efficacy of RIMON 10EC and ADMIRE 240F for control of Colorado potato beetle (CPB) 1st and 2nd instar larvae on potato (cv. Kennebec). RIMON 10EC treatments occurred when CPB egg masses (EM) or 2nd instar larvae (L2) were first observed. ADMIRE 240F was applied when CPB egg masses were first observed. Values within columns with different letters are significantly different from each other (Tukey-Kramer test, $P < 0.05$).

Treatment	Mean Number of CPB 1st and 2nd instar Larvae/Plant (±SEM) at Indicated Days After Treatment*										
	1-0	3-0	5-0	7-0	8-0	10-1	12-3	15-5	22-13	29-20	36-27
Untreated control	0.0	0.0	4.28 (1.63)a	9.88 (3.03)a	11.08 (2.86)a	16.53 (3.25)a	11.88 (2.26)a	10.42 (2.08)a	3.78 (1.34)ab	0.53 (0.19)a	0.25 (0.23)a
ADMIRE, 50 g a.i./ha	0.0	0.0	0.0	0.95 (0.62)b	0.0	0.0	0.0	4.28 (2.04)a	6.25 (1.75)b	2.50 (0.91)a	1.03 (0.39)a
RIMON, 12.5 g a.i./ha (EM)	0.0	0.0	0.0	5.38 (1.92)ab	0.0	0.0	0.0	8.18 (1.82)a	3.83 (1.29)ab	1.78 (0.92)a	0.87 (0.43)a
RIMON, 12.5 g a.i./ha (L2)	0.0	0.0	1.55 (0.83)a	0.0	10.20 (2.76)a	12.85 (2.65)a	8.00 (1.98)a	5.43 (1.29)a	2.78 (1.04)ab	1.30 (0.74)a	0.18 (0.10)a
RIMON, 25 g a.i./ha (EM)	0.0	0.0	0.0	7.53 (2.77)ab	0.0	0.0	0.0	8.10 (1.98)a	5.13 (1.55)ab	3.28 (1.05)a	1.10 (0.51)a
RIMON, 25 g a.i./ha (L2)	0.0	0.0	2.98 (1.40)a	0.0	10.95 (3.04)a	17.55 (4.17)a	8.13 (2.09)a	5.30 (1.45)a	0.70 (0.50)a	1.40 (0.66)a	0.20 (0.08)a
RIMON, 50 g a.i./ha (EM)	0.0	0.0	0.0	4.70 (1.51)ab	0.0	0.0	0.0	5.48 (2.41)a	2.98 (0.82)ab	3.93 (2.20)a	0.62 (0.25)a
RIMON, 50 g a.i./ha (L2)	0.0	0.0	3.95 (1.47)a	0.0	8.90 (2.35)a	15.10 (2.70)a	5.18 (1.57)a	4.13 (1.56)a	0.20 (0.08)a	1.05 (0.56)a	0.00 (0.00)a

* Number before the hyphen refers to the number of days after the first RIMON treatment. Number after the hyphen refers to the number of days after the second RIMON treatment.

Table 4. Relative efficacy of RIMON 10EC and ADMIRE 240F for control of Colorado potato beetle (CPB) 3rd and 4th instar larvae on potato (cv. Kennebec). RIMON 10EC treatments occurred when CPB egg masses (EM) or 2nd instar larvae (L2) were first observed. ADMIRE 240F was applied when CPB egg masses were first observed. Values within columns with different letters are significantly different from each other (Tukey-Kramer test, $P < 0.05$).

Treatment	Mean Number of CPB 3rd and 4th instar Larvae/Plant (±SEM) at Indicated Days After Treatment*										
	1-0	3-0	5-0	7-0	8-0	10-1	12-3	15-5	22-13	29-20	36-27
Untreated control	0.0	0.0	0.00 (0.00)a	0.0	0.03 (0.03)a	2.53 (1.04)a	7.32 (2.12)a	9.22 (1.81)a	13.68 (2.17)a	6.88 (1.75)a	0.85 (0.22)a
ADMIRE, 50 g a.i./ha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.98 (0.59)bc	1.30 (0.58)c	6.78 (1.34)a	1.90 (0.38)a
RIMON, 12.5 g a.i./ha (EM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.60 (1.53)ab	10.38 (2.10)ab	8.00 (1.63)a	0.93 (0.29)a
RIMON, 12.5 g a.i./ha (L2)	0.0	0.0	0.00 (0.00)a	0.0	0.00 (0.00)a	1.10 (0.64)a	1.08 (0.41)b	1.18 (0.39)c	3.70 (0.75)c	4.75 (1.44)abc	1.75 (0.50)a
RIMON, 25 g a.i./ha (EM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.10 (1.55)abc	5.75 (1.15)cb	6.30 (1.44)ab	3.53 (0.59)a
RIMON, 25 g a.i./ha (L2)	0.0	0.0	0.48 (0.45)a	0.0	0.58 (0.55)a	0.28 (0.11)a	0.38 (0.17)b	1.05 (0.52)c	2.78 (1.05)c	0.98 (0.37)bc	0.92 (0.34)a
RIMON, 50 g a.i./ha (EM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.20 (0.93)bc	4.60 (1.00)c	6.33 (1.46)ab	2.45 (0.69)a
RIMON, 50 g a.i./ha (L2)	0.0	0.0	0.05 (0.03)a	0.0	0.08 (0.04)a	1.80 (1.17)a	0.10 (0.06)b	0.18 (0.13)c	0.68 (0.17)c	0.55 (0.18)c	0.78 (0.34)a

* Number before the hyphen refers to the number of days after the first RIMON treatment. Number after the hyphen refers to the number of days after the second RIMON treatment.

2003 PMR REPORT # 27 **SECTION C : POTATOES - Insect Pests**
STUDY DATA BASE: 160.3

CROP: Potato (*Solanum tuberosum*), cv. Kennebec
PEST: Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say)
Potato leafhopper (PLH), *Empoasca fabae* (Harris)

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TITLE: EVALUATION OF PLANTING TREATMENTS FOR CONTROL OF INSECT PESTS OF POTATO ON MINERAL SOIL, 2003

MATERIALS: ADMIRE 240 F (imidacloprid 240 g/L), TI-435 600 F (clothianidin 600 g/L)

METHODS: Using a hand-operated mist-applicator, seed treatments (Tmts. 1, 2, 5) were uniformly applied in 1.15 L/100 kg seed on 15 May to chitted B-size whole seed potatoes contained in a 50 lb clear plastic bag. The bag was then closed and seed tumbled for 2 minutes to ensure even coating of all seed potatoes. Treated seed potatoes were allowed to dry and stored in vented, plastic tubs until planting. All treated seed potatoes were planted on the SCPFRC-London Research Farm on 20 May in single-row (10 plants/row) microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free mineral soil. All treatments were replicated 3 times in a randomized complete block design. To supplement scanty rainfall, microplots received 10-15 mm water via sprinkler-irrigation on 4 and 18 July and 1 August. IFS-treatments (Tmts. 3, 6-8) were applied on 21 May in a 10-12 cm band over the seed potatoes in the bottom of the seed furrow at 175 kPa in 5 L/100 m row using a hand-held, CO_2-pressurized, R&D plot sprayer with a single 4004E flat spray tip. Once growing plants had developed at least 2 tri-foliate leaves, residual effectiveness of all treatments against both adult and larval insecticide-susceptible, laboratory-reared CPB was measured by bioassay. On each collection date (Tables 1-4) a total of 6 leaves was harvested from each plot of each treatment and returned to the laboratory. A total of 9 adult-bioassays (3 bioassays/plot x 3 plots/tmt.), each containing 1 tri-foliate leaflet and 5 CPB adults, and 9 larval-bioassays (3 bioassays/plot x 3 plots/tmt.), each containing a 12.0 cm^2 leaf disc and 5 first instar larvae, was then established for each treatment. Bioassays were held at 25°C, 55% RH, and 16:8 L:D photoperiod. For each set of bioassays, mortality and leaf damage were recorded after 72 hrs. Mortality was corrected using Abbott's factor and subjected to arcsin square root transformation prior to statistical analysis by analysis of variance (ANOVA). Tukey's (HSD) Comparison was then used to estimate significance of differences among treatment means. Untransformed data are presented in the tables. Adult-feeding damage was rated using a 0-10 scale where 0.0 represents no feeding damage, 5.0 represents 50% loss of leaf area, 10.0 represents 100% consumption of the leaf. Larval feeding damage was measured directly. Areas of leaf discs remaining after 72 hrs were read directly using a LI-COR® portable leaf-area meter; larval-leaf consumption was calculated by subtracting the disc-area at the end of each bioassay from the area of standard leaf discs collected at the beginning of each bioassay and held under the same conditions as the bioassays.

On 15 August, a total of 10 randomly selected, terminal leaflets in each plot were rated for PLH damage on a 0 - 2 scale assigned as follows: 0 - no symptoms of PLH feeding; 1 - leaf-curling only; 2 - leaf-curling + necrosis and/or brown leaf margins around at least part of the leaflet. A Cumulative PLH-Rating was then calculated for each plot by summing individual leaf-ratings for that plot. Significance of observed differences in leaf consumption (CPB) and leaf damage (PLH) among treatments was determined using ANOVA and Tukey's (HSD) Comparison.

RESULTS: No phytotoxicity was noted following any treatment. At the time of the first bioassay, 27 days after treatment (DAT), all adult CPB died after feeding for 72 h on foliage from potatoes

treated with TI-435 (Table 1). There were no significant differences among any treatment with ADMIRE for adult mortality following consumption of potato foliage; mortality in all treatments exceeded 55% on that date (Table 1). By 48 DAT no treatment caused more than 40% mortality of adult CPB in bioassay (Table 1). All treatments significantly reduced feeding damage by adult CPB as long as 69 DAT (Table 2). As long as 91 DAT, all seed treatments and the higher rate of IFS application of ADMIRE significantly reduced feeding by adult CPB (Table 2).

Due to relatively slow plant growth, leaves were not large enough for larval bioassay until 34 DAT. There were no significant differences in larval mortality among treatments 34 DAT; on that date at least 70% of first instar larvae died within 72 h after feeding on foliage from all treatments (Table 3). As long as 62 DAT larval mortality approached 50% in bioassay of leaves from potatoes growing from seed treated with TI-435 (Table 3). In this trial, even though high larval mortality was not seen in bioassay beyond 34 DAT, significantly less leaf area was consumed in bioassay of all treatments as long as 48 DAT (Table 4). By 62 DAT, significant hopperburn was observed in CONTROL plots as due to feeding by PLH. Leaf discs harvested from CONTROL plots were less palatable to first instar larvae in bioassay and less feeding was observed; approximately 60% less leaf area was consumed in CONTROL bioassays 62 DAT than 48 DAT (Table 4). Beyond 62 DAT, due to varying quality of harvested potato leaves, no treatment had a significant impact on leaf consumption by CPB larvae in bioassay (Table 4).

Although differences were not statistically significant in this trial, trends for ADMIRE were observed as follow: for adult CPB, the higher rate proved equal or superior to the lower rate for 6 of 10 comparisons of ST application and 9 of 10 comparisons of IFS application; for CPB larvae, the higher rate was equal or better than the lower rate for 4 of 7 comparisons of ST application and 7 of 7 comparisons of IFS application. If average damage ratings for the 2 rates of ST and IFS application were calculated for adult CPB, ST application proved equal or better than IFS application for 8 of 10 sampling dates. If feeding consumption was similarly compared for CPB larvae, ST application proved equal or superior to IFS application on 5 of 7 sampling dates. Clothianidin ST (Tmt. 5) generally provided somewhat better protection of potato foliage than an equivalent rate of ST application of imidacloprid (Tmt. 1).

When plots were rated for PLH damage 86 DAT, leaves in CONTROL plots and plots receiving the lower IFS application of ADMIRE (Tmt. 3) were heavily damaged with significant leaf death. On that date, significantly less hopperburn was recorded in plots planted with seed potatoes treated with the lower rate of ADMIRE (Tmt. 1) or with TI-435 (Table 5). Leaves from potatoes treated with TI-435 were only slightly curled with no necrosis (Table 5) and suffered relatively moderate feeding damage when exposed to CPB adults (Table 2) or larvae (Table 4) in bioassay.

CONCLUSIONS: Under the conditions of this trial sufficient systemic residues of all planting treatments remained in potato foliage to significantly reduce feeding by both adult and larval CPB several weeks beyond the period that those residues caused significant mortality of introduced insects. Although observed differences were not always statistically significant, the higher rate of application of both ST and IFS application of ADMIRE appeared to more effectively reduce feeding damage by both adult and larval CPB than did the lower rate of application. Similarly ST application of ADMIRE appeared to provide slightly better protection of CPB foliage than IFS application. ST application of clothianidin appeared to provide superior protection of potato foliage from feeding adult or larval CPB than a slightly higher rate of imidacloprid. ST application of clothianidin effectively protected potato foliage from PLH feeding for the duration of this experiment.

Table 1. Effect of treated potato foliage on mortality of Colorado potato beetle (CPB) adults after feeding for 72 hours in bioassay, planting treatments, London, ON, 2003.

Tmt. No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Average % Corrected CPB Mortality on Indicated DAT[3]				
					27	34	41	48	55
1	imidacloprid	ADMIRE 240 F	ST	39.0 ml/100 kg seed	59.1 a[2]	40.6 a	10.4 a	19.2 a	41.4 a
2	imidacloprid	ADMIRE 240 F	ST	52.0 ml/100 kg seed	59.1 a	54.5 ab	50.3 bc	21.5 a	23.0 a
3	imidacloprid	ADMIRE 240 F	IFS	7.5 ml/100 m row	59.1 a	33.4 a	14.9 ab	8.1 a	14.7 a
4	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	72.7 a	53.5 ab	19.4 ab	17.2 a	14.7 a
5	clothianidin	TI-435 600 F	ST	12.0 ml/100 kg seed	100.0 b	79.1 b	61.6 c	39.4 a	32.3 a

Tmt. No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Average % Corrected CPB Mortality on Indicated DAT[3]				
					62	69	77	83	91
1	imidacloprid	ADMIRE 240 F	ST	39.0 ml/100 kg seed	56.3 a[2]	27.0 ab	18.6 a	17.8 a	27.4 a
2	imidacloprid	ADMIRE 240 F	ST	52.0 ml/100 kg seed	51.2 a	23.8 ab	9.0 a	33.9 a	16.2 a
3	imidacloprid	ADMIRE 240 F	IFS	7.5 ml/100 m row	26.1 a	12.7 a	15.4 a	11.4 a	10.3 a
4	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	31.3 a	49.2 b	10.8 a	35.3 a	18.0 a
5	clothianidin	TI-435 600 F	ST	12.0 ml/100 kg seed	61.0 a	45.2 ab	15.1 a	8.3 a	23.1 a

[1] ST - seed treatment; IFS - in furrow spray
[2] Means within an indicated DAT followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Tukey's (HSD) Comparison.
[3] Days after Treatment.

Table 2. Effect of treated potato foliage on feeding damage by Colorado potato beetle (CPB) adults after 72 hours in bioassay, planting treatments, London, ON, 2003.

Tmt. No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Average Feeding Damage Rating[4] on Indicated DAT[5]				
					27	34	41	48	55
1	imidacloprid	ADMIRE 240 F	ST	39.0 ml/100 kg seed	0.6 a[3]	0.6 a	1.2 ab	1.1 a	2.2 ab
2	imidacloprid	ADMIRE 240 F	ST	52.0 ml/100 kg seed	0.5 a	0.9 a	0.6 a	1.5 a	1.3 a
3	imidacloprid	ADMIRE 240 F	IFS	7.5 ml/100 m row	0.5 a	1.0 a	2.3 b	1.1 a	3.9 b
4	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	0.5 a	0.8 a	1.4 ab	1.6 a	2.7 ab
5	clothianidin	TI-435 600 F	ST	12.0 ml/100 kg seed	0.5 a	0.6 a	1.1 ab	1.7 a	2.2 ab
6	CONTROL	No Insecticide	-----[2]	-----	5.5 b	5.3 b	6.8 c	5.9 b	7.2 c

Tmt. No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Average Feeding Damage Rating[4] on Indicated DAT[5]				
					62	69	77	83	91
1	imidacloprid	ADMIRE 240 F	ST	39.0 ml/100 kg seed	2.7 a[3]	2.4 a	2.9 a	1.6 a	1.8 a
2	imidacloprid	ADMIRE 240 F	ST	52.0 ml/100 kg seed	1.9 a	1.6 a	3.2 a	3.2 a	1.3 a
3	imidacloprid	ADMIRE 240 F	IFS	7.5 ml/100 m row	2.9 a	2.9 a	4.2 ab	2.2 a	4.5 bc
4	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	2.9 a	1.1 a	3.2 a	1.9 a	2.0 ab
5	clothianidin	TI-435 600 F	ST	12.0 ml/100 kg seed	0.8 a	2.3 a	3.1 a	3.5 a	1.1 a
6	CONTROL	No Insecticide	-----[2]	-----	7.2 b	7.2 b	7.3 b	4.8 a	5.3 c

[1] ST - seed treatment; IFS - in furrow spray. [2] No insecticide applied. [3] Means within an indicated DAT followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Tukey's (HSD) Comparison. [4] Actual 72-hour leaf damage rating (0-10 scale where 0.0 represents no feeding damage, 5.0 represents 50% loss of leaf area, 10.0 represents 100% consumption of the leaf).
[5] Days after Treatment.

Table 3. Effect of treated potato foliage on mortality of first instar Colorado potato beetle (CPB) larvae after feeding for 72 hours in bioassay, planting treatments, London, ON, 2003.

Tmt. No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Average % Corrected CPB Mortality on Indicated DAT[3]				
					34	41	48	62	71
1	imidacloprid	ADMIRE 240 F	ST	39.0 ml/100 kg seed	70.3 a[2]	24.4 a	2.9 a	21.4 ab	28.9 a
2	imidacloprid	ADMIRE 240 F	ST	52.0 ml/100 kg seed	100.0 a	46.7 a	18.7 a	11.9 a	20.0 a
3	imidacloprid	ADMIRE 240 F	IFS	7.5 ml/100 m row	74.4 a	22.2 a	2.5 a	22.2 ab	4.4 a
4	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	81.9 a	42.2 a	15.9 a	1.6 a	6.7 a
5	clothianidin	TI-435 600 F	ST	12.0 ml/100 kg seed	84.3 a	40.0 a	57.5 b	46.0 b	35.0 a

Tmt. No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Average % Corrected CPB Mortality on Indicated DAT[3]	
					77	83
1	imidacloprid	ADMIRE 240 F	ST	39.0 ml/100 kg seed	8.6 a[2]	1.6 a
2	imidacloprid	ADMIRE 240 F	ST	52.0 ml/100 kg seed	6.0 a	9.5 a
3	imidacloprid	ADMIRE 240 F	IFS	7.5 ml/100 m row	6.0 a	7.9 a
4	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	3.4 a	29.4 a
5	clothianidin	TI-435 600 F	ST	12.0 ml/100 kg seed	2.9 a	29.5 a

[1] ST - seed treatment; IFS - in furrow spray

[2] Means within a given DAT followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Tukey's (HSD) Comparison.

[3] Days after Treatment.

Table 4. Effect of treated potato foliage on feeding damage by first instar Colorado potato beetle (CPB) larvae after 72 hours in bioassay, planting treatments, London, ON, 2003.

Tmt. No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Average Leaf Area Consumed[4] (cm^2) on Indicated DAT[5]				
					34	41	48	62	71
1	imidacloprid	ADMIRE 240 F	ST	39.0 ml/100 kg seed	1.4 a[3]	6.5 b	2.8 a	5.6 b	2.4 a
2	imidacloprid	ADMIRE 240 F	ST	52.0 ml/100 kg seed	0.1 a	0.3 a	1.2 a	6.2 b	3.0 a
3	imidacloprid	ADMIRE 240 F	IFS	7.5 ml/100 m row	1.4 a	3.8 ab	2.8 a	7.2 b	3.2 a
4	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	0.5 a	1.5 a	1.8 a	6.3 b	3.2 a
5	clothianidin	TI-435 600 F	ST	12.0 ml/100 kg seed	1.0 a	1.5 a	1.0 a	2.1 a	2.1 a
6	CONTROL	No Insecticide	-----[2]	-----	5.5 b	6.2 b	7.6 b	3.0 a	4.1 a

Tmt. No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Average Leaf Area Consumed[4] (cm^2) on Indicated DAT[5]	
					77	83
1	imidacloprid	ADMIRE 240 F	ST	39.0 ml/100 kg seed	3.9 a[3]	2.6 c
2	imidacloprid	ADMIRE 240 F	ST	52.0 ml/100 kg seed	4.0 a	2.4 bc
3	imidacloprid	ADMIRE 240 F	IFS	7.5 ml/100 m row	5.5 a	1.9
4	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	4.7 a	0.6 a
5	clothianidin	TI-435 600 F	ST	12.0 ml/100 kg seed	3.9 a	0.9 ab
6	CONTROL	No Insecticide	-----[2]	-----	4.0 a	0.9 ab

[1] ST - seed treatment; IFS - in furrow spray. [2] No insecticide applied.
[3] Means within a given DAT followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Tukey's (HSD) Comparison.
[4] Actual area (cm^2) of leaf-disc consumed during 72 hour feeding period.
[5] Days after Treatment.

Table 5. Impact of planting treatments on damage to potato foliage by the potato leafhopper, *Empoasca fabae*, London, ON, 2003.

Tmt No.	Treatment Applied	Formulation Applied	Timing[1]	Rate Applied (product)	Mean Cumulative PLH-Rating[2]
1	imidacloprid	ADMIRE 240 F	ST	39.0 ml/100 kg seed	13.3 ab[3]
2	imidacloprid	ADMIRE 240 F	ST	52.0 ml/100 kg seed	15.0 bc
3	imidacloprid	ADMIRE 240 F	IFS	7.5 ml/100 m row	19.3 c
4	imidacloprid	ADMIRE 240 F	IFS	12.0 ml/100 m row	17.0 bc
5	clothianidin	TI-435 600 F	ST	12.0 ml/100 kg seed	8.7 a
6	CONTROL	No Insecticide	-----[4]	-----	20.0 c

[1] ST - seed treatment; IFS - in furrow spray
[2] 0 - 2 scale assigned as follows: 0 = no symptoms of PLH feeding; 1 = leaf-curling only; 2 = leaf-curling + necrosis and/or brown leaf margins around at least part of the leaflet. Cumulative rating is sum of ratings for all 10 leaves selected from each plot.
[3] Means within a column followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and Tukey's (HSD) Comparison.
[4] No insecticide applied.

2003 PMR REPORT # 28 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR : 61006537

CROP: Barley, (*Hordeum vulgare* L.), cv CDC Dolly
PEST: Wireworm, (Elateridae, spp)

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TITLE: CONTROL OF WIREWORM IN BARLEY WITH SEED TREATMENTS

MATERIALS: RAXIL (tebuconazole, 250 g ai/L); GAUCHO 480 FS (imidacloprid, 480 g ai/L); PONCHO 600 FS (clothianidin, 600 g ai/L);

METHODS: Treated seed was supplied by Gustafsom on 28 April, 2003. The barley was planted on 13 May, 2003 at Rodney, ON, using a two-row cone-seeder mounted on a John Deere Max Emerge planter at a seeding rate of 75 seeds/m. Plots were single rows spaced 0.76 m apart and 6 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Emergence counts were recorded on 27 May, 2003. Plant stand was determined on 3 June, 2003. The total number of plants and the number of damaged plants per metre in the check plots was recorded on 3 June, 2003. Wireworm populations were estimated by digging up 1 m of row in a trench 15.2 cm deep and 10.16 cm wide in the check plots, sifting the soil and separating out the wireworms. Vigor, using a scale of 0-100 (100= most advanced plants and 0 = plants dead) was recorded on 10 June, 2003. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1 and 2. Plots were not harvested.

CONCLUSIONS: Although wireworms were present in the trial, there was insufficient wireworm activity to result in significant treatment effects.

Table 1. Emergence, plant stand and vigor assessments in barley at Rodney, Ontario. 2003

Treatment	Rate	Emergence	Plant Stand	Vigor
	g ai/100 kg	Number plants/row		0-100 %
		38133	38140	37781
RAXIL	1.5	469	480	80
RAXIL	1.5	432	425	82.5
+GAUCHO 480	5			
RAXIL	1.5	465	462	90
+GAUCHO 480	10			
RAXIL	1.5	456	435	80
+PONCHO 600	5.1			
RAXIL	1.5	453	467	77.5
+PONCHO 600	10			
CV		5.6	12.1	16.8

Table 2. Plant damage and wireworm counts in barley check plots at Rodney, Ontario. 2003

Treatment	Plant Stand	Plant Damage	Wireworms
		Number per metre June 3	
RAXIL	78	10	7
RAXIL	101	5	1
RAXIL	90	0	0
RAXIL	70	1	3
Average	85	4	3

2003 PMR REPORT # 29 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Corn, (*Zea maize* L.), cv D73
PEST: Corn flea beetle (*Chaetocnema pulicaria*, Melsheimer)

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TITLE: CONTROL OF CORN FLEA BEETLE IN CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (fludioxonil + metalaxyl-M, 229.59 + 87.66 g ai/L); CRUISER 5 FS (thiamethoxam, 5 g ai/L); CRUISER 350 FS (thiamethoxam, 350 g ai/L); GAUCHO 480 FS (imidacloprid, 350 g ai/L); PONCHO 600 FL (clothianidin, 600 g ai/L).

METHODS: Seed was treated on 2 May, 2003 in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 6.0 ml per kg) of the material via a syringe to each inflated bag. The seed was then mixed for 1 minute in an inflated bag to ensure thorough seed coverage. Seed weight was 275 g/1000 seeds. Corn was planted on 30 May and 3 June, 2003 at Ridgetown and Wallacetown, ON respectively using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were four rows 4 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications at a seeding rate of 7 seeds/m. Plant emergence was assessed on 16 and 17 June, 2003 at Ridgetown and Wallacetown, respectively. Plant stand was recorded on 23 June and 2 July, 2003 at Ridgetown and on 24 June and 2 July, 2003 at Wallacetown. Vigour rating was assessed on 16 and 23 June, 2003 at Ridgetown and on 17 and 24 June, 2003 at Wallacetown, using a scale of 0-100% (100 = most advance plant and 0 = dead plants). Plots were monitored for presence of flea beetles. Plots were not harvested at Wallacetown location. Plots were harvested on 21 and 25 Nov, 2003 at Ridgetown and Wallacetown, respectively, and yields corrected to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-3. No insect damage was evident in this experiment.

CONCLUSIONS: CRUISER 350, PONCHO and CRUISER 5 FS at the mid and high rates, significantly improved plant stand and seedling plant vigour. Some interesting increases in yield were observed with all materials in the absence of insect activity.

Table 1. Emergence, plant stand and vigour assessments of corn at Ridgetown, Ontario. 2003

Treatment	Rate	Emergence	Plant Stand		Vigour	
	g ai/100 kg	Number of plants in 3m			0-100 %	
	or mg ai/seed**	37787	37794	37803	37787	37794
FUNGICIDE CHECK	3.5	124 bc *	123 b	124 b	77.5	80.0 abc
MAXIM XL	3.5	127 bc	128 b	127 ab	80	92.5 a
+CRUISER 5 FS	25					
MAXIM XL	3.5	132 a	134 a	133 a	95	82.5 ab
+CRUISER 5 FS	50					
MAXIM XL	3.5	123 c	122 b	122 b	82.5	67.5 c
+CRUISER 5 FS	100					
MAXIM XL	3.5	129 ab	125 b	127 ab	80	77.5 bc
+GAUCHO 480 FS	256					
MAXIM XL	3.5	127 bc	126 b	126 b	80	92.5 a
+PONCHO 600 FL	0.25 **					
MAXIM XL	3.5	128 ab	125 b	127 b	85	75.0 bc
+CRUISER 350 FS	100					
CV		2.4	2.2	2.9	12.1	12.4

* Means followed by same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed.

Table 2. Plant stand and vigour assessments of corn at Wallacetown, Ontario. 2003

Treatment	Rate	Emergence	Plant Stand		Vigour	
	g ai/100 kg	Number plants/3m			0-10 %	
	or mg ai/seed**	37788	37795	37803	37788	37795
FUNGICIDE CHECK	3.5	112 b *	118 b	123 d	67.5 c	77.5
MAXIM XL	3.5	126 a	127 a	124 cd	87.5 ab	92.5
+CRUISER 5 FS	25					
MAXIM XL	3.5	130 a	127 a	130 abc	85.0 ab	87.5
+CRUISER 5 FS	50					
MAXIM XL	3.5	132 a	133 a	135 a	85.0 ab	90
+CRUISER 5 FS	100					
MAXIM XL	3.5	126 a	129 a	128 bcd	77.5 bc	82.5
+GAUCHO 480 FS	256					
MAXIM XL	3.5	129 a	131 a	131 ab	85.0 ab	90
+PONCHO 600 FL	0.25 **					
MAXIM XL	3.5	131 a	130 a	130 abc	92.5 a	92.5
+CRUISER 350 FS	100					
CV		3.4	3.8	3.5	11.6	7.9

* Means followed by same letter do not significantly differ (P=0.05, LSD), data was not transformed. All other data was homogeneous and not transformed.

Table 3. Test weights and yields in corn at Ridgetown and Wallacetown, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/ seed *	Test Weight kg/hl		Yield T/ha	
		Ridgetown	Wallacetown	Ridgetown	Wallacetown
FUNGICIDE CHECK	3.5	68.24	60.05	9.8 c **	5.8
MAXIM XL	3.5	68.54	59.54	10.8 ab	8.8
+CRUISER 5 FS	25				
MAXIM XL	3.5	68.38	61.67	10.4 abc	6.3
+CRUISER 5 FS	50				
MAXIM XL	3.5	67.7	61.2	9.9 bc	6.3
+CRUISER 5 FS	100				
MAXIM XL	3.5	68.89	59.28	11.2 a	6
+GAUCHO 480 FS	256				
MAXIM XL	3.5	68.63	60.42	10.7 abc	5.9
+PONCHO 600 FL	0.25 *				
MAXIM XL	3.5	69.04	60.19	10.9 a	5.8
+CRUISER 350 FS	100				
CV		1.1	2.1	6.3	25.2

** Means followed by same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed.

2003 PMR REPORT # 30 SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects
ICAR : 61006537

CROP: Corn, (*Zea maize* L.), cv Climax
PEST: Wireworm, (Elateridae, spp)

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TITLE: CONTROL OF WIREWORM IN SWEET CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (fludioxonil + metalaxyl-M, 2.5 + 0.96 g ai/L); PONCHO 600 FS (clothianidin, 600 g ai/L); GAUCHO 480 FL (imidacloprid, 480 g ai/L); L1282-A1 (exp); L1283-A1 (exp); AGROX DL Plus (captan + diazinon + lindane, 30 + 30 + 50 g ai/Kg).

METHODS: Seed was treated on 2 May, 2003 in 1 kg lots in individual plastic bags by applying a slurry of material via a syringe to each bag (all treatments diluted in water to the same volume of 5.0 ml per kg). The seed was then mixed in the inflated bag for 1 min to ensure thorough seed coverage. Seed weight was 190 g/1000 seeds. The corn was planted on 13 May, 2003 at Rodney, ON using a two-row cone-seeder mounted on a John Deere Max Emerge planter at a seeding rate of 8 seeds/m. Plots were single rows spaced 0.76 m apart and 6 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant emergence was determined on 3 June, 2003. Plant stand was determined on 10, 17, 24 June and 2 July, 2003. Vigour ratings were recorded on the same dates using a scale of 0-100 % (100 = furthest developed plant and 0= dead plants). Wireworm populations were estimated on in the check plots on 3 June, 2003 by digging up 1 m of row in a trench 15 cm deep and 10 cm wide in the check plots, sifting the soil and separating out the wireworms. Plots were hand harvested on 13 August, 2003 and the number of cobs per plot and total cob weight recorded. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-3. The average number of wireworms recovered from the check plots was 2.0/m. Based on our experience, wireworms are more or less uniformly distributed throughout areas similar in size to the plot area of this experiment. Since the wireworms were randomly dispersed throughout, the population in the checks sampled constitutes a reasonable estimate of the population throughout the trial area. The recovery of wireworms varies with time and soil temperature because they migrate vertically in the soil so assessment population estimates are difficult to make. We advise producers that if wireworms are easily found in the soil, a threshold level has usually been reached.

CONCLUSIONS: Wireworms at 3 larva/m constitutes a moderate infestation and would probably cause economic loss. Emergence was significantly higher in the treated plots.

Table 1. Emergence and plant stand assessments in sweet corn at Rodney, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/seed*	Emergence	Plant Stand Number plants/row			
		37774	37781	37788	37795	37803
MAXIM XL CHECK	3.5	78	77 b **	78 c	80 c	74 c
MAXIM XL +PONCHO 600	3.5 0.25 *	87	93 a	92 a	96 a	94 a
MAXIM XL +GAUCHO 480	3.5 0.16*	85	89 a	87 ab	89 ab	85 b
MAXIM XL +L1282-A1	3.5 0.23*	87	92 a	85 b	91 ab	85 b
MAXIM XL L1283-A1	3.5 0.146*	89	92 a	92 a	90 ab	86 ab
MAXIM XL +AGROX DL Plus	3.511	81	87 a	83 bc	88 b	86 ab
CV		6	6.1	4.7	5.5	6.2

**Means of transformed data followed by same letter do not significantly differ (P=0.05, LSD), data transformed by arcsine square root for means separation and CV, means de-transformed.
All other data homogeneous and not transformed.

Table 2. Vigour assessments in sweet corn at Rodney, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/seed*	Vigour 0-100%				
		37774	37781	37788	37795	37803
MAXIM XL CHECK	3.5	67.5	67.4**	67.5	60.0 c ***	62.5 c
MAXIM XL +PONCHO 600	3.5 0.25*	82.5	90.0	90.0	97.5 a	97.5 a
MAXIM XL +GAUCHO 480	3.5 0.16*	72.5	77.4	80.0	72.5 bc	72.5 bc
MAXIM XL +L1282-A1	3.5 0.23*	90	88	87.5	75.0 b	72.5 bc
MAXIM XL +L1283-A1	3.5 0.146*	87.5	87.4	90.0	85.0 ab	82.5 ab
MAXIM XL +AGROX DL Plus	3.511	80	81.8	85	82.5 b	87.5 ab
CV		15.1	3.1	12.7	12.6	13.5

**Means of transformed data followed by same letter do not significantly differ (P=0.05, LSD), data transformed by log for means separation and CV, means de-transformed.
****Means of transformed data followed by same letter do not significantly differ (P=0.05, LSD), data transformed by arcsine square root for means separation and CV, means de-transformed
All other data homogeneous and not transformed.

Table 3. Hand harvest assessments in sweet corn at Rodney, Ontario. August 13, 2003

Treatment	Rate	Yield		
	g ai/100 kg or mg ai/seed	Cobs/plot	Average Cob Wt grams	Total Plot Wt kg
MAXIM XL CHECK	3.5	54 c **	81***	4.59
MAXIM XL +PONCHO 600	3.5 0.25*	64 ab	99	6.48
MAXIM XL +GAUCHO 480	3.5 0.16*	65 ab	92	6.26
MAXIM XL +L1282-A1	3.5 0.23*	69 a	96	6.67
MAXIM XL +L1283-A1	3.5 0.146*	67 ab	90	5.91
MAXIM XL +AGROX DL Plus	3.511	60 bc	94	5.53
CV		7.9	21.2	20.9

**Means followed by same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed.
***Data transformed using arcsine square root for means separation and CV, means de-transformed. All other data homogeneous and not transformed.

2003 PMR REPORT # 31 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Corn, (*Zea maize* L.), cv DKC 46-26 Isoline, DKC 46-23 Transgenic
PEST: Western corn rootworm, *Diabrotica virgifera virgifera* LeConte

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TITLE: CONTROL OF CORN ROOTWORM IN CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (fludioxonil + metalaxyl-M, 2.5 + 0.96 g ai/L); PONCHO 600 FS (clothianidin 600 g ai/L); GAUCHO 480 FL (480 g ai/L); FORCE 3G (tefluthrin 3%); COUNTER 15 G (terbufos, 7.5 kg/ha); YIELDGARD - Rootworm CRY 3B61.

METHODS: Seed was treated on 5 May, 2003 in 1 kg lots in individual plastic bags by applying a slurry of the material via syringe to each bag (all treatments diluted to a total volume of 12.0 ml/kg using water). The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. All seed was treated first with MAXIM XL. Seed weight for DKC 46-26 and DKC 46-23 was 316 and 295 g/1000 seeds, respectively. Inoculations with corn rootworm eggs were made only at the Ridgetown College site prior to planting using a two-row cultivator modified to apply a 4 cm band of eggs, 5 cm deep and 9 cm on each side of the corn row. Eggs were suspended uniformly in a 0.15% agar solution at a concentration of 30 eggs/ml and delivered through tubes from a holding tank at a rate of 2000 eggs/m/row by a ground driven metering pump (Demco model MP-466). Corn was planted in 1 row plots on 22 May, 2003 at a Ridgetown off-campus site, with a natural infestation from a high beetle count the previous year, and on 30 May, 2003 at a Ridgetown on campus site, using a two-row cone-seeder at a seeding rate of 8 seeds/m. FORCE 3G and COUNTER 15 G were applied in-furrow at planting using a Noble® plot scale applicator. Plots were spaced 0.76 m apart and were 10 m long in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant emergence was assessed on 17 and 11 June at the on-campus and off-campus sites, respectively. Vigour was recorded on the same dates using a scale of 0-100% (100= furthest developed plant and 0 = dead plants). Plant stand was assessed on 24 June and 2 July at the on-campus site and on 18 and 25 June at the off-campus site. Plant lodging was assessed as no. plants per plot leaning greater than 30^{o} from vertical on 7 and 8 Aug at both the on and off-campus sites, respectively. Root damage was assessed on 8 and 11 Aug at the on and off-campus sites, respectively, by digging up five plants per plot, washing roots and rating them using the Iowa 0-6 scale where 0= no damage and 6= 3 or more nodes severely pruned. Plots were harvested on 4 Nov and 31Oct, 2003 at the on and off-campus sites, respectively and yields converted to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-3.

CONCLUSIONS: Seedling vigour and plant stand were not affected by any of the treatments. Rootworm damage was similar and well above the economic threshold of 3.0 at both locations. All treatments with the exception of GAUCHO and PONCHO low rate consistently reduced root damage ratings. PONCHO high rate was not significantly different from FORCE or COUNTER. YIELDGARD had the lowest numerical ratings for root damage over all.

Table 1. Crop tolerance and vigour at Ridgetown, Ontario. 2003

Treatment	Insecticide	Rate	Average Plant Stand		Average Vigour	
		g ai/100 kg	Number per plot		0 - 100 %	
			Ridgetown College Inoculated	Wolter Farm Natural	Ridgetown College Inoculated	Wolter Farm Natural
Isoline **	Check		76	76	80	77.5
Transgenic **	Check		78	79	90	75
Isoline	PONCHO ST	Low *	80	78	85	90
Isoline	PONCHO ST	High	80	78	85	77.5
Isoline	GAUCHO ST	Low	79	79	80	85
Isoline	GAUCHO ST	High	78	78	87.5	85
Isoline	COUNTER IF	Normal	77	78	90	80
Isoline	FORCE IF	Normal	76	77	90	77.5
CV			2.9	2.9	9.6	15.1

*PONCHO ST low rate - 0.25 mg ai/seed
GAUCHO ST low rate - 0.16 mg ai/seed
GAUCHO ST high rate - 0.6 mg ai/seed
FORCE IF - 1.13 g ai/100 m row in-furrow
**DKC 46-26 Isoline
**DKC 46-23 YIELDGARD rootworm transgenic

Table 2. Insect damage and lodging at Ridgetown, Ontario. 2003

Treatment	Insecticide	Rate	Insect Damage		Lodging	
		g ai/100 kg	Iowa Scale 0-6		Number plants per plot	
			Ridgetown College Inoculated	Wolter Farm Natural	Ridgetown College Inoculated	Wolter Farm Natural
Isoline **	Check		3.8 a ***	4.4 a ***	12.3	1
Transgenic **	Check		0.01 c	0.01 d	5.8	0.5
Isoline	PONCHO ST	Low *	1.71 b	2.6 b	3	0.5
Isoline	PONCHO ST	High	0.17 c	0.69 c	2.3	0
Isoline	GAUCHO ST	Low	4.0 a	2.12 b	4	0.3
Isoline	GAUCHO ST	High	1.68 b	1.81 b	7.5	0.8
Isoline	COUNTER IF	Normal	0.04 c	0.40 c	3.5	0.8
Isoline	FORCE IF	Normal	0.01 c	0.32 c	4.8	0.8
CV			36	26.6	79.3	105.4

*PONCHO ST low rate - 0.25 mg ai/seed
GAUCHO ST low rate - 0.16 mg ai/seed
GAUCHO ST high rate - 0.6 mg ai/seed
FORCE IF - 1.13 g ai/100 m row in-furrow
**DKC 46-26 Isoline
**DKC 46-23 YIELDGARD rootworm transgenic
***Means on transformed data followed by same letter do not significantly differ (P=0.05, LSD), data transformed by arcsine square for means separation and CV, means de-transformed.
All other data homogeneous and not transformed.

Table 3. Test weights and yields in corn at on and off campus sites at Ridgetown, Ontario. 2003

Treatment	Insecticide	Rate	Test Weight		Yield	
		g ai/100 kg	kg/hl		T/ha	
			Ridgetown College Inoculated	Wolter Farm Natural	Ridgetown College Inoculated	Wolter Farm Natural
Isoline **	Check		67.54	67.34 ***	6.9 c ****	11.2 b
Transgenic **	Check		67.07	66.4	11.3 a	13.5 a
Isoline	PONCHO ST	Low *	67.52	67.6	10.3 ab	11.9 b
Isoline	PONCHO ST	High	67.57	68.09	11.2 a	13.5 a
Isoline	GAUCHO ST	Low	67.45	69.16	9.0 b	11.5 b
Isoline	GAUCHO ST	High	67.48	67.44	9.9 ab	12.3 ab
Isoline	COUNTER IF	Normal	67.6	67.36	10.0 ab	12.2 ab
Isoline	FORCE IF	Normal	68.05	67.75	10.2 ab	12.0 b
CV			0.6	2.4	11.8	7.7

*PONCHO ST low rate - 0.25 mg ai/seed
GAUCHO ST low rate - 0.16 mg ai/seed
GAUCHO ST high rate - 0.6 mg ai/seed
FORCE IF - 1.13 g ai/100 m row in-furrow
**DKC 46-26 Isoline
**DKC 46-23 YIELDGARD rootworm transgenic
***Data not homogeneous. Means transformed by arcsine square root for means separation and CV, means de-transformed.
****Means followed by same letter do not significantly differ (P=0.05, LSD), data not transformed
All other data homogeneous and not transformed.

2003 PMR REPORT # 32 SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects ICAR: 61006537

CROP: Corn, (*Zea maize* L.), cv Pride PPG
PEST: Wireworm, (Elateridae, spp)

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TITLE: CONTROL OF CORN WIREWORM IN LARGE AND SMALL SEEDED CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (fludioxonil + metalaxyl-M, 2.5 + 0.96 g ai/L); PONCHO 600 FS (clothianidin 600 g ai/L); GAUCHO 480 FS (imidacloprid, 480 g ai/L); G7065-00 (exp); L1282-A1(exp); L1283-A1(exp); AGROX DL Plus (captan + diazinon +lindane, 30 + 30 + 50 g ai/Kg)

METHODS: Seed was passed through a 17/64 inch round hole sieve and seed that did not pass though was used as large seed and the seed that passed through was used as small seed. The seed was treated on 29 April, 2003 in 1 kg lots in individual plastic bags by applying a slurry of the material via syringe to each bag (all treatments diluted in water to the same volume of 8.0 ml/kg). The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. Seed weight was 268 g/1000 seeds. The corn was planted on 13 May, 2003 at Rodney, ON using a two-row cone-seeder mounted on a John Deere Max Emerge planter at a seeding rate of 8 seeds/m. Plots were single rows, spaced 0.76 m apart and were 6 m in length in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant emergence was assessed on 3 June, 2003. Plant stand was assessed on 10, 17 and 24 June and 2 July, 2003. Vigour was assessed on the same dates using a scale of 0-100% (100= furthest developed plant and 0 = dead plants). Wireworm populations were estimated by digging up 1 m of row in a trench 15 cm deep and 10 cm wide in the check plots, sifting the soil and separating out the wireworms. Plots were harvested on 13 Nov, 2003 and yields converted to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1 to 5. Check plots averaged 1.5 wireworms/m. Based on our experience, wireworms are more or less uniformly distributed throughout areas similar in size to the plot area of this experiment. Since the wireworms were randomly dispersed throughout, the population in the checks sampled constitutes a reasonable estimate of the population throughout the trial area. The recovery of wireworms varies with time and soil temperature because they migrate vertically in the soil. Assessment population estimates are difficult to make. We advise producers that if wireworms are easily found in the soil, a threshold level has usually been reached.

CONCLUSIONS: For large seeds, all treatments resulted in significantly improved plant stand. Emergence was delayed with AGROX DL Plus relative to other treatments. No differences in vigour were noted in large seed for any treatment. Performance of treatments with smaller seeds (more seeds/kg) was less uniform. Only three of the treatments resulted in significantly improved stands. Only G7009-01 in smaller seed resulted in improved vigour until 2 July. None of the treatments resulted in significantly higher yield, although most treated plots had numerically higher yields than the untreated controls.

Table 1. Emergence and plant stand in large seed corn at Rodney, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai seed *	Emergence	Plant Stand Number plants/plot			
		37774	37781	37788	37795	37803
MAXIM XL CHECK		80 c **	79 c	80 b	79 c	78 b
MAXIM XL +PONCHO 600	3.5 0.125*	92 ab	91 ab	95 a	95 ab	94 a
MAXIM XL +PONCHO 600	3.5 0.25*	94 ab	96 a	94 a	95 ab	97 a
MAXIM XL +GAUCHO 480	3.5 0.16*	90 ab	89 ab	91 a	91ab	89 a
MAXIM XL +G7065-00 (exp)	3.5 1.3*	90 ab	90 ab	91 a	88 b	88 a
MAXIM XL +L1282-A1(exp)	3.5 0.2236*	91 ab	87 b	92 a	94 ab	93 a
MAXIM XL +L1283-A1 (exp)	3.5 0.1456*	95 a	95 ab	94 a	96 a	93 a
MAXIM XL +AGROX DL Plus	3.511	89 b	91 ab	94 a	93 ab	93 a
CV		4.1	5.9	5.6	5.4	7

**Means followed by same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed.

Table 2. Vigour assessments in large seed corn at Rodney, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/seed	Vigour 0-100 %				
		37774	37781	37788	37795	37803
MAXIM XL CHECK		70	77.5	77.5	70	70
MAXIM XL +PONCHO 600	3.5 0.125*	90	82.5	85	85	85
MAXIM XL +PONCHO 600	3.5 0.25*	90	87.5	87.5	87.5	87.5
MAXIM XL +GAUCHO 480	3.5 0.16*	77.5	82.5	85	77.5	82.5
MAXIM XL +G7065-00 (exp)	3.5 1.3*	80	82.5	85	75	67.5
MAXIM XL +L1282-A1(exp)	3.5 0.2236*	87.5	92.5	95	82.5	80
MAXIM XL +L1283-A1 (exp)	3.5 0.1456*	85	85	90	82.5	85
MAXIM XL +AGROX DL Plus	3.511	77.5	82.5	80	75	72.5
CV		14.1	12.3	10	17.6	18.6

Table 3. Emergence and plant stand assessments in small seed corn at Rodney, Ontario. 2003.

Treatment	Rate	Emergence	Plant Stand			
	g ai/100 kg		Number of plants per row			
	or mg ai/seed*	37774	37781	37788	37795	37803
MAXIM XL CHECK	3.5	89 bc **	84 c	83 c	84 c	86 b
MAXIM XL +PONCHO 600	3.50 0.125*	92 bc	92 b	93 b	93 ab	94 a
MAXIM XL +PONCHO 600	3.5 0.25*	91 bc	89 b	92 b	92 b	91 ab
MAXIM XL +GAUCHO 480	3.5 0.16*	92 abc	94 b	95 b	96 ab	95 a
MAXIM XL +G7065-00 (exp)	3.5 1.3*	86 c	92 b	92 b	90 bc	90 ab
MAXIM XL +L1282-A1 (exp)	3.5 0.2236*	99 a	100 a	101 a	100 a	96 a
MAXIM XL +L1283-A1 (exp)	3.5 0.1456*	96 ab	94 b	97 ab	94 ab	93 ab
MAXIM XL +AGROX DL Plus	3.5 110	89 c	94 b	94 b	93 b	89 ab
CV		5.3	3.4	4.2	4.9	5.5

**Means followed by same letter do not significantly differ, (P=0.05, LSD), data homogeneous and not transformed.

Table 4. Vigour assessments in small seed corn at Rodney, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/seed *	Vigour 0-100 % 37774	37781	37788	37795	37803
MAXIM XL CHECK	3.5	77.5 ab **	77.5 bcd	75.0 b	55.0 d	70.0 b
MAXIM XL +PONCHO 600	3.50 0.125*	87.5 a	87.5 ab	90.0 a	85.0 ab	92.5 a
MAXIM XL +PONCHO 600	3.5 0.25*	87.5 a	92.5 a	90.0 a	97.5 a	92.5 a
MAXIM XL +GAUCHO 480	3.5 0.16*	85.0 a	87.5 ab	87.5 ab	82.5 abc	80.0 ab
MAXIM XL +G7065-00 (exp)	3.5 1.3*	70.0 b	70.0 d	80.0 ab	65.0 cd	67.5 b
MAXIM XL +L1282-A1 (exp)	3.5 0.2236*	88.7 a	84.8 abc	84.0 ab	80.0 abc	77.5 ab
MAXIM XL +L1283-A1 (exp)	3.5 0.1456*	90.0 a	92.5 a	92.5 a	72.5 bcd	82.5 ab
MAXIM XL +AGROX DL Plus	3.5 110	70.0 b	72.5 cd	80.0 ab	65.0 cd	75.0 b
CV		11.8	10.2	11	15.9	13.3

**Means followed by same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed.

Table 5. Test weight and yield assessments in large and small seed corn at Rodney, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/seed	Test Weight kg/hl 37937		Yield T/ha	
		Large seed	Small seed	Large seed	Small seed
MAXIM XL CHECK		61.46	59.67	8.8	8
MAXIM XL +PONCHO 600	3.5 0.125*	59.4	60.14	10.1	9.1
MAXIM XL +PONCHO 600	3.5 0.25*	59.87	60.78	9.1	9.5
MAXIM XL +GAUCHO 480	3.5 0.16*	55.05	61.12	8.8	10.2
MAXIM XL +G7065-00 (exp)	3.5 1.3*	60.53	59.78	8.7	8.2
MAXIM XL +L1282-A1(exp)	3.5 0.2236*	60.5	59.24	9.1	9.3
MAXIM XL +L1283-A1 (exp)	3.5 0.1456*	60.37	60.22	8.5	8.7
MAXIM XL +AGROX DL Plus	3.511	59.94	60.55	9.2	8.8
CV		6.3	1.8	13.1	12.7

2003 PMR REPORT #33 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Corn, (*Zea maize* L.), D 73
PEST: European chafer, *Rhizotrogus (Amphimallon) majalis*, Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL IN CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (fludioxonil + metalaxyl-M, 229.59 + 87.66 g ai/L); CRUISER 350 FS (thiamethoxam 350 g ai/L); GAUCHO 480 FS (imidacloprid, 480 g ai/L); FORCE 3 G (tefluthrin, 3 % w/w); FORCE 200 ME (tefluthrin, 200 g ai/L)

METHODS: Seed was treated in 500 g lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 6 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. Seed weight was 277 g/1000 seeds. Seed was planted in the Greenhouse (GH) on 20 Nov. 2002 as a RCBD with 6 replications in 30.5 x 30.5 x 30.5 cm micro plots. Each micro plot, enclosed in a metal cube open at two ends, was placed in a plastic tray, partially (½ to 3/4) filled with a moistened 50:50 heat pasteurized sandy field soil to potting soil mixture, and planted by hand with 3 corn seeds to each enclosure to a depth of 5 cm. FORCE IF and T band rates were calculated by assuming corn seeds would be spaced approx. 15 cm apart, simulating a field situation, and equal to 0.45 m of row. FORCE 3 G IF and T band at 37.5 g product/100 m row = 0.17 g product/enclosure. The in-furrow method was accomplished by making furrows for the seed and dividing up the FORCE among the furrows. The T band treatments were applied in a similar fashion, with the exception that ½ the product was applied in-furrow and ½ applied on the soil surface. Furrows were closed by hand. Third star European chafer (ECH) larvae were pre-collected from nearby turf areas and placed in cold storage. On the same day as planting, six larvae were placed on the soil surface in each micro plot as outlined in Tables below. Injured or damaged larvae that did not burrow into the soil were replaced by healthy larvae until all had burrowed into the soil. All micro plots were adequately watered on a daily basis. Plant stand and damaged plants were assessed on 2, 5, 12, and 18 Dec. 2002. A plant that was wilted was considered damaged. On 18 Dec. 2002 the corn plants in each micro plot were cut at the soil level and fresh weight measured. The soil in each micro plot was sorted to recover and count the live and dead larvae present.

RESULTS: See Table 1.

CONCLUSIONS: Low rate CRUISER significantly improved emergence compared to the fungicide check with 6 ECH. On the final evaluation date, low and high rate CRUISER and FORCE 200 seed treatments significantly improved plant stand compared to the fungicide check with 6 ECH. Damage and the number of live larvae recovered were too variable to be used for meaningful comparisons.

Table 1. Emergence and plant stand assessments of corn in Greenhouse at Ridgetown, Ontario. 2003

Treatment	Rate	Emer-gence	Plant Stand	Damaged Plants	Affected Plants	Live Chafers	Fresh Wt/Plot
	g ai/100 kg or g ai/100 m row	Number per enclosure					grams
		38322			18 Dec		
UNTREATED CHECK + 6 ECH		1.5 e **	1.3 d	1	0.3 d	5.0 a	0.12 d***
UNTREATED CHECK + 6 ECH		2.0 de	1.8 cd	1	0.8 cd	4.0 ab	0.71 cd
FUNGICIDE CHECK + 0 ECH	3.5	2.7 abc	2.7 ab	0.3	2.3 a	0 c	1.81 a
FUNGICIDE CHECK + 6 ECH	3.5	2.3 bcd	2.0 bcd	1	1.0 cd	4.5 a	0.82 bc
MAXIM XL 324 FS + CRUISER 350 FS + 6 ECH	3.2 50	3.0 a	2.8 a	0.7	2.2 ab	4.0 ab	1.87 a
MAXIM XL 324 FS + CRUISER 350 FS + 6 ECH	3.5 100	2.7 abc	2.8 a	0.3	2.5 a	4.0 ab	1.61 ab
MAXIM XL 324 FS + GAUCHO 480 FL + 6 ECH	3.5 256	2.7 abc	2.7 ab	0.5	2.2 ab	3.8 b	1.96 a
MAXIM XL 324 FS +FORCE 3G IF * + 6 ECH	3.5 1.13	2.2 cd	2.2 abc	1.3	0.8 cd	4.7 a	1.04 abc
MAXIM XL 324 FS + FORCE 3G T band* + 6 ECH	3.5 1.13	2.5 a-d	1.8 cd	0.7	1.2 bcd	4.3 a	0.72 cd
MAXIM XL 324 FS + FORCE 200 ME + 6 ECH	3.5 40	2.8 ab	2.8 a	1.2	1.7 abc	3.5 ab	1.15 abc
CV		22.2	27.1	105.4	57	42	22

*IF - In-Furrow and T band applied at planting
**Means followed by same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed
***Means on transformed data followed by same letter do not significantly differ (P=0.05, LSD), data transformed using square root for means separation and CV, means de-transformed.

2003 PMR REPORT #34 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR : 61006537

CROP: Corn, (*Zea maize* L.), cv D73
PEST: Wireworm, (Elateridae, *spp*)

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TITLE: CONTROL OF WIREWORM IN CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (fludioxonil + metalaxyl-M, 229.59 + 87.66 g ai/L); CRUISER 5 FS (thiamethoxam, 5 g ai/L); CRUISER 350 (thiamethoxam, 350 g ai/L); GAUCHO 480 FS (imidacloprid, 350 g ai/L); PONCHO 600 FS (clothianidin, 600 g ai/L).

METHODS: Seed was treated on 30 April, 2003 in 1 kg lots in individual plastic bags by applying a slurry of material via a syringe to each bag (all treatments diluted in water to the same volume of 5.0 ml per kg). The seed was then mixed in the inflated bag for 1 min to ensure thorough seed coverage. Seed weight was 275 g/1000 seed. Corn was planted on 13 May, 2003 at Rodney ON using a two-row cone-seeder mounted on a John Deere Max Emerge planter at a seeding rate of 8 seeds/m. Plots were 2 rows spaced 0.76 m apart and 6 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Plant emergence was determined on 3 June, 2003. Plant stand was recorded on 10, 17, 24 June and 2 July, 2003. Vigour, using a scale of 0 -100, (100= most advanced plant and 0 = dead plants dead in the trial) was recorded on the same dates. The total number of plants and the number of damaged plants per metre in the check plots was recorded on 3 June, 2003. Wireworm populations were estimated on 3 June, 2003 by digging up 1 m of row in a trench 15 cm deep and 10 cm wide in the check plots, sifting the soil and separating out the wireworms. Plots were harvested on 13 Nov, 2003 and yields converted to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-3. Check plots averaged 3.0 wireworms/m. Based on our experience, wireworms are more or less uniformly distributed throughout areas similar in size to the plot area of this experiment. Since the wireworms were randomly dispersed throughout, the population in the checks sampled constitutes a reasonable estimate of the population throughout the trial area. The recovery of wireworms varies with time and soil temperature because they migrate vertically in the soil, so assessment population estimates are difficult to make. We advise producers that if wireworms are easily found in the soil, a threshold level has usually been reached.

CONCLUSIONS: Plant establishment was significantly reduced by wireworm activity in this trial. Wireworms at 3 larva/m constitutes a moderate infestation and would probably cause economic loss. Emergence was significantly higher in treated plots. All treatments, with the exception of CRUISER 350 FS, improved yields significantly higher than the untreated check.

Table 1. Emergence and plant stand assessments of corn at Rodney, Ontario, 2003.

Treatment	Rate	Emergence	Plant Stand			
	g ai/100 kg		Number of plants per row			
	or mg ai/seed *	37774	37781	37788	37795	37803
FUNGICIDE CHECK-MAXIM XL	3.5	80 b **	84 b	80 b	81 b	80 b
MAXIM XL	3.5	93 a	91 a	93 a	94 a	91 a
+CRUISER 5 Low	50					
MAXIM XL	3.5	89 a	92 a	91 a	91 a	92 a
+CRUISER 5 High	100					
MAXIM XL	3.5	91 a	91 a	93 a	95 a	93 a
+GAUCHO 480	256					
MAXIM XL	3.5	91 a	95 a	95 a	95 a	93 a
+PONCHO 600	0.125 *					
MAXIM XL	3.5	91 a	93 a	94 a	95 a	92 a
+CRUISER 350	50					
CV		4.1	4.2	3.6	3.8	4.4

**Means on transformed data followed by same letter do not significantly differ (P=0.05, LSD), data transformed by arsine square root for means separation and CV, means de-transformed.
All other data homogeneous and not transformed.

Table 2. Vigour assessments of corn at Rodney, Ontario, 2003.

Treatment	Rate g ai/100 kg or mg ai/seed *	Vigour 37995 37774	37781	37788	37795	37803
FUNGICIDE CHECK-MAXIM XL	3.5	6.5 d **	6.8 d	6.5 d	5.3 b	7.0 c
MAXIM XL	3.5	8.0 bc	8.3 bc	8.3 bc	8.0 a	8.5 ab
+CRUISER 5 Low	50					
MAXIM XL	3.5	7.5 cd	7.5 cd	7.8 c	7.5 a	7.8 bc
+CRUISER 5 High	100					
MAXIM XL	3.5	9.0 ab	9.0 ab	9.0 ab	8.5 a	9.3 a
+GAUCHO 480	256					
MAXIM XL	3.5	8.5 abc	8.5 abc	8.5 abc	8.0 a	9.0 ab
+PONCHO 600	0.125 *					
MAXIM XL	3.5	9.5 a	9.5 a	9.5 a	9.0 a	8.8 ab
+CRUISER 350	50					
CV		10.5	9	9	17.2	12.4

*Means followed by same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed.

Table 3. Test weight and yield assessments in corn at Rodney, Ontario, 2003

Treatment	Rate	Test Weight	Yield
	g ai/100 kg or mg ai/seed *	kg/hl	T/ha
		13 Nov	
FUNGICIDE CHECK-MAXIM XL	3.5	64.31 **	7.4 c ***
MAXIM XL	3.5	64.69	9.5 a
+CRUISER 5 Low	50		
MAXIM XL	3.5	64.31	8.7 ab
+CRUISER 5 High	100		
MAXIM XL	3.5	65.83	9.3 ab
+GAUCHO 480	256		
MAXIM XL	3.5	64.69	9.1 ab
+PONCHO 600	0.125 *		
MAXIM XL	3.5	65.45	8.1 bc
+CRUISER 350 FS	50		
CV		0.7	10

**Data transformed by log for means separation and CV, means de-transformed.
***Means followed by same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed.

2003 PMR REPORT # 35 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR : 61006537

CROP: Corn, (*Zea maize* L.), cv DKC53-32, DK 537, 38P04, 38P05
PEST: Armyworm, *Pseudaletia unipuncta* (Haworth)

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TITLE: CONTROL OF ARMYWORM WITH TRANSGENIC CORN

MATERIALS: CRY 1F, MON 810

METHODS: The seed was planted on 16 and 25 June, 2003 using a two-row cone-seeder mounted on a John Deere Max Emerge planter at a seeding rate of 8 seeds/m. Plots were two row spaced 0.76 m apart and 4 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Emergence counts were recorded on 25 June and 3 July, 2003 for early and late plantings, respectively. Armyworms were released at the 4th to 5th instar (mature larvae) on 11 July, 2003 in both early and late plantings on treatments 5-8 at a rate of 2 larvae/plant in the whorl of 6 plants/plot and at the 1st instar (young larvae) on 25 July, 2003 in both early and late plantings on treatments 1-4 at a rate of 5 instar/plant in the whorl of 4 plants/plot. Plant damage for young larvae was assessed on 30 July, 1, 6 and 8 August and for mature larvae on 15 July, 2003, in both plantings. Plant fresh weights, % damaged leaves, no. larvae recovered from plants and larva fresh weights were recorded on 13 Aug and 15 July, 2003 for young and mature larvae, respectively, in both plantings. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1and 2.

CONCLUSIONS: Late instar larvae wandered off the plants that they were placed on, diluting their effect. Despite the short period of feeding, some differences were noted. Both MON 810 CRY 1F events sustained less damage than their respective isolines. The MON 810 event afforded more consistent protection.

Table 1. Average plant damage (% of leaves damaged, mean of incidence and severity) at Ridgetown, Ontario. 2003

Treatment	Variety	Early Planting		Late Planting	
		1st - 2nd Instar Infested 25 July	4th - 5th Instar Infested 11 July	1st - 2nd Instar Infested 25 July	4th - 5th Instar Infested 11 July
MON 810		1	4 c *	1 b	4 c
MON 810	Isoline	2	9 ab	2 b	12 ab
CRY 1F		1	6 bc	2 b	8 bc
CRY 1F	Isoline	2	0.45833333333	0.125	0.0416666667
CV		25.4	37.9	30.1	33.6

* Means followed by same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed.

Table 2. Plant fresh weight after infestations at Ridgetown, Ontario. 2003

Treatment	Variety	Fresh weight - 6 plants per plot (kg)			
		Early Planting		Late Planting	
		1st - 2nd Instar Infested 25 July	4th - 5th Instar Infested 11 July	1st - 2nd Instar Infested 25 July	4th - 5th Instar Infested 11 July
MON 810		2.8 a *	0.27	2.2	0.1
MON 810	Isoline	2.2 b	0.23	2	0.07
CRY 1F		2.2 b	0.24	2.2	0.08
CRY 1F	Isoline	2.0 b	0.23	1.9	0.1
CV		7.3	30.8	10.8	20.6

*Means on transformed data followed by same letter do not significantly differ (P=0.05, LSD), data transformed by log for means separation and CV, means de-transformed. All other data homogeneous and not transformed.

2003 PMR REPORT # 36 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Corn, (*Zea maize* L.), cv D73
PEST: European chafer, *Rhizotrogus (Amphimallon) majalis*, Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL IN CORN WITH SEED TREATMENTS

MATERIALS: MAXIM XL 324 FS (fludioxonil + metalaxyl-M, 2.5 + 0.96 g ai/L); CRUISER 5 FS (thiamethoxam 5 g ai/L); CRUISER 350 FS (thiamethoxam 350 g ai/L); GAUCHO 480 FS (imidacloprid, 350 g ai/L); PONCHO 600 FS (clothianidin, 600 g ai/L); AGROX DL Plus (captan + diazinon + lindane, 150 + 150 + 250 g ai/Kg)

METHODS: Seed was treated on 30 April, 2003 in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 6.0 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. Seed weight was 275 g/1000 seeds. Corn was planted at a seeding rate of 8 seeds/m on 19 and 29 May, 2003 at Alymer and Ridgetown, ON respectively, using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were two rows of 4 m each, spaced 0.76 m apart, and arranged in a RCBD with 4 replications. European chafer 3rd- instar larvae were released on 30 May at the Ridgetown site in a 1 m strip in the left plot row at a rate of 16 chafers/m (2 chafers/plant), and on 2 June in an additional 1 m strip in the same row, leaving the non-infested row as a buffer between treatments. Plant emergence was recorded on 9 and 16 June, 2003 at Alymer and Ridgetown, respectively. Plant stand was recorded on 16, 23 June and 2 and 9 July at Alymer and on 23 June, and 2, 9 and 16 July at Ridgetown. Vigour ratings were assessed on the same dates using a scale of 0-100% (100 = most advance plant and 0 = dead plants). At the first emergence assessment date, damaged plants and chafers were counted in the check plots. A 1 m trench of soil, 15 cm wide and 10 cm deep, was removed and larvae hand sifted out of the soil. Plots were harvested on 12 Nov, 2003 at Ridgetown and yields corrected to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-6. The average number of chafers found in the check plots at Alymer was 0.5/m. Plots are Alymer were not harvested due to poor ear development because of drought.

CONCLUSIONS: In the non-infested corn plots at Ridgetown, plant stand was significantly increased only by a high rate of G7009-01 (clothianidin) compared to the fungicide check. In the infested corn plots at Ridgetown, there were no significant treatment differences for plant stand. None of the treatments significantly improved vigour compared to the fungicide check, and the damage assessments were too variable to be used for meaningful comparisons. Test weights and yields were not significantly increased by any of the seed treatments. At the Alymer location, all the insecticide treatments significantly improved plant stand compared to the fungicide check for all the assessment dates. There were no significant treatment differences for vigour assessments.

Table 1. Emergence and plant stand assessments in non-infested corn at Ridgetown, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/seed *	Emergence	Plant Stand Number plants per row			
		37787	37794 4-5 leaf	37803 7-8 leaf	37810	37817
FUNGICIDE CHECK-MAXIM XL	3.5	32	30	31	31	31 b-e **
MAXIM XL +PONCHO 600	3.5 0.125 *	31	30	30	32	31 a-d
MAXIM XL +PONCHO 600	3.5 0.25 *	32	31	32	32	32 a-d
MAXIM XL +PONCHO 600	3.5 1.25 *	33	32	32	32	34 a
MAXIM XL +GAUCHO 480	3.5 0.16 *	32	32	31	32	32 a-d
MAXIM XL +GAUCHO 480	3.5 0.6 *	30	30	30	30	30 de
MAXIM XL +AGROX DL Plus	3.511	33	33	33	33	33 ab
MAXIM XL +CRUISER 5	3.2 50	31	30	29	29	29 e
MAXIM XL +CRUISER 5	3.5 100	33	32	32	32	33 ab
MAXIM XL +GAUCHO 480	3.5 256	31	31	32	32	32 abd
MAXIM XL +CRUISER 350	3.5 50	31	32	32	32	33 ab
MAXIM XL +CRUISER 350	3.5 100	31	30	30	30	30 cde
CV		6.8	6	5.6	6.2	5.4

**Means followed by same letter do not significantly differ (P=0.05, LSD)

Table 2. Emergence and plant stand assessments in infested corn at Ridgetown, Ontario. 2003

Treatment	Rate	Emergence	Plant Stand			
	g ai/100 kg		Number plants per 2m			
	or mg ai/seed *	37787	37794	37803	37810	37817
			4-5 leaf	7-8 leaf		
FUNGICIDE CHECK-MAXIM XL	3.5	15	15	15	13	14
MAXIM XL	3.5	15	14	15	15	15
+PONCHO 600	0.125 *					
MAXIM XL	3.5	15	15	15	15	15
+PONCHO 600	0.25 *					
MAXIM XL	3.5	15	14	14	14	15
+PONCHO 600	1.25 *					
MAXIM XL	3.5	15	14	14	15	14
+GAUCHO 480	0.16 *					
MAXIM XL	3.5	14	14	14	14	15
+GAUCHO 480	0.6 *					
MAXIM XL	3.511	15	16	16	15	16
+AGROX DL Plus						
MAXIM XL	3.2	14	14	14	14	13
+CRUISER 5	50					
MAXIM XL	3.5	14	13	14	14	14
+CRUISER 5	100					
MAXIM XL	3.5	17	16	16	16	16
+GAUCHO 480	256					
MAXIM XL	3.5	16	17	16	16	16
+CRUISER 350	50					
MAXIM XL	3.5	13	14	14	13	13
+CRUISER 350	100					
CV		11.3	13.3	13.2	17.6	14.2

Table 3. Vigour and plant damage assessments at Ridgetown, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/seed *	Vigour 0-100 % 37787	37794	37803	37810	37817	Damage #pl/plot 37787	#pl/2 m 37787
FUNGICIDE CHECK-MAXIM XL	3.5	82.5 abc**	65	75	80	80	0.3	0.5
MAXIM XL +PONCHO 600	3.5 0.125 *	77.5 bc	67.5	87.5	77.5	58	0.8	0.5
MAXIM XL +PONCHO 600	3.5 0.25 *	82.5 abc	65	80	85	87.5	0.3	0.3
MAXIM XL +PONCHO 600	3.5 1.25 *	85.0 abc	75	75	82.5	87.5	0	0.3
MAXIM XL +GAUCHO 480	3.5 0.16 *	85.0 abc	67.5	82.5	80	82.5	0.3	0.3
MAXIM XL +GAUCHO 480	3.5 0.6 *	75.0 c	77.5	80	80	87.5	0	0.8
MAXIM XL +AGROX DL Plus	3.511	92.5 a	80	72.5	75	80	0.5	0.8
MAXIM XL +CRUISER 5	3.2 50	75.0 c	70	80	85	87.5	0	0.5
MAXIM XL +CRUISER 5	3.5 100	90.0 a	90	85	87.5	85	0.8	0.8
MAXIM XL +GAUCHO 480	3.5 256	77.5 bc	77.5	77.5	87.5	90	0.5	0.5
MAXIM XL +CRUISER 350	3.5 50	77.5 bc	77.5	80	82.5	90	0.3	0.8
MAXIM XL +CRUISER 350	3.5 100	87.5 ab	80	72.5	77.5	87.5	0.3	0.5
CV		9.5	18.1	14	12.1	8.6	183.8	137.2

**Means followed by same letter do not significantly differ (P=0.05, LSD)

Table 4. Test weight and yield assessments in corn at Ridgetown, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/seed *	Test Weight kg/hl 12 Nov	Yield T/ha
FUNGICIDE CHECK-MAXIM XL	3.5	72.69	9.9
MAXIM XL +PONCHO 600	3.5 0.125 *	73.39	11.2
MAXIM XL +PONCHO 600	3.5 0.25 *	73.19	11
MAXIM XL +PONCHO 600	3.5 1.25 *	73.6	10.9
MAXIM XL +GAUCHO 480	3.5 0.16 *	73.23	9.6
MAXIM XL +GAUCHO 480	3.5 0.6 *	73.61	10.1
MAXIM XL +AGROX DL Plus	3.511	72.2	9.4
MAXIM XL +CRUISER 5	3.2 50	73.03	9.2
MAXIM XL +CRUISER 5	3.5 100	72.86	10.7
MAXIM XL +GAUCHO 480	3.5 256	71.37	11.2
MAXIM XL +CRUISER 350	3.5 50	72.79	10.3
MAXIM XL +CRUISER 350	3.51	73.53	9.5
CV		1.9	10.2

Table 5. Emergence and plant stand in naturally infested corn at Alymer, Ontario. 2003

Treatment	Rate g ai/100 kg or mg ai/seed *	Emergence	Plant Stand Number plants per 2 rows			
		37780	37787	37794	37803	37810
FUNGICIDE CHECK-MAXIM XL	3.5	60	52 b **	52 b	52 b	51 b
MAXIM XL +PONCHO 600	3.5 0.125 *	61	61 a	60 a	59 a	59 a
MAXIM XL +PONCHO 600	3.5 0.25 *	64	64 a	63 a	63 a	64 a
MAXIM XL +PONCHO 600	3.5 1.25 *	62	63 a	63 a	63 a	62 a
MAXIM XL +GAUCHO 480	3.5 0.16 *	64	62 a	61 a	62 a	62 a
MAXIM XL +GAUCHO 480	3.5 0.6 *	62	62 a	61 a	60 a	61 a
MAXIM XL +AGROX DL Plus	3.511	61	61 a	60 a	60 a	60 a
MAXIM XL +CRUISER 5	3.2 50	63	61 a	62 a	62 a	61 a
MAXIM XL +CRUISER 5	3.5 100	62	62 a	62 a	60 a	60 a
MAXIM XL +GAUCHO 480	3.5 256	61 63	61 a	61 a	61 a	60 a
MAXIM XL +CRUISER 350	3.5 50	63	64 a	62 a	61 a	62 a
MAXIM XL +CRUISER 350	3.51	61	61 a	60 b	60 a	59 a
CV		5.5	4.9	6.5	6.3	6.6

**Means followed by same letter do not significantly differ (P=0.05, LSD), data not transformed

Table 6. Vigour assessments in naturally infested corn at Alymer, Ontario. 2003

Treatment	Rate g ai/100 kg 0r mg ai/seed *	Vigour 0-100 % 37780	37787	37794	37803	37810
FUNGICIDE CHECK-MAXIM XL	3.5	72.5	62.5	65.0	70.0	75.0
MAXIM XL +PONCHO 600	3.5 0.125 *	80.0	70.0	72.5	75.0	80.0
MAXIM XL +PONCHO 600	3.5 0.25 *	85.0	77.5	80.0	85.0	85.0
MAXIM XL +PONCHO 600	3.5 1.25 *	80	67.5	82.5	77.5	77.5
MAXIM XL +GAUCHO 480	3.5 0.16 *	80	67.5	77.5	77.5	77.5
MAXIM XL +GAUCHO 480	3.5 0.6 *	82.5	72.5	77.5	67.5	75
MAXIM XL +AGROX DL Plus	3.511	77.5	77.5	67.5	70	75
MAXIM XL +CRUISER 5	3.2 50	87.5	82.5	82.5	77.5	87.5 87.5
MAXIM XL +CRUISER 5	3.5 100	85.0	85.0	85.0	87.5	87.5 87.5
MAXIM XL +GAUCHO 480	3.5 256	77.5	80.5	82.5	82.5	85 85
MAXIM XL +CRUISER 350	3.5 50	85.0	75.0	70.0	72.5	90 90
MAXIM XL +CRUISER 350	3.5 100	75.0	82.5	77.5	72.5	80
CV		16	22.9	18.3	16.3	16.2

2003 PMR REPORT # 37 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Corn, (*Zea maize* L.), cv DKC 46-26 Isoline, DKC 46-23 Transgenic
PEST: European chafer, *Rhizotrogus (Amphimallon) majalis*, Razoumowsky

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TITLE: EUROPEAN CHAFER CONTROL IN TRANSGENIC CORN WITH SEED TREATMENTS

MATERIALS: PONCHO 600 FS (clothianidin, 600 g ai/L); GAUCHO 480 FS (imidacloprid, 480 g ai/L); CRUISER 350 FS (thiamethoxam, 350 g ai/L).

METHODS: Seed was treated on 30 April, 2003 in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 6.0 ml per kg) of the material via a syringe to each bag. The seed was then mixed for 1 min in the inflated bag to ensure thorough seed coverage. Seed weight for DKC 46-26 was 316 g/1000 seeds and for DKC 46-23 was 259 g/1000 seeds. Corn was planted at a seeding rate of 7 seeds/m on 19 and 29 May, 2003 at Alymer and Ridgetown, ON respectively, using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were two rows of 6 m each, spaced 0.76 m apart, and arranged in a RCBD with 4 replications. Late second and early third instar European chafers were released at Ridgetown on 30 May and 2 June, 2003 in a two 1 m lengths in the left plot row at a rate of 16 chafers /m, leaving the non-infested row as a buffer between treatments. Plant emergence was recorded on 16 June and 9 June, 2003 at Ridgetown and Alymer, respectively. Plant stands were recorded on 23 June, 29 and 16 July at Ridgetown and on 16, 23 June and 2 and 9 July, 2003 at Alymer. Vigour was assessed on the same dates using a scale of 0-100% (100 = most advance plant and 0 = dead plants). Damage was assessed on 16 June and 9 June at Ridgetown and Alymer, respectively using a scale of 0-10 (0= no damage and 10=dead plants). The number of chafers was counted in one row of the check plots at Alymer by removing a 1-m trench of soil 15 cm wide and 10 cm deep and sifting the larvae from the soil. Plant height and gap counts were recorded on 23 June at both sites. The gap counts were assessed by counting the number of gaps between plants in the buffer row and in 2m of the infested row at Ridgetown and in one row of the non-infested plots at Alymer. Plots were harvested on 12 Nov, 2003 at Ridgetown and yields corrected to 15.5% moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Tables 1-4. The average number of chafers recovered from the check plots at Alymer was 0.25/m. Plots were not harvested at Alymer due to poor ear development.

CONCLUSIONS: For the Alymer location, all treatments including the transgenic check, significantly improved the average number of plants in a non-infested row compared to the control. For all variables measured at both locations, there were no significant treatment differences.

Table 1. Corn tolerance at Ridgetown and Alymer, Ontario. 2003

Treatment	Insecticide	Rate *	Ridgetown		Alymer
			Average number of plants		
			Infested 2m	Non-infested row	Non-infested row
Isoline	CHECK		14	32	55 b **
Transgenic	CHECK		15	32	64 a
Transgenic	PONCHO	Low	15	32	63 a
Transgenic	GAUCHO	Low	17	32	63 a
Transgenic	CRUISER	Low	15	33	63 a

*PONCHO low rate - 0.25 mg ai/seed
*GAUCHO low rate - 0.16 mg ai/seed
* CRUISER low rate - 25 g ai/100 kg.
**Means followed by same or no letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed

Table 2. Plant height and damage assessments in corn at Ridgetown and Alymer, Ontario. 2003

Treatment	Insecticide	Rate *	Ridgetown		Alymer	Ridgetown		Alymer
			Average Plant Height (cm) 16 June			Damaged Plants - Scale 0-10 16 June		
			Infested 2m	Non-infested row	Non-infested row	Infested 2m	Non-infested row	Non-infested row
Isoline	CHECK		21.9	25	27.8	1	0.3	1.5
Transgenic	CHECK		22.9	23.7	26.9	0.3	0	0
Transgenic	PONCHO	Low	23.1	23.2	25.8	0	0.3	0
Transgenic	GAUCHO	Low	22.4	23.3	26.4	0	0.3	0
Transgenic	CRUISER	Low	22.4	23.8	26.8	0.5	0	0.5

*PONCHO low rate - 0.25 mg ai/seed
*GAUCHO low rate - 0.16 mg ai/seed
*CRUISER low rate - 25 g ai/100 kg.

Table 3. Gap counts in corn at Ridgetown and Alymer, Ontario. 2003

Treatment	Insecticide	Rate *	Ridgetown		Alymer	
			Average Gap Counts 23 June			
			Infested 2m	Non-infested row	Non-infested 2m	Non-infested row
Isoline	CHECK		13.1	12.7	13	12.4
Transgenic	CHECK		14.1	12.1	12.7	12.5
Transgenic	PONCHO	Low	12.7	12.9	12.3	12.5
Transgenic	GAUCHO	Low	11.4	13	11.8	13
Transgenic	CRUISER	Low	12.7	12.2	11.9	11.9

*PONCHO low rate - 0.25 mg ai/seed
*GAUCHO low rate - 0.16 mg ai/seed
*CRUISER low rate - 25 g ai/100 kg.

2003 PMR REPORT # 38 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR : 61006537

CROP: Corn (*Zea mays* L.)
PEST: Black cutworm *(Agrotis ipsilon, Hufnagel)*

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TITLE: EFFECTIVENESS OF A BT HYBRID AND CLOTHIANIDIN IN PROTECTING CORN SEEDLINGS FROM BLACK CUTWORM

MATERIALS: PIONEER HI-BRED 38P04 (HERCULEX I Cry 1F Bt), PIONEER HI-BRED 38P05 (non-Bt isoline of 38P04), PONCHO 1250 (clothianidin, 600 g a.i. L^{-1}), and PONCHO 250 (clothianidin, 600 g a.i. L^{-1}).

METHODS: Eight farm fields were selected from across southern Ontario before corn planting in the spring of 2003. All of these fields had a history of heavy cutworm infestations in the past four years. Approximately two weeks before planting, seeds were treated using a gasoline-powered portable cement mixer and $C0_2$-powered spray atomizer. All seed was pre-treated commercially with a fungicide. Each treatment was planted in strips that were 6-rows wide (4.56 m) and at least 800-m long. All treatments were planted by the growers or co-operators using their own planting equipment and at their target plant populations. Treatments included an untreated check of Pioneer Hi-Bred 38P05 (non-Bt) with no insecticide seed treatment, Pioneer Hi-Bred 38P05 treated with PONCHO 250 (0.25 mg a.i. $kernel^{-1}$), Pioneer Hi-Bred 38P05 treated with PONCHO 1250 (1.25 mg a.i. $kernel^{-1}$), Pioneer Hi-Bred 38P04 (Herculex I Bt) treated with no insecticide, and Pioneer Hi-Bred 38P04 treated with PONCHO 250. All treatments were replicated four times in a randomized complete block design, for a total of 20 plots per site. All sites were monitored throughout the season for insect damage and plant stand. If there where no visual differences apparent among the treatments during early growth, and if there were no apparent cutworm infestations, then the sites were abandoned and no grain yields were recorded. At approximately the eighth leaf stage of crop development, plant spacing variability was assessed by measuring the distance between plants in six, 10-m row segments of each treatment. Data was collected from the two center rows only. Before harvest in November, the percentage of broken stalks (i.e., stalks broken below the ear) and root-lodged plants (i.e. stalks lodging more than 45 degrees from horizontal) were recorded for a hundred plants in each of the treatment strips. Grain yields and moisture contents were determined by harvesting the entire plot using the harvesting equipment of the respective farmer/co-operator, and weighing the corn with a weigh wagon (Long Point) or with the use of a yield monitor on the combine (Dunnville).

RESULTS: Several sites had to be abandoned because no cutworm activity occurred. Only two of the sites experienced infestations, and these were located in Long Point and Dunnville. The Long Point site experienced the heaviest infestation of cutworms; populations varied from 1 to 7 late instar cutworms per 10 m of row from corn emergence to the 6 or 7 leaf stage of corn development. The trial was planted into dense chickweed, which was sprayed with herbicides to burn it down at planting. The corn seedlings were under heavy attack from cutworms that no longer had any weeds to feed on. At the 8^{th} leaf stage of corn development, plant populations were superior for the treatments planted with Pioneer Hi-Bred 38P04 (Herculex I Bt) compared to any treatment planted with its isoline Pioneer Hi-Bred 38P05 (Table 1). The addition of PONCHO 250 to the hybrid containing Herculex did not affect the plant population. However, PONCHO 1250 increased plant populations of the isoline Pioneer Hi-Bred 38P05 compared to the no insecticide treatment of the same non-Bt hybrid. The low rate of PONCHO did not improve plant populations compared to the treatment with no insecticide (Table 1). Treatment responses to both plant spacing variability

(Table 2) and grain yields were similar to the response in plant populations. The highest grain yields were produced from the Herculex I treatments (Table 2). There was no response in yield with the addition of PONCHO 250 to the Herculex I hybrid. Yields of the isoline were higher when treated with PONCHO 1250 ($P < 0.05$), but not high as the yields in the Herculex I treatments. Yields from the isoline check were not significantly different from the same hybrid treated with PONCHO 250. Compared to the field at Long Point, there was only a light infestation of cutworm at the Dunnville field. The average distance between plants was the highest in the PONCHO 1250 treatment of the isoline hybrid compared to all other treatments ($P < 0.05$), and these differences were also reflected in the plant populations (Table 3). This response may not be the result of cutworm activity, but rather some metering problems of the seed with the heaviest coating of seed treatment through the corn planter. Despite differences in the plant stand, grain yields were not significantly different among the treatments (Table 4). Stalk lodging and stalk breakage at this field may have induced some variability during harvest, which may have also obscured some treatment effects on grain yields.

CONCLUSIONS: Corn establishment, spacing and yield were improved by the use of Herculex I hybrid on a field heavily infested with cutworm. There was no evidence that PONCHO 250 was beneficial to early corn establishment or grain yields when applied to the seed of either the hybrid containing the Herculex I or to the isoline. However, with the non-Bt hybrid, corn establishment and grain yields were improved when PONCHO 1250 was applied to the seed, compared to the same hybrid with no insecticide seed treatment. Because there were only two fields with low or high populations of cutworm in this study, it is recommended that more studies are needed to determine whether or not the low rate of clothianidin (PONCHO 250) provides sufficient protection of corn seedlings from infestations of cutworm.

Table 1. The effect of clothianidin seed treatments and Cry 1F Bt corn on plant establishment, and spacing in fields infested with black cutworm in Long Point, Ontario 2003.

Treatment	Plants ha^{-1}		% of Check	Plant Spacing (cm)	
	Avg.	Std. Dev.		Avg.	Std. Dev.
Isoline check	33816.4c*	8126.5	100%	40.1c	11.1
Isoline with low clothianidin	31195.1c	10364.9	92%	43.6c	17.6
Isoline with high clothianidin	44695.5b	16384	132%	33.0b	13.3
Herculex I Cry 1F Bt corn	54919.0a	9961.4	162%	24.2 a	4.2
Herculex I with low clothianidin	50854.0b	11534.4	150%	27.7ab	5.9
Average	42991.6			18.24	
p (0.05)	<0.0001			<0.0001	
CV	25.6			7.05	

***** Means followed by the same letter do not significantly differ (p= 0.05, Tukey)

Table 2. The effect of clothianidin seed treatments and Cry 1F Bt corn on yield and plant populations in fields infested with black cutworm in Long Point, Ontario 2003.

Treatment	Yield t / ha^{-1} Avg.	Std. Dev	% of Check	Harvest Grain Moisture	Broken Stalks	Lodged Stalks
Isoline check	3.8c	0.6	100%	25.2	13%	9%
Isoline with low clothianidin	3.8c	0.3	100%	22.35	5%	4%
Isoline with high clothianidin	5.0b	0.4	132%	22.35	14%	5%
Herculex I Cry 1F Bt corn	6.0a	0.1	159%	22.9	21%	12%
Herculex I with low clothianidin	5.7a	0.4	152%	22.3	18%	10%
Average	4.9			23	14%	8%
p (0.05)	<0.0001					
CV	6.23					

***** Means followed by the same letter do not significantly differ (p= 0.05, Tukey)

Table 3. The effect of clothianidin seed treatments and Cry 1F Bt corn on plant establishment, and spacing in fields infested with black cutworm in Dunnville, Ontario 2003.

Treatment	Plants ha^{-1}		% of Check	Plant Spacing (cm)	
	Avg.	Std. Dev.		Avg.	Std. Dev.
Isoline check	68641.6	8718.9	100%	17.7b	11.1
Isoline with low clothianidin	72482.7	10485.7	106%	18.3b	17.5
Isoline with high clothianidin	65273.8	11665.4	95%	19.7a	5.9
Herculex I Cry 1F Bt corn	74448.8	9961.5	108%	17.5b	4.2
Herculex I with low clothianidin	72089.6	16384.6	105%	18.1b	13.3
Average	70587.3			18.2	
p (0.05)	ns			<0.0001	
CV	10.9			8.6	

***** Means followed by the same letter do not significantly differ (p= 0.05, Tukey)

Table 4. The effect of clothianidin seed treatments and Cry 1F Bt corn on yield and plant populations in fields infested with black cutworm in Dunnville, Ontario 2003.

Treatment	Yield t / ha^{-1} Avg.	Std. Dev	% of Check	% Harvest Grain Moisture	Broken Stalks	Lodged Stalks
Isoline check	10.2	0.5	100%	21.7%	16%	24%
Isoline with low clothianidin	10.3	0.3	101%	21.9%	22%	22%
Isoline with high clothianidin	9.9	1	97 %	21.8%	24%	19%
Herculex I Cry 1F Bt corn	10.4	0.8	102%	22.3%	16%	30%
Herculex I with low clothianidin	10.6	0.2	104%	22.2%	24%	25%
Average	10.3			21.9%	20%	24%
p (0.05)	ns					
CV	6.03					

2003 PRM REPORT # 39 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Corn (*Zea mays* L.)
PESTS: European chafer *(Rhizotrogus majalis*, Razoumowsky)

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TITLE: THE EFFECTS OF PONCHO ON CORN ESTABLISHMENT AND EARLY CORN GROWTH IN FARM FIELDS INFESTED EUROPEAN CHAFER.

MATERIALS: PONCHO 250 (clothianidin, 600 g a.i. L^{-1}), GAUCHO 480 FL (imidacloprid 480 g a.i. L^{-1})

METHODS: Eight farm fields were selected in 2003 across southern Ontario with anticipated or known infestations of European chafer. The density of chafers grubs at the 3rd leaf stage of corn development varied from 20 to 100 m^{-2} in the surface 0.15 m, depending on the field and sampling location within each field. At approximately two weeks before planting, seeds were treated on-farm using a gasoline-powered portable cement mixer and $C0_2$-powered spray atomizer. The hybrid of seed corn used at each field location was chosen by the grower. All seeds used in the study were pre-treated commercially with a fungicide. Three insecticide treatment strips replicated four times in a randomized complete block design (RCBD). The strips were planted across the entire length of each field by each corn grower/co-operator using their own planting equipment and at their own desired target plant populations. The seed treatments included an untreated check (i.e. not treated with insecticide), PONCHO 250 (0.25 mg a.i. $kernel^{-1}$, and GAUCHO 480 FL (0.16 mg a.i. $kernel^{-1}$). All sites were monitored after planting to assess insecticide performance on insect populations (counts) and/or insect damage on corn emergence, plant stand, vigour and yield. Dates and growth stages were recorded for all assessments. Treatments were assessed along three transects that were established across treatment strips. If there was evidence that natural populations of the target pest may be higher in specific areas of each strip, then the transects crossed those areas. A visual assessment was made on most fields at corn emergence; however, most of the measurements in the crop were conducted between the third and sixth leaf stage of corn development. Measurements included plant populations of both healthy and plants lacking vigour, average leaf developmental stage per treatment strip, number of missing plants per 2, 5 m row segments, and plant height about 3 wk before tasseling. Populations of target pests were assessed in each of the untreated check plots. The proportion of broken stalks (i.e. stalks broken below the ear) and root-lodged plants (i.e. stalks lodging more than 45 degrees from horizontal at the soil surface) were determined in each plot before harvest. Corn yields and harvest grain moisture were determined by harvesting the entire plot using the harvesting equipment of each farm co-operator. Grain corn was weighed in most fields using a weigh wagon or a calibrated yield monitor on a combine. Harvest data were not obtained from several fields because either grain yields were not expected to be influenced by the insecticide treatments (i.e., low or non-existent insect infestations), or if high field variability was expected from factors not related to the treatments (e.g. planter problems, extreme drought, etc.).

RESULTS: Populations of European chafer grubs in fields remained active during early growth of corn. Differences in corn growth and stand establishment were most apparent at the Aerts, Skinner, and Walcarius fields; chafers populations were greater than 50 m^{-2} in areas within each of these three fields. Seeds treated with PONCHO increased early plant populations at the 4- to 6-leaf stage, increased the proportion of emerged plants with high vigour, and increased early development compared to seeds that were not treated with PONCHO or GAUCHO ($P > 0.01$; Tables 1a and 1b). There was some evidence that PONCHO protected plant populations better than GAUCHO, but the response was only significant with $P > 0.08$. Plant populations were only slightly higher with the use of insecticides across other fields where chafer populations were lower (< 50 m^{-2} in surface 0.15

m). Averaged across all fields, the use of insecticides resulted in plant stands that were approximately 4 000 plants ha^{-1} higher than in plots where no insecticide was used ($0.0008 > P > 0.0007$; Table 1). When averaged across all fields, seeds treated with PONCHO produced the tallest plants with a lower coefficient of variation of plant heights within the stand (Table 2). The use of PONCHO resulted in a marginal increase in grain corn yields across all fields where yields were measured (0.20 t ha^{-1}); however, the increase did not reach statistical significance ($P > 0.30$). Both the Walcarius and the MSCIA_2 fields had severe drought stress at tasseling which may have confounded any effect from insecticide treatments. Yields were not obtained from the Aerts, VanLeeuwen, and VanQuaethem fields because of situations unrelated to the study.

CONCLUSIONS: Corn establishment and early corn growth were improved with the low use rate of PONCHO (0.25 mg a.i. $kernel^{-1}$) in most fields with infestations of European chafer. Stand establishment and early corn growth appeared to be greater with the use of PONCHO compared to GAUCHO. These improvements did not necessarily increase grain yields across 5 of the 8 fields in the study, although no yield data was available for the field with the greatest early response to PONCHO.

Table 1a. The effect of clothianidin seed treatments on corn plant population and early growth in fields infested with European chafer across southern Ontario, 2003.

Co-operator (Field Location)	Treatment/Contrast	Overall Population plants ha^{-1}	"High Vigour" Population plants ha^{-1}	Plant Spacing CV %	Plant Height cm	Plant Height CV %
Aerts	Untreated	63.2	52.2	73.3	27.8	35.5
(Melbourne)	GAUCHO	68.8	57.5	57	29.2	29.7
	PONCHO 250	70.4	61.6	46.5	33.1	27
	Untreated vs Treated	0.007	0.02	<0.0001	0.06	0.0003
	G vs P250	ns	0.24	0.08	0.06	0.2
Barendregt	Untreated	63.2	61.4	44.1	41.4	19.1
(Port Stanley)	GAUCHO	65.1	62.8	54.3	42.8	18.8
	PONCHO 250	63.3	61.8	50.3	41.7	19.6
	Untreated vs Treated	ns	ns	0.07	ns	ns
	G vs P250	ns	ns	ns	ns	ns
Skinner	Untreated	62.8	55.9	58.4	40.8	24.2
(Mt.Brydges)	GAUCHO	66	61.5	56.7	42.8	23.5
	PONCHO 250	69.6	66.8	48.8	46.3	18.7
	Untreated vs Treated	0.01	0.002	0.21	0.02	0.06
	G vs P250	0.13	0.08	0.13	0.05	0.01
MSCIA 1	Untreated	70.9	69.8	45.4	51.8	16.9
(Strathroy)	GAUCHO	72.8	71.8	50.3	54.5	13.1
	PONCHO 250	74.4	74.1	48.8	56.3	11.2
	Untreated vs Treated	0.24	0.29	ns	0.05	0.01
	G vs P250	0.18	ns	ns	ns	ns
MSCIA 2	Untreated	69.5	68	45.7	54.1	15.9
(Strathroy)	GAUCHO	70.9	69.5	49.7	54.4	15.5
	PONCHO 250	72.4	70.5	49.4	55.9	12.1
	Untreated vs Treated	ns	ns	ns	ns	0.25
	G vs P250	ns	ns	ns	ns	0.11

Table 1b. Insecticide seed treatments on corn plant population and early growth in fields infested with European chafer across southern Ontario, 2003.

Co-operator (Field Location)	Treatment/Contrast	Overall Population plants ha^{-1}	"High Vigour" Population plants ha^{-1}	Plant Spacing CV %	Plant Height cm	Plant Height CV %
Walcarius	Untreated	60.4	51.9	50.5	37.8	23.8
(Aylmer)	GAUCHO	65.8	57.6	45.7	37.9	22.6
	PONCHO 250	67.2	60.4	45.6	39.5	22.7
	Untreated vs Treated	0.007	0.02	ns	ns	ns
	G vs P250	ns	ns	ns	ns	ns
VanLeeuwen	Untreated	68.6	64.3	37.8	48.5	19.3
Tillsonburg; Stanley	GAUCHO	70.1	67	41.6	51.8	17.5
	PONCHO 250	67.8	64.7	44.8	52.6	18.5
	Untreated vs Treated	ns	ns	ns	0.02	ns
	G vs P250	ns	ns	ns	ns	ns
VanQuaethem	Untreated	71.9	71.1	35.3	60	10.8
(Tillsonburg)	GAUCHO	69.6	68.7	31.3	61.9	11.4
	PONCHO 250	68.9	68.7	32.8	61.4	11.7
	Untreated vs Treated	0.14	ns	ns	0.24	ns
	G vs P250	ns	ns	ns	ns	ns
Average	Untreated	66.3	61.8	48.8	45.3	20.7
	GAUCHO	68.7	64.6	48.4	46.9	19
	PONCHO 250	69.2	66.1	45.2	48.3	17.7
	Untreated vs Treated	0.0008	0.0007	0.23	0.0001	0.0002
	G vs P250	ns	0.17	0.1	0.03	0.06

Table 2. PONCHO and GAUCHO seed treatments on grain moisture and yield in fields infested with European chafer across southern Ontario, 2003.

Co-operator (Field Location)	Treatment/Contrast	Grain Moisture Content %		Grain Yield t ha^{-1}
Barendregt	Untreated	23.5		9.66
(Port Stanley)	GAUCHO	23		10.02
	PONCHO 250	22.7		9.87
	Untreated vs Treated	0.08		ns
	G vs P250	ns	ns	
Skinner	Untreated	26.8		9.64
(Mt.Brydges)	GAUCHO	26.8		9.44
	PONCHO 250	26.8		10.18
	Untreated vs Treated	ns		ns
	G vs P250	ns		0.09
MSCIA 1	Untreated	19.4		4.18
(Strathroy)	GAUCHO	19.2		4
	PONCHO 250	19.5		4.07
	Untreated vs Treated	ns		ns
	G vs P250	ns		ns
MSCIA 2	Untreated	25.2		7.68
(Strathroy)	GAUCHO	25.3		7.79
	PONCHO 250	25.2		7.94
	Untreated vs Treated	ns		ns
	G vs P250	ns		ns
Walcarius	Untreated	23.5		3.6
(Aylmer)	GAUCHO	23.3		3.53
	PONCHO 250	23.1		3.74
	Untreated vs Treated	ns		ns
	G vs P250	ns		ns
Average	Untreated	23.7		6.95
(5 fields)	GAUCHO	23.5		6.95
	PONCHO 250	23.5		7.16
	Untreated vs Treated	ns		ns
	G vs P250	ns		ns

2003 PRM REPORT# 40 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Corn (*Zea mays* L.)
PESTS: Corn rootworm *(Diabrotica virgifera* virgifera)

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TITLE: THE EFFECTS OF PONCHO ON CORN ESTABLISHMENT AND EARLY CORN GROWTH IN FARM FIELDS INFESTED CORN ROOTWORM

MATERIALS: PONCHO 1250 (clothianidin, 600 g a.i. L^{-1}), FORCE 3G (tefluthrin, 3% w/w)

METHODS: Two farm fields were selected near Ridgetown, Ontario, with anticipated infestations of corn rootworm in 2003. Corn was the previous crop in 2002. All seeds of Pioneer 37R71 used in this study were pre-treated commercially with a fungicide. Three insecticide treatments were planted using a 2-row corn planter with rows spaced 0.76-m apart. Each plot was 2-rows wide by 50-m long. The treatments included an untreated check (i..e., not treated with insecticide), PONCHO 1250 (1.25 mg a.i. $kernel^{-1}$) on the seed, and FORCE 3G (0.375 g m^{-1} row) applied in-furrow on the planter using a Noble applicator. Each treatment was replicated four times in a randomized complete block design. PONCHO 1250 was applied to the seed approximately two wks before planting using a gasoline-powered portable cement mixer and $C0_2$-powered spray atomizer. All seeds used in the study were pre-treated commercially with a fungicide. Both sites were monitored after planting to assess insecticide performance on insect populations (counts) and/or insect damage on the plant stand, vigour and yield, as appropriate throughout the season. Dates and growth stages were recorded for all assessments. Measurements included plant populations of healthy, missing, and plants lacking vigour, in 2, 20-m row segments of each plot. Plant heights and plant spacings were also measured within this measurement area when the plants were approximately 40 cm tall. The effects of corn rootworm were assessed about 2 wk before tasseling by excavating and washing roots from 12 plants per treatment in each field. The roots were rated using the the Iowa 1-6 scale (Hills and Peters, 1971). Corn yields and harvest grain moisture were obtained by harvesting entire plot areas using a combine. Grain corn was weighed with a weigh wagon.

RESULTS: Overall, plant populations in the untreated check and FORCE treatments were only 85% of that in the PONCHO 1250 treatment (Table 1). Variability of plant spacing was slightly lower in the plots treated with insecticides compared to plots where no insecticides were applied, but only at the Wolters location ($P = 0.09$; Table 1). The height of corn plants were 3.8 cm higher at the time of measurement in mid-June. Plant-to-plant variability in height was also less in the plots treated with insecticide compared to the untreated check (Table 1). Both insecticides were effective against root pruning by corn rootworm. Corn roots in plots treated with insecticide showed some pruning injury compared to moderate or severe root pruning injury in the untreated check at both locations ($P < 0.0001$; Table 2).

Insecticides increased grain corn yields at both field locations (Table 2). The yield response was higher at the Wolters location where root pruning was the most severe in the untreated check treatment before tasseling. At this field, insecticides increased grain yield by an average of 1.4 t ha^{-1} compared to a 1.0 t ha^{-1} increase at the Vyn location ($P = 0.004$; Table 2). Across both fields, PONCHO 1250 yielded 0.8 t ha^{-1} higher than the plots treated with FORCE ($P = 0.03$). Grain moisture at harvest was 0.6% lower in the plots treated with an insecticide at Wolters ($P = 0.08$), but the response was only significant across both locations $P = 0.18$ (Table 2).

CONCLUSIONS: Both PONCHO 1250 and FORCE 3G provided a similar level of protection from corn root feeding injury by corn rootworm. There was strong evidence that both insecticides increased grain yield because of reduced corn root injury. The highest yields were likely obtained from the PONCHO treatment because of superior corn establishment and early growth compared to the FORCE 3G treatment.

Table 1. The effect of insecticides on corn plant population and early growth in fields infested with corn rootworm across southern Ontario, 2003.

Co-operator (Field Location)	Treatment/Contrast	Emerged Plant Population plants ha^{-1}	Plant Spacing CV %	Plant Height cm	Plant Height CV %
Wolters	Untreated	65.5	56.5	51.4	13.8
	FORCE	69.2	49.9	54	9.4
	PONCHO 1250	79.7	45.9	55.6	9.6
	ANOVA	0.002	0.18	0.1	0.05
	Treated vs untreated	0.001	0.09	0.05	0.01
	FORCE vs PONCHO 1250	0.0009	ns	ns	ns
Vyn	Untreated	84.3	50.1	40.8	18.4
	FORCE	83.6	50.2	44.3	14.9
	PONCHO 1250	96.4	49.2	44.3	14.3
	ANOVA	0.0006	ns	0.12	0.08
	Treated vs untreated	0.02	ns	0.04	0.03
	FORCE vs PONCHO 1250	0.0004	ns	ns	ns
Average	Untreated	74.9	53.3	46.1	16.1
	FORCE	76.4	50.1	49.1	12.1
	PONCHO 1250	88.1	47.5	49.9	11.9
	ANOVA	<0.0001	ns	0.02	0.009
	Treated vs untreated	0.0004	0.2	0.008	0.002
	FORCE vs PONCHO 1250	<0.0001	ns	ns	ns

Table 2. The effect of insecticides on corn root ratings, grain moisture content at harvest, and grain yields in two fields infested with corn rootworm near Ridgetown, ON, 2003.

Co-operator (Field Location)	Treatment/Contrast	Root Rating Iowa Scale 1-5	Grain Moisture Content %	Grain Yield t ha^{-1}
Wolters	Untreated	3.6	27.4	11.6
	FORCE	1.4	26.9	12.6
	PONCHO 1250	1.3	26.8	13.3
	ANOVA	<0.0001	0.19	0.02
	Treated vs untreated	<0.0001	0.08	0.01
	FORCE vs PONCHO 1250	ns	ns	0.17
Vyn	Untreated	2	28.1	9.9
	FORCE	1.2	28	10.2
	PONCHO 1250	1.3	28.1	11.2
	ANOVA	0.03	ns	0.04
	Treated vs untreated	0.01	ns	0.07
	FORCE vs PONCHO 1250	ns	ns	0.06
Average	Untreated	2.8	27.7	10.8
	FORCE	1.3	27.4	11.4
	PONCHO 1250	1.3	27.4	12.2
	ANOVA	<0.0001	ns	0.003
	Treated vs untreated	<0.0001	0.18	0.004
	FORCE vs PONCHO 1250	ns	ns	0.03

2003 PRM REPORT # 41 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insect**
ICAR: 61006537

CROP: Corn (*Zea mays* L.)
PESTS: Wireworm *(Elateridae* spp.)

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TITLE: CONTROL OF WIREWORM WITH INSECTICIDES IN CORN, 2003.

MATERIALS: PONCHO 250 (clothianidin, 600 g a.i. L^{-1}), GAUCHO 480 FL (imidacloprid 480 g a.i. L^{-1}), AGROX DL Plus (lindane + diazinon + captan, 25% + 15% + 15% w/w), GAUCHO POWDER (imidacloprid + diazinon + captan), FORCE 3G (tefluthrin, 3% w/w)

METHODS: Two farm fields were selected near Wallacetown and Rodney, ON, with anticipated or known infestations of wireworm. Approximately two weeks before planting, seeds of Pioneer 37R71 were treated using a gasoline-powered portable cement mixer and $C0_2$-powered spray atomizer. All seeds used in the study were pre-treated commercially with a fungicide. Six treatments were replicated four times in plots that were 2 rows wide and 0.76 m between the rows. Each plot was planted along the entire length of each field. Treatments included an untreated check (i.e. no insecticide), PONCHO 250 (0.25 mg a.i. $kernel^{-1}$), GAUCHO 480 FL (0.16 mg a.i. $kernel^{-1}$), AGROX DL Plus (2 g kg^{-1} of seed), FORCE 3G applied in-furrow on the planter with a Noble® applicator (0.375 g a.i. m^{-1} row), and GAUCHO Powder. The target seeding rate was 75,000 seeds per ha^{-1}. All sites were monitored after planting to assess seed treatment performance on insect populations (counts) and/or insect damage on the plant stand, vigour and yield, as appropriate throughout the season. Dates and growth stages were recorded for all assessments. Harvest date, grain yield, grain test weight, grain moisture will be recorded on sites with visible differences among treatments. Treatments were assessed along three transects that were established across the plots. If there was evidence that natural populations of wireworm may be higher in specific areas along the length of the field across the plots, then the transects crossed those areas. A visual assessment was made on most fields at corn emergence; however, most of the measurements in the crop were conducted between the third and sixth leaf stage of corn development. Measurements included plant populations of both healthy and plants lacking vigour, average leaf developmental stage per treatment strip, number of missing plants per 2, 5 m row segments, and plant height about 3 wk before tasseling. Populations of target pests were assessed in each of the check treatments where no insecticide was applied. The proportion of broken stalks (i.e. stalks broken below the ear) and root-lodged plants (i.e. stalks lodging more than 45 degrees from horizontal at the soil surface) were determined in each plot before harvest. Corn yields and harvest grain moisture were determined by machine harvesting the entire plot area. Grain was weighed using a weigh wagon.

RESULTS: Differences among treatments of early plant populations occurred only at the Littlejohn location where wireworm infestations were higher than at the Prieksaitis field. At both locations however, early plant populations were higher when treatments contained an insecticide versus the treatment where no insecticide was applied ($0.07 > P > 0.01$; Table 1). There were no differences between AGROX DL and PONCHO 250 treatments at either location. There was some evidence that insecticides improved stand establishment and early growth at both locations. Wireworm populations varied from 0 to 2 m^{-1} of corn row, depending on the field and the areas selected (i.e., along transects) within each field. In general, seeds treated with PONCHO increased early plant populations at the 4- to 6-leaf stage, increased the proportion of emerged plants with high vigour and increased early development compared to seeds that were not treated with insecticides (Table 1). Despite these positive effects in early corn establishment, there were no differences in grain yield among the treatments in both fields (Table 2). Grain corn was 1.5% lower in moisture the corn treated with PONCHO compared to the untreated check at the Wallacetown field (Table 2).

Although there was some evidence that grain yields with PONCHO were improved compared to the untreated check treatment (Table 2), any real differences were probably negated with high variability from severe drought conditions during August.

CONCLUSIONS: Corn establishment and early corn growth were improved with the use of PONCHO at 0.25 mg a.i. kernel^{-1}.

Table 1. The effect of insecticides on corn plant population and early growth in fields infested with wireworm across southern Ontario, 2003.

Co-operator (Field Location)	Treatment/Contrast	Emerged Plant Population plants ha^{-1}	Plant Spacing CV %	Plant Height cm	Plant Height CV %
Littlejohn	Untreated	66.4 b	40.6	28.5	17.9
(Wallacetown)	D+L	74.7 a	44.9	28.4	15.4
	FORCE	71.3 ab	39.3	29	15.3
	GAUCHO 480	68.4 b	42	29	15.7
	GAUCHO powder	74.6 a	43.5	29.8	15.6
	PONCHO 250	71.1 ab	42.4	30.8	16.9
	ANOVA	0.04	ns	ns	ns
	Treated vs untreated	0.01	ns	ns	0.08
Prieksaitis	Untreated	71.5	32.7	30.4	12.7
(Rodney)	D+L	72.3	42.7	29	12.6
	FORCE	69.7	34.4	32.4	12
	GAUCHO 480	71.5	28	31.5	12.7
	GAUCHO powder	72.1	34.3	31.3	12.1
	PONCHO 250	73	35.6	31.2	11.1
	ANOVA	ns	ns	0.18	ns
	Treated vs untreated	0.07	ns	ns	ns
Average	Untreated	69	36.7	29.5	15.3
(2 fields)	D+L	73.5	43.8	28.7	14
	FORCE	70.5	36.9	30.7	13.7
	GAUCHO 480	70	35	30.3	14.2
	GAUCHO powder	73.4	38.9	30.6	13.9
	PONCHO 250	72	39	31	14
	ANOVA	0.15	ns	0.14	ns
	Treated vs untreated	ns	ns	ns	0.11

Table 2. The effect of insecticides on grain corn moisture and yield in fields infested with wireworm near Wallacetown, ON, and Rodney, ON.

Co-operator (Field Location)	Treatment/Contrast	Grain Moisture Content %	Grain Yield t ha^{-1}
Littlejohn (Wallacetown)	Untreated	18.6	8.05
	D+L	17.3	7.59
	FORCE	17.9	7.9
	GAUCHO 480	17.3	7.37
	GAUCHO powder	17.6	8.53
	PONCHO 250	17.1	9.19
	ANOVA	ns	ns
	Treated vs untreated	0.06	ns
Prieksaitis (Rodney)	Untreated	20.5	8.07
	D+L	21	7.72
	FORCE	20.5	8.54
	GAUCHO 480	20.3	7.3
	GAUCHO powder	20.5	7.52
	PONCHO 250	20.8	6.75
	ANOVA	ns	ns
	Treated vs untreated	ns	ns
Average (2 fields)	Untreated	19.5	8.06
	D+L	19.1	7.66
	FORCE	19.2	8.22
	GAUCHO 480	18.8	7.33
	GAUCHO powder	19.1	8.03
	PONCHO 250	18.9	7.97
	ANOVA	ns	ns
	Treated vs untreated	0.22	ns

2003 PMR REPORT # 42 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Soybean, (*Glycine max* (L.) Merrill), cv Renoun
PEST: Bean leaf beetle, *Cerotoma trifurcata* (Förster)

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TITLE: CONTROL OF BEAN LEAF BEETLE IN SOYBEANS WITH SEED TREATMENTS.

MATERIALS: APRON MAXX RTA 19.05 FS (fludioxonil + metalaxyl-M, 7.69 + 11.54 g ai/L); CRUISER 5 FS (thiamethoxam, 5 g ai/L); PONCHO 600 FS (clothianidin, 600 g ai/L); GAUCHO 480 FS (imidacloprid, 480 g ai/L).

METHODS: Seed was treated on 26 May, 2003 in 1 kg lots in individual plastic bags by applying a slurry (all treatments diluted in water to the same volume of 5.5 ml per kg) of the material via a syringe to each inflated bag. The seed was then mixed for 1 minute in an inflated bag to ensure thorough seed coverage. Seed weight was 164 g/1000 seeds. Beans were planted on 6 and 17 June, 2003 at Ridgetown and Highgate, ON respectively, using a two-row cone-seeder mounted on a John Deere Max Emerge planter. Plots were two rows 4 m in length and spaced 0.76 m apart arranged in a RCBD with 4 replications at a seeding rate of 8 seeds/m. Plant emergence was assessed on 27 June and 8 July, 2003 at Ridgetown and Highgate, respectively. Plots were harvested on 29 Oct, 2003 and corrected to 14.5 % moisture. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Table 1. No bean leaf beetle damage was observed. While seed corn maggot damage was not assessed per se, seed corn maggot damage was observed in the trial and probably accounted for the emergence loss in the fungicide controls. The emergence period was cool and backwards. Soybean aphids were also noted in the trial, but not rated because the trial was not planted for soybean aphid. Warrior was not sprayed because no bean leaf beetle were observed.

CONCLUSIONS: The use of CRUISER at 50 g ai/kg seed increased yields by 20%. The PONCHO treatment was more effective than the GAUCHO treatment, and similar to CRUISER.

Table 1: Emergence counts and yield assessments in soybeans at Ridgetown and Highgate, Ontario. 2003

Treatment	Rate g ai/kg seed or mg ai/seed *	Emergence Ridgetown 27 June	Emergence Highgate 8 July	Yield Ridgetown 29 Oct
		Number plants per row		T/ha
FUNGICIDE CHECK-APRON MAXX RTA		64 d **	100	5.7 c ***
APRON MAXX RTA + CRUISER	6.2515	80 cd	110	7.0 ab
APRON MAXX RTA + CRUISER	6.253	91 bc	120	6.9 b
APRON MAXX RTA + CRUISER	6.255	99 ab	120	7.4 a
APRON MAXX RTA + CRUISER	6.251	100 a	106	7.4 a
APRON MAXX RTA + CRUISER	6.255	72 cd	108	7.1 ab
APRON MAXX RTA + PONCHO	6.25 0.25 *	100 a	107	7.1 ab
APRON MAXX RTA + GAUCHO	6.25 31.25	68 d	102	6.1 c
CV		17.1	10	4.5

**Means on transformed data followed by same letter do not significantly differ (P=0.05, LSD), data transformed by arcsine square root for means separation and CV, means de-transformed
***Data homogeneous and not transformed

2003 PMR REPORT # 43 **SECTION E: CEREAL, FORAGE, AND OILSEED CROPS -Insects**
ICAR: 61006537

CROP: Soybean, (*Glycine max* (L.) Merrill), cv Renoun
PEST: Soybean aphid (*Aphis glycine*, Matsumura)

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TITLE: CONTROL OF SOYBEAN APHIDS WITH SEED TREATMENT

MATERIALS: APRON MAXX RTA 19.05 FS (fludioxonil + metalaxyl-M, 7.69 + 11.54 g ai/L); CRUISER 5 FS (thiamethoxam, 5 g ai/L); GAUCHO 350 FS (imidacloprid, 350 g ai/L); PONCHO 600 FL (clothianidin, 600 g ai/L)

METHODS: Seed was treated on 26 May, 2003 in 1 kg lots in individual new plastic bags by applying the treatment or slurry via a syringe to each bag (all treatments diluted to the same volume of 5.5 ml/kg seed using water). The seed was then mixed in the inflated bags for 1 min to ensure thorough seed coverage. Seed weight was 164 g/1000 seeds. The crop was planted on 16 and 17 June at Ridgetown and Highgate, ON, respectively, using a 2-row cone seeder at a seeding rate of 15 seeds/m. Plots were 2 rows spaced 0.76 m apart and 4 m in length placed in a RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Emergence counts were recorded on 7 July at Ridgetown. Plots were harvested on 31 Oct, 2003 at Ridgetown. Emergence data was analysed using Friedman's test and means were separated using least significant difference (LSD) at P= 0.05. Nymph counts and yield were analysed using ANOVA and means were separated using least significant difference (LSD) at P= 0.05.

RESULTS: See Table 1. Plots at Highgate were not assessed due to accidental spraying of plots with herbicide.

CONCLUSIONS: All treatments but GAUCHO improved emergence relative to the fungicide-treated check. During the first week of observations, plots treated with the two highest rates of CRUISER (50 and 100 g ai/100 kg), had significantly lower aphid numbers compared to the control. All treatments increased yield relative to the control. Although treatment with GAUCHO increased yield relative to the control, it did not increase yield to the same extent as did PONCHO Low rate. Treatment with any rate of CRUISER increased yield compared to the control, and no significant differences were observed among individual rates of CRUISER.

Table 1. Emergence, nymph counts and yield assessments in soybeans at Ridgetown, Ontario. 2003

Treatment	Rate	Emerg	Nymphs	Nymphs	Yield
	g ai/100 kg	#plant/plot	#/plant	#/plant	T/ha
	or mg ai/seed**	37808	12 Aug	18 Aug	31 Oct
FUNGICIDE CHECK-MAXIM XL		82.7 b*	112.1 a*	554.9 a*	4.0 c*
APRON MAXX RTA +CRUISER	6.2533	109.9 a	54.3 ab	299.3 abc	6.0 a
APRON MAXX RTA +CRUISER	6.255	108.0 a	28.5 b	133.9 a	5.8 ab
APRON MAXX RTA +CRUISER	6.251	102.5 a	25.5 b	153.9 bc	5.8 ab
APRON MAXX RTA +CRUISER	6.255	106.8 a	42.3 ab	243.1 abc	6.0 a
APRON MAXX RTA +PONCHO Low	6.25 0.25 **	103.7 a	63.9 ab	301.0 abc	6.1 a
APRON MAXX RTA +GAUCHO	6.25 31.25	91.3 b	94.5 a	343.1 ab	5.1 b
APRON MAXX RTA +CRUISER	6.2515	105.5 a	90.7 a	450.9 a	5.8 ab
CV		1.5	16.2	10.8	4.5

* Means on transformed data followed by the same letter do not significantly differ (P=.05 LSD), data transformed by log for means separation and CV, means de-transformed. Extreme upper and lower outliers in first and second week nymph count data sets removed prior to analysis.

2003 PMR REPORT # 44 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Soybean, (*Glycine max* (L.) Merrill), cv First Line 32 03 Roundup ready, Hyland 95
PEST: Soybean aphid (*Aphis glycine*, Matsumura)

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TITLE: CONTROL OF SOYBEAN APHIDS WITH FOLIAR TREATMENT
MATERIALS: MATADOR 120 EC (cyhalothrin-lambda, 120 g ai/L); WARRIOR 122 SC (cyhalothrin-lambda, 122 g ai/L); CYGON 480 E (dimethoate, 480 g ai/L).

METHODS: Two sites with soybean aphid populations were identified for spraying at Chatham (Marsh Line) and Prairie Siding, ON during mid-July, 2003. Seed was planted in rows spaced 40 cm apart on 15 May, 2003 at the Chatham site and solid seeded on 29 May, 2003 at Prairie Siding. Plots were maintained according to Provincial recommendations. All plots were 8 m by 3 m, placed in RCBD with 4 replications and were separated by 1 m guard strips. On the day of insecticide application, aphid numbers on the top trifoliate of 4 plants in each plot were counted to assess pre-spray aphid populations. At the Marsh Line site, aphid numbers averaged 10 nymphs per top trifoliate. At Prairie Siding, aphid numbers were 20 nymphs per top trifoliate. Plant stages at time of spraying were R1-R2 (Marsh Line), and R2 (Prairie Siding). Insecticide was applied using a handheld three-nozzle CO_2 precision sprayer (R&D Sprayers Inc.). Nozzle type was XR Teejet (11003 V5) with nozzle spacing of 50 cm. Insecticide was prepared in two litre plastic pop bottles according to assigned rates with 0.285 L of distilled water or 120 L/ha. In all plots, insecticide was applied during one pass down the plot centre, on the morning of 24 July, 2003 at a height of 0.5 m above the crop, and at a walking speed of 0.5 m/s. Spraying took place during periods with no wind turbulence. No precipitation fell on the day of application at either site. The number of aphids per plant was assessed weekly for 3 weeks following the spraying. For each week of observations, 4 plants were removed from the centre line of each plot and aphid nymphs counted. Plots were harvested on 7 and 8, Oct, 2003, at Chatham and Prairie Siding, respectively, using a small plot combine. Data were analysed using ANOVA and means were separated using least significant difference (LSD) at P=0.05. First week nymph count data for Marsh line was analysed using Friedman's analysis, and means were separated using least significant difference (LSD) at P=0.05.

RESULTS: See Tables 1 and 2.

CONCLUSIONS: For two weeks following insecticide application, plots at both sites treated with MATADOR or WARRIOR had significantly fewer aphids per plant than did control plots. By the third week of observations, all plots at Prairie Siding, regardless of treatment, had aphid populations indistinguishable from control plots. At the Marsh line site, MATADOR and WARRIOR continued to provide control into the third week of post-spray observations. No significant differences in yield were observed among any of the treatment groups.

Table 1. Nymph counts and yield assessments at Prairie Siding, Ontario. 2003.

Treatment	Rate	Nymphs			Yield
	g ai/ha	Number per plant			T/ha
		Week 1	Week 2	Week 3	8 Oct
CHECK	0	440.6 a *	433.0 a*	911.0*	2.7*
MATADOR 120 EC FOLIAR	10	15.7 b	125.6 b	793.3	2.6
WARRIOR 122 SC FOLIAR	10	22.6 b	146.9 b	679	2.6
CYGON 480 FOLIAR	480	248.8 a	198.5 ab	633.6	2.5
CV		17.5	9.8	6.1	4.3

* Means on transformed data followed by the same letter do not significantly differ (P=0.05 LSD), nymph count and yield data transformed by log for means separation and CV, means de-transformed.

Table 2. Nymph counts and yield assessments at Marsh Line, Chatham, Ontario. 2003.

Treatment	Rate	Nymphs			Yield
	g ai/ha	Number per plant			T/ha
		Week 1	Week 2	Week 3	8 Oct
CHECK	0	141.9 a*	610.5 a*	1064.4 a*	2.4*
MATADOR 120 EC FOLIAR	10	10.5 bc	227.5 bc	477.2 b	2.7
WARRIOR 122 SC FOLIAR	10	5.3 c	139.5 c	526.5 b	3
CYGON 480 FOLIAR	480	34.1 ab	391.1 ab	1195.6 a	2.7
CV		29	6.1	4.1	8.2

* Means on transformed data followed by the same letter do not significantly differ (P=0.05 LSD), nymph count and yield data transformed by log for means separation and CV, means de-transformed. Extreme upper and lower outliers removed from yield data set prior to analysis.

2003 PMR REPORT # 45 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**
ICAR: 61006537

CROP: Soybean, (*Glycine max* (L.) Merrill), cv Nemesis 26R, Roundup ready Hyland 37
PEST: Soybean aphid (*Aphis glycine*, Matsumura)

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TITLE: CONTROL OF SOYBEAN APHIDS WITH FOLIAR TREATMENT (2)

MATERIALS: MATADOR 120 EC (cyhalothrin-lambda, 120 g ai/L); FULFILL (pymetrozine, 50 % w/w); APRON MAX RTA 19.05 FS (fludioxonil + metalaxyl-M, 7.69 + 11.54 g ai/L).

METHODS: Two sites with soybean aphid populations were identified for spraying at Chatham (Marsh Line) and Prairie Siding, ON during mid-July, 2003. Seed was treated with APRON MAXX RTA and was solid-seeded on 15 May, 2003 at the Marsh Line site. Seed was solid-seeded on 29 May, 2003 at the Prairie Siding site. Plots were maintained according to Provincial recommendations. All plots were 8 m by 3 m in RCBD with 4 replications and were separated by 1 m guard strips. On the day of insecticide application, aphid numbers on the top trifoliate of 4 plants in each plot at Prairie Siding were counted to assess pre-spray aphid populations. At Prairie Siding, aphid numbers averaged 54 nymphs per top trifoliate. Aphid numbers for the Marsh Line site were sampled seven days prior to spraying, and had averaged 58 nymphs per top trifoliate from a sample of 204 plants from an adjacent test plot. Plant stages at time of spraying were early R2 (Marsh Line), and R3 (Prairie Siding). Insecticide was applied using a handheld three-nozzle CO_2 precision sprayer (R&D Sprayers Inc.). Nozzle type was XR Teejet (11003 V5) with nozzle spacing of 50 cm. Insecticide was prepared in two-litre plastic pop bottles according to assigned rates with 0.285 L of distilled water or 120 L/ha. In all plots, insecticide was applied during one pass down the plot centre, on the morning of 31 July, 2003 at Marsh Line and the afternoon of 31 July, 2003 at Prairie Siding. Insecticide was applied at a height of 0.5 m above the crop, and at a walking speed of 0.5 m/s. Spraying took place during periods with no wind turbulence. No precipitation fell on the day of application at either site. The number of aphids per plant was assessed weekly for 3 weeks following the spraying in Prairie Siding, and for 2 weeks following spraying at Marsh line. For each week of observations, 4 plants were removed from the centre line of each plot and aphid nymphs counted. Plots were harvested on 7 and 8 Oct, 2003 at Chatham and Prairie Siding, respectively, using a small plot combine. Counts and yields were analysed using ANOVA and means were separated using least significant difference (LSD) at P=0.05.

RESULTS: See Tables 1 and 2.

CONCLUSIONS: For two weeks following insecticide application, plots at both locations treated with MATADOR had significantly fewer aphids per plant compared to control plots. During the first two weeks of observations, FULFILL-treated plots at Prairie Siding had significantly fewer aphid nymphs per plant compared to controls. By the third week of observations, all plots at Prairie Siding, regardless of treatment, had aphid populations indistinguishable from control plots. No significant differences in yield were observed among any of the treatment groups, at either site.

Table 1. Nymph counts and yield assessments at Prairie Siding, Ontario. 2003.

Treatment	Rate	Number nymphs per plant			Yield
	g ai/ha	Week 1	Week 2	Week3	T/ha
CHECK		520.8 a *	625.1 a*	2124.7 *	2.7*
MATADOR 120 EC Foliar	15	109.9 b	269.7 b	2629.3	2.7
FULFILL	96	74.0 b	186.6 b	2569.4	2.7
CV		9.3	8.2	6	4.8

* Means on transformed data followed by the same letter do not significantly differ (P=0.05, LSD), data transformed by log for means separation and CV, means de-transformed.

Table 2. Nymph counts and yield assessments at Marsh Line site, Chatham, Ontario. 2003.

Treatment	Rate	Number nymphs per plant		Yield
	g ai/ha	Week 1	Week 2	T/ha
CHECK		106.2 a *	835.6 a*	2.0*
MATADOR 120 EC Foliar	15	8.2 b	318.9 b	1.9
FULFILL	96	62.5 ab	508.9 ab	1.6
CV		19.1	6.8	10.7

* Means on transformed data followed by the same letter do not significantly differ (P=0.05, LSD), data transformed by log for means separation and CV, means de-transformed.

2003 PMR REPORT # 46 SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects
ICAR : 61006537

CROP: Spring wheat, (*Triticum* spp. L.), cv AC Taber
PEST: Wireworm, (Elateridae, *spp*)

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TITLE: CONTROL OF WIREWORM IN SPRING WHEAT WITH SEED TREATMENTS

MATERIALS: RAXIL (tebuconazole, 250 g ai/L); GAUCHO 480 FS (imidacloprid, 480 g ai/L); PONCHO 600 FS (clothianidin, 600 g ai/L)

METHODS: Treated seed was supplied by Gustafson on 28 Apr, 2003. The seed was planted on 13 May, 2003 at Rodney, ON using a two-row cone-seeder mounted on a John Deere Max Emerge planter at a seeding rate of 75 seeds/m. Plots were single rows spaced 0.76 m apart and 6 m in length placed in RCBD with 4 replications. The plots were fertilized and maintained according to provincial recommendations. Emergence counts were taken on 27 May, 2003. Plant stand was determined on 3 June, 2003 and vigour assessment, using a scale of 0 -10, (10= most advanced plant and 0 = dead plants dead in the trial) was recorded on 10 June, 2003. The total number of plants and the number of damaged plants per metre were recorded on 3 June, 2003. Wireworm populations were estimated by digging up 1 m of row in a trench 15 cm deep and 10 cm wide in the check plots, sifting the soil and separating out the wireworms. Data were analysed using analysis of variance and means were separated using least significant differences (LSD) at P= 0.05.

RESULTS: See Table 1. The average number of damaged plants and wireworms in the check plots was 1.0 and 1.0/m, respectively. Plots were not harvested.

CONCLUSIONS: There were no significant reductions in plant stand caused by wireworms in this test. All treatments improved plant vigour significantly.

Table 1. Emergence, plant stand and vigour assessments in spring wheat at Rodney, Ontario. 2003

Treatment	Rate g ai/100 kg	Emergence Number plants/row	Plant Stand Number plants/row		Vigour 0-100 %
		37767	37774	37781	37781
RAXIL	1.5	394	418	413	60.0 b *
RAXIL +GAUCHO 480	1.5 5	424	423	436	90.0 a
RAXIL +GAUCHO 480	1.5 10	399	436	442	87.5 a
RAXIL +PONCHO 600	1.5 5.1	401	415	430	80.0 a
RAXIL +PONCHO 600	1.5 10	407	430	435	82.5 a
CV		7.2	7.8	6.4	14

* Means with same letter do not significantly differ (P=0.05, LSD), data homogeneous and not transformed.

PMR REPORT # 47 **SECTION E: CEREAL, FORAGE and OILSEED CROPS - Insects**

STUDY MANAGEMENT SYSTEM: 364-2120-9604

CROP: Spring wheat (*Triticum* spp. L.)
PEST: Hessian fly, *Mayetiola destructor* (Say)

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TITLE: RESISTANCE OF SPRING WHEAT CULTIVARS TO THE HESSIAN FLY

MATERIALS: Canadian spring wheat cultivars 'Invader', 'AC Barrie', 'Superb', 'AC Glenlea', 'Prodigy'; American spring wheat cultivars 'Guard', 'Grandin', 'Argent'; experimental spring wheat lines BW 314, ES73, 6 lines of 98B69*, 3 lines of 98B19*

METHODS: Nineteen wheat entries were seeded in 4 m rows, 30 cm apart, on 03 June 2003 at Glenlea, Manitoba. The cultivar 'Guard' was included because of its known resistance to Hessian fly. The entries were replicated 3 times, and sown in blocks 1 m apart. The number of upright and fallen stems in each row were counted from a randomly selected area of row to a maximum of 100 upright stems on 4-5 September 2003. On the same days upright and fallen stems were collected separately throughout each row by severing the stems at ground level. All stems were later analyzed by removing the leaf sheath on all nodes to determine the presence of stem breakage and Hessian fly puparia. A minimum of 40 upright stems from each row were assessed. The wheat lines were rated as resistant (% infested stems and stem breakage not different (5% Tukey MRT) from 'Guard'), tolerant (infested stems higher than 'Guard' but stem breakage lower than some resistant lines), partially resistant (infested stems higher but stem breakage not different from 'Guard'), or susceptible.

RESULTS: Hessian fly infestations at the Glenlea in 2003 were very high. The majority of the stems of the cultivars 'AC Barrie', 'AC Glenlea' and ES 73 were infested and >40% of the stems of

these wheats (Table 1) were broken by the Hessian fly. Eight wheat lines were rated as partially resistant. Five of the lines were cultivars: ‘Argent’, ‘Superb’, ‘Prodigy’, ‘Invader’, and ‘Grandin’, and three were 98B19* lines. BW 314 was rated as tolerant because very few of the infested stems broke (16.5%), resulting in lower stem breakage than 3 resistant wheat lines. The only wheats found to be as resistant as ‘Guard’ were the six lines of 98B69*. Stem infestation varied from 5.5% to 17.5% and stem breakage was from 1.5% to 7.8% among the lines, compared to 0.3% for ‘Guard’ (Table 1). Except for 98B69*H36, most infested stems of the 98B69* lines did not break.

CONCLUSIONS: The cultivars ‘Superb’, ‘Prodigy’, and ‘Invader’ had 3-5 times less damage by the Hessian fly than ‘AC Barrie’, and should be recommended in areas of western Canada where Hessian fly populations are high. ‘AC Glenlea’ was less susceptible to stem breakage than ‘AC Barrie’, but was >2-fold more susceptible than the 3 recommended cultivars. A number of lines of 98B69* could provide growers with resistance to the Hessian fly that would be comparable to ‘Guard’ if registered. The wheat midge resistant line BW 314 holds promise as a spring wheat with a high tolerance to stem breakage by the Hessian fly.

Table 1. Experimental lines and cultivars of spring wheat rated as resistant (R), tolerant (T) partially resistant (PR), or susceptible (S) to yield loss by the Hessian fly.

Wheat cultivar or line	% Infested stems	% Stem breakage	% Infested stem breakage	Resistance Rating
Guard	0.3f[1]	0.3	100	R
98B69*D37	5.5ef	1.5	27.3	R
98B69*N20	6.8ef	2.3	33.8	R
98B69*H36	6.6ef	3.6de	54.5	R
98B69*X54	9.2ef	3.7de	40.2	R
98B69*X8	16.7def	4.7de	28.1	R
98B69*W66	17.5c-f	7.8de	44.6	R
BW 314	18.8b-e	3.1	16.5	T
Invader	29.3bcd	10.3de	35.2	PR
98B19*F124	18.4b-e	10.5de	57.1	PR
Grandin	19.2b-e	12.0de	62.5	PR
98B19*T214	21.8b-e	12.1de	55.5	PR
Prodigy	35.2b	13.4de	38.1	PR
98B19*Q74	26.9bcd	15.4de	57.2	PR
Superb	34.9bc	18.8de	53.7	PR
Argent	31.8bcd	21.8cd	68.6	PR
ES 73	58.3a	40.2bc	69	S
Glenlea	60.8a	41.0b	67.4	S
AC Barrie	69.0a	60.9a	88.3	S

[1] Means followed by the same letter are not significantly different at the 5% level (Tukey's Multiple Range test).

2003 PMR REPORT # 48 **SECTION G : BASIC STUDIES - Insect Pests**
STUDY DATA BASE: 160.3

CROP: Canola (*Brassica napus*), cv. Lolinda, various breeding lines
PEST: Cabbage maggot (CM), *Delia radicum* (Linnaeus)

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TITLE: EVALUATION OF RELATIVE SUSCEPTIBILITY TO FEEDING DAMAGE BY CABBAGE MAGGOT OF EXPERIMENTAL LINES OF CANOLA GROWN ON MINERAL SOIL IN SOUTHWESTERN ONTARIO, 2003

METHODS: Using a 1-row, V-Belt seeder, canola seed was hand planted at a density of 25 seeds/m row in single row plots in mineral soil on the SCPFRC-London Research Farm on 22 May. Rows measured 4 m long and were separated by 1 m cultivated walkways. Four replicates of each canola line (Table 1) were planted in a randomized complete block design. Blocks were separated by 1.5 m cultivated walkways. Five guard rows of commercial canola, cv. Avalanche were planted at 0.3 m row spacing around the entire block. On 16 June, due to very poor germination of cv. Avalanche canola, guard rows and the commercial standard (Tmt. 11, Table 1) were replanted with cv. Lolinda. Weeds were controlled throughout the growing season by cultivation and manual weeding. On 26 August, taproots of 10 randomly selected plants from each plot were dug up, washed and the damage caused by feeding CM assessed for each root using a semi quantitative rating scale where 0 = no root damage, 1 = less than 10% of the root surface with root maggot feeding channels, 2 = 11-25%, 3 = 26-50%, 4 = 51-75%, and 5 = 76-100% of the taproot surface area damaged. (Dosdall, L. M., M. J. Herbut, and N. T. Cowle. 1994). For each plot, the % roots in each damage category was then calculated. Data were subjected to arcsin square root transformation prior to statistical analysis by analysis of variance (ANOVA); significance of differences among treatments means was determined using Student-Neuman-Koyle's (SNK) Multiple Range Test. Untransformed data are presented.

OBSERVATIONS: Germination of the initial commercial canola, cv. Avalanche was so poor that a second commercial cv. (Lolinda) was re-seeded 25 days after trial establishment. Development of the commercial standard canola was thus later than the experimental lines. As the smaller commercial plants were less attractive to CM searching for suitable oviposition sites, it was not possible to obtain a reliable comparison of the experimental canola lines to the commercial standard. All lines and the commercial standard were heavily damaged by a very high population of the crucifer flea beetle, *Phyllotreta cruciferae* (Goeze).

RESULTS: Experimental results are presented in Table 1. CM feeding damage was not uniformly distributed across the experimental area; inter-block variation was thus high, possibly masking some of the differences in susceptibility among experimental lines. Significant differences among lines were only recorded for roots with damage ratings of 0 (clean) or 4 (51%-75% root area damaged). In this trial experimental line 700 was least susceptible to CM feeding damage; approximately 1 root in 5 of this line showed no damage and no roots suffered damage to more than 50% of the surface of the tap root (Table 1).

CONCLUSION: Due to uneven CM population pressure, the experiment should be repeated to verify observations. Experimental Line 700 was least susceptible to CM feeding damage and warrants further investigation.

Table 1. Mean root damage ratings caused by root maggots, *Delia* spp. feeding on selected lines of canola in field plots, London, ON, 2003.

Tmt. No.	Line Identity	Percent of Roots with Indicated Rating[1]						
		0	1	2	3	4	5	0 + 1
1	38	0.0 b[2]	26.1 a	23.6 a	30.3 a	20.0 abc	0.0 a	26.1 ab
2	67	0.0 b	22.5 a	30.0 a	27.5 a	20.0 abc	0.0 a	22.5 ab
3	200	7.5 ab	40.0 a	17.5 a	25.0 a	10.0 abc	0.0 a	47.5 ab
4	229	15.0 ab	27.5 a	20.8 a	26.7 a	10.0 abc	0.0 a	42.5 ab
5	273	2.5 b	20.0 a	20.0 a	27.5 a	30.0 ab	0.0 a	22.5 ab
6	308	0.0 b	9.6 a	7.5 a	35.4 a	44.5 a	3.1 a	9.6 b
7	319	5.3 b	31.1 a	15.6 a	38.1 a	10.0 bc	0.0 a	36.4 ab
8	347	2.5 b	20.9 a	26.4 a	39.5 a	10.5 abc	0.0 a	23.3 ab
9	465	5.0 b	30.0 a	22.5 a	25.0 a	17.5 abc	0.0 a	35.0 ab
10	700	22.5 a	35.0 a	17.5 a	25.0 a	0.0 c	0.0 a	57.5 a
11	Lolinda (Standard)	5.6 b	44.2 a	17.8 a	27.5 a	5.0 bc	0.0 a	49.7 ab

[1] - **Rating Scale:** 0 = no root damage, 1 = less than 10% of the root surface with root maggot feeding channels, 2 = 11-25%, 3 = 26-50%, 4 = 51-75%, and 5 = 76-100% of the taproot surface area damaged. [Dosdall, L. M., M. J. Herbut, and N. T. Cowle. 1994. Susceptibilities of species and cultivars of canola and mustard to infestation by root maggots (Delia spp.) (Diptera: Anthomyiidae). The Canadian Entomologist 126: 251-260.]

[2] - For each damage rating category, means followed by the same letter are not significantly different ($P \leq 0.05$) as determined using ANOVA and an SNK Multiple Range Test.

2003 PMR REPORT# 49 **SECTION G: BASIC STUDIES – Insect Pests ICAR :**

CROP: Green Ash Tree, *Fraxinus pennsylvanica*
PEST: Emerald Ash Borer (EAB), *Agrilus planipennis* Fairmare

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TITLE: PRELIMINARY ASSESSMENT OF TRUNK INJECTION OF IMIDACLOPRID FOR CONTROL OF EMERALD ASH BORER BEETLES

MATERIALS: Imidacloprid (50 g/L)

METHODS: On 13 June 2003, small potted green ash trees (average dbh = 2.2cm, sd = 0.310) were injected via digital pipette with a 5% imidacloprid tree injection liquid developed by the Canadian Forest Service. Three holes were drilled with a 1/4" bit into the base of the ash bole, approximately 2-3 cm apart at a downward angle to a depth of approximately 2 cm for injecting the insecticide. Six concentrations of imidacloprid were applied to determine effective control of EAB beetles (Table 1). Five trees were injected with each concentration except for the lowest concentration (0.00375 g active ingredient/tree), where only 3 trees were healthy enough to administer the insecticide. Periodically throughout the summer (7, 14, 20, 28, and 40 days after treatment (DAT)), foliar residue samples were taken from selected trees to examine temporal trends in uptake, translocation and distribution of imidacloprid residues. On 11 July, 28 DAT, 10 leaflets per tree were removed. Five leaflets were used per each no-choice foliar feeding bioassay with 3 males and 3 females held at 14L:10D, at 21 ± 1°C, while the other five leaflets were kept frozen for analysis of insecticidal residues. EAB mortality was scored every 3 days, for 15 days and results were used to determine concentration-response trends in beetle mortality.

RESULTS: Results are outlined in Tables 1 and 2. Considerable differences were seen between treatments over all of the observation periods from day 3 to day 15 ($p<0.0001$), differences were not seen specifically between treatment levels for fifteen day observations ($p=0.0665$). The highest total mortality after 15 days was 83.33% (sem = 11.682) following injection of 0.015 g imidacloprid per tree. Recovered insecticidal residues correlated significantly with increasing treatment concentration ($r = 0.995$). Table 2 shows mean foliar residues and variation through time for replicate trees injected with 0.12g/tree rate.

CONCLUSIONS: Results demonstrate that imidacloprid was rapidly taken up and translocated throughout the crowns of small potted green ash trees. Foliar residues remained high throughout the

natural feeding period of EAB adults (Table 2). Detection of residues in control trees is due to trace coexatives that have the same retention time on HPLC (high performance liquid chromatography), and sorb at the same wavelengths as imidacloprid. Feeding bioassay results showed concentration-dependent mortality in adult EAB beetles feeding on excised leaflets, with a maximum mortality (83.33%) at intermediate exposure concentrations. The threshold effects suggest the possibility of feeding deterrence at higher imidacloprid residue levels. Parallel studies are being conducted to examine concentration-response relations relative to larval feeding on stem tissue and to investigate the influence of tree size and injection timing on stem tissue and foliar residue levels. Feeding bioassays will be repeated using modified methods to reduce control mortality and quantify the feeding deterrence effect.

Table 1. Imidacloprid concentrations injected in to potted green ash trees, mean chemical residue (± sem) recovered from the foliage, and mean EAB mortality (± sem).

Injected Concentrations (g a.i./tree)	Mean Foliar Residues (µg a.i./g fresh weight)	Mean (%) Mortality
0	0.04 ± 0.160	36.66 ± 11.682
0.00375	0.07 ± 0.206	44.44 ± 15.081
0.0075	0.10 ± 0.160	50.00 ± 11.682
0.015	0.15 ± 0.160	83.33 ± 11.682
0.03	0.38 ± 0.160	70.00 ± 11.682
0.06	0.53 ± 0.160	80.00 ± 11.682
0.12	1.14 ± 0.178	70.00 ± 11.682

Table 2. Mean foliar residues (± sem) from potted green ash trees for the maximum injected concentration (0.12 g a.i./tree), over time.

Days After Treatment	Mean Foliar Residues Recovered (µg a.i./g fresh weight)
7	5.6 ± 6.70
14	3.0 ± 1.67
20	4.3 ± 4.98
28	1.1 ± 0.85
40	1.8 ± 0.64

2003 PMR REPORT # 50 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE 402-1531-8605

CROP: Apples cv. Gala
PEST: Gray mold, *Botrytis cinerea* Pers., Blue mold, *Penicillium expansum* Link

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TITLE: EVALUATION OF THREE BIOCONTROL AGENTS FOR CONTROL OF POSTHARVEST BLUE AND GRAY MOLD DECAY OF APPLES, 2002

MATERIALS: BIO-SAVE 10 LP (*Pseudomonas syringae*), CIM *(Cystofilobasidium infirmominiatum)*, 1100-6 (*Pseudomonas fluorescens)*

METHODS: Gala apples, harvested September 2002 and stored in air storage at 1 °C until November 27, 2002, were used in an experiment to compare three biocontrol agents for the control of postharvest decay by *Penicillium expansum* and *Botrytis cinerea*. Four replicate sets of ten apples each were wounded in triplicate using an ethanol sterilized nail embedded in cork. Each wound was inoculated with 20 µl of an inoculum suspension of biocontrol agent combined with postharvest pathogen or pathogen alone. Biocontrol suspensions were prepared as follows: CIM inoculum was prepared from a 48 hour lawn culture on Yeast Malt Dextrose agar. Sterile distilled water (SDW) was used to wash inoculum into 50 cc tubes, which were centrifuged at 7000 rpm for 15 minutes. The supernatant was discarded and pelleted cells were resuspended in SDW to a transmittance of 1.9% at 650 nm. BIO-SAVE was prepared according to package directions (150 g in 5 gallons) in SDW. 1100-6 was prepared from a 24 h plate culture on Pseudomonas F agar (Difco) in SDW by visual comparison with a 3 x 10^8 McFarland standard (0.5 ml of 0.048M $BaCl_2$ in 99.5 ml 0.35 N H_2SO_4). For each biocontrol suspension, 0.1 ml of an approximately 10^6 conidia/ml SDW suspension as determined by haemocytometer counts of *Penicillium expansum* (strain 1790) or *Botrytis cinerea* (strain B-27) was added to 9.9 ml of biocontrol suspension to produce the inoculum dispensed into the apple wounds. Final concentration of pathogen in each wound was approximately 1 x10^4 conidia/ml (200 per wound); final concentration of BIO-SAVE, CIM, and 1100-6 each was approximately 1 x10^8 CFU/ml (2 x 10^6 per wound) as confirmed by dilution plating. Inoculated apples on trays were covered with pear liners and placed on wire rack shelves for incubation. Duplicate sets of inoculated apples were prepared for incubation at 20 °C and 1 °C. Inoculated apples incubated at 20 °C were rated after five days incubation. Apples incubated at 1 °C were rated after approximately two months incubation (10 January, 2003) . Apples were rated for diameter of decay (two measurements per wound using calipers), percent incidence of fruit with decay, and percent incidence of wounds with decay. Results were analyzed using the SAS General Linear Model LSMeans procedure.

RESULTS: Each of the biocontrol agents significantly reduced gray mold decay diameter, percentage of fruit and percentage of wounds with gray mold decay over the control at 1 and 20°C (Table1 and 2). Similarly, each of the biocontrol agents reduced blue mold decay at 1 and 20°C (Table 3 and 4).

CONCLUSIONS: BIO-SAVE and CIM were more effective than 1100-6 in reducing decay by *Botrytis cinerea* for fruit incubated at 1°C. The three biocontrol agents were equally effective in controlling blue mold by *Penicillium expansum* at 1°C. 1100-6 was as effective as CIM and BIO-SAVE at controlling gray mold at 20°C, but was the least effective biocontrol agent for controlling blue mold at this temperature. Overall BIO-SAVE was more effective than CIM although CIM was

used at one-half its recommended rate. 1100-6 is a promising new biocontrol for postharvest disease control and requires more study on rates and conditions for its use.

Table 1. Mean diameter, percentage of fruit, and percentage of wounds with gray mold decay for Gala apples treated with biocontrol agents and challenged with *Botrytis cinerea* after two months at 1°C.

Biocontrol Rate 2×10^6 CFU/wound	Mean decay diameter†, mm	Mean percentage of fruit with decay	Mean percentage of wounds with decay
1100-6	11.49 b*	65.00 b	38.25 b
BIOSAVE	7.10 a	32.50 a	18.25 a
CIM	7.01 a	40.00 a	21.75 a
SDW	41.29 c	100.00 c	100.00 c
Standard error	± 1.25	± 5.75	± 5.20

†Diameter of 4.00 mm is equivalent to apple wound diameter without decay.
*Means of four replicates of ten apples per replicate. Each apple was wounded in triplicate prior to treatment. Numbers followed by the same letter are not significantly different at the $p = 0.05$ level.

Table 2. Mean diameter, percentage of fruit, and percentage of wounds with gray mold decay for Gala apples treated with biocontrol agents and challenged with *Botrytis cinerea* after five days at 20°C

Biocontrol Rate 2×10^6 CFU/wound	Mean decay diameter†, mm	Mean percentage of fruit with decay	Mean percentage of wounds with decay
1100-6	4.32 a*	10.00 a	3.25 a
BIOSAVE	4.20 a	10.00 a	3.25 a
CIM	4.27 a	10.00 a	3.25 a
SDW	24.86 b	92.50 b	87.50 b
Standard error	± 1.64	± 7.38	± 5.64

†Diameter of 4.00 mm is equivalent to apple wound diameter without decay.
*Means of four replicates of ten apples per replicate. Each apple was wounded in triplicate prior to treatment. Numbers followed by the same letter are not significantly different at the $p = 0.05$ level.

Table 3. Mean diameter, percentage of fruit, and percentage of wounds with blue mold decay for Gala apples treated with biocontrol agents and challenged with *Penicillium expansum* after two months at 1°C

Biocontrol Rate 2×10^6 CFU/wound	Mean decay diameter†, mm	Mean percentage of fruit with decay	Mean percentage of wounds with decay
1100-6	4.07 a*	5.00 a	1.75 a
BIOSAVE	4.00 a	0.00 a	0.00 a
CIM	4.00 a	0.00 a	0.00 a
SDW	10.60 b	95.00 b	72.50 b
Standard error	± 1.25	± 5.75	± 5.20

†Diameter of 4.00 mm is equivalent to apple wound diameter without decay.
*Means of four replicates of ten apples per replicate. Each apple was wounded in triplicate prior to treatment. Numbers followed by the same letter are not significantly different at the $p = 0.05$ level.

Table 4. Mean diameter, percentage of fruit, and percentage of wounds with blue mold decay for Gala apples treated with biocontrol agents and challenged with *Penicillium expansum* after five days at 20°C

Biocontrol Rate 2×10^6 CFU/wound	Mean decay diameter† mm	Mean percentage of fruit with decay	Mean percentage of wounds with decay
1100-6	7.94 a*	77.50 b	60.75 c
BIOSAVE	4.91 a	37.50 a	15.00 a
CIM	6.37 a	70.00 b	36.00 b
SDW	22.66 b	100.00 c	100.00 d
Standard error	± 1.64	± 7.38	± 5.64

†Diameter of 4.00 mm is equivalent to apple wound diameter without decay.
*Means of four replicates of ten apples per replicate. Each apple was wounded in triplicate prior to treatment. Numbers followed by the same letter are not significantly different at the $p = 0.05$ level.

2003 PMR REPORT # 51 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE 402-1531-8605

CROP: Apples cvs. Gala, McIntosh, and Red Delicious
PEST: Grey mold, *Botrytis cinerea* Pers., Blue mold, *Penicillium expansum* Link

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TITLE: EVALUATION OF FLUDIOXONIL FOR CONTROL OF POSTHARVEST BLUE AND GRAY MOLD DECAY OF APPLES, 2002

MATERIALS: MERTECT (thiabendazole 45%), SCHOLAR (fludioxonil 50%)

METHODS: Apples of three cultivars: McIntosh, Gala and Red Delicious, harvested at commercial maturity in September and early October 2002, were removed from cold air storage on October 23, 2002 for treatment. Apples were wounded in triplicate using an alcohol sterilized 3 mm diameter nail embedded in cork to provide wounds of uniform width and depth, and were then inoculated with a two minute dip in one of three conidial spore suspensions amended with 0.01% Tween 20: *Botrytis cinerea* isolate B-27, 2 X 10^4 conidia/ml, *Penicillium expansum* isolate 986-2W (thiabendazole-sensitive), 7 X 10^4 conidia/ml, *Penicillium expansum* isolate 1790 (thiabendazole-resistant), 7 X 10^4 conidia/ml, or in sterile distilled water (SDW). Wounded, inoculated apples, were allowed to dry for 12 hours at room temperature before subsequent fungicide treatment. Five replicate samples of five apples each, in plastic mesh bags were treated. The various fungicide treatment rates (Tables 1 to 7) were prepared in 10 L volumes in 20 L plastic tubs with lids. Apples were dipped for at least 30 seconds in the fungicide solutions, allowed to drain, and returned to cold storage (1 ± 0.2°C). Apples were examined monthly in storage for decay development and were removed from storage and measured for incidence and severity of decay when untreated apples had developed sufficient decay to clearly separate the treatments. Severity was measured as decay diameter associated with a wound and incidence was measured as the percentage of wounds showing decay. Wound decay data was analyzed using the General Linear Model of SAS. Means were separated using the LSMeans comparative test.

RESULTS: As outlined in Tables 1 to 7.

CONCLUSIONS: SCHOLAR is a very effective postharvest fungicide for the control of both gray and blue mold of apples. In this trial SCHOLAR at the rate 0.15 g/L completely controlled both gray and blue mold and was more effective than MERTECT for the control of blue mold caused by a thiabendazole-resistant isolate of *P. expansum*.

Table 1. Percentage of wounded apple fruit inoculated with various postharvest pathogens exhibiting grey mold or blue mold decay after two months storage at 1 °C.

Inoculum	Percent fruit with decay		
	Gala	McIntosh	Red Delicious
Control	4	0	0
Botrytis cinerea B-27	96	76	100
Penicillium expansum 986-2W*	100	96	100
Penicillium expansum 1790†	100	92	96

* Sensitive to thiabendazole(TBZ).
† Resistant to thiabendazole (TBZ).

Table 2. Gray mold decay severity of wounded Gala, McIntosh, or Red Delicious apples inoculated with *Botrytis cinerea*, dip treated and stored at 1 °C for two months.

Treatment	Rate	Mean decay diameter[1] in mm by cultivar		
	/10 L	Gala	McIntosh	Red Delicious
Control		17.1 a*	9.1 a	20.8 a
MERTECT	10 ml	4.2 b	4.4 b	4.8 a
SCHOLAR	1.5 g	4.0† b	4.0 b	4.4 b
SCHOLAR	3.0 g	4.0 b	4.0 b	4.7 b
SCHOLAR	6.0 g	4.0 b	4.0 b	4.0b
SCHOLAR	12.0 g	4.0 b	4.0 b	4.2 b
Standard error		± 0.6	± 0.2	± 0.6

[1] Mean of 5 samples of 5 apples from each of five replicates. Each apple was wounded in triplicate, dip inoculated and treated. Decay diameters were measured in two directions for the purpose of calculating mean values.
* Numbers followed by the same letter are not statistically different at the p= 0.05 level.
† Diameter of 4.0 mm indicates no decay

Table 3. Mean percentage of wounds with gray mold decay for Gala, McIntosh, or Red Delicious apples inoculated with *Botrytis cinerea*, treated and stored at 1°C for two months.

Treatment	Rate	Mean Percent incidence of wound decay		
	/10 L	Gala	McIntosh	Red Delicious
Control		40.7 a*	22.7 a	42.0 a
MERTECT	10 ml	2.1 b	2.7 b	2.7 b
SCHOLAR	1.5 g	0.0 b	0.0 c	2.1 b
SCHOLAR	3.0 g	0.0 b	0.0 c	3.4 b
SCHOLAR	6.0 g	0.0 b	0.0 c	0.0 b
SCHOLAR	12.0 g	0.0 b	0.0 c	0.7 b
Standard error		± 1.4	± 0.8	± 1.4

[1] Mean of 5 samples of 5 apples from each of five replicates. Each apple was wounded in triplicate, dip inoculated then treated.
* Numbers followed by the same letter are not statistically different at the p= 0.05 level.

Table 4. Blue mold decay severity of wounded Gala, McIntosh, or Red Delicious apples inoculated with thiabendazole-sensitive *Penicillium expansum*, treated and stored at 1 °C for two months

Treatment	Rate	Mean decay diameter[1] in mm by cultivar		
	/10 L	Gala	McIntosh	Red Delicious
Control		11.2 a*	10.4 a	11.6 a
MERTECT	10 ml	4.2 b	4.8 b	5.4 b
SCHOLAR	1.5 g	4.0[†] b	4.2 c	4.1 c
SCHOLAR	3.0 g	4.0 b	4.1 c	4.1 c
SCHOLAR	6.0 g	4.0 b	4.0 c	4.2 c
SCHOLAR	12.0 g	4.0 b	4.1 c	4.0 c
Standard error		± 0.2	± 0.1	± 0.3

[1] Mean of 5 samples of 5 apples from each of five replicates. Each apple was wounded in triplicate, dip inoculated then treated. Decay diameters were measured in two directions for the purpose of calculating mean values.
* Numbers followed by the same letter are not statistically different at the p= 0.05 level.
[†] Diameter of 4.0 mm indicates no decay

Table 5. Mean percentage of wounds with blue mold decay for Gala, McIntosh, or Red Delicious apples inoculated with thiabendazole-sensitive *Penicillium expansum*, treated and stored at 1 °C for two months

Treatment	Rate	Mean Percent incidence of wound decay		
	/10 L	Gala	McIntosh	Red Delicious
Control		49.4 a*	42.7 a	46.7 a
MERTECT	10 ml	2.8 b	7.4 b	12.1 b
SCHOLAR	1.5 g	0.0 c	2.7 c	0.7 c
SCHOLAR	3.0 g	0.0 c	1.4 c	0.7 c
SCHOLAR	6.0 g	0.0 c	0.7 c	0.7 c
SCHOLAR	12.0 g	0.0 c	1.4 c	0.7 c
Standard error		± 0.9	± 0.8	± 1.8

[1] Mean of 5 samples of 5 apples from each of five replicates. Each apple was wounded in triplicate, dip inoculated then treated
* Numbers followed by the same letter are not statistically different at the p= 0.05 level.

Table 6. Blue mold decay severity of wounded Gala, McIntosh, or Red Delicious apples inoculated with thiabendazole-resistant *Penicillium expansum*, treated and stored at 1 °C for two months

Treatment	Rate	Mean decay diameter[1] in mm by cultivar		
	/10 L	Gala	McIntosh	Red Delicious
Control		11.8 a*	8.8 a	6.9 a
MERTECT	10 ml	10.6 b	8.8 a	7.2 a
SCHOLAR	1.5 g	4.0[†] c	4.1 b	4.2 b
SCHOLAR	3.0 g	4.0 c	4.1 b	4.3 b
SCHOLAR	6.0 g	4.0 c	4.1 b	4.1 b
SCHOLAR	12.0 g	4.0 c	4.0 b	4.0 b
Standard error		± 0.4	± 0.4	± 0.4

[1] Mean of 5 samples of 5 apples from each of five replicates. Each apple was wounded in triplicate, dip inoculated then treated. Decay diameters were measured in two directions for the purpose of calculating mean values.
* Numbers followed by the same letter are not statistically different at the p= 0.05 level.
[†] Diameter of 4.0 mm indicates no decay

Table 7. Mean percentage of wounds with blue mold decay for Gala, McIntosh, or Red Delicious apples inoculated with thiabendazole-resistant *Penicillium expansum*, treated and stored at 1 °C for two months.

Treatment	Rate	Mean Percent incidence of wound decay		
	/10 L	Gala	McIntosh	Red Delicious
Control		49.4 a*	35.3 a	34.6 b
MERTECT	10 ml	46.4 a	33.2 a	38.7 a
SCHOLAR	1.5 g	0.0 b	0.7 b	2.8 cd
SCHOLAR	3.0 g	0.0 b	0.7 b	3.4 c
SCHOLAR	6.0 g	0.0 b	0.7 b	1.4 cd
SCHOLAR	12.0 g	0.0 b	0.0 b	0.0 d
Standard error		± 1.7	± 2.0	± 0.4

[1] Mean of 5 samples of 5 apples from each of five replicates. Each apple was wounded in triplicate, dip inoculated then treated.
* Numbers followed by the same letter are not statistically different at the p= 0.05 level.

2003 PMR Report # 52 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 280-1261-9912

CROP: Apples (*Malus domestica* Borkh.) cv. Gala
PEST: Blue mold (*Penicillium expansum* Link)

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TITLE: EVALUATION OF THE POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF BLUE MOLD ON SMARTFRESH (1-MCP)-TREATED 'GALA' APPLES, 2002-2003.

MATERIALS: SCHOLAR (50% fludioxonil), MERTECT 500 SC (45% thiabendazole, TBZ), SMARTFRESH (1-methylcyclopropene; 1-MCP).

METHODS: SCHOLAR 50WP (fludioxonil) and MERTECT (thiabendazole; TBZ) were tested for efficacy against blue mold caused by *Penicillium expansum* on apples treated with SMARTFRESH (1-methylcyclopropene; 1-MCP). Within 24 hours of harvest 'Gala' apples were treated with 1-MCP and stored at 0˚C and >95% RH for 100 days at the University Guelph.The trial on the efficacy of fungicides on blue mold was conducted at SCPFRC, AAFC, Vineland Station. The fungicide treatments were: (1) wound only (no inoculum or fungicide), (2) inoculum only, (3)Scholar @ 600 g/L, and (4) Mertect 1.15 g/L. Apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represented a treatment replication and four replicate trays of 12 apples per replicate were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were inoculated with a 20 ml drop of TBZ-resistant *P. expansum* isolate PS-1R at a concentration of 1 x 10^5 conidia/ml and incubated at 12°C for 18-24 hours at which time they were drenched with fungicide treatments. The drench application consisted of mixing appropriate amount of fludioxonil concentration in water and pouring it on to wounded and inoculated fruit for 20 seconds or until the fruit was completely drenched. The treatments were randomized completely. The apples were treated on Jan 11, 2003 and incubated at 4˚C for 3 months. Apples in each of the experiments were evaluated for decay at monthly intervals during the three month incubation period. To determine the efficacy of fungicide treatments on the shelflife of the fruit, after first fruit decay evaluations following incubation at 4˚C ,the fruits were moved to 20˚C and 85% RH and incubated for an

additional 6 days. The apples were again evaluated for blue mold incidence (percent infected apples). Fruits were considered decayed when a lesion develop on the fruit. The data obtained was analyzed with SigmaStat statistical package. Analysis of variance was determined by using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Percent reduction of blue mold is outlined in Table 1.

CONCLUSIONS: SCHOLAR (fludioxonil) at 0.6 g/L concentrations effectively controlled blue mold (*P. expansum*) in both 1-MCP-treated and non-treated apples for 2 months at 4˚C. Higher disease incidence, 5.6 and 16.7 % of blue mold was observed in 1-MCP-treated and non-treated apples, respectively, after 3 months of incubation. As expected, MERTECT did not control blue mold caused by TBZ-resistant *P. expansum* 1-MCP had no effect on blue mold incidence which was >94.4% was observed in both 1-MCP-treated and non-treated apples. In the shelflife study, an increase of blue mold was observed in SCHOLAR-treated apples. In summary, a) there was no significant antagonistic interaction between 1-MCP and SCHOLAR and MERTECT treatments, and b) 1-MCP had no effect on blue mold incidence caused by TBZ-resistant *P. expansum* in 'Gala' apples.

Table 1. Mean percentage incidence of blue mold after postharvest treatment of SCHOLAR (fludioxonil) on 1-MCP- treated 'Gala' apples, 2002-2003 storage season.

Treatment[1]	Incidence of blue mold (%)			
Rate g/L	after incubation at 4˚C over 3 months			Shelflife at 20˚C for an additional 6 days
	11 Feb, 2003	12 Mar, 2003	10 Apr, 2003	17 Apr, 2003
Without 1-MCP				
Wound only	0.0a [23]	0.0a	0.0a	0.0a
Inoculum only	83.3b	100.0b	100.0d	100.0d
SCHOLAR @ 0.60 g/L	0.0a	0.0a	16.7c	27.8b
MERTECT @ 1.15 g/L	94.4c	100.0b	100.0d	100.0d
With 1-MCP				
Wound only	0.0a	0.0a	0.0a	0.0a
Inoculum only	94.4c	100.0b	100.0d	100.0d
SCHOLAR @ 0.60 g/L	0.0a	0.0a	5.6b	44.4c
MERTECT @ 1.15 g/L	94.4c	100.0b	100.0d	100.0d

[1] Apples were treated with 1 ppm 1-MCP and stored at 0˚C and >95% RH for 100 days prior to the test.
[2] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[3] Data is the mean of four replicate of 12 apples per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *P. expansum* before treatment.

2003 PMR Report # 53 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 280-1261-9912

CROP: Apples (*Malus domestica* Borkh.) cv. Delicious
PEST: Blue mold (*Penicillium expansum* Link)

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TITLE: EVALUATION OF THE POSTHARVEST FUNGICIDE SCHOLAR (FLUDIOXONIL) FOR CONTROL OF BLUE MOLD ON SMARTFRESH (1-MCP) TREATED 'DELICIOUS' APPLES, 2002-2003.

MATERIALS: Scholar (50% fludioxonil), SmartFresh™ (1-methylcyclopropene).

METHODS: Scholar 50WP (fludioxonil) was tested for efficacy against blue mold caused by *Penicillium expansum* on 'Delicious' apples treated with SmartFresh™ (1-methylcyclopropene; 1-MCP). The apples used in this experiment were precooled after harvest, treated with 1-MCP for 24 hours and then stored at 0˚C and >95% RH for 90 days at the University of Guelph. The trial on the efficacy of fungicides on blue mold was conducted at SCPFRC, AAFC, Vineland. The fungicide treatments were: (1) wound only (no inoculum or fungicide), (2) inoculum only; and (3)Scholar @ 150, 300 and 1200 g/L. Apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represents a treatment replication and three replicate trays with 12 fruit per replicate were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were inoculated with a 20 ml drop of TBZ-resistant *P. expansum* isolate PS-1R at a concentration of 1 x 10^5 conidia/ml and incubated at 12°C for 18-24 hours. After incubation apples were drenched with fungicide treatments. The drench application consisted of mixing the appropriate amount of fludioxonil in water and pouring it on to wounded and inoculated fruit for 20 seconds or until the fruit was completely drenched. The treatments were randomized completely. The apples were treated on Jan 11, 2003 and incubated at 4˚C for 3 months. were evaluated monthly for decay. To determine the efficacy of fungicides on the shelflife of the fruit, the fruits were moved to 20˚C and 85% RH and incubated for an additional 6 days. The fruit were evaluated again for blue mold incidence (percent infected apples). Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed with SigmaStat statistical package. Analysis of variance was determined by

using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Percent reduction of blue mold is outlined in Table 1.

CONCLUSIONS: The results demonstrate that at higher concentrations SCHOLAR (fludioxonil) was effective on blue mold (*P. expansum*) in both 1-MCP-treated and non-treated 'Delicious' apples for 3 months at 4˚C. In the post-inoculation treatment (curative), SCHOLAR at 0.3 and 1.2 g /L completely controlled blue mold (0.0%) in 1-MCP treated apples, but 5.6 to 11.1% blue mold incidence was observed in apples that were not treated with 1-MCP (Table 4). The control treatments (inoculum only) had >94.5% blue mold incidence after 2 months incubation period. In the shelf life studies, blue mold ranging from 16.7 to 38.9% developed in all the treatments of SCHOLAR following storage for 3 months at 4˚C. In summary, a) there was no significant antagonistic interaction between 1-MCP and SCHOLAR treatments, and b) better control of blue mold was achieved with SCHOLAR on the 1-MCP treated 'Delicious' apples.

Table 1. Mean percentage incidence of blue mold after postharvest treatment of SCHOLAR (fludioxonil) on 1-MCP-treated 'Delicious' apples, 2002-2003 storage season.

Treatment[1]	Incidence of blue mold (%)			
	Following incubation at 4˚C for 3 months			Shelflife at 20˚C for an additional 6 days
	11 Feb, 2003	12 Mar, 2003	10 Apr, 2003	17 April, 2003
Without 1-MCP				
Wound only	0.0 a [23]	0.0 a	0.0 a	0.0 a
Inoculum only	0.0 a	100.0 d	100.0 d	100.0 f
SCHOLAR @ 0.15 g/L	0.0 a	0.0 a	0.0 a	33.3 d
SCHOLAR @ 0.30 g/L	5.6 b	5.6 b	11.1 c	22.2 c
SCHOLAR @ 1.20 g/L	0.0 a	5.6 b	5.6 b	22.2 c
With1-MCP				
Wound only	0.0 a	0.0 a	0.0 a	0.0 a
Inoculum only	0.0 a	94.5 c	100.0 d	100.0 f
SCHOLAR @ 0.15 g/L	0.0 a	5.6 b	5.6 b	16.7 b
SCHOLAR @ 0.30 g/L	0.0 a	0.0 a	0.0 a	38.9
SCHOLAR @ 1.20 g/L	0.0 a	0.0 a	0.0 a	16.7 b

[1] Apples were treated with 1 ppm 1-MCP and stored at 0˚C and >95% RH for 100 days prior to the test.
[2] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[3] Data is the mean of four replicate of 12 apples per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *P. expansum* before treatment.

2003 PMR Report # 54 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: **280-2127-9912**

CROP: Apples (*Malus domestica* Borkh.) cv. Empire
PEST: Blue mold (*Penicillium expansum* Link)

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TITLE: **STORAGE EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL), MERTECT (THIABENDAZOLE) AND DIPHENYLAMINE (DPA) FOR CONTROL OF BLUE MOLD OF APPLES CV. EMPIRE, 2002-2003.**

MATERIALS: SCHOLAR 50 WG (50% fludioxonil), No Scald Diphenylamine EC 283 (DPA), and MERTECT 500 SC (45% thiabendazole; TBZ).
METHODS: A trial was conducted to determine the effect of diphenylamine (DPA), an antiscalding agent, on the effectiveness of SCHOLAR (fludioxonil) against blue mold of apple caused by *Penicillium expansum*. The treatments were compared with MERTECT (TBZ) for efficacy against blue mold. Commercially ripe apple cv. Empire were obtained from a AAFC research orchard in Jordan Station, ON. All fruits were stored in cold storage at 2 °C until used in experimental treatments. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 20 apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represented a treatment replication and three replicate trays with 12 apples per replicate were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were inoculated with a 20 ml drop of TBZ-resistant *P. expansum* isolate PS-1R at a concentration of 1 x 10^5 conidia/ml and incubated at 12 C for 18-24 hours and then treated with fungicide treatments. The drench application consisted of mixing appropriate amount of fludioxonil concentration in water and pouring it on to wounded and inoculated fruit for 20 seconds or until the fruit was completely drenched. Half of the apples were treated with DPA and fludixonil and the other half were treated with fungicides only. Untreated check had no fungicides or DPA. The treatments were randomized completely. Treatments were applied on 28 January, 2002 and the treated apples were stored at 2.0°C for120 days. Efficacy of fungicides and DPA against TBZ-resistant (TBZ-R) *P. expansum* were evaluated for blue mold incidence (percent infected apples) at monthly intervals. Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Percent reduction of blue mold in Table 1.

CONCLUSIONS: The efficacy of the SCHOLAR (fludioxonil) on both DPA-treated and -not treated 'Empire' apples decreased with time. At higher concentrations (600µg/ml), fludioxonil gave 100% control of blue mold for 3 months and an increase in blue mold disease incidence was observed after 4 months. This reflects the effectiveness of the fludioxonil postharvest treatment. DPA neither negatively nor positively interacted with postharvest fungicide. As expected, TBZ was not effective against TBZ-resistant isolates.

Table 1. Evaluation of postharvest drench treatment of fludioxonil and diphenylamine (DPA) for control of blue mold, caused by *Penicillium expansum*, of 'Empire', 2002-2003.

Treatment and rate	% apples with blue mold [ab] after incubation at 2C for					
	2 months		3 months		4 months	
	DPA [1]	No DPA	DPA [1]	No DPA	DPA [1]	No DPA
Inoculated control	100.0 g [23]	100.0 e	100.0 g	100.0 f	100.0 h	100.0 g
Non-inoculate, non-treated control	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.001 g/L	74.9 f	100	100.0 g	100.0 f	100.0 h	100.0 g
SCHOLAR @ 0.012 g/L	25	75.0 d	87.5 f	100.0 f	91.6 g	100.0 g
SCHOLAR @ 0.025 g/L	12.5 d	12.5 c	45.8 d	87.5	75.0 f	100.0 g
SCHOLAR @ 0.05 g/L	8.3 bc	4.2 b	58.3	50.0 d	58.3	66.6
SCHOLAR @ 0.15 g/L	0.0 a	0.0 a	12.5 b	25.0 c	25.0 d	37.5 d
SCHOLAR @ 0.3 g/L	0.0 a	0.0 a	16.7 c	50.0 d	20.8 c	70.8 f
SCHOLAR @ 0.6 g/L	4.2 b	4.2 b	12.5 b	4.2 b	12.5 b	25.0 c
SCHOLAR @ 1.2 g/L	0.0 a	0.0 a	0.0 a	0.0 a	12.5 b	12.5 b
MERTECT @ 1.16g/L	100.0 f	100	100.0 fg	100.0 f	100.0 h	100.0 g

[1] Apples were treated with 3.86g/L of DPA.
[2] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[3] Data is the mean of three replicate of 12 apples per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *P. expansum* before treatment.

2003 PMR Report # 55 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 280-2127-9912

CROP: Apples (*Malus domestica* Borkh.) cv. Empire
PEST: Blue mold (*Penicillium expansum*)

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TITLE: EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF BLUE MOLD OF APPLES CV. EMPIRE, IN CONTROLLED ATMOSPHERE (CA) STORAGE, 2002-2003.

MATERIALS: SCHOLAR 50 WG (50% fludioxonil) and MERTECT 500 SC (45% thiabendazole; TBZ).

METHODS: A trial was conducted to determine the effectiveness of SCHOLAR (fludioxonil) against blue mold of apple caused by Penicillium expansum. The treatments were compared with MERTECT (TBZ) for efficacy against blue mold. Commercially ripe apple cv. Empire were obtained from a AAFC research orchard in Jordan Station, ON. All fruits were stored in cold storage at 2 °C until used in the experimental treatments. Apples were harvested October 10, 2002 and experiment was initiated on October 22, 2002. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represented a treatment replication and three replicate trays with 12 apples per replicate were prepared for each treatment. Post-inoculation treatment, which was used to simulate the "pre-storage" treatment intervals where the infection may have occurred at the time of harvest in the field or in transit prior to the treatment at storage of SCHOLAR was evaluated. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were inoculated with a 20 ml drop of TBZ-resistant *P. expansum* isolate PS-1R at a concentration of 1×10^5 conidia/ml and incubated at 12 °C for 18-24 hours and then treated with fungicide treatments. The fungicide treatments were: innoculum only; SCHOLAR @ 0.01, 0.15, 0.30, 0.60, 1.20 g/L; and MERTECT@ 1.15 g/L. The drench application consisted of mixing appropriate amount of SCHOLAR in water and pouring it on to wounded and inoculated fruit for 20 seconds or until the fruit was completely drenched. In the dip application, the wounded and inoculated fruit were placed in fungicide solution for 30 ± 5 seconds and then the fruit were drained on the wire mesh before placing them on the fruit inserts. Untreated check had no fungicides. The treatments were completely randomized. Treated apples were incubated in CA (2 °C, 2.5% O_2 AND 2.5 % CO_2) storage for 4.5 months. Apples in each of the experiments were evaluated for decay after both incubation periods. Untreated check had no fungicides. The treatments were randomized completely. To determine the efficacy of fungicides on the shelf-life of the fruit, the fruits were moved to 20°C, 85% RH and incubated for 6 additional days. The fruit were again evaluated for blue mold incidence (percent infected apples). Efficacy of

fungicides against TBZ-resistant (TBZ-R) *P. expansum* were evaluated after both incubation periods . Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed with SigmaStat statistical package. Analysis of variance was determined by using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Incidence of blue mold is outlined in Table 1.

CONCLUSIONS: In CA storage, SCHOLAR at 0.15, 0.6, and 1.2 g/L concentration gave 0.0% blue mold for over 4.5 months in drench and dip fruit treatments. In the shelf life studies, apples treated with SCHOLAR, at 1.2 g/L concentration gave 0.0% blue mold in both drench and dip fruit treatments. At recommended concentration (1.15 g/L), MERTECT (thiabendazole), was not effective against TBZ-resistant *P. expansum* innoculum, as blue mold incidence was 100.0 %. In summary, SCHOLAR, at 1.2 g/L concentration, was effective (100.0 % control of blue mold) as a curative treatment against TBZ -resistant *P. expansum* on apples under CA conditions and shelf-life conditions. High disease incidence was observed in MERTECT treatments in which TBZ-resistant innoculum was used.

Table 1. Mean percentage incidence of blue mold after postharvest treatment of SCHOLAR (fludioxonil) on apple, cv. Empire, 2002-2003.

Treatment and rate (g/L)	Incidence of blue mold (%)			
	Following incubation in CA for 4.5 months		Shelf-life at 20°C for 6 additional days	
	Drench	Dip	Drench	Dip
Innoculum only	96.7d[12]	100.0 c	100.0 f	100.0 f
SCHOLAR @ 0.01	26.7 c	46.7 b	93.3	46
SCHOLAR @ 0.15	0.0 a	0.0 a	30.0 d	30.3 c
SCHOLAR @ 0.30	3.3 b	0.0 a	23.3 c	36.7 d
SCHOLAR @ 0.60	0.0 a	0.0 a	6.7 b	6.6 b
SCHOLAR @ 1.20	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @ 1.15	100.0 d	100.0 c	100.0 f	100.0 f

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2] Data is the mean of three replicate of 12 apples per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *P. expansum* before treatment.

2003 PMR Report # 56 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 280-2127-9912

CROP: Apples (*Malus domestica* Borkh.) cv. Empire
PEST: Gray mold (*Botrytis cinerea*. Pers.)

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TITLE: EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF GRAY MOLD ON 'EMPIRE'APPLES, IN CONTROLLED ATMOSPHERE (CA) STORAGE, 2002-2003.

MATERIALS: SCHOLAR 50 WG (50% fludioxonil) and MERTECT 500 SC (45% thiabendazole, TBZ).

METHODS: A trial was conducted to determine the effectiveness of SCHOLAR (fludioxonil) against gray mold of apple caused by *Botrytis cinerea*. The treatments were compared with MERTECT (TBZ) for efficacy against gray mold. Commercially ripe apple cv. Empire were obtained from a AAFC research orchard in Jordan Station, ON. All fruits were stored in cold storage at 2 °C until used in experimental treatments. Apples were harvested October 10, 2002 and experiment was initiated on October 22, 2002. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represented a treatment replication and three replicate trays with 12 fruit per replicate were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were inoculated with a 20 ml drop of thiabendazole-resistant *B. cinerea* isolate Bc-8DR at a concentration of 1 x 10^5 conidia/ml and incubated at 12 C for 18-24 hours and then treated with fungicide treatments. The fungicide treatments were: innoculum only; SCHOLAR @ 0.01, 0.15, 0.30, 0.60, 1.20 g/L; and MERTECT@ 1.15 g/L. The drench application consisted of mixing appropriate amount of SCHOLAR in water and pouring it on to wounded and inoculated fruit for 20 seconds or until the fruit was completely drenched. In the dip application, the wounded and inoculated fruit were placed in fungicide solution for 30 ± 5 seconds and then the fruit were drained on the wire mesh before placing them on the packing inserts. Untreated check had no fungicides. The treatments were completely randomized. Treated apples were incubated in CA (2 °C, 2.5% O_2 AND 2.5 % CO_2) storage for 4.5 months. Apples in each of the experiments were evaluated for decay after the respective incubation periods. Untreated check had no fungicides. The treatments were randomized completely. Efficacy of fungicides against thiabendazole-resistant (TBZ-R) *B. cinerea* were evaluated for gray mold incidence (percent infected apples) after 4.5 months storage. To determine the efficacy of fungicides on the shelflife of the fruit, the fruits were moved to 20°C, 85% RH and incubated for 6 additional days. Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed with SigmaStat statistical package. Analysis of variance was determined by using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Incidence of gray mold is outlined in Table 1.
CONCLUSIONS: Results were inconclusive during this trial. *Botrytis cinerea* produced only 0-3.3 % gray mold of apple in the 'innoculum only' treatment under CA conditions and 10.0% and 26.7% gray mold in the shelf-life study.

Table 1. Mean percentage incidence of gray mold (caused by *Botrytis cinerea*) after postharvest treatment of SCHOLAR (fludioxonil) on apple, cv. Empire, 2002-2003.

Treatment and rate (g/L)	% apples with gray mold			
	After incubation in CA for 4.5 months		Shelf-life at 20 °C for 6 additional days	
	Drench	Dip	Drench	Dip
Innoculum only	3.3 b [12]	0.0 a	10.0 b	26.7 c
SCHOLAR @ 0.01	0.0 a	0.0 a	10.0 b	0.0 a
SCHOLAR @ 0.15	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.30	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 0.60	0.0 a	0.0 a	0.0 a	0.0 a
SCHOLAR @ 1.20	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @ 1.15	0.0 a	6.6 b	26.7 c	13.3 b

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2] Data is the mean of three replicate of 12 apples per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *P. expansum* before treatment.

2003 PMR Report # 57 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 280-2127-9912

CROP: Apples (*Malus domestica Borkh*.) cv. Gala
PEST: Blue mold (*Penicillium expansum*)

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TITLE: EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF BLUE MOLD ON 'GALA' APPLES IN COLD STORAGE, 2002-2003.

MATERIALS: SCHOLAR (50% fludioxonil) and MERTECH 500SC (45% thiabendazole).

METHODS: SCHOLAR 50WP (fludioxonil) was compared with the MERTECT (thiabendazole; TBZ) for efficacy against blue mold of apples caused by *Penicillium expansum*. Commercially ripe Apples cv. Gala were obtained from an orchard in Jordan Station, Ontario. The trial was conducted at SCPFRC, AAFC, Vineland. All fruits were stored at 4°C until used in experimental treatments. Apples were harvested October 10, 2002 and experiment was initiated on November 6, 2002. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 apples were placed on a plastic packing insert (fruit master) contained in a plastic box. Each box represents a treatment replication and three replicate trays were prepared for each treatment. The fungicide treatments were: inoculum only; SCHOLAR @ 0.006, 0.01, 0.05, 0.15, 0.30, 0.60, 1.20 g/L; and MERTECT@ 1.15 g/L. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were inoculated with a 20 ul drop of TBZ-resistant *Penicillium expansum* isolate PS-1R at a concentration of 1 x 10^5 conidia/ml and incubated at 12 °C for 18-24 hours and then treated with fungicide treatments. The drench application consisted of mixing appropriate amount of SCHOLAR concentration in water and poured on to wounded and inoculated fruit for 20 seconds or until the fruit was completely drenched. In the dip application, the wounded and inoculated fruit were placed in fungicide solution for 30 ±5 seconds and then the fruit were drained on the wire mesh before placing them on the fruit inserts. Untreated check had no fungicides. The treatments were completely randomized. Treated apples were incubated at 4°C for 2 months. Apples in each of the experiments were evaluated for decay after the respective incubation periods. To determine the efficacy of fungicides on the shelf-life of the fruit, the fruits were then moved to 20 °C, 85% RH and incubated for 6 additional days. The fruit were again evaluated for blue mold incidence (percent infected apples). Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed with SigmaStat statistical package. Analysis of variance was determined by using appropriate transformations and significance between means were separated by LSD comparative tests.

RESULTS: Incidence of blue mold is outlined in Table 1.

CONCLUSIONS: The efficacy of SCHOLAR (fludioxonil), as a post-inoculation treatment (curative) was evaluated on blue mold (*P. expansum*) of apples in cold storage conditions for 2 months after harvest. The post-inoculation treatment was used to simulate the "pre-storage" treatment intervals where the infection may have occurred at the time of harvest in the field or in transit prior to the treatment at storage. SCHOLAR, as a drench at dip, at concentrations of 0.6 and 1.2 g/L were effective against blue mold in cold storage and also in the shelf-life study. As expected MERTECT (TBZ) was ineffective against blue mold caused by the TBZ-resistant *P. expansum.*

Table 1. Mean percentage incidence of blue mold after postharvest treatment of SCHOLAR (fludioxonil) in a post-inoculation treatment on 'Gala' apple in cold storage and shelf-life conditions, 2002-2003.

Treatment g/L	% blue mold incidence			
	4EC for 2 months		Shelf-life study at 20EC for 6 additional days	
	Drench	Dip	Drench	Dip
Inoculated control	100.0 g[12]	95.8	100.0 f	95.8 g
Fludioxonil				
SCHOLAR @ 0.006	20.8	79.1 d	25	79.2 f
SCHOLAR @ 0.01	12.5 c	37.5 c	12.5 c	49.9
SCHOLAR @ 0.025	16.7 d	37.5 c	20.8 d	41.7 d
SCHOLAR @ 0.05	0.0 a	16.7 b	0.0 a	16.7 c
SCHOLAR @ 0.15	4.2 b	0.0 a	4.2 b	8.3 b
SCHOLAR @ 0.30	0.0 a	12.5 b	0.0 a	16.7 c
SCHOLAR @ 0.60	0.0 a	0.0 a	4.2 b	0.0 a
SCHOLAR @ 1.20	0.0 a	0.0 a	0.0 a	0.0 a
MERTECT @1.15	95.8 f	95.8	100.0 f	100.0 h
Non-inoculate, non-treated control	0.0 a	0.0 a	0.0 a	0.0 a

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2] Data is the mean of three replicate of 12 apples per replicate. Each apple was wounded and inoculated with thiabendazole-resistant P. expansum before treatment.

2003 PMR Report # 58 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 280-2127-9912

CROP: Apples (*Malus domestica* Borkh.) cv. McIntosh
PEST: Blue mold (*Penicillium expansum*)

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TITLE: **EVALUATION OF THE FUNGICIDES, SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR POSTHARVEST CONTROL OF BLUE MOLD ON 'MCINTOSH' APPLES IN CONTROLLED ATMOSPHERE (CA) STORAGE, 2002-2003.**

MATERIALS: Scholar (50% fludioxonil) and Mertect 500SC (45% thiabendazole).

METHODS: Scholar 50WP (fludioxonil) was compared with the MERTECT (thiabendazole;TBZ) for efficacy against blue mold of apples caused by *Penicillium expansum*. Commercially ripe Apples cv. McIntosh were obtained from an orchard at Jordan Station, Ontario. The trial was conducted at SCPFRC, AAFC, Vineland. All fruits were stored at 4°C until used in experimental treatments. Apples were harvested October 10, 2002 and experiment was initiated on October 22, 2002. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 apples were placed on a plastic packing insert contained in a plastic box. Each box represents a treatment replication and three replicate trays were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were inoculated with a 20 ul drop of TBZ-resistant *Penicillium expansum* isolate PS-1R at a concentration of 1 x 10^5 conidia/ml and incubated at 12°C for 18-24 hours and then treated with fungicide treatments.The fungicide treatments were: inoculum only; SCHOLAR @ 0.01, 0.15, 0.30, 0.60 g/L; and MERTECT@ 1.15 g/L. In the dip application, the wounded and inoculated fruit were placed in fungicide solution for 30 ±5 seconds and then the fruit were drained on the wire mesh before placing them on the fruit inserts. Untreated check had no fungicides. The treatments were completely randomized. Treated apples were incubated at 4°C for 3-6 months. Apples in each of the experiments were evaluated for decay after the respective incubation periods. To determine the efficacy of fungicides on the shelflife of the fruit, the fruits were then moved to 20 °C, 85% RH and incubated for an additional 6 days. The fruit were again evaluated for blue mold incidence (percent infected apples). Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed with SigmaStat statistical package. Analysis of variance was determined by using appropriate transformations and significance between means was separated by LSD comparative tests.
RESULTS: Incidence of blue mold is outlined in Table 1.

CONCLUSIONS: The efficacy of SCHOLAR (fludioxonil), as a post-inoculation treatment (curative) was evaluated on blue mold (*P. expansum*) of apples under controlled atmosphere (CA)

conditions for 4.5 months after harvest. SCHOLAR at 0.6 g /L concentration gave 0.0% blue mold in dip applications. In shelflife studies, apples treated with SCHOLAR, at 0.6 g/L concentration gave 8.3% compared to 100.0% in untreated "inoculum only" fruit. At recommended concentration (1.15 g/L), MERTECT (thiabendazole), was not effective against TBZ-resistant *P. expansum* inoculum, as blue mold incidence was 100.0 %. In summary, SCHOLAR, at 0.6 g/L concentration, was effective (100.0 % control of blue mold) against TBZ -resistant *P. expansum* on apples under CA conditions and 96.4% control in shelflife study. High disease incidence was observed in MERTECT treatments in which TBZ-resistant inoculum was used.

Table 1. Mean percentage incidence of blue mold after postharvest treatment of SCHOLAR (fludioxonil) on apple, cv. McIntosh under controlled atmosphere (CA) and shelflife conditions, 2002-2003.

Treatment g/L	% blue mold incidence	
	CA storage for 4.5 months	Shelf- life study at 20EC for 6 additional days
Inoculum only	100.0 c[12]	100.0 d
SCHOLAR @ 0.05	37.5 b	100.0 d
SCHOLAR @ 0.15	0.0 a	4.2 b
SCHOLAR @ 0.3	0.0 a	8.3 c
SCHOLAR @ 0.6	0.0 a	8.3 c
MERTECT @ 1.15	100.0 c	100.0 d
Non-inoculate, non-treated control	0.0 a	0.0 a

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2] Data is the mean of three replicate of 12 apples per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *P. expansum* before treatment.

2003 PMR REPORT # 59 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Apple, cv. Jonagold
PEST: Powdery mildew, *Podosphaera leucotrica* (Ell. and Ev.) Salm.

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TITLE: EFFICACY OF FLINT, NOVA, AND SOVRAN AGAINST POWDERY MILDEW ON APPLE, 2002

MATERIALS: FLINT 50 WG (trifloxystrobin), NOVA 40 WP (myclobutanil) SOVRAN 50 WG (Kresoxim methyl)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 15-year-old Jonagold apple trees on M7a rootstocks spaced at 3.0 x 6.0 m. The statistical design of the trial was the randomized complete block with four treatments replicated five times on single tree replicates. Average volume of water applied per tree was 4 litres for a total of 3000 litres per hectare. Treatment quantities for each 100 litres of water were based on these water volumes. Twenty trees were separated into 5 blocks of 4 random single tree replicates per block. The treatments were applied until run-off with a handgun operated at approximately 400 kPa.. FLINT (0.75 kg/ha), SOVRAN (0.12 kg/ha) and NOVA (0.34 kg/ha) were applied on 24 April (Tight cluster), 7 May (Pink), 15 May (Late bloom), 23 May (Petal fall), 31 May (First cover), 11 June (Second cover), 20 June (Third cover), 26 June (Fourth cover), 3 July (Fifth cover), 17 July (Sixth cover). Primary powdery mildew was assessed on 10 May by counting the total number of branch terminal white tips on each single tree replicate. Secondary foliage powdery mildew incidence and severity were evaluated on 3 July and 9 August by rating 10 leaves on 5 shoots per tree for percent area covered by powdery mildew. Fruit mildew was determined 24 September on 25 harvested apples from each single tree replicate and evaluating each fruit for net russetting and sunburn. These counts were converted to percent infected leaves per tree, mean severity per leaf, and percent russetted or sunburned fruit. Because the values were proportions they were arcsin-transformed and subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller-Duncan k-ratio t test (k = 100) was used for multiple comparison of means.

RESULTS and DISCUSSION: White tips which indicate primary infection ranged from a mean number of 3.8 to 20.4 per tree (Table 1). The number of white tips on the control trees were significantly higher than on the trees treated with NOVA, FLINT, and SOVRAN. This indicates that these fungicides have some eradicant properties because they reduced primary infections by the time the white tips were counted. Incidence and severity of foliar powdery mildew was effectively controlled by FLINT after the first reading in July and the second reading in August although NOVA was slightly more effective. Incidence and severity of fruit russetting due to powdery mildew was extremely low in this trial and no significant differences occured between the treatments (Table 2). Sunburn ranged from 2.0 to 16.0% of the fruit but none of the treatments significantly reduced it although the lowest rate of sunburn corresponded to the SOVRAN treatment.

CONCLUSIONS: FLINT was effective for the control of foliar powdery mildew of Jonagold apples.

Table. 1. Powdery mildew of foliage of Jonagold trees treated with FLINT as compared to SOVRAN and NOVA.

Treatment[1] and Rate/100 L (kg a.i. /ha)	White Tips	%Foliage Powdery Mildew[2]			
		3 July		9 August	
		% Incidence	% Severity	% Incidence	% Severity
CONTROL	20.4 a[3]	82.8 a	17.0 a	74.0 a	16.7 a
SOVRAN 8.0 g (0.12 kg/ha)	7.4 b	14.8 b	0.9 bc	15.2 bc	1.0 c
FLINT 5.0 g (0. 75 kg/ha)	6.2 b	22.0 b	1.5 b	22.0 b	2.5 b
NOVA 11.3 g (0.34 kg/ha)	3.8 b	6.8 c	0.4 c	10.4 c	0.7 c
ANOVA Pr>F	0.0082	<.0001	<.0001	<.0001	<.0001

[1] Treatments were applied consecutively 10 times on a two week schedule starting on 24 April at tight cluster and ending on 17 July, 2002. The CONTROL was left unsprayed.
[2] Primary powdery mildew was assessed on 10 May by counting the total number of branch terminal white tips on each single tree replicate. Secondary foliar powdery mildew incidence and severity were evaluated on 3 July and 9 August by visually rating 10 leaves on 5 shoots per tree for percent area covered by powdery mildew.
[3] Powdery mildew data were arcsin transformed prior to analysis of variance. The detransformed means are presented here. Means followed by the same letter are not significantly different according to the Waller-Duncan k-ratio t test (*k*ratio = 100).

Table 2. Percent Jonagold apples treated with FLINT, SOVRAN, or NOVA russetted and sunburned at harvest on 24 September.

Treatment[1] and Rate/100 L (kg/ha)	%Powdery mildew fruit russetting		%Sunburn Incidence [2]
	Incidence	Severity	
Control	1.6 a[3]	0.8 a	13.6 a
SOVRAN 8.0 g (0.12 kg/ha)	0.0 a	0.0 a	2.0 a
FLINT 5.0 g (0. 75 kg/ha)	0.0 a	0.0 a	16.0 a
NOVA 11.3 g (0.34 kg/ha)	0.8 a	0.3 a	13.6 a
ANOVA Pr>F	0.6231	0.6229	0.4121

[1] Treatments were applied consecutively 10 times on a two week schedule starting on 24 April at tight cluster and ending on 17 July, 2002. The CONTROL was left unsprayed.
[2] Fruit mildew was determined 24 September on 25 harvested apples from each single tree replicate and evaluating each fruit for net russetting and sunburn.
[3] Powdery mildew data were arcsin transformed prior to analysis of variance. The detransformed means are presented here. Means followed by the same letter are not significantly different according to the Waller-Duncan k-ratio t test (*k*ratio = 100).

2003 PMR REPORT #60 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Stone fruit: Apricot (*Prunus armeniaca* L. cv. Blenhiem; Peach (*Prunus persica* (L.) Batsch cv. Red Haven)
PEST: Brown rot, *Monilinia fructicola* (Wint.) Honey

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TITLE: USE OF ORGANIC TREATMENTS FOR CONTROL OF BROWN ROT OF APRICOTS IN 2002

MATERIALS: COR-CLEAR (34.5% calcium); TRILOGY (neem oil 70%); SODIUM BICARBONATE; STYLET OIL (paraffinic oil 97.1%); SEA BUCKTHORN JUICE (SBT) (cv. Indian Summer) SBT SEED OIL; FUNGINEEM (potassium salts of fatty acids 40%); ROVRAL 50 W (iprodione); ARMICARB (potassium bicarbonate 85%); CALTRAC (23.7% calcium); AGROGREEN (pine oil fertilizer 4-1-1); SBT PULP OIL

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. Dip tests with Blenhiem apricots and Red Haven peaches were conducted on the 8 and 14 August, respectively. Three replicates of 10 fruit were dipped for 1 min in 2 L of each of the above treatments and incubated at 13°C for approximately a week. Peaches were inoculated with a spore suspension of *Monilinia fructicola* (isolates #1555 and #1179) containing 2 x 10^5 colony-forming units of spores one day after treatment. Apricots were not inoculated because of sufficient natural contamination in the orchard. Brown rot was recorded on 13 August on apricots and on the 20 August on peaches by recording the number of fruit with brown soft areas and buff colored sporulation. These values were converted to percent infected and the arcsin transformed values were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller-Duncan Kratio t test (k = 100) was used for multiple comparison of means and the detransformed means are reported.

RESULTS AND DISCUSSION: ROVRAL was the only fungicide that provided significant control on apricots and very effective control on peaches. This could have been a result of heavy contamination of the fruit before it was picked and the ability of ROVRAL to provide local systemic protection. Sea buckthorn pulp oil and seed oil were difficult to apply and did not cover the fruit evenly in all three replicates. They would be applied better in the form of a spray. The Neem and calcium products were not effective against brown rot. ARMICARB and sea buckthorn oil were moderatley effective and provided a similar level of control on peaches.

CONCLUSIONS: ROVRAL was the only material that provided control of brown rot on apricots. ROVRAL provided the best control on peaches but ARMICARB and sea buckthorn seed and pulp oil also provided some control
of brown rot.

Table 1. Percent post harvest brown rot in apricots and peaches that were treated by dipping fruit in various organic treatments

Treatment[1] and Rate/ L water	Apricot % Brown rot[2]	Peach % Brown rot
Sea buckthorn juice	100 a	-----
Sodium bicarbonate 1% +Stylet oil 1%	90 ab	-----
Control	83 bc	93 a
Trilogy 1	83 bc	-----
SBT pulp oil 1%	-----	69 b
SBT seed oil 1%	77 bc	73 b
Cor-Clear 0.4 g	73 c	-----
Fungineem 5%	73 c	93 a
Armicarb 6.0 g	----	73 b
Caltrac 3%	----	80 ab
Agrogreen	----	80 ab
Rovral 0.5 g	30 d	4 c
ANOVA Pr>F	0.0002	<.0001

[1] Treatments were replicated three times with 10 fruit per replicate. Fruit were treated by dipping for 1 min, allowed to drip dry and incubated at 13°C for 5-6 days.
[2] Brown rot was recorded on 13 August on apricots and on the 20 August on peaches by recording the number of fruit with brown soft areas and buff colored sporulation.
[3] Raw data were arcsin transformed before ANOVA and the detransformed means are presented here. Numbers within a column followed by the same letter are not significantly different according to the Waller-Duncan Kratio t test (K=100).

2003 PMR REPORT #61 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Cherry (*Prunus avium* L.) cv. Sweetheart
PEST: Bacterial canker, *Pseudomonas syringae* pv. *syringae* van Hall

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TITLE: EFFICACY OF KOCIDE (COPPER HYDROXIDE) FOR CONTROL OF CHERRY BACTERIAL CANKER, 2002

MATERIALS: KOCIDE (copper hydroxide), DP 114 (inorganic fertilizer containing P, K, Zn, Cu and Mn)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C on one-year-old Sweetheart cherry trees on Mazzard rootstocks. The bare root trees approx. 1.5 m in height by 1.5 cm in diameter were planted after trimming the roots in 5 gallon pots containing sand. The trees were planted in sand to help induce bacterial canker. The trees were put in a screen house on 3 May, arranged into two rows of 10, and watered for 10 min. The trees were fertilized with a solution of 10-52-10 at 5.0 g/L on 9 May. Kocide (1.2 g/L) and DP 114 (1%) treatments were applied once with a spray bottle (70 ml per tree) on 15 May (3 cm shoot). The trees were spray inoculated on 17 May with a cocktail suspension of four *Pseudomonas syringae* pv. *syringae* (6.8 x 10^8 colony-forming-units/ml) isolates except for five trees that were left as an uninoculated control trees. The *P. syringae* suspension was produced by growing the bacteria in nutrient broth for 24 hours. Leaves in one of the Kocide treatments were damaged by pulling off three leaf leaf swirls per tree. Each tree was a single replicate and each treatment was replicated five times in the randomised block design used in this trial. The *P. syringae* suspension was reapplied (5.1 x 10^8 CFU/ml) to the 20 trees on 21 May and again on 23 May (7.0 x 10^8 CFU/ml). Symptoms of bacterial canker are round to ragged holes in the leaves often with a yellow halo around the hole. Incidence of bacterial canker was recorded by counting number of leaves or leaf clusters with symptoms on 25-26 June. These values were converted to percent infected of the total number of leaves in the tree and the arcsin transformed values were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller-Duncan Kratio t test were used for multiple comparison of means and the detransformed means are reported.

RESULTS and DISCUSSION: Leaf symptoms caused by bacterial canker were very low in this trial. This could have been because most of the isolates used for inoculation were not pathogenic. It is even possible that some of the isolates used in the suspension reduced the pathogenicity of the known pathogenic isolate (#980). Based on this trial KOCIDE did not provide effective control.

CONCLUSIONS: This trial was inconclusive because of the low level of disease in the control and it was not possible to make any conclusions on the effectiveness of KOCIDE or DP 114.

Table 1. Percent Sweetheart cherry leaves with bacterial canker symptoms or shot holes.

Treatment[1] and Rate	% leaves with shot-hole symptoms[2]
Inoculated control	3.3 ab[3]
DP 114 Fertilizer 1% vol/vol	3.6 a
Kocide 1.2 g/L	1.8 ab
Kocide on injured leaves 1.2 g/L	1.7 ab
Noninoculated control	0.5 b
ANOVA Pr>F	0.148

[1] Kocide (1.2 g/L) and DP 114 (1%) treatments were applied with a spray bottle (70 ml per tree) first on 15 May (3 cm shoot) prior to inoculation with *P. syringae*.
[2] Incidence of bacterial canker was recorded by counting number of leaves or leaf clusters with shot holes on 25-26 June, 2002.
[3] Numbers within a column followed by the same letter are not significantly different according to the Waller-Duncan K-ratio T test (k =100).

2003 PMR REPORT # 62 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Grape, *Vitis vinifera* cv. Pinot noir
PEST: Powdery mildew, *Uncinula necator* (Schwein.) Burrill
Bunch rot, *Botrytis cinerea* Pers.:Fr.

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TITLE: EFFICACY OF FLINT NOVA AND SOVRAN AGAINST POWDERY MILDEW AND BUNCH ROT OF GRAPE, 2002

MATERIALS: NOVA 40W (myclobutanil), FLINT 50 WDG (trifloxystrobin), SOVRAN 50 WDG (kresoxim methyl)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on 17 year old cv. Pinot Noir grape vines. Spacing was 1.4 x 3.6 m for each panel of five grape vines. The cordon trained, spur pruned vines (ca. 20 nodes/m row) on vertical trained canopies were hedged around lag phase of berry development. The experimental design was a randomized complete block with five replicates. Each 5-vine replicate had vines 1 and 5 as guards for disease evaluation, thus the treatments were separated by 2 buffer vines. The treatments were applied until run-off with a handgun operated at approximately 400 kPa at a rate of 1500 L water/ha. FLINT (0.15 kg), SOVRAN (0.24 kg), NOVA (0.2 kg) were applied on 4 June (10-15 cm shoot), 14 June (Bloom), 27 June (Post-bloom), 11 July (Post bloom), 29 July (Cluster closure), 15 August (Veraison), 29 August (Post veraison), 25 September (14 days preharvest). The NOVA standard, FLINT, and SOVRAN treatments were applied consecutively on dates indicated above and the CONTROL was left unsprayed. Percent incidence of powdery mildew was based on the number of leaves (adaxial side) or clusters with white mildew growth and percent severity was based on the estimated area of infected leaves and clusters with mildew recorded on 30 July, 11 September, and 7 October by examining ten leaves on each of five shoots per three middle vines, and on 10 berry clusters per three middle vines. On the same dates leaves and clusters were evaluated for any signs of damage such as a typical leaf browning or fruit coloring. The total number of clusters per replicate were recorded at harvest on 9 October and 50 clusters from the total number of clusters were examined for powdery mildew and Botrytis bunch rot. Fifty berries collected randomly from each treatment were weighted to obtain average berry weight. Clusters were considered to have bunch rot if gray mold was observed growing among the berries. Five clusters from each replicate were incubated at 13°C for 12 days to determine if they were infected by *Botrytis* spp. Counts of cluster, leaf powdery mildew and bunch rot incidence and severity were converted to the percent infected per replicate and arcsin-transformed. The transformed data for leaf and cluster mildew and untransformed yield and quality data were subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller-Duncan k ratio t test (k=100) was used to separate means.

RESULTS and DISCUSSION: Powdery mildew was first observed on grape foliage on 2 July and by 30 July the incidence of both foliar and cluster powdery mildew was 100% (Table 1a). FLINT and SOVRAN were equally effective in reducing incidence and severity of foliar and cluster powdery mildew after the first reading on 30 July (Table 1a) and second readings on 11 September (Table 1b). FLINT, SOVRAN and NOVA were equally effective in reducing foliar powdery mildew after the third reading on 7 October just before harvest (Table 1c). FLINT was the most effective material for grape cluster powdery mildew reducing it by 70% compared to 28% for SOVRAN. Relatively large numbers of clusters had bunch rot at harvest but the treatments did not differ significantly (Table 2). Treated clusters varied significantly for powdery mildew. FLINT reduced incidence of powdery mildew by 76% compared to 58% for SOVRAN. The number of

grape clusters that were harvested per treatment were not significantly different, but mean berry weight for FLINT treated grapes was double that of the control
(Table 3). Because the bunch rot analysis at harvest could not separate differences, sound grape clusters were incubated at 13ºC for up to 12 days. This test showed that FLINT and SOVRAN were effective treatments for reducing decay caused by *Botrytis cinerea*. There were no signs of phytotoxicity for any of the treatments on clusters or leaves throughout the entire study.

CONCLUSIONS: FLINT is an effective product for the control of powdery mildew on grape foliage and berry clusters. It also may be an effective treatment for the control of bunch rot (*B. cinerea*) on grapes.

Table 1a. Percent incidence and severity of foliar and berry cluster powdery mildew on Pinot Noir grapes treated with FLINT, SOVRAN or NOVA after the first evaluation on 30 July, 2002.

Treatment[1] and Rate Product/1500L	FoliarPowdery Mildew		Cluster Powdery Mildew[2]	
	%Incidence	%Severity	%Incidence	%Severity
CONTROL	100 a[3]	47 a	100 a	40 a
FLINT (0.15 kg)	83 b	17 b	66 b	4 c
SOVRAN (0.24 kg)	86 b	17 b	70 b	4 c
NOVA (0.2 kg)	94 ab	26 b	94 a	17 b
Pr>F	0.0421	0.0017	0.0007	<.0001

[1] Treatments included eight applications of FLINT, SOVRAN and NOVA usually applied at two week intervals beginning in June and ending on 25 September. The CONTROL was left unsprayed.
[2] Percent incidence of powdery mildew was based on the number of leaves (adaxial side) or clusters with white mildew growth and percent severity was based on the estimated area of infected leaves and clusters with mildew.
[3] Numbers followed by the same letter are not significantly different according to the Waller-Duncan k ratio t test. Treatments consisted of 50 leaves on five shoots for leaf powdery mildew and 10 clusters randomly chosen for cluster powdery mildew replicated five times.

Table 1b. Percent incidence and severity of powdery mildew on Pinot Noir grapes treated with FLINT, SOVRAN or NOVA after the second evaluation on 11 September, 2002.

Treatment[1] and rate (Product/1500 L)	Leaf Powdery Mildew		Clustre Powdery Mildew[2]	
	% Incidence	% Severity	%Incidence	%Severity
CONTROL	100 a[3]	69 a	100 a	68 a
FLINT (0.15kg)	84 b	10 b	38 c	3 c
SOVRAN (0.24 kg)	88 b	12 b	52 c	5 c
NOVA (0.2 kg)	86 b	13 b	84 b	14 b
Pr>F	0.0069	<.0001	<.0001	<.0001

[1] Treatments included eight applications of FLINT, SOVRAN and NOVA usually applied at two week intervals beginning in June and ending on 25 September. The CONTROL was left unsprayed.
[2] Percent incidence of powdery mildew was based on the number of leaves (adaxial side) or clusters with white mildew growth and percent severity was based on the estimated area of infected leaves and clusters with mildew.
[3]Numbers followed by the same letter are not significantly different according to the Waller-Duncan k ratio t test. Treatments consisted of 50 leaves on five shoots for leaf powdery mildew and 10 clusters randomly chosen for cluster powdery mildew replicated five times.

Table 1c. Percent incidence and severity of powdery mildew on Pinot Noir grapes treated with FLINT, SOVRAN, or NOVA after the third evaluation on 7 October, 2002.

Treatment[1] and Rate (Product/1500 L)	Leaf Powdery Mildew		Cluster Powdery Mildew[2]	
	%Incidence	%Severity	%Incidence	%Severity
CONTROL	100 a[3]	67 a	100 a	78 a
FLINT (0.15 kg)	83 b	14 b	30 c	3 c
SOVRAN (0.24 kg)	78 b	11 b	72 b	9 c
NOVA (0.2 kg)	90 b	14 b	100 a	25 b
Pr>F	0.0029	<.0001	<.0001	<.0001

[1] Treatments included eight applications of FLINT, SOVRAN and NOVA usually applied at two week intervals beginning in June and ending on 25 September. The CONTROL was left unsprayed.
[2] Percent incidence of powdery mildew was based on the number of leaves (adaxial side) or clusters with white mildew growth and percent severity was based on the estimated area of infected leaves and clusters with mildew.
[3]Numbers followed by the same letter are not significantly different according to the Waller-Duncan k ratio t test. Treatments consisted of 50 leaves on five shoots for leaf powdery mildew and 10 clusters randomly chosen for cluster powdery mildew replicated five times.

Table 2. Percent incidence and severity of bunch rot and powdery mildew on Pinot Noir grapes treated with FLINT, SOVRAN or NOVA at harvest on 9 October, 2002

Treatment[1] and Rate (Product/1500 L)	Cluster Bunch rot		Cluster Powdery Mildew[2]	
	%Incidence	%Severity	%Incidence	%Severity
CONTROL	16 a[3]	8.0 a	100 a	75 a
FLINT (0.15 kg)	0.25	1.0 a	24 c	2.0 c
SOVRAN (0.24 kg)	0.1666666667	1.7 a	42 b	3.2 c
NOVA (0.2 kg)	5 a	1.0 a	100 a	22 b
Pr> F	0.6338	0.5943	<.0001	<.0001

[1] Treatments included eight applications of FLINT, SOVRAN and NOVA usually applied at two week intervals beginning in June and ending on 25 September. The CONTROL was left unsprayed.
[2] Fifty clusters were visually examined for percent powdery mildew and Botrytis bunch rot at harvest.
[3] Numbers followed by the same letter are not significantly different according to the Waller-Duncan k ratio t test. Treatments consisted of 50 leaves on five shoots for leaf powdery mildew and 10 clusters randomly chosen for cluster powdery mildew replicated five times.

Table 3. Yield of Pinot Noir grapes after seasonal sprays of FLINT, SOVRAN, or NOVAas indicated by number of clusters and mean weight of 50 berries at harvest on 9 October

Treatment[1] and rate (Product/1500L)	Number of clusters	Mean weight of 50 berries[2]
CONTROL	132 a[3]	33.4 b
FLINT (0.15 kg)	132 a	66.7 a
SOVRAN (0.24 kg)	115 a	70.4 a
NOVA (0.2 kg)	142 a	64.3 a
Pr> F	0.9175	<.0001

[1] Treatments included eight applications of FLINT, SOVRAN and NOVA usually applied at two week intervals beginning in June and ending on 25 September. The CONTROL was left unsprayed.
[2] Fifty berries collected randomly from each treatment were weighted to obtain average berry weight.
[3] Numbers followed by the same letter are not significantly different according to the Waller-Duncan k ratio t test. Treatments consisted of 50 leaves on five shoots for leaf powdery mildew and 10 clusters randomly chosen for cluster powdery mildew replicated five times.

Table 4. Percent incidence and severity of bunch rot, *Botrytis cinerea*, on Pinot noir grapes after seasonal sprays of FLINT, SOVRAN, or NOVA. Fruit was incubated at 13°C for 7 to 12 days then rated for disease incidence and severity.

Treatment[1] and Rate (Product/1500 L)	After 7 days		After 12 days	
	%Incidence	%Severity	%Incidence	%Severity[2]
CONTROL	80 a[3]	7.2 a	44 a	2.8 a
FLINT (0.15 kg)	24 b	1.2 b	24 b	1.2 b
SOVRAN (0.24 kg)	8 b	0.6 b	12 b	0.6 b
NOVA (0.2 kg)	80 a	4.8 a	56 a	3.4 a
Pr> F	0.0007	0.0002	0.0023	0.0042

[1] Treatments included eight applications of FLINT, SOVRAN and NOVA usually applied at two week intervals beginning in June and ending on 25 September. The CONTROL was left unsprayed.
[2] Five clusters from each replicate of each treatment were incubated at 13°C and visually examined for growth of *B. cinerea* after 7 and 12 days.
[3] Numbers followed by the same letter are not significantly different according to the Waller-Duncan k ratio t test. Treatments consisted of 50 leaves on five shoots for leaf powdery mildew and 10 clusters randomly chosen for cluster powdery mildew replicated five times.

2003 PMRR Report # 63 **SECTION K: FRUIT – Diseases**
STUDY DATABASE: 280-2127-9912

CROP: Peaches (Prunus persica) cv. Redhaven
PEST: Gray mold (*Botrytis cinerea)*

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TITLE: EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF GRAY MOLD OF PEACH CV. REDHAVEN IN COLD STORAGE, 2003.

MATERIALS: SCHOLAR (50% fludioxonil) and MERTECT 500SC (45% thiabendazole, TBZ).

METHODS: SCHOLAR 50wp (fludioxonil) was compared with the MERTECT (thiabendazole, TBZ) for efficacy against gray mold of peaches caused by *Botrytis cinerea*. Commercially ripe peaches were obtained from an orchard in Jordan Station, Ontario. All fruits were stored at 4EC until used in experimental treatments. peaches were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 peaches were on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represents a treatment replication and four replicate trays with 12 fruit /replicate were prepared for each treatment. Peaches were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, peaches were inoculated with a 20 ul drop of TBZ-resistant *B. cinerea* isolate BC-8D at a concentration of 1×10^5 conidia/ml and incubate at 12EC for 18-24 hours and then treated with fungicide treatments. Treatments were: control, 0.01, 0.02, 0.04, 0.15, 0.3, 0.6, 1.2 g/L of SCHOLAR and MERTECT at 1.15 g/L. The peaches were dip treated. Dip treatment consisted of dipping wounded and inoculated fruits in the fungicide suspension for 30 sec. The fruits were then placed on the packing inserts. Untreated check had no fungicides. The treatments were completely randomized. The peaches, which were treated on September 4, were evaluated for gray mold incidence after 3 week incubation at 4EC on Sept 25. To determine the efficacy of fungicides on the shelf-life of the fruit, the fruits were then moved to 20EC, 85% RH and incubated for an additional 4 days and then evaluated on September 29. Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Percent disease incidence is presented in Table 1.

CONCLUSIONS: SCHOLAR at 1.2 g/L gave 100% of control of gray mold of peaches after three weeks of storage and 85% of control after shelf-life storage. As expected, MERTECT did not control gray mold caused by TBZ-resistant *B. cinerea*. Due to wet weather conditions during the spring, a high incidence of brown rot was observed. In summary, after three weeks of storage at 4EC, SCHOLAR significantly reduced gray mold.

Table 1. Mean percentage incidence of gray mold after postharvest treatment of SCHOLAR (fludioxonil) on Peaches, cv. Redhaven after cold and shelf-life storage, 2003.

Treatment and rate (g/L)	Incidence of gray mold (%)	
	after Incubation at 4°C for 3 weeks	Shelf-life at 20°C an additional 4 days
Inoculum only	100.0 g [1,2]	100.0 g
SCHOLAR @ 0.01	64.5 f	87.5 f
SCHOLAR @ 0.02	50	75
SCHOLAR @ 0.04	37.5 d	73.3
SCHOLAR @ 0.15	14.5 c	31.2 c
SCHOLAR @ 0.3	16.6 c	27.0 b
SCHOLAR @ 0.6	5.5 b	36.0 d
SCHOLAR @ 1.2	0.0 a	14.5 a
MERTECT @ 1.15	100.0 g	100.0 g

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.

[2] Data is the mean of four replicate of 12 peaches per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *B. cinerea* before treatment.

2003 PMRR Report # 64 **SECTION K: FRUIT – Diseases**
STUDY DATABASE: 280-2127-9912

CROP: Peaches (Prunus persica) cv. Redhaven
PEST: Brown Rot (*Monilinia fructicola*)

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TITLE: EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF BROWN ROT ON 'REDHAVEN' PEACHES IN COLD STORAGE, 2003.

MATERIALS: SCHOLAR (50% fludioxonil) and MERTECT 500SC (45% thiabendazole,TBZ).

METHODS: SCHOLAR 50wp (fludioxonil) was compared with the MERTECT (thiabendazole, TBZ) for efficacy against brown rot of peaches caused by *Monilinia fructicola*. Commercially ripe peaches were obtained from an orchard at Jordan Station, Ontario. All fruits were stored at 4EC until used in experimental treatments. Peaches were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 peaches were placed on a plastic packing insert contained in a plastic box. Each box represents a treatment replication and four replicate trays with 6 or 12 fruits /replicate were prepared for each treatment. The peaches were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, peaches were inoculated with a 20 ul drop of TBZ-sensitive M. fructicola isolate MF-106 at a concentration of 1×10^5 conidia/ml and incubate at 12EC for 18-24 hours and then treated with fungicide treatments. Treatments were: control, 0.01, 0.02, 0.04, 0.15, 0.3, 0.6, 1.2 g/L of SCHOLAR and MERTECT at 1.15 g/L. The peaches were dip treated. Dip treatment consisted of dipping wounded and inoculated fruits in the fungicide suspension for 30 sec. The fruits were then placed on the fruit inserts. Untreated check had no fungicides. The treatments were completely randomized. Peaches, which were treated on September 4 were observed after 3 weeks of incubation on September 25. To determine the efficacy of fungicides on the shelflife of the fruit, the fruits were then moved to 20EC, 85% RH and incubated for an additional 4 days and observed for decay on Sept 29. Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS. Percent disease incidence is presented in Table 1.

CONCLUSIONS: SCHOLAR at concentrations starting from 0.04 to 1.2 g/L gave 100% of control of brown rot after three weeks of storage at 4EC. SCHOLAR at 1.2 g/L gave 100 % of control after shelflife storage. Due to wet weather conditions during the spring, a high incidence of brown rot was observed. MERTECT gave 100% and 79% control of brown rot after cold storage and shelf-life storage, respectively. In summary, after three weeks of storage at 4E, and after shelf-life storage, SCHOLAR significantly reduced brown rot.

Table 1. Mean percentage incidence of brown rot after postharvest treatment of SCHOLAR (fludioxonil) on Peaches, cv. Redhaven after cold storage and shelf-life storage, 2003.

Treatment and rate (g/L)	Incidence of brown rot (%)	
	after Incubation at 4EC for 3 weeks	Shelf-life at 20EC for 4 days following Incubation at 4EC for 3 weeks
Inoculum only	100.0 d[12]	100.0 g
SCHOLAR @ 0.01	4.1 b	30.0 f
SCHOLAR @ 0.02	8.3 c	27.7 f
SCHOLAR @ 0.04	0.0 a	16.6 d
SCHOLAR @ 0.15	0.0 a	4.1 b
SCHOLAR @ 0.3	0.0 a	16.6 d
SCHOLAR @ 0.6	0.0 a	8.3 c
SCHOLAR @ 1.2	0.0 a	0.0 a
MERTECT @ 1.15	0.0 a	20.8 d

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2] Data is the mean of four replicate of 12 peaches per replicate. Each apple was wounded and inoculated with thiabendazole-sensitive *M. fructicola* before treatment.

2003 PMRR Report # 65 **SECTION K: FRUIT - Diseases**
STUDY DATABASE: 280-2127-9912

CROP: Peaches (Prunus persica) cv. Loring
PEST: Brown Rot (*Monilinia fructicola*)

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TITLE: **EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF BROWN ROT ON 'LORING' PEACHES IN COLD STORAGE, 2003.**

MATERIALS: SCHOLAR (50% fludioxonil) and MERTECT 500SC (45% thiabendazole, TBZ).

METHODS: SCHOLAR 50wp (fludioxonil) was compared with the MERTECT (thiabendazole, TBZ) for efficacy against brown rot of peaches caused by *Monilinia fructicola*. Commercially ripe peaches were obtained from an orchard at Jordan Station, Ontario. All fruits were stored at 4EC until used in experimental treatments. Peaches were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 peaches were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represents a treatment replication and four replicate trays with 6 or12 fruits /replicate were prepared for each treatment. The peaches were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, peaches were inoculated with a 20 ul drop of TBZ-resistant *M. fructicola* isolate MF-6 at a concentration of 1 x 10^5 conidia/ml and incubate at 12EC for 18-24 hours and then treated with fungicide treatments. Treatments were: control, 0.01, 0.02, 0.04, 0.15, 0.3, 0.6, 1.2 g/L of SCHOLAR and MERTECT at 1.15 g/L. The peaches were dip treated. Dip treatment consisted of dipping wounded and inoculated fruits in the fungicide suspension for 30 sec. The fruits were then placed on packing inserts. Untreated check had no fungicides. The treatments were completely randomized. Peaches, which were treated on September 9 were evaluated for disease incidence after 3 weeks of incubation at 4EC on October 2. To determine the efficacy of fungicides on the shelflife of the fruit, the fruits were then moved to 20EC, 85% RH and incubated for an additional 4 days and then evaluated for brown rot incidence on October 6. Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Percent disease incidence is presented in Table 1.
CONCLUSIONS: SCHOLAR at concentrations starting from 0.3 to 1.2 g/L gave100% of control of brown rot after three weeks of storage at 4EC. SCHOLAR at 1.2 g/L gave 96 % control of brown rot after the shelf-life storage. Due to wet weather conditions during the spring, latent brown rot symptoms were observed on the fruit. MERTECT gave 100% and 55% control of brown rot after cold storage and shelf-life storage, respectively. In summary, after three weeks of storage at 4EC and after shelf-life storage, SCHOLAR significantly reduced brown rot.

Table 1. Mean percentage incidence of brown rot after postharvest treatment of SCHOLAR (fludioxonil) on Peaches, cv. Loring after cold storage and shelflife storage, 2003.

Treatment and rate g/L	Incidence of brown rot (%)	
	after incubation at 4EC for 3 weeks	Shelf-life at 20EC for an additional 4 days
Inoculum only	100.0 d[1,2]	100.0 h
SCHOLAR @ 0.01	4.1 b	91.6 g
SCHOLAR @ 0.02	8.3 c	66.6 f
SCHOLAR @ 0.04	0.0 a	50.0 e
SCHOLAR @ 0.15	4.1 b	30.0 c
SCHOLAR @ 0.3	0.0 a	8.3 b
SCHOLAR @ 0.6	0.0 a	4.1 a
SCHOLAR @ 1.2	0.0 a	4.1 a
MERTECT @ 1.15	0.0 a	45.8 d

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2] Data is the mean of four replicate of 12 peaches per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *M. fructicola* before treatment.

2003 PMRR Report # 66 **SECTION K: FRUIT – Diseases**
STUDY DATABASE: 280-2127-9912

CROP: Peaches (Prunus persica) cv Loring
PEST: Gray mold (*Botrytis cinerea* Pers.:Fr.)

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TITLE: EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF GRAY MOLD ON 'LORING' PEACHES IN COLD STORAGE, 2003.

MATERIALS: SCHOLAR (50% fludioxonil) and MERTECT 500SC (45% thiabendazole, TBZ).

METHODS: SCHOLAR 50wp (fludioxonil) was compared with the MERTECT (thiabendazole, TBZ) for efficacy against gray mold of peaches caused by *Botrytis cinerea*. Commercially ripe peaches were obtained from an orchard at Jordan Station, Ontario. All fruits were stored at 4EC until used in experimental treatments. peaches were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 peaches were on a plastic packing insert contained in a plastic box. Each box represents a treatment replication and four replicate trays with 6 or12 fruits /replicate were prepared for each treatment. Peaches were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, peaches were inoculated with a 20 ul drop of TBZ-resistant *B. cinerea* isolate BC-8D at a concentration of 1×10^5 conidia/ml and incubate at 12EC for 18-24 hours and then treated with fungicide treatments. Treatments were: control, 0.01, 0.02, 0.04, 0.15, 0.3, 0.6, 1.2 g/L of SCHOLAR and MERTECT at 1.15 g/L. The peaches were dip treated. Dip treatment consisted of dipping wounded and inoculated fruits in the fungicide suspension for 30 sec. The fruits were then placed on packing inserts. Untreated check had no fungicides. The treatments were completely randomized. The peaches, which were treated on September 9, were evaluated for gray mold incidence after 3 week incubation on October 2. To determine the efficacy of fungicides on the shelflife of the fruit, the fruits were then moved to 20EC, 85% RH and incubated for an additional 4 days and then evaluated on October 6. Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Percent disease incidence is presented in Table 1.

CONCLUSIONS: SCHOLAR at 1.2 g/L gave 91% control of gray mold of peaches after three weeks of cold storage and 62% of control in the shelflife study. As expected, MERTECT did not control gray mold caused by TBZ-resistant *B. cinerea*. Due to wet weather conditions during the spring, a high incidence of brown rot was observed on fruits. In summary, after three weeks of storage at 4EC and after shelflife storage, SCHOLAR significantly reduced gray mold.

Table 1. Mean percentage incidence of gray mold after postharvest treatment of SCHOLAR (fludioxonil) on Peaches, cv. Loring after cold and shelflife storage, 2003.

Treatment and rate (g/L)	Incidence of gray mold (%)	
	after incubation at 4C for 3 weeks	Shelflife at 20C for an additional 4 days
Inoculum only	95.8 h[1]	100.0 g
SCHOLAR @ 0.01	91.6g	70.8d
SCHOLAR @ 0.02	58.3f	58.3c
SCHOLAR @ 0.04	41.6d	87.5f
SCHOLAR @ 0.15	50	75
SCHOLAR @ 0.3	33.3c	58.3c
SCHOLAR @ 0.6	23.3b	45.8b
SCHOLAR @ 1.2	8.3a	37.5a
MERTECT @ 1.15	100.0i	100.0g

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2] Data is the mean of four replicate of 12 peaches per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *B. cinerea* before treatment.

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SECTION K: FRUIT - Diseases
STUDY DATA BASE: 280-2127-9912

CROP: Pears (*Pyrus communis*) cv. Bosc
PEST: *Penicillium expansum* Link.

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TITLE: **EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF BLUE MOLD OF PEARS CV. BOSC IN CONTROLLED ATMOSPHERE (CA) STORAGE, 2002-2003.**

MATERIALS: SCHOLAR (fludioxonil 50%) and MERTECT 500SC (thiabendazole 45%).

METHODS: SCHOLAR (fludioxonil) was compared with the MERTECT (thiabendazole, TBZ) for efficacy against blue mold of pears caused by *Penicillium expansum*. Commercially ripe Pears cv.Bosc were obtained from an orchard at Jordan Station, Ontario. All fruits were stored at 1 - 4 °C until used in experimental treatments. The pears were harvested October 5, 2002 and experiment was initiated on October 15, 2002. Pears were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 pears were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represents a treatment replication and three replicate trays were prepared for each treatment. The pears were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, pears were inoculated with a 20 µl drop of TBZ-resistant *P. expansum* isolate PS-1R at a concentration of 1×10^5 conidia/ml and incubate at 12°C for 18-24 hours and then treated with fungicide treatment. The treatments were, inoculum only, SCHOLAR at 0.01, 0.15, 0.30, 0.60, 1.2 g/L and MERTECT AT 1.15 g/L. Drench treatment included mixing of an appropriate amount of SCHOLAR in water and pouring on to wounded and inoculated fruit for 20 seconds or until the fruit was completely drenched. In dip treatments, the wounded and inoculated fruit were placed in fungicide solution for 30 ±5 seconds and then the fruits were drained on the wire mesh before placing them on the packing inserts. Untreated check had no fungicides. The treatments were completely randomized. Treated pears were incubated at 4°C for 4.5 months. Pears in each of the experiments were evaluated for decay after the respective incubation periods. To determine the efficacy of fungicides on the shelflife of the fruit, the fruits were then moved to 20 °C, 85% RH and incubated for 6 days. The fruit were again evaluated for blue mold incidence (percent infected pears). Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means were separated by LSD comparative tests.

RESULTS: Percent disease incidence of blue mold is outlined in Table 1.

CONCLUSIONS: In summary, SCHOLAR, which gave 0 % blue mold on apple, was very effective against TBZ-resistant *P. expansum* on pears, while high disease incidence (100 %) was observed in MERTECT treatments.

Table 1. Mean percentage incidence of blue mold after postharvest treatment of SCHOLAR (fludioxonil) on pear cv. Bosc, under controlled atmosphere (CA) conditions and shelf-life, 2002-2003.

Treatment and rate (g/L)	Incidence of blue mold (%)			
	Incubation in CA in controlled atmosphere for 4.5 months		20°C Shelf-life at 20°C for 6 additional days	
	Drench	Dip	Drench	Dip
Inoculum only	100.0 e [12]	100	100.0 c	100
SCHOLAR @ 0.01	100	100	100.0 c	100
SCHOLAR @ 0.15	46.6 d	26.7 d	86.6 a	83.3 d
SCHOLAR @ 0.30	40.0 c	20.0 c	83.3 a	66.7 c
SCHOLAR @ 0.60	26.7 b	16.7 b	90.0 b	46.7 b
SCHOLAR @ 1.20	6.0 a	6.6 a	86.7 a	33.3 a
MERTECT @ 1.15	100	100	100.0 c	100

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2] Data is the mean of three replicate of 12 pears per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *P. expansum* before treatment.

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SECTION K: FRUIT - Diseases
STUDY DATA BASE: 280-2127-9912

CROP: Pears (*Pyrus communis*) cv. Bosc
PEST: *Botrytis Cinerea* Pers.:Fr.

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TITLE: EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT(THIABENDAZOLE) FOR THE CONTROL OF GRAY MOLD OF PEARS CV. BOSC IN CONTROLLED ATMOSPHERE (CA) STORAGE, 2002-2003.

MATERIALS: SCHOLAR (50% fludioxonil) and MERTECT 500SC (45% thiabendazole).
METHODS: SCHOLAR 50WP (fludioxonil) was compared with the MERTECT (thiabendazole; TBZ) for efficacy against gray mold of pears caused by *Botrytis cinerea*. The trial was conducted at SCPFRC, AAFC, Vineland. Commercially ripe Pears (*Pyrus communis*) cv. Bosc were obtained from an orchard at Jordan Station, Ontario. All fruits were stored at 4°C until used in experimental treatments. The pears were harvested October 5, 2002 and experiment was initiated on October 15, 2002. Pears were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 pears were on a plastic packing insert (fruit master) contained in a plastic box. Each box represents a treatment replication and five replicate trays were prepared for each treatment. The pears were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, pears were inoculated with a 20 ul drop of TBZ-resistant *B. cinerea* isolate BC-8D at a concentration of 1×10^5 conidia/ml and incubate at 12°C for 18-24 hours and then treated with fungicide drenches. The treatments were, control, SCHOLAR at 0.01, 0.15, 0.30, 0.60, 1.2 g/L and MERTECT AT 1.15 g/L. In the drench application an appropriate amount of SCHOLAR was mixed in water and pouring it on to wounded and inoculated fruit for 20 seconds or until the fruit was completely drenched. In the dip application, the wounded and inoculated fruit were placed in the fungicide solution for 30 ± 5 seconds and then the fruit were drained on the wire mesh then placed on packing inserts. Untreated check had no fungicides. The treatments were randomized completely . Treated pears were incubated at CA storage for 4.5 months and then evaluated for decay. To determine the efficacy of fungicides on the shelf-life of the fruit, the fruits were moved to 20 °C and 85% RH and incubated for an additional 6 days. The fruit were again evaluated for gray mold incidence (percent infected pears). Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed with SigmaStat statistical package. Analysis of variance was determined by using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Percent disease incidence of gray mold is outlined in Table 1.

CONCLUSIONS: In the post-inoculation treatment (curative), SCHOLAR at 1.2 g /L concentration gave 6.7 and 0.0 % gray mold in drench and dip applications, respectively. Following 4.5 months under CA conditions. In the shelf life studies, SCHOLAR at 1.2 g /L concentration gave 6.7 % gray mold in both drench and dip applications. At recommended concentration (1.15 g/L), MERTECT, was ineffective against TBZ-resistant *B. cinerea* inoculum, as the gray mold incidence was >90.0 % in METERCT-treated pears. In summary, SCHOLAR at 1.20 g/L concentration was effective (93.0 % control of gray mold) against TBZ -resistant *B. cinerea* on pears, while high disease incidence was observed in MERTECT treatments in which TBZ-resistant inoculum was used.

Table 1. Mean percentage incidence of gray mold after postharvest treatment of SCHOLAR (fludioxonil) on pear cv. Bosc, after controlled atmosphere (CA) storage, and shelf-life, 2002-2003.

Treatment and rate (g/L)	Incidence of gray mold (%)			
	After incubation in CA for 4.5 months		Shelf-life at 20°C for 6 additional days	
	Drench	Dip	Drench	Dip
Inoculum only	1.0 e+14	100.0 f	100.0 d	96.6
SCHOLAR @ 0.01	20.0 c	43.3	100.0 d	70.0 d
SCHOLAR @ 0.15	10.0 b	6.7 b	60.0 c	40.0 c
SCHOLAR @ 0.30	10.0 b	20.0 d	53.3 b	30.0 b
SCHOLAR @ 0.60	6.7 a	10.0 c	60.0 b	40.0 c
SCHOLAR @ 1.20	6.7 a	0.0 a	6.7 a	6.7 a
MERTECT @ 1.15	90.0 d	100.0 f	100.0 d	100.0 f

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2] Data is the mean of three replicate of 12 pears per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *B. cinerea* before treatment.

2003 PMR REPORT # 69 **SECTION K: FRUIT - Diseases**
STUDY DATA BASE: 402-1531-8605

CROP: Pear, cv. Anjou
PEST: Powdery mildew, *Podosphaera leucotrica* (Ell. and Ev.) Salm.

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TITLE: EFFICACY OF MINERALL CLAY AGAINST POWDERY MILDEW AND CERTAIN INSECTS ON PEAR, 2001

MATERIALS: AGRAL 90 (non-ionic surfactant), DIPEL 2X DF (*Bacillus thuringiensis*), MINERAL CLAY (glacial marine clay)

METHODS: The trial was conducted at the Pacific Agri-Food Research Centre, Summerland, B.C. on Anjou pear trees approximately 30 years-old on seedling rootstocks spaced at 6.0 x 7.5 m. Average volume of water applied per tree was 6 litres for a total of 3075 litres per hectare. Treatment quantities for each 100 litres of water were based on these water volumes. Twenty trees were separated into 4 blocks of 5 random single tree replicates per block. The treatments were applied until run-off with a handgun operated at 500 kPa. Treatments were applied on 17 May (Petal fall), 28 May (First cover), 11 July (Second cover), 25 July (Third cover). First generation leafroller (oblique/threelined/budmoth) damage was evaluated 7 June on 50 fruit per tree when average fruit size was 15 mm diameter. First and second generation leafroller (oblique/threelined/budmoth) damage on fruit and leaf surface damage by pear slugs were evaluated on 9 August. Pear slug damage on leaves was evaluated one more time on 11 September. Leafroller and European red mite damage were evaluated on 18-19 of September. Powdery mildew was evaluated on 18-19 of September by counting the number of fruit out of 25 per replicate that were russetted and the area of the fruit covered by russetting. Phytotoxicity was evaluated by counting the number of fruit that had brown ring margins. Because the values were proportions they were arcsin-transformed and subjected to analysis of variance with the General Linear Models Procedure (SAS Institute, Cary, NC). The Waller Duncan k-ratio t test was used for multiple comparison of means.

RESULTS and DISCUSSION: Clay did not appear to have any effect on leafrollers in June early in the season or later in the season in August and September (Table 1). Clay without surfactant reduced pear slug damage compared to DIPEL (Table 2). However DIPEL, that is not normally used for pear slug control, increased pear slug damage compared to the unsprayed control. Clay reduced the incidence of powdery mildew (Table 3) but increased the number of European red mite eggs on Anjou pear fruit (Table 4). This could indicate that clay has a detrimental effect on predatory mites. AGRAL 90 surfactant in clay was very effective in spreading the clay over leaf and fruit surfaces but led to phytotoxicity indicated by rings where the clay drops dried on the fruit surfaces (Table 5). This phytotoxicity could probably be prevented by a lower concentration of AGRAL 90.

CONCLUSIONS: Clay was effective against powdery mildew even when used primarily for control of insects. Clay is better than DIPEL for reducing pear slug damage but can increase European Red Mite populations. The use of adjuvant with clay on pear can lead to fruit damage.

Table 1. Effect of Minerall Clay on leafrollers

Treatment[1] and Rate /100 L water	%Incidence of leafroller damage on fruit[2]		
	37048	37111	37151
Clay 4 kg	2 a[3]	0.25	0.375
Clay 4 kg + 100 ml Agral 90	0.0416666667	0.0833333333	6 ab
Dipel 37 g	0.0416666667	0.0416666667	2 b
Control	0.125	0.16666666667	6 ab
ANOVA Pr>F	0.6578	0.1632	0.1057

[1] Each treatment was applied to four single tree replicates every two weeks from petal fall until the end of terminal growth for a total of four applications.
[2] First generation leafroller (oblique/threelined/budmoth) damage was evaluated 7 June on 50 fruit per tree and again on 9 August, 2001.
[3]Means followed by the same letter are not significantly different according to the Waller Duncan k-ratio t test (K=100).

Table 2. Effect of Mineral Clay on pear slug damage % incidence and severity, to Anjou pear leaf surfaces.

Treatment[1] and Rate /100 L water	37111		37144	
	%Incidence	%Severity	%Incidence	%Severity[2]
Clay 4 kg	20 a[3]	0.125	48 a	13 c
Clay 4 kg + 100 ml Agral 90	0.29166666667	0.0833333333	60 a	24 ab
Dipel 37 g	26 a	0.0833333333	70 a	29 a
Control	0.375	0.0416666667	60 a	18 bc
ANOVA Pr>F	0.6149	0.6074	0.2385	0.0023

[1] Each treatment was applied to four single tree replicates every two weeks from petal fall until the end of terminal growth for a total of four applications.
[2] Leaf surface damage by pear slugs was evaluated on 9 August and 11 September, 2001.
[3] Means followed by the same letter are not significantly different according to the Waller Duncan k-ratio t test (K=100).

Table 3. Effect of Mineral clay on powdery mildew percent incidence and severity on Anjou pear fruit

Treatment[1] and Rate /100 L water	18-19 September	
	%Incidence	%Severity[2]
Clay 4 kg	66 b[3]	0.25
Clay 4 kg + 100 ml Agral 90	83 ab	0.29166666667
Dipel 37 g	86 a	0.33333333333
Control	91 a	0.33333333333
ANOVA Pr>F	0.0708	0.6252

[1]Each treatment was applied to four single tree replicates every two weeks from petal fall until the end of terminal growth for a total of four applications.
[2] Powdery mildew was evaluated on 18-19 of September by counting the number of fruit out of 25 per replicate that were russetted (incidence) and the area of the fruit (severity) covered by russetting.
[3] Means followed by the same letter are not significantly different according to the Waller Duncan k-ratio t test (K=100).

Table 4. Effect of Mineral clay on the presence of European red mite eggs on fruit.

Treatment[1] and Rate /100 L water	18-19 September
	%Incidence (>20 eggs at calyx end)[2]
Clay 4 kg	70 a[3]
Clay 4 kg + 100 ml Agral 90	80 a
Dipel 37 g	5 b
Control	7 b
ANOVA Pr>F	0.0006

[1] Each treatment was applied to four single tree replicates every two weeks from petal fall until the end of terminal growth for a total of four applications.
[2] Number of European red mite eggs were counted with the aid of a dissecting microscope in the fruit calyx end.
[3] Means followed by the same letter are not significantly different according to the Waller Duncan k-ratio t test (K=100).

Table 5. Phytotoxicity of Mineral Clay on Anjou pear fruit surface.

Treatment and Rate /100 L water	18-19 September %Incidence of Phytotoxicity[2]
Clay 4 kg	0 b[3]
Clay 4 kg + 10 ml Agral 90	74 a
Dipel 37 g	0 b
Control	0 b
ANOVA Pr>F	<.0001

[1] Each treatment was applied to four single tree replicates every two weeks from petal fall until the end of terminal growth for a total of four applications.
[2] Phytotoxicity was evaluated by counting the number of fruit that had brown ring margins.
[3] Means followed by the same letter are not significantly different according to the Waller Duncan k-ratio t test (K=100).

2003 PMR Report # 70 **SECTION K: FRUIT – Diseases**
STUDY DATABASE: 280-2127-9912

CROP: Plum (Prunus domestica) cv. Shiro
PEST: Gray mold (*Botrytis cinerea* Pers.:Fr)

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TITLE: EVALUATION OF POSTHARVEST FUNGICIDES SCHOLAR (FLUDIOXONIL) AND MERTECT (THIABENDAZOLE) FOR CONTROL OF GRAY MOLD OF PLUM CV. SHIRO IN COLD STORAGE, 2003.

MATERIALS: SCHOLAR (50% fludioxonil) and MERTECT 500SC (45% thiabendazole, TBZ).

METHODS: SCHOLAR 50wp (fludioxonil) was compared with the MERTECT (thiabendazole; TBZ) for efficacy against gray mold of plum caused by *Botrytis cinerea* . Commercially ripe plum was obtained from an orchard at Jordan Station, Ontario. All fruits were stored at 4EC until used in experimental treatments. plum were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 plum was on a plastic packing insert contained in a plastic box. Each box represents a treatment replication and four replicate trays with 12 fruit /replicate were prepared for each treatment. Plums were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, plum was inoculated with a 20 ul drop of TBZ-resistant *B. cinerea* isolate BC-8D at a concentration of 1 x 10^5 conidia/ml and incubate at 12E for 18-24 hours and then treated with fungicide treatments. Treatments were: control, 0.01, 0.02, 0.04, 0.15, 0.3, 0.6, 1.2 g/L and thiabendazole at 1.15 g/L. The plums were drop treated. Drop treatment consisted of placing a drop of fungicide suspension on the wounded and inoculated fruits. The inoculated fruits were placed on the fruit inserts. Untreated check had no fungicides. The treatments were completely randomized. Treated plums were incubated at 4EC for 3 wk. Plums in each of the experiments were evaluated for decay after the respective incubation periods. To determine the efficacy of fungicides on the shelf-life of the fruit, the fruits were then moved to 20EC, 85% RH and incubated for14 days. The fruits were again evaluated at 7 and 14 days at 20EC for gray mold incidence (percent infected plums). Fruits were considered decayed when a lesion developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means was separated by LSD comparative tests.

RESULTS: Percent disease incidence is presented in Table 1.

CONCLUSIONS: SCHOLAR at concentrations starting from 0.3 to 1.2 g/L gave > 98.0%of control of gray mold after three weeks of storage at 4EC. In post shelflife evaluations, SCHOLAR at 0.6 and 1.2 g/L gave 94 % control of gray mold after 7 days and 14 days. MERTECT gave 50 % control of gray mold after cold storage. In post-shelflife evaluations, MERTECT gave 47% and 29% control after 7 and 14 days, respectively. In summary, after three week of storage at 4EC, SCHOLAR significantly reduced gray mold.
After shelf-life storage, the higher rates of SCHOLAR, 0.3 and 1.2 g/L controlled gray mold.

Table 1. Mean percentage incidence of gray mold after postharvest treatment of SCHOLAR (fludioxonil) on Plums, cv. Shiro, in cold storage and shelf-life storages, 2003.

Treatment and rate (g/L)	Incidence of gray mold (%)		
	Incubation at 4°C for 3 weeks	Shelf-life at 20C for additional 7 and 14 days	
		7 days	14 days
Inoculum only	100.0 e [12]	100.0 g	100.0 f
SCHOLAR @ 0.01	8.3 c	100.0 g	100.0 f
SCHOLAR @ 0.02	5.5 b	61.1	72.2 d
SCHOLAR @ 0.04	0.0 a	33.3 c	88.8
SCHOLAR @ 0.15	4.2 b	81.3 f	100.0 f
SCHOLAR @ 0.3	0.0 a	0.0 a	18.7 c
SCHOLAR @ 0.6	0.0 a	0.0 a	0.0 a
SCHOLAR @ 1.2	2.0 b	6.3 b	6.3 b
MERTECT @ 1.15	50.0 d	52.5 d	70.8 d

[1] Means within columns followed by the same letter are not significantly different using the Tukey test at P = 0.05.
[2]Data is the mean of three replicate of 12 plums per replicate. Each apple was wounded and inoculated with thiabendazole-resistant *B. cinerea* before treatment.

2003 PMR REPORT # 71 **SECTION L: VEGETABLES and SPECIAL CROPS - Diseases**
STUDY DATA BASE 280-2124-9915

CROP: Ginseng (*Panax quinquefolius* L.)
PEST: Damping-off, *Rhizoctonia solani* (Kühn)

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TITLE: EFFICACY OF QUADRIS AND BAS 500 (CABRIO) FOR THE CONTROL OF RHIZOCTONIA DAMPING-OFF IN GINSENG, 2001-2003.

MATERIALS: QUADRIS (azoxystrobin; 229 g ai /L); BAS 500 (pyraclostrobin; 200 g ai /kg); NUTRI-Q 0-0-5 (5 % quintozene)

METHODS: The trial was established on a brunisolic grey-brown luvisol (Fox loamy sand; Delhi research farm) in Oct 2001. Plots (2.5 m long x 1.5 m wide), separated by 0.5 - m buffers, were laid out in a conventional cambered ginseng bed under plastic shade cloth using a randomized complete block design with four replications. Plots were seeded at a rate of 325 seeds/m^2. Each plot was subdivided into two 1- m^2 subplots, designed to receive pathogen inoculum either in the fall (30 Oct 2001), or the following spring (1 Mar 2002). Inoculum consisted of pieces of *R. solani*-colonized ginseng roots, prepared by slicing fresh roots into 5 mm thick sections then double-autoclaving in erlenmeyer flasks. Root pieces were inoculated with an agar culture of *R. solani* then incubated under ambient light in the laboratory for 4 wk. Five g (fresh wt) of colonized root, held in a cheesecloth bag, were placed in a shallow (2 cm) depression in the soil centrally located in each fall-infested subplot. Additional inoculum, prepared simultaneously, was stored at 8 C until 1 Mar 2002, when it was added to spring-infested subplots, as per the fall inoculum. Fall application of fungicide treatments was made to both subplots on 30 Oct 2001, prior to placement of an oat straw mulch over the seeded beds. Spring fungicide applications (QUADRIS and BAS 500 only) to both subplots were made on 17 April 2002, over the existing straw mulch. Applications of QUADRIS and BAS 500 were made in the fall in 2000 L water/ha (TG-2 nozzle; 276 kPa) and, in the spring, in 4000 L water/ha (TG-3 nozzle; 234 kPa), using a CO_2 - powered backpack sprayer. Movable spray curtains were placed around each plot during application, in order to minimize spray drift. By contrast, the granular product NUTRI-Q 0-0-5 (quintozene) was applied only once (30 Oct 2002), using a spice shaker to uniformly distribute the material over the plot area. Control plots were untreated. Efficacy was evaluated during the 2002 and 2003 growing seasons but no further treatment applications were made after 17 April 2002. Ginseng stand counts for each 1.0 m^2 area subplot were recorded in August 2002 and July 2003. Radial extension of disease (cm) from the central inoculum point in each subplot was determined on the same dates. In each subplot, the extent of disease spread (as expressed by missing or damped-off seedlings) was measured in the south and west directions; means of the two radii were used in analysis. Data were analysed using ANOVA; the Holms-Sidak test was used to separate treatment means (SigmaStat v. 3).

RESULTS: As outlined in Table 1. No significant treatment effects were observed in 2002, however, poor emergence (< 17 % of planted seeds) in 2002 may have obscured treatment effects. Poor emergence was likely a consequence of poorly stratified seed. Radii of damped-off areas could not be accurately determined in 2002 due to poor stands. The winter of 2002-2003 provided cool temperatures required to complete the stratification process of non-emerged seed. Emergence was thus improved in 2003 and treatment effects were evident in fall-infested subplots for both plant stand and radius of damped-off area. It is likely that the radial spread of the pathogen occurred mainly in the 2002 growing season, but was not detected (in terms of differences between treatments) due to insufficient plant stand. Disease incidence in spring-infested subplots was less

than in fall-infested subplots, and treatments in spring-infested subplots were not significantly different from one another in 2002 or 2003.

CONCLUSIONS: All product treatments resulted in 2003 stands that were significantly superior to those in the untreated check. Both Quadris rates and the high BAS 500 rate were superior to the low BAS 500 rate with respect to stand. Damped-off areas were significantly smaller for both Quadris rates, Nutri-Q and the high BAS 500 rate than in the untreated check. Quadris and BAS 500 provided levels of disease control similar to that of Nutri-Q.

Table 1. Effect of fungicides on plant stand and radius of damped-off area in *Rhizoctonia*-infested plots, 2003.

Treatment and rate a.i./ ha	Fall-infested subplots[4]		
	16 Aug 2002[5]	14 Jul 2003[5]	
	Plant stand [6]	Plant stand [6]	Radius (cm)[7]
Quadris; 280 g ai/ha (2X)[1]	55.2	90.7 a	28.0 ab
Quadris; 560 g ai/ha (2X)[1]	37.2	91.3 a	18.9 a
BAS 500; 220 g ai/ha (2X)[1]	44	67.7 b	37.2 bc
BAS 500; 440 g/ha (2X)[1]	53.2	94.3 a	31.1 ab
Nutri-Q (0-0-5); 6.75 kg ai/ha (1X)[2]	41.5	75.3 ab	21.1 a
Check[3]	39.2	45.7 c	45.8 c
P > F	0.432	0.004	0.003

[1] Applications were made twice (30 Oct 2001 and 17 April 2002) to each plot, at the rate indicated.
[2] Nutri-Q (quintozene) was added to plots on 30 Oct 2001 only.
[3] Untreated plots to which inoculum was added (positive control).
[4] Fungal inoculum was added to fall-infested subplots on 30 October 2001, prior to treatment application. No significant treatment effects were observed in spring-infested subplots and data from these plots are not shown.
[5] Dates when observations of plant stand and disease radius were recorded.
[6] Plant stand / m^2 . Stands in 2002 were comprised of seedlings; stands in 2003 were comprised of two-year old plants and seedlings. Treatment values in a column followed by the same letter indicate that treatments are not significantly different according to the Holm-Sidak test (alpha=0.05).
[7] Radius of damped-off area (cm). Treatment values in a column followed by the same letter indicate that treatments are not significantly different according to the Holm-Sidak test (alpha=0.05). Radius data for 2002 are not shown.

2003 PMR REPORT # 72 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Dry bean (*Phaseolus vulgaris* L.), cv. Great Northern
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROLOF RHIZOCTONIA SEEDLING BLIGHT OF DRY BEAN IN ALBERTA IN 2003

MATERIALS: VITAFLO 280 (carbathiin 14.9% + thiram 13.2% FS), ALLEGIANCE (metalaxyl, 320 g/L FS), L0288 (*Bacillus* sp.), L1269 (proprietary), L1050 (proprietary)

METHODS: Seed of the dry bean cv. Great Northern was treated in a Hege small batch seed treater with L1050 at 3.25 mL/kg seed, L0288 at 0.065 g/kg seed, L1269 at 3.7 mL/kg seed, or with VITAFLO 280 at 2.6 mL/kg seed, either alone or in combination with ALLEGIANCE at 0.128 mL/kg seed. An experimental plot was established on 22 May at Brooks, Alberta, in a brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Nontreated seeds were planted as inoculated and noninoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 40 mL/row. Emerged seedlings were counted on 19 June. At maturity (18 September), plants were cut and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly ($P \leq 0.05$) higher for all seed treatments in the trial, except for L0288 alone, than for the inoculated control (Table 1). Emergence was significantly ($P \leq 0.05$) higher for L1050 and for L1269 than for VITAFLO 280 alone. Seed yield was significantly greater for VITAFLO 280 alone than for L0288 and the inoculated control.
CONCLUSIONS: All seed treatments in the trial, except L0288 alone, markedly improved emergence over the inoculated control. VITAFLO 280, alone, improved seed yield compared to the inoculated control.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of the dry bean cv. Great Northern grown in field plots inoculated with *Rhizoctonia solani* at Brooks, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Stand (plants/m^2)	Seed yield (t/ha)
Noninoculated Control		35.4 a[1]	5.43 ab
Inoculated Control [2]		14.1 c	4.05 c
L1050	3.25	32.8 a	4.69 abc
L1269	3.7	32.7 a	4.96 abc
L0288	0.065 g	17.4 c	4.29 bc
VITAFLO 280	2.6	26.9 b	5.63 a
ALLEGIANCE + VITAFLO 280	0.13 + 2.6	30.0 ab	4.96 abc

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2003 PMR REPORT # 73 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Bean (*Phaseolus vulgaris* L.), cv. Great Northern
PEST: Anthracnose (*Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib.)

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TITLE: GREENHOUSE EVALUATION OF FOLIAR FUNGICIDES FOR THE CONTROL OF ANTHRACNOSE ORIGINATING FROM INFECTED BEAN SEED IN 2003

MATERIALS: QUADRIS 250 (azoxystrobin 22.9% SU), HEADLINE 250 (pyraclostrobin 250 g/L EC), DITHANE 75 (mancozeb 75% WG)

METHODS: Anthracnose-infected seed of the bean cv. Great Northern was grown in Kord fibre pots (12.5-cm diameter) filled with pasteurized soil mix (1:1 loam : peat moss). Seven seeds were planted in each pot and ten pots were used for each treatment. Foliar fungicide treatments QUADRIS 250, HEADLINE 250 and DITHANE 75 were applied either three weeks (Timing A) or five weeks (Timing B) after seeding in the spraying chamber using an H-set airbrush at 100 Kpa. Application rates were 125, 100 and 1688 g ai/ha, respectively. Disease development was assessed based on disease incidence (percentage of diseased plants) and severity [a scale of 0 (no disease lesions) to 5 (over 80% of the leaf surface area infected)]. Data were subjected to analysis of variance using a General Linear Models Procedure from the Statistical Analysis System (SAS 8.01) and Tukey's honest significant difference test was performed for means comparisons.

RESULTS: Both QUADRIS treatments significantly reduced disease incidence and severity ($P \leq 0.001$) compared to the infected control and other fungicide treatments (Table 1). HEADLINE significantly reduced severity of anthracnose, but reduced disease incidence only for timing B. Disease incidence and severity in pots treated with DITHANE were similar to the infected control. There were no significant differences ($P \leq 0.05$) in disease incidence or severity between the two spray application timings for any of the fungicides.

CONCLUSIONS: QUADRIS 250 consistently reduced anthracnose infection in dry bean. HEADLINE also reduced anthracnose infection in most cases. DITHANE 75did not reduce anthracnose infection.

Table 1. Effects of foliar fungicide treatments on the incidence and severity of anthracnose on the bean cv. Great Northern in a greenhouse experiment at Vegreville, Alberta in 2003.

Treatment	Rate (g ai/ha)	Spray timing[1]	Disease[2]	
			Incidence (%)	Severity (0-4)
QUADRIS 250	125	A	59.5 c	0.7 d
QUADRIS 250	125	B	51.2 c	0.7 d
HEADLINE 250	100	A	88.5 ab	1.2 bc
HEADLINE 250	100	B	77.5 b	1.0 c
DITHANE 75	1688	A	98.3 a	1.3 ab
DITHANE/ DITHANE 75	1688/1688	A/B	93.0 a	1.3 abc
Infected control	--	--	98.6 a	1.5 a

[1] Timing A: Foliar spray applied three weeks after seeding. Timing B: Foliar spray applied five weeks after seeding.
[2] Values are means of ten replications for each treatment. Means in a column within each category followed by the same letter are not significantly different according to Tukey's honest significant difference (TUKEY) at $P \leq 0.05$.

2003 PMR REPORT # 74 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Bean (*Phaseolus vulgaris* L.), cv. Great Northern
PEST: Anthracnose (*Colletotrichum lindemuthianum* (Sacc. & Magnus) Lams.-Scrib.)

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TITLE: GREENHOUSE EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEED BORNE ANTHRACNOSE IN BEAN IN 2003

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), PROTEGE 100 (azoxystrobin 9.6% SU), THIABENDAZOLE (TBZ) (thiabendazole 42.28% SU),, and DCT 28% (diazinon 6% + captan 18% + thiophanate-methyl 4% WP)

METHODS: Anthracnose-infected seed of bean cv. Great Northern was treated with APRON MAXX RTA at either 0.0625 or 0.125 g ai/kg seed, PROTEGE 100F at 0.1 g ai/kg seed, TBZ at 0.2 g ai/kg seed, DCT at 1.98 g ai/kg seed, APRON MAXX RTA + PROTEGE 100 and APRON MAXX RTA + TBZ at the previously specified rates, and DCT at 1.98 g ai/kg seed. Treated seeds were grown in Kord fibre pots (12.5-cm diameter) filled with pasteurized soil mix (1:1 loam:peat moss). Seven seeds were planted in each pot and ten pots were used for each treatment. Final plant stand count and plant height were recorded. Disease development was assessed based on the incidence (percentage of diseased plants) and severity [a scale of 0 (no disease lesions) to 5 (over 80% of the leaf surface area infected)]. Data were subjected to analysis of variance using a General Linear Models Procedure from the Statistical Analysis System (SAS 8.01) and Tukey's honest significant difference test was performed for means comparisons.

RESULTS: All seed treatments, except DCT, had significantly lower ($P \leq 0.01$) disease severity than the infected control (Table 1). However, treatments with PROTEGE 100F, either alone or in combination with APRON MAXX RTA also had a significantly lower ($P \leq 0.01$) plant stand compared to the infected control. Treatment with DCT produced significantly shorter ($P \leq 0.001$) plants compared to the infected control. There were no statistical differences ($P \leq 0.05$) among treatments with regard to disease incidence.

CONCLUSIONS: All seed treatments in the trial, except DCT, significantly reduced the severity of anthracnose infection in bean. APRON MAXX RTA, PROTEGE 100F and TBZ significantly

improved plant height, but treatments containing PROTEGE 100 showed reduced seedling establishment.

Table 1. Efficacy of fungicidal seed treatments on seed-borne *Colletotrichum lindemuthianum* in the bean cv. Great Northern in a greenhouse experiment at Vegreville, Alberta in 2003.

Treatment	Rate (g ai/ kg seed)	Final stand/ 7 seeds [1]	Plant height (cm)[1]	Disease [1]	
				Incidence (%)	Severity (0-4)
APRON MAXX RTA	0.0625	5.0 bcd	17.3 ab	100 a	1.7 bc
APRON MAXX RTA	0.125	5.2 abc	18.1 a	100 a	1.8 bc
PROTEGE 100	0.1	4.0 d	16.5 b	100 a	1.3 c
TBZ	0.2	6.1 a	16.5 b	100 a	1.6 c
APRONMAXX RTA + PROTEGE 100	0.0625 + 0.1	4.5 cd	14.3 c	100 a	1.4 c
APRON MAXX RTA + TBZ	0.0625 + 0.2	5.7 ab	14.7 c	100 a	1.5 c
DCT	1.98	5.1 abc	12.7 d	100 a	2.0 ab
Infected control	--	5.8 ab	14.9 c	100 a	2.3 a

[1] Values are means of ten replications in each treatment. Means in a column within each category followed by the same letter are not significantly different according to Tukey's honest significant difference at $P \leq 0.05$.

2003 PMR REPORT # 75 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. CDC Xena
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF CHICKPEA IN ALBERTA IN 2003

MATERIALS: CROWN (carbathiin, 90 g/L + thiabendazole, 58 g/L SU), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl 320 g/L SU), L1269 (proprietary), L1050 (proprietary), L0288 (*Bacillus* sp.)

METHODS: Seed of chickpea cv. CDC Xena was treated in a Hege II small batch seed treater with L1050 at 3.25 mL/kg seed, L1269 at 3.7 mL/kg seed, or with ALLEGIANCE at 0.16 mL/kg seed either alone or in combination with CROWN at 3.0 mL/kg seed, VITAFLO 280 at 3.3 mL/kg seed, or L0288 at 0.065 g/kg seed. Experimental plots were established on 22 May, 2003 at Brooks, Alberta in a brown chernozemic clay loam soil. The plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Nontreated seeds were planted as inoculated and noninoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum at the time of seeding at the rate of 30 mL/row. Emerged seedlings were counted for each plot on 19 June. At maturity (2 October), plants were harvested by small-plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly higher ($P \leq 0.05$) than the inoculated control for all seed treatments in the trial, except for ALLEGIANCE alone or combined with L0288 (Table 1). Seed treated with VITAFLO 280 + ALLEGIANCE showed significantly greater seedling emergence than seed treated with CROWN + ALLEGIANCE, which, in turn, showed significantly greater seedling emergence than seed treated with L1269 or L1050. Seed yield was significantly higher ($P \leq 0.05$) in plots seeded with L1269 or VITAFLO 280 + ALLEGIANCE compared to the inoculated control.

CONCLUSIONS: All seed treatments in the trial, except for ALLEGIANCE alone or combined with L0288, improved emergence compared to the inoculated control. VITAFLO 280 + ALLEGIANCE and L1269 were the only products that significantly improved seed yield.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of chickpea cv. CDC Xena grown in field plots inoculated with *Rhizoctonia solani* at Brooks, Alberta in 2003.

Treatment	Rate (product/kg seed)	Stand (plants/m^2)	Seed yield (t/ha)
Noninoculated Control		19.5 a[1]	3.07 ab
Inoculated Control [2]		0.1 e	0.07 b
ALLEGIANCE	0.16 mL	0.7 e	0.28 b
CROWN + ALLEGIANCE	3.0 mL + 0.16 mL	14.4 c	3.46 ab
L1269	3.7 mL	6.2 d	4.77 a
VITAFLO 280 + ALLEGIANCE	3.3 mL + 0.16 mL	17.3 b	4.01 a
L1050	3.25 mL	5.9 d	2.25 ab
L0288 + ALLEGIANCE	0.065 g + 0.16 mL	0.5 e	0.13 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2003 PMR REPORT # 76 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Chico
PEST: Seedling blight, *Botrytis cinerea* Pers.: Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF BOTRYTIS SEEDLING BLIGHT OF CHICKPEA IN ALBERTA IN 2003

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% SU), CROWN (carbathiin, 92 g/L + thiabendazole, 58 g/L SU).

METHODS: Seed of chickpea cv. Chico was treated with CROWN at 0.9 g ai/kg seed or APRON MAXX at 0.0625 or 0.125 g ai/kg seed in a Hege II small batch seed treater. An experimental plot was established on 15 May, 2003 at Vegreville Alberta, in a black chernozemic sandy loam soil and on 23 May at Brooks, Alberta, in a brown chernozemic clay loam soil. The plots were seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. *Botrytis cinerea* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 mL/row. Nontreated seeds were planted as inoculated and non-inoculated controls. Emerged seedlings were counted on 17 June at Vegreville and 19 June at Brooks. At maturity (5 September at Vegreville and 3 October at Brooks), plants were hand-harvested, dried and then threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seedling emergence was significantly greater ($P \leq 0.05$) for all seed treatments compared to the inoculated control (Table 1). Seedling emergence was significantly greater ($P \leq 0.05$) for APRON MAXX than for CROWN at both sites, and for the high rate of APRON MAXX compared to the low rate at Vegreville. At Vegreville, seed yield was very low overall, but was greater ($P \leq 0.05$) for all treatments than the inoculated control. Plots treated with APRON MAXX produced a greater yield compared to CROWN at this site. At Brooks, all treatments produced a similar yield, compared to both the inoculated and non-inoculated controls.

CONCLUSIONS: Seedling emergence was improved over the inoculated control by both the CROWN and APRON MAXX treatments. Treatment with APRON MAXX resulted in greater emergence than treatment with CROWN. Seed yield followed the same ranking trend for the three

treatments and the inoculated control at both sites, but differences were significant ($P \leq 0.05$) at the Vegreville site,

Table 1. Effect of seed treatments on plant stand and seed yield of chickpea cv. Chico grown in soil inoculated with *Botrytis cinerea* at Brooks and Vegreville, Alberta in 2003.

Treatment	Rate	Stand (plants/m^2)		Seed yield (t/ha)	
	(g a.i./kg seed)	Brooks	Vegreville	Brooks	Vegreville
Non-inoculated Control	--	22.5 b[1]	4.9 d	5.17 a	0.22 a
Inoculated Control [2]	--	9.0 c	0.9 e	4.80 a	0.02 c
APRON MAXX	0.0625	28.1 a	20.5 b	5.41 a	0.25 a
APRON MAXX	0.125	27.6 a	30.4 a	5.65 a	0.21 a
CROWN	0.9	21.9 b	8.9 c	5.03 a	0.10 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Botrytis cinerea* at the time of seeding.

2003 PMR REPORT # 77 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. CDC Xena
PEST: Seedling blight, *Botrytis cinerea* Pers.:Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROLOF BOTRYTIS SEEDLING BLIGHT ON INFESTED CHICKPEA SEED IN ALBERTA IN 2003

MATERIALS: CROWN (carbathiin, 90 g/L + thiabendazole, 58 g/L SU), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl, 320 g/L SU), L1269 (proprietary), L1050 (proprietary), L0288 (*Bacillus* sp.).

METHODS: *Botrytis*-infested seed of the chickpea cv. CDC Xena was treated in a Hege II small batch seed treater with L1050 at 3.25 mL/kg seed, L1269 at 3.7 mL/kg seed, or with ALLEGIANCE at 0.16 mL/kg seed, either alone or in combination with CROWN at 3.0 or 4.5 mL/kg seed, VITAFLO 280 at 3.3 mL/kg seed, or L0288 at 0.65 g/kg seed. Experimental plots were established on 22 May, 2003 at Brooks, Alberta, in a brown chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Nontreated seeds were planted as a control. Emerged seedlings were counted for each plot on 19 June. At maturity (3 October), plants were harvested by small-plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly ($P \leq 0.05$) higher for L1269 compared to the other seed treatments in the trial, except for L1050 (Table 1). Seed yield was significantly greater ($P \leq 0.05$) for plots treated with L1050 or ALLEGIANCE + CROWN compared to ALLEGIANCE + L0288.

CONCLUSIONS: Treatment of chickpea seed with L1269 resulted in greater emergence than treatment with ALLEGIANCE, either alone or combined with CROWN, VITAFLO 280 or L0288. Seed yield was comparable for all of the products tested, except for the ALLEGIANCE + L0288 treatment, which yielded significantly less than L1050 or ALLEGIANCE + CROWN.

Table 1. Effect of seed treatments on plant stand and seed yield of chickpea cv. CDC Xena grown from seed infested with *Botrytis cinerea* at Brooks, Alberta in 2003.

Treatment	Rate (product/kg seed)	Stand (plants/m^2)	Seed yield (t/ha)
ALLEGIANCE	0.16 mL	20.5 b[1]	5.22 ab
L1269	3.7 mL	29.4 a	5.09 ab
L1050	3.25 mL	25.3 ab	5.71 a
ALLEGIANCE + CROWN	0.16 mL + 3.0 mL	22.9 b	5.59 a
ALLEGIANCE + VITAFLO 280	0.16 mL + 3.3 mL	23.4 b	5.16 ab
ALLEGIANCE + L0288	0.16 mL + 0.065 g	20.8 b	4.51 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2003 PMR REPORT # 78 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Chico
PEST: Seedling blight, *Ascochyta rabiei* (Pass.) Lab.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS TO CONTROL ASCOCHYTA SEEDLING BLIGHT OF CHICKPEA IN ALBERTA IN 2003

MATERIALS: ALLEGIANCE (metalaxyl, 320 g/L SU), CROWN (carbathiin, 90 g/L + thiabendazole, 58 g/L SU), L1050 (proprientary), L0121 (proprietary).

METHODS: Ascochyta-infested seed (35%) of the chickpea cv. Chico was treated in a Hege II small batch seed treater with L1050 at 3.25 mL/kg seed, ALLEGIANCE at 0.16 mL/kg seed, alone, as a control, or in combination with CROWN at 3.0 mL/kg seed or L 0121 at 1g/kg seed. Experimental plots were established on 22 May at Brooks, Alberta in a brown chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 30 cm apart. Two rows of fababeans were seeded as a barrier between each plot to reduce interplot spread of spore inoculum. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Emerged seedlings were counted for each subplot on 19 June. At maturity (3 October), plots were harvested by small-plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Seed treated with CROWN + ALLEGIANCE showed significantly greater ($P \leq 0.05$) emergence than those treated with any of the other seed treatments in the trial (Table 1). The treatments with ALLEGIANCE + CROWN and ALLEGIANCE + L0121 showed significantly greater ($P \leq 0.05$) yield than those treated with ALLEGIANCE (control) or with L1050 alone.

CONCLUSIONS: Treatment of seed with CROWN + ALLEGIANCE improved both emergence and yield compared to the ALLEGIANCE- treated control. Treatment with ALLEGIANCE + L0121 significantly improved yield but not emergence.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of chickpea cv. Chico grown from seed infested with *Ascochyta rabiei* at Brooks, Alberta in 2003.

Treatment	Rate (product/kg seed)	Stand (plants/m^2)	Seed yield (t/ha)
ALLEGIANCE + CROWN	0.16 mL + 6.0 mL	19.0 a[1]	3.01 a
L1050	3.25 mL	14.7 b	2.44 ab
ALLEGIANCE (Control)	0.16 mL	13.6 b	2.23 b
ALLEGIANCE + L0121	0.16 mL + 1.0 g	13.1 b	3.06 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).

2003 PMR REPORT # 79 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Chico
PEST: Ascochyta blight (*Ascochyta rabiei* (Pass.) Labrousse)

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TITLE: GREENHOUSE EVALUATION OF FUNGICIDAL SEED TREATMENTS FORTHE CONTROL OF SEED-BORNE ASCOCHYTA IN CHICKPEA IN 2003

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), PROTEGE 100 (azoxystrobin 9.6% SU), THIABENDAZOLE (TBZ) (thiabendazole 42.28% SU), CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), and ALLEGIANCE (metalaxyl 28.35% SU)

METHODS: Seed of the chickpea cv. Chico was treated with APRON MAXX RTA at 0.0625 g ai/kg seed, PROTEGE 100 at 0.1 g ai/kg seed, TBZ at 0.2 g ai/kg seed, APRON MAXX RTA + PROTEGE 100 and APRON MAXX RTA + TBZ at the previously specified rates, and CROWN + APRON at 0.9 and 0.05 g ai/kg seed, respectively. Treated seeds were grown in Kord fibre pots (12.5-cm diameter) filled with pasteurized soil mix (1:1, loam:peat moss). Seven seeds were planted in each pot and ten replicate pots were used for each seed treatment. Final plant stand count and plant height data were recorded. Disease development was assessed based on the incidence (percentage of diseased plants) and severity [a scale of 0 (no disease lesions) to 4 (over 75% of the leaf surface area infected)]. Data were subjected to analysis of variance using a General Linear Models Procedure from the Statistical Analysis System (SAS 8.01) and Tukey's honest significant difference test was performed for mean comparison.

RESULTS: Plant stands were significantly ($P \leq 0.05$) lower in pots treated with CROWN + ALLEGIANCE, PROTEGE 100 or TBZ compared to the infected control (Table 1). Plant height was significantly greater ($P \leq 0.0001$) in pots treated with TBZ, either alone or combined with APRON MAXX RTA, compared to the infected control, but was significantly lower in pots treated with PROTEGE, either alone or combined with APRON MAXX. There were no statistical differences among treatments with regard to disease incidence since all plants were infected. Disease severity was significantly lower ($P \leq 0.01$) in pots treated with APRON MAXX RTA, TBZ, PROTEGE 100, or APRON MAXX RTA + PROTEGE 100 compared to the infected control.

CONCLUSIONS: APRON MAXX RTA and TBZ reduced the severity of seed-borne ascochyta blight in chickpea and improved plant growth. PROTEGE 100F reduced disease severity, but also reduced final stand and plant height.

Table 1. Efficacy of fungicidal seed treatments on seed-borne *Ascochyta rabiei* in the chickpea cv. Chico in a greenhouse experiment at Vegreville, Alberta in 2003.

Treatment	Rate (g ai/ kg seed)	Final stand/ 7 seeds [1]	Plant height (cm)[1]	Disease [1]	
				Incidence (%)	Severity (0-4)
APRON MAXX RTA	0.0625	6.6 abc	13.8 ab	100 a	1.3 b
PROTEGE 100F	0.1	6.2 c	11.1 d	100 a	1.3 b
TBZ	0.2	6.3 c	14.2 a	100 a	1.4 b
APRON MAXX RTA + PROTEGE 100F	0.0625 + 0.1	6.6 abc	11.4 d	100 a	1.4 b
APRON MAXX RTA + TBZ	0.0625 + 0.2	6.8 ab	14.4 a	100 a	1.7 ab
CROWN + ALLEGIANCE	0.9 + 0.05	6.4 bc	12.6 c	100 a	1.9 a
Infected control		6.9 a	13.1 bc	100 a	2.1 a

[1] Values are means of ten replications in each treatment. Means in a column followed by the same letter are not significantly different according to Tukey's honest significant difference at $P \leq 0.05$.

2003 PMR REPORT # 80 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.), cv. Xena
PEST: Grey mold (*Botrytis cinerea* Pers.:Fr.)

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TITLE: GREENHOUSE EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEED-BORNE BOTRYTIS IN CHICKPEA IN 2003

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), and APRON FL (metalaxyl 28.35% SU)

METHODS: Seed of the chickpea cv. Xena was treated with APRON MAXX RTA 0.0625 g ai/kg seed or with CROWN + APRON at 0.9 and 0.05 g ai/kg seed, respectively. Treated seeds were grown in Kord fibre pots (12.5-cm diameter) filled with pasteurized soil mix (1:1 loam:peat moss). Seven seeds were planted in each pot and replicate ten pots were used for each seed treatment. Final plant stand count and plant height were recorded. Disease development was assessed based on the incidence (percentage of diseased plants) and severity [a scale of 0 (no disease lesions) to 4 (over 75% of the stem and pod infected)]. Data were subjected to analysis of variance using a General Linear Models Procedure from the Statistical Analysis System (SAS 8.01) and Tukey's honest significant difference test was performed for mean comparison.

RESULTS: Plant stands were significantly ($P \leq 0.02$) lower in pots planted with seeds treated with CROWN + APRON compared to the infected control (Table 1). Plant height was similar among the treatments. Disease incidence and severity were significantly lower ($P \leq 0.01$) in pots containing treated seeds compared to the control.

CONCLUSIONS: Both APRON MAXX RTA and CROWN + APRON reduced grey mold caused by seed-borne botrytis in chickpea. However, the latter treatment reduced seedling establishment.

Table 1. Efficacy of fungicidal seed treatments on seed-borne *Botrytis cinerea* in chickpea cv. Xena in a greenhouse experiment at Vegreville, Alberta in 2003

Treatment	Rate (g ai/kg seed)	Final stand/ 7 seeds [1]	Plant height (cm)[1]	Disease [1]	
				Incidence (%)	Severity (0-4)
APRON MAXX RTA	0.0625	3.6 ab	19.4 a	20.1 b	0.2 b
CROWN + APRON	0.9 + 0.05	2.8 b	21.1 a	24.2 b	0.2 b
Infected control	--	4.9 a	20.4 a	50.7 a	0.5 a

[1] Values are means of ten replications in each treatment. Means in a column within each category followed by the same letter are not significantly different according to Tukey's honest significant difference at $P \leq 0.05$.

2003 PMR REPORT # 81 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.)
PEST: Ascochyta blight (*Ascochyta rabiei* (Pass.) Labrousse), isolates CMG and VAUX

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TITLE: ***IN VITRO* EVALUATION OF THE INHIBITORY EFFECT OF TENFUNGICIDES ON MYCELIAL GROWTH OF *ASCOCHYTA RABIEI* CAUSING ASCOCHYTA BLIGHT IN CHICKPEA IN 2003**

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), PROTEGE 100 (azoxystrobin 9.6% SU), THIABENDAZOLE (TBZ) (thiabendazole 42.28% SU), CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), ALLEGIANCE (metalaxyl 28.35% SU), FOLICUR (tebuconazole 432 g/L SU), QUADRIS (azoxystrobin 22.9% SU), DITHANE (macozeb 75% WG), TILT (propiconazole 250 g/L EC), and BRAVO (chlorothalonil 50% SU)

METHODS: *In vitro* fungicide bioassays were conducted in the laboratory by growing two isolates of *Ascochyta rabiei* (isolates CMG and VAUX) on potato-dextrose agar (PDA) plates amended with APRON MAXX RTA, PROTEGE 100F, THIABENDAZOLE (TBZ), CROWN, ALLEGIANCE, FOLICUR, QUADRIS, DITHANE, TILT or BRAVO. The final concentration of fungicides was adjusted to 0.1, 0.5, 1, 10, 50, and 100 ppm. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *A. rabiei*. The plugs were inserted into the center of the bioassay plates which were then incubated at 20-25 °C. The plates were arranged in a completely randomized design. Colony diameters were measured every five days until the non-fungicide control plates were fully overgrown. Each concentration was tested on 5 plates and the bioassay was repeated once. Data were converted to percent inhibition of mycelial growth by comparing with non-amended controls and were subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System 8.01 (SAS Institute, Cary, NC).

RESULTS: PROTEGE and QUADRIS had the greatest suppressive effect on *Ascochyta* growth even at the lowest concentration, while TBZ, TILT, FOLICUR and DITHANE were effective at higher concentrations. ALLEGIANCE, APRON MAXX RTA and BRAVO were the least effective fungicides, showing less than 30% inhibition even at the highest concentration. CROWN was only

effective at the highest concentration (Figure 1). The *Ascochyta* isolate VAUX was significantly ($P \leq 0.001$) more sensitive to fungicide treatments than CMG (Figure 2).

CONCLUSIONS: PROTEGE and QUADRIS were the most effective fungicides for controlling *Ascochyta rabiei in vitro* (Figure 1). TBZ, TILT, FOLICUR and DITHANE effectively controlled the pathogen at higher concentrations. ALLEGIANCE, APRON MAXX RTA and BRAVO had little effect on growth of *Ascochyta*. Combining data across concentrations within each fungicide, FOLICUR, DITHANE, PROTEGE, QUADRIS, TBZ, and TILT showed the greatest inhibitory effects.

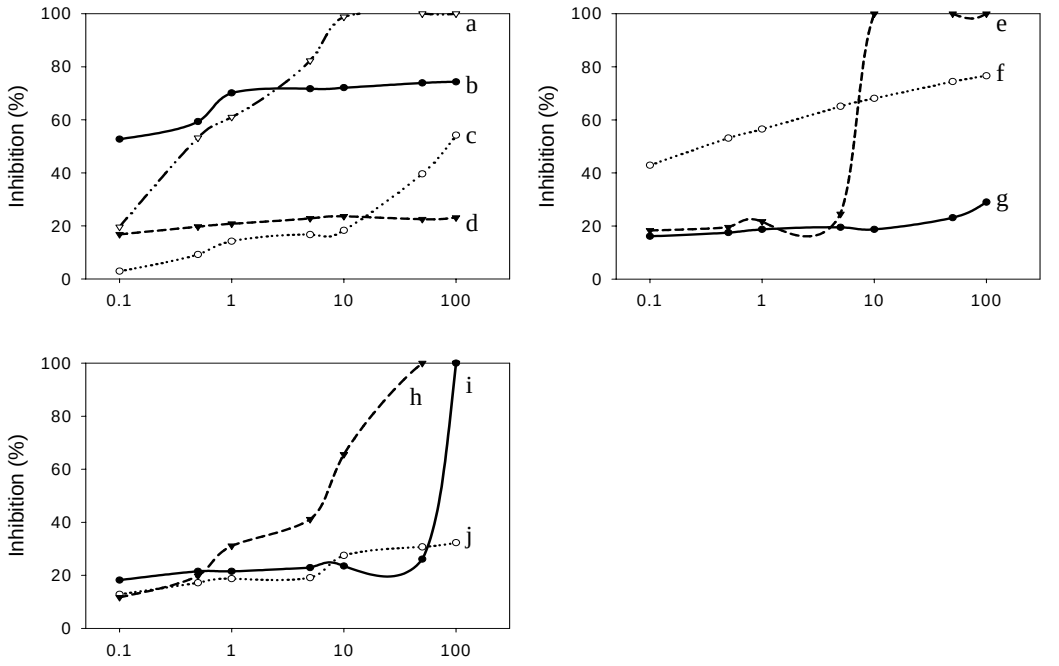

Figure 1. Dose-response (mycelial growth) of *Ascochyta rabiei* (isolates CMG and VAUX were combined) to ten fungicides on potato-dextrose agar plates. In the figures, a = FOLICUR, b = QUADRIS, c = DITHANE, d = ALLEGIANCE, e = THIABENDAZOLE (TBZ), f = PROTEGE 100F, g = APRON MAXX RTA, h = TILT, i = CROWN, and j = BRAVO.

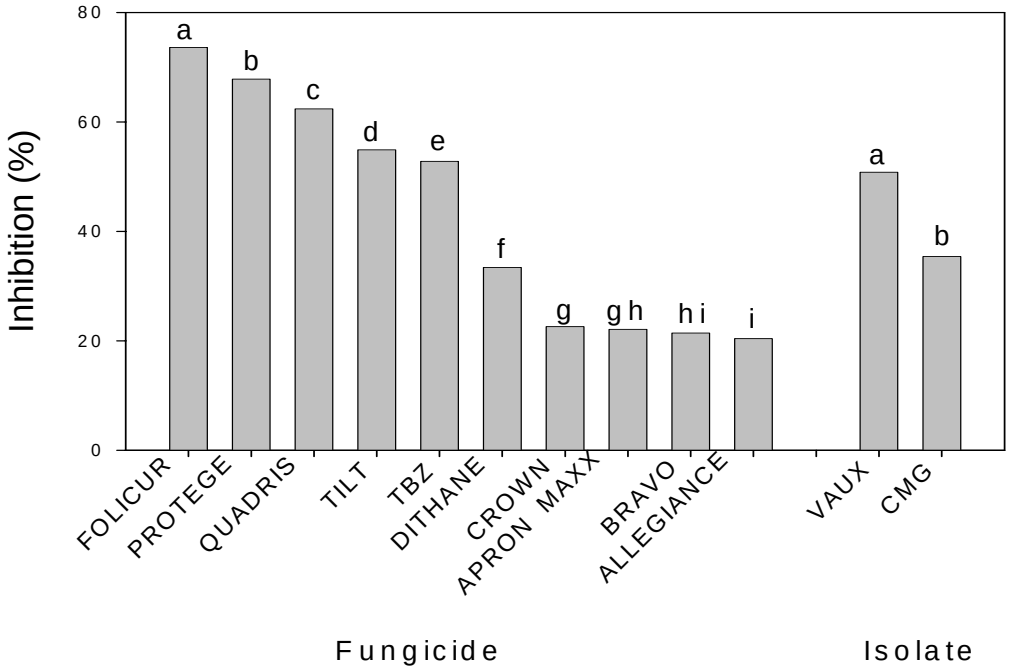

Figure 2. The effect of ten fungicides on mycelial growth of two isolates of *Ascochyta rabiei* in potato-dextrose agar plates. Bars within each category capped by the same letter are not significantly different according to least significant difference at $P \leq 0.05$. Data were combined across concentrations within each fungicide to show the fungicide effect, and were combined across all fungicides for each *Ascochyta* isolate to show the isolate effect.

2003 PMR REPORT # 82 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Chickpea (*Cicer arietinum* L.)
PEST: Botrytis grey mold (*Botrytis cinerea* Pers.:Fr.), isolates SC7 and SC26

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TITLE: ***IN VITRO* EVALUATION OF THE INHIBITORY EFFECT OF SEVENFUNGICIDES ON MYCELIAL GROWTH OF *BOTRYTIS CINEREA* CAUSING GREY MOLD IN CHICKPEA IN 2003**

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), BENLATE (benomyl 50% WP), RONILAN (vinclozolin 50% WP), DITHANE (macozeb 75% WG), TILT (propiconazole 250 g/L EC), and BRAVO (chlorothalonil 50% SU)

METHODS: *In vitro* fungicide bioassays were conducted in the laboratory by growing two isolates of *Botrytis cinerea* (isolates SC7 and SC26) on potato-dextrose agar (PDA) plates amended with APRON MAXX RTA, CROWN, BENLATE, RONILAN, DITHANE, TILT or BRAVO. The final concentration of fungicides was adjusted to 0.1, 0.5, 1, 10, 50, and 100 ppm. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *B. cinerea*. The plugs were inserted into the center of the bioassay plates which were then incubated at 20-25 °C. The plates were arranged in a completely randomized design. Colony diameters were measured every 24 hr until the non-fungicide control plates were fully overgrown. Each concentration was tested on 5 plates and the bioassay was repeated once. Data were converted to percent inhibition of mycelial growth by comparing with non-amended controls and were subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System 8.01 (SAS Institute, Cary, NC).

RESULTS: There was no mycelial growth on plates treated with BENLATE (Figure 1). RONILAN, TILT and BRAVO inhibited colony growth by 27% to 42% at 0.1 ppm, and their effects increased with increasing concentration. There was no mycelial growth on plates treated with 5 ppm or more of RONILAN, or with 50 ppm or more of TILT. APRON MAXX RTA and CROWN did not suppress growth of *Botrytis* at or below 1 ppm, but were effective at or above 10 ppm. DITHANE was much less effective than APRON MAXX RTA or CROWN. There was no statistical difference ($P > 0.05$) in the reaction of the two *Botrytis* isolates to fungicide treatments (Figure 2).

CONCLUSIONS: BENLATE was the most effective fungicide for suppression of mycelial growth of *Botrytis cinerea*. RONILAN, TILT and BRAVO were also effective at relatively low concentrations. APRON MAXX RTA and CROWN controlled the pathogen at higher concentrations. DITHANE showed limited supression of the pathogen at or above 10 ng/mL. Combining data across concentrations within each fungicide, BENLATE, RONILAN, TILT and BRAVO showed the greatest inhibitory effects.

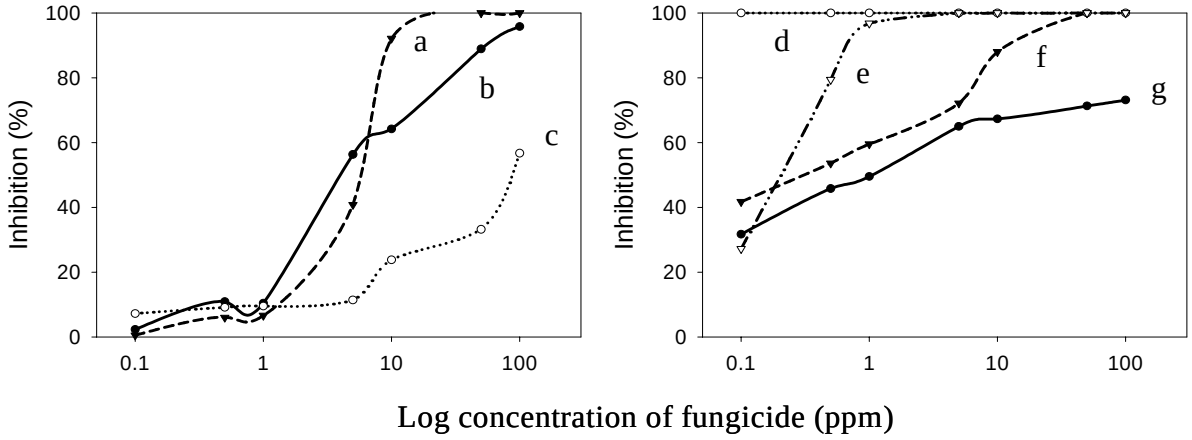

Figure 1. Dose-response (mycelial growth) of *Botrytis cinerea* (isolates SC7 and SC26 were combined) to seven fungicides (a = CROWN, b = APRON MAXX RTA, c = DITHANE, d = BENLATE, e = RONILAN, f = TILT, g = BRAVO) in potato-dextrose agar plates in a laboratory assay.

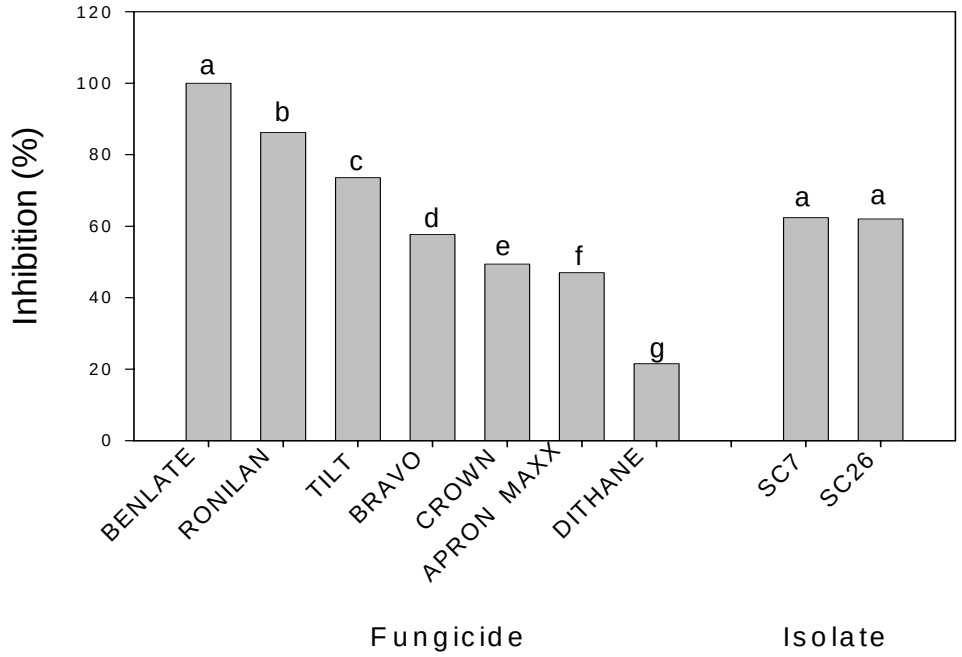

Figure 2. The effect of seven fungicides on mycelial growth of two isolates of *Botrytis cinerea* in potato-dextrose agar plates in the laboratory assay. Bars within each category capped by the same letter are not significantly different according to least significant difference at $P \leq 0.05$. Data were combined across concentrations within each fungicide to show fungicide effect, and were combined across all fungicides for each *Botrytis* isolate to show the isolate effect.

2003 PMR REPORT # 83 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* L.), cvs. CDC Sovereign and Laird
PEST: Root rot, *Rhizoctonia solani* Kühn, *Botrytis cinerea* Pers.:Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEEDLING BLIGHT OF LENTIL CAUSED BY *RHIZOCTONIA SOLANI* AND *BOTRYTIS CINEREA* IN ALBERTA IN 2003

MATERIALS: CROWN (carbathiin 90 g/L + thiabendazole 58 g/L SU), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), L1269 (proprietary), L1050 (proprietary), L0288 (*Bacillus* sp.)

METHODS: Seed of the lentil cv. CDC Sovereign and *Botrytis*-infested seed of Laird was treated in a Hege II small batch seed treater with L1050 at 3.25 mL/kg seed, L1269 at 3.7 mL/kg seed, CROWN at 6.0 mL/kg seed, VITAFLO 280 at 3.3 mL/kg seed, or L0288 at 0.0065 or 0.065 g/kg seed. Two experimental plots were established on 22 May, 2003 at Vegreville, Alberta in a black chernozemic sandy loam soil. Both plots were seeded in a randomized complete block design with four replications. Each sub-plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 8 g of seed per row for CDC Sovereign and 10 g of seed per row for Laird. In the experiment using CDC Sovereign, *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum at the time of seeding at the rate of 30 mL/row. Nontreated seeds were planted as inoculated and noninoculated controls. In the experiment using *Botrytis*-infested seed of Laird, no inoculum was applied in the field, and diseased seeds were used as controls. Seedlings were counted for each plot on 6 June and dead and dying seedlings were noted in the *Botrytis* experiment. Survival was calculated as the number of dead and dying plants subtracted from the total number of plants that emerged. At maturity (4 September), plants were hand harvested, then dried and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly higher ($P \leq 0.05$) than the inoculated control for all seed treatments in the trial except for L0288 at either rate or L1269 (Table 1). Seed treated with VITAFLO 280 or CROWN showed significantly greater seedling emergence than seed treated with any of the other fungicides in the *Rhizoctonia* trial. L1050, CROWN and VITAFLO 280 also showed a significantly higher emergence and survival than the control for the *Botrytis* trial. In this

trial, L1269 also showed a significantly higher survival than the control, and L1050 showed a significantly higher survival rate than L1269. CROWN, L1050 and VITAFLO 280 showed higher yield in *Rhizoctonia*-inoculated soils. L1050 and VITAFLO 280 showed higher yield than the inoculated control in the experiment using *Botrytis*-infested seed.

CONCLUSIONS: VITAFLO 280 and CROWN provided greater protection against seedling blight caused by *R. solani* than any of the other treatments in the trial. L1050 also provided protection against this disease. L1050, VITAFLO 280 and CROWN provided the greatest protection against seedling blight caused by *B. cinerea.* L1050 and VITAFLO 280 improved yield in both *Rhizoctonia* and *Botrytis*-inoculated soils. In addition, CROWN improved yield in the *Rhizoctonia*-inoculated soils.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of the lentil cv. CDC Sovereign grown in soil inoculated with *Rhizoctonia solani* or using seed of Laird infested with *Botrytis cinerea* at Vegreville, Alberta in 2003.

Treatment	Rate (product/ kg seed)	Emergence	Emergence (plants/m^2)	Survival[1]	Seed yield (t/ha)	
		Rhizoctonia	*Botrytis*	*Botrytis*	*Rhizoctonia*	*Botrytis*
Non-inoculated control	--	62.3 a[2]	--	--	1.16 a	--
Infected control [3]	--	9.1 d	44.4 c	34.6 d	0.66 c	1.22 c
L0288	0.0065 g	9.7 d	45.2 c	37.3 d	0.75 bc	1.33 bc
L0288	0.065 g	10.3 d	47.9 bc	39.7 cd	0.59 c	1.37 abc
CROWN	6.0 mL	30.9 b	59.6 ab	59.1 ab	1.09 a	1.50 abc
L1269	3.7 mL	13.6 cd	52.6 abc	49.7 bc	0.69 c	1.41 abc
VITAFLO 280	3.3 mL	31.4 b	59.0 ab	58.3 ab	1.00 ab	1.65 a
L1050	3.25 mL	19.6 c	64.6 a	63.2 a	1.19 a	1.61 ab

[1] Number of dead and dying plants subtracted from the number of seedlings that emerged..
[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[3] This and all subsequent treatments were either inoculated with *Rhizoctonia solani* at the time of seeding or used *Botrytis*-infested seed.

2003 PMR REPORT # 84 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* L.), cv. CDC Sovereign
PEST: Root rot, *Fusarium avenaceum* (Fr.) Sacc.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEEDLING BLIGHT OF LENTIL CAUSED BY *FUSARIUM AVENACEUM* IN ALBERTA IN 2003

MATERIALS: VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), L1269 (proprietary)

METHODS: Seed of the lentil cv. CDC Sovereign was treated in a Hege II small batch seed treater with L1269 at 3.7 mL/kg seed or with VITAFLO 280 at 3.3 mL/kg seed. An experimental plot was established on 19 June, 2003 at Vegreville, Alberta in a black chernozemic sandy loam soil. The plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 8 g of seeds per row. *Fusarium avenaceum* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum at the time of seeding at the rate of 40 mL/row. Nontreated seeds were planted as inoculated and noninoculated controls. Seedlings were counted for each plot on 18 July. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly higher ($P \leq 0.05$) than the inoculated control for L1269, but not for VITAFLO 280 (Table 1).

CONCLUSIONS: L1269 significantly improved lentil emergence in *Fusarium*-inoculated soils, but its overall effectiveness was low when compared to emergence in the noninoculated control.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of the lentil cv. CDC Sovereign grown in soil inoculated with *Fusarium avenaceum* at Vegreville, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Emergence (plants/m^2)
Noninoculated control	--	76.1 a[1]
Inoculated control [2]	--	10.6 c
L1269	3.7	31.8 b
VITAFLO 280	3.3	18.2 c

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Fusarium avenaceum* at the time of seeding.

2003 PMR REPORT # 85 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* L.), cv. CDC Gold
PEST: Root rot, *Rhizoctonia solani* Kühn, *Botrytis cinerea* Pers.:Fr.

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TITLE: EFFICACY OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEEDLING BLIGHT OF LENTIL CAUSED BY *RHIZOCTONIA SOLANI* AND *BOTRYTIS CINEREA* IN ALBERTA IN 2003

MATERIALS: CROWN (carbathiin 90 g/L + thiabendazole, 58 g/L SU), VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl 320 g/L SU), L1269 (proprietary).

METHODS: Healthy and *Botrytis*-infested seed of the lentil cv. CDC Gold was treated in a Hege II small batch seed treater with L1269 at 3.7 mL/kg seed, VITAFLO 280 at 3.3 mL/kg seed, or with ALLEGIANCE at 0.13 mL/kg seed. Two experimental plots were established on 14 and 15 May, 2003, respectively, at Vegreville, Alberta in a black chernozemic sandy loam soil. The plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 8 g per row. For the experiment using healthy seed, *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum at the time of seeding at the rate of 30 mL/row. Nontreated seeds were planted as inoculated and noninoculated controls. In the experiment using *Botrytis*-infested seed, untreated diseased seeds were used as controls. Seedlings were counted for each plot on 6 June and dead and dying seedlings were noted in the *Botrytis* experiment. Survival was calculated as the number of dead and dying plants subtracted from the total number of plants that emerged. At maturity (4 September), plants were hand harvested, then dried and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly higher ($P \leq 0.05$) than the inoculated control for L1269 and VITAFLO 280 for both *Rhizoctonia*-inoculated soils and *Botrytis*-infested seed (Table 1). Survival and seed yield in the experiment using *Botrytis*-infested seed was also greater than in the control for these two treatments. Seed yield in *Rhizoctonia*-inoculated soils was higher than the inoculated control only for the VITAFLO 280 treatment.

CONCLUSIONS: VITAFLO 280 and L1269 improved seedling establishment in both *Rhizoctonia*-inoculated soils and *Botrytis*-infested seed. VITAFLO 280 also improved seed yield in both experiments, but L1269 improved yield only for the experiment using *Botrytis*-infested seed.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of lentil cv. CDC Gold grown in soil inoculated with *Rhizoctonia solani* or *Botrytis cinerea* at Vegreville, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Emergence (plants/m^2)		Survival[1] (plants/m^2)	Seed yield (t/ha)	
		Rhizoctonia	*Botrytis*	*Botrytis*	*Rhizoctonia*	*Botrytis*
Non-inoculated Control	–	31.9 a[2]	--	--	0.98 a	--
Inoculated Control [3]	–	1.9 d	7.9 c	6.9 c	0.11 c	0.39 c
ALLEGIANCE	0.13	3.1 cd	26.4 b	24.8 b	0.12 c	0.94 b
L1269	3.7	6.3 bc	36.3 a	35.3 a	0.22 bc	1.34 a
VITAFLO 280	3.3	8.6 b	35.9 a	32.9 a	0.35 b	1.23 a

[1] Number of dead and dying plants subtracted from the number of seedlings that emerged.
[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[3] This and all subsequent treatments were either inoculated with *Rhizoctonia solani* at the time of seeding or planted with *Botrytis*-infested seed.

2003 PMR REPORT # 86 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* L.), cv. Milestone
PEST: Root rot, seedling blight, *Botrytis cinerea* Pers.:Fr.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEEDLING BLIGHT OF LENTIL CAUSED BY *BOTRYTIS CINEREA* IN ALBERTA IN 2003

MATERIALS: APRON MAXX (metalaxyl-M 13.6% + fludioxonil 9.11% SU), CROWN (carbathiin, 92 g/L + thiabendazole, 58 g/L SU)

METHODS: Seed of the lentil cv. CDC Milestone was treated in a Hege II small batch seed treater with APRON MAXX at 0.0625 or 0.125 mL/kg seed, or with CROWN at 0.9 mL/kg seed. An experimental plots was established on 15 May, 2003 at Vegreville, Alberta in a black chernozemic sandy loam soil and on 23 May at Brooks, Alberta in a brown chernozemic clay loam soil. The plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 4 cm deep at a rate of 8 g of seeds per row. *Botrytis cinerea* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum at the time of seeding at the rate of 40 mL/row. Nontreated seeds were planted as inoculated and noninoculated controls. Emerged seedlings were counted for each plot on 6 June. To calculate survival, the number of dead and dying seedlings were noted and subtracted from the emergence count. At maturity (4 September at Vegreville and 26 August at Brooks), plants were hand harvested, then dried and threshed. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.
RESULTS: Emergence, survival and yield were significantly higher ($P \leq 0.05$) than the inoculated control for all seed treatments in the trial (Table 1). Treatment with CROWN showed a significantly higher yield than treatment with APRON MAXX at the high rate at Brooks.

CONCLUSIONS: All seed treatments in the trial provided protection against seedling blight caused by *B. cinerea.*

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of lentil cv. CDC Milestone grown in soil inoculated with *Botrytis cinerea* at Brooks and Vegreville, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Emergence (plants/m^2)	Survival[1] (plants/m^2)	Emergence (plants/m^2)	Seed yield (t/ha)	
		Vegreville		Brooks	Vegreville	Brooks
Non-inoculated Control	--	79.3 a[2]	79.3 a	87.7 a	0.22 a	2.92 a
Inoculated Control [3]	--	5.1 c	5.0 c	26.8 c	0.07 c	0.96 c
APRON MAXX	0.063	19.9 b	19.1 b	59.8 b	0.15 b	2.47 ab
APRON MAXX	0.125	24.4 b	23.9 b	64.6 b	0.16 b	2.23 b
CROWN	0.9	22.2 b	21.6 b	64.0 b	0.14 b	2.74 a

[1] Number of dead and dying plants subtracted from the number of seedlings that emerged.
[2] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[3] This and all subsequent treatments were inoculated with *Botrytis cinerea* at the time of seeding.

2003 PMR REPORT # 87 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cv. Shaddock
PEST: Anthracnose (*Colletotrichum truncatum* (Schwein.) Andrus & W.D. Moore)

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TITLE: GREENHOUSE EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEED-BORNE ANTHRACNOSE IN LENTIL IN 2003

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), PROTEGE 100 (azoxystrobin 9.6% SU), THIABENDAZOLE (TBZ) (thiabendazole 42.28% SU), CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), and APRON FL (metalaxyl 28.35% SU)

METHODS: Seed of the lentil cv. Shaddock was treated with APRON MAXX RTA at either 0.0625 or 0.125 g ai/kg seed, PROTEGE 100 at 0.1 g ai/kg seed, TBZ at 0.2 g ai/kg seed, APRON MAXX RTA + PROTEGE 100 and APRON MAXX RTA + TBZ, at the previously specified rates, and CROWN + APRON at 0.9 and 0.05 g ai/kg seed, respectively. Treated seeds were grown in Kord fibre pots (12.5-cm diameter) filled with pasteurized soil mix (1:1 loam:peat moss). Seven seeds were planted in each pot and ten replicate pots were used for each seed treatment. Final plant stand count and plant height data were recorded. Disease development was assessed based on the incidence (percentage of diseased plants) and severity [a scale of 0 (no disease lesions) to 5 (over 80% of the leaf surface area infected)]. Data were subjected to analysis of variance using a General Linear Models Procedure from the Statistical Analysis System (SAS 8.01) and Tukey's honest significant difference test was performed for means comparisons.

RESULTS: Seed treatments with APRON MAXX RTA + TBZ or with PROTEGE 100, either alone or in combination with APRON MAXX RTA, significantly reduced ($P \leq 0.05$) disease severity (Table 1). Disease severity in plants treated with APRON MAXX RTA alone, at either rate, were similar to the untreated control, but plants grew significantly ($P \leq 0.05$) taller. There were no statistically significant differences ($P \leq 0.05$) among the treatments with regard to final plant stand or disease incidence.

CONCLUSIONS: Seed treatments with APRON MAXX RTA + TBZ or with PROTEGE 100F, either alone or in combination with APRON MAXX RTA, significantly reduced the severity of seed-borne anthracnose in lentil.

Table 1. Efficacy of fungicidal seed treatments on seed-borne *Colletotrichum truncatum* in the lentil cv. Shaddock in a greenhouse experiment at Vegreville, Alberta in 2003.

Treatment	Rate (g ai/kg seed)	Final stand/ 7 seeds[1]	Plant height (cm)[1]	Disease[1]	
				Incidence (%)	Severity (0-4)
APRON MAXX RTA	0.0625	6.9 a	43.5 abc	100 a	1.8 abc
APRON MAXX RTA	0.125	6.6 a	48.3 a	100 a	1.7 abc
PROTEGE 100	0.1	6.9 a	39.2 cd	100 a	1.3 cd
TBZ	0.2	6.9 a	48.0 ab	100 a	1.6 abcd
APRON MAXX RTA + PROTEGE 100	0.0625 + 0.1	6.5 a	37.4 d	100 a	1.1 d
APRON MAXX RTA + TBZ	0.0625 + 0.2	6.9 a	43.0 bc	100 a	1.5 bcd
CROWN + APRON	0.9 + 0.05	6.8 a	37.6 d	100 a	1.9 ab
Infected control	--	6.7 a	37.7 d	100 a	2.1 a

[1] Values are means of ten replications in each treatment. Means in a column within each category followed by the same letter are not significantly different according to Tukey's honest significant difference at $P \leq 0.05$.

2003 PMR REPORT # 88 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cv. Laird
PEST: Ascochyta blight (*Ascochyta lentis* Vassilievsky)

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TITLE: GREENHOUSE EVALUATION OF FUNGICIDAL SEED TREATMENTS FORTHE CONTROL OF SEED-BORNE ASCOCHYTA IN LENTIL IN 2003

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), PROTEGE 100 (azoxystrobin 9.6% SU), THIABENDAZOLE (TBZ) (thiabendazole 42.28% SU), CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), and APRON FL (metalaxyl 28.35% SU)

METHODS: Seed of lentil cv. Laird was treated with APRON MAXX RTA at either 0.0625 or 0.125 g ai/kg seed, PROTEGE 100 at 0.1 g ai/kg seed, TBZ at 0.2 g ai/kg seed, APRON MAXX RTA + PROTEGE 100F and APRON MAXX RTA + TBZ at the previously specified rates, and CROWN + APRON at 0.9 and 0.05 g ai/kg seed, respectively. Treated seeds were grown in Kord fibre pots (12.5-cm diameter) filled with pasteurized soil mix (1:1 loam:peat moss). Seven seeds were planted in each pot and ten replicate pots were used for each seed treatment. Final plant stand count and plant height data were recorded. Disease development was assessed based on the incidence (percentage of diseased plants) and severity [based on a scale of 0 (no disease lesions) to 4 (over 75% of the leaf surface area was infected)]. Data were subjected to analysis of variance using a General Linear Models Procedure from the Statistical Analysis System (SAS 8.01) and Tukey's honest significant difference test was performed for means comparisons.

RESULTS: Seed treatments with with PROTEGE 100 or TBZ, either alone or in combination with APRON MAXX RTA, had significantly lower ($P \leq 0.05$) disease severity compared to the infected control (Table 1). The APRON MAXX RTA and CROWN + APRON treatments did not significantly affect the disease development. There were no statistical differences ($P \leq 0.05$) between treatments with regard to final plant stand, plant height or disease incidence.

CONCLUSIONS: Seed treatments with with PROTEGE 100F or TBZ, either alone or in combination with APRON MAXX RTA, significantly reduced the severity of seed borne ascochyta blight on lentil.

Table 1. Efficacy of fungicidal seed treatments on seed borne *Ascochyta lentis* in the lentil cv. Laird in a greenhouse experiment at Vegreville, Alberta in 2003.

Treatment	Rate (g ai/kg seed)	Final stand/ 7 seeds[1]	Plant height (cm)[1]	Disease[1]	
				Incidence (%)	Severity (0-4)
APRON MAXX RTA	0.0625	5.9 a	40.7 a	100 a	2.7 a
APRON MAXX RTA	0.125	6.1 a	41.8 a	100 a	2.2 bc
PROTEGE 100F	0.1	6.1 a	42.8 a	100 a	1.8 d
TBZ	0.2	6.1 a	40.6 a	100 a	1.9 cd
APRON MAXX RTA + PROTEGE 100F	0.0625 + 0.1	6.3 a	38.9 a	100 a	1.8 cd
APRON MAXX RTA + TBZ	0.0625 + 0.2	6.6 a	39.0 a	100 a	2.1 cd
CROWN + APRON	0.9 + 0.05	6.3 a	39.2 a	100 a	2.6 ab
Infected control		5.7 a	40.8 a	100 a	2.6 ab

[1] Values are means of ten replications in each treatment. Means in a column within each categoryfollowed by the same letter are not significantly different according to Tukey's honest significant difference at $P \leq 0.05$.

2003 PMR REPORT # 89 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.), cv. Milestone
PEST: Stem and pod rot (*Botrytis cinerea* Pers.:Fr.)

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TITLE: GREENHOUSE EVALUATION OF FUNGICIDAL SEED TREATMENTS FORTHE CONTROL OF SEED-BORNE BOTRYTIS IN LENTIL IN 2003

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), and APRON FL (metalaxyl 28.35% SU)

METHODS: Seed of the lentil cv. Milestone was treated with APRON MAXX RTA at 0.0625 g ai/kg seed or with CROWN + APRON at 0.9 and 0.05 g ai/kg seed, respectively. Treated seeds were grown in Kord fibre pots (12.5-cm diameter) filled with pasteurized soil mix (1:1. loam:peat moss). Seven seeds were planted in each pot and ten replicate pots were used for each seed treatment. Final plant stand counts and plant heights were recorded. Disease development was assessed based on the incidence (percentage of diseased plants) and severity [based on a scale of 0 (no disease lesions) to 4 (over 75% of the stem and pods infected)]. Data were subjected to analysis of variance using a General Linear Models Procedure from the Statistical Analysis System (SAS 8.01) and Tukey's honest significant difference test was performed for means comparisons.

RESULTS: Seed treated with APRON MAXX RTA and CROWN + APRON had significantly lower ($P \leq 0.01$) disease incidence and severity compared to the infected control, but final plant stand was not affected (Table 1). Seeds treated with CROWN + APRON produced seedlings that were significantly ($P \leq 0.002$) taller compared to the infected control and APRON MAXX RTA. Although both APRON MAXX RTA and CROWN + APRON significantly reduced disease incidence and severity, incidence levels remained relatively high in these treatments.

CONCLUSIONS: APRON MAXX RTA and CROWN + APRON reduced the incidence and severity of seed-borne botrytis infection in lentil.

Table 1. Efficacy of fungicidal seed treatments on seed-borne *Botrytis cinerea* in the lentil cv. Milestone in a greenhouse experiment at Vegreville, Alberta in 2003.

Treatment	Rate (g ai/kg seed)	Final stand/ 7 seeds [1]	Plant height (cm)[1]	Disease [1]	
				Incidence (%)	Severity (0-4)
APRON MAXX RTA	0.0625	6.2 a	12.8 b	76.8 b	0.9 b
CROWN + APRON	0.9 + 0.05	5.8 a	14.5 a	65.6 b	0.8 b
Infected control	--	6.4 a	11.6 b	100.0 a	1.5 a

[1] Values are means of ten replications in each treatment. Means in a column within each category followed by the same letter are not significantly different according to Tukey's honest significant difference at $P \leq 0.05$.

2003 PMR REPORT # 90 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.)
PEST: Anthracnose (*Colletotrichum truncatum* (Schwein.) Andrus & W.D. Moore), isolates GHL1A and GHL1B

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TITLE: ***IN VITRO* EVALUATION OF THE INHIBITORY EFFECT OF SIX FUNGICIDES ON MYCELIAL GROWTH OF *COLLETOTRICHUM TRUNCATUM* CAUSINGANTHRACNOSE IN LENTIL IN 2003**

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), PROTEGE 100 (azoxystrobin 9.6% SU), THIABENDAZOLE (TBZ) (thiabendazole 42.28% SU), CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), APRON FL (metalaxyl 28.35% SU), and BRAVO (chlorothalonil 50% SU)

METHODS: *In vitro* fungicide bioassays were conducted in the laboratory by growing two isolates of *Colletotrichum truncatum* (isolates GHL1A and GHL1B) on potato-dextrose agar (PDA) plates amended with APRON MAXX RTA, PROTEGE 100F, TBZ, CROWN, APRON, or BRAVO. The final concentration of fungicides was adjusted to 0.1, 0.5, 1, 10, 50 and 100 ppm. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm diameter plugs of agar with mycelium from actively growing colonies of *Colletotrichum*. The plugs were placed at the center of the bioassay plates, which were then incubated on a laboratory bench at 20-25°C. The plates were arranged in a completely randomized design. Colony diameters were measured every five days until the non-fungicide control plates were fully overgrown. Each concentration was tested on 5 plates and the bioassay was repeated once. Data were converted to percent inhibition of mycelial growth by comparing with non-amended controls and were subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System 8.01 (SAS Institute, Cary, NC).

RESULTS: PROTEGE and TBZ suppressed growth of *Colletotrichum* by more than 70% at or above concentrations of 1 ppm (Figure 1). CROWN suppressed mycelial growth by more than 80% at or above 10 ppm. APRON MAXX RTA was not effective at the lower concentrations, but inhibited mycelial growth by 40 and 70% at concentrations of 50 and 100 ppm, respectively. The

inhibitory effect of BRAVO increased from 10% to 45% as the concentration increased from 0.1 to 100 ppm. APRON was the least effective fungicide, inhibiting colony growth by 10% at the highest concentration. *Colletotrichum* isolate GHL1A was significantly (*P* # 0.001) more sensitive to fungicide treatments than isolate GHL1B (Figure 2).

CONCLUSIONS: PROTEGE and TBZ were the most effective fungicides for controlling *Colletotrichum truncatum in vitro*. APRON MAXX RTA, and CROWN suppressed pathogen growth at higher concentrations. BRAVO showed poor efficacy against *Colletotrichum* growth, while APRON had virtually none. When combining data across concentrations within each fungicide, PROTEGE and TBZ showed the greatest inhibitory effects amongst the fungicides tested.

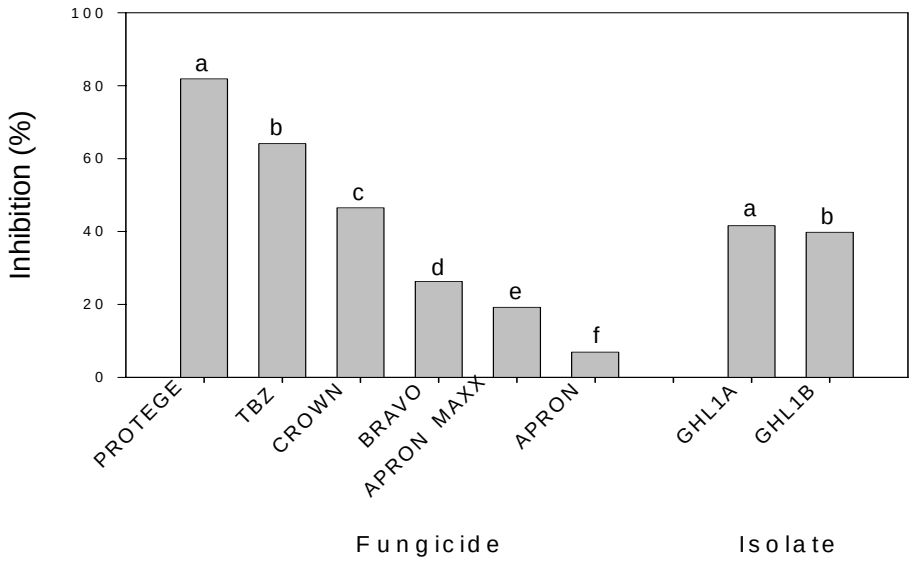

Figure 1. Dose-response (mycelial growth) of *Colletotrichum truncatum* (isolates GHL1A and GHL1B were combined) to six fungicides (a = PROTEGE 100, b = APRON MAXX RTA, c = APRON FL, d = CROWN, e = TBZ, f = BRAVO) in potato-dextrose agar plates in a laboratory assay.

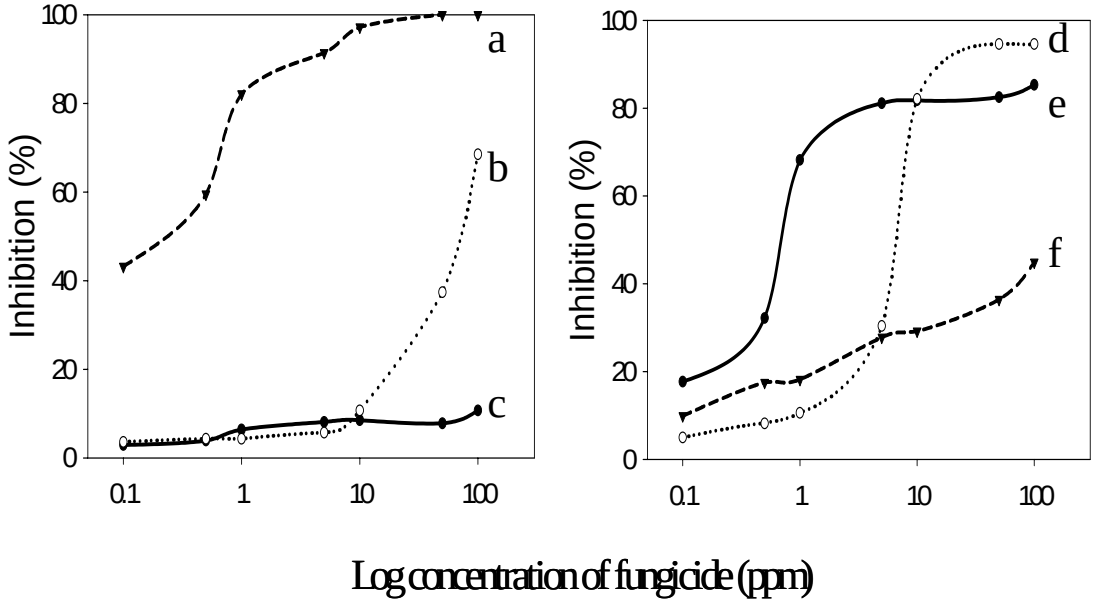

Figure 2. The effect of six fungicides on mycelial growth of two isolates of *Colletotrichum truncatum* in potato-dextrose agar plates. Bars within each category capped by the same letter are not significantly different according to least significant difference at *P* # 0.05. Data were combined across concentrations within each fungicide to show fungicide effect, and were combined across all fungicides for each *Colletotrichum* isolate to show the isolate effect.

2003 PMR REPORT # 91 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Lentil (*Lens culinaris* Medik.)
PEST: Ascochyta blight (*Ascochyta lentis* Vassilievsky), isolates GHL1 and GHL2

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TITLE: ***IN VITRO* EVALUATION OF THE INHIBITORY EFFECT OF SIX FUNGICIDES ON MYCELIAL GROWTH OF *ASCOCHYTA LENTIS* CAUSING ASCOCHYTA BLIGHT IN LENTIL IN 2003**

MATERIALS: APRON MAXX RTA (fludioxonil 0.77% + mefenoxam 1.44% SU), PROTEGE 100 (azoxystrobin 9.6% SU), THIABENDAZOLE (TBZ) (thiabendazole 42.28% SU), CROWN (carbathiin 92 g/L + thiabendazole 58 g/L SU), APRON FL (metalaxyl 28.35% SU), and BRAVO (chlorothalonil 50% SU)

METHODS: *In vitro* fungicide bioassays were conducted in the laboratory by growing two isolates of *Ascochyta lentis* (isolates GHL1 and GHL2) on potato-dextrose agar (PDA) plates amended with APRON MAXX RTA, PROTEGE 100F, TBZ, CROWN, APRON, or BRAVO. The final concentration of fungicides was adjusted to 0.1, 0.5, 1, 10, 50 and 100 ppm. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm diameter plugs of agar with mycelium from actively growing colonies of *Ascochyta*. The plugs were placed at the center of the bioassay plates, which were then incubated on a laboratory bench at 20-25°C. The plates were arranged in a completely randomized design. Colony diameters were measured every five days until the non-fungicide control plates were fully overgrown. Each concentration was tested on 5 plates and the bioassay was repeated once. Data were converted to percent inhibition of mycelial growth by comparing with non-amended controls and were subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System 8.01 (SAS Institute, Cary, NC).

RESULTS: PROTEGE suppressed growth of *Ascochyta* colonies even at the lowest concentration, but the level of suppression was 50-60% throughout the range of concentrations (Figure 1). TBZ suppressed more than 80% of pathogen growth at and above concentrations of 10 ppm (Fig. 1). CROWN suppressed colony growth to a similar degree at 100 ppm. APRON MAXX RTA inhibited 40-50% of colony growth at 50 and 100 ppm BRAVO inhibited colony growth 21% at the highest

concentration, while APRON inhibited growth by less than 5% throughout the range of concentrations. Both of the *Ascochyta* isolates had similar ($P > 0.05$) reactions to the fungicide treatments (Figure 2).

CONCLUSIONS: PROTEGE was the most effective fungicide for suppressing mycelial growth of *Ascochyta rabiei*. APRON MAXX RTA, TBZ and CROWN suppressed pathogen growth at higher concentrations. APRON and BRAVO had little effect on colonies of *A. rabiei*. Combining data across concentration within each fungicide, PROTEGE and TBZ showed the greatest inhibitory effects among the tested fungicides.

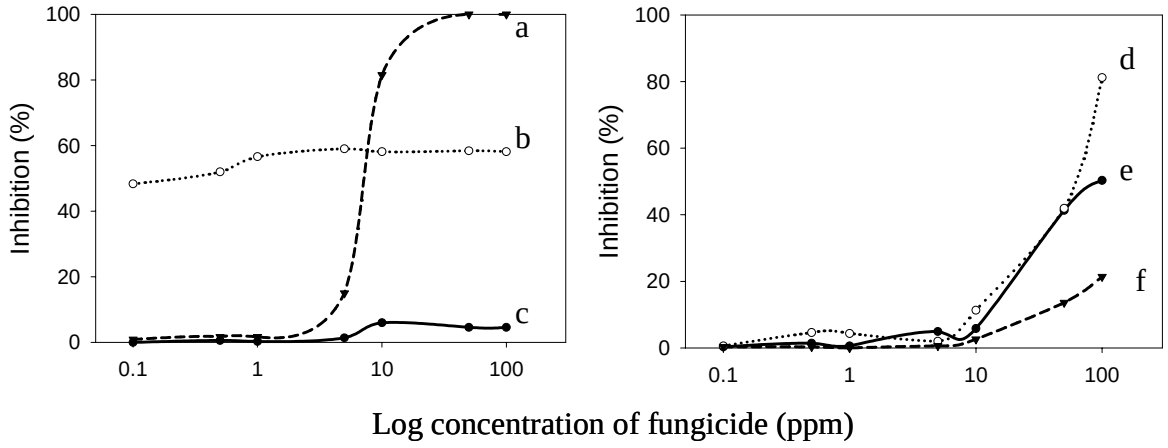

Figure 1. Dose-response of *Ascochyta lentis* (isolates GHL1 and GHL2) to six fungicides (a = TBZ, b = PROTEGE 100, c = APRON FL, d = CROWN, e = APRON MAXX RTA, f = BRAVO) on mycelial growth in potato-dextrose agar plates

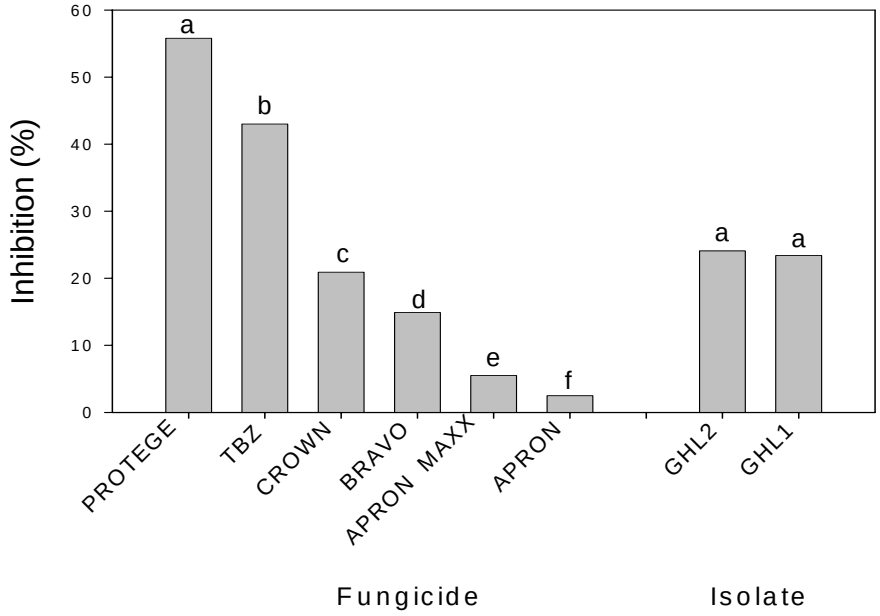

Figure 2. The effect of six fungicides on mycelial growth of two isolates of *Ascochyta lentis* on potato-dextrose agar plates. Bars within each category capped by the same letter are not significantly different according to least significant difference at *P* # 0.05. Data were combined across concentrations within each fungicide to show fungicide effect, and were combined across all fungicides in each *Ascochyta* isolate to show the isolate effect.

2003 PMR REPORT # 92 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field Pea (*Pisum sativum* L.), cv. Mozart
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF FIELD PEA IN ALBERTA IN 2003

MATERIALS: VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl 320 g/L SU), L0288 (*Bacillus* sp.), L1269 (proprietary), L1050 (proprietary).

METHODS: Seed of the field pea cv. Mozart was treated in a Hege small batch seed treater with L1050 at 3.25 mL/kg seed, L0288 at 0.065 or 0.65 g/kg seed, L1269 at 3.7 mL/kg seed, ALLEGIANCE at 0.128 mL/kg seed, or with VITAFLO 280 at 2.6 mL/kg seed, either alone or in combination with ALLEGIANCE at 0.128 mL/kg seed. An experimental plot was established on 14 May at Westlock, Alberta, in a black chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 5 cm deep at a rate of 20 g per row. Non-treated seeds were planted as inoculated and non-inoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 15 mL/row. Emerged seedlings were counted on 19 June. At maturity (25 August), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly ($P \leq 0.05$) higher than the inoculated control for L1050 and TFL RTU (Table 1). Yield was similar for all treatments.

CONCLUSIONS: L1050 and L1269 significantly improved emergence over the inoculated control, but neither of the treatments improved yield.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of field pea cv.. Mozart grown in soil inoculated with *Rhizoctonia solani* at Westlock, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Stand (plants/m^2)	Seed yield (t/ha)
Non-inoculated Control	--	66.4 ab[1]	4.92 a
Inoculated Control [2]	--	55.9 b	4.56 a
L1050	3.25	70.1 a	5.38 a
L1269	3.7	69.0 a	4.90 a
L0288	0.065 g	60.8 ab	5.05 a
L0288	0.65 g	60.8 ab	4.59 a
ALLEGIANCE	0.128	60.7 ab	5.48 a
VITAFLO	2.6	64.8 ab	4.63 a
ALLEGIANCE + VITAFLO	0.128 + 2.6	59.6 ab	4.92 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2003 PMR REPORT # 93 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Field Pea (*Pisum sativum* L.), cv. CDC Mozart
PEST: Root rot, *Fusarium avenaceum* (Fr.) Sacc.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEEDLING BLIGHT OF FIELD PEA CAUSED BY *FUSARIUM AVENACEUM* IN ALBERTA IN 2003

MATERIALS: VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), TFL RTU (trifloxystrobin 15.4 g/l + metalaxyl 12.3 g/L FL)

METHODS: Seed of the field pea cv. CDC Mozart was treated in a Hege II small batch seed treater with TFL RTU at 3.25 mL/kg seed or with VITAFLO 280 at 2.6 mL/kg seed. An experimental plot was established on 19 June, 2003 at Vegreville, Alberta in a black chernozemic sandy loam soil. The plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 6 m rows of plants spaced 25 cm apart. Seeds were planted 5 cm deep at a rate of 20 g of seeds per row. *Fusarium avenaceum* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum at the time of seeding at the rate of 40 mL/row. Nontreated seeds were planted as inoculated and noninoculated controls. Seedlings were counted for each plot on 18 July. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly higher ($P \leq 0.05$) than the inoculated control for both seed treatments (Table 1).

CONCLUSIONS: Both VITAFLO 280 and TFL RTU significantly improved emergence in *Fusarium*-inoculated soils, but average plant stands were still well below those of the noninoculated control.

Table 1. Effects of fungicidal seed treatments on plant stand and seed yield of field pea cv. CDC Mozart grown in soil inoculated with *Fusarium avenaceum* at Vegreville, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Emergence (plants/m^2)
Noninoculated Control	--	18.9 a[1]
Inoculated Control [2]	--	6.9 c
TFL RTU	3.25	12.9 b
VITAFLO 280	2.6	11.3 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Fusarium avenaceum* at the time of seeding.

2003 PMR REPORT # 94 **SECTION M: FIELD LEGUMES - Diseases**
ICAR: 61009653

CROP: Soybean (*Glycine max* L.), cv. Gaillard
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF SOYBEAN IN ALBERTA IN 2003

MATERIALS: VITAFLO 280 (carbathiin 14.9% + thiram 13.2% SU), ALLEGIANCE (metalaxyl 320 g/L SU), L0288 (*Bacillus* sp.), L1269 (Proprietary), L1050 (Proprietary).

METHODS: Seed of the soybean cv. Gaillard was treated in a Hege small batch seed treater with L1050 at 3.7 mL/kg seed, L0288 at 0.065 g/kg seed, L1269 at 3.25 mL/kg seed, or with VITAFLO 280 at 2.6 mL/kg seed, either alone or in combination with ALLEGIANCE at 0.128 mL/kg seed. An experimental plot was established on 22 May at Brooks, Alberta, in a brown chernozemic clay loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 30 cm apart. Seeds were planted 5 cm deep at a rate of 75 seeds per row. Nontreated seeds were planted as inoculated and noninoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 40 mL/row. Emerged seedlings were counted on 19 June. At maturity (October 2), plants were harvested by small plot combine. Seeds were weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence and seed yield were significantly ($P \leq 0.05$) higher for all seed treatments in the trial, except for L0288 alone, than for the inoculated control (Table 1). Emergence and seed yield of plots treated with L1050 were similar to those treated with VITAFLO 280 alone and were significantly higher ($P \leq 0.05$) compared to both of the L1269 treatments and to ALLEGIANCE + VITAFLO 280.

CONCLUSIONS: All seed treatments in the trial, except L0288 alone, improved emergence and seed yield over the inoculated control. L1050 was more effective than treatment with L1269 or with ALLEGIANCE + VITAFLO 280.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of soybean cv. Gaillard grown in field plots inoculated with *Rhizoctonia solani* at Brooks, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Stand (plants/m^2)	Seed yield (t/ha)
Non-inoculated Control		27.9 a[1]	5.17 a
Inoculated Control [2]		2.4 f	0.96 c
L1050	3.25	24.4 ab	4.52 a
L1269	3.7	15.2 cde	3.60 b
L0288	0.065 g	2.4 f	1.15 c
L1269 + L0288	3.7 + 0.065 g	13.6 de	3.79 b
VITAFLO 280	2.6	20.8 bc	4.58 a
ALLEGIANCE + VITAFLO 280	0.13 + 2.6	18.0 cd	3.74 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2003 PMR REPORT # 95 **SECTION N: POTATOES - Diseases**
ICAR: 61009653

CROP: Potato (*Solanum tuberosum* L.), cv. Yukon Gold
PEST: Fusarium seed piece decay (*Fusarium sambucinum* Fuckel)

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TITLE: EVALUATION OF SEED PIECE TREATMENTS FOR THE CONTROL OF FUSARIUM SEED PIECE DECAY OF POTATO IN ALBERTA IN 2003

MATERIALS: GENESIS (imidacloprid 240 g/L SU), GENESIS MZ (imidacloprid and mancozeb 1.25 and 6.0% wt./wt. DF), GENESIS XT (imidacloprid, thiophanate-methyl and mancozeb 1.25, 2.5 and 6.0% wt./wt. DF), SENATOR (thiophanate-methyl 10% DF), and MAXIM (fludioxonil 0.5% DF)

METHODS: Efficacy of seed piece treatments in controlling fusarium seed piece decay of potato was evaluated in a black chernozemic sandy loam soil at Vegreville, Alberta in 2003. Cut seed-potato pieces of Yukon Gold (Elite III) were planted on May 27, 2003, in four-row plots with a plant spacing of 0.3 m within rows and 1.0 m between rows. Plots were arranged in a randomized complete block design and replicated four times. The plots measured 6.0 m in length and 4.0 m in width, and were separated by a 2.0 m buffer zone between replicates. Seed pieces for all inoculated treatments were sprayed with a spore suspension of *Fusarium sambucinum* at a rate of 500 mL/100 kg of cut seeds, immediately after cutting. The spore suspension was prepared by flooding the surface of 3-week-old agar cultures with sterile distilled water, gently scraping the colony with a glass rod, and filtering the suspension through two layers of cheesecloth. The concentration of spores was determined with a hemacytometer and adjusted to 1.4×10^7 spores/mL. The experiment included six seed piece treatments: (1) GENESIS XT 750 g/100 kg seed; (2) GENESIS XT 500 g/100 kg seed; (3) GENESIS 26 mL/100 kg seed and SENATOR 500 g/100 kg seed; (4) GENESIS 26 mL/100 kg seed and MAXIM 500 g/100 kg seed; (5) GENESIS MZ 500 g/100 kg seed; and (6) GENESIS MZ 750 g/100 kg seed. The treatments were applied 2-3 h after inoculation. To dry the seed pieces after treatment, talc was applied to treatments (3) and (4) at a rate of 500 g/100 kg seeds. The seed pieces for inoculated and non-inoculated controls did not receive any fungicides. Seed pieces were planted 18-24 h after application of the treatments. Plant stand counts were taken on July 16, and stem counts and plant height measurements were made on July 28. Potatoes were harvested on September 24 and yields were recorded from the two central rows of each treatment

plot. Data were subjected to analysis of variance using a General Linear Models Procedure from the Statistical Analysis System (SAS 8.01) and Tukey's honest significant difference test was performed for means comparison.

RESULTS: Plant stand counts were significantly ($P \leq 0.005$) greater in plots treated with GENESIS XT, GENESIS MZ or GENESIS + MAXIM compared to the *Fusarium*-inoculated control (Table 1). Stem counts were similar among the treatments (*data not shown*). Plants grew significantly taller ($P \leq 0.008$) than the inoculated control in plots treated with GENESIS MZ at the higher rate and GENESIS + MAXIM. Plots treated with GENESIS MZ at the higher rate had significantly taller plants than those treated with GENESIS MZ at the lower rate. Tuber yield was greater ($P \leq 0.007$) than both the inoculated and non-inoculated controls for plots treated with GENESIS XT at both rates, GENESIS + MAXIM, and GENESIS MZ at the higher rate. Dry soil conditions in the spring may have reduced emergence, which was only 80% of the number of seed pieces planted for the non-inoculated control.

CONCLUSIONS: GENESIS XT, GENESIS + MAXIM and GENESIS MZ seed piece treatments significantly improved establishment of potato plants. These treatments, except for GENESIS MZ at the lower rate, also improved tuber yield.

Table 1. Efficacy of seed piece treatments on fusarium seed piece decay of potato (*Fusarium sambucinum*) in field experiment at Vegreville, Alberta in 2003

Treatment	Rate (100 kg seed)	Final stand (80 seed pieces)	Plant height (cm)	Tuber yield (t/ha)
Non-inoculated control	–	64.5 a[1]	41.6 c	9.6 c
Inoculated control	--	53.8 c	46.9 bc	9.5 c
GENESIS XT[2]	750 g	63.3 a	50.2 ab	14.6 a
GENESIS XT	500 g	60.3 ab	51.5 ab	14.8 a
GENESIS + SENATOR	26 mL + 500 g	54.5 bc	48.9 ab	10.8 bc
GENESIS + MAXIM	26 mL + 500 g	63.0 a	53.6 a	14.9 a
GENESIS MZ	500 g	64.3 a	46.4 bc	10.2 bc
GENESIS MZ	750 g	62.3 a	53.2 a	13.6 ab

[1] Values are means of four replications in each treatment. Means in a column within each category followed by the same letter under same category are not significantly different according to Tukey's honest significant difference at $P \leq 0.05$.

[2] This and subsequent treatments inoculated with *Fusarium sambucinum.*

PMR REPORT # 96 **SECTION O: DISEASES OF CEREALS, FORAGE CROPS AND OILSEEDS**
STUDY DATA BASE: 375-1231-9614

CROP: Alfalfa (*Medicago sativa)*
PEST: Blossom blight (*Sclerotinia sclerotiorum, Botrytis cinerea*) and spring black stem (*Phoma medicaginis*)

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TITLE: EFFECT OF FUNGICIDE APPLICATION ON BLOSSOM BLIGHT AND SEED YIELD OF ALFALFA IN SASKATCHEWAN IN 2003

MATERIALS: BENLATE (benomyl, 50% WP); BRAVO 500 (chlorothalonil, 50% F); DITHANE (mancozeb, 75% DG), LANCE (boscalid, 70% WDG) and QUADRIS (azoxystrobin, 250 g/L)

METHODS: The efficacy of fungicides in reducing alfalfa blossom blight infection caused by *Botrytis cinerea* and *Sclerotinia sclerotiorum* was evaluated in commercial seed fields at Hague, Macdowall, and Valparaiso, SK in 2003. Five fungicides, BENLATE (0.93 kg a.i. ha^{-1}), BRAVO 500 (1.5 L a.i. ha^{-1}), DITHANE (1.6 kg a.i. ha^{-1}), LANCE (0.3 kg a.i. ha^{-1}), and QUADRIS (125 g a.i. ha^{-1}), were applied to the crop at mid-bloom (July 15-18) only, or at mid- and late-bloom (July 24-28). Each fungicide was applied in 200 L ha^{-1} spray volume using a truck-mounted boom sprayer with Tee-Jet 8002 nozzles at 275 kPa. Fungicide treatments were compared with an untreated control. A randomized complete block design with four replications was used at each site, and each plot was 6 x 12 m. Mature florets (20 per plot) were collected from the controls prior to the first spray application, and from each plot at approx.10 days after each spray application. The flowers were plated onto semi-selective media without surface sterilization and incubated at room temperature and lighting. The number of florets infected with *S. sclerotiorum* and *B. cinerea* were assessed after 6 d of incubation and expressed as a percentage. Plots were rated for foliage disease severity (leaf spot and blackstem) at about 10 days after fungicide application (late flowering to early seed set) using the Horsfall-Barratt scale (0-11). Seed harvest ($30m^2$) was taken on Sept. 5 at Hague, Sept. 19 at Macdowall, and on Oct. 03 at Valparaiso. The fields at Hague and Macdowall were dessicated prior to harvest, and the field at Valparaiso was harvested after a killing frost. Analysis of variance (General Linear Model Procedure of SAS) was used to analyse infection incidence and yield. Duncan's Multiple Range Test was used for comparison of means.

RESULTS: *Sclerotinia sclerotiorum* was the dominant pathogen isolated from alfalfa flowers at all three sites. Prior to fungicide application, the incidence of *S. sclerotiorum* was 27% at Hague, 22% at Macdowall, and 20% at Valparaiso; the incidence of *B. cinerea* was 0% at all three sites. The incidence of *S. sclerotiorum* in the controls remained fairly constant from this first assessment until the second rating date (early August) at all three sites, and levels of *B. cinerea* remained very low (Table 1). The first application of each fungicide reduced the incidence of *S. sclerotiorum* at all three sites. The second application of fungicide had no further impact on the incidence of flower pathogens. Foliar diseases (primarily spring blackstem) were present at all three sites, but severity was quite low. Fungicide application reduced foliar disease severity slightly at Macdowall, but not at Hague or Valparaiso (Table 2). The first fungicide application resulted in very substantial increases in yield at one of three sites (Table 3). A second application of fungicide had no additional impact on yield.

CONCLUSIONS: In 2003, blossom blight levels were fairly low early in flowering, and remained quite constant throughout the flowering period. Severe drought conditions limited the development of epidemics of blossom blight and foliar disease. Application of fungicide at mid-flower reduced the incidence of *S. sclerotiorum* at all three sites, but increased yield only at Macdowall. A second application of fungicide did not affect blossom blight incidence or subsequent yield at any site.

ACKNOWLEDGEMENT: Thanks to BASF Canada and Syngenta for providing fungicides, and to the alfalfa seed producers who provided sites for the research plots.

Table 1. Impact of timing and frequency of fungicide application on incidence (%) of *Botrytis cinerea* (*Bc*) and *Sclerotinia sclerotiorum* (*Ss*) in three alfalfa seed production fields in Saskatchewan, 2003.

Fungicide &Timing	Rate (a.i. ha^{-1})	Hague *Bc*	Macdowall *Ss*	Valparaiso *Bc*	Mean *SsBcSsBcSs*
Ratings on July 24-28					
Mid bloom					
Benlate	0.9 kg	0 a†	13 b	0	4 b0 a14 ab010
Bravo	1.5 L	0.041667	14 b	0	2 b0 a 4 b0 7
Dithane	1.6 kg	0	8 b	0	3 b0 a 8 b0 6
Lance	0.3 kg	0.041667	9 b	0	4 b0 a 6 b0 6
Quadris	125 g	0.083333	13 b	0	4 b1 a 5 b1 7
Control		**0**	**34 a**	**0**	**23 a0 a24 a027**
Ratings on Aug. 01-07					
Mid bloom					
Benlate	0.9 kg	0 a†	5 b	0.041666667	9 ab0 a 4 b0 6
Bravo	1.5 L	0.041667	6 b	0	10 ab0 a 6 b0 7
Dithane	1.6 kg	0	1 b	0	5 b0 a 5 b0 4
Lance	0.3 kg	0	6 b	0	5 b0 a 6 b0 6
Quadris	125 g	0	5 b	0.125	13 ab0 a 4 b1 7
Mid + Late bloom					
Benlate	0.9 kg	0	5 b	0.041666667	9 ab0 a 5 b0 6
Bravo	1.5 L	0	5 b	0	10 ab0 a 5 b0 7
Dithane	1.6 kg	0	3 b	0.2083333333	11 ab1 a 1 b2 5
Lance	0.3 kg	0	4 b	0	8 ab0 a 5 b0 6
Quadris	125 g	0	4 b	0	6 b0 a 6 b0 5
Control		**0**	**21 a**	**0**	**19 a0 a24 a021**

† Means in a column followed by the same letter did not differ based on DMRT at $P \leq 0.05$.

Table 2. Impact of timing and frequency of fungicide application on foliar disease severity (%) in three alfalfa seed production fields in Saskatchewan, 2003.

Fungicide & Timing	Rate (a.i. ha^{-1})	Hague	Macdowall	Valparaiso	Mean
Mid bloom					
Benlate	0.9 kg	12 a†	5 b	20 a	12
Bravo	1.5 L	14 a	6 b	21 a	14
Dithane	1.6 kg	13 a	6 b	23 a	14
Lance	0.3 kg	14 a	4 b	19 a	12
Quadris	125 g	12 a	5 b	23 a	13
Mid + Late bloom					
Benlate	0.9 kg	16 a	5 b	18 a	13
Bravo	1.5 L	16 a	6 b	17 a	13
Dithane	1.6 kg	13 a	6 b	20 a	13
Lance	0.3 kg	10 a	4 b	15 a	10
Quadris	125 g	16 a	6 b	23 a	15
Control		**18 a**	**10 a**	**28 a**	**19**

† Means in a column followed by the same letter did not differ based on DMRT at $P \leq 0.05$.

Table 3. Impact of timing and frequency of fungicide application on alfalfa seed yield (kg ha^{-1}) in three commercial alfalfa seed production fields in Saskatchewan, 2003 (n = 3).

Fungicide & Timing	Rate (a.i. ha^{-1})	Hague	Macdowall	Valparaiso	Mean
Mid bloom					
Benlate	0.9 kg	241 a†	384 a	579 a	401
Bravo	1.5 L	252 a	298 ab	591 a	380
Dithane	1.6 kg	276 a	367 a	547 a	397
Lance	0.3 kg	266 a	350 a	590 a	402
Quadris	125 g	254 a	342 a	579 a	392
Mid + Late bloom					
Benlate	0.9 kg	272 a	299 ab	589 a	387
Bravo	1.5 L	265 a	370 a	541 a	392
Dithane	1.6 kg	249 a	350 a	549 a	383
Lance	0.3 kg	254 a	339 a	590 a	394
Quadris	125 g	260 a	345 a	572 a	392
Control		**240 a**	**236 b**	**539 a**	**338**

† Means in a column followed by the same letter did not differ based on DMRT at $P \leq 0.05$.

2003 PMR REPORT # 97

SECTION O: DISEASES OF CEREALS, FORAGE CROPS AND OILSEEDS
ICAR: 61009653

CROP: Alfalfa (*Medicago sativa* L.), cv. Algonquin
PEST: Seedling blight, *Rhizoctonia solani* Kühn, *Fusarium avenaceum* (Corda) Sacc.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEEDLING BLIGHT OF ALFALFA CAUSED BY *RHIZOCTONIA SOLANI* AND *FUSARIUM AVENACEUM* IN ALBERTA IN 2003

MATERIALS: APRON FL (metalaxyl 317 g/L SU), MAXIM 480 (fludioxonil 480g/L SU).

METHODS: Seed of the alfalfa cv. Algonquin was treated in a Hege II small batch seed treater with APRON FL at 0.47 mL/kg seed, with MAXIM 480 at 0.104 or 0.052 mL/kg seed, or with a combination of APRON FL and MAXIM 480 at 0.47 and 0.052 mL/kg seed, respectively. Experimental plots were established on 19 May, 2003 at Vegreville, Alberta, in a black chernozemic sandy loam soil and on 28 May at Edmonton, Alberta in a black chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 4 m rows spaced 25 cm apart. Seeds were planted 1 cm deep at a rate of 0.6 g of seeds per row. *Rhizoctonia solani* and *Fusarium avenaceum* were grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum into separate trials at the time of seeding at the rate of 20 mL/row. Non-treated seeds were planted as inoculated and non-inoculated controls. Seedlings were counted for each plot on 24 June. Plots were harvested by hand-cutting the plants on 20 August. The material collected was dried and weighed to determine yield. The *Fusarium* and *Rhizoctonia* inocula were also incorporated into a greenhouse potting mix at 12.5 mL/L v/v. The inoculated soil was transferred to 400 mL plastic cups and 12 cups of each treatment were planted with 10 seeds at a 1 cm depth. Emerged seedlings were counted two weeks after planting. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: In the experiment inoculated with *R. solani*, emergence was significantly greater ($P \leq 0.05$) than the inoculated control for all treatments containing MAXIM at the Vegreville site and for the MAXIM + APRON and the MAXIM treatment at the higher rate at the Edmonton site (Table 1). Yield exceeded that of the inoculated control for MAXIM + APRON and the MAXIM treatment at the lower rate at Vegreville and for all treatments containing MAXIM at Edmonton. In the

experiment inoculated with *F. avenaceum*, only the MAXIM + APRON treatment showed significantly greater emergence than the inoculated control (Table 2). This response was noted at both locations. Yield exceeded that of the inoculated control for MAXIM + APRON and the MAXIM treatment at the higher rate at Vegreville, but none of the treatments yielded significantly better than either the non-inoculated or inoculated controls at Edmonton. All fungicidal seed treatments in the trial resulted in greater emergence in greenhouse soils inoculated with *Fusarium* and all treatments including MAXIM had greater emergence than the APRON treatment.

CONCLUSIONS: MAXIM + APRON improved emergence in soils infested with either *R. solani* or *F. avenaceum* and yield in those infested with *R. solani*. Treatment with MAXIM at the higher rate improved emergence in soils infested by *R. solani*. While none of the treatments resulted in increased yield in plots inoculated with *F. avenaceum* at Edmonton, both APRON + MAXIM and MAXIM at the higher rate resulted in increased yield compared to the *Fusarium*-inoculated control at Vegreville.

Table 1. Effects of fungicidal seed treatments on plant stand and dry matter forage yield of alfalfa cv. Algonquin grown in soil inoculated with *Rhizoctonia solani* at Vegreville and Edmonton, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Emergence (plants/m^2)		Forage yield (t/ha)		Greenhouse emergence
		Veg.	Edm.	Veg.	Edm.	(/10 seeds)
Non-inoculated control	--	83.6 a[1]	6.4 b	0.62 a	0.27 bc	7.9 a
Inoculated control [2]	--	21.4 c	3.2 b	0.18 b	0.15 c	7.8 ab
MAXIM	0.052	48.6 b	14.8 ab	0.58 a	0.51 b	7.8 ab
MAXIM	0.104	51.5 b	25.2 a	0.37 ab	0.93 a	8.2 a
MAXIM + APRON	0.052 + 0.47	59.0 b	20.4 a	0.55 a	0.81 a	6.6 b
APRON	0.47	17.5 c	4.8 b	0.23 b	0.23 bc	7.3 ab

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

Table 2. Effects of fungicidal seed treatments on plant stand and dry matter forage yield of alfalfa cv. Algonquin grown in soil inoculated with *Fusarium avenaceum* at Vegreville and Edmonton, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Emergence (plants/m^2)		Forage yield (t/ha)		Greenhouse emergence
		Veg.	Edm.	Veg.	Edm.	(/10 seeds)
Non-inoculated control	--	79.6 a[1]	22.7 bc	0.38 ab	0.71 a	6.5 a
Inoculated Control [2]	--	26.9 bc	22.1 bc	0.14 b	0.63 a	1.8 c
MAXIM	0.052	47.3 b	28.2 abc	0.33 ab	0.67 a	6.1 a
MAXIM	0.104	51.8 b	34.7 ab	0.49 a	0.74 a	6.7 a
MAXIM + APRON	0.052 + 0.47	76.5 a	35.7 a	0.65 a	0.75 a	6.1 a
APRON	0.47	26.9 c	19.7 c	0.34 ab	0.74 a	3.1 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Fusarium avenaceum* at the time of seeding.

2003 PMR REPORT # 98

SECTION O: CEREALS, FORAGE CROPS and OILSEEDS - Diseases
STUDY DATA BASE: 303-1212-8907

CROP: Barley, cv. Westford
PEST: Root Rot, various pathogens Scald, *Rhynchosporium secalis* Net blotch, *Pyrenophora teres* Loose smut, *Ustilago nuda*

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TITLE: EFFICACY OF FUNGICIDE SEED TREATMENTS ON CONTROL OF LOOSE SMUT AND FOLIAR DISEASES, AND ON YIELD OF BARLEY, 2003

MATERIALS: VITAFLO 280 (G2051-16, carbathiin 169.7 g ai/L, thiram 151.5 g ai/L), RAXIL-Thiram (L0180-02, tebuconazole 6.67 g ai/L thiram 222.2 g ai/L), RAXIL 250FL (G7040-06, tebuconazole 6 g ai/L), CHARTER (triticonazole, 25 g ai/L), DIVIDEND XL RTA (difenoconazole 36.9 g ai/L, metalaxyl-m 3.11 g ai/L), JAU6476 (triazolinthion, 100 g ai/L).

METHODS: Barley seed, cv. Westford, was treated in a Hege treater by Gustafson personnel and supplied for the field trial. Plots were established on May 19, 2003, at a seeding rate of 300 viable seeds per m^2. Each plot was 5 rows wide, five metres long and 17.8 cm between rows. Between each treatment plot was an equal sized wheat guard plot. Plots received a herbicide application of MCPA600 (1 L/ha) plus REFINE EXTRA (20 g/ha) at Zadok's Growth Stage (ZGS) 22. Treatments were replicated four times in a randomized complete block design.

Emergence was taken on 1m of row prior to tillering. Root rot/seedling blight severity was rated on July 4, ZGS 40-45, on one metre of plot, on a 0 to 9 scale, where 0 = no disease and 9 = very severe. Net blotch severity was rated on July 29, at ZGS 84, on the penultimate leaves on ten randomly selected tillers per plot, using the Horsfall and Barratt Rating system. The number of smutted heads per plot and the total number of healthy and smutted heads in one row was determined and percent smutted heads determined. Yield and thousand kernel weight were determined from the harvest of the entire plot area, on August 19, using a small plot combine.

RESULTS: Results are contained in Table 1. Scald and net blotch ratings taken at ZGS 40-45 in not presented, the amount of infection was low and no significant differences, or even trends, were evident.

CONCLUSIONS: RAXIL containing treatments, VITAFLO 280 and CHARTER treatments were all effective at controling loose smut expression. There was no significant differences within these treatments. DIVIDEND XL RTA had no effect on loose smut, similarly JAU6476 demonstrated no loose smut control capabilities at the rate used in the trial. RAXIL was very effective on loose smut, even at very low active ingredient application levels.

Seed treatments had no effect on emergence. This may occur for several reasons, including mechanical planting results in an uneven seed placement. While the seed placement in the plot is overall very uniform, when it come to counting emergence, and random selection of a row section to count, variability is high. This could be overcome via larger replication, counting more lengths of row, or planting a set number of seeds separate to the yield plots, and using this for effect on emergence. For simplicity the latter would be the preferable method. One other reason for difficulty in showing effects on emergence may relate to the quality of seed used in experiments. Usually good quality seed is used and as such is perhaps less likely to be negatively affected by root rot

pathogens. In addition, in Charlottetown, the past number of years have not been overly conducive to root rot development, which would also impact on emergence responses.

Foliar diseases were not particularly excessive in 2003 which may account, in part for the lack of an impact on yield.

Table 1. Efficacy of fungicide seed treatments in spring barley, Charlottetown, PEI, 2003.

Treatment	Rate*	Emergence	Root rot	Net blotch**	Smut	Yield	1000 Kwt
		(#/m)	(0-9)	(%)	(%)	(kg/ha)	(g)
Untreated Control		37.7	4.5	20.4	22.8	2271	34.7
RAXIL 250FL	2.5	35.5	2.8	21.4	1.1	2647	35.25
VITAFLO 280	3.3	37	3.8	12.5	2.3	2513	35.65
DIVIDEND XL RTA	3.25	34	3	17.4	21.7	2490	34.45
CHARTER	1	32.7	3.8	16.6	0.5	2510	37.05
RAXIL-THIRAM	2.25	29	3.3	23.6	0.2	2508	35.3
RAXIL250 FL + JAU6476	1.25 + 0.50	51.5	3.3	8.8	2.4	2537	34.75
RAXIL250 FL + JAU6476	1.67 + 0.50	40	4	16.8	0.8	2344	35.65
JAU6476	0.5	37	3	20.7	20.2	2163	36
VITAFLO280	2.3	39	3.8	11.6	2.2	2576	35.95
SEM		5.04	0.43	4.68	1.009	163.3	0.838
LSD (0.05)		(ns)	(ns)	(ns)	2.92	(ns)	(ns)

* ml product/kg seed
** ZGS 84, July 29, rating
(ns) - no significant difference, p=0.05

2003 PMR REPORT # 99

SECTION O: DISEASES OF CEREALS, FORAGE CROPS AND OILSEEDS
ICAR: 61009653

CROP: Bird's foot trefoil (*Lotus corniculatus* L.), cv. Leo
PEST: Seedling blight, *Rhizoctonia solani* Kühn, *Fusarium avenaceum* (Corda) Sacc.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEEDLING BLIGHT OF BIRDS FOOT TREFOIL CAUSED BY *RHIZOCTONIA SOLANI* AND *FUSARIUM AVENACEUM* IN ALBERTA IN 2003

MATERIALS: APRON FL (metalaxyl 317 g/L SU), MAXIM 480 (fludioxonil 480g/L SU)

METHODS: Seed of the birds foot trefoil cv. Leo was treated in a Hege II small batch seed treater with APRON FL at 0.47 mL/kg seed, or with MAXIM 480 at 0.104 or 0.052 mL/kg seed, or with a combination of APRON FL and MAXIM 480 at 0.47 and 0.052 mL/kg seed, respectively. Experimental plots were established on 19 May, 2003 at Vegreville, Alberta, in a black chernozemic sandy loam soil and on 28 May at Edmonton, Alberta in a black chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 4 m rows spaced 25 cm apart. Seeds were planted 1 cm deep at a rate of 0.6 g of seeds per row. *Rhizoctonia solani* and *Fusarium avenaceum* were grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum into separate trials at the time of seeding at the rate of 20 mL/row. Non-treated seeds were planted as inoculated and non-inoculated controls. Seedlings were counted for each plot on 24 June. Plots were harvested by hand-cutting the plants on 20 August. The material collected was dried and weighed to determine yield. The *Fusarium* and *Rhizoctonia* inocula were also incorporated into a greenhouse potting mix at 12.5 mL/L v/v. The inoculated soil was transferred to 400 mL plastic cups and 12 cups of each treatment were planted with 10 seeds at a 1 cm depth. Emerged seedlings were counted two weeks after planting. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: In plots inoculated with *R. solani*, emergence was significantly greater ($P \leq 0.05$) than the inoculated control for the MAXIM + APRON treatment at both sites, and for the MAXIM treatment at the higher rate at the Edmonton site (Table 1). Yield of all of the treatments containing MAXIM exceeded that of the inoculated control at Edmonton, but none of the treatments were significantly greater than the yield of the inoculated control at Vegreville. In plots inoculated with

F. avenaceum, emergence was significantly greater than the inoculated control for all of the treatments containing MAXIM at Vegreville, but only for MAXIM at the higher rate at Edmonton (Table 2). Forage yield exceeded that of the inoculated control for MAXIM + APRON and the MAXIM treatment at the higher rate at both sites. Greenhouse trials inoculated with *F. avenaceum* showed significantly greater emergence for all treatments containing MAXIM. Treatment with APRON alone resulted in similar emergence and yield to the inoculated control at both sites in soils inoculated with either *R. solani* or *F. avenaceum*.

CONCLUSIONS: Treatment with MAXIM + APRON improved emergence, compared to inoculated controls, in plots inoculated with *R. solani*. Treatment with MAXIM at the higher rate consistently improved emergence in plots inoculated with *F. avenaceum*. Forage yield in these plots was improved relative to inoculated controls by treatment with MAXIM + APRON or MAXIM at the higher rate.

Table 1. Effects of fungicidal seed treatments on emergence and dry matter forage yield of bird's foot trefoil cv. Leo grown in soil inoculated with *Rhizoctonia solani* at Vegreville and Edmonton, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Emergence (plants/m^2)		Forage yield (t/ha)		Greenhouse emergence
		Veg.	Edm.	Veg.	Edm.	(/10 seeds)
Non-inoculated control	--	83.1 a[1]	4.1 abc	0.28 a	0.01 c	6.3 a
Inoculated control [2]	--	52.9 b	1.7 c	0.17 b	0.04 c	6.7 a
MAXIM	0.052	56.3 b	5.3 abc	0.06 c	0.15 b	6.3 a
MAXIM	0.104	53.8 b	7.8 a	0.18 b	0.37 a	7.6 a
MAXIM + APRON	0.052 + 0.47	58.9 a	6.1 ab	0.16 b	0.24 b	6.8 a
APRON	0.47	45.1 b	3.1 bc	0.15 b	0.04 c	6.4 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

Table 2. Effects of fungicidal seed treatments on emergence and dry matter forage yield of bird's foot trefoil cv. Leo grown in soil inoculated with *Fusarium avenaceum* at Vegreville and Edmonton, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Emergence (plants/m^2)		Forage yield (t/ha)		Greenhouse emergence
		Veg.	Edm.	Veg.	Edm.	/10 seeds
Non-inoculated control	--	79.8 a[1]	0.2 b	0.25 a	0.26 bc	6.5 a
Inoculated control [2]	--	10.9 c	1.4 b	0.15 b	0.23 bc	3.7 b
MAXIM	0.052	34.8 b	3.1 ab	0.18 ab	0.45 ab	6.8 a
MAXIM	0.104	47.0 b	9.6 a	0.26 a	0.64 a	6.0 a
MAXIM + APRON	0.052 + 0.47	43.3 b	4.7 ab	0.24 a	0.61 a	6.2 a
APRON	0.47	8.9 c	0.2 b	0.11 b	0.11 c	3.5 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Fusarium avenaceum* at the time of seeding.

2003 PMR REPORT # 100

SECTION O: CEREALS, FORAGE CROPS AND OILSEEDS - Diseases
ICAR: 61009653

CROP: Canola (*Brassica napus* L.), cv. DKL 34-55
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF CANOLA IN ALBERTA IN 2003

MATERIALS: PONCHO 600 FS (clothianidin, 600 g/L SU), G7061 (proprietary), PROSPER (carbathiin, 52.5 g/L + metalaxyl 3.75 g/L + thiram, 112.5 g/L + clothianidin, 150 g/L SU), G7073 (proprietary), G7074 (proprietary), G7078 (proprietary), L0121 (proprietary), Helix (difenconazole 16 g/L, fludioxonil 1.67 g/L, metalaxyl-M 5 g/L, thiamethoxam 133.3 g/L SU)

METHODS: Seed of the canola cv. DKL 34-55 was treated in a Hege small batch seed treater with G7061, G7070, G7074 and G7078 at 14 mL/kg seed, G7061 at 14 mL/kg seed + L0121 at 0.5 mL/kg seed, PROSPER at 13.3 mL/kg seed, or with HELIX at 15 mL/kg seed. PONCHO was used at 3.3 mL/kg seed as inoculated and non-inoculated controls (insecticide only for flea beetle control). An experimental plot was established on 19 May, 2003 at Vegreville, Alberta, in a black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 1.5 cm deep at a rate of 1.0 g of seed per row. Non-treated seeds were planted as inoculated and non-inoculated controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 30 mL/row. Emerged seedlings were counted on 17 June. At maturity (20 September), plants were harvested and seed was weighed to determine yields. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence and yield were significantly ($P \leq 0.05$) higher than for the inoculated control for PROSPER, G7073, G7074 and for the G7061 + L0121 treatments (Table 1).

CONCLUSIONS: PROSPER, G7073, G7074, as well as the G7061 + L0121 treatment, significantly improved emergence and yield over the inoculated control.

Table 1. Effect of seed treatments on the number of emerged seedlings and seed yield of the canola cv. DKL 34-55 grown in field plots inoculated with *Rhizoctonia solani* at Vegreville, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Stand (plants/m^2)	Yield (t/ha)
PONCHO Non-inoculated	3.33	67.0 a[1]	1.34 abc
PONCHO[2]	3.33	12.9 d	0.70 cd
G7061	14	26.9 cd	1.01 bcd
G7061 + L0121	14 + 0.5	32.8 bc	1.41 ab
PROSPER	13.3	49.5 b	1.39 ab
G7073	14	42.9 bc	1.42 ab
G7074	14	50.5 ab	1.85 a
G7078	14	27.8 cd	1.30 abc
HELIX	15	13.4 d	0.60 d

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2003 PMR REPORT # 101

SECTION O: CEREALS, FORAGE CROPS AND OILSEEDS - Diseases
ICAR: 61009653

CROP: Canola (*Brassica napus* L.), cv. DKL 35-85
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEEDLING BLIGHT OF CANOLA CAUSED BY *RHIZOCTONIA SOLANI* IN ALBERTA IN 2003

MATERIALS: VITAVAX RS (carbathiin, 80 g/L + thiram, 160 g/L SU), PROSPER (carbathiin, 56 g/L + metalaxyl 4 g/L + thiram, 120 g/L + clothianidin, 120 g/L SU), ALLEGIANCE (metalaxyl, 317 g/L SU), L0029 (proprietary), L0090 (proprietary), FOUNDATION LITE (iprodione, 133.3 g/L + thiram, 88.9 g/L SU), L0148 (proprietary)

METHODS: Seed of the canola cv. DKL 35-85 was treated in a Hege small batch seed treater with VITAVAX RS + ALLEGIANCE at 8.33 and 0.32 mL/kg seed, respectively, PROSPER at 16.7 mL/kg seed, FOUNDATION LITE at 22.5 mL/kg seed, or L0029 + L0090 + L0148 at 0.153, 1.3, and 0.06 mL/kg seed, respectively. Untreated seed was used as a control. An experimental plot was established on 19 May, 2003 at Vegreville, Alberta, in a black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 1.5 cm deep at a rate of 1.0 g of seed per row. Non-treated seeds were planted as controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated into all plots at the time of seeding at the rate of 30 mL/row. Emerged seedlings were counted on 17 June. At maturity (20 September), plants were harvested and seed was weighed to determine yield. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly ($P \leq 0.05$) higher for the PROSPER and FOUNDATION LITE treatments than for the inoculated control (Table 1). Emergence was significantly ($P \leq 0.05$) higher for plots treated with PROSPER compared to those treated with FOUNDATION LITE. Seed yield was significantly ($P \leq 0.05$) greater for PROSPER compared to any of the other seed treatments, and to the inoculated control.

CONCLUSIONS: PROSPER and FOUNDATION LITE improved emergence over the inoculated control. PROSPER provided more protection against seedling blight caused by *R. solani* than FOUNDATION LITE. PROSPER improved seed yield over the inoculated control.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of canola cv. DKL 35-85 grown in field plots inoculated with *Rhizoctonia solani* at Vegreville, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Stand (plants/m^2)	Yield (t/ha)
Inoculated Control[2]	--	8.8 c[1]	0.17 b
VITAVAX RS + ALLEGIANCE	8.33 + 0.32	16.8 bc	0.44 b
PROSPER	16.7	46.8 a	1.11 a
FOUNDATION LITE	22.5	26.0 b	0.45 b
L0029 + L0090 + L0148	0.153 + 1.3 + 0.06	19.2 bc	0.32 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] All treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2003 PMR REPORT # 102

SECTION O: CEREALS, FORAGE CROPS AND OILSEEDS - Diseases
ICAR: 61009653

CROP: Canola (*Brassica napus* L.), cv. Kelsey
PEST: Root rot, *Rhizoctonia solani* Kühn

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TITLE: EFFICACY OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF RHIZOCTONIA SEEDLING BLIGHT OF CANOLA IN ALBERTA IN 2003

MATERIALS: VITAVAX RS (carbathiin, 80 g/L + thiram, 156 g/L SU), G7065 (proprietary), ALLEGIANCE (metalaxyl, 317 g/L SU), GAUCHO 480 (imidaclopirid, 480 g/L SU), GAUCHO CS (carbathiin, 47.6 g/L + thiram, 95.2 g/L + imidaclopirid, 285.7 g/L SU), G7069 (carbathiin, 46.5 g/L + thiram, 93.1 g/L + metalaxyl, 7.1 g/L + imidaclopirid, 285.7 g/L SU), L0109 (proprietary)

METHODS: Seed of canola cv. Kelsey was treated in a Hege small batch seed treater with G7069 at 14.32 mL/kg seed, GAUCHO 480 + GAUCHO CS + ALLEGIANCE at 8.33, 14 and 0.32 mL/kg seed, respectively; VITAVAX RS + G7065 + ALLEGIANCE at 8.33, 3.57 and 0.32 mL/kg seed, respectively; or G7065 + L0109 at 3.57 and 22.5 mL/kg seed, respectively. Untreated seed was used as a control. An experimental plot was established on 19 May, 2003 at Vegreville, Alberta, in a black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 1.5 cm deep at a rate of 1.0 g of seed per row. Non-treated seeds were planted as controls. *Rhizoctonia solani* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated into all plots at the time of seeding at the rate of 30 mL/row. Emerged seedlings were counted on 17 June. At maturity (20 September), plants were harvested and seed was weighed to determine yield. Some shattering of seed pods occurred before harvest. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly ($P \leq 0.05$) higher for the GAUCHO CS + GAUCHO 480 + ALLEGIANCE treatment compared to the inoculated control (Table 1). Yield was significantly ($P \leq 0.05$) greater compared to the inoculated control for the G7035 + G7014 + L0020 treatment, as well as for G7069.

CONCLUSIONS: The GAUCHO CS + GAUCHO 480 + ALLEGIANCE treatment significantly improved emergence over the untreated control. This treatment, as well as G7069, also improved seed yield.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of the canola cv. Kelsey grown in a field plot inoculated with *Rhizoctonia solani* at Vegreville, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Stand (plants/m^2)	Yield (t/ha)
Inoculated Control[2]	--	9.1 b[1]	0.50 b
VITAVAX RS + G7065 + ALLEGIANCE	8.33 + 3.57 + 0.32	35.0 ab	1.15 ab
G7069	14.32	34.9 ab	1.28 a
GAUCHO CS + GAUCHO 480 + ALLEGIANCE	14.0 + 8.33 + 0.32	47.6 a	1.28 a
G7065 + L0109	3.57 + 22.5	37.0 ab	1.18 ab

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] All treatments were inoculated with *Rhizoctonia solani* at the time of seeding.

2003 PMR REPORT # 103

SECTION O: CEREALS, FORAGE CROPS AND OILSEEDS - Diseases
ICAR: 61009653

CROP: Canola (*Brassica napus* L.), cv. DKL 34-55
PEST: Root rot, *Fusarium avenaceum* (Corda) Sacc.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF FUSARIUM SEEDLING BLIGHT OF CANOLA IN ALBERTA IN 2003

MATERIALS: PONCHO 600 FS (clothianidin, 600 g/L SU), G7061 (proprietary), PROSPER (carbathiin, 52.5 g/L + metalaxyl 3.75 g/L + thiram, 112.5 g/L + clothianidin, 150 g/L SU), G7073 (proprietary), G7074 (proprietary), G7078 (proprietary), L0121 (proprietary), HELIX (difenconazole 16 g/L, fludioxonil 1.67 g/L, metalaxyl-M 5 g/L, thiamethoxam 133.3 g/L SU).

METHODS: Seed of the canola cv. DKL 34-55 was treated in a Hege small batch seed treater with G7061, G7073, G7074 and G7078 at 14 mL/kg seed, G7061 at 14 mL/kg seed + L0121 at 0.5 mL/kg seed, PROSPER at 13.3 mL/kg seed, or with HELIX at 15 mL/kg seed. PONCHO was used at 3.33 mL/kg seed as inoculated and non-inoculated controls (insecticide only). An experimental plot was established on 19 May, 2003 at Vegreville, Alberta, in a black chernozemic sandy loam soil. The plot was seeded in a randomized complete block design with four replications. Each subplot consisted of four, 6 m rows of plants spaced 20 cm apart. Seeds were planted 1.5 cm deep at a rate of 1.0 g of seed per row. Non-treated seeds were planted as inoculated and non-inoculated controls. *Fusarium avenaceum* was grown on sterilized oat grains for 14 days, dried, ground, and incorporated at the time of seeding at the rate of 40 mL/row. Emerged seedlings were counted on 17 June. At maturity (20 September), plants were harvested and seed was weighed to determine yield. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence and yield were similar for all treatments and the inoculated control (Table 1). Treatment with G7061 alone resulted in a significantly ($P \leq 0.05$) greater yield than treatment with PROSPER or HELIX.

CONCLUSIONS: None of the seed treatments significantly improved emergence or yield over the inoculated control.

Table 1. Effect of seed treatments on number of emerged seedlings and seed yield of the canola cv. DKL 34-55 grown in a field plot inoculated with *Fusarium avenaceum* at Vegreville, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Stand (plants/m^2)	Yield (t/ha)
G7009 Non-inoculated	3.33	69.6 a[1]	1.67 ab
G7009[2]	3.33	26.4 b	1.28 ab
G7061	14	46.8 ab	1.75 a
G7061 + L0121	14 + 0.5	46.8 ab	1.35 ab
PROSPER	13.3	50.8 ab	1.20 b
G7073	14	51.6 ab	1.28 ab
G7074	14	43.2 ab	1.45 ab
G7078	14	39.2 b	1.50 ab
HELIX	15	23.6 b	1.16 b

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Fusarium avenaceum* at the time of seeding.

2003 PMR REPORT # 104

SECTION O: DISEASES OF CEREALS, FORAGE CROPS AND OILSEEDS
ICAR: 61009653

CROP: Canola (*Brassica napus* L.)
PEST: Fusarium root rot (*Fusarium avenaceum*), isolates CA1-13 and CA11-9

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TITLE: ***IN VITRO*** **EVALUATION OF THE INHIBITORY EFFECT OF FIVE FUNGICIDES ON MYCELIAL GROWTH OF *FUSARIUM* SPP.**

MATERIALS: APRON FL (metalaxyl 317 g/L SU), VITAVAX RS (thiram 11.94% + carbathiin 5.97% SU), FOUNDATION LITE (iprodione 132 g/l + thiram 88 g/L SU), HELIX XTRA (thiamethoxam 20.7% + difenoconazole 1.25% + metalaxyl-M 0.39% + fludioxonil 0.13% SU), PROSPER 400 (carbathiin, 56 g/L + thiram, 120 g/L + metalaxyl, 4 g/L + clothianidin, 220 g/L SU)

METHODS: *In vitro* fungicide bioassays were conducted by growing two isolates of *Fusarium avenaceum* (isolates CA1-13 and CA11-9) on potato-dextrose agar (PDA) plates amended with APRON FL, VITAVAX RS, FOUNDATION LITE, HELIX XTRA or PROSPER 400. The final concentration of fungicides in the plate was adjusted to 0.1, 0.5, 1, 5, 10, 50, and 100 ppm of formulated product. Non-amended PDA plates served as controls. A cork borer was used to remove 5-mm plugs of agar with mycelium from actively growing colonies of *Fusarium*. The plugs were inserted into the center of the bioassay plates, which were then incubated at 20-25°C. The plates were arranged in a completely randomized design. Colony diameters were measured every five days until the non-fungicide control plates were fully overgrown. Each concentration was tested on 5 plates and the bioassay was repeated once. Data were converted to percent inhibition of mycelial growth by comparing with non-amended controls and were subjected to analysis of variance and least significant difference (LSD) mean separations with the Statistical Analysis System 8.01 (SAS Institute, Cary, NC).

RESULTS: The results from the two *Fusarium* isolates are presented separately since there was a significant interaction (*P* # 0.001) between fungicide and isolate. HELIX XTRA had a consistently high suppressive effect on *Fusarium* isolate CA1-13 at all concentrations (Figure 1). Inhibition ranged from 48% to 90%. VITAVAX RS, FOUNDATION LITE and PROSPER 400 had a highly suppressive effect (67 - 76%) on the same isolate, but only at the highest concentrations. APRON

was the least effective fungicide against the isolate CA1-13. HELIX XTRA had the greatest suppressive effect against isolate CA11-9 (82% inhibition at its highest concentration). VITAVAX RS, FOUNDATION LITE and PROSPER 400 had no inhibitory effect at 0.1 - 5 ppm, and APRON did not inhibit isolate CA11-9 at any concentration. At 100 ppm, FOUNDATION LITE showed 56% inhibition, and VITAVAX RS and PROSPER showed 10-26% inhibition. Combining data across all concentrations for each fungicide, HELIX XTRA showed the greatest inhibitory effect on mycelial growth of *Fusarium*, and APRON showed the least among the fungicides tested (Figure 2).

CONCLUSIONS: HELIX XTRA was the most effective fungicide for controlling *Fusarium avenaceum in vitro*. APRON did not control the *Fusarium* isolates tested in this study.

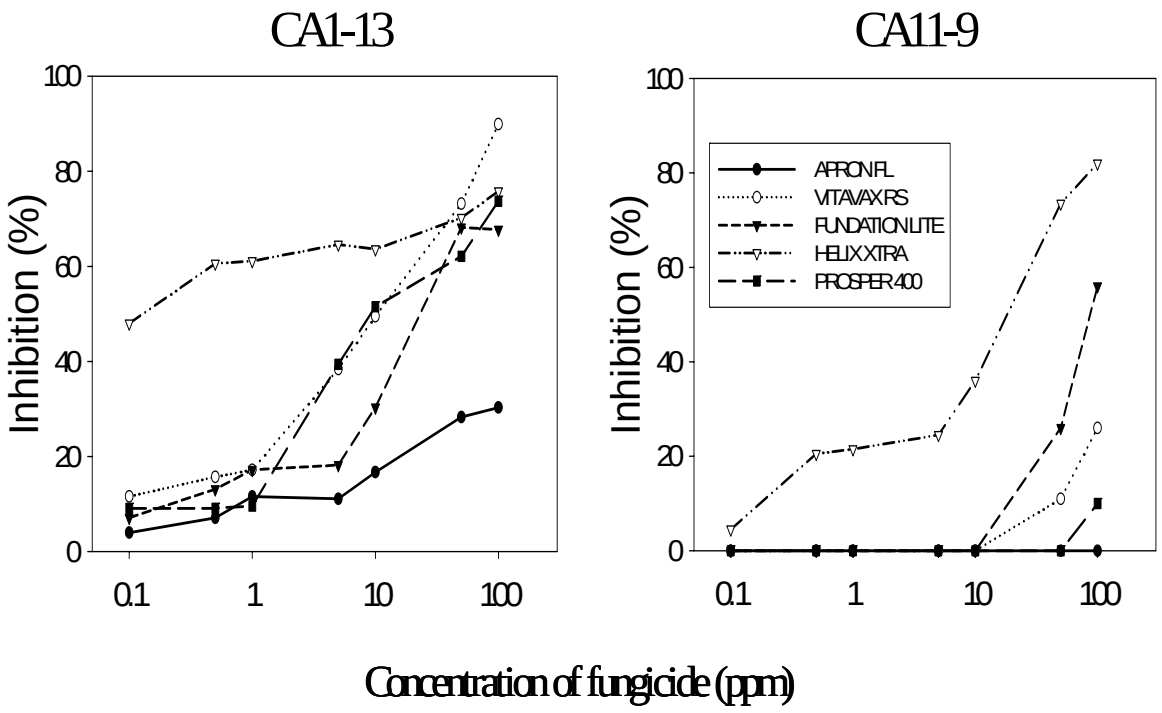

Figure 1. Dose-response on mycelial growth of *Fusarium avenaceum* (isolates CA1-13 and CA11-9) to five fungicides in potato-dextrose agar plates in a laboratory assay.

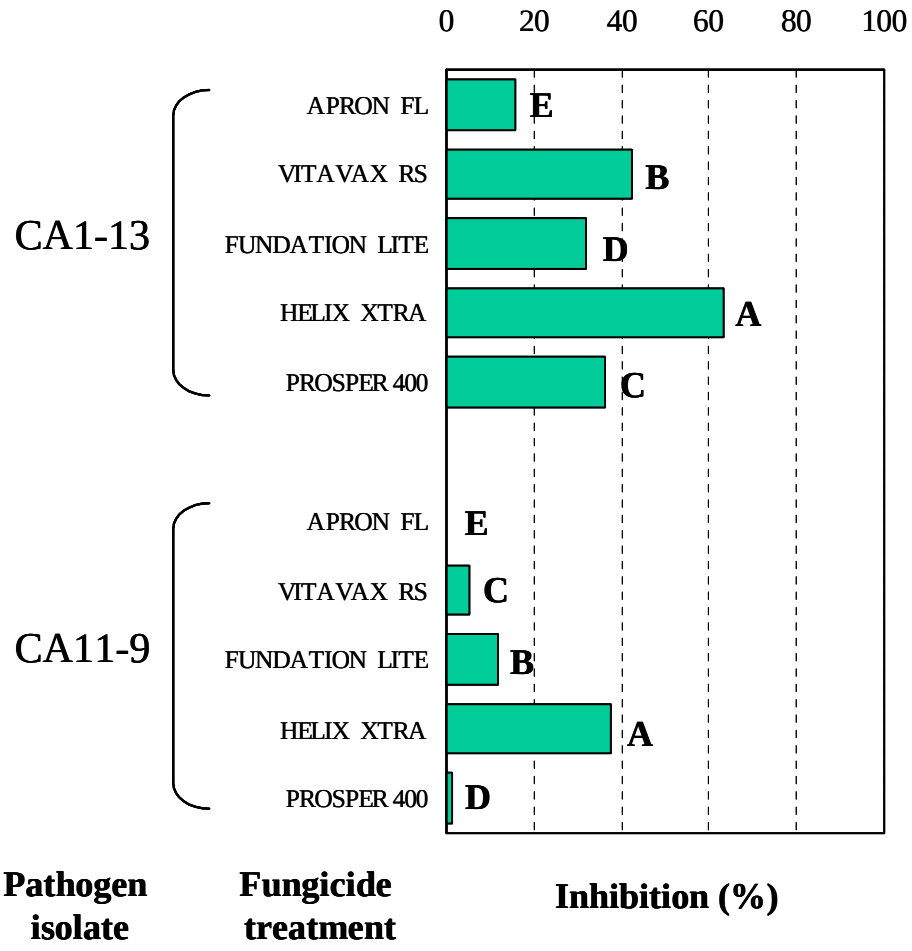

Figure 2. The effect of five fungicides on mycelial growth of *Fusarium avenaceum* in potato-dextrose agar plates in a laboratory assay. Bars within each pathogen isolate followed by the same letter are not significantly different according to least significant difference at *P* # 0.05. Data were combined across concentrations within each fungicide to show fungicide effect.

2003 PMR REPORT # 105

SECTION O: DISEASES OF CEREALS, FORAGE CROPS AND OILSEEDS
ICAR: 61009653

CROP: Clover (*Melilotus officinalis* (L.) Lam., cv. Yukon
PEST: Seedling blight, *Rhizoctonia solani* Kühn, *Fusarium avenaceum* (Corda) Sacc.

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TITLE: EVALUATION OF FUNGICIDAL SEED TREATMENTS FOR THE CONTROL OF SEEDLING BLIGHT OF CLOVER CAUSED BY *RHIZOCTONIA SOLANI* AND *FUSARIUM AVENACEUM* IN ALBERTA IN 2003

MATERIALS: APRON FL (metalaxyl 317 g/L SU), MAXIM 480 (fludioxonil 480g/L SU).

METHODS: Seed of the sweet clover cv. Yukon was treated in a Hege II small batch seed treater with APRON FL at 0.47 mL/kg seed, or with MAXIM 480 at 0.104 or 0.052 mL/kg seed, or with a combination of APRON FL and MAXIM 480 at 0.47 and 0.052 mL/kg seed, respectively. Experimental plots were established on 19 May, 2003 at Vegreville, Alberta, in a black chernozemic sandy loam soil and on 28 May at Edmonton, Alberta in a black chernozemic clay loam soil. Plots were seeded in a randomized complete block design with four replications. Each plot consisted of four, 4 m rows spaced 25 cm apart. Seeds were planted 1 cm deep at a rate of 0.6 g of seeds per row. *Rhizoctonia solani* and *Fusarium avenaceum* were grown on sterilized oat grains for 14 days, dried, ground, and incorporated as inoculum into separate trials at the time of seeding at the rate of 20 mL/row. Non-treated seeds were planted as inoculated and non-inoculated controls. Seedlings were counted for each plot on 24 June. Plots were harvested by hand-cutting the plants on 20 August. The material collected was dried and weighed to determine yield. The *Fusarium* and *Rhizoctonia* inocula were also incorporated into a greenhouse potting mix at 12.5 mL/L v/v. The inoculated soil was transferred to 400 mL plastic cups and 12 cups of each treatment were planted with 10 seeds at a 1 cm depth. Emerged seedlings were counted two weeks after planting. Data were subjected to analysis of variance using a General Linear Models Procedure (SAS) and, where appropriate, Duncan's New Multiple Range Test was performed for means comparison.

RESULTS: Emergence was significantly greater ($P \leq 0.05$) for all treatments containing MAXIM than for the inoculated control at both sites for *R. solani* (Table 1). For *F. avenaceum*, all treatments containing MAXIM showed significantly greater emergence at the Edmonton site, and MAXIM + APRON and MAXIM at the low rate showed greater emergence than the inoculated control at the Vegreville site (Table 2). Emergence was greater for the MAXIM + APRON treatment than for the

treatments with MAXIM alone at the Vegreville site, for both experiments (Tables 1 and 2). Yield was significantly greater than the inoculated control for all treatments containing MAXIM at Edmonton for the *Rhizoctonia* experiment, and for MAXIM at Vegreville. Yield and emergence in plots treated with APRON alone were similar to those of the inoculated control at both sites.

CONCLUSIONS: MAXIM improved emergence over untreated plots inoculated with *R. solani*. The same applied to *F. avenaceum*, except that MAXIM at the higher rate did not significantly improve emergence at the Vegreville site. MAXIM + APRON and MAXIM at the high rate improved yield compared to the inoculated control for both experiments. MAXIM at the low rate improved yield compared to the inoculated control in both experiments at Edmonton but in neither at Vegreville.

Table 1. Effects of fungicidal seed treatments on plant stand and dry matter forage yield of clover cv. Yukon grown in soil inoculated with *Rhizoctonia solani* at Vegreville, Alberta in 2003.

Treatment	Rate (mL/kg seed)	Emergence (plants/m^2)		Forage yield (t/ha)		Greenhouse emergence
		Veg.	Edm.	Veg.	Edm.	(/10 seeds)
Non-inoculated Control	--	85.1 a[1]	2.2 c	0.76 a	0.67 b	8.2 a
Inoculated Control [2]	--	11.4 c	1.3 c	0.18 c	0.22 c	8.1 a
MAXIM	0.052	55.3 b	13.2 b	0.29 bc	0.72 b	8.6 a
MAXIM	0.104	54.3 b	18.9 a	0.52 ab	1.16 a	9.1 a
MAXIM + APRON	0.052 + 0.47	78.4 a	14.1 b	0.58 a	0.81 b	7.9 a
APRON	0.47	19.6 c	1.7 c	0.25 bc	0.24 c	8.2 a

[1] Means within a column followed by the same letter are not significantly different using Duncan's New Multiple Range Test ($P \leq 0.05$).
[2] This and all subsequent treatments were inoculated with *Rhizoctonia solani* at the time of seeding.