1993 PEST MANAGEMENT RESEARCH REPORT

Compiled for:

THE EXPERT COMMITTEE ON PEST MANAGEMENT

A/Chairman: Craig Hunter

by:

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

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This annual report is designed to encourage and facilitate the rapid dissemination of pest management research results amongst researchers, the pest management industry, university and government agencies, and others concerned with the development, registration and use of effective pest management strategies. The use of alternative and integrated pest management products is seen by the ECPM as an integral part in the formulation of sound pest management strategies. If in doubt about the registration status of a particular product, consult the Plant Industry Directorate, Food Production and Inspection Branch, Agriculture Canada, Ottawa, Ontario, K1A 0C5.

This year there were 165 reports. We are indebted to the research workers for their cooperation in this field, from provincial and federal departments, as well as universities and industry, together with the section editors and members of the Research Information Management Service for making this report possible.

1993 RAPPORT DE RECHERCHE DE LA LUTTE DIRIGÉE

Préparé pour:

LE COMITÉ D'EXPERTS DE LA LUTTE DIRIGÉE

Président intermédiaire, Craig Hunter

par:

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

JANVIER 1994

L'objectif poursuivi par la compilation du rapport annuel est de faciliter la diffusion des résultats de la recherche de la lutte dirigée auprès des chercheurs, des industries, des universités, des organismes gouvernementaux et toutes les personnes ou groupes concernés par le développement, la fabrication, l'homologation et l'emploi des produits pour la lutte dirigée. Utilization de produits pour la lutte intégrée ou de produits alternatifs est perçu par Le Comité d'experts de la lutte dirigée comme faisant parti intégrante de l'élaboration d'une stratégie pour la lutte dirigée. En cas de doute relatif à l'enregistrement d'un produit donné, consulter la Direction de l'industrie des produits végétaux, Direction générale de la production et de l'inspection des aliments, Agriculture Canada, Ottawa (Ontario) K1A 0C5.

Ainsi, cette année, il y a 165 rapports. Les membres du Comité tiennent à remercier chaleureusement les chercheurs des ministères provinciaux et fédéraux, des universités et du secteur privé sans oublier les rédacteurs et le personnel de la Service à la direction de l'information sur la recherche scientifique dont la collaboration a permis de rédiger le présent rapport.

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Section Editors / Réviseurs de section : M. Steiner, T.J. Lysyk, and C. Bolter

#001 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 375-1221-8177

CROP: Canola, *Brassica napus* L. cv Excel

PEST: Sclerotinia stem rot, *Sclerotinia sclerotiorum*

NAME AND AGENCY:
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TITLE: BIOLOGICAL CONTROL OF SCLEROTINIA STEM ROT OF CANOLA USING FOLIAR APPLIED FUNGI, 1993

MATERIALS: AGENTS - Species and isolates of *Aspergillus, Penicillium, Trichoderma, Mucor, Absidia, Cunninghamella*

METHODS: The test, established at the Agriculture Canada research farm near Saskatoon in an area where sclerotia of *S. sclerotiorum* were abundant in the soil, consisted of 3 m X 2 m plots arranged in a four replicate RCB design. Adequate rainfall occurred during June and July to establish a dense canopy and to stimulate production of apothecia by *S. sclerotiorum*. At growth stage 3.3 daily misting of the plots was begun to maintain leaf wetness and soil moisture.

The fungi chosen for the test had either displayed strong antagonism towards *S. sclerotiorum* in culture plates (*Penicillium*, *Aspergillus* spp.) or were fast growing species (*Mucor*, *Absidia*, *Cunninghamella* spp.) which may colonize fallen canola petals more rapidly than *S. sclerotiorum*. *Trichoderma spp.* displayed moderate antagonism and were fast growers. Inoculum was prepared using various methods. Some fungi were grown on pda (Difco) petri plates for two weeks; the spores were collected by adding deionized water supplemented with 0.05% Tween 80, scraping the surface with a glass rod, and collecting the spore suspension. Other fungi were grown in 2 L Nalgene bottles containing autoclaved moist rye grain for two weeks; the overgrown grain was then macerated for 15 seconds in a Waring blender. One fungus was cultured in potato sucrose broth (22 g dehydrated potato + 10 g domestic sugar /L) for two weeks followed by 15 second maceration in a Waring blendor. All inoculum suspensions were vacuum filtered through 1 mm mesh. Inoculum concentrations were determined by use of a haemocytometer and were diluted or concentrated to 10^8 spores or mycelium fragments/ml. Final volumes were about 2 L. Inoculum was stored overnight at 5°C. Immediately before use 1500 ml of the suspension was diluted with 1500 ml of filtered sterile potato sucrose broth to obtain 3 L of suspension at 5 X 10^7 spores or mycelial fragments/ml.

The inoculum was applied on July 16 at growth stage 4.2 (50% bloom) using a R&D plot sprayer at 276 kPa and 350 L solution/ha. On

September 20, at growth stage 5.2, 100 plants/plot were rated for disease severity using the following categories: 1. no stem lesions, 2. lesion had girdled less than 50% of the stem circumference, 3. lesion had girdled 50% or more of the stem circumference, 4. lesion had girdled the entire stem circumference: the plant had prematurely ripened but had normal seed, 5. as in 4 but the seeds had shrivelled. Disease severity values (% DRAT) were calculated for each plot using the formula: % DRAT = 3 (number of plants in category X NV) x 100/total number of plants X 4, where NV for categories 1, 2, 3, 4, 5 were 0, 1, 2, 3, 4 respectively. Analysis of variance for % DRAT and % disease incidence, and, the Waller - Duncan k -ratio t test on treatment means were done.

RESULTS: See table.

CONCLUSIONS: Sclerotinia stem rot incidence and severity was suppressed by eight of the treatments. Control of sclerotinia stem rot may be possible by using antagonistic fungi but also by using superior substrate colonizing fungi.

Fungus	Type of Inoculum	DRAT (%)	Disease Incidence(%)
Check	-----	37.7 a	51.4 a
Aspergillus ochraceus	spores from plate culture	35.3 ab	49.8 a
Aspergillus rugulosum	spores from plate culture	34.5 ab	49.2 ab
Trichoderma harzianum	mycelium from broth culture	27.7 abc	37.4 abc
Trichoderma isolate 1	spores from plate culture	21.8 abc	31.3 abc
Penicillium isolate 3	spores from plate culture	20.9 abc	31.7 abc
Mucor mucedo	mycelium from macerated grain	19.3 bc	28.4 bc
Penicillium isolate 5	spores from plate culture	18.8 bc	22.8 c
Aspergillus isolate 4	spores from plate culture	18.4 bc	28.4 bc
Penicillium isolate 23	spores from plate culture	15.9 c	20.1 c
Absidia spinosa	mycelium from macerated grain	15.3 c	23.0 c
Cunninghamella echinulata	mycelium from macerated grain	14.3 c	23.2 c
Trichoderma harzianum	spores from plate culture	13.3 c	19.6 c
Trichoderma isolate F5	mycelium from macerated grain	13.2 c	19.1 c
.			
Standard Error for Treatment Means		5.2	6.5

* Values within a column followed by the same letter are not significantly different according to the Waller Duncan k-ratio t test, P = 0.05.

#002
STUDY DATA BASE: 375-1221-8177
CROP: Mustard, *Brassica juncea* L. cv. Burgundy

PEST: White rust, *Albugo candida* race 2

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TITLE: FOLIAR APPLICATION OF MICROBIAL INOCULANTS FOR THE SUPPRESSION OF WHITE RUST OF MUSTARD, 1993

MATERIALS: Microbial inoculants (Strain Ral-3 of *Pseudomonas cepacia,* Strains U-14, 63-49, and G1-3 of *P. fluorescens)*; Ridomil (metalaxyl 30% ai)

METHODS: A field trial was conducted at the Agriculture Canada research farm near Saskatoon during 1993 field season to test the efficacy of four microbial inoculants to suppress white rust. The trial consisted of seven treatments replicated four times in a RCB design. The microbial cultures were prepared by growing on potato agar fructose (PAF) medium for 48 h at 30°C, then harvesting, centrifuging and suspending in sterile distilled water. The concentration of each culture was adjusted to 10^8 cells/ml. The plots of mustard were misted immediately before application of the cultures. At growth stage 3.0 (26 days old) of the plants, each of the four microbial inoculants were sprayed, using a R&D plot sprayer at 40 psi and 400 ml/2.5 m^2 plot. Ridomil at 300 g ai/ha was applied in the same manner. After 24 h, all these plots plus the inoculated control were sprayed with a germinating zoosporangia (8.5 x 10^4 zoospores/ml) of *A. candida* at 40 psi and 350 ml/2.5 m^2 plot. One set of plots (uninoculated control) was not inoculated with microbial inoculant or zoospores in order to determine the level of natural infection. Low temperature and high humidity during next two days favoured the disease development. Disease ratings were done three weeks after inoculating plants with white rust using the following system: 1- no apparent infection, 2- white rust pustules on 25% of the leaf surface, 3- pustules on 50% of the leaf surface, 4- pustules on 75% of the leaf surface, and 5- pustules on 100% of the leaf surface. Fifty leaves/replicate (five leaves/plant) were rated for disease severity. Data was analysed using analysis of variance (ANOVA). Treatment means were compared by calculatiing LSD at P=0.05 level of significance.

RESULTS: See table.

CONCLUSIONS: Among the four bacteria tested, only *P. cepacia* (Ral-3) provided significant suppression of white rust severity in all the five leaves, compared to non-bacterized infested control. Ridomil also provided significant control of the disease.

Table 1. Relative efficacy of microbial inoculants for suppression of white rust on the leaves of mustard cv. Burgundy in a field trial.

Treatments	% disease severity on mustard leaves*				
	Leaf 1	Leaf 2	Leaf 3	Leaf 4	Leaf 5
Uninoculated Control	24 cd*	23 bc**	21ab**	12 b**	6bc**
Inoculated Control	58 a	47 a	34 a	26 a	18 a
Ridomil	9 b	6 d	4 c	2 c	1 c
U-14	46 a	38 a	28 ab	20 ab	15 ab
G1-3	38 bc	38 ab	31 ab	19 ab	11 ab
63-49	27 cd	27 ab	27 ab	13 b	7 bc
Ral-3	24 d	18 cd	18 b	10 bc	6 bc

* Mean of four replicates per ten plants.
** Values followed by the same letter are not significantly different according to the L.S.D. test P=0.05.

#003

ICAR: 93000469

CROP: Corn, processing

PEST: European corn borer, *Ostrinia nubilalis* Hübner

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TITLE: **PEST MANAGEMENT OF EUROPEAN CORN BORER IN PROCESSING CORN: ASSESSING RISK OF LARVAL DAMAGE USING PHEROMONE TRAP DATA**

MATERIALS: The pheromone, ((Z)-11-tetradecenyl acetate + (E)-11-tetradecenyl acetate, 97:3) for European corn borer was prepared at the Lethbridge Research Station and impregnated on rubber septa. Pheromone traps were the delta type (Pherocon III, orange, purchased from Trece Inc., Salinas California).

METHODS: Two traps, mounted on stakes at about 1.5 m above ground level and about 100 m apart, were placed on the west edge of corn fields on June 07, 1993. Traps and lures were replaced weekly. Numbers of European corn borer moths caught in traps were recorded weekly and a weekly summary of catch data was sent out to growers along with appropriate management information. Eight ha plots (untreated) were established in selected fields for sampling unsprayed larval populations; one plot was set up per field and comparisons made with the remainder of the field to determine efficacy. Larval sampling was conducted in thirteen fields from the middle to the end of August. Ten random samples of 20 plants each were used to determine larval infestation and damage rates. Pheromone monitoring continued until August 24.

RESULTS: Forty-three fields (including 33 processing corn fields) were monitored in the Taber area. Dates for the first moth capture in the various fields extended from the week of June 07-14 through to July 05-12. Mean first capture date was June 27. Season cumulative totals for the two traps per field ranged from 2 to 179 (mean 47.5 ± 39.5). Weekly total moth captures for the area peaked during the week of August 02-09, the same period as 1992, however, the total moth capture for the year was about half that of 1992. Larval head capsule width distribution was strongly skewed to smaller sizes-for-sampling-date this year. Stepwise regression analysis of the 11 weeks of trap data showed a positive relationship ($R^2 = 0.84$) between log-transformed data for percent plants infested and weekly moth captures.

CONCLUSIONS: In 1993, both European corn borer and corn populations were delayed substantially by a wet, cool growing season. Throughout the season, corn growth was behind normal development by about two weeks. Although some corn borer phenological events, such as the appearance of moths, were comparable to last year, by mid August heat accumulation was more than 200 degree-days behind 1992 and infestation levels were also considerably lower. Growers have become involved in the management program and recognize the value of pheromone monitoring as a management tool; as a result, few fields were sprayed for corn borer this year.

Previous studies of European corn borer control in Alberta processing corn have shown that insecticides can be successfully applied in late July. This model suggests that weekly data of moths caught in pheromone traps can be used to assess the risk of larval damage prior to making properly timed insecticide applications.

Table 1. Anova for stepwise regression of log-transformed percent infested plants vs weekly pheromone trap data.

Source	DF	Sum of Squares	Mean Square	F	Prob>F
Regression	4	5.86380758	1.46595189	7.72	0.0151
Error	6	1.13902473	0.18983746		
Total	10	7.00283231			

Trap catch data from four weeks were admitted in the analysis at the 0.15 probability level. Pheromone trap data for the week ending July 20 accounted for 54% of the variation (P=0.01).

Table 2. Parameter estimates for the regression model.

Variable Week Ending	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob>|T|
INTERCEPT	1	0.30435	0.36991	0.823	0.4421
July 20	1	0.11943	0.03565	3.350	0.0154
Aug 03	1	-0.05684	0.02288	-2.484	0.0475
Aug 10	1	0.02871	0.01456	1.971	0.0962
Aug 17	1	-0.03887	0.02155	-1.804	0.1214

INSECTS OF FRUIT CROPS / INSECTES DES FRUITS

Section Editors / Réviseurs de section : C. Vincent and G. Judd

#004 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv McIntosh

PEST: Apple brown bug, *Atractotomus mali* (Meyer)

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TITLE: EFFICACY OF FIVE MALATHION RATES FOR SUPPRESSION OF APPLE BROWN BUG, 1993

MATERIALS: MALATHION 25WP (malathion).

METHODS: The trials were conducted in an experimental apple orchard cv McIntosh at the Agriculture Canada research station Kentville, N.S. Trees were spaced 6 m apart in the rows and 7 m between rows. Individual trees four to each treatment were randomly selected and a completely randomized design used to assign treatments. The experiment was conducted June 10th when apple brown bug overwintering eggs had begun to hatch as determined by limb-tap jarring of nymph on a 0.5 x 0.5 m white tray. Treatments were applied at a rate of 3300 L water/ha. MALATHION 25 WP was tested at five application rates (Table 1). Mortality counts were taken at 48h post treatment by limb-tap samples, four per treatment. Data were transformed square root (n+ 1) prior to analysis of variance (ANOVA) and separation of the means by Tukey's pairwise comparison.

RESULTS: MALATHION 25 WP at all the tested rates gave near 100% control within 48h of application (Table 1).

CONCLUSIONS: Current label rate for MALATHION 25 WP is 875 g ai/ha, but for purposes of resistance management lower rates would be just as effective.

Table 1. Efficacy of five MALATHION 25WP rates in suppressing apple brown bug populations Kentville, N.S. in 1993. Mean number of live brown bug per limb tap.*

Treatment rate g ai/ha	Pre treatment	Post treatment
check (water only)	4.8a	3.8a
MALATHION		
875.0	3.3a	0.0b
500.0	3.7a	0.0b
250.0	4.3a	0.3b
125.0	4.7a	0.0b
62.5	4.0a	0.0b

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

^

#005

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. McIntosh

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

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TITLE: EVALUATION OF ISOMATE C FOR MATING DISRUPTION OF CODLING MOTH IN NOVA SCOTIA ORCHARDS

MATERIALS: ISOMATE C (E, E-8, 10-Dodecadien-1-ol, 1-Dodecanol, 1-Tetradecanol), IMIDAN 50 WP (phosmet)

METHODS: The test site was a 3 ha block of ten year old apple, cv. McIntosh. At the 'full bloom' one half the orchard was treated with ISOMATE C twist tie dispensers at a rate of 1000 units/ha, the other half received 500 dispensers per ha; dispensers were manually tied in the upper tree canopy. An adjacent orchard block 0.5 ha (same age, cultivar and management system) had one half treated with 2100 g ai/ha IMIDAN while the other received no pesticide. In both test sites crop damage from codling moth was 1-2% at harvest in the previous year (1992). IMIDAN was sprayed at a rate of 3300 L water/ha using a truck mounted sprayer maintaining a tank pressure of

2800 kPa. On September 1st fruit injury in all plots was assessed by randomly picking 50 fruit from each of 100 trees. Percent damaged fruit was transformed to arcsin prior to analysis of variance and separation of the means by Tukey's pairwise comparison.

RESULTS: Both rates of ISOMATE C gave fruit protection equivalent to IMIDAN. All three controls were superior to the unsprayed check orchard.

CONCLUSIONS: Successful mating disruption of the codling moth was achieved using full registered rate and 50% (500) of the recommended rate of dispensers per ha. This latter approach would enhance the economic feasibility of this alternative to conventional pesticides.

Table 1. Comparison of apples protected for codling moth damage by mating disruption and conventional organophosphorus insecticide.*

Treatment	Rate/ha	Percent fruit damaged
Unsprayed check	-	4.2a
IMIDAN 50 WP	2100 g ai	1.8b
ISOMATE C	1000 dispensers	0.9b
ISOMATE C	500 dispensers	1.1b

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

#006
CROP: Apple, cv. Red Delicious

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

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TITLE: EVALUATION OF BAS 300 11I FOR MITE CONTROL IN APPLE

MATERIALS: BAS 300 11I (75% WP), OMITE 30 WP (propargite 30%)

METHODS: An eighteen year old orchard in St. George, Ontario was used as the trial site. Treatments (Table 1) were assigned to single tree plots, replicated four times and arranged according to a randomized complete block design. Application was made on August 6 when mite populations reached approximately seven active mites per leaf. European red mite was present in all growth stages at application. Application was dilute, using a hand gun sprayer delivering 3000 L/ha. Spray pressure was 2760 kPa (400 psi) at the source. The grower maintained the crop using standard agronomic practices for control of apple scab, insect pests, etc. Visual phytotoxicity ratings were conducted at 3, 7 and 13 days after treatment (DAT). Efficacy ratings were conducted at the same interval and consisted of counts made with a microscope and hand lens on 25 whole leaves per tree. Data were analyzed using an analysis of variance and Duncan's multiple range test at the 5% significance level.

RESULTS: Efficacy data is presented in Table 2 and Table 3. There was no visual phytotoxicity to trees in any of the treatments tested.

CONCLUSIONS: All treatments significantly reduced the number of adult and nymph mites per leaf at 3, 7 and 13 DAT. The only treatment to significantly reduce the number of eggs per leaf at 13 DAT compared to the untreated control, was OMITE. Treatments 2, 4 and 5 had significantly fewer eggs at 7 DAT. No treatments significantly reduced the number of eggs at 3 DAT. Mite numbers were low all season, peaking at approximately seven mites per leaf in the first week of August. Population numbers diminished towards the end of August to between one and two active mites per leaf.

Table 1. Treatment list and timing of application for control of European red mites in apples.

Treatment	Rate (kg ai/375 L water)	Timing
1. Untreated control	-----	---
2. BAS 300 11I 75 WP	0.023	7-10 mites/leaf
3. BAS 300 11I 75 WP	0.045	7-10 mites/leaf
4. BAS 300 11I 75 WP	0.069	7-10 mites/leaf
5. OMITE 30 WP	0.272	7-10 mites/leaf

Table 2. Response of European red mites to chemical treatments three and seven days after treatment (DAT), 1993.

		Mean Number of Mites/Eggs per Leaf					
	Rate	3 DAT			7 DAT		
Trt	prod/100L water)	Adult	Nymph	Egg	Adult	Nymph	Egg
1	---	3.92 a*	1.54 a	1.35 a	1.29 a	0.77 a	2.16 a
2	0.023	0.03 b	0.06 b	0.98 a	0.04 b	0.04 b	1.66 b
3	0.045	0.04 b	0.05 b	1.04 a	0.00 b	0.02 b	1.76 ab
4	0.068	0.22 b	0.13 b	1.14 a	0.00 b	0.00 b	1.48 b
5	0.272	0.08 b	0.14 b	1.02 a	0.00 b	0.03 b	1.61 b

* Means followed by the same letter not significant (P=0.05, Duncan's MRT)

Table 3. Response of European red mites to chemical treatments 13 days after treatment (DAT), 1993.

Treatment	Rate (prod/100 L water)	Mean Number of Mites/Eggs per Leaf 13 DAT Adult	Nymph	Egg
1	---	0.92 a*	0.69 a	2.31 a
2	0.023	0.00 b	0.00 b	1.91 ab
3	0.045	0.00 b	0.00 b	2.09 ab
4	0.068	0.01 b	0.00 b	1.90 ab
5	0.272	0.00 b	0.00 b	1.48 b

* Means followed by the same letter not significant (P=0.05, Duncan's MRT)

#007

CROP: Apple, cv. Red Delicious

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

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TITLE: FLUAZINAM FOR CONTROL OF EUROPEAN RED MITE IN APPLES, 1993

MATERIALS: fluazinam (500 g/L SC), OMITE 30 WP (propargite 30%)

METHODS: An eighteen year old orchard in St. George, Ontario was used as the trial site. Treatments (Table 1) were assigned to single tree plots, replicated four times and arranged according to a randomized complete block design. Application was made on August 6 when mite populations reached approximately seven active mites per leaf. Application was dilute, using a hand gun sprayer delivering 3000 L/ha. Sprayer pressure was 2760 kPa (400 psi) at the source. Apples were maintained through the season with a NOVA/DITHANE apple scab control program and IMIDAN for general insect control. Visual phytotoxicity ratings were conducted at 3, 7 and 13 days after treatment (DAT). Efficacy ratings were conducted at the same interval and consisted of counts made with a microscope and hand lens on 25 whole leaves per tree. Data were analyzed using an analysis of variance and Duncan's multiple range test at the 5% significance level.

RESULTS: Efficacy data is presented in Table 2 and Table 3. There was no visual phytotoxicity to trees in any of the treatments tested.

CONCLUSIONS: All treatments provided significantly greater control of adult and nymph mites compared to untreated check plots after 3, 7 and 13 days. There was no significant difference between treatments. Mite numbers were low all season, peaking at approximately seven mites per leaf in the first week of August and then diminishing towards the end of August.

Table 1. Treatment list and timing of application.

Treatment	Rate (prod/100 L water)	Timing
1. Untreated control	----	---
2. fluazinam 500 SC	0.10 L	7-10 adults/leaf
3. fluazinam 500 SC	0.075 L	7-10 adults/leaf
4. fluazinam 500 SC	0.050 L	7-10 adults/leaf
5. OMITE 30 WP	2.15 kg ai/ha	7-10 adults/leaf

Table 2. Response of mites to various chemical treatments three and seven days after treatment (DAT).

		Mean Number of Mites/Eggs per Leaf					
		3 DAT			7 DAT		
Treatment	Rate prod/100 L)	Adult	Nymph	Egg	Adult	Nymph	Egg
1	---	3.81 a*	1.50 a	2.19 a	1.29 a	0.77 a	2.16 a
2	0.10 L	0.64 b	0.20 b	1.92 ab	0.03 b	0.11 b	1.53 b
3	0.075 L	0.49 b	0.28 b	2.08 ab	0.10 b	0.17 b	1.85 ab
4	0.050 L	0.41 b	0.23 b	1.72 b	0.06 b	0.10 b	1.47 b
5	2.15 kg ai/ha	0.08 b	0.14 b	1.84 ab	0.00 b	0.03 b	1.61 b

* Means followed by the same letter not significantly different (P=0.05, Duncan's MRT)

Table 3. Response of mites to various chemical treatments 13 days after treatment (DAT).

Treatment	Rate (prod/100 L)	Mean Number of Mites/Eggs per Leaf 13 DAT Adult	Nymph	Egg
1	---	0.92 a*	0.69 a	2.31 a
2	0.10 L	0.00 b	0.03 b	1.56 b
3	0.075 L	0.00 b	0.03 b	1.65 b
4	0.050 L	0.00 b	0.00 b	1.20 b
5	2.15 kg ai/ha	0.00 b	0.00 b	1.48 b

* Means followed by the same letter not significantly different (P-0.05, Duncan's MRT).

#008

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv. McIntosh

PEST: European red mite, *Panonchus ulmi*

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TITLE: EVALUATION OF APOLLO SC FOR EFFICACY AGAINST EUROPEAN RED MITE

MATERIALS: APOLLO 500 SC (clofentezine), SUPERIOR 70 SEC OIL

METHODS: The test site was a 5 ha commercial block of 35 yr old apple, cv. Cortland. At the 'tight cluster' stage of development (May 19th) six trees were sprayed with one of the of the following (rates are product per ha): APOLLO 500 SC 200, 300 or 400 mL or SUPERIOR OIL at 65 litres. An adjacent portion of the growers orchard was treated with 600 mL APOLLO; and additional part received no miticide. Treatments were sprayed to run-off at a rate of 3300 L/ha using a truck mounted sprayer maintaining a tank pressure of 2800 kPa. On June 9, June 18th, July 11, July 29 and August 21 leaf cluster samples were randomly taken from each treatment, passed through a mite brushing machine and life stages counted under a dissecting microscope. In addition to red mite, apple rust mite and the predatory mite *Typhlodromus pyri* were tallied.

RESULTS: Tables 1 through 5 summarize the treatment programs and subsequent results.

CONCLUSIONS: The first detectable differences were from the 30 day post treatment, (Table 2) June 18th with all treatments adequately controlling both red mite motiles and eggs. All rates of APOLLO and even the SUPERIOR dilute oil suppressed red mite populations till the latter part of July, a span of over 70 days. Only by mid August (Table 5) did red mite resurge to levels that equalled the unsprayed control trees. There as no effect on apple rust mite nor predatory mites with the exception of the commercial grower's block where an additional late season miticide was applied. Poor spray coverage by the grower in his APOLLO application is attributed to control failure in red mite suppression (Tables 3,4 and 5).

Table 1. Spray program and summary of results comparing European red mite populations treated on May 19th and sampled June 9th. Mite numbers mean (SE) are per fruit leaf cluster.

Treatment rate product/ha	red mite eggs	red mite mobiles	rust mite	Typhlodromus
APOLLO 200 ml	1.0 (1.0)a	1.0 (0)a	0a	0.5 (0.5)a
APOLLO 300 ml	0a	1.5 (1.5)a	3.0 (1.0)a	0a
APOLLO 400 ml	0a	1.0 (1.0)a	0a	0a
SUPERIOR OIL 65 litres	0a	0.5 (0.5)a	0a	0a

Table 2. Spray program and summary of results comparing European red mite populations treated on May 19th and sampled June 18th. Mite numbers, mean (SE) are per fruit leaf cluster.

Treatment rate product/ha	red mite eggs	red mite mobiles	rust mite	Typhlodromus
APOLLO				
200 ml	0a	0a	1.0 (1.0)a	0.5 (0.5)a
300 ml	2.5 (1.5)a	0a	2.0 (1.0)a	0a
400 ml	1.0 (1.0)a	0a	2.5 (1.5)a	0a
SUPERIOR OIL 65 litres	0.5 (0.5)a	0a	0a	0a
unsprayed check	72.0 (28.0)b	2.5 (0.5)b	1.5 (0.5)a	0a

Table 3. Spray program and summary of results comparing European red mite populations treated on May 19th and sampled July 11th. Mite numbers mean (SE) are per fruit leaf cluster.

Treatment rate product/ha	red mite eggs	red mite mobiles	rust mite	Typhlodromus
APOLLO				
200 ml	0a	0a	7.5 (7.0)a	0a
300 ml	0a	0a	14.0 (5.5)a	0a
400 ml	0a	0a	11.0 (8.0)a	0a
SUPERIOR OIL				
65 litres	0a	0a	0.5 (0.5)a	0a
unsprayed check	7.5 (4.5)b	12.5 (3.0)b	7.5 (4.5)a	0a
grower APOLLO				
600 ml	6.0 (2.0)b	26.0 (2.0)b	0.5 (0.5)a	0a

Table 4. Spray program and summary of results comparing European red mite populations treated on May 19th and sampled July 29th. Mite numbers, mean (SE) are per fruit leaf cluster.

Treatment rate product/ha	red mite eggs	red mite mobiles	rust mite	Typhlodromus
APOLLO				
200 ml	5.5 (5.0)a	0.5 (0.1)a	19.0 (7.0)a	0a
300 ml	5.0 (1.0)a	1.0 (0.4)a	134.0 (115.5)a	0a
400 ml	6.0 (2.0)a	1.0 (0.1)a	96.0 (44.5)a	0.5(0.1)a
SUPERIOR OIL				
65 litres	4.5 (0.5)a	0a	16.0 (8.0)a	0a
unsprayed check	25.0 (1.0)a	23.0 (18.5)a	80.5 (52.5)a	0.5(0.1)a
grower APOLLO				
600 ml	77.5 (0.5)b	16.5 (3.5)a	17.5 (3.0)a	0a

Table 5. Spray program and summary of results comparing European red mite populations treated on May 19th and sampled August 21st. Mite numbers, mean (SE) are per fruit leaf cluster.

Treatment rate product/ha	red mite eggs	red mite mobiles	rust mite	Typhlodromus
APOLLO 200 ml	1.0 (0)a	0a	115.5 (27.5)a	10.5 (1.5)a
300 ml	9.0 (1.0)a	3.5 (0.5)a	194.5 (100.5)a	3.5 (0.5)c
400 ml	4.5 (2.5)a	1.5 (1.0)a	114.0 (34.5)a	5.5(1.1)abc
SUPERIOR OIL 65 litres	4.0 (1.0)a	1.5 (1.0)a	103.0 (46.0)a	4.0 (0.1)bc
unsprayed check	16.0 (8.0)a	5.0 (2.0)b	128.0 (27.0)a	6.0 (0.1)ab
grower APOLLO 600 ml	12.5 (5.5)a	3.5 (0.5)b	40.0 (31.0)a	1.5 (0.5)c

#009

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv McIntosh

PEST: Green apple aphid, *Aphis pomi* (DeGeer)

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TITLE: EFFICACY OF TWO PESTICIDES FOR SUPPRESSION OF GREEN APPLE APHID, 1993

MATERIALS: BAY NTN 33893 240FS (unknown), PIRIMOR 50 WP (pirimicarb).

METHODS: The trials were conducted in an experimental apple orchard cv Cortland at the Agriculture Canada research station Kentville, N.S. Trees were spaced 4 m apart in the rows and 5 m between rows. Individual trees for each treatment were randomly selected and a completely randomized design used to assign treatments. The experiment began July 10th when colonies of green apple aphid were established on water sprouts within the tree canopy. Treatments were applied at a rate of 3300 L water/ha using a truck-mounted sprayer maintaining a tank pressure of 2800 kPa. Two control products and an untreated control were compared for efficacy against the aphid (Table 1). Post treatment mortality counts were taken at 24h, 48h and 96h intervals by randomly examining ten aphids from each of four sprouts for each treatment. Data were transformed square root (n+ 1) prior to analysis of variance (ANOVA) and separation of the means by Tukey's pairwise comparison.

RESULTS: PIRIMOR gave the most rapid rate of kill with nearly 100% control within 24h of application (Table 1) but by the 96h interval both products had achieved the same level of aphid suppression.

CONCLUSIONS: Both insecticides were effective in eliminating green apple aphid and BAY NTN representing a new class of product will be most useful in resistance management within orchard Integrated Pest Management.

Table 1. Efficacy of two pesticides in suppressing green apple aphid populations Kentville, N.S. in 1993. Mean number of dead aphids from initial group of ten.*

Treatment/rate ai/ha	Post treatment sample interval 24h	48h	96h
check (water only)	0.5a	0.0c	0.0c
PIRIMOR 50 WP 500g	9.8b	10.0a	10.0a
BAY NTN 33893 240 FS 90g	1.0b	4.3b	9.8a

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

#010

ICAR: 91000658

CROP: Apple, cv. McIntosh

PEST: Spotted Tentiform Leafminer, *Phyllonorycter blancardella* (F.); European Red Mite (ERM), *Panonychus ulmi* (Koch); Tarnished Plant Bug (TPB), *Lygus lineolaris* (P. de B.)

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TITLE: EVALUATION OF AC 303,630 AND ADMIRE (NTN 33893) FOR CONTROL OF EARLY SEASON INSECT PESTS IN APPLES, 1993

MATERIALS: AC 303,630 - 240g/L SC, ADMIRE - 240g/L F (NTN 33893), DECIS - 25g/L EC (deltamethrin), MORESTAN - 25 WP (chinomethionat), APOLLO - 50g/L SC (clofentezine), GUTHION - 50 WP (azinphos-metyl)

METHODS: Trial was established in a twelve year old plantation of McIntosh trees on M-26 rootstock, spaced 1.83 m X 3.66 m, using a R.C.B. design with five-tree plots and four replicates. Applications were made with a diaphram pump/handgun system, operating at 1380 kPa, and were made on a spray to run-off basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis. TREATMENT DATES: On May 10(A), with the trees at the full pink stage, the 1st applications were made on treatments 1-4 and 6. DECIS, MORESTAN, and APOLLO were applied in treatment 6, the commercial standard. On May 28(B), with the trees at calyx, applications were made on treatments 1, 2, 4, 5 and 6. GUTHION was applied in treatment 6. On June 8(C), with the apples at 8-10 mm in diameter, applications were made on treatments 1, 2, 5 and 6. GUTHION was applied in treatment 6. On July 7(D), a final scheduled application was applied to treatment 3. ASSESSMENTS: The leaves on 160 clusters per plot were all examined on July 30 for TLM mines; the number of spurs with mines present are reported. A harvest of 175 apples per plot was made on 21/09 for assessment; the percentage of apples that displayed TPB injury are reported. At each of the ERM assessment dates presented, 15 leaves/plot were examined for motile forms and eggs using a binocular microscope.

RESULTS: As presented in the table.

CONCLUSIONS: As compared to the control, all treatments significantly reduced the numbers of TLM mines present. ADMIRE treatments that received a calyx application gave the best TLM control; all treatments containing this product gave results that were statistically comparable to those of the commercial standard. AC 303,630, at the higher rate, did not differ statistically from the trial's commercial standard treatment, but the higher level of mines in the 75g treatment was significantly different from all treatments but the 100g treatment. The TPB injury levels in the untreated control were representative of those found commercially in this region. None of the treatment programmes used, including the commercial standard, resulted in any significant reduction of the TPB damage. The ADMIRE treatments containing a pre-bloom application had the lowest level of injury. The ERM counts performed in the 10-14 day period following each of the first three applications, did not reveal any of the treatments to have any significant impact on the population levels. The weather in this period was cooler and wetter than usual, and was not favourable to mite development. As the ERM population developed through late June and into July, only the commercial standard treatment demonstrated any significant levels of control.

Treatment	Rate g ai/ha	Timing	TLM MINES /160 SPURS	TPB %INJ. FRUIT	ERM 23/05 MOTILES	EGGS
1.AC 303,630***	75	ABC	7.7b*	11.2a**	0.5c	0.1a
2.AC 303,630***	100	ABC	6.0bc	10.1a	2.0a	0.0a
3.ADMIRE	90	AD	2.0cd	7.0a	0.7bc	0.0a
4.ADMIRE	90	AB	0.2d	7.4a	0.5c	0.0a
5.ADMIRE	90	BC	0.6d	10.0a	N/A	N/A
6.DECIS/APOLLO/ MORESTAN; GUTHION		A/A/ A BC	2.7cd	8.6a	0.2c	0.0a
7.CONTROL	-	-	26.8a	11.6a	1.9ab	0.0a

* Means in same column, followed by same letter are not significantly different (P<.05,DMRT), data square root transformed before DMRT(detransformed data shown).

** Means in same column, followed by same letter are not significantly different (P<.05,DMRT), data arcsin square root transformed before DMRT(detransformed data shown).

*** Tween 20 was used for application timings B&C at 0.1% v/v.

Treatment	Rate g ai/ha	Timing	ERM 08/06 MOTILES	EGGS	ERM 23/06 MOTILES	EGGS	ERM 01/07 MOTILES	EGGS	ERM21/07 MOTILES	EGGS
1.AC 303,630*	75	ABC	0.3a	1.6a	0.9a	0.0	0.8b	3.2ab	8.4ab	25.6bc
2.AC 303,630*	100	ABC	0.2a	1.7a	0.7ab	0.0	0.9b	1.8bc	7.3bc	17.3cd
3.ADMIRE	90	AD	0.1a	1.2ab	0.6ab	0.0	1.2ab	4.2ab	10.7ab	26.0bc
4.ADMIRE	90	AB	0.1a	1.0ab	0.9a	0.0	1.4ab	3.8ab	12.5ab	37.3ab
5.ADMIRE	90	BC	0.2a	1.2ab	1.1a	0.1	1.9a	5.1a	14.7a	45.5a
6.DECIS/ APOLLO/ MORESTAN; GUTHION	12.5 225 563 1125	A/ A/ A; BC	0.1a	0.2b	0.1b	0.0	0.0c	0.0c	1.3c	2.5d
7.CONTROL	-	-	0.1a	1.5a	1.1a	0.1	1.5ab	3.1ab	10.6ab	28.0abc

* Tween 20 was used for application timings B&C at 0.1% v/v.

#011

STUDY DATA BASE: 306-1261-9019

CROP: Apple, cv. Red Delicious

PEST: Tarnished plant bug, *Lygus lineolaris* L.

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TITLE: EFFICACY OF TWO INSECTICIDES AGAINST TARNISHED PLANT BUG ON APPLE, 1993

MATERIALS: ADMIRE 240 FS (Imidacloprid), RIPCORD 400 EC (cypermethrin).

METHODS: Apple shoots were obtained from an experimental apple orchard at the Agriculture Canada Research Station, Kentville, N.S. Treatments replicated four times were applied on August 9, 1993 by immersing two shoots from Red Delicious apple trees in the respective solution (5 L, with concentrations based on a spray application of 3300 L water/ha) and allowing the shoots to air dry. Field collected adult tarnished plant bugs TPB (eight per cage) were placed in saran screened insect cages (70 cm by 48 cm by 48 cm) containing the treated apple bearing shoots. Following treatment, mortality was recorded at 24 hour intervals for four days. The least significant difference test used for means separation following t test analysis of the combined data.

RESULTS: Mean % mortality and standard error of the mean, SEM, predicted from analysis of the combined data are presented in the table.

CONCLUSIONS: Cypermethrin increased TPB mortality. Imidacloprid (90 g ai/ha) did not significantly increase TPB mortality above control levels.

Table 1. Mean percent mortality of tarnished plant bug caged with treated apple bearing shoots, Kentville, N.S. in 1993.*

Treatment	Rate (ml/ha)	Rate (g ai/ha)	% mortality (SEM) 24 hour	48 hour	72 hour	96 hour
Control	-	-	12.5a	28.8a	43.8a	56.3a
				(8.75)	(6.25)	(11.25)
(11.25)						
ADMIRE 240 FS	375	90	18.8a	31.3a	43.8a	53.8a
				(3.75)	(8.75)	(23.75)
(12.50)						
RIPCORD 400EC	125	30	50.0b	62.5b	75.0b	78.8a
				(8.75)	(8.75)	(5.00)
(6.25)						

* Means within a column sharing a common letter are not significantly different P=0.1, according to the least significance difference test.

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#012

STUDY DATA BASE: 352-1461-8501

CROP: Apple, Currant, Hops, Raspberry, Strawberry

PEST: Two spotted spider mite (TSSM) *Tetranychus urticae*, European red mite (ERM) *Panonychus ulmi* (Garman), Apple rust mite *Aculus schlechtendali*

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TITLE: COMPATIBILITY OF PESTICIDES TO AN INSECTICIDE-RESISTANT STRAIN OF THE PREDATORY MITE *AMBLYSEIUS FALLACIS*, 1993

MATERIALS: KELTHANE AP 35 (dicofol), OMITE 30 W (propargite), CARZOL 92 SP (formetanate HCL), CYMBUSH 250 EC (cypermethrin), DECIS 2.5 EC (deltamethrin), GUTHION 50 W (azinphos-methyl), DIAZINON 50 W (diazinon), IMIDAN 50 W (phosmet), CYGON 480 E (dimethoate), SEVIN 50 W (sevin), LANNATE L 24 (methomyl), THIODAN 4 EC (endosulfan).

METHODS: A sequential assay was developed to rapidly classify the compatibility of selected insecticides and acaricides employed on berry and fruit crops in B.C. and Ontario, for a pesticide-resistant strain of *A. fallacis* which is commercially available. This strain is resistant to many organophosphorous insecticides and has been pressured and selected with AMBUSH (permethrin) in the laboratory to improve pyrethroid resistance discovered in a field population.
The assessment involved two modes of testing. The initial step required brushing untreated *Tetranychus urticae* (all stages) onto a

section of apple leaf (3x4 cm; lower leaf surface up) set on a piece of moistened cotton contained in a Petri dish. Using a binocular microscope, 5 adult gravid females were transferred to each leaf, for a total of 100-120 per product. The recommended field rates of the pesticides were converted to dilute spray rates. Five ml of the dilute material was applied through a Potter spray tower (topically to each unit). Controls (n=40 females) were treated with distilled water. The mites were held after treatment in an environmentally controlled room at 24°C, 60±10% RH, with a light/dark photoperiod of 16/8h for up to 96 hours. Unsprayed *T. urticae* were added after treatment as required.

Observations were made at post-treatment intervals of 24±1hr and 96±1hr, but ceased after 24 hr. and 72 hr. when mortality was $99%, with the exception of Guthion and Diazinon. Mortality was measured as the sum of percent dead on leaf and percent repellency. Repellency was measured as the sum of percent in water and percent missing, (under leaf, etc.). Grand means for the control mortality and repellency were calculated and Abbott's formula was used to correct treatment mortality and repellency. Data were also collected on the number of eggs present, percent egg hatch, percent larval mortality and percent larval repellency, which are not reported.

Using values suggested by the International Organization for Biological Control, test materials were categorised as harmless if adult mortality was #30% and harmful if mortality $99% and repellency <40%. If mortality by the Potter spray tower method was >30% and <99% or $99% with repellency $40%, we employed a second test, i.e. the FAO slide dip method. This test would estimate mortality without the effects of repellency, displayed by pyrethroids and other products. Gravid females (n=120, 10 mites/slide) were treated topically with pesticides at recommended field rates and held as above for a 24 hr. post-treatment period. Treatment mortalities were adjusted by applying Abbott's formula using the grand mean for the controls. After completing the second step, mortality by the slide dip method was reviewed and final classification occurred: harmless if mortality #30%, moderately harmful if mortality >30% and <95%, and harmful if mortality $95%.

RESULTS: As presented in table.

CONCLUSIONS: The pyrethroid DECIS and the three organophosphorous insecticides GUTHION, DIAZINON, and IMIDAN are rated as harmless according to our method of classification. The tolerance to the OP's was demonstrated when this strain of *A. fallacis* was released into Ontario apple orchards and survived sprays of IMIDAN and GUTHION, and when it was released into British Columbia hops fields and survived three applications of DIAZINON. OMITE, CYMBUSH, CYGON, SEVIN, and THIODAN were classified as moderately harmful. KELTHANE, CARZOL, and LANNATE were harmful.

Both pyrethroids tested, CYMBUSH and DECIS, were repellent in the leaf assay, which incorporated topical and residual effects, and required slide dip assays to estimate toxicity by topical application. SEVIN and THIODAN were also repellent.

The compatibility classifications are based on the assessment of adult gravid females. DECIS was reclassified from harmless to moderately harmful based on our discretion due to a significant decrease in egg production. The information presented in this report allows growers to select pesticides which would allow survival of populations of this strain of *A. fallacis*. Results obtained were related to the highest recommended field rates to simulate the worst case scenarios.

Table 1. Classification of the compatibility of pesticides to adult *A. fallacis* utilizing a sequential assay method.

Tradename	Field rate*	Field rate equiv.** (g ai/L)	Assay 1 - Potter spray tower: Hrs post-treat.	Corr.***,@ % mort.	Corr.*** % repell.	Assay 2 slide dip: Corr.*** % mort.	Compt. class
Acaricide							
KELTHANE	4.5kg/3000L	0.53	96	100.00	21.24	N.A.~	harmful
OMITE	5.5kg/1000L	1.65	96	50.57	38.96	N.A.	moderately harmful
CARZOL	1.1kg/3000L	0.34	24	99.10	14.35	N.A.	harmful
Pyrethroid							
CYMBUSH	280-400ml/1000L	0.10	72	98.99	48.92	37.48	moderately harmful
DECIS	500ml/3000L	0.004	96	85.43	66.0	21.59	moderately harmful
Organophosphate							
GUTHION	1.75kg/2000L	0.44	72	0	0	N.A.	harmless
DIAZINON	3.25kg/3000L	0.54	72	26.24	10.74	N.A.	harmless
IMIDAN	3.75kg/3000L	0.63	96	0	0	N.A.	harmless
CYGON	2.75L /2000L	0.66	96	84.31	28.90	N.A.	moderately harmful
Carbamate							
SEVIN	3.0-6.75kg/3000L	1.13	24	100.00	45.31	93.64	moderately harmful
LANNATE	6.75L/3000L	0.54	24	100.00	7.90	N.A.	harmful
Chlorinated hydrocarbon							
THIODAN	1.25L/1000L	0.60	96	100.00	91.25	43.84	moderately harmful

* Highest rate selected from Ontario and B.C. Production Guides for apple, raspberry, strawberry, currant and hops.
** Using values for highest field rate in 1,000-3,000L water, as recommended.
*** Treatment mortality corrected using grand mean and Abbott's formula. Grand mean check mortality 10.79%, n=460; repellency 8.58%, n=460; slide dip mortality 5.63%, n=160.
@ Mortality equals the sum of % dead on leaf plus % repellency.
~ N.A. - not applicable.

#013

STUDY DATA BASE: 353-1261-9007

CROP: Apple, cv McIntosh

PEST: Winter moth, *Operophtera brumata* (L.);
Green pug moth *Choroclystis rectangula* (L.)

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TITLE: EFFICACY OF TWO INTEGRATED PEST MANAGEMENT COMPATIBLE PESTICIDES FOR SUPPRESSION OF WINTER MOTH AND GREEN PUG MOTH ON APPLE, 1993

MATERIALS: RH5992 (unknown), DIPEL WP plus 10% RIPCORD 400 EC (cypermethrin).

METHODS: The trials were conducted in an experimental apple orchard cv McIntosh at the Agriculture Canada research station Kentville, N.S. Trees were spaced 6 m apart in the rows and 7 m between rows. Four individual trees for each treatment were randomly selected and a completely randomized design used to assign treatments. The experiment began May 16th when fruit spur clusters were at the flower bud separation stage. Treatments were applied at a rate of 3300 L water/ha using a truck-mounted sprayer maintaining a tank pressure of 2800 kPa. Two control products and an untreated control were compared for efficacy against neonate winter moth and green pug moth. Pre-treatment larvae counts were taken 1h prior to pesticide application and then at two, three, and seven days post treatment. One hundred fruit spur clusters per replicate were randomly picked and brought to the laboratory for microscopic examination of mortality counts. Direct damage to the fruit was assessed 60 days post-treatment. One hundred randomly picked fruit per replicate (400 per treatment) were examined for feeding injury. Data were transformed to square root (n + 1) prior to subjection to analysis of variance (ANOVA) and separation of the means by Tukey's pairwise comparison.

RESULTS: Pre-spray larval counts did not differ among treatment trees (Table 1 and 2) and an economically significant population was present for both winter moth and pug moth. Within 48 h of application the DIPEL/RIPCORD tank mix showed activity against the larvae, the RH5992 appear slower acting but by day seven equalled the effectiveness of DIPEL/RIPCORD. Fruit injury was minimized to 2.8 and 0.8%, respectively for DIPEL/RIPCORD and RH5992 compared to 22% for the untreated control.

CONCLUSIONS: Both insecticides were effective in controlling winter moth and green pug moth on apple and are useful alternative to convention broad spectrum organophosphorus insecticides as an enhancement of Integrated Pest Management in Nova Scotia orchards.

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Table 1. Efficacy of two pesticides against neonate winter moth larvae on apple, Kentville, N.S. in 1993.*

Days post treatment	Untreated control	DIPEL WP 560g (product) RIPCORD 3.6 ml (ai/ha)	RH5992 240F 240 g(ai/ha)
0	15.5a	12.0a	12.0a
2	17.3a	1.3b	7.5ab
3	12.5a	3.0b	4.0ab
7	9.5a	0.0b	1.8b

Table 2. Efficacy of two pesticides against neonate green pug moth larvae on apple, Kentville, N.S. in 1993.*

Days post treatment	Untreated control	DIPEL WP 560g (product) RIPCORD 3.6 ml (ai/ha)	RH5992 240F 240 g(ai/ha)
0	13.3a	12.5a	11.5a
2	17.3a	4.3b	9.5ab
3	9.5a	4.8b	5.5ab
7	11.0a	0.3c	5.5b

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

#014

ICAR: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* var. Smoky and Pembina

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

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TITLE: LORSBAN RATE TRIAL FOR CONTROL OF WOOLLY ELM APHID ON ESTABLISHED SASKATOONS

MATERIALS: LORSBAN 4E (clorphyrifos)

METHODS: The woolly elm aphid is a serious pest of the roots of saskatoon. In an attempt to control this pest, various rates of LORSBAN were tested on 'Pembina' and 'Smoky' varieties of saskatoon planted at Saskatoon, Saskatchewan. The trial was conducted on three year old plants spaced approximately one meter apart. The trial consisted of five treatments; single applications of LORSBAN at rates of 0.05 ml/L, 0.1 ml/L and 0.2 ml/L, LORSBAN applied at 0.1 ml/L on two dates and a water check. The five treatments were replicated 14 times for each variety, in a Randomized Complete Block design with single plant plots. All treatments were applied as a soil drench at a rate of 1 L of solution/plant. On July 9, the solutions were poured over the main stems of each plant, saturating the soil around the roots. The repeat application of the LORSBAN was applied on July 18. The 'Pembina' variety was evaluated on August 17 and 18, and the 'Smoky' variety was evaluated on August 28, by examining half the root system of each plant for aphid colonies. Evaluations were conducted by digging a 15 cm deep trench in a semicircle approximately 30 cm away from the main stems of each plant. The soil around the roots were then removed to expose aphid colonies. Aphid colonies were rated on a scale of 0-5 as follows: 0-no aphids present; 1-under 2 cm of aphid infested roots; 2-between 2 and 4 cm of aphid infested roots; 3-between 4 and 7 cm of aphid infested roots; 4-between 7 and 10 cm of aphid infested roots; 5-over 10 cm of aphid infested roots. A square root (x + 0.5) transformation was conducted before analysis of variance and means were separated by a Student-Newman-Keuls' test (alpha = 5%).

RESULTS: There were no significant differences between the LORSBAN treatments and the water check for the 'Smoky' variety (see table). On the 'Pembina' variety, only the LORSBAN treatment applied on two dates significantly reduced the aphid infestation rating when compared to the check. No phytotoxic damage was recorded on any of the saskatoon plants in the trial.

CONCLUSIONS: Infestation ratings were too low on 'Smoky' to evaluate the effectiveness of LORSBAN. On the 'Pembina' variety, only the repeat application of LORSBAN significantly reduced the aphid infestation rating when compared to the water check. This reduced rating in the LORSBAN treatment was still considered unacceptable. The difference in the infestation ratings for the two varieties suggest that varietal susceptibility should be further evaluated.

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Treatment	Rate (product/L)	Number of applications	Infestation rating* Pembina	Infestation rating* Smoky
LORSBAN 4E	0.05 ml	1	2.6ab	0.4a
LORSBAN 4E	0.10 ml	1	2.5ab	0.1a
LORSBAN 4E	0.20 ml	1	2.3ab	0.1a
LORSBAN 4E	0.10 ml	2	1.3b	0.0a
Water check	-	1	4.1a	0.4a

* Means within a column followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keuls' test.

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#015

ICAR: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* Nutt.;
Saskatoon, *Amelanchier alnifolia* var. Thiessen

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

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TITLE: LORSBAN RATE TRIAL FOR CONTROL OF WOOLLY ELM APHID ON NEWLY ESTABLISHED SASKATOONS

MATERIALS: LORSBAN 4E (clorphyrifos)

METHODS: The woolly elm aphid spends part of it's life cycle on the roots of saskatoon. Establishment of saskatoon plantings can be difficult due to damage by this aphid. Various rates of LORSBAN were tested as root drenches in saskatoon plantings at White City and Indian Head, Saskatchewan and Edmonton, Alberta. The plants at Indian Head and Edmonton were open pollinated seedlings, whereas at White City, Thiessen variety were used. First year seedlings spaced approximately one meter apart were used at all sites. The trials consisted of five treatments; single applications of LORSBAN at 0.05 ml/L, 0.10 ml/L and 0.20 ml/L, LORSBAN applied at 0.10 ml/L twice over a one week interval and a water check. The five treatments were replicated 14 times at White City, and 20 times at Indian Head and Edmonton, in a Randomized Complete Block design with single plant plots. All treatments were applied as a soil drench at a rate of 1 L of solution/seedling. Dikes of soil were formed around each seedling to allow the solution to saturate the soil around the roots. Treatments were applied during the first week in July while the repeat 0.10 ml/L application was applied approximately one week later. Peak flight period of the early summer generation of the woolly elm aphid occurred at Indian Head on July 2. On August 12, the trial at White City was evaluated by examining half the roots by digging a 15 cm deep trench in a semicircle approximately 30 cm away from each plant. The soil around the roots was then removed to expose aphid colonies. Aphid colonies were rated on a scale of 0-5 as follows: 0-no aphids present; 1-under 2 cm of aphid infested roots; 2-2 to 4 cm of aphid infested roots; 3-4 to 7 cm of aphid infested roots; 4-7 to 10 cm of aphid infested roots; 5-over 10 cm of aphid infested roots. The trials at Indian Head and Edmonton were evaluated during the last week of August. Each seedling was lifted with a 20 x 20 x 20 cm ball of soil. The soil around the roots was removed to expose the aphid colonies. Infestation levels were determined using the above mentioned rating system. A square root (x + 0.5) transformation was conducted prior to analysis of variance and means were separated by the Student-Newman-Keuls' test (alpha = 5%).

RESULTS: Infestation ratings were generally low at all three sites (see table). There was no significant difference in aphid infestation ratings between treatments and the water check at trials conducted at Indian Head and Edmonton. All LORSBAN treatments at White City had significantly lower infestation rates than the water check. No phytotoxic damage was noted for treatments tested.

CONCLUSIONS: LORSBAN provided a significant reduction in ratings of the woolly elm aphid at only one of three locations tested. LORSBAN failed to give complete control of the woolly elm aphid, even at the low infestation levels tested.

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Treatment	Rate (product/L)	Number of applica-tions	Infestation rating* Indian Head	White City	Edmonton
LORSBAN 4E	0.05 ml	1	0.4a	0.4b	0.0a
LORSBAN 4E	0.10 ml	1	0.1a	0.4b	0.0a
LORSBAN 4E	0.20 ml	1	0.2a	0.1b	0.0a
LORSBAN 4E	0.10 ml	2	0.0a	0.4b	0.3a
Water check	-	1	0.5a	1.6a	0.8a

* Means within a column followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keuls' test.

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#016

ICAR: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* Nutt.

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

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TITLE: LORSBAN TIMING TRIAL FOR CONTROL OF WOOLLY ELM APHID ON NEWLY ESTABLISHED SASKATOONS

MATERIALS: LORSBAN 4E (chlorpyrifos)

METHODS: The woolly elm aphid is a serious pest of the saskatoon roots. LORSBAN at 0.1 ml/L was applied as a soil drench on one of four weekly intervals from June 23 to July 14, 1993 at Indian Head, Saskatchewan. Open-pollinated seedlings were planted in a Randomized Complete Block design at a 1.0 m spacing. The four treatment application dates and a dry check were replicated 25 times using single plant plots. One litre of solution was applied on each plant. Dikes of soil were formed around each seedling to allow the solution to saturate the soil around the roots. Peak flight period of the summer generation of woolly elm aphid occurred July 2, 1993. On August 24 the root system of each seedling was lifted with a 20 x 20 x 20 cm ball of soil. The soil around the roots was then removed to expose aphid colonies. The aphid colonies were rated using a scale of 0-5 as follows: 0-no aphids present; 1-under 2 cm of aphid infested roots; 2-2 to 4 cm of aphid infested roots; 3-4 to 7 cm of aphid infested roots; 4-7 to 10 cm of aphid infested roots; 5-over 10 cm of aphid infested roots. A square root (x + 0.5) transformation was conducted before analysis of variance with means separated by a Student-Newman-Keuls' test (alpha = 5%).

RESULTS: Populations of the woolly elm aphid were low throughout the study (see table). Plants treated with LORSBAN on June 23, 30 and July 14 had a significantly lower aphid rating than the dry check. There was no difference in aphid ratings between the July 7 application and the dry check. No phytotoxic damage was recorded on any of the Saskatoon plants.

CONCLUSIONS: LORSBAN reduced the population of the woolly elm aphid when applied on three of the four dates tested. None of the treatments however provided complete control, even with low infestation rates observed.

Treatment	Rate (product/L)	Application date	Aphid infestation rating*
LORSBAN 4E	0.1 ml	June 23	0.56b
LORSBAN 4E	0.1 ml	June 30	0.60b
LORSBAN 4E	0.1 ml	July 7	0.88ab
LORSBAN 4E	0.1 ml	July 14	0.28b
Dry check	-	-	1.52a

* Means followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keuls test.

#017
ICAR: 87000180

CROP: Saskatoon, *Amelanchier alnifolia* var. Pembina;
Saskatoon, *Amelanchier sanguinea* var. Parkhill

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

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TITLE: POST-HARVEST INSECTICIDE TRIAL FOR CONTROL OF WOOLLY ELM APHID ON ESTABLISHED SASKATOONS

MATERIALS: MALATHION 50 EC (malathion); CYGON 240 E (dimethoate); DIAZINON 12.5 EC (diazinon)

METHODS: The woolly elm aphid spends part of its life cycle on the roots of saskatoon. In an attempt to control this pest, a post-harvest insecticide trial was conducted at White City and Saskatoon, Saskatchewan. 'Parkhill' variety was used at White City and 'Pembina' at Saskatoon. Three-year-old plants spaced one meter apart were used at each site. The trial consisted of five treatments; three insecticide treatments, a water check and a dry check. Treatments were replicated 11 times at White City and 15 times at Saskatoon, in a Randomized Complete Block design with single plant plots. Treatments were applied as a soil drench at a rate of 10 L solution/per seedling. Retention bands were placed around each plant to allow the solution to saturate the soil around the roots. The bands were constructed from 22 gauge sheet metal and measured 120 cm long by 15 cm high, providing a 45 cm diameter area around each plant. Treatments were applied on September 1 at White City and September 2 at Saskatoon. The trials were evaluated on September 9 and 10 at White City and September 12 and 13 at Saskatoon. To determine the infestation rate of aphids, half of the root system of each plant was assessed. Assessments were made by digging a 15 cm deep trench in a semicircle approximately 60 cm away from each plant. The soil around the roots was then removed to expose aphid colonies. Only the roots directly under the retention bands were assessed. The aphid colonies were rated using a scale of 0-5 as follows: 0-no aphids present; 1-under 2 cm of aphid infested roots; 2-2 to 4 cm of aphid infested roots; 3-4 to 7 cm of aphid infested roots; 4-7 to 10 cm of aphid infested roots; 5-over 10 cm of aphid infested roots. An estimate of the pre-treatment colony size was made by looking for a blueish-purple colouration on the roots and soil. This colouration is associated with the woolly elm aphid colony and is present even after the demise of the colony. The post-treatment colony size was estimated by looking for live aphids in the blueish-purple area. A binocular microscope was used to confirm the presence of live aphids. Only plants that exhibited evidence of pre-treatment aphid colonization were included in the evaluation of products. Percent control was estimated by calculating the difference between pre-treatment and post-treatment ratings. Analysis of variance was conducted and means separated by a Student-Newman-Keuls' test (alpha = 5%). Data were not transformed.

RESULTS: There was no significant difference in the pre-treatment infestation rates for all treatments (see table). Post-treatment infestation rates were significantly lower for all three insecticide treatments when compared to the water check or dry check. Leaf burn was recorded on approximately 80% of the DIAZINON treated seedlings. No leaf burn was noted on seedlings in the MALATHION, CYGON, water check and control check plots.

CONCLUSIONS: CYGON and MALATHION reduced woolly elm aphid populations on the roots of saskatoon and did not cause phytotoxic damage. Although DIAZINON reduced aphid populations, the phytotoxic damage was unacceptable. DIAZINON should be tested at lower rates to determine if phytotoxic damage can be avoided. MALATHION and CYGON applied after berry harvest has potential in reducing woolly elm aphid populations on saskatoon roots.

		White City*			Saskatoon*		
Treatment	Rate (product/L)	Pre-trtmt. infes. rate	Post-trtmt. infes. rate	% ** control	Pre-trtmt. infes. rate	Post-trtmt. infes. rate	% ** control
MALATHION 50 EC	2.0 ml	2.8a	0.7a	78a	2.9a	0.4a	93a
CYGON 240 EC	2.5 ml	3.1a	0.1a	99a	3.5a	0.0a	100a
DIAZINON 12.5 EC	5.0 ml	1.9a	0.0a	100a	2.5a	0.1a	96a
Water check	-	2.8a	2.7b	17b	3.5a	2.9b	16b
Dry check	-	2.7a	2.1b	30b	3.8a	3.7b	7b

* Means in the same column followed by the same letter are not significantly different at the 5% level according to the Student-Newman-Keuls' test.

** Percent control was calculated only for plants that showed signs of aphid infestation before treatment.

**INSECTS OF VEGETABLE AND SPECIAL CROPS /
INSECTES DES LÉGUMES ET CULTURES SPÉCIALES**

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

#018 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61002030

CROP: Bean, white cv. ExRico

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

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TITLE: VALIDATION OF DAMAGE THRESHOLD USING LEAFHOPPER NYMPH COUNTS AS THE DECISION TOOL

MATERIALS: CYGON 480E (dimethoate)

METHODS: The crop was planted on 14 June, 1993 at 600,000 seeds/ha in rows 0.5 m apart at Ridgetown, Ontario. Plots were eight rows wide by 8 m in length. Treatments were arranged in a randomized complete block design with four replications. CYGON was applied banded at 0.48 kg ai/ha in 170 L water/ha at 206 kPa pressure with a backpack field sprayer. Plots were sprayed with a single nozzle directed over each row. Plots were sprayed on 16, 23, 30 July, 6, 9, and 16 August when beans were at the five to seven trifoliate, 10-12 trifoliate, pod set, mid pod fill (6 and 9 August), and late pod fill stages, respectively. Leafhopper populations were estimated by counting nymphs from ten leaflets selected at random from the centre of the crop canopy. Countswere expressed as the average number of nymphs/trifoliate. Yields were taken from three rows by 3 m out of the centre of the plot on 5 October and corrected to 18% moisture.

RESULTS: Rainfall data are presented in Table 1. Little rain fell before mid July. Populations in all plots did not exceed 2.5 nymphs/trifoliate. Leafhopper populations in the controls declined gradually after a period of four out of six days of rain in end July (Table 2). Rainfall was not heavy in any of these four days. Mortality was not directly due to the mechanical effects of rain, but rather a mortality factor related to moisture. Leafhopper counts and corresponding yields are presented in Table 2.

CONCLUSIONS: While nymph counts for potato leafhopper exceeded 2.0 nymphs/trifoliate no economic return was obtained for dimethoate sprays. There was no benefit to weekly sprays compared with non-treated controls. Some mortality factor related to moisture was responsible for population decline at the end of July.

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Table 1. Precipitation for July and August during period of sampling for potato leafhoppers in white beans. Ridgetown, Ontario 1993.

Date	mm precipitation
14 July	17.4
19	0.2
25	4.2
28	17.8
29	16.6
30	0.2
6 August	0.2
7	0.2
11	15.0
16	12.2
17	0.2
19	0.8

Table 2. Validation of decision threshold for potato leafhopper on white bean using nymphs as the sample target. Ridgetown, Ontario, 1993.

Decision Threshold (nymph/ trifoliate)*	----leafhopper counts (nymphs/trifoliate) ------------								Crop yield (T/ha)
	15 Jly	19 Jly	22 Jly	26 Jly	06 Aug	09 Aug	12 Aug	16 Aug	5 Oct
0.5 (16 Jly)	0.6a**	0.2a	0.1c	0.1b	0.1b	0.0b	0.0a	0.0a	3.14a
1.0 (23 Jly)	0.5a	0.5a	1.3b	0.1b	0.0b	0.0b	0.4a	0.2a	2.85a
2.0 (23 Jly)	0.3a	0.5a	2.3a	0.1b	0.0b	0.1b	0.2a	0.0a	2.94a
CONTROL	0.6a	0.6a	1.9a	2.3a	1.3a	0.6a	0.2a	0.0a	3.12a
WKLY SPRAY	0.4a	0.1a	0.1c	0.0b	0.1b	0.0b	0.0a	0.0a	2.91a
CV %	69.9	90.7	20.5	82.3	58.3	245.4	192.1	361.8	6.9

* Bracketed dates are dates the plots were sprayed when thresholds were reached.

** Means followed by same letter do not significantly differ (P=.05, Duncan's MRT)

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#019

ICAR: 61002030

CROP: Bean, white, cv. ExRico

PEST: Seed corn maggot, *Delia platura*

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TITLE: INSECTICIDES FOR THE CONTROL OF SEED CORN MAGGOT IN WHITE BEANS

MATERIALS: AC303,630 240SC; AGROX B3 (diazinon + lindane + captan); AGROX DL+ (diazinon + lindane + captan); FORCE 50EC (tefluthrin); TF3755 200ST (tefluthrin); UBI 2627 200ST (NTN33893); VITAFLO 280 (carbathiin + thiram).

METHODS: The crop was planted on 10 May, 1993 at Ridgetown, Ontario on a sandy loam soil near a manure pit, in 6 m rows spaced 0.76 m apart at 100 seeds/plot, using a John Deere Max-emerge planter which was fitted with a cone seeder. Plots were single rows, arranged in a randomized complete block design with four replicates. Plots were prepared on top of winter wheat (killed with glyphosate + ammonium sulfate + Agral 90) green manure ploughed in early May. Cattle manure was disced in four weeks prior to planting. Plots were planted when adults were numerous (monitored by yellow sticky cards). The granular materials were applied using a plot scale Noble applicator. T-band applications were placed in a 15 cm band over the open seed furrow. In-furrow applications were placed directly into the seed furrow. Seeds were treated in 200 g lots using a desk-top treater supplied by UNIROYAL CHEMICAL. Percent emergence was calculated by counting all the plants emerged per plot at the first leaf stage and relating that to the total number of seeds planted. Percent injury was calculated the following day as the number of seedlings showing maggot injury over the number of seedlings dug up in a 2 m section of row. Non-emerged seeds/seedlings were included in the calculation.

RESULTS: Results are presented in Table 1.

CONCLUSIONS: No materials provided better control than the standard seed treatments containing lindane and diazinon.

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Table 1. Control of seed corn maggot in white beans with insecticides at Ridgetown, Ontario in 1993.

Treatment	Rate	Method		Percent Emergence	Percent Infestation
NON-TREATED CONTROL				20 e*	81 a
VITAFLO 280	2.6	ml/kg SEED	ST	49 a-d	44 ab
AGROX B3	3.2	g/kg SEED	ST	59 a	37 b
VITAFLO 280 +	2.6	ml/kg SEED	ST	53 abc	27 b
AGROX DL+	2.6	g/kg SEED	ST		
VITAFLO 280 +	2.6	ml/kg SEED	ST	45 a-d	41 b
UBI 2627 ST	5	ml/kg SEED	ST		
VITAFLO 280 +	2.6	ml/kg SEED	ST	32 de	43 b
UBI 2627 ST	10	ml/kg SEED	ST		
VITAFLO 280 +	2.6	ml/kg SEED	ST	39 cd	46 ab
UBI 2627 ST	15	ml/kg SEED	ST		
VITAFLO 280 +	2.6	ml/kg SEED	ST	37 cd	48 ab
AC303,630 240SC	2.7	ml/100m row	IN-FURROW		
VITAFLO 280 +	2.6	ml/kg SEED	ST	57 ab	30 b
TF 3755 200ST	3.0	ml/kg SEED	ST		
VITAFLO 280 +	2.6	ml/kg SEED	ST	50 abc	39 b
TF 3755 200ST	4.0	ml/kg SEED	ST		
VITAFLO 280 +	2.6	ml/kg SEED	ST	40 bcd	49 ab
FORCE 50EC	22.6	ml/100m row	IN-FURROW		
CV (%)				15.3	33.7

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

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#020

STUDY DATA BASE: 306-1252-9016

CROP: Cabbage, cv Stonehead

PEST: Diamondback moth (DBM), *Plutella xylostella* (L.); cabbage looper (CL), *Trichoplusia ni* (Hub.) and imported cabbageworm (ICW), *Artogeia rapae* (L.)

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

MATERIALS: RH-5992 2F, LANNATE L (methomyl), TRITON B-1956 (surfactant).

METHODS: The experimental site was a cabbage field at the Agriculture Canada Research Station, Kentville N.S. Cabbage plots (five rows of 17 cabbage plants each, 5 m wide by 7.5 m long) assigned to treatment in a randomized complete block design, were monitored weekly from the time of heading (June 15, 1993) by counting the number of larvae on 1/3 the leaves of 15 cabbages in the centre three rows of each plot. When the mean number of Cabbage Looper Equivalents (CLE; 1 CL=1 CLE, 1 ICW=0.75 CLE, 1 DBM=0.2 CLE) exceeded 0.5, sprays containing TRITON B-1956 (0.1%) were applied using a tractor with a 12 nozzle side boom sprayer calibrated to deliver 1316 L/ha at 1000 kPa. Control plots were not sprayed. At harvest August 11, 1993, plant number 3, 7 and 11 were sampled from the centre three rows of each plot. For each cabbage plant, injury was rated as none, light, medium, or heavy, and the weight was measured.

RESULTS: Injury ratings are shown in the table. The mean cabbage head weight (1.46 kg; SEM, 0.052) did not differ among treatments.

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

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

Treatment	Rate (ai/ha)	Injury Rating None	Light	Medium	Heavy
Control	--	15	9	9	3
RH-5992	0.4 kg	36	0	0	0
Lannate L	0.5 kg	35	1	0	0

#021

STUDY DATA BASE: 303-1452-8703

CROP: Cabbage, cv. Lennox

PEST: Imported cabbageworm, *Artogeia rapae* (L.);
diamondback moth, *Plutella xylostella* (L.)

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TITLE: EVALUATION OF INSECTICIDES FOR CONTROL OF IMPORTED CABBAGEWORM (ICW)AND DIAMONDBACK MOTH (DBM) ON CABBAGE, 1993

MATERIALS: RH 5992 2F 24%; AC303 630 24% (pyrrole); AGRIDYNE 3% (azadirachtin); PBO 90% (piperonylbutoxide).

METHODS: Cabbage seedlings were transplanted at Harrington, P.E.I., on June 15, 1993. Plants were spaced at about 45 cm within rows and 87 cm between rows. Each four row plot measured 3.5 m wide by 23 m long. Plots were arranged in a randomized complete block design with eight treatments each replicated a total of four times. Fertilizer was applied in accordance with recommendations for cole crop production on P.E.I. Plots were sampled weekly beginning on July 29 and ending on September 1. Counts of ICW and DBM larvae were derived from the destructive sampling of six plants systematically selected from the two center rows of each plot. Insecticides were applied whenever a threshold of 0.25 Cabbage Looper Equivalents (CLE) was surpassed. The number of ICW and DBM were multiplied by 0.67 and 0.2, respectively, to convert to CLE. Insecticides were applied using a precision plot sprayer delivering about 1240 L/ha at about 240 kPa. The spreader sticker LATRON-B was added to all spray mixtures and the untreated check at the rate of 1.2 L/ha. Weeds were controlled by a pre-plant application of trifluralin at a rate of 600 g ai/ha on June 9 and several mechanical cultivations. Ten heads from the center two rows of each plot were harvested on September 13, and weight and marketability were recorded. Heads which were free of insects, frass, and feeding damage were considered marketable. An analysis of variance was performed on the data and Least Squares Differences (LSD) determined.

RESULTS: The results are summarized in the table.

CONCLUSIONS: Good control of ICW and DBM larvae was provided by all the insecticides tested. Plots treated with AC303 630 required fewer sprays than plots treated with the other insecticides. The addition of PBO to the AGRIDYNE spray mixture enhanced the level of insect control compared to AGRIDYNE alone. There were no significant differences in head weights, but more marketable heads were harvested from plots treated with RH 5992 or AC303 630 than with AGRIDYNE. Heads taken from the check plots or plots treated with PBO alone were not considered marketable. Cabbage plants treated with PBO either alone or with AGRIDYNE had a yellowish colouring.

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Table 1. Efficacy of several insecticides against larvae of the imported cabbageworm (ICW).

Treatment	Rate g ai/ha	No. of Sprays	No. of ICW Larvae/Plant August 4	August 11	August 18	August 25	Sept. 1	Sept. 9	% Markets
Check	-	-	0.0	4.5	12.2	15.0	16.0	12.8	0
RH5992	140	5	0.1	4.7*	3.3*	0.9*	0.3*	0.0*	95
RH5992	240	5	0.0	3.6*	2.8*	0.7*	0.0*	0.0*	93
AC303630	50	4	0.1*	2.3*	1.8*	0.3*	0.0	0.0	93
AC303630	100	3	0.0*	1.8*	1.2*	0.2	0.1	0.0	100
Agridyne	25	6	0.1*	2.8*	8.9*	6.6*	2.7*	1.4*	85
Agridyne+PBO	25+504	6	0.2*	3.7*	5.2*	2.3*	0.2*	0.4*	80
PBO	504	6	0.2*	4.2*	9.0*	12.4*	11.8*	10.2*	0
LSD (P<0.05)			0.14	1.97	3.21	2.01	4.27	3.49	9.7

* Application of insecticide following count.

Table 2. Efficacy of several insecticides against larvae of the diamondback moth (DBM).

Treatment	Rate g ai/ha	No. of DBM Larvae/Plant August 4	August 11	August 18	August 25	Sept. 1	Sept. 9	Head Wts. kg/10 Heads
Check	-	0.8	2.7	3.6	5.3	3.5	3.1	31.4
RH5992	140	1.0	2.0*	2.0*	4.0	4.1*	3.1*	33.2
RH5992	240	0.5	1.6*	1.9*	3.3	3.2*	2.7*	33.5
AC303630	50	1.0*	2.0*	0.7*	0.3	0.1*	0.0	32.9
AC303630	100	1.4*	1.7*	0.4*	0.2	0.2	0.0	34.6
Agridyne	25	1.2*	3.5*	2.3*	3.3	2.6*	2.3*	33.2
Agridyne+PBO	25+504	0.9*	0.9*	1.2*	1.5	1.3*	0.8*	33.4
PBO	504	1.5*	2.2*	2.6*	4.3	6.6*	5.7*	33.4
LSD (P<0.05)		0.58	1.77	1.51	2.05	2.08	2.68	N.S.

* Application of insectide following count.

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#022

BASE DE DONNÉES DES ÉTUDES: 310-1452-8504

CULTURE: Chou, cv. Bartolo

RAVAGEUR: Piéride du chou, *Pieris rapae* (L.);
fausse-teigne des crucifères, *Plutella xylostella* (L.);
fausse-arpenteuse du chou, *Trichoplusia ni* (Hübner)

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TITRE: CONTROLE DES POPULATIONS LARVAIRES CHEZ LE CHOU PAR L'UTILISATION DE SEUILS D'INTERVENTION

PRODUITS: AMBUSH 500 EC (Permethrin)

MÉTHODES: L'étude a été effectuée selon un plan à blocs complets aléatoires contenant 8 parcelles répétées 3 fois. Chaque parcelle contenait 8 rangs de 5,6 m de long espacés de 1 m. Les choux furent transplantés le 16 juin 1993 à raison de 16 plants/rang espacés de 35 cm. Une application d'herbicide trifluralin (TREFLAN 545 EC, 2,0 L/ha, 206 kPa) fut effectuée le 14 juin ainsi qu'une application de fensulfothion (DASANIT 720 SC, 25 ml/rang - 100 m; 482 kPa) contre la mouche du chou le 17 juin. Les traitements comprenaient un témoin sans insecticide; application d'insecticide de façon régulière à toutes les 2 semaines dès l'apparition des insectes (Cédule); application d'insecticide à toutes les 2 semaines dès la formation des têtes (Tête) et application d'insecticide dès l'obtention de seuils d'intervention de 0,10; 0,15; 0,20; 0,25; et 0,50 CLE (CLE: Cabbage Looper Equivalent). L'AMBUSH fut appliqué au moyen d'un pulvérisateur monté sur tracteur à une pression de 552 kPa avec un débit de 140 ml/ha. Le dépistage des trois espèces de lépidoptères larvaires sur 10 plants choisis au hasard dans les 4 rangs du centre de chacune des parcelles fut effectué une fois par semaine pour un total de 15 dépistages. La récolte eut lieu les 14 et 15 octobre. Le poids, le diamètre et la qualité commerciale de 30 choux choisis au hasard dans les rangs du centre de chaque parcelle furent enregistrés. Les choux étaient jugés de qualité commerciale lorsqu'ils n'avaient pas de larves, matières fécales ou dégats causés par les insectes.

RÉSULTATS: Voir tableau ci-dessous.

CONCLUSIONS: Tous les traitements basés sur le CLE ont maintenu dans l'ensemble des CLE moyens significativement différents du Cédule et du Témoin. Le traitement Cédule avec 6 applications d'insecticide a significativement maintenu le plus faible CLE moyen et a présenté un poids, un diamètre, et une qualité commerciale significativement supérieurs aux autres traitements. Par rapport au traitement Cédule, les seuils 0.1 et 0.2 CLE ont nécessité respectivement 3 et 4 applications d'insecticide en moins, mais n'ont donné qu'une qualité commerciale d'environ 90% seulement. Pour leurs parts, les seuils 0.25 et 0.5 CLE ont permis d'économiser 5 arrosages chacun mais les qualités commerciales obtenues sont trop faibles pour être acceptables. En effet, le seuil 0.5 CLE a présenté après le Témoin la deuxième plus faible valeur commerciale (52.3%) significative. Les traitements Tête et 0.25 CLE ne diffèrent pas significativement entre eux pour la qualité commerciale et le CLE moyen mais le seuil 0.25 CLE a permis d'économiser par rapport au traitement Cédule 5 applications d'insecticide contre seulement 2 pour le traitement Tête. Ainsi, un seuil de 0.5 CLE serait beaucoup trop élevé pour contrôler efficacement les larves phyllophages du chou. Dans les conditions rencontrées, le traitement Cédule est celui qui a permis de produire la meilleure qualité commerciale de chou. Cependant, le seuil qui semblerait présenter le meilleur potentiel devrait être entre 0.1 et 0.2 CLE. Ces seuils permettent d'économiser 3 ou 4 arrosage tout en maintenant des CLE moyens faibles pour des qualités commerciales comparables et qui s'approchent du traitement Cédule. Dans la présente étude, le seuil 0.1 CLE est celui qui est le plus près des résultats obtenus avec des arrosages réguliers (Cédule).

Tableau 1. Productivité du chou soumis à différent traitements.

Traitements	# d'arrosage	CLE (Moyenne)	Poids (g)	Diamètre (cm)	Qualité* (%)
Témoin	0	0.322d**	1052.6d	13.3c	9.0e
Cédule	6	0.030a	1233.4a	14.1a	98.0a
Tête	4	0.104bc	1052.6d	13.3c	78.0c
0.10 CLE	3	0.052ab	874.8e	12.4d	91.3ab
0.15 CLE	2	0.071abc	1085.8c	13.3c	86.7bc
0.20 CLE	2	0.079abc	1031.3d	13.2c	90.0bc
0.25 CLE	1	0.104bc	1198.9b	13.9b	81.0bc
0.50 CLE	1	0.113c	1025.7d	13.2c	52.3d

* Transformation arcsin (SQRT (%)) des données avant le test.

** Les valeurs suivies de la même lettre ne sont pas significativement différentes au seuil 5% (Fisher's LSD [Statistix Analytical Software 1992]).

#023

ICAR: 61006535

CROP: Cabbage, cv. Zenlingal

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

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TITLE: EFFECT OF SURFACTANTS FOR THE CONTROL OF CABBAGE INSECTS USING AC303,630 240 SC

MATERIALS: AC303,630 240SC (experimental); AGRAL 90 (ni) (non-ionic surfactant); COMPANION (ni) (non-ionic surfactant); FRIGATE (ci) (cationic surfactant); ENHANCE (ci) (cationic surfactant).

METHODS: Cabbage was transplanted on June 4 in two row plots spaced 0.9 m apart. Plots were 8 m in length, replicated four times in a randomized complete block design. Spray applications were made with a back pack airblast sprayer at 240 L/ha of water. Insecticides were applied on June 22, July 10, 20, 30, and August 19. Insect leaf feeding damage assessments were made by counting areas of insect feeding across a plot on August 10 and a foliar damage rating on August 21.

RESULTS: As presented in the table.

CONCLUSIONS: None of the surfactants alone provided any consistant level of cabbage insect control. However, when used in combination with the insecticide AC303,630 240SC, the surfactants AGRAL 90, COMPANION and ENHANCE significantly improved the effectiveness of the insecticide. Foliar damage ratings for plants treated with AGRAL 90 at the higher rate and COMPANION combined with AC 303,630 were significantly higher than the rating for the insecticide applied at 100 g ai/ha without surfactants. This suggests that half rates of AC303,630 240SC when mixed with the higher rate of AGRAL 90 and COMPANION provided equal control than when the insecticide was used alone at the full rate.

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Table 1. Imported cabbageworm foliar damage assessments in cabbage.

Treatments	Rate kg ai/ha	# of Insect Feeding Damage Areas* Aug. 10	Foliar Damage Ratings (0-10)** Aug. 21
AC303,630 240SC	0.05	8.5b***	3.3cde
AC303,630 240SC	0.10	5.3b	4.8bc
AC303,630 240SC + AGRAL 90 (ni)****	0.05 0.05% v/v	6.3b	6.0ab
AC303,630 240SC + AGRAL 90 (ni)	0.05 0.1% v/v	4.3b	7.5a
AC303,630 240SC + COMPANION (ni)	0.05 0.1% v/v	7.3b	6.5a
AC303,630 240SC + FRIGATE (ci)	0.05 0.1% v/v	4.8b	4.5bcd
AC303,630 240SC + ENHANCE (ci)	0.05 0.1% v/v	5.8b	6.0ab
AGRAL 90	0.1% v/v	18.8a	1.0f
COMPANION	0.1% v/v	19.5a	2.0ef
FRIGATE	0.1% v/v	18.8a	2.8e
ENHANCE	0.1% v/v	20.8a	3.0de
Control		22.0a	1.0f

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

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

*** Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

**** (ni) - non-ionic surfactant; (ci) - cationic curfactant.

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#024

ICAR: 61006535

CROP: Cabbage, cv. Zenlingal

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

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TITLE: INSECT CONTROL IN CABBAGE

MATERIALS: MONITOR 480 LC (methamidophos); DIPEL (*Bacillus thuringiensis* var. *kurstaki*); RH-5992 240EC (experimental); GUTHION 240 SC (azinphos-methyl); AC303,630 240 SC (experimental); THIODAN 4EC (endosulfan); RIPCORD 400EC (cypermethrin).

METHODS: Cabbage was transplanted on June 4 in two row plots spaced 0.9 m apart. Plots were 8 m in length, replicated four times in a randomized complete block design. Spray applications were made with a back pack airblast sprayer at 240 L/ha of water. Insecticides were applied on June 22, July 10, 20, 30, and August 19. A 0.25% concentration of the surfactant COMPANION was added to each treatment. Insect leaf feeding damage assessments were taken by counting areas of insect feeding across a plot on August 10 and a foliar damage rating on August 21.

RESULTS: As presented in the table.

CONCLUSIONS: The imported cabbageworm was most effectively controlled when AC303,630 240SC was mixed with either THIODAN 4EC or RIPCORD 400EC. All three rates of AC303,630 240SC, the higher rate of RH-5992 240EC, and MONITOR 480LC also provided imported cabbageworm control. High levels of insect control was not achieved using DIPEL, the lower rate of RH-5992 240EC, or GUTHION 240SC.

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Treatments	Rate product/ha	# of Insect Feeding Damage Areas* Aug. 10	Foliar Damage Ratings (0-10)** Aug. 21
MONITOR 480LC	1.1 L	6.3cde***	5.0bc
DIPEL	1.0 kg	14.5ab	2.3f
RH-5992 240EC	0.3 L	13.5ab	3.5c-f
RH-5992 240EC	0.6 L	6.0cde	4.3b-e
GUTHION 240SC	2.25 L	10.5bc	3.0def
AC303,630 240SC	0.21 L	6.3cde	4.8bcd
AC303,630 240SC	0.31 L	7.8cd	3.0def
AC303,630 240SC	0.42 L	5.0de	5.5b
AC303,630 240SC;	0.21 L		
THIODAN 4EC	2.00 L	4.8de	7.4a
AC303,630 240SC;	0.21 L		
RIPCORCD 400EC	0.125 L	2.3e	8.3a
Control		17.3a	2.5ef

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

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

*** Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

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#025

STUDY DATA BASE: 364-1421-8704

CROP: Canola, var. Excel

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

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

MATERIALS: FURADAN 10G (carbofuran); CLOAK (lindane 53.3%, carbathiin 4.5%, thiram 9%); COUNTER 5G, BIODAC 5G (terbufos); FORCE (tefluthrin 14.3%); AMAZE (isofenphos 93%, benomyl 20%, thiram 2%); UBI 2608-1; PREMIERE PLUS (lindane 35%, thiabendazole 1.4%, thiram 4.2%); PREMIERE (lindane 40%, thiabendazole 1.6%, thiram 4.8%); EXP 80511A; ROVRAL ST (lindane 50%, iprodione 16.7%); VITAVAX RS (lindane 68%, carbathiin 4.5%, thiram 9%); EXP 80430B;

METHODS: Canola at 5.6 kg/ha was seeded May 18, 1993 in 17.5 cm row spacings in field plots at a depth of 2 to 3 cm with a double disc press drill at Glenlea, Manitoba. Plots of 1.25 m by 8.0 m were replicated five times in a randomized complete block design. Effects of treatments on germination were tested at seeding by placing 4 samples of 25 seeds/treatment onto moistened filter paper in covered petri dishes for six days at 25 C. Two plant counts of 0.25 m2 and a visual assessment of flea beetle damage were taken in each plot on June 21. Flea beetle damage was rated using a scale based on percent of leaf surface area damaged; 0 = no damage; 0.5 = 5%; 1.0 = 10%; 2 = 25%; 3 = 50%; 3.5 = 75%; 4 = 100%. Plots were harvested by straight combining on September 30 and October 4, 1993 and seed samples were dried before being weighed.

RESULTS: Rates in the table refer to the weight of the active ingredient of the insecticide in the pesticide formulation.

CONCLUSIONS: Seed germination was not affected by any insecticide treatment. Flea beetle populations in all plots during the canola seedling stage were very low because of cool, wet weather. No feeding injury by flea beetles to the cotyledons or first true leaves was observed in any treatment. Plant stand and yields in all treatments did not differ from the CHECK.

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Treatments	Rate (g ai/ kg seed)	Seed Germ. (%)	Plant Damage	Plants /m2	Canola Yield (g/m2)
CHECK	-	98a*	0	161ab	168.8a
FURADAN	50	99a	0	162ab	163.5a
FURADAN + CLOAK	50 + 12	94a	0	138ab	167.0a
COUNTER	50	99a	0	128b	178.7a
COUNTER + CLOAK	50 + 12	91a	0	129ab	166.0a
BIODAC	50	97a	0	148ab	170.6a
BIODAC + CLOAK	50 + 12	94a	0	132ab	168.5a
FORCE	4	99a	0	145ab	171.7a
FORCE	8	94a	0	158ab	170.7a
AMAZE	12	96a	0	163ab	163.6a
UBI 2608-1	4	95a	0	148ab	185.2a
UBI 2608-1	6	97a	0	167a	169.0a
UBI 2608-1	8	97a	0	163ab	169.9a
UBI 2608-1	10	95a	0	139ab	165.7a
PREMIERE PLUS	11.2	97a	0	163ab	179.4a
PREMIERE	11.2	100a	0	165ab	163.7a
EXP 80511A	12	97a	0	155ab	164.1a
ROVRAL ST	12	98a	0	151ab	175.9a
CLOAK	12	94a	0	133ab	187.0a
ROVRAL ST	15	97a	0	159ab	171.9a
VITAVAX RS	15	98a	0	137ab	169.4a
EXP 80430B	15	97a	0	132ab	183.6a

* Means followed by the same letter are not significant (DMR test, P>0.05).

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#026

STUDY DATA BASE: 364-1421-8704

CROP: Canola, cv. Excel

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

NAME AND AGENCY:
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TITLE: SEEDLING PROTECTION AND FLEA BEETLE CONTROL IN CANOLA WITH SEED DRESSING INSECTICIDES

MATERIALS: AMAZE (isofenphos 93%, benomyl 20%, thiram 2%); FORCE (tefluthrin 14.3%); UBI 2608-1; PREMIERE PLUS (lindane 35%, thiabendazole 1.4%, thiram 4.2%); PREMIERE (lindane 40%, thiabendazole 1.6%, thiram 4.8%); EXP 80511A; ROVRAL ST (lindane 50%, iprodione 16.7%); CLOAK (lindane 53.3%, carbathiin 4.5%, thiram 9%); VITAVAX RS (lindane 68%, carbathiin 4.5%, thiram 9%); EXP 80430B;

METHODS: Treatments were seeded on June 2, 1993 into sterile soil in 16 dram plastic vials that had a 2 mm hole in the bottom for water entry. Plants were thinned to a maximum of four per vial. White quartz sand was placed on the soil, and clear plastic cages with screened openings were placed over the vials after seedlings emerged. Plots of one cage/treatment were replicated eight times. Three beetles/plant were added to each cage one to two days after seedling emergence, and beetle mortality was assessed two, four, and seven days later. All dead beetles were replaced after each assessment. After seven days plant damage was rated according to percent of leaf surface damaged by beetles: 0 = no damage; 0.5 = 5%; 1.0 = 10%; 2.0 = 25%; 3.0 = 50%; 3.5 = 75%; 4.0 = 100%, and the cotyledons were weighed. The trial was run in a greenhouse at 25 - 28 C with a 16:8 photoperiod.

RESULTS: Flea beetle mortality presented in the table was analyzed by Duncan's Multiple Range test after arcsine transformation and before adjustment by Abbott's formula.

CONCLUSIONS: Excellent flea beetle control and seedling protection were provided by AMAZE and all lindane formulations. Althouigh all treatments of FORCE or UBI 2608-1 reduced plant damage and significantly increased cotyledon weight, flea beetle efficacy was significantly less than AMAZE and all lindane formulations on all assessment dates. While flea beetle mortality and cotyledon weight were not affected by increases in UBI 2608-1 rates, FORCE at 8 g ai/kg seed was significantly more effective against flea beetles after seven days than the low rate.

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Treatment	Rate (g ai/ kg seed	Flea Beetle Mortality 2 D.	4 D.	7 D.	Plant Damage 7 D.	Cotyledon Wt. (mg)
CHECK	-	0d*	0c	0c	3.4	15e
AMAZE	12	100a	100a	100a	0.1	97a
FORCE	4	84b	72b	11c	1.1	69d
FORCE	8	92b	78b	66b	0.7	70d
UBI 2608-1	4	10cd	69b	68b	0.9	79bcd
UBI 2608-1	6	3d	74b	32bc	1.1	68d
UBI 2608-1	8	21c	69b	29bc	0.7	78bcd
UBI 2608-1	10	10cd	84b	71b	0.3	74d
PREMIERE PLUS	11.2	100a	100a	100a	0.1	79bcd
PREMIERE	11.2	100a	100a	100a	0	75cd
EXP 80511A	12	100a	100a	100a	0	91abc
ROVRAL ST	12	100a	100a	100a	0	96a
CLOAK	12	100a	100a	100a	0	76cd
ROVRAL ST	15	100a	100a	100a	0.1	91abc
VITAVAX RS	15	100a	100a	100a	0	78bcd
EXP 80430B	15	100a	100a	100a	0	93ab

* Means followed by the same letter are not significant (DMR test, P>0.05).

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#027

BASE DE DONNÉES DES ÉTUDES: 310-1452-8504

CULTURE: Chou-fleur, cv. Andes

RAVAGEUR: Piéride du chou, *Pieris rapae* (L.);
fausse-arpenteuse du chou, *Trichoplusia ni* (Hübner);
fausse-teigne des crucifères, *Plutella xylostella* (L.)

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TITRE: CONTROLE DES INSECTES RAVAGEURS DU CHOU-FLEUR PAR L'UTILISATION DE SEUILS D'INTERVENTION

PRODUITS: AMBUSH 500 EC (Permethrin)

MÉTHODES: L'étude fut réalisée selon un plan à blocs complets aléatoires contenant 8 parcelles répétées 4 fois. Chaque parcelle contenait 6 rangs de 4.5 m de long espacés de 90 cm. Les choux-fleurs furent transplantés le 16 juin 1993 à raison de 15 plants par rang espacés de 35 cm. Une application d'herbicide trifluralin (TREFLAN 545 EC, 2.0 L/ha) fut réalisée le 14 juin ainsi qu'une application de fensulfothion (DASANIT 720 SC, 25 ml/rang) contre la mouche du chou, le 17 juin. Les traitements comprenaient un témoin sans insecticide; application d'insecticide de façon régulière à toutes les 2 semaines dès l'apparition des insectes dans les parcelles (Cédule); application d'insecticide à toutes les 2 semaines dès la formation des têtes (Tête) et application d'insecticide dès l'obtention des seuils d'intervention de 0,10; 0,15; 0,20; 0,25; et 0,5 CLE (CLE: Cabbage Looper Equivalent). L'insecticide fut appliqué au moyen d'un pulvérisateur monté sur tracteur à une pression de 552 kPa avec un débit de 140 ml/ha. Le dépistage des 3 espèces larvaires était effectué 1 fois par semaine sur 10 plants choisis au hasard dans les 4 rangs du centre de chaque parcelle pour un total de 10 dépistages. La récolte se fit à la maturité des choux-fleurs les 19, 23 et 30 août. Le poids, le diamètre et la qualité commerciale de 28 choux-fleurs choisis au hasard dans les rangs du centre de chacune des parcelles furent enregistrés. Les choux-fleurs étaient jugés de qualité commerciale lorsqu'ils n'avaient pas de larves, de matières fécales ni de dégats causés par les insectes.

RÉSULTATS: Voir tableau ci-dessous.

CONCLUSIONS: Aucune différence significative n'a été enregistrée pour le poids et le diamètre pour l'ensemble des 8 traitements. Le traitement Cédule avec 3 arrosages d'Ambush a maintenu un CLE moyen significativement plus faible que les 7 autres traitements. Les 5 seuils utilisés n'ont tous nécessité qu'un seul arrosage et ont présenté des CLE moyens équivalents. Seul le seuil 0.2 CLE a eu un CLE moyen comparable à celui du traitement Cédule. Tous les traitements ont présenté des qualités commerciales très faibles. Les seuils qui ont donné les meilleurs rendements non significatifs entre eux ont été ceux de 0.25, 0.15 et 0.1 CLE. Les rendements obtenus en qualité commerciale ne permettent pas de conclure sur la pertinence des seuils choisis et nécessiteront une reprise de l'étude à l'été 1994.

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Tableau 1. Productivité du chou-fleur soumis à différents traitements.

Traitements	# d'arrosage	CLE (Moyenne)	Poids (g)	Diamètre (cm)	Qualité* (%)
Témoin	0	0.299a	324.1	12.4	6.3c
Cédule	3	0.053c	330.9	12.6	76.5a
Tête	0	0.164b	302.0	11.9	57.0b
0.10 CLE	1	0.140b	329.9	12.3	64.8ab
0.15 CLE	1	0.153b	317.6	12.1	65.2ab
0.20 CLE	1	0.078bc	352.0	12.4	58.0b
0.25 CLE	1	0.146b	309.0	12.0	69.5ab
0.50 CLE	1	0.162b	332.0	12.3	58.0b

* Transformation arcsin (SQRT (%)) des données avant le test.

** Les valeurs suivies de la même lettre ne sont pas significativement différentes au seuil 5% (Fisher's LSD [Statistix Analytical Software 1992]).

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#028

BASE DE DONNÉES DES ÉTUDES: 310-1452-8504

CULTURE: Chou-fleur, cv. Andes

RAVAGEUR: Piéride du chou, *Pieris rapae* (L.);
fausse-arpenteuse du chou, *Trichoplusia ni* (Hübner);
fausse-teigne des crucifères, *Plutella xylostella* (L.)

NOM ET ORGANISME:
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TITRE: APPLICATION DE SEUILS D'INTERVENTION SELON LES PRATIQUES CULTURALES DANS L'ÉRADICATION DES INSECTES RAVAGEURS DU CHOU-FLEUR

PRODUITS: AMBUSH 500 EC (Permethrin).

MÉTHODES: Les choux-fleurs furent transplantés le 29 juin 1993 dans des parcelles comprenant 6 rangs longs de 4,2 m espacés de 90 cm. Chaque rang comptait 11 choux-fleurs espacés de 35 cm. Les parcelles étaient disposées selon un plan "split plot" avec 8 traitements principaux et 2 sous-traitements, chacun répété 3 fois. Les sous-traitements comprenaient dépistages continus et application d'insecticide suite au recouvrement des têtes; et arrêt de dépistage et d'application d'insecticide suite au recouvrement des têtes. Les traitements principaux comprenaient 1) un témoin sans insecticide 2) application d'insecticide à toutes les 2 semaines suite à l'apparition des insectes dans les parcelles (Cédule) 3) application d'insecticide à toutes les 2 semaines dès l'apparition de la tête (Tête) et dès l'obtention de seuils d'intervention de 4) 0,10; 5) 0,15; 6) 0,20; 7) 0,25; et 8) 0,50 CLE (CLE: Cabbage Looper Equivalent). L'insecticide AMBUSH 500 EC fut appliqué au moyen d'un pulvérisateur monté sur tracteur (140 m/ha; 552 kPa). Une application de fensulfothion (DASANIT 720 SC, 25 ml/rang) fut réalisée le 30 juin contre la mouche du chou. Le recouvrement des têtes consistait à attacher les feuilles des plants au-dessus des choux-fleurs lorsque ceux-ci commencaient à paraître. Le dépistage des lépidoptères larvaires se fit une fois par semaine sur 10 plants/parcelle de la mise en terre à la récolte pour les traitements avec dépistages continus pour un total de 8 dépistages et jusqu'au recouvrement des têtes pour les traitements avec arrêt d'application d'insecticide et de dépistage.

Dans les traitements avec dépistages et applications continues d'insecticide les feuilles étaient détachées pour le dépistage et rattachées par après. Les récoltes se firent à maturité des plants soit les 6, 7 et 16 septembre. Le poids, le diamètre et la qualité commerciale de 20 choux-fleurs choisis au hasard dans les rangs du centre de chacune des parcelles furent enregistrés. Les choux-fleurs étaient jugés de qualité commerciale lorsqu'ils n'avaient pas de larves, de matières fécales, ni de dégats causés par les insectes.

RÉSULTATS: Voir tableau ci-dessous.

CONCLUSIONS: Les traitements avec dépistage continus ont démontré dans l'ensemble des CLE différents du traitement Cédule qui avec 3 arrosages a pu maintenir les populations larvaires les plus faibles. Par contre le traitement Tête avec 1 seul arrosage a connu les infestations les plus élevées. Pour leur part, les traitements avec arrêt de dépistage une fois les têtes attachées ont connu des populations extrêmement variables avec le Témoin et le traitement tête qui ont démontré les populations larvaires les plus fortes et le traitement Cédule avec 4 arrosages qui a connu les populations les plus faibles. Il n'y a pas de différence significative dans les poids et les diamètres des choux-fleurs pour aucun des traitements et sous-traitements. Alors qu'il y a différence significative chez la qualité commerciale des plants des différents traitements à l'intérieur des sous-traitements, il n'y a pas de différence significative dans la qualité commerciale des choux-fleurs entre les plants des 2 sous-traitements. Ceci veut dire qu'il n'y a aucun avantage à continuer le dépistage et l'application d'insecticide une fois les têtes attachées.

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Tableau 1. Productivité du chou-fleur soumis à différents traitements et pratiques culturales.

Dépistage	Traitements	# d'arrosage	CLE (Moyenne)	Poids (g)	Diamètre (cm)	Qualité* (%)
Continu	Témoin	0	0.247ab**	687.8	15.6	4.7d***
Continu	Cédule	3	0.027d	787.5	16.5	46.7b
Continu	Tête	1	0.337a	708.9	15.7	15.7cd
Continu	0.10 CLE	2	0.157bc	733.3	16.1	55.7ab
Continu	0.15 CLE	1	0.169bc	775.1	16.5	66.7a
Continu	0.20 CLE	2	0.153bc	691.8	16.1	35.7bc
Continu	0.25 CLE	2	0.103cd	791.7	16.4	80.0a
Continu	0.50 CLE	1	0.194bc	716.2	15.9	55.3ab
Arrêt	Témoin	0	0.391a	759.6	16.2	2.3d
Arrêt	Cédule	4	0.035e	785.7	16.3	71.3a
Arrêt	Tête	2	0.333a	767.9	16.1	13.3cd
Arrêt	0.10 CLE	3	0.090cd	748.9	16.3	60.0ab
Arrêt	0.15 CLE	1	0.087cd	760.4	16.5	71.0a
Arrêt	0.20 CLE	1	0.075de	722.6	15.8	44.7ab
Arrêt	0.25 CLE	1	0.136c	750.3	16.1	51.0ab
Arrêt	0.50 CLE	1	0.205b	724.4	15.8	35.3bc

* Transformation arcsin (SQRT (%)) des données avant le test.

** Les valeurs suivies de la même lettre ne sont pas significativement différentes au seuil 5% (Fisher's LSD [Statistix Analytical Software 1992]).

*** Les valeurs suivies de la même lettre ne sont pas significativement différentes au seuil 5% (Test t d'approximation Steel and Torrie 1980).

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#029

ICAR: 92000164

CROP: Cole crops: cabbage, cauliflower, broccoli, Brussels sprouts

PEST: Various insects

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TITLE: INTEGRATED PEST MANAGEMENT STUDIES IN COLE CROPS, 1993

METHODS: The following trials were conducted in 1993 at the Horticultural Experiment Station, Simcoe, Ontario. Data have not yet been analyzed.

A. Timing of sprays for control of Lepidopterous larvae on cole crops.

	Crop	Transplanted in field
1.	Early cabbage	20 May
2.	Early cabbage	11 June
3.	Mid-season cabbage	23 June
4.	Mid-season broccoli	23 June
5.	Late cabbage	23 June
6.	Late cauliflower	23 June
7.	Early cabbage, late planted	22 July

Treatments

1. No spray
2. Sprayed every seven days
3. Spray timing based on pest monitoring threshold (Cabbage Looper Equivalent > 0.3)

B. Timing of sprays for control of Thrips in cabbage (transplanted 23 June).

Treatments

1. No spray
2. Sprayed every ten days starting 6 August
3. Sprayed every ten days starting when the second population peak is detected on monitoring

In 1993, no second population peak of thrips was detected.

C. Use of Trap Crops for Flea Beetles, on early cabbage (transplanted 7 May).

Treatments

1. No trap crop border row
2. Border row of Chinese cabbage
3. Border row of Indian mustard (*Brassica juncea*, cv. *crispifolia*)

D. Use of Trap Crops for Diamondback Moth in late-season cabbage and Brussels sprouts (transplanted 16 June).

Treatments

1. No trap crop border row
2. Border row of Chinese cabbage
3. Border row of Indian mustard (*Brassica juncea*, cv. *crispifolia*)

E. Evaluation of late-season cabbage cultivars (storage types) for incidence of thrips injury during storage (transplanted 15 June).

Fourteen cultivars:- Marathon, Hyb. #4, National, Albion, Bently, Provita, Avalon, Bingo, Montego, Hilton, Bartolo, Galaxy, Multiton, Masada.

#030

ICAR: 61006535

CROP: Sweet corn, cv. Crisp'N Sweet 710, More

PEST: Western corn rootworm, *Diabrotica virgifera virgifera*, Leconte, and Northern corn rootworm, *Diabrotica barberi* Smith and Lawrence

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TITLE: USE OF FORCE 1.5G ON STANDARD AND SUPERSWEET SWEET CORN FOR THE CONTROL OF CORN ROOTWORMS

MATERIALS: FORCE 1.5G (tefluthrin)

METHODS: Sweet corn cultivars were planted with a John Deere corn planter on May 19. Plots were two rows spaced 0.9 m apart and 8 m in length, replicated four times in a randomized complete block design. The supersweet Crisp'n Sweet 710 was planted in a different part of the field for purposes of isolation from the standard More sweet corn. The granular FORCE 1.5G was applied in-furrow using a plot-scale Noble applicator in a T-band application placed in a 15 cm band over the open seed furrow and banded over the row in a 1.5 cm band. Phytotoxicity assessments were taken on June 4 by counting the number of emerged plants. Final yields were collected on August 23 and reported on an ear weight basis.

RESULTS: As presented in the table.

CONCLUSIONS: The application of the corn rootworm granular insecticide FORCE 1.5G did not cause any phytotoxicity to either the super sweet or standard sweet corn cultivars used in this test. There was no reduction in corn emergence or yield.

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Table 1. Effect of the use of the insecticide FORCE 1.5G on the emergence and yield of sweet corn.

Treatments	Rate g prod/100m	Application	Emergence Counts No./plot CRISP 'N SWEET 710	MORE	Yield kg/plot MORE
FORCE 1.5G	75.0	In-Furrow	118.5a*	137.0a	10.61a
FORCE 1.5G	75.0	Banded	117.0a	134.5a	10.05a
Control			111.8a	136.0a	10.65a

* Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test)

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#031

ICAR: 860000190

CROP: Onion, Yellow cooking

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

NAME AND AGENCY:
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TITLE: EVALUATION OF ONION LINES FOR ONION MAGGOT FLY RESISTANCE

MATERIALS: Onion breeding lines obtained from Dr. W.B. Gabelman, University of Wisconsin and Dr. Tom Walters, Cornell University, N.Y., two commercial cultivars, Norstar and Fortress.

METHODS: Two trials were conducted at the Muck Research Station where onion flies occurred naturally. The same onion lines were evaluated in both trials; in one, onion transplants were planted in the field, in the other, they were direct-seeded. There were four replicates of transplanted onions and three replicates of seeded onions per line, arranged in a randomized complete block design. Each replicate consisted of a 2.25 m row for transplants, and a 1 m row for seeded onions. The transplants were seeded in the greenhouse on April 8 and 30 plants per 2.25 m row were transplanted on May 20. Onions were seeded on May 21 at 42 seeds/m. Two commercial cultivars, Norstar and Fortress, were used as checks for the trial. No insecticides were applied throughout the trial period. Germination counts were recorded for the seeded onions on June 14, 17 and 18. Damage assessment began one week after the peaks of the first (June 17), second (August 3) and third (September 9) generation of maggot flies. Maggot damage was assessed twice per week by counting the number of wilted plants, once per week these assessments were confirmed by rogueing the onions and looking for symptoms of maggot damage at the base of the plant. Assessments on harvested onions were done on August 31 and October 15 for the transplanted and seeded onions, respectively.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant differences were found in the susceptibility to onion maggot damage among the onions in the trial. Among the transplanted onions, 124-93 had less first generation damage than Norstar but none of the lines had significantly less onion maggot damage than Norstar at the harvest assessment or when total damage was assessed.

Among the seeded onions, differences in susceptibility were found for first generation maggot damage only. Onions W456 and WH57, 1292-91 and W454 had low levels of maggot damage compared to the other lines, and significantly less damage than Norstar. Only W456 had less damage than Fortress.

Different susceptibility rankings were found between the transplanted and direct seeded onions. The seeded onions were seeded relatively late in the season and this may have affected the levels of first generation onion maggot damage that developed.

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Table 1. A comparison of percent onion maggot damage of transplanted and direct seeded yellow cooking onion breeding lines at Kettleby/Bradford, Ontario in 1993.

	Transplanted			Direct Seeded		
Treatment	First Generation	Harvest* Assessment	Total* Damage	First Generation	Harvest Assessment	Total Damage
124-93	35.3a**	35.0abcd	56.3ab	56.5ijkl	16.0a	74.3a
114-93	37.7ab	51.3bcd	62.8abc	46.2e-l	29.7a	64.7a
123-93	43.3bcd	58.0bcd	73.8a-f	61.5kl	22.7a	87.3a
Norstar	44.4bc	45.5abcd	52.8a	49.6f-k	33.3a	82.0a
117-93	46.4b-e	37.5abcd	63.0a-d	51.4g-l	8.7a	74.3a
126-93	46.4b-g	69.5cd	74.8a-f	64.6l	58.3a	91.7a
W454	47.1b-f	34.8abcd	60.3abc	28.4bcd	28.0a	55.0a
1295-91	49.9b-h	8.0a	55.0ab	31.8b-f	15.7a	41.0a
102-93	53.1c-i	57.8bcd	73.5b-f	44.4d-k	18.3a	49.3a
118-93	53.5c-j	35.3abcd	67.8a-e	62.0kl	13.3a	88.0a
W459	57.6h-k	40.8abcd	76.3a-f	39.9d-i	31.3a	67.7a
1292-91	60.6h-l	47.5bcd	72.0a-f	24.6abc	9.7a	74.0a
W455	62.3i-m	23.5ab	69.5a-f	63.0l	33.3a	52.0a
W458	64.2k-n	31.0abc	76.3a-f	33.0c-g	30.3a	64.3a
116-93	65.5k-r	44.3abcd	81.0e-f	42.2d-j	14.3a	43.0a
W456	65.8k-o	59.0bcd	81.0c-f	13.6a	45.7a	43.0a
106-93	68.0k-p	72.3d	76.8c-f	59.0jkl	13.3a	84.0a
125-93	69.0k-q	31.0ab	76.0a-f	58.5jkl	16.0a	74.3a
107-93	72.8o-r	61.0bcd	85.3def	37.7d-h	28.3a	74.0a
W457	78.2pqr	65.0cd	85.3ef	16.7ab	41.7a	43.7a
105-93	81.5r	59.0bcd	91.5f	47.5e-l	35.3a	68.3a
Fortress	-	-	-	29.9bcde	22.7a	63.0a
LSD	7.7	30.7	15.7	10.9	-	-

* Harvest assessment was based on the number of bulbs with maggot damage in relation to the number of bulbs remaining at harvest. Total damage was based on the total cumulative number of plants damaged in relation to the original number of plants.

** Numbers in a column followed by the same letter are not significantly different at P=0.05, Protected L.S.D. Test. Data were subjected to an Arcsin transformation for analysis; untransformed data are presented in the table.

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#032

ICAR: 84100737

CROP: Onion, var. Copra, Corona, Prince
onion, bunching, var. Parade

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

NAME AND AGENCY:
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TITLE: INSECTICIDE SEED COATINGS FOR ONION MAGGOT CONTROL

MATERIALS: TRIGARD 75% (cyromazine), LORSBAN 480 g/L (chlorpyrifos), DYFONATE 250 g/L (fonofos), FORCE 18% (tefluthrin), ONCOL 40% (benfuracarb), CARBATHIIN, THIRAM, DITHANE M45 (mancozeb).

METHODS: The tests were done at the Holland Marsh on muck soil. The onion and bunching onion experiments were each arranged in a randomized complete block design with four replicates. Commercial film seed coatings (Bejo FILMKOTE) were provided by Bejozaden Ltd., Warmenhuizen, Holland. All seed plus DITHANE M45 (2.6 kg ai/ha) were applied in the furrow at planting time (May 7, 1993) by an Earthway precision garden seeder. Each plot of the onion experiment was two rows, 6 m long and 40 cm between the rows. Estimates for the effectiveness of treatments were made as follows: the number of plants in one row of each plot were counted for initial stand on June 9 and then examined June 10, 14, 17, 21, 24, 28, 30, July 2, 5, 8, and 12 for onion maggot damage. On each date plants wilting from onion maggot were counted and removed. On July 16, the remaining plants were pulled and examined for onion maggots. On August 24 the second row of plants were pulled and examined for onion maggots. The proportion of plants damaged by the onion maggot was used to estimate stand loss. The bunching onion experiment had rows 5 m long with 40 cm between the rows. Two-m section of each row was examined for onion maggot damage with accumulative counts twice weekly from June 10 to July 21. On each date plants wilting from onion maggot were counted and removed. On July 26, the remaining plants were pulled, examined for onion maggots.

RESULTS: Data are presented in Table 1.

CONCLUSIONS: In the first generation the commercial seed treatment of TRIGARD was more effective than either rate of DYFONATE and the higher rate of LORSBAN in controlling the onion maggot. FORCE and ONCOL was not satisfactory. The seed variety, Prince and Corona, had a lower maggot infestation than the seed Copra. The seed treatment on bunching onions was satisfactory and showed potential for the control of the onion maggot.

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Table 1. Initial onion plant, percent maggot damage, following the indicated seed treatment.

Seed Treatments	Rate (g ai/kg seed)	Initial plant count /6 m	% maggot damage/6 m* Gen. 1	% stand loss Gen. 1 & 2***
Onions (Copra)				
TRIGARD 75%	35	219	10.1f**	33.5e
TRIGARD 75%	25	296	6.2f	16.3fgh
LORSBAN 480 g/L	35	246	25.3de	34.8e
LORSBAN 480 g/L	30	271	26.6d	40.2de
LORSBAN 480 g/L	25	239	21.2def	38.2de
DYFONATE 250 g/L	35	211	19.8def	14.3gh
DYFONATE 250 g/L	25	170	28.8d	30.7ef
FORCE 18%	30	231	51.1bc	68.1abc
FORCE 18%	40	238	47.1c	61.7bc
ONCOL 40%	34	237	70.0a	68.7ab
LORSBAN 480 g/L (Corona)	30	178	16.5def	29.6efg
LORSBAN 480 g/L (Prince)	30	275	10.0ef	7.0h
untreated	-	169	68.5ab	56.1cd
raw seed + PRO GRO	-	217	58.8abc	78.9a
.				
Bunching onions				
LORSBAN 480 g/L	25	175	3.3****	
LORSBAN 480 g/L	35	183	2.7	
untreated		180	29.9	

* Accumulative counts June 10, 14, 17, 21, 24, 28, 30, July 2, 5, 8, 12 and 16. Based on 6 m, four replicates.
** Means followed by the same letter are not significantly different (P=0.05; LSD test).
*** 2nd generation, final count August 24.
**** Accumulative counts June 10, 14, 17, 21, 24, 28, 30, July 2, 5, 8, 12, 16, 21 and 26. Based on 2 m, four replicates.

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#033

ICAR: 84100737

CROP: Onion, var. Stokes Exporter II; Onion, var. Copra

PEST: Onion maggot, *Delia antiqua* (Meig.)
Onion smut, *Urocystis magica* Pass. Ap. Thüm

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TITLE: PESTICIDES FOR ONION MAGGOT AND ONION SMUT CONTROL

MATERIALS: Each of the following treatments was applied at different rates of application (see Table for rates of application): DYFONATE 10 G (fonofos), LORSBAN 15 G (chlorpyrifos), FORCE 15 G (tefluthrin), AZTEC 2.1 G (phosetbupirin 2.0% + cyfluthrin 0.1%), DYFONATE 431 g/L (fonofos), FORCE 200 g/L (tefluthrin), LORSBAN 480 g/L (chlorpyrifos), PRO GRO (carbathiin 30%, thiram 50%).

METHODS: The tests were done at the Holland Marsh on muck soil. The experimental plot was arranged in a randomized complete block design with four replicates. Each plot had two rows 6 m long with 40 cm between the rows. In addition to the granular pesticides applied with the seed, all seed was treated by shaking it with a dust formulation of PRO GRO at 25 g PRO GRO/kg seed. The granular formulations were applied in the furrow at planting time (May 6) by adding them with the seed on a V-belt planter. The LORSBAN and FORCE treatments were applied directly on the seed and then treated with the dust formulation of PRO GRO. The Copra seed was a commercial film seed coating by Bejozaden Ltd., Holland. Estimates of the effectiveness of treatments were made as follows: the number of plants in one row of each plot were counted for initial stand on June 8 and then examined June 10, 14, 17, 21, 24, 28, 30, July 2, 5, 8, and 12 for onion maggot damage. On each date plants wilting from onion maggot were counted and removed. On July 16, the remaining plants were pulled and examined for onion maggots. On June 22 and July 5, 50 plants, per replicate were removed to determine smut infection. The plants were rinsed with water to remove adhering dirt and then examined visually for smut symptoms. The second row was harvested on September 28 for yield.

RESULTS: Data are presented in Table 1.

CONCLUSIONS: With the high rate of infestation (93.4%), the LORSBAN granular was more effective than DYFONATE in controlling the onion maggot. The unregistered granular insecticide AZTEC was more effective in controlling the onion maggot than the registered insecticides. The commercial seed treatment of COPRA controlled the onion maggot infestation more effectively than the DYFONATE and FORCE seed treatment. Plants protected with the granular insecticides, AZTEC and LORSBAN, had the highest yields.

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

Treatments	Rate (kg ai/ha)	Initial plant count / 6 m	Maggot damage* (%)	Yield (kg/ha x 10^3)
LORSBAN 15 G	1.1	237	49.0cde**	64.4b
	2.2	226	23.1fg	77.4ab
DYFONATE 10 G	1.1	220	63.1bcd	25.8def
	2.2	192	65.4bc	40.7cd
FORCE 1.5 G (clay)	0.45	223	71.4b	23.3def
	0.6	234	60.0bcd	36.7cd
(gypsum)	0.6	233	40.1def	57.3bc
AZTEC 2.1 G	0.5	206	16.4g	78.2ab
DYFONATE S.T.***	0.02****	195	80.2ab	34.6de
	0.025****	204	66.2bc	23.3def
FORCE S.T.***	0.008****	228	81.5ab	22.6def
	0.010****	233	67.4ab	14.9ef
LORSBAN S.T.*****	0.030****	233	34.9efg	66.1b
LORSBAN S.T.***** + LORSBAN 15 G	0.030**** 1.1	216	29.5efg	91.1a
CHECK	-	215	93.4a	7.6f

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onion smut June 22 14.6% (Pro Gro treated seed), 44.1% (raw seed)
July 5 1.9% (Pro Gro treated seed), 12% (raw seed)

* Accumulative counts June 10, 14, 17, 21, 24, 28, 30, July 2, 5, 8, 12, and 13. Based on 6 m, four replicates.

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

*** ST = seed treated (Zeneca Agro).

**** kg ai/kg seed.

***** S.T. = commercial seed treatment, Copra (Bejozaden Ltd., Holland).

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#034

ICAR: 84100737

CROP: Onion, var. Benchmark

PEST: Onion maggot, *Delia antiqua* (Meig.)
Onion smut, *Urocystis magica* Pass. Ap. Thüm

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TITLE: PESTICIDES FOR ONION MAGGOT CONTROL - PRECISION SEEDING

MATERIALS: Each of the following treatments was applied at 3 different rates of application: DYFONATE 10 G (fonofos); LORSBAN 15 G (chlorpyrifos);
FORCE 1.5 G (tefluthrin); AZTEC 2.1 G (phosetbupirin 2.0% + cyfluthrin 0.1%); PRO GRO (carbathiin 30%, thiram 50%).

METHODS: The tests were done at the Holland Marsh on muck soil. The experimental plot was arranged in a randomized complete block design with four replicates. Seed was custom-coated PRO GRO-treated seed. The granular formulations were applied by using a Stan-Hay precision seeder in a bed of four double rows 24 metres long on May 26, 1993. Each bed had three different rates of application of a granular treatment and an untreated row. On June 7 initial stand was based on the number of plants in each of two, two-m lengths in each row. The designated segments for the first generation were checked on June 10, 14, 17, 21, 24, 28, 30, July 2, 5, 8, 12 and 16, and damaged plants were counted and removed. On July 20, all plants were pulled from the same two, two-m segments in each row and plants examined for maggot damage. At the end of the second and third generation, all plants were pulled from the designated two, two-metre lengths in each row and plants were examined for maggot damage. On June 22 and July 5, fifty plants per replicate were removed to determine smut infection. The plants were rinsed with water to remove adhering dirt and then examined visually for smut symptoms. On September 28, five metres of onions of each row were harvested for yield.

RESULTS: Data are presented in Table 1.

CONCLUSIONS: The lower rates of the granular insecticide DYFONATE was not as effective as LORSBAN in controlling the infestation of the onion maggot. The unregistered insecticide AZTEC was more effective than FORCE at 0.6 kg ai/ha in controlling the onion maggot. By the end of the third generation, the accumulative damage of the onion maggot had increased for all treatments. The treatments with the lower plant loss were reflected in the higher yields. Overall, plants treated with AZETC had the highest yields.

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

Treatments	Rate kg ai/ha	Initial plant count /4 m	% Maggot damage Gen 1*	Stand loss Gen 1&2**	Stand loss Gen 1,2&3**	Yield (kg/ha x 10^3)
CHECK	0	190	46.8ab***	47.2abc	44.7bc	40.3c
LORSBAN 15G	1.1	192	18.3d	27.5cdef	26.2de	48.2bc
	2.2	191	12.7ed	23.7defg	20.0e	55.6bc
	4.5	179	9.1ed	9.5g	14.8e	63.4b
.						
CHECK	0	187	50.5a	50.1a	66.9a	52.2bc
DYFONATE 10G	2.2	183	41.1bc	45.9ab	55.6ab	44.4c
	4.5	172	16.6d	27.8cdef	35.9cd	43.7c
AZTEC 2.1G	0.5	201	6.2e	11.8fg	18.4e	81.4a
.						
CHECK	0	181	35.2c	40.1abcd	53.8ab	49.4bc
FORCE 1.5G	0.6	181	18.3d	31.0bcde	45.3bc	49.1bc
	0.75	192	11.9de	26.4def	30.8cde	50.2bc

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Onion Smut - 16.9% - 7.3% bulb, 9.6% leaf (June 22)
- 5.2% - 4.6% bulb, 0.6% leaf (July 5)

* Accumulative counts June 10,14,17,21,24,28,30, July 2,5,8,12,16, and 20.

** 1st and 2nd generation final count August 25, 1st, 2nd and 3rd generation final count September 23.

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

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#035

STUDY DATA BASE: 280-1252-9304

CROP: Onion, cooking, cv. Copra

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

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

MATERIALS: BAY NTN 33893 2.5G (imidacloprid); UBI 2627 175SD (175 g ai/L) (imidacloprid); TF 3765 200SD (200 g ai/L) (tefluthrin); FORCE 1.5G (tefluthrin); FORCE 18WP (tefluthrin); LORSBAN 15G (chlorpyrifos); LORSBAN 480E (480 g ai/L) (chlorpyrifos); DYFONATE 250E (250 g ai/L) (fonofos); ONCOL 40WP (benfuracarb); TRIGARD 75WP (cyromazine); methyl cellulose; talc.

METHODS: Commercial film seed coatings (Tmts. 1, 3, 4, 7-9) were applied by BEJOZADEN Ltd. in Warmenhuizen, Holland. Laboratory-applied seed treatments (Tmts. 2, 5, 6) were applied 10 May by tumbling cooking onion seed, moistened with 1% (w/v) methyl cellulose (Tmt. 2), or liquid insecticide (Tmts. 5, 6) with inert talc, until seeds were uniformly coated. All seed was planted in London on 10 May in 3-row microplots (2.25 m long x 0.9 m wide) filled with insecticide residue-free organic soil; all treatments were replicated three times in a randomized complete block design. Before the seed furrow was closed, granular insecticides were hand-applied, with a modified salt shaker, in a 2-3 cm band in the bottom of the furrow. Counts of newly emerged seedlings began 25 May and continued until 6 June. On 3 June a total of 250 OM eggs were buried 1 cm deep beside one onion row in each plot. The infested row was delineated by stakes and the number of onions counted. Infestations were repeated on 8 and 10 June. Surviving onions were counted four weeks after each infestation and percent loss calculated. Data were subjected to arcsin transformation prior to statistical analysis by ANOVA. Untransformed data are presented in Table 1.

RESULTS: See Table 1.

CONCLUSIONS: With the exception of tefluthrin, applied as a seed treatment at 30 g ai/ha, all treatments significantly reduced loss of onion seedlings to larvae emerging from introduced OM eggs. Best and most consistent control followed application, as seed treatments, of fonofos at 25.0 g ai/kg seed and imidacloprid at 35.0 g ai/kg seed; both proved at least as effective as furrow granular application of LORSBAN 15G, the commercial standard. In this experiment, application of any OM control measure significantly reduced emergence of seedlings.

RESIDUES: Samples of soil and onions for measurement of pesticide residues were collected from microplots for Treatments 5, 6, 9 and 12. Analyses are incomplete. Results of analyses of samples collected either at harvest or the following spring from microplots established at London in 1992 are shown in Table 2. No residues of either tefluthrin (detection limit 0.01 ppm) or imidacloprid (detection limit 0.31 ppm) were measured in onions at harvest. Imidacloprid soil residues from the treated furrow declined from 8.23 ppm at harvest to 4.21 ppm the following spring. Application of tefluthrin and imidacloprid, as seed treatments instead of furrow granular insecticides, significantly reduced residues of both insecticides remaining in the soil at harvest. Measured soil residues of tefluthrin, imidacloprid and cyromazine, applied as seed treatments, were all less than 1.0 ppm.

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

No.	Insecticide Treatment	Rate (g ai/ kg seed)	Mean % Seedling Emergence	Mean % Onion Stand Loss Infestation I	Infestation II	Infestation III
*1	TRIGARD 75WP	35.0	75.8 bc***	28.0 c	27.0 def	22.7 c
2	TRIGARD 75WP	50.0	75.2 bc	33.5 bc	29.6 de	25.4 c
*3	LORSBAN 480E	25.0	67.4 cd	5.7 d	10.5 efg	15.3 c
*4	DYFONATE 250E	25.0	76.0 bc	0.0 d	4.6 fg	4.3 c
5	UBI 2627 175SD	25.0	65.5 cd	37.6 bc	11.4 efg	19.2 c
6	UBI 2627 175SD	35.0	71.5 bcd	0.0 d	2.8 g	9.9 c
*7	ONCOL 40WP	34.0	59.2 d	1.8 d	20.5 efg	40.6 bc
*8	FORCE 18WP	30.0	76.0 bc	41.9 bc	75.0 ab	65.4 ab
*9	FORCE 18WP	40.0	77.6 bc	27.1 c	45.4 cd	27.6 c
10	FORCE 1.5G**	2.25	77.3 bc	49.8 b	55.3 bc	33.0 bc
11	LORSBAN 15G**	4.8	80.9 b	6.0 d	17.3 efg	3.4 c
12	CONTROL	---	94.2 a	98.9 a	95.7 a	89.7 a

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

Table 2. Pesticide residues measured in soil and onion samples collected from microplots established at London, ON in 1992.

No	Insecticide Treatment	Rate (g ai/ 100 m)	Measured Residues (ppm) Soil (Harvest '92)	Onion (Harvest '92)	Soil (Spring '93)
1	FORCE 1.5G	2.25	1.59	<0.01	ND**
2	TF 3765 200SD*	20.0	0.49	<0.01	ND
3	NTN 33983 2.5G	1.50	ND	ND	1.70
4	NTN 33893 2.5G	3.00	8.23	<0.31	4.21
5	UBI 2627 175SD*	10.5	0.85	<0.31	0.58
6	TRIGARD 75WP*	50.0	0.42	ND	ND

* Seed treatment applied as g ai/kg seed;
** Samples not taken.

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#036

ICAR: 84100737

CROP: Onion, var. Benchmark

PEST: Onion thrips, *Thrips tabaci*

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TITLE: INSECTICIDE FOLIAR TREATMENT TO CONTROL THRIPS ON ONIONS

MATERIALS: DIAZINON 500 EC, RIPCORD 400 EC (cypermethrin), DECIS 5.0 EC (deltamethrin).

METHODS: The tests were done at the Holland Marsh on muck soil. Onions were planted with a Stan-Hay precision seeder in a bed of four double rows. The experimental plot was arranged in a randomized complete design. The plots were two beds, 7 m long, replicated four times. The treatments were applied at 353 L of liquid/ha with an Enti 3200 high clearance sprayer with solid cone spray nozzles at 433 kPa on August 17, 1993. The thrips population was assessed by examining ten onions in each plot. Nymphs and adults were counted on each leaf and the leaf was stripped to count thrips in the leaf axil.

RESULTS: As presented in the table.

CONCLUSIONS: DECIS was as effective as RIPCORD in controlling the onion thrips. DIAZINON was not as efficacious as the pyrethroid treatments.

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

Treatments	Rate g/ai/ha	Mean number of thrips per plant: pre-application* N	A	days after application 2 N	2 A	6 N	6 A
Decis 5 EC	10	12.9a**	1.1b	3.6b	0.0b	6.7b	0.2b
Decis 5 EC	12.5	13.1a	0.9b	3.1b	0.0b	6.7b	0.1b
Ripcord 400 EC	70	18.5a	1.7b	4.3b	0.0b	5.0b	0.1b
Diazinon 500 EC	750	15.5a	3.4a	11.6b	0.2b	29.7a	0.5b
Control	-	14.9a	2.4ab	30.4a	1.8a	38.9a	1.3a

* Count August 9.
** Means followed by the same letter are not significantly different (P=0.05; LSD test).

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#037

STUDY DATA BASE: 1252-352-8501

CROP: Sweet pepper, cv. Jupiter Stirling

PEST: Green peach aphid, *Myzus persicae* (Sulzer)

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TITLE: CONTROL PROGRAMMES FOR APHIDS, WITH EFFECTS ON YIELD

MATERIALS: PIRIMOR 50 #WG (pirimicarb)

METHODS: Plots consisting of four rows of ten plants, replicated four times, were transplanted on June 3, 1993. Aphid activity was determined by examining ten leaves per plot at weekly intervals. The first leaf exceeding 5 cm in length behind a terminal was selected at random from plants from the two centre rows of each plot. The number of aphids per leaf was counted if less than 50. The proportions of leaves(P) having not more than (t)= 10, 20, 30, 40, or 50 and more than 50 aphids was recorded so that the various values of t could be compared as criteria for spraying for aphid control. Based on previously-obtained data, various values of P (t=10) were chosen as thresholds for this experiment(see tables). Sprays of pirimicarb at 425 g ai/ha were applied with a Rittenhouse SBR-2P backpack power sprayer, applying insecticides in 660 L/ha water. Peppers were harvested on 7 dates from August 5 to September 27; on the last date all immature peppers also were harvested. Data were analyzed using SAS ANOVA and means separated using Duncan's Multiple Range test at the 0.05 level of significance.

RESULTS: Results of aphid counts and yields are presented in tables. Aphid populations declined rapidly in the latter part of July probably due to fungal pathogens.

CONCLUSIONS: Only the treatment receiving two applications of pirimor (#1) had yields significantly different from untreated plots on all harvesting dates. Although treatments 2 and 3 with one application were not significantly different from the check, their yields were not significantly worse than plots treated twice, indicating that one application properly timed may be acceptable for aphid control. By late September, yields no longer were influenced by aphid injury. The results suggest that aphid counts based on proportions of leaves having no more than selected levels of infestation would be useful in aphid management.

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Table 1. Proportion of leaves having 10 or fewer aphids on indicated dates at Jordan Station, Ontario, 1993.

Threshold for spraying P(t=10):	(1) 92	(2) 78	(3) 48	(4) Check
June 29	97.5*	90	97.5	95
July 6	100	67.5**	72.5	70.7
July 9	-	-	52.5	52.5
July 13	80**	100	10**	22.5
July 16	100	90	100	37.5
July 20	100	97.5	100	47.5
July 27	97.5	95	100	100

* Threshold modified for this date only.
** Indicates aphid count creating decision to apply spray.
Spray dates: (1) June 30, July 13; (2) July 7; (3) July 13.

Table 2. Cumulative yield units of pepper fruit in mean whole numbers of fruit per plot* on indicated dates.

Threshold for spraying P(t=10):	(1) 92	(2) 78	(3) 48	(4) Check
August 5	76a	64ab	50ab	36b
August 13	112a	107a	83ab	58b
August 19	132a	124a	97ab	66b
August 27	153a	140ab	118abc	80bc
September 7	189a	168ab	153abc	106bc
September 20	198a	180ab	167ab	119b
September 27	219a	199ab	189ab	148ab
September 27**	237a	219ab	210ab	200ab

* For each date, means followed by the same letter are not significantly different according to a Duncan's Multiple Range Test ($P < 0.05$).
** Includes all immature fruit present on September 27.

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#038

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

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

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TITLE: A COMPARISON OF NOZZLE TYPES IN CONTROLLING THE COLORADO POTATO BEETLE

MATERIALS: M-TRAK (delta endotoxin of *Bacillus thuringiensis* var. *san diego* encapsulated in killed *Pseudomonas fluorescens* (10%)).

METHODS: Plots consisted of four 7.3 m long rows spaced 0.9 m apart. There were four sets of plots. The sets were planted at 41 cm spacing on the following dates: set 1 on May 18, sets 2 and 3 on May 19, and set 4 on May 24. There were different sets to determine if potato plant size had any effect on the relative performance of the two nozzle types. This report is condensed from a trial with two treatments (nozzle types) and six subtreatments (various nozzle arrangements). Subtreatments were replicated four times per set in randomized block designs. Half of each plot was sprayed with disc and core nozzles (Tee Jet D4-45) and the other half with extended range nozzles (Tee Jet 8006). In this report only the treatments are discussed, thus treatments were replicated 24 times. The sets were sprayed on the following dates: set 1 on July 7, sets 2 and 3 on July 13, and set 4 on July 19. Treatments were applied using a tractor mounted sprayer operating at 380 kPa with extended range nozzles and 1210 kPa with the disc and core nozzles. The mean nozzle flow rate was 1.4 L/min for both types of nozzle. Tractor speed was 6.1 kph. M-TRAK was applied at 7.5 L/ha of product. The application volume was 905 L/ha. The number of larvae on five randomly chosen plants in the two outside rows of each plot were counted the afternoon of the day before the sprays. Sprays were applied in the morning. The efficacy of the treatments was assessed by post-spray counts on July 9 (Set 1), July 16 (Sets 2 and 3), and July 23 (Set 4).

RESULTS: Treatment means are presented in the table.

CONCLUSIONS: Extended range nozzles provided consistently better control of Colorado potato beetle larvae than the disc and core nozzles. Thus, plant size had no effect on the relative performance of the two nozzle types. The number of Colorado potato beetle larvae per five plants averaged 129 with the extended range nozzles and 143 with the disc and core nozzles. Thus, the extended range nozzles reduced populations of larvae by 9.8% more than the disc and core nozzles did. Therefore, replacing the traditional disc and core nozzles with the extended range nozzles which produce less drift, would not reduce the level of protection from the Colorado potato beetle larvae.

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

Nozzle type	Set 1		Set 2		Set 3		Set 4	
	Pre-Spray	Post-Spray	Pre-Spray	Post-Spray	Pre-Spray	Post-Spray	Pre-Spray	Post-Spray
Disc and Core	124	141	246	210	147	96	222	129a
Extended Range	124	129	224	200	152	84	194	102b

* Figures are the means of 24 replicates rounded off to the nearest whole number. Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test ($P<0.05$).

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#039

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

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

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TITLE: BIOLOGICAL, CHEMICAL, AND MECHANICAL CONTROL OF THE COLORADO POTATO BEETLE

MATERIALS: NOVODOR FC (3% *Bacillus thuringiensis* subsp *tenebrionis*), KRYOCIDE 96W (96% sodium fluoaluminate), TRIGARD 75WP (75% cyromazine), plastic (4 mil black mulching), BELMARK 300EC (fenvalerate), FURADAN 480F (carbofuran), GUTHION 240SC (azinphos-methyl).

METHODS: Plots consisted of four, 7.3 m long rows spaced 0.9 m apart. The plots were laid out in a completely randomized block design where each treatment was replicated four times. Potatoes were planted May 20 at 41 cm spacing. The trenches were hand dug, "V"-shaped, roughly 60 cm deep and 70 cm wide, with sides sloping 60-70 degrees. The inner edge of the trench was 90 cm from the plots. The trenches were lined with 4 mil black mulching plastic. The lengths of plastic in each trench were attached with hot glue. All insecticides were applied using a tractor mounted hydraulic sprayer operating at 1210 kPa. The application volume was 905 L/ha. The tractor speed was 6.1 kph. There were three disc and core (D4-45) nozzles per row on the straight boom of the hydraulic sprayer. The first sprays of the insecticides were on July 6. On July 12 the second sprays of TRIGARD (final spray), both KRYOCIDE treatments, and NOVODOR (every seven days) were applied. The second spray of NOVODOR (every ten days) was on July 16. The last sprays of the KRYOCIDE and NOVODOR (every seven days) treatments were on July 19. The last spray of NOVODOR (every ten days) was on July 26. The plots surrounded by the plastic lined trenches were sprayed with BELMARK (0.2 L product/ha) on July 20 and with GUTHION (3.6 L product/ha) on July 29 to protect the foliage so the tubers could bulk up. All plots were sprayed with GUTHION on August 4, 12 and 19, and with FURADAN (1.7 L product/ha) on August 9 to protect the foliage so the tubers could bulk up. The number of various life stages of the Colorado potato beetle (CPB) were counted weekly on 5 randomly chosen potato plants in the middle two rows of each plot. The defoliation rating for a plot was taken weekly as the defoliation of the potato plant with the maximum defoliation in that plot. The defoliation rating is explained in the first footnote of Table 1. The plots were topkilled on August 24 and the two middle rows of each plots were harvested on September 7.

RESULTS: The highlights of the treatment (and defoliation) means are presented in the Table 1.

CONCLUSIONS: The best treatment for protecting foliage and marketable yield was three sprays of NOVODOR (7.0 L/ha) applied at seven day intervals. This spray schedule was more effective, over the whole season, than (in descending order): three sprays of KRYOCIDE (13.5 kg/ha), plastic lined trenches, three sprays of KRYOCIDE (11.4 kg/ha), three sprays of NOVODOR (7.0 L/ha) applied at ten day intervals, two sprays of NOVODOR (4.7 L/ha) plus one spray of KRYOCIDE (11.4 kg/ha) applied at seven day intervals, three sprays of NOVODOR (4.7 L/ha) applied at seven day intervals, and two sprays of TRIGARD applied at seven day intervals. The TRIGARD and NOVODOR (4.7 L/ha) treatments resulted in plots that had mean marketable yields that were not significantly different from the untreated check plots. This does not mean that TRIGARD or NOVODOR (4.7 L/ha) are ineffective but that the usual number of sprays of TRIGARD and this rate of NOVODOR did not give long term control of the CPB. In the short term, both treatments were effective. The yields in this experiment were low because the period of CPB defoliation extended beyond the experimental spray period and because the CPB population had some resistance to BELMARK, FURADAN and GUTHION which were applied in an attempt to protect the foliage so the tubers could bulk up. The two rates of KRYOCIDE gave similar levels of foliage and marketable yield protection compared to each other and compared to NOVODOR at 7.0 L/ha at either seven or ten day intervals. The treatment of two sprays of NOVODOR (4.7 L/ha) and one spray of KRYOCIDE (11.4 kg/ha) applied at seven day intervals was between NOVODOR (4.7 L/ha) and KRYOCIDE (11.4 kg/ha), in terms of foliage and marketable yield protection; these differences were not significant. KRYOCIDE (13.5 kg/ha) was the most effective treatment at reducing the number of CPB larvae. Trenched plots had higher CPB populations and defoliation levels in mid- to late-season than the pesticide treated plots but marketable yields were comparable. This may be due to the delay in colonization by CPB adults, caused by the trenches, allowing the potato plants to become vigorous enough to overcome subsequent damage. Many CPB adults present on the potato plants in the trenched plots emerged from within the plots. If this experiment had been conducted in a field where potatoes had not been present the year before, the yields in the trench plots likely would have been even larger than observed this year.

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Table 1. The mean number of Colorado potato beetles per five potato plants (and mean defoliation rating) for each treatment.*

Treatment**	First Instars	Second Instars		Fourth Instars		Yield (t/ha)	
	Jul 5	Jul 12	Jul 19	Jul 19	Jul 26	Mark'bl	Total
Plastic lined trench	14.5 (1)	53.8a (2)	17.5 (3)	127.0a (3)	87.8a (3)	7.1ab	15.2a
NOVODOR 4.7 L/ha	35.8 (2)	27.8ab (2)	29.8 (1)	19.0b (1)	43.3ab (1)	4.7abc	15.6a
NOVODOR 7.0 L/ha	56.3 (1)	31.8ab (2)	2.8 (1)	22.0b (1)	25.5b (1)	8.2a	18.5a
NOVODOR 7.0 L/ha (10)	28.5 (2)	7.0b (2)	26.5 (2)	7.3b (2)	45.0ab (2)	5.9ab	14.6a
NOVODOR/KRYOCIDE***	43.8 (2)	35.5ab (2)	25.0 (1)	16.8b (1)	48.5ab (2)	5.7ab	14.2a
TRIGARD****	48.3 (1)	43.0ab (2)	9.0 (2)	19.8b (2)	41.0ab (2)	2.2abc	13.2a
KRYOCIDE 11.4 kg/ha	44.3 (1)	9.5b (2)	17.5 (1)	22.0b (1)	18.8b (1)	6.6ab	16.8a
KRYOCIDE 13.5 kg/ha	26.0 (1)	13.0b (2)	1.0 (1)	8.0b (1)	3.5b (1)	7.6ab	17.3a
Untreated check	34.0 (2)	54.8a (3)	4.8 (>3)	150.3a (>3)	50.5ab (>3)	0.0c	0.3b

* Figures are the means of four replicates. Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P<0.05). Defoliation rating (on a per plot basis; mean of four replicates rounded to nearest whole number): 0) no defoliation; 1) some leaflets with holes; 2) some leaflets consumed, a few bare petioles; 3) 50% of one stem defoliated; >3) more than 50% of one stem defoliated.

** All insecticide treatments had seven days between sprays, except NOVODOR 7.0 L/ha (10) which had ten days between sprays. All insecticide treatments had 3 sprays, except for the TRIGARD treatment which had two sprays. Treatments are listed in L or kg of product /ha.

*** Two sprays of NOVODOR (4.7 L product/ha) then one spray of KRYOCIDE (11.4 kg product/ha) applied at seven day intervals.

**** The first spray was 373 g product/ha, the second spray was 187 g product/ha, applied at seven day intervals.

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#040

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

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

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TITLE: CHEMICAL CONTROL OF THE COLORADO POTATO BEETLE

MATERIALS: BAY NTN 33893 240FS, BAY NTN 33893 2.5G, THIMET (phorate)

METHODS: Plots consisted of four, 7.3 m long rows spaced 0.9 m apart. The plots were laid out in a randomized block design where each treatment was replicated four times. Potatoes were planted May 27 and 28 at 41 cm spacing. On May 27 and 28 the in-furrow NTN FS treatments were applied using a CO_2 pressurized backpack sprayer set at 415 kPa equipped with a single extended range nozzle (8002VS). The application volume was approximately 700 L/ha at 4.3 kph. NTN G and THIMET were applied using a conveyor belt fertilizer applicator on May 27. On July 16 and August 12 the foliar NTN FS treatments were applied using a hydraulic tractor mounted sprayer operating at 1210 kPa. The application volume was 905 L/ha. The tractor speed was 6.1 kph. There were three disc and core nozzles (D4-45) per row on the boom of the hydraulic sprayer. The number of various life stages of the Colorado potato beetle (CPB) were counted weekly on five randomly chosen plants in the middle two rows of each plot. In plots where there were fewer than five plants in the middle two rows the five plants were randomly chosen from the entire plot. The defoliation rating from a plot was taken weekly as the defoliation of the potato plant with the maximum defoliation in that plot. The defoliation rating is explained in the first footnote of Table 2. The plots were topkilled on August 31 and all the rows in each plot were harvested on September 8.

RESULTS: The treatment means are presented in Tables 1 and 2. There were two replicates in the 0.02, 0.03, 0.066 and 0.098 g/m NTN FS treatments due to over application in two replicates in both the 0.02 and 0.03 g/m treatments.

CONCLUSIONS: The length of effectiveness, from application, against CPB adults was: ten weeks for the 0.03 g/m NTN FS applied in-furrow, six weeks for the other in-furrow NTN FS treatments, five weeks for THIMET, and two weeks for the two foliar NTN FS treatments. Thus NTN FS applied in-furrow had at least three times the effective lifetime than foliar applied NTN FS against CPB adults. The length of effectiveness, from application, against CPB larvae was 13 weeks for 0.02, 0.03, 0.066 and 0.098 g/m NTN FS applied in-furrow, eight weeks for 0.02 g/m NTN G, six weeks for 0.01 g/m NTN FS applied in-furrow, and four weeks for the first application of both rates of the foliar applied NTN FS and two weeks for the second. THIMET had lost its effectiveness by the time the larvae were present. Thus in-furrow applied NTN FS had 2.5-6.5 times the effective period of foliar applied NTN FS against CPB larvae. In terms of protecting foliage from CPB defoliation the NTN G treatment was the best treatment, followed by the 0.03 g/m NTN FS applied in-furrow, then the 0.098 and the 0.066 g/m NTN FS applied in-furrow, the 25 g/ha NTN FS foliar applied, the 0.02 g/m NTN FS applied in-furrow, the 50 g/ ha NTN FS foliar applied, the 0.01 g/m NTN FS applied in-furrow, THIMET and the untreated check. All NTN formulations, application methods and rates resulted in similar total weight yields, all of which were superior to the untreated check yield, but only the 0.066 and 0.098 g/m NTN FS applied in-furrow treatments resulted in yield significantly greater than that of the untreated check. THIMET resulted in a total weight yield that was no better than that of the untreated check.

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

Treatment**	Egg Masses 05/07	Second Instars 13/07	Third Instars 20/07	Fourth Instars 17/08	Adults 23/08	Yield
NTN 33893 FS 0.010 g/m	0.5a	0.0a	8.0a	79.0a	21.3ab	30.6abcd
NTN 33893 FS 0.020 g/m	0.0a	0.0a	0.0a	58.0ab	14.0a	34.6abc
NTN 33893 FS 0.030 g/m	0.5a	0.0a	0.0a	0.0c	15.0a	28.8abcd
NTN 33893 FS 0.066 g/m	0.0a	0.0a	0.0a	1.0c	13.0a	38.5ab
NTN 33893 FS 0.098 g/m	0.0a	0.0a	0.0a	20.0bc	4.0a	40.7a
NTN 33893 G 0.020 g/m	0.0a	0.0a	3.5a	10.7c	15.0a	23.4bcd
NTN 33893 FS 25 g/ha	2.8ab	42.8ab	0.5a	1.3c	7.0a	31.5abcd
NTN 33893 FS 50 g/ha	5.8bc	46.3ab	0.3a	5.5c	10.3a	25.0abcd
THIMET 3.69 kg/ha	1.8ab	9.5ab	35.0a	6.0c	57.3b	15.3d
Untreated check	8.8c	58.3b	79.0b	44.8abc	60.5b	18.9cd

* Figures are the means of four replicates (two in the 0.02, 0.03, 0.066 and 0.098 g/m NTN 33893 FS treatments and three in the NTN 33893 treatment on 05/07, 17/08 and 23/08). Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P<0.05).

** In-furrow NTN 33893 FS treatments are in g/m; foliar applied NTN 33893 FS treatments are in g/ha. All treatments are listed in g or kg ai/m or ha.

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

Treatment**	June	July				August				
	28	5	13	20	27	4	10	17	23	30
NTN 33893 FS 0.010 g/m	1	1	1	1	1	1	1	2	3	3
NTN 33893 FS 0.020 g/m	1	1	1	1	1	2	1	2	2	2
NTN 33893 FS 0.030 g/m	1	1	1	1	1	1	1	1	2	2
NTN 33893 FS 0.066 g/m	1	1	1	1	1	1	1	2	2	2
NTN 33893 FS 0.098 g/m	0	1	1	1	1	1	1	2	2	2
NTN 33893 G 0.020 g/m	1	1	1	1	1	1	1	1	2	2
NTN 33893 FS 25 g/ha	1	1	1	2	1	1	1	1	2	2
NTN 33893 FS 50 g/ha	1	1	2	2	1	1	1	1	2	3
THIMET 3.69 kg/ha	1	1	1	1	2	2	2	3	3	3
Untreated check	1	1	1	2	3	3	3	3	3	3

* Figures are the means of four replicates (two in the 0.02, 0.03, 0.066 and 0.098 g/m NTN 33893 FS treatments and three in the NTN 33893 G treatment before July 13 and after August 10) rounded to the nearest whole number. Defoliation rating (on a per plot basis): 0) no defoliation; 1) some leaflets with holes; 2) some leaflets consumed, a few bare petioles; 3) 50% of one stem defoliated.

** In-furrow NTN 33893 FS treatments are in g/m; foliar applied NTN 33893 FS treatments are in g/ha. All treatments are listed in g or kg ai/m or ha.

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#041

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

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

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TITLE: CONTROL OF THE COLORADO POTATO BEETLE WITH NEMATODES AND STRAW MULCH

MATERIALS: Nematodes (*Steinernema carpocapsae* All strain), BELMARK 300EC (fenvalerate), THIODAN 400EC (endosulfan), FURADAN 480F (carbofuran), GUTHION 240SC (azinphos-methyl).

METHODS: Plots consisted of four 7.3 m long rows spaced 0.9 m apart. The plots were laid out in a split-plot design, with two main treatments (straw spread over plots after application of the nematodes and BELMARK, and no straw mulch present), three subplot treatments, replicated four times plus four single plots (early straw treatment) where straw was applied June 18 when the potato plants were 10 cm tall. Potatoes were planted May 25 at 41 cm spacing. Foliar application of BELMARK and soil application of the nematodes were made on July 14 between 8 and 9 pm. The plots to be treated with nematodes had water (roughly 2700 L/ha) sprayed on them with a tractor mounted sprayer before and again after the application of the nematodes. Nematodes were applied at a rate of 6.4 billion/ha using a CO_2 pressurized backpack sprayer equipped with a single extended range nozzle (Teejet 8002VS) set at 140 kPa. The application volume was approximately 200 L/ha at an application speed of 4.3 kph. BELMARK was applied at 0.2 L product/ha using a tractor mounted sprayer operating at 1210 kPa. The application volume was 905 L/ha. The tractor speed was 6.1 kph. There were three disc and core nozzles (Teejet D4-45) per row on the straight boom of the hydraulic sprayer. All plots were sprayed with THIODAN (1.4 L product/ha) on July 26, FURADAN (1.7 L product/ha) on August 9, GUTHION (3.6 L product/ha) on August 12 and 19 to protect the foliage against adult beetles so the tubers could bulk up. The number of various life stages of the Colorado potato beetle (CPB) were counted weekly on five randomly chosen potato plants in the middle two rows of each plot. The plots were topkilled on August 24 and the middle two rows of each plot harvested on September 7.

RESULTS: Treatment means are presented in Table 1.

CONCLUSIONS: Early straw mulching resulted in fewer CPB fourth instars and delayed their peak incidence (Table 1). The early straw mulch likely insulated the soil in these plots delaying the emergence of the overwintered adults, from within these plots, and thus the peak of the fourth instar larvae. Table 1 also shows that the fourth instar larvae were present for a long period. The nematodes with straw mulch treatment resulted in lower CPB adult emergence, compared to the two check treatments, for a short period. Therefore more than one application of the nematodes is necessary against a population of fourth instars that is present for extended periods. Straw mulch applied alone at the same time as the nematodes resulted in fewer late-season CPB adults than the nematodes applied alone. Early straw mulching resulted in fewer late-season CPB adults than nematodes, or than BELMARK applied against a CPB population known to be somewhat resistant to BELMARK. The low total yield in this experiment was a result of late potato plant development and because population has some resistance to THIODAN, FURADAN and GUTHION. In terms of total yield the early straw mulching is the best treatment, followed by the BELMARK with and without straw mulching, then by the nematodes with straw mulching, then by the check with and without straw mulching, and last by the nematodes without straw mulching.

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Table 1. The mean number of fourth instars and adult Colorado potato beetles per five plants and the mean marketable yield in T/ha.*

Treatment	Fourth instar larvae			Adults		Total Yield
	14/07	20/07	28/07	04/08	09/08	(t/ha)
Check straw	138.3a	125.5a	51.5a	16.0	87.3abc	4.6
Check no straw	95.3ab	139.5a	105.3b	22.8	151.0a	4.4
NEMATODES straw	94.3ab	110.8a	47.0a	5.3	61.0c	5.5
NEMATODES no straw	79.0ab	158.8a	77.5ab	38.8	143.0ab	2.7
BELMARK straw	107.3a	112.3a	43.3a	7.5	41.5c	6.3
BELMARK no straw	73.8ab	108.3a	63.8a	14.5	84.8abc	7.5
Early straw	34.5b	52.5b	73.8ab	1.0	19.0c	10.4

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

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#042

CROP: Potato, cv. Chieftain

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

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

MATERIALS: TRIGARD 75WP (cyromazine); RIPCORD 400EC (cypermethrin); GUTHION 240SC (azinphos-methyl); THIODAN 400EC (endosulfan)

METHODS: The test site was located near Thedford, Ontario. Potato seed pieces were planted on May 10, 1993 into rows spaced 0.91 m apart with a plant spacing of 30 cm. Plots were 6 m long and three rows wide. Each treatment was replicated four times in a completely randomized block design. Applications of insecticides were made on the following dates (Schedule No.): 17 June (1), 24 June (2), 1 July (3), 8 July (4). See the results table for the application dates for each treatment. With the emergence of second generation adults a maintenance program consisting of RIPCORD and GUTHION was applied to all plots except those of CHECK 1 for the remainder of the season as needed. This was done to isolate the effect of the first generation of insects. The effect of the second generation on defoliation and yield was not measured, however, due to severe erosion experienced during heavy rains in late July and August. All insecticides were applied using a CO2 pressurized 3 m hand boom sprayer with XR11002VS flat fan tips delivering 400 L/ha at 345 kPa. Evaluation data were collected on 23, 29 June, 7, 14 July. On each date the total numbers of CPB egg masses, 1st, 2nd, 3rd, and 4th instars, and adults were counted from ten plants in the middle row of each plot. Percent defoliation due to feeding was visually assessed using the middle row of each plot on 14 July.

RESULTS: As presented in Table 1.

CONCLUSIONS: Variability was high within treatments as is expected with insects in small plot trials. No treatment affected the egg hatching of the potato beetle. Small larvae were affected in so much as they did not progress to become large larvae but counts of small larvae showed no significant differences between treatments. Large larvae counts showed no significant differences until the fourth evaluation. TRIGARD at 280 g ai/ha did not persist to prevent small larvae from progressing to large larvae; TRIGARD at 70 g ai/ha applied twice at seven day interval did not persist. Any treatment with two (or three) applications of TRIGARD at 140 g ai/ha (or more) tended to have lower numbers of large larvae. These larval counts are reflected in lower defoliation ratings for any treatment with two (or three) applications of 140 g ai/ha (or more) of TRIGARD. Although not significantly different the best treatments on a numerical basis have an early application of 280 g ai/ha of TRIGARD followed by another application of TRIGARD. All treatments with two or more applications of TRIGARD $ 140 g ai/ha performed equal to or better than the "Commercial Standard" Treatment.

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

TREATMENT	RATE g ai/ha	SCHEDULE**	CPB LARVAE COUNTS*/10 PLANTS July 7/93 LL	CPB LARVAE COUNTS*/10 PLANTS July 14/93 L	% DEFOLIATION July 14/93
1. CHECK 1	--	--	23ab	86c	55
2. CHECK 2	--	--	39b	58abc	46
3. TRIGARD	280	2	13a	67bc	23
4. TRIGARD	70	2,3	10a	39abc	21
5. TRIGARD	140	2,3	10a	14a	6
6. TRIGARD	280, 140	2,3	2a	10a	8
7. TRIGARD	280	2,3	3a	10a	6
8. TRIGARD	280;	2			
	140	3,4	5a	5a	6
9. GUTHION	360;	1;			
TRIGARD	280, 140	2,3	6a	7a	9
10.GUTHION	360;	1;			
RIPCORD	35;	2;			
THIODAN	560;	3;			
GUTHION	360	4	7a	40abc	17

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

** See text for spray dates.

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#043

CROP: Potato, cv. Superior

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

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

MATERIALS: TRIGARD 75WP (cyromazine); RIPCORD 400EC (cypermethrin); GUTHION 240SC (azinphos-methyl); THIODAN 400EC (endosulfan).

METHODS: The test site was located near Cambridge, Ontario. Potato seed pieces were planted on May 11, 1993 into rows spaced 0.91 m apart with a plant spacing of 30 cm. Plots were 6 m long and three rows wide with a buffer row between each plot. Each treatment was replicated four times in a completely randomized block design. Insecticide applications were made on the following dates (Schedule No.): 28 June (1 & 2), 6 July (3), and 13 July (4). See the results table for the application dates for each treatment. With the emergence of second generation adults a maintenance program consisting of RIPCORD and GUTHION was applied to all plots except those of CHECK 1 for the remainder of the season as needed. This was done to isolate the effect of the first generation of insects. All treatments were applied using a CO2 pressurized 3 m hand boom sprayer with XR11002VS flat fan tips delivering 400 L/ha at 345 kPa. Evaluation data were collected on 5, 12, and 19, July. On each date the total numbers of CPB egg masses, 1st, 2nd, 3rd, and 4th instars, and adults were counted from ten plants in the middle row of each plot. Percent defoliation due to feeding was visually assessed using the middle row of each plot on 23 July. The plots were harvested, weighed and graded on 25 August. Tubers with diameters from 55 - 85 mm were graded as "marketable" (MKT). Total yield was the weight of all tubers including "off types".

RESULTS: As presented in Table 1.

CONCLUSIONS: Variability was high within treatments as is expected with insects in small plot trials. None of the treatments appears to have affected the egg hatching of the Colorado potato beetle as shown by the lack of significant differences between treatments in numbers of small larvae on the July 12 evaluation date. All TRIGARD treatments significantly reduced the numbers of large larvae after two applications by preventing small larvae from progressing through the growth stages. TRIGARD at 70 g ai/ha applied twice at a seven day interval did not persist to reduce large larvae numbers two weeks after the second application, (July 19 evaluation). Treatments with early applications of TRIGARD at 280 g ai/ha showed good larval control, defoliation, and yield results. The best treatments were: two applications of TRIGARD at 280 g ai/ha with a seven day interval;

and three applications of TRIGARD at 280, 140, 140 g ai/ha at weekly intervals.

The lack of significant differences between the two Check treatments shows that the first generation of larvae caused most of the damage shown in the defoliation rating and yield reduction.

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Table 1. A comparison of counts of 1st and 2nd instars (SL) and 3rd and 4th instars (LL) of the Colorado potato beetle (CPB) treated with different insecticides, percent defoliation, and yield. Cambridge, Ontario, 1993.

TREATMENT	RATE g ai/ha	SCHEDULE**	CPB LARVAE COUNTS*/10 PLANTS July 5 LL	July 12 SL	July 12 LL	July 19 LL	% DEFOL July 23	YIELD* kg/PLOT MKT	TOTAL
1. CHECK 1	---	---	85b	104b	200c	55c	49	13c	15c
2. CHECK 2	---	---	104b	67ab	202c	84c	50	16bc	18bc
3. TRIGARD	280	2	1a	22ab	10ab	6ab	6	27ab	29ab
4. TRIGARD	70	2,3	17a	69ab	33ab	48bc	15	20abc	22abc
5. TRIGARD	140	2,3	8a	25ab	10ab	8ab	6	20abc	22abc
6. TRIGARD	280, 140	2,3	4a	27ab	1a	2ab	5	28ab	30ab
7. TRIGARD	280	2,3	1a	4a	1a	1ab	4	31a	33a
8. TRIGARD	280;	2							
	140	3,4	0a	34ab	1a	0a	3	29a	31a
9. GUTHION	360;	1;							
TRIGARD	280, 140	2,3	3a	19ab	1a	0a	3	25ab	27abc
10. GUTHION	360;	1;							
RIPCORD	35;	2;							
THIODAN	560;	3;							
GUTHION	360	4	14a	22ab	118bc	85c	17	26ab	28ab

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

** See text for spray dates.

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#044

CROP: Potato, cv. Chieftain

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

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

MATERIALS: TRIGARD 75WP (cyromazine); RIPCORD 400EC (cypermethrin); GUTHION 240SC (azinphos-methyl); THIODAN 400EC (endosulfan).

METHODS: The test site was located near Alliston, Ontario. Potato seed pieces were planted on May 07, 1993 into rows spaced 0.91 m apart with a plant spacing of 30 cm. Plots were 6 m long and three rows wide with a buffer row in between each plot. Each treatment was replicated four times in a completely randomized block design. Applications of insecticides were made on the following dates (Schedule No.): June 29 (1,2), July 10 (3) and July 16, 1993 (4). See the results tables for the schedules for each treatment. With the emergence of second generation adults a maintenance program consisting of RIPCORD and GUTHION was applied to all plots except those of CHECK 1 for the remainder of the season as needed. This was done to isolate the effect of the first generation of insects. All treatments were applied using a CO2 pressurized 3 m hand boom sprayer with XR11002VS flat fan tips delivering 400 L/ha at 345 kPa. Evaluation data were collected on June 29, July 8, 15 and 22, 1993. On each date the total numbers of CPB egg masses, 1st, 2nd, 3rd, 4th instars, and adults were counted from ten plants in the middle row of each plot. Percent defoliation due to feeding was visually assessed on July 15 and July 22, 1993. The plots were harvested, weighed and graded on August 26, 1993. Tubers with diameters from 55-85 mm were graded as "marketable".

RESULTS: As presented in Tables 1 and 2.

CONCLUSIONS: Nine days after applications one and two, there were no significant differences in the numbers of small larvae among the treatments, with an average of 123 small larvae on ten plants. However, TRIGARD treatments did show a significant reduction in the numbers of large larvae. Therefore, TRIGARD appears to control Colorado potato beetles by inhibiting their development between successive larval stages. At the third evaluation, all TRIGARD treatments (with the exception of the 70 g ai/ha rates) performed significantly better than the check and standard. There was little difference in defoliation among the application rates of TRIGARD, with the exception of the 70 g ai/ha program, which did not perform as well. Yield data confirmed that most yield reduction was the result of feeding by the first generation of the pest. There were no significant yield differences among the TRIGARD treatments, all of which performed significantly better than the check.

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Table 1. A comparison of counts of 1st and 2nd instars (SL) and 3rd and 4th instars (LL) of the Colorado potato beetle (CPB) treated with different insecticides.

TREATMENT	RATE g ai/ha	SCHEDULE**	CPB LARVAE COUNTS/10 PLANTS* July 8 LL	July 15 SL	July 15 LL	July 22 SL	July 22 LL
1. CHECK 1	--	--	246b	160b	323c	58a	166c
2. CHECK 2	--	--	252b	23a	243bc	39a	122bc
3. TRIGARD	280	2	64a	48a	69a	55a	50ab
4. TRIGARD	70	2,3	188b	139ab	164ab	69a	119bc
5. TRIGARD	140	2,3	51a	104ab	72a	51a	42ab
6. TRIGARD	280,140	2,3	37a	29a	66a	75a	22ab
7. TRIGARD	280	2,3	43a	41a	58a	56a	15ab
8. TRIGARD	280;	2					
	140	3,4	48a	56ab	77a	18a	8a
9. GUTHION	360;	1;					
TRIGARD	280,140	2,3	61a	41a	38a	50a	14ab
10.GUTHION	360;	1;					
RIPCORD	35;	2;					
THIODAN	560;	3;					
GUTHION	360	4	74a	199b	227bc	101a	125bc

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

Table 2. A comparison of potato defoliation and yields.

TREATMENT	RATE g ai/ha	SCHEDULE**	% DEFOLIATION* July 15	July 22	YIELD kg/PLOT MARKETABLE	TOTAL
1. CHECK 1	--	--	53c	47b	9c	12c
2. CHECK 2	--	--	51c	48ab	12bc	16bc
3. TRIGARD	280	2	15ab	6a	22a	25ab
4. TRIGARD	70	2,3	31b	12a	22ab	24ab
5. TRIGARD	140	2,3	10a	3a	25a	28a
6. TRIGARD	280,140	2,3	9a	4a	27a	28a
7. TRIGARD	280	2,3	11a	4a	23a	27a
8. TRIGARD	280;	2				
	140	3,4	13ab	3a	26a	30a
9. GUTHION	360;	1;				
TRIGARD	280, 140	2,3	9a	3a	24a	28a
10.GUTHION	360;	1;				
RIPCORD	35;	2;				
THIODAN	560;	3;				
GUTHION	360	4	23ab	13a	21ab	24ab

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

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#045

CROP: Potato, cv. Yukon Gold

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

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TITLE: **EVALUATION OF TRIGARD 75WP FOR THE CONTROL OF COLORADO POTATO BEETLE IV**

MATERIALS: TRIGARD 75WP (cyromazine); RIPCORD 400EC (cypermethrin); GUTHION 240SC (azinphos-methyl); THIODAN 400EC (endosulfan).

METHODS: The test site was located near Plattsville, Ontario. Potato seed pieces were planted on May 13, 1993 into rows spaced 1.0 m apart with a plant spacing of 30 cm. Plots were 6 m long and three rows wide. Each treatment was replicated four times in a completely randomized block design. Treatment applications were made on the following dates (Schedule No.): June 29 (1), July 7 (2) and July 14, 1993 (3). See the results tables for the schedules for each treatment. With the emergence of second generation adults a maintenance program consisting of RIPCORD and GUTHION was applied to all plots except those of CHECK 1 for the remainder of the season as needed. This was done to isolate the effect of the first generation of insects. All treatments were applied using a CO2 pressurized 3 m hand boom sprayer with XR11002VS flat fan tips delivering 400 L/ha at 345 kPa. Evaluation data were collected on June 28, July 6, 13 and 20, 1993. On each date the total numbers of CPB egg masses, 1st, 2nd, 3rd, 4th instars, and adults were counted from 10 plants in the middle row of each plot. Percent defoliation due to feeding was visually assessed on July 20, 1993. The plots were harvested, weighed and graded on August 25, 1993. Tubers with diameters from 55-85 mm were graded as "marketable".

RESULTS: As presented in the tables.

CONCLUSIONS: Seven days after the first application there were no significant differences in the number of larvae among the treatments. The average number of small larvae on ten plants was 43. Though not significant, TRIGARD treatments did reduce the number of large larvae. This indicated an inhibition of the pest's development between successive larval stages. At the third evaluation, larval counts for the two check treatments were very different, indicating high variability in the pest population at the test site. At this time, however, all TRIGARD treatments showed significant control of large larvae as compared to Check 1. All TRIGARD treatments had significantly less defoliation than the checks, although they were not significantly different from the 'standard' (Trt 8). There were no significant differences among the yields, possibly a reflection of the light and variable pest population.

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Table 1. A comparison of counts of 1st and 2nd instars (SL) and 3rd and 4th instars (LL) of the Colorado potato beetle (CPB) treated with different insecticides.

TREATMENT	RATE g ai/ha	SCHEDULE**	CPB LARVAE COUNTS/10 PLANTS* July 6 LL	July 13 SL	July 13 LL	July 20 SL	July 20 LL
1. CHECK 1	--	--	52a	18a	70ab	30a	141b
2. CHECK 2	--	--	45a	51a	93b	23a	42ab
3. TRIGARD	70	1,2	15a	21a	12ab	1a	5a
4. TRIGARD	140	1,2	6a	34a	8ab	0a	8a
5. TRIGARD	280, 140	1,2	1a	6a	4a	11a	0a
6. TRIGARD	280	1,2	1a	47a	1a	2a	9a
7. TRIGARD	280;	1					
	140	2,3	0a	11a	9ab	12a	0a
8. RIPCORD	35;	1;					
THIODAN	560;	2;					
GUTHION	360	3	9a	27a	60ab	48a	55ab

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

Table 2. A comparison of potato defoliation and yields.

TREATMENT	RATE g ai/ha	SCHEDULE**	% DEFOLIATION* July 20	YIELD kg/PLOT MARKETABLE	TOTAL
1. CHECK 1	--	--	28c	26b	30b
2. CHECK 2	--	--	22b	34ab	40a
3. TRIGARD	70	1,2	3a	36ab	41a
4. TRIGARD	140	1,2	3a	41a	45a
5. TRIGARD	280, 140	1,2	2a	44a	48a
6. TRIGARD	280	1,2	4a	33ab	38ab
7. TRIGARD	280;	1			
	140	2,3	4a	39ab	43ab
8. RIPCORD	35;	1;			
THIODAN	560;	2;			
GUTHION	360	3	4a	43a	47a

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

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#046

IRAC: 86000718

CULTURE: Pomme de terre, cv. Superior

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

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

PRODUITS: NTN 33893 240 FS (imidacloprid); GUTHION 240 EC (azinphos-méthyl); RIPCORD 400 EC (cyperméthrine); DECIS 5,0 EC (deltaméthrine).

MÉTHODES: L'essai a été réalisé selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 19 mai. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Afin d'évaluer l'incidence de traitements insecticides contre les adultes et de comparer l'efficacité à celle d'interventions contre les larves, les traitements suivants ont été définis selon le type et le nombre d'applications faites contre les adultes (seuil $ 1 adulte/plant): 1- NTN à la plantation: 17 mai, 2- une application foliaire: 17 juin, 3- deux applications foliaires: 17 et 23 juin, 4- trois applications foliaires: 17, 23 et 25 juin, 5- témoin: aucune application contre les adultes. Pour tous les traitements, sauf le traitement No 1, des applications ont été effectuées contre les larves (seuil $ 5 larves/plant) aux dates suivantes: 29 juin (traitement 2, 3, 4 et 5; 2 et 5 juillet (traitement 2, 3 et 5); 8, 13 et 19 juillet (traitement 2, 3, 4 et 5). Afin d'augmenter les densités d'adultes et d'accroître leur impact sur les plants, des introductions ont été faites le 15 juin (300 adultes/parcelle) et le 19 juin (150 adultes/parcelle) pour l'ensemble du projet. L'évaluation des densités du doryphore a été faite régulièrement sur 10 plants pris au hasard dans les 2 rangées du centre. Le défanage des plants a été fait les 10 et 17 août et la récolte des 2 rangées du centre effectuée le 9 septembre a servi à déterminer le rendement en tubercules. Tous les insecticides ont été utilisés en rotation, selon les conditions météorologiques, à la dose maximale recommandée sur l'étiquette.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: L'ajout de traitements insecticides (GUTHION, RIPCORD, DECIS) contre les adultes en début de saison n'a pas amélioré la gestion saisonnière du doryphore. Les rendements sont semblables et le dommage au feuillage est demeuré bas et stable toute la saison à un indice n'affectant pas le rendement. L'approche contre les adultes à 1, 2 et 3 traitements se révèle moins économique en nombre de traitements. En effet, de 4 à 6 traitements additionnels ont été nécessaires contre les larves, portant le total en saison à 7, 8 et 7 pour les traitements 2, 3 et 4 respectivement comparativement à 6 pour le traitement 5 (stratégie orientée strictement contre les larves). Toutefois, deux et trois traitements contre les adultes ont cependant réduit significativement les densités larvaires le 29 juin et le 8 juillet par rapport aux traitements 2 et 5. L'impact de ces traitements n'est pas suffisant, car les densités sont demeurées souvent supérieures au seuil de 5 L/plant. De plus, des traitements contre les adultes retardent l'apparition des masses d'oeufs et entraînent un décalage d'émergence des larves rendant plus difficile la gestion des densités larvaires par la suite. Ainsi, l'incidence des traitements contre les adultes n'est pas suffisamment positive pour en recommander l'approche de façon régulière. Selon les densités et les produits utilisés, des traitements occasionnels peuvent toutefois être justifiés. Ainsi, l'emploi du NTN (imidacloprid) à la plantation confirme cette position, puisque un seul traitement a été nécessaire afin de maintenir la rentabilité de la culture. Ces résultats avec le NTN démontrent de nouveau la performance du produit.

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Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1993.

Traitement	Population larvaire				Dommage*				Rendement
	juin		juillet		juin	juillet			(t/ha)
	25	29	08	19	29	08	19	30	
NTN à la plantation ***	0,0	1,0c**	0,4c	0,5c	0,0b	0,3b	0,3b	0,8	36,19
Adultes (1)**** + larves (6)	0,0	12,3a	14,0a	4,8a	1,0a	1,0a	1,0a	1,0	34,24
Adultes (2) + larves (6)	0,2	6,7b	8,3b	3,9ab	1,0a	1,0a	1,0a	1,0	37,92
Adultes (3) + larves (4)	0,3	5,8bc	8,6b	3,3b	1,0a	1,0a	1,0a	1,0	35,06
TÉMOIN, larves (6)	0,0	15,7a	17,3a	3,8ab	1,0a	1,0a	1,0a	1,0	34,32

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

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

*** NTN, dose de 0,02 g m a/ha.

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

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#047

IRAC: 86000718

CULTURE: Pomme de terre, cv. Superior

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

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TITRE: ESSAI DE AC 303,630 CONTRE LE DORYPHORE DE LA POMME DE TERRE

PRODUITS: AC 303,630; DECIS 5,0 EC (deltaméthrine)

MÉTHODES: L'essai a été réalisé à Saint-Augustin-de-Desmaures (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 18 mai. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués les 29 juin, 5 et 8 juillet avec un pulvérisateur monté sur tracteur (dose: g MA/ha, pression: 1641,4 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été faite régulièrement sur 10 plants pris au hasard dans les 2 rangées du centre. Le défanage des plants a été effectué les 10 et 17 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 24 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Le produit AC 303,630 a fourni des résultats différents selon la dose utilisée. La dose de 100 g MA/ha a permis de réduire les densités larvaires du doryphore et de protéger les plants d'une façon plus efficace. Ainsi, à partir de la mi-juillet, les densités larvaires et le dommage aux plants ont été significativement plus faibles dans ces parcelles. De même, le rendement a été significativement plus élevé pour ce traitement que pour les trois autres. L'impact des traitements a semblé meilleur à partir de la troisième application, comparativement aux traitements du début de saison. Ainsi à partir de la mi-juillet, les densités étaient plus basses, principalement pour la dose de 100 g MA/ha. Quant à la plus faible dose du produit, elle a fourni des résultats plus élevés que DECIS quant aux densités larvaires et au dommage aux plants. Le rendement a toutefois été semblable pour AC (75 g MA/ha), DECIS et le témoin.

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Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1993.

Traitement Insecticide	Dose	Population larvaire juin 28	juillet 05	14	20	Dommage* juin 05	juillet 14	23	août 03	Rendement (t/ha)
AC 303,630	75,0	1,2	9,4ab**	6,1b	5,9b	1,0	1,5b	2,3ab	3,3ab	29,72b
AC 303,630	100,0	1,1	8,1ab	1,3c	0,8c	0,8	1,0b	0,5c	1,0c	36,81a
DECIS	7,5	1,1	3,0b	2,4bc	4,9b	0,8	1,0b	1,0bc	2,3b	29,62b
TÉMOIN	-----	2,9	13,2a	31,7a	15,1a	1,5	3,8a	4,5a	4,8a	24,95b

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

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

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#048

IRAC: 86000718

CULTURE: Pomme de terre, cv. Superior.

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

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TITRE: ESSAI DE L'IODE CONTRE LE DORYPHORE DE LA POMME DE TERRE

PRODUITS: DECIS 5,0 EC (deltaméthrine); ULTRA-T (17,500 ppm iode titrable, 18,05%, acide phosphorique, grade alimentaire, 10,0%).

MÉTHODES: L'essai a été réalisé à Saint-Augustin-de-Desmaures (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 18 mai. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. L'insecticide et l'iode ont été appliqués les 29 juin, 5 et 8 juillet à l'aide d'un pulvérisateur monté sur tracteur (dose: p.c/ha, pression: 1641,4 kPa, volume: 800 L/ha). L'évaluation des densités a été faite régulièrement sur 10 plants pris au hasard dans les 2 rangées du centre. Le défanage des plants a été effectué les 10 et 17 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 24 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: L'iode, produit <<miracle>>, a été définitivement inefficace contre le doryphore de la pomme de terre, pour une saison où les densités étaient au départ relativement faibles. En effet, les densités larvaires, sensiblement comparables au témoin, étaient significativement plus élevées que celles obtenues avec DECIS. Le dommage au feuillage a de plus augmenté progressivement jusqu'à la fin juillet. Il est de beaucoup supérieur aux résultats avec DECIS et semblable au témoin. Le rendement n'a toutefois pas été significativement différent entre les trois traitements. Pour DECIS, même si le rendement n'a pas été optimal, il est demeuré légèrement plus élevé que les deux autres traitements. La performance de DECIS n'a pas été à son maximum comme en témoigne aussi l'indice de dommage à la fin de juillet. Un tel indice occasionne une baisse de rendement.

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Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1993.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juillet				(t/ha)
		28	05	14	20	05	14	20	30	
DECIS	150 ml	1,1	3,0b**	2,4b	4,9c	0,8b	1,0b	1,0b	1,8b	9,62
IODE	1,0 L	1,5	7,5b	36,2a	27,7a	1,0ab	2,8a	4,0a	5,3a	26,09
TÉMOIN	---	2,9	13,2a	31,7a	15,1b	1,5a	3,8a	4,3a	5,0a	24,95

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

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

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#049

IRAC: 86000718

CULTURE: Pomme de terre, cv. Superior

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

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TITRE: ESSAI D'IMIDACLOPRID (NTN) CONTRE LE DORYPHORE DE LA POMME DE TERRE

PRODUITS: NTN 33893 240 FS (imidacloprid); DECIS 5,0 EC (deltaméthrine).

MÉTHODES: L'essai a été réalisé à Saint-Augustin-de-Desmaures (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 18 mai dans un sol de type loam sablo-argileux Tilly. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués les 18 mai (traitement 1, à la plantation), 29 juin et 5 juillet (traitement 2, 3 et 4) ainsi que le 8 juillet (traitement 4), (dose: g MA/ha, pression: 1641,4 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été faite régulièrement sur 10 plants pris au hasard dans les 2 rangées du centre. Le défanage des plants a été effectué les 10 et 17 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 24 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Le produit NTN 33893 a donné pour une troisième année des résultats très satisfaisants et relativement comparables aux deux dernières saisons. Il a permis de maintenir à un niveau très bas les densités larvaires et le dommage aux plants. Les rendements ont été semblables pour les trois traitements avec NTN, à la plantation et aux doses de 25 et 50 g MA/ha et significativement plus élevés que pour le témoin. Pour la dose de 50 g MA/ha, aucune larve n'a été observée après la deuxième application; un faible dommage aux plants a tout de même été noté. Cependant dans les parcelles où le produit a été appliqué à la plantation, aucun dommage n'a été observé sur les plants pendant toute la saison et les densités sont demeurées très faibles en juillet. Les plants ont été colonisés par les adultes plus tard, alors que les premières masses d'oeufs y ont été observées environ 3 semaines après les autres traitements. Tous les traitements avec NTN ont été dans l'ensemble supérieurs à DECIS principalement à la fin de juillet où les résultats (dommages et densités) ont été significativement différents. Il est à noter que les densités du doryphore ont été en 1993 très faibles comparativement aux autres saisons. Cela se traduit par un rendement relativement élevé chez le témoin. Enfin, des observations faites le 14 juillet n'ont démontré aucune présence de pucerons sur les plants dans les parcelles traitées avec NTN alors qu'on en trouvait dans les parcelles témoins.

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Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1993.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juillet			août	(t/ha)
		28	05	14	23	05	14	28	06	
NTN	0,02 g	0,0	0,3b**	0,1b	0,2c	0,0c	0,0c	0,0c	0,0d	36,24a
NTN	25,00 g	2,4	3,0b	0,8b	0,6c	1,0ab	1,0b	0,3c	1,0c	37,35a
NTN	50,00 g	1,9	1,6b	0,0b	0,0c	0,8b	1,0b	0,3c	0,3d	34,25a
DECIS	7,5 g	1,1	3,0b	2,4b	2,6b	0,8b	1,0b	1,0b	2,5b	29,62ab
TÉMOIN	-----	3,0	13,2a	31,7a	7,2a	1,5a	3,8a	5,0a	5,5a	24,95b

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

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

#050

IRAC: 86000718

CULTURE: Pomme de terre, cv. Superior

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

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TITRE: ESSAI DE CYROMAZINE CONTRE LE DORYPHORE DE LA POMME DE TERRE

PRODUITS: TRIGARD 75 WP (cyromazine); DECIS 5,0 EC (deltaméthrine); RIPCORD 400 EC (cyperméthrine)

MÉTHODES: L'essai a été réalisé selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 18 mai. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides ont été appliqués les 29 juin et 2 juillet (traitements 1, 2, 3, 4, 5 et 6) ainsi que le 8 juillet (traitements 4 et 6) à l'aide d'un pulvérisateur monté sur tracteur (dose: g MA/ha, pression: 1641,4 kPa, volume: 800 L/ha). Pour le traitement 5, une application (RIPCORD 400 EC) a de plus été faite contre les adultes le 23 juin (seuil: 1 adulte/plant) afin de respecter le protocole prévu. L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Par ailleurs des masses d'oeufs (10 masses/parcelle) ont été suivies régulièrement afin de pouvoir initier les premiers traitements à environ 33% d'éclosion des masses d'oeufs. Afin d'accroître les densités, des adultes (50 adultes/parcelle) ont été introduits le 22 juin. Les plants ont été défanés les 10 et 17 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 30 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: L'insecticide cyromazine a été relativement efficace à réprimer les densités de doryphores et à assurer la protection du feuillage. Les résultats, généralement supérieurs à DECIS, ont été plus satisfaisants encore pour les traitements ayant reçu (1 ou 2 fois) la plus forte dose (280 g) du produit. Le dommage y a été significativement plus faible que dans les autres traitements à partir de la mi-juillet. Les densités larvaires ont été généralement plus faibles et les rendements plus élevés, mais non significativement différents. Une charge totale en saison de 560 g de cyromanize pour deux ou trois applications pour les traitements 3 et 4 a procuré à la fin juillet une protection du feuillage significativement meilleure que tous les autres traitements. Trois applications, dont deux à dose réduite de la moitié, ont donné des résultats équivalents à deux applications à la dose de 280 g. Selon les densités, trois applications s'avéreraient plus sécuritaires, tout comme l'emploi stratégique du produit à des doses de 140 et 280 g en alternance. L'application de RIPCORD contre les adultes n'a pas amélioré les résultats. Enfin, un délai de quelques jours (3-4 jours) pour la première et la deuxième application aurait sans doute amélioré les résultats.

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Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1993.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juin	juillet			(t/ha)
		25	06	13	20	29	08	20	30	
Cyromazine	140,0 + 140,0	0,5	19,9b**	25,4b	10,2b	0,5	1,0b	1,8c	2,5c	37,95bc
Cyromazine	280,0 + 140,0	0,5	18,3b	17,4cd	6,2c	0,3	1,0b	1,3d	1,8d	39,42ab
Cyromazine	280,0 + 280,0	1,7	18,2b	14,0cd	4,1c	0,3	1,3b	1,3d	1,3e	39,84ab
Cyromazine	280,0 + 140,0 + 140,0	0,0	13,6bc	12,0d	3,0c	0,0	1,0b	1,0d	1,3e	41,71a
Cyromazine + RIPCORD (adulte)	280,0 + 140,0 + 35,0	0,0	5,2c	20,3bc	11,5b	0,0	1,0b	1,0d	2,0d	39,88ab
DECIS	7,5	0,2	12,0bc	27,0b	20,5a	0,5	1,0b	2,8b	3,8b	35,28c
TÉMOIN	-----	0,3	39,7a	57,1a	19,6a	0,3	4,3a	7,3a	7,3a	16,03d

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

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

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#051

IRAC: 87000221

CULTURE: Pomme de terre, cv. Superior

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

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

PRODUITS: M-TRAK LI (MYX-1806, endotoxine-delta encapsulée de *Bacillus thuringiensis* var. *san diego*, 10%); NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3,0%); DECIS 5,0 EC (deltaméthrine); GUTHION 240-EC (azinphos-méthyl); RIPCORD 400 EC (cyperméthrine).

MÉTHODES: L'essai a été réalisé à Saint-Augustin-de-Desmaures (Québec) selon un plan à blocs aléatoires complets avec 4 répétitions. Les pommes de terre ont été plantées le 18 mai. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides biologiques et chimiques (séquence des produits = DECIS, GUTHION, RIPCORD, GUTHION) ont été appliqués les 29 juin, 2, 7 et 9 juillet à l'aide d'un pulvérisateur monté sur tracteur (dose: p.c./ha, pression: 1641,4 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été faite sur 10 plants pris au hasard dans les 2 rangées du centre. Le défanage des plants a été effectué les 10 et 17 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 30 août.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Les insecticides biologiques M-TRAK et NOVODOR ont été dans l'ensemble plus performants que les insecticides chimiques. Les densités larvaires et les dommages aux plants ont été maintenus à des niveaux très bas à la mi-juillet, comparables aux insecticides chimiques. De plus, ces résultats ont été significativement plus élevés avec les insecticides chimiques et le témoin à partir du 19 juillet. Les rendements ont toutefois été comparables pour tous les traitements et significativement plus faibles pour le témoin. Quelle que soit la dose de NOVODOR, l'efficacité est semblable à M-TRAK. La saison 1993 se distingue de celle de 1992 par des densités larvaires plus faibles.

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Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1993.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	juin	juillet			juillet				(t/ha)
		28	06	15	22	09	15	22	30	
M-TRAK	7,5 L	2,0	3,7b**	0,0b	0,1c	1,0b	1,0b	0,8cd	0,8c	39,56a
NOVODOR	4,6 L	3,4	4,6b	1,4b	0,5c	1,0b	1,0b	1,0bc	1,0c	35,75a
NOVODOR	7,0 L	2,0	5,3b	0,0b	0,2c	1,0b	1,0b	0,5d	1,0c	37,27a
CHIMIQUES***	---	1,2	3,2b	3,9b	4,0b	1,0b	1,0b	1,3b	1,5b	36,25a
TÉMOIN	---	0,9	12,2a	36,5a	13,8a	2,3a	3,3a	4,5a	4,5a	29,54b

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

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

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

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#052

IRAC: 87000221

CULTURE: Pomme de terre, cv. Superior

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

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TITRE: EFFICACITÉ DES INSECTICIDES BIOLOGIQUES M-TRAK ET NOVODOR CONTRE LES GROSSES LARVES (L3 ET L4) DU DORYPHORE DE LA POMME DE TERRE

PRODUITS: M-TRAK LI (MYX-1806, endotoxine-delta encapsulée de *Bacillus thuringiensis* var. *san diego*, 10%); NOVODOR FC (endotoxine-delta de *Bacillus thuringiensis* var. *tenebrionis*, 3,0%); DECIS 5,0 EC (deltaméthrine);
GUTHION 240-EC (azinphos-méthyl); RIPCORD 400 EC (cyperméthrine).

MÉTHODES: L'essai a été réalisé à Saint-Augustin-de-Desmaures (Québec) selon un plan en blocs complets aléatoires avec 4 répétitions. Les pommes de terre ont été plantées le 19 mai. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Les insecticides biologiques et chimiques (séquence des produits = DECIS, GUTHION, RIPCORD) ont été appliqués les 5, 9 et 13 juillet avec un pulvérisateur monté sur tracteur (dose: p.c./ha, pression: 1641,4 kPa, volume: 800 L/ha). La première intervention a été retardée de façon à ce que la proportion de grosses larves (L3 et L4) sur les plants soit élevée. Celle-ci était alors respectivement de 51,5, 56,1 et 61,5% pour les trois traitements. L'évaluation des densités du doryphore a été faite régulièrement sur 10 plants pris au hasard dans les deux rangées du centre. Les plants ont été défanés les 10 et 17 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 9 septembre.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: Les insecticides biologiques M-TRAK et NOVODOR ont démontré dans l'ensemble une très bonne efficacité à réduire à des niveaux acceptables les densités des grosses larves L3 et L4. Aux doses utilisées, M-TRAK et NOVODOR sont sensiblement d'efficacité égale. Après le premier traitement, l'incidence sur les grosses larves a été plus grande et significative dans les parcelles traitées biologiquement. Les densités de L4 y ont été significativement plus faibles le 9 juillet. Les autres applications de M-TRAK et NOVODOR ont permis de maintenir les densités à des niveaux très bas. Le dommage au feuillage est ainsi demeuré plus faible et plus stable pour les parcelles traitées avec le *B.t.* Suite aux observations qualitatives, des larves L4 affectées par *B.t.* ont été remarquées sur le feuillage. Les applications ont entraîné une réduction importante de la consommation; ceci explique l'absence d'augmentation du dommage pour ces parcelles. Enfin, cet essai démontre que des applications tardives de M-TRAK et NOVODOR peuvent être autant et même plus efficaces et rentables que les produits chimiques. Ces applications doivent cependant tenir compte des densités et de la rapidité du développement de l'insecte.

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Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1993.

Traitement Insecticide	Dose	Stade larvaire	Population larvaire juillet 05	09	13	19	Dommage* juillet 05	15	22	30	Rendement (t/ha)
M-TRAK	7,5 L	L14	22,7	17,5ab**	3,6a	0,8b	1,3	1,3	1,3	1,7	36,62
		L3	6,8	2,3	0,1ab	0,0b					
		L4	4,9	7,4b	2,2a	0,8b					
NOVODOR	7,0 L	L14	24,4	12,6b	1,6b	0,3b	1,7	1,3	1,3	1,3	34,96
		L3	8,5	2,4	0,0b	0,0b					
		L4	5,2	6,3b	1,1b	0,3b					
CHIMIQUES***		L14	27,0	22,9a	2,7ab	2,1a	1,7	1,7	1,3	2,0	33,78
		L3	10,3	3,7	0,3a	0,1a					
		L4	6,3	15,3a	1,9ab	2,0a					

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

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

*** Dose maximale recommandée sur l'étiquette.

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#053

IRAC: 87000221

CULTURE: Pomme de terre, cv. Superior

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

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TITRE: ESSAI D'UN PHAGOSTIMULANT (PHEAST) AVEC M-TRAK CONTRE LE DORYPHORE DE LA POMME DE TERRE

PRODUITS: M-TRAK LI (MYX-1806, endotoxine-delta encapsulée de *Bacillus thuringiensis* var. *san diego*, 10%); PHEAST (phagostimulant).

MÉTHODES: L'essai a été réalisé à Saint-Augustin-de-Desmaures

(Québec) selon un plan en blocs complets aléatoires avec 3 répétitions. Les pommes de terre ont été plantées le 31 mai. Les parcelles de 7,5 m de longueur comprenaient 4 rangs espacés de 0,91 m. Pour augmenter les densités, des adultes ont été introduits le 13 juillet, également dans chaque parcelle. L'insecticide biologique M-TRAK a été appliqué seul ou en mélange avec PHEAST les 3 et 6 août avec un pulvérisateur monté sur tracteur (dose: p.c./ha, pression: 1641,4 kPa, volume: 800 L/ha). L'évaluation des densités du doryphore a été faite régulièrement sur 10 plants pris au hasard dans les deux rangées du centre. Les plants ont été défanés le 25 août. Le rendement en tubercules a été déterminé à partir de la récolte des deux rangées du centre de chaque parcelle faite le 9 septembre.

RÉSULTATS: Voir le tableau ci-dessous.

CONCLUSIONS: L'analyse des résultats (densités larvaires, dommage au feuillage et rendement) ne démontre aucune différence significative entre les traitements pour l'ensemble des observations. Ainsi, l'emploi du PHEAST a permis de réduire de moitié la quantité de M-TRAK tout en obtenant des résultats similaires. L'augmentation de la dose de PHEAST n'a pas amélioré la performance de M-TRAK contre le doryphore. L'emploi de PHEAST à 0,5 kg a maintenu l'indice de défoliation à un niveau plus stable et plus faible du 2 au 9 août. Le taux de défoliation a aussi été légèrement plus bas le 13 août. Cependant, les résultats obtenus et les tendances observées doivent être perçus avec réserve. La saison avec de faibles densités a été très particulière et l'ajout d'adultes a sans aucun doute modifié l'évolution saisonnière des densités. Les avantages identifiés à l'emploi du PHEAST avec M-TRAK sont donc préliminaires et devront faire l'objet de nouvelles évaluations dans des conditions différentes. D'autres phagostimulants devront aussi être évalués. Enfin, des recherches visant l'identification de substances spécifiques à l'insecte conduiront à l'obtention de phagostimulants optimaux contre le doryphore.

Table 1. Nombre moyen de larves de doryphores/plant, dommage et rendement vendable, 1993.

Traitement		Population larvaire				Dommage*				Rendement
Insecticide	Dose	août				août				(t/ha)
		02	06	09	13	02	06	09	13	
M-TRAK	7,5 L	4,9	7,5	1,0ab**	1,8	1,0	1,7	1,7	2,7	36,38
M-TRAK + PHEAST	3,75 L 0,5 kg	9,0	3,1	0,9b	1,4	1,0	1,0	1,3	2,0	35,68
M-TRAK + PHEAST	3,75 L 1,0 kg	5,3	3,8	2,1a	1,7	1,0	1,7	1,7	2,7	34,70

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

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

#054

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

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

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TITLE: EVALUATION OF BACTERIAL AND ALTERNATIVE INSECTICIDES FOR CONTROL OF COLORADO POTATO BEETLE IN POTATOES, 1993

MATERIALS: NOVODOR 3% (*Bacillus thuringiensis* var. *tenebrionis*); AGRIDYNE 3% (azadirachtin); IMIDAN 50 WP (phosmet).

METHODS: Small, whole, seed pieces were planted in Sherwood, P.E.I. on May 19, 1993. Plants were spaced at about 40 cm within rows and about 90 cm between rows in four row plots. Each plot measured 7.6 m long by 3.6 m wide. Plots were separated by two rows of potatoes and arranged in a randomized complete block design with seven treatments with four replications. The number of CPB larvae and adults per ten sweeps (net dia. 0.4 m) were counted from the center two rows of each plot from June 29 until August 23. Insecticides were applied to all treatments on August 4 using a precision plot sprayer delivering approximately 300 L of spray mixture/ha at a pressure of about 240 kPa. In addition, the following products were sprayed whenever a threshold of ten CPB (adults or larvae) per sweep was surpassed: IMIDAN (July 22); NOVODOR at 2.8 L prod./ha (July 27 and Aug. 10); NOVODOR at 5.6 L prod./ha (Aug. 10); NOVODOR at 8.4 L prod./ha (July 27); and AGRIDYNE at 1.6 L prod./ha (Aug. 10). THIODAN at 1.4 L product/ha was applied on Aug. 26 to control summer adults. Weeds were controlled with an application of metribuzin at 750 g ai/ha on June 11. Plots received applications of chlorothalonil at 1.25 kg ai/ha for blight control or as required. Plants were sprayed with diquat at 300 g ai/ha for top desiccation on Sept. 2. Tubers from the center two rows of each plot were harvested on September 22 and total and marketable (i.e. >40 mm) recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated.

RESULTS: The results are summarized in the table.

CONCLUSIONS: CPB populations were very uneven between plots and it appeared by early Aug. that populations would not surpass the threshold of 10 CPB per ten sweeps in some plots. A spray on all treatments on Aug. 4 resulted in lower populations of late instar larvae in plots treated with IMIDAN, NOVODOR at 8.4 L prod./ha, and AGRIDYNE at 8.3 L prod./ha, on the count following the spray. Total and marketable tuber yields were not significantly different, except for those taken from plots treated with NOVODOR 8.4 L/ha, which were lower than those taken from the untreated check and other insecticide-treated plots. No phytotoxicity was observed in any of the plots.

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Table 1. Mean number of Colorado potato beetles larvae and adults (CPB)/10 sweeps per plot and tuber yield.

Treatment	Rate Prod./ha (L)	No. of Sprays	CPB July 19	CPB July 26	CPB August 3	CPB August 9	CPB August 16	CPB August 23	Marketable Yield (t/ha)
Check	-	-	6	12	19	20	8	6	33
Novodor	2.8 L	3	6	13*	12*	12*	8	14	35
Novodor	5.6 L	2	2	7	23*	15*	8	5	34
Novodor	8.4 L	2	8	23*	9*	10	7	7	29
Agridyne	0.8 L	1	4	6	5*	6	6	6	33
Agridyne	1.6 L	2	2	8	15*	11*	4	5	35
Imidan	2.2 kg	2	11*	3	7*	1	3	3	34
LSD (P<0.05)			NS	19	12	11	NS	8	5

* Application of insecticide following count.

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#055

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

PEST: Colorado potato beetle (CPB) *Leptinotarsa decemlineata* (Say); potato flea beetle (PFB), *Epitrix cucumeris* (Harr.).

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TITLE: EVALUATION OF INSECTICIDES FOR CONTROL OF THE COLORADO POTATO BEETLE AND POTATO FLEA BEETLE, 1993

MATERIALS: KRYOCIDE 98% (Sodium fluoaluminate); AC 303 630 24% (Pyrrole); IMIDAN 50 WP (phosmet).

METHODS: Small, whole, seed pieces were planted in Sherwood, P.E.I. on May 19, 1993. Plants were spaced at about 40 cm within rows and about 90 cm between rows in four row plots. Each plot measured 7.6 m long by 3.6 m wide, were separated by two rows of potatoes. Plots were arranged in a randomized complete block design with six treatments each replicated a total of four times. All treatments were applied on July 27 using a precision plot sprayer delivering approximately 300 L of spray mixture/ha at a pressure of about 240 kPa. The additional spray of AC 303 630 was applied on August 10 (14 days post hatch). IMIDAN was applied a second time on August 16. Each week starting on June 27 and ending on August 30, the number of insects per ten net sweeps (0.37 m diameter opening) were counted from the center two rows of each plot. Weeds were controlled with an application of metribuzin at 750 g ai/ha on June 11. Plots received recommended applications of chlorothalonil at 1250 g ai/ha for blight control. Plants were sprayed with Reglone (diquat) at 300 g ai/ha for top desiccation on Sept. 2. Tubers from the center two rows of each plot were harvested on September 22 and total and marketable (>40 mm) recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated.

RESULTS: The results are summarized in the table.

CONCLUSIONS: CPB populations were low and unevenly distributed between plots, therefore the results were inconclusive.

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Table 1. Colorado potato beetle (CPB) counts ten net sweeps per plot.

	Rate kg ai/ha	Time of Application	July 26	August 3	August 9	August 16	August 23	August 30	Tuber Yield Market (t/ha)
Check	-		3	2	6	8	2	2	34
Kryocide	11	egg hatch	1	1	2	2	2	1	29
AC303630	.05	egg hatch	2	1	7	3	1	0	25
AC303630	.1	egg hatch	2	1	2	1	1	1	29
AC303630	.05	egg hatch + 14 days post	1	2	11	1	1	1	29
Imidan	1.1	egg hatch + summer adults	1	2	4	1	1	1	27
LSD (P<0.05)			NS	NS	NS	NS	NS	NS	6

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

Treatment	Rate kg ai/ha	July 26	August 3	August 9	August 16	August 23	August 30
Check	-	3	2	9	104	148	64
Kryocide	11	3	1	9	65	155	102
AC303630	.05	4	2	7	102	142	92
AC303630	.1	4	1	5	84	124	119
AC303630	.05 + .05	5	2	15	169	105	80
Imidan	1.1	5	0	6	89	51	81
LSD (P<0.05)		NS	NS	NS	NS	78	NS

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#056

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

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

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TITLE: EVALUATION OF TIMED APPLICATIONS OF SYNTHETIC INSECTICIDES FOR CONTROL OF THE COLORADO POTATO BEETLE ON POTATOES, 1993

MATERIALS: TRIGARD 75 WP (cyromazine); IMIDAN 50 WP (phosmet)

METHODS: Small, whole, seed pieces were planted in Sherwood, P.E.I. on May 19, 1993. Plants were spaced at about 40 cm within rows and about 90 cm between rows in four row plots. Each plot measured 7.6 m long by 3.6 m wide. Plots were separated by two rows of potatoes and arranged in a randomized complete block design with seven treatments and four replications. Insecticides were applied to all treatments on July 14 using a precision plot sprayer delivering approximately 300 L of spray mixture/ha at a pressure of about 240 kPa. The one week and two week post-hatch applications were sprayed on July 20 and 27. Imidan was re-applied on July 27. Each week starting on June 29 and ending on August 23, the number of insects per ten net sweeps (0.37 m diameter opening) were counted from the center two rows of each plot. Weeds were controlled with an application of metribuzin at 750 g ai/ha on June 11. Summer adults were controlled on all plots with an application of Thiodan at 1.4 L product /ha on Sept. 14. Plots received recommended applications of chlorothalonil at 1250 g ai/ha for blight control. Plants were sprayed with Reglone (diquat) at 300 g ai/ha for top desiccation on Sept. 2. Tubers from the center two rows of each plot were harvested on September 22 and total and marketable ($\geq$40 mm) recorded. Analyses of variance were performed on the data and Least Squares Differences (LSD) were calculated.

RESULTS: The results are reported in the table.

CONCLUSIONS: There were significantly lower CPB populations on all plots receiving spray treatments as compared to the untreated check plots. The CPB populations were lowest on plots sprayed once with IMIDAN, twice with TRIGARD at 0.280, and on plots sprayed three times. The foliage damage rating on August 26 reflects this trend. There were no significant differences between treatments in total and marketable tuber yields.

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Table 1. Number of Colorado potato beetle (CPB) per ten net sweeps/plot.

Treatment	Rate kg ai/ha	Time of application	July 12	July 19	July 26	August 3	August 9	August 16	August 23
Check	-	-	8	44	74	91	29	23	31
Trigard	.14+.14	egg hatch+ 1 week	8	8	17	14	17	6	9
Trigard	.28+.14	egg hatch+ 1 week	10	19	12	18	13	11	8
Trigard	.28+.28	egg hatch+ 1 week	8	19	11	7	2	3	6
Trigard	.28+.14+.14	egg hatch+ 1 wk + 1 wk	14	14	8	4	0	3	3
Imidan + Trigard	1.1+.28+.14	egg hatch+ 1 wk + 1 wk	10	7	18	4	2	5	14
Imidan	1.1		15	7	19	8	1	3	11
LSD ($P \leq 0.05$)			NS	32	53	45	13	10	13

Table 2. Damage ratings and yield.

Treatment	Rate kg ai/ha	Foliage Damage Rating* July 21	July 30	August 9	August 13	August 20	August 26	Tuber Yield T/ha Total Markets
Check	-	1.8	3.0	3.5	4.3	4.8	5.3	32
Trigard	.14+.14	1.0	1.5	2.5	3.3	2.8	3.5	31
Trigard	.28+.14	1.3	1.3	2.3	3.0	3.0	3.5	31
Trigard	.28+.28	1.5	1.8	2.3	3.0	3.0	2.8	31
Trigard	.28+.14+.14	1.3	1.5	2.0	2.0	2.5	2.8	31
Imidan + Trigard	1.1+.28+.14	1.3	1.8	1.5	2.3	3.0	2.8	32
Imidan	1.1	1.5	1.5	1.8	2.0	2.5	2.5	30
LSD ($P \leq 0.05$)		NS	0.7	0.8	0.4	0.9	0.9	NS

* 0 = none, 1 = trace, 2 = some consumed, 3 = 0-9% consumed, 4 = 10-24% consumed, 5 = 25-49% consumed

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#057

STUDY DATA BASE: 303-1452-8702

CROP: Potato, cv. Superior

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

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TITLE: EVALUATION OF SYNTHETIC INSECTICIDES FOR CONTROL OF INSECT PESTS ON POTATOES, 1993

MATERIALS: NTN 33893 2.5 G, 240 FS (imidacloprid); IMIDAN 50 WP (phosmet).

METHODS: Small, whole seed pieces were planted in Sherwood, P.E.I. on May 27, 1993. Plants were spaced at about 40 cm within rows and about 90 cm between rows in four row plots. Each plot, which measured 7.6 m in length and 3.6 m in width, was separated by two rows of potatoes. Plots were arranged in a randomized complete block design with eight treatments each replicated a total of four times. In-row insecticides were applied at planting. Foliar sprays were applied to IMIDAN plots on August 4, NTN 33893 25 g on August 4 and 17, and NTN 33893 50 g on August 10 (300 L of spray mixture/ha at a pressure of about 240 kpa) when a threshold of ten CPB per net sweep was surpassed. Each week starting on June 29 and ending on August 30, the number of insects per ten net sweeps (0.37 m diameter opening) and the number of PFB induced holes per 4th terminal leaf, were counted from the center two rows of each plot. Weeds were controlled with an application of metribuzin at 750 g ai/ha on June 11. Plots received recommended applications of chlorothalonil at 1250 g ai/ha for blight control. Plants were sprayed with REGLONE (diquat) at 300 g ai/ha for top desiccation on September 2. Tubers from the center two rows of each plot were harvested on September 22 and total and marketable ($ 40 mm) recorded. Analysis of variance were performed on the data and Least Squares Differences (LSD) were calculated.

RESULTS: The number of PFB holes per 4th terminal leaf reflected the same pattern as PFB counts on the foliage. Potato leafhopper and tarnished plant bug populations were counted, but were very low. The other results are reported in the Tables.

CONCLUSIONS: Granular insecticide placed in-furrow was the most effective in controlling insect pests on potatoes. There were no significant rate responses between foliar or in-furrow applications of the FS formulation, but the number of CPB tended to decrease as the rate of application increased. Tuber yields from plots treated with the lower rate of the foliarly applied NTN 33893 were significantly lower than from plots treated with the highest rate of NTN 33893 in-furrow at planting.

Table 1. Colorado potato beetle (CPB) counts per ten net sweeps/plot.

Treatment	Rate (g ai/ha)	Placement	Number of CPB July 19	July 26	August 3	August 9	August 16	August 23	August 30	Tuber yield (t/ha) Total	Tuber yield (t/ha) Markets
Check	-	-	3	5	10	13	36	9	6	36	32
NTN 33893 FS	109	furrow	0	0	2	6	22	14	7	37	33
NTN 33893 FS	218	furrow	0	0	1	6	15	10	10	39	34
NTN 33893 FS	327	furrow	1	0	2	3	12	8	2	40	36
NTN 33893 FS	25	foliar	1	2	10	1	16	1	4	35	32
NTN 33893 FS	50	foliar	0	0	6	11	1	0	1	39	35
NTN 33893 G	218	furrow	0	0	2	2	7	6	4	38	33
IMIDAN WP	1100	foliar	1	3	12	2	9	5	5	37	37
LSD (P#0.05)			2	4	12	9	24	8	6	4	4

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

Treatment	Rate (g ai/ha)	Placement	Number of PFB June 29	July 5	July 12	July 19	July 26	August 3	August 9	August 16	August 23	August 30
Check	-	-	11	22	25	18	23	5	1	33	85	66
NTN 33893 FS	109	furrow	1	9	17	15	17	4	1	1	26	65
NTN 33893 FS	218	furrow	1	5	7	18	20	5	3	3	38	59
NTN 33893 FS	327	furrow	1	4	9	17	21	4	2	1	27	39
NTN 33893 FS	25	foliar	7	19	27	14	18	5	4	26	80	94
NTN 33893 FS	50	foliar	12	26	23	12	11	6	1	19	70	64
NTN 33893 G	218	furrow	1	3	4	5	25	9	1	3	20	50
IMIDAN WP	1100	foliar	9	21	27	14	17	7	1	8	41	77
LSD (P#0.05)			6	14	8	10	14	4	2	23	42	31

Table 3. Potato aphid (PA) counts per ten net sweeps/plot.

Treatment	Rate (g ai/ha)	Placement	Number of PA July 12	19	26	August 3	9	16	23	30
Check	-	-	1	2	11	37	74	155	136	90
NTN 33893 FS	109	furrow	0	1	1	3	9	37	86	154
NTN 33893 FS	218	furrow	0	0	1	1	7	20	81	87
NTN 33893 FS	327	furrow	0	0	1	2	9	20	45	55
NTN 33893 FS	25	foliar	1	2	10	29	20	40	33	32
NTN 33893 FS	50	foliar	1	2	12	39	78	53	37	51
NTN 33893 G	218	furrow	0	0	0	3	10	21	31	51
IMIDAN WP	1100	foliar	0	2	14	46	101	43	82	118
LSD (P#0.05)			1	2	5	27	24	39	46	52

#058

ICAR: 61006535

CROP: Potato, cv. Superior

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

NAME AND AGENCY:
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TITLE: EFFECT OF SURFACTANTS FOR THE CONTROL OF COLORADO POTATO BEETLES (CPB) USING AC 303,630 240SC

MATERIALS: AC303,630 240SC (experimental); AGRAL 90 (ni) (non-ionic surfactant); COMPANION (ni) (non-ionic surfactant); FRIGATE (ci) (cationic surfactant); ENHANCE (ci) (cationic surfactant).

METHODS: Potatoes were planted in two row plots, 6 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed pieces were planted with a commercial planter on May 1. Spray applications were made using a back pack airblast sprayer using 240 L/ha of water. Insecticides were applied June 24, July 5, 13 and 20. Assessments were taken by counting Colorado potato beetle (CPB) larvae at intervals throughout the summer, foliage damage ratings caused by leafhoppers and CPB on July 2, 13 and potato yields on August 18.

RESULTS: As presented in the tables.

CONCLUSIONS: The level of CPB control using AC 303,630 240SC at the tested rates was not very high, however the higher rate of AC 303,630 240SC was most effective. The addition of the surfactant products did not significantly increase the level of control for the CPB. The surfactants by themselves were not very effective in controlling populations of CPB, however, they did provide a small margin of leafhopper control. Even though the addition of the surfactants to AC303,630 240 SC did not provide noticeable control of foliar insects, the highest numerical yields were obtained from combinations of surfactants and inseciticides.

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Table 1. Colorado potato beetle counts.

Treatments	Rate kg ai/ha	CPB LarvalCounts (# per plot) June 25	June 30	July 9
AC303,630 240SC	0.05	157.5bc*	83.8d	156.3bcd
AC303,630 240SC	0.10	162.5bc	67.5d	87.5d
AC303,630 240SC + AGRAL 90 (ni)**	0.05 0.05% v/v	172.5bc	205.0abc	205.0a-d
AC303,630 240SC + AGRAL 90 (ni)	0.05 0.1% v/v	117.5c	256.3a	92.5d
AC303,630 240SC + COMPANION (ni)	0.05 0.1% v/v	135.0bc	132.5bcd	85.0d
AC303,630 240SC + FRIGATE (ci)	0.05 0.1% v/v	137.5bc	140.0bcd	82.5d
AC303,630 240SC + ENHANCE (ci)	0.05 0.1% v/v	157.5bc	117.5cd	108.8cd
AGRAL 90	0.1% v/v	200.0abc	227.5ab	285.0a
COMPANION	0.1% v/v	155.0bc	246.3a	180.0a-d
FRIGATE	0.1% v/v	230.0ab	272.5a	290.0a
ENHANCE	0.1% v/v	282.5a	262.5a	217.5abc
Control		282.5a	297.5a	245.0ab

* Means followed by the same letter are not significantly different ($P<0.05$ Duncan's multiple range test).

** (ni) - non-ionic surfactant; (ci) - cationic surfactant.

Table 2. Insect damage and yield results.

		Foliar Ratings (0-10)***				Yield
	Rate	Leafhoppers		CPB		kg/plot
Treatments	kg ai/ha	July 2	July 13	July 2	July 13	Aug. 18
AC303,630 240SC	0.05	8.8abc*	5.7bc	9.0ab	7.4ab	7.62ab
AC303,630 240SC	0.10	9.0ab	7.7a	9.3a	8.9a	8.52ab
AC303,630 240SC + AGRAL 90 (ni)**	0.05 0.05% v/v	8.6abc	6.8abc	8.0b	6.8bc	9.40ab
AC303,630 240SC + AGRAL 90 (ni)	0.05 0.1% v/v	8.5abc	7.3ab	8.3b	7.6ab	9.95a
AC303,630 240SC + COMPANION (ni)	0.05 0.1% v/v	8.9abc	7.3ab	8.9ab	7.6ab	9.00ab
AC303,630 240SC + FRIGATE (ci)	0.05 0.1% v/v	8.9abc	7.3ab	8.6ab	7.9ab	10.0a
AC303,630 240SC + ENHANCE (ci)	0.05 0.1% v/v	9.1a	7.0ab	8.6ab	8.0ab	9.82a
AGRAL 90	0.1% v/v	7.3d	5.8bc	6.5c	5.3cd	6.97ab
COMPANION	0.1% v/v	7.9cd	6.5abc	6.8c	4.8d	7.32ab
FRIGATE	0.1% v/v	8.0bcd	5.8bc	6.3c	5.0d	6.10ab
ENCHANCE	0.1% v/v	8.0bcd	5.8bc	6.8c	4.3e	6.80ab
Control		7.5d	5.3c	6.8c	2.3e	7.15ab

* Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).
** (ni) - non-ionic surfactant; (ci) - cationic surfactant.
*** Foliar Ratings (0-10) - 0, no control, foliage severely damaged; 10, complete control.

#059

ICAR: 61006535

CROP: Potato, cv. Superior

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

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TITLE: PESTICIDE TIMING (BACK TO BACK - EXTENDED INTERVALS) AND ITS EFFECT ON INSECT CONTROL IN POTATOES

MATERIALS: GUTHION 240SC (azinphos-methyl); DECIS 5.0 FL (deltamethrin).

METHODS: Potatoes were planted in two row plots, 6 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed pieces were planted with a commercial

planter on April 30. Spray applications were made using a back pack airblast sprayer using 240 L/ha of water. Spray timing was scheduled either every seven days with and without a back to back spray (sprayed again three days later) or every 14 days with and without a back to back spray (again three days later). The seven day spray schedule was June 21, 29, July 5 and 12. The 14 day spray schedule was June 21 and July 5.
Assessments were taken by counting Colorado potato beetle (CPB) larvae at intervals throughout the summer, foliage damage ratings caused by leafhoppers and potato beetle damage on July 2 and July 13 and potato yields on Aug. 17.

RESULTS: As presented in the tables.

CONCLUSIONS: High Colorado potato beetle pressures were observed. Foliar insecticides applied every seven days proved more effective in reducing insect numbers but had no significant effect on yields compared to the extended spray schedules of 14 days. Beetle numbers were best reduced when sprays were applied at half rates every seven days followed within three days with an additional application again at half rates - what is referred to as "back to back spraying. GUTHION 240SC provided a higher level of CPB control than DECIS 5.0 Fl by the end of the 1st generation (July 13).

Table 1. Colorado potato beetle counts.

Treatments	Rate product/ha	Spray Timing	CPB Larval Counts June 28	July 2	July 5	July 9
GUTHION 240SC	1.75 L	7 DAYS	160.0bc*	500.0a	135.0b	10.5c
GUTHION 240SC	1.75 L	14 DAYS	180.0bc	500.0a	290.0a	50.0abc
GUTHION 240SC	0.875 L	BB 7 DAYS	102.5c	172.5b	157.5b	17.5c
GUTHION 240SC	0.875 L	BB 14 DAYS	145.0bc	500.0a	272.5a	23.5bc
DECIS 5.0 FL	100.0 ml	7 DAYS	147.5bc	500.0a	295.0a	95.0ab
DECIS 5.0 FL	100.0 ml	14 DAYS	152.5bc	500.0a	290.0a	120.0a
DECIS 5.0 FL	50.0 ml	BB 7 DAYS	127.5bc	193.8b	287.5a	95.0ab
DECIS 5.0 FL	50.0 ml	BB 14 DAYS	140.0bc	500.0a	300.0a	95.8ab
Control			300.0a	500.0a	300.0a	17.8c

* Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

Table 2. Insect damage and yield results.

Treatments	Rate product/ha	Spray Timing	Foliar Ratings (0-10)** Leafhoppers July 2	CPB July 13	Yield kg/plot Aug. 17
GUTHION 240SC	1.75 L	7 DAYS	8.3a*	8.5a	7.3ab
GUTHION 240SC	1.75 L	14 DAYS	8.9a	8.3a	7.0ab
GUTHION 240SC	0.875 L	BB 7 DAYS	8.1a	9.0a	8.0ab
GUTHION 240SC	0.875 L	BB 14 DAYS	8.6a	7.0ab	8.5a
DECIS 5.0 FL	100.0 ml	7 DAYS	8.1a	3.5cd	7.5ab
DECIS 5.0 FL	100.0 ml	14 DAYS	9.0a	2.8cd	7.3ab
DECIS 5.0 FL	50.0 ml	BB 7 DAYS	8.0a	4.8bc	7.0ab
DECIS 5.0 FL	50.0 ml	BB 14 DAYS	8.1a	3.8cd	7.3ab
Control			7.8a	1.5d	5.5b

* Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

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

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#060

ICAR: 61006535

CROP: Potato, cv. Superior

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

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TITLE: POTATO INSECT CONTROL USING ADMIRE FORMULATIONS

MATERIALS: ADMIRE 240FS, 2.5G (imidacloprid)

METHODS: Potatoes were planted in two row plots, 6 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed pieces were planted with a commercial planter on May 1. Granular insecticides were applied by hand in a 15 cm band in-furrow while the foliar insecticides were applied on June 21. Assessments were taken by counting the number of Colorado potato beetle (CPB) larvae per plot on June 21, 25, 29 and July 5. Foliar damage ratings caused by leafhoppers and beetle feeding damage were taken on July 2 and 13. Potato were harvested on August 18.

RESULTS: As presented in the tables.

CONCLUSIONS: ADMIRE, regardless of whether applied in-furrow or as a foliar spray, provided outstanding potato beetle control. The trial demonstrated an increased control of CPB as the rates of the in-furrow (liquid) or foliar formulations were increased. The granular material applied in-furrow took longer to achieve full activity compared to the liquid formulations. Good leafhopper control was also achieved with all insecticide treatments relative to the control. By July 5, 65 days after application, the level of CPB control was beginning to diminish. Effective CPB and leafhopper control was achieved for 2 1/2 months after treatment using the highest tested liquid rate of ADMIRE 240FS at 12.5 ml product/100 m of row applied in-furrow prior to planting.

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Table 1. Colorado potato beetle larval counts.

Treatments	Rate (product)	Application	CPB Larval Counts (# per plot) June 21	June 25	June 29	July 5
ADMIRE 240FS	4.17 ml/100m	In-Furrow	0.0b*	67.5b	16.0b	58.8a
ADMIRE 240FS	8.33 ml/100m	In-Furrow	0.0b	10.0bc	1.8c	16.3b
ADMIRE 240FS	12.5 ml/100m	In-Furrow	0.0b	3.8c	0.3c	7.5b
ADMIRE 2.5G	80.0 gm/100m	In-Furrow	0.3b	23.8bc	3.0c	12.5b
ADMIRE 240FS	104.2 ml/ha	Foliar	39.0a	0.0c	0.3c	21.3b
ADMIRE 240FS	208.3 ml/ha	Foliar	35.3a	2.5c	0.5c	13.8b
Control			38.8a	227.5a	100.0a	82.5a

* Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

Table 2. Insect damage and yield results.

Tretments	Rate (product)	Application	Foliar Ratings (0-10)** Leafhopper July 2	CPB July 13	Yield kg/plot Aug. 18
ADMIRE 240FS	4.17 ml/100m	In-Furrow	8.3a*	7.3ab	10.60a
ADMIRE 240FS	8.33 ml/100m	In-Furrow	8.9a	8.7a	11.95a
ADMIRE 240FS	12.50 ml/100m	In-Furrow	8.9a	8.0ab	11.60a
ADMIRE 2.5G	80.0 gm/100m	In-Furrow	8.6a	7.3ab	10.98a
ADMIRE 240FS	104.2 ml/ha	Foliar	7.5b	8.5a	11.05a
ADMIRE 240FS	208.3 ml/ha	Foliar	8.5a	8.5a	11.00a
Control			5.5c	6.7b	8.55b

* Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

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

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#061

ICAR: 61006535

CROP: Potato, cv. Superior

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

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TITLE: POTATO INSECT CONTROL USING FOSTHIAZATE 900EC

MATERIALS: FOSTHIAZATE 900EC (fosthiazate); THIMET 15G (phorate); ADMIRE 240FS (imidacloprid)

METHODS: Potatoes were planted in two row plots, 6 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed pieces were planted with a commercial planter on May 1. Granular insecticides were applied by hand in a 15 cm band in-furrow while the foliar applications were applied using a back pack airblast sprayer using 240 L/ha of water. The broadcast and in-furrow treatments of fosthiazate were applied using an Oxford precision boom sprayer, applying 200 L/ha of water. The treatments were raked into the soil simulating a preplant incorporation treatment. The in-furrow and broadcast treatments were applied just prior to planting the potatoes. The foliar spray of ADMIRE was applied only once on June 21 at 50% CPB egg hatch. Assessments were taken by counting CPB larvae per plot on June 21, 25, 28 and July 5, foliage damage ratings caused by leafhopper and CPB feeding damage on July 2 and 13, and potato yields on August 18. In addition, plant parasitic nematodes and *Verticillium dahliae* were counted with sampling taken on May 28 and July 4.

RESULTS: As presented in the tables.

CONCLUSIONS: FOSTHIAZATE 900EC provided very early season control of CPB, which was equivalent to THIMET 15G. Under more severe CPB populations after June 21, the level of CPB control was not outstanding. The most effective fOSTHIAZATE 900EC treatment was the combination of a broadcast and in-furrow spray at the rate of 37.8 ml product/100 m of row. This same treatment had the highest tuber yields of any of the fosthiazate treatments. Leafhopper control was also achieved early in the season with many of the fosthiazate treatments.
The most effective CPB control material was the treatment of ADMIRE 240FS applied either as an in-furrow spray or as a foliar application providing insect control 2 1/4 months after planting. Plant parasitic nematode populations were extremely low, and thus were not reported however, *Verticillium* counts were high. None of the treatments appeared to reduce the high *Verticillium* populations.

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Table 1. Colorado potato beetle counts.

Treatments	Rate prod/100m	Application	CPB Larval Counts (# per plot) June 21	June 25	June 28	July 5
FOSTHIAZATE 900EC	56.0 ml	Broadcast-ppi	22.3c*	207.5a	342.5ab	122.5a
FOSTHIAZATE 900EC	74.0 ml	Broadcast-ppi	7.0de	190.0a	270.0bc	115.0a
FOSTHIAZATE 900	150.0 ml	Broadcast-ppi	9.5cde	222.5a	302.5abc	108.8a
FOSTHIAZATE 900EC+	28.0 ml	Broadcast-ppi				
FOSTHIAZATE 900EC	28.0 ml	In-Furrow	9.0cde	175.0a	280.0bc	136.3a
FOSTHIAZATE 900EC+	28.0 ml	Broadcast-ppi				
FOSTHIAZATE 900EC	37.8 ml	In-Furrow	14.3cde	165.0a	182.5d	107.5a
THIMET 15G	224.0 gm	In-Furrow	21.8cd	160.0a	245.0cd	86.3a
ADMIRE 240FS	9.0 ml	In-Furrow	0.5e	2.5b	38.8e	8.8b
ADMIRE 240FS	1.0 ml	Foliar Spray	41.3ab	0.0b	18.8e	8.8b
Control			62.5a	240.0a	365.0a	131.3a

* Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

Table 2. Insect damage, yield results and *Verticillium* counts.

Treatments	Rate prod/100m	Application	Foliar Ratings(0-10)** Leaf-hopper July2	CPB July13	Yield kg/plot Aug18	Vert*** May28	July4
FOSTHIAZATE 900EC	56.0 ml	Broadcast-ppi	8.5b*	7.3ef	9.73ab	34	28
FOSTHIAZATE 900EC	74.0 ml	Broadcast-ppi	9.0a	8.1cd	9.95ab	32	24
FOSTHIAZATE 900EC	150.0 ml	Broadcast-ppi	9.1a	7.0f	9.27ab	28	30
FOSTHIAZATE 900EC+	28.0 ml	Broadcast-ppi					
FOSTHIAZATE 900EC	28.0 ml	In-Furrow	9.1a	8.0cd	9.63ab	18	12
FOSTHIAZATE 900EC+	37.8 ml	Broadcast-ppi					
FOSTHIAZATE 900EC	37.8 ml	In-Furrow	9.0a	8.0cd	10.02ab	30	34
THIMET 15G	224.0 gm	In-Furrow	9.1a	8.6bc	8.45b	36	26
ADMIRE 240FS	9.0 ml	In-Furrow	9.1a	9.6a	10.60a	18	22
ADMIRE 240FS	1.0 ml	Foliar Spray	9.0a	9.0b	10.73a	34	24
Control			6.2c	7.8de	8.40b	22	22

* Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

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

*** *Verticillium dahliae* counts No. of colonies/g of soil

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#062

ICAR: 61006535

CROP: Potato, cv. Superior

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

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TITLE: POTATO INSECT CONTROL USING TRIGARD 75WP

MATERIALS: TRIGARD 75WP (cyromazine); GUTHION 240SC (azinphos-methyl); RIPCORD 400EC (cypermethrin); THIODAN 4EC (endosulfan).

METHODS: Potatoes were planted in two row plots, 6 m in length with rows spaced 1 m apart, replicated four times in a randomized complete block design. Potato seed pieces were planted with a commercial planter on May 1. Spray applications were made using a back pack airblast sprayer using 240 L/ha of water. An early adulticide spray of GUTHION 240SC was applied on June 10 for treatments 6 and 7. Subsequent timings were initiated at 30-50% egg hatch on June 22 and seven to ten days later on July 2 and 9. All treatments were sprayed on July 12 which was the beginning for the 2nd generation Colorado potato beetle (CPB). Assessments were taken by counting the number of Colorado potato beetle larvae per plot at intervals (see RESULTS) throughout the summer, foliage damage ratings caused by leafhoppers, potato beetle damage on July 2, 13 and potato yields on August 18.

RESULTS: As presented in the table.

CONCLUSIONS: Large numbers of Colorado potato beetles caused severe potato defoliation. The use of GUTHION 240SC early in the spray program, treatments 6, 7, and 10, significantly delayed the presence of CPB larvae on June 24. However, all three of the GUTHION early treatments had larger CPB larval counts by mid-season, July 2 and by July 13, the foliar ratings of the GUTHION treatments were not different from the TRIGARD 75WP treatments. However, all three of the GUTHION early treatments had larger CPB larval counts by mid-season, July 2, and by July 13 the foliar ratings of the GUTHION treatments were not different from the TRIGARD treatments. The initial CPB adulticide application of GUTHION 240SC on June 10 also were effective against leafhoppers.

The initial application of TRIGARD 75WP on June 22 significantly reduced the CPB larvae counts relative to the control as recorded on June 24. There were higher beetle numbers on the reduced TRIGARD rate of 0.14 kg ai/ha. Subsequent sprays, regardless of rate or choice of products kept beetles controlled, with little difference between treatments in their relative control of CPB.

Table 1. Colorado potato beetle counts, insect damage ratings and yield results.

Treatments	Rate kg ai/ha	Timing*	CPB Larval Counts June 24	CPB Larval Counts July 2	CPB Larval Counts July 9	Foliar Ratings(0-10)*** Leaf-hopper July 3	Foliar Ratings(0-10)*** CPB July 13	Yield kg/plot Aug.18
TRIGARD 75WP	0.28	2 + 5	109.5c**	32.5de	82.5bc	7.0cd	8.0a	8.67abc
TRIGARD 75WP;	0.14	2						
TRIGARD 75WP	0.14	3 + 5	205.0b	31.3de	11.3d	7.0cd	9.0a	9.02abc
TRIGARD 75WP;	0.28	2						
TRIGARD 75WP	0.14	3 + 5	112.5c	25.0e	13.8d	7.0cd	8.9a	9.45ab
TRIGARD 75WP;	0.28	2						
TRIGARD 75WP	0.28	3 + 5	137.5bc	43.8de	17.5d	6.8d	8.8a	8.95abc
TRIGARD 75WP;	0.28	2						
TRIGARD 75WP;	0.14	3						
TRIGARD 75WP	0.14	4 + 5	132.5bc	16.3e	12.5d	7.3cd	8.6a	10.02ab
GUTHION 240SC;	0.54	1						
TRIGARD 75WP;	0.28	2						
TRIGARD 75WP	0.14	3 + 5	6.3d	87.5bcd	36.3cd	8.5a	8.9a	9.55ab
GUTHION 240SC;	0.54	1						
RIPCORD 400EC;	0.036	2						
THIODAN 4EC;	0.56	3						
GUTHION 240SC	0.54	4 + 5	10.0d	138.8b	87.5bc	8.4ab	9.3a	10.18ab
TRIGARD 75WP;	0.28	2						
TRIGARD 75WP;	0.14	3						
GUTHION 240SC	0.54	4 + 5	121.3c	40.0de	16.3d	7.5cd	9.1a	9.98ab
TRIGARD 75WP;	0.28	2						
TRIGARD 75WP;	0.14	3						
THIODAN 4EC	0.56	4 + 5	155.0bc	72.5cde	21.3d	7.0cd	8.6a	9.50ab
GUTHION 240SC;	0.54	2						
RIPCORD 400EC;	0.036	3						
THIODAN 4EC	0.56	4 + 5	7.5d	115.0bc	170.0a	7.8bc	9.3a	11.03a
Control			300.0a	295.0a	113.8ab	6.8d	1.5b	8.00bc

* Timing: 1 - early adulticides, 1st adults 3 - 7-10 days later
2 - 30-5-% egg hatch 4 - 7-10 days later
5 - 2nd generation

** Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

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

#063

ICAR: 61002036

CROP: Potato, cv. Superior

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

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TITLE: USE OF INSECTICIDES ON A POTATO TRAP CROP TO CONTROL INSECTS ATTACKING FIELD TOMATOES

MATERIALS: THIMET 15G (phorate); ADMIRE 240FS (imidacloprid)

METHODS: Potatoes were planted in single row plots around the perimeter of a tomato range at RCAT. The plots were 8 m in length and replicated two times One set of treatments were planted on the east side of the tomato field, the other set was on the west side. The treatments were in reverse order from one side to the other. Potato seed pieces were planted with a commercial planter on May 8. The granular insecticide was applied in a 15 cm band in-furrow prior to planting while the liquid insecticides were sprayed in a 15 cm band either in-furrow or over the row after planting. Assessments were taken by counting Colorado potato beetle larvae per plot on June 30 and July 12. Foliar damage ratings were taken on July 2 and 28.

RESULTS: As presented in the table.

CONCLUSIONS: ADMIRE 240FS sprayed in-furrow provided outstanding Colorado
Potato Beetle control throughout the critical part of the season for CPB attack. This treatment allowed the potato plant to retain its foliage thus being most effective as a beetle trap crop, protecting the tomato crop from CPB attack. The band application of ADMIRE 240FS sprayed over the row after planting was also effective early in the season, maintaining excellent foliage protection against the most critical 1st generation CPB. However, plants became defoliated later in the season. THIMET 15G was ineffective, resulting in a significant loss of foliage which renders this treatment ineffective as a potato trap crop treatment.

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Table 1. Colorado potato beetle laval counts and foliar damage ratings on the potato trap crop.

Treatments	Rate prod/100m	Application	CPB Larval Counts (# per plot) June 30	July 12	Foliar Damage Ratings(0-10)** July l2	July 28
THIMET 15G	224 gm	In-Furrow	40.0b*	185.0b	7.0b	3.0c
ADMIRE 240FS	9 ml	In-Furrow	0.0b	2.0c	9.8a	9.0a
ADMIRE 240FS	9 ml	Band	0.0b	52.5bc	9.8	6.0b
Control			200.0a	500.0a	5.5c	0.1d

* Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

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

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#064

ICAR: 86100104

CROP: Potato, *Solanum tuberosum*, cv. Kennebec

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

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TITLE: CONTROL OF COLORADO POTATO BEETLE WITH *BACILLUS THURINGIENSIS* (*B.t.*) AND CONVENTIONAL INSECTICIDES

MATERIALS: M-TRAK (*B.t. san diego*), 15.8 g toxin/L, at 2.5 and 5.0 L prod/ ha; DECIS 2.5 EC (deltamethrin), 25 g/L, at 7.5 g ai/ha; INCITE (piperonyl butoxide [PBO]), 920 g/L, at 500 ml prod/ha; RIPCORD (cypermethrin), 400 g/ L, at 35 g ai/ha; AC 303 630 (a pyrrole), 240 g/L, at 50 and 100 g ai/ha; NOVODOR (*B.t. tenebrionis*), 3% active protein, at 5.0 and 7.5 L prod/ha; TRIGARD 75 WP (cyromazine) at 140 and 280 g ai/ha; ADMIRE FS (imidacloprid) 240 g/L at 25 and 50 g ai/ha.

METHODS: Potatoes were seeded on May 4 in 4-row plots, 13 m long. Rows were spaced at 0.9 m and plots were separated by 3 m spray lanes. Treatments were arranged in a randomized complete block design. Insecticides were applied with a tractor-mounted, four-row boom sprayer that delivered 800 L/ha at 450 kPa. One hundred egg masses were tagged on June 14 and checked daily to determine hatch. On June 16 there was 0% hatched, on June 18, 22% had hatched, and on June 21, 82% had hatched. There were four application schedules. Treatments were applied on June 21 (Schedule A), or June 21 and 28 (B), or June 21, 28 and July 5 (C). A single treatment was applied on June 18 (Schedule D) to curtail the egg laying of the adult beetles.

Populations of Colorado potato beetle were monitored three to four days after the treatments were applied by examining five plants in each plot and the numbers of beetle larvae and adults were recorded. The percent defoliation caused by adults and larvae was estimated. Mean defoliation for the period of adult and larval feeding during the first generation was calculated for each treatment. Yield data was obtained at harvest for the centre two rows of each plot on August 27. The numbers of large larvae, the percent defoliaton and the yield for all treatments were compared by Analysis of Variance (SAS Inst.) and means separated by Tukey's Studentized Range Test when significant at $P < 0.05$.

RESULTS: See Table 1.

CONCLUSIONS: All treatments were effective in controlling large larvae (instars 3 and 4) after two applications and subsequently displayed significantly less defoliation than the control. All treatments, with the exception of M-TRAK, NOVODOR, TRIGARD (Schedule A) and DECIS + PBO (Schedule B), maintained control of large larvae for the balance of the first generation, through July 15, without further sprays. According to defoliation rating on July 15, only DECIS + PBO was inferior to the other treatments. TRIGARD (Schedule A) gave two weeks of control with a single application. All treatments produced a significantly higher yield than the control with the exception of TRIGARD (Schedule A) and the higher rate of NOVODOR.

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Table 1. Means* of Colorado potato beetle, percent defoliation and yield per treatment, cv Kennebec 1993.
S = schedule, LL = 1st generation large larvae/5 plants,
DEF = percent defoliation, and YIELD = yield in T/ha.

Insecticide	Rate (ai/ha)	S	July 1 LL	July 1 DEF	July 8 LL	July 8 DEF	July 15 LL	July 15 DEF	YIELD
AC303 630 + M-Trak	50 g + 2.5 L/ha	B	0.0b	1.3de	0.5c	1.4c	0.6c	2.0c	34.0b
AC303 630 + M-Trak	100 g + 2.5 L/ha	B	0.0b	1.8cde	0.0c	1.2c	0.0c	1.3c	34.9b
AC303 630	50 g	B	0.6b	2.5bcde	1.0c	2.3c	0.3c	2.5c	36.3b
M-TRAK	5 L/ha	B	0.3b	1.5cde	0.4c	2.2c	2.5abc	3.2c	33.0b
M-TRAK	5 L/ha	B	0.1b	1.8cde	0.7c	2.0c	2.3abc	3.1c	33.1b
Trigard	280 g	A	0.3b	3.5bcde	10.1abc	13.0b	5.1ab	9.9bc	31.2ab
Trigard	140 g	B	1.7b	4.9bc	2.2bc	6.0bc	1.7abc	5.2c	35.4b
Trigard	280; 140 g	B	0.2b	5.4b	0.9c	4.5bc	0.9bc	2.9c	32.7b
Trigard	280 g	B	0.1b	4.7bcd	1.1c	4.0bc	0.2c	2.3c	32.4b
Trigard	280; 140; 140 g	C	0.8b	4.2bcde	0.2c	3.9bc	0.3c	3.1c	33.2b
Trigard then Ripcord	280; 280 g 35 g	C	1.7b	4.7bcd	0.2c	4.1bc	0.1c	2.6c	32.4b
Admire	25 g	B	0.0b	1.3e	0.4c	0.7c	0.7bc	1.0c	33.9b
Admire	50 g	B	0.0b	1.2e	0.0c	0.5c	0.0c	0.7c	37.4b
Novodor	5 L/ha	B	0.2b	2.7bcde	2.4bc	3.6bc	3.8abc	6.3c	35.0b
Novodor	7.5 L/ha	B	0.2b	3.4bcde	2.2bc	4.9bc	3.8abc	4.9c	27.8ab
Decis + PBO	5 g + 500 mL/ha	B	1.1b	3.4bcde	12.2ab	12.1c	5.7a	16.2b	33.5b
Decis + PBO then Vydate	5 g + 500 mL/ha; 3 L/ha	D; B	0.0b	0.9e	0.1c	0.9b	0.0c	0.9c	36.0b
CHECK	-		8.0a	10.0a	13.5a	35.1a	4.3abc	50.3a	20.0a

* Means in each column followed by the same letter are not significantly different at P = 0.05 (Tukey's Studentized Range Test [SAS Inst. 1987]).

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#065

STUDY DATA BASE: 280-1252-9304

CROP: Potato, cv. Conestoga

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

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TITLE: EVALUATION OF SOIL INSECTICIDES FOR CONTROL OF COLORADO POTATO BEETLE (CPB) ATTACKING POTATOES IN MINERAL SOIL

MATERIALS: ADMIRE 240FS (240 g ai/L) (imidacloprid); NTN 33893 2.5G (imidacloprid); THIMET 15G (phorate)

METHODS: Potatoes were planted in London on 7 May in single-row microplots (2.25 m long x 0.9 m wide) filled either with insecticide residue-free mineral soil (Tmts. 1, 4, 6, 7) or with soil treated with the same insecticides in previous years (Tmts. 2, 3, 5). All treatments were replicated three times in a randomized complete block design. Granular insecticides were hand-applied with a modified salt shaker in a 5 cm band in the bottom of the furrow below seed potatoes. Furrow sprays were applied in a 5-7 cm band in the bottom of the planting furrow at 135 kPa in 5 L water/100 m row using a single-nozzled (6504 flat fan) Oxford precision sprayer. CPB larvae were counted on 5 plants in each microplot on 29 June. Feeding damage to foliage was assessed visually on 2, 7, 14 and 22 July. Potatoes were dug on 20 August. Tubers were graded, counted and weighed and marketable (Canada #1) yields were calculated. At regular intervals, potato leaflets were also harvested from each microplot, returned to the laboratory and fed to 2nd instar larvae of an insecticide-susceptible CPB strain; 5 bioassays were conducted per treatment for each collection date. Larval mortality and feeding damage in each bioassay were rated after 96 h.

RESULTS: See Table 1 and Table 2.

CONCLUSIONS: All rates of imidacloprid maintained excellent protection of potato foliage until late-July, resulting in significant yield increases relative to CONTROL plots. No significant differences were noted between performance of granular and flowable formulations of imidacloprid. Repeat application of imidacloprid to the same soil had no significant effect on either CPB larval populations or foliage damage in 1993; reduced yields following the 3rd application of imidacloprid are felt to be due to deleterious effects on soil of continuous potato production rather than a direct effect of insecticide application. Although higher CPB larval populations and increased foliage damage were recorded in plots where THIMET 15G was applied for the first time, yields in these plots were not significantly lower than yields in plots treated with either formulation of imidacloprid. CPB were not effectively controlled in plots treated with THIMET 15G for two years in succession. In bioassay, feeding damage by 2nd instar CPB larvae was reduced by roughly 25% for: 60 days in microplots treated with imidacloprid for the first time; 66 days in microplots receiving a third annual application of imidacloprid; for 39 days in microplots treated with phorate for the first time; and for less than 24 days in microplots receiving a second annual application of phorate.

RESIDUES: Samples of soil and potatoes for measurement of pesticide residues were collected from microplots for Treatments 1, 3, 4 and 7. Analyses are incomplete. No residues were detected in potatoes grown in 1992 in soil treated with imidacloprid (detection limit 0.02 ppm) at 3.0 g ai/100 m; soil residues of imidacloprid in these plots measured 0.17 ppm at harvest on 18 August 1992.

Table 1. Effect of soil insecticides on CPB damage to potatoes in mineral soil.

No.	Treatment	Rate (g ai/ 100 m)	Years* Applied	# CPB Larvae/ Plant	Foliar Damage Rating** 07/07	Foliar Damage Rating** 22/07	Mkt. Yield (t/ha)
1	ADMIRE 240FS	2.0	1	0.6 d***	9.9 a	9.6 a	33.3 ab
2	ADMIRE 240FS	2.0	2	1.0 d	9.9 a	9.7 a	32.7 ab
3	ADMIRE 240FS	2.0	3	0.2 d	9.9 a	9.6 a	29.0 b
4	NTN 33893 2.5G	2.0	1	0.9 d	9.9 a	9.7 a	37.9 a
5	THIMET 15G	26.3	2	24.9 b	7.8 c	0.8 c	21.7 c
6	THIMET 15G	26.3	1	14.3 c	9.2 b	3.5 b	29.7 b
7	CONTROL	----	---	36.3 a	8.0 c	0.4 c	21.6 c

* Number of years insecticides (re-)applied to same soil.
** Rating scale (0-10): 0 = no control, plants defoliated, 10 = complete control, no CPB damage.
*** Means within a column followed by the same letter are not significantly different (P = 0.05) as determined by Duncan's New Multiple Range Test.

Table 2. Measurement, by bioassay, of biological activity of toxicants in potato foliage following insecticide application in seed furrow.

No. Days*	ADMIRE-1 % Mort**	ADMIRE-1 D.R.***	ADMIRE-3 % Mort	ADMIRE-3 D.R.	THIMET-1 % Mort	THIMET-1 D.R.	THIMET-2 % Mort	THIMET-2 D.R.
24	71.3	80.9	100.0	98.9	90.9	46.1	13.6	4.5
32	91.7	92.4	100.0	97.0	87.5	50.0	50.7	22.7
39	41.8	70.3	49.4	67.6	67.8	39.2	1.5	6.8
46	0.0	11.8	40.0	98.8	4.0	7.1	0.0	4.7
53	20.8	35.7	55.6	64.3	0.0	0.0	0.0	0.0
60	4.2	24.6	0.0	23.0	ND	ND****	ND	ND
66	0.0	6.8	40.0	60.3	ND	ND	ND	ND
74	---	---	0.0	18.6	ND	ND	ND	ND

* Number of days post application.
** 96 hr mortality.
*** % reduction in feeding damage to treated potato leaves relative to damage to leaves harvested from CONTROL plots.
**** Bioassay not done.
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#066

STUDY DATA BASE: 309-1251-9321

CROP: Potato, cv. Russet Burbank

PEST: Potato aphid, *Macrosiphum euphorbiae* (Thomas); green peach aphid, *Myzus persicae* (Sulzer)

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TITLE: CHEMICAL CONTROL OF TWO APHID SPECIES ON POTATOES

MATERIALS: BAY NTN 33893 240FS, BAY NTN 33893 2.5G, THIMET (phorate).

METHODS: Plots consisted of four 7.3 m long rows spaced 0.9 m apart. The plots were laid out in a randomized block design where each treatment was replicated four times. Potatoes were planted on May 27 and 28 at 41 cm spacing. On May 27 and 28 in-furrow NTN FS treatments were applied using a CO_2 pressurized backpack sprayer set at 415 kPa equipped with a single extended range nozzle (8002VS). The application volume was approximately 700 L/ha at 4.3 kph. NTN G and THIMET were applied using a conveyor belt fertilizer applicator on May 27. The plots were topkilled on August 31. *Myzus persicae* and *Macrosiphum euphorbiae* taken from greenhouse colonies (18L:6D) were reared for two generations on cut leaves (16L:8D). Newly matured adults were used in tests. Five *Myzus persicae* (mostly apterae) and five *Macrosiphum euphorbiae* (approximately 50% apterae and 50% alatae) per clip cage were put on terminal leaflets of potato plants. Clip cages measured 3 cm in diameter by 1 cm in height. One cage of each aphid species was placed in each plot for each treatment assessed. Whenever possible the same plant was used in each trial. Trials 1-4 for *Myzus persicae* were set up on July 8, 21, August 4, and 19, respectively. For *Macrosiphum euphorbiae* trials 1-4 were set up on July 9, 22, August 4, and 19 respectively. Cages were checked daily for a period of seven days to record mortality. Aphid mortality was converted to percent mortality. Analyses of variance were carried out on data that was transformed to the corresponding arcsin value before analysis.

RESULTS: Treatment means are presented in Tables 1 and 2. There were two replicates in the 0.02, 0.03, 0.066 and 0.098 g/m NTN FS treatments due to over application in two replicates of both the 0.02 and 0.03 g/m NTN FS treatments.

CONCLUSIONS: The liquid NTN formulation applied in-furrow tended to provide the highest level of protection followed by THIMET then NTN G. The liquid formulation of NTN must be applied at a rate of at least 0.03 g/m to obtain season-long aphid control.

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Table 1. Mean *Myzus persicae* mortality (%) after seven days in clip cages set on field grown potato plants.*

Treatment**	*Myzus persicae*			
	Trial 1	Trial 2	Trial 3	Trial 4
	15/07	28/07	11/08	26/08
NTN 33893 FS 0.010 g/m**	100.0a	0.0a	0.0a	0.0a
NTN 33893 FS 0.020 g/m	100.0a	50.0ab	0.0a	0.0a
NTN 33893 FS 0.030 g/m	.	100.0b	100.0b	100.0b
NTN 33893 FS 0.066 g/m	100.0a	60.0ab	70.0ab	10.0a
NTN 33893 FS 0.098 g/m	.	100.0b	0.0a	0.0a
NTN 33893 G 0.020 g/m	0.0b	50.0ab	66.7ab	0.0a
THIMET 3.69 kg/ha	8.3b	0.0a	45.0ab	25.0a
Untreated check	0.0b	0.0a	0.0a	5.0a

* Figures are the means of four replicates (two in the 0.02, 0.03, 0.066 and 0.098 g/m NTN 33893 FS treatments, and three in the NTN 33893 G treatment). Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P<0.05).

** All treatments are listed in g or kg of a i/m or ha.

Table 2. Mean *Macrosiphum euphorbiae* mortality (%) after seven days in clip cages set on field grown potato plants.*

Treatment**	*Macrosiphum euphorbiae*			
	Trial 1	Trial 2	Trial 3	Trial 4
	16/07	29/07	11/08	26/08
NTN 33893 FS 0.010 g/m**	100.0a	40.0ab	15.0a	0.0a
NTN 33893 FS 0.020 g/m	100.0a	40.0ab	0.0a	20.0ab
NTN 33893 FS 0.030 g/m	.	60.0ab	100.0b	70.0ab
NTN 33893 FS 0.066 g/m	100.0a	40.0ab	90.0b	50.0ab
NTN 33893 FS 0.098 g/m	.	80.0a	50.0ab	40.0ab
NTN 33893 G 0.020 g/m	0.0b	16.7b	33.3ab	0.0a
THIMET 3.69 kg/ha	75.0a	15.0b	55.0ab	75.0b
Untreated check	8.3b	0.0b	0.0a	0.0a

* Figures are the means of four replicates (two in the 0.02, 0.03, 0.066 and 0.098 g/m NTN 33893 FS treatments and three in the NTN 33893 G treatment). Numbers followed by the same letter are not significantly different according to a Duncan's Multiple Range Test (P<0.05).

** All treatments are listed in g or kg of a i/m or ha.

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#067

BASE DE DONNÉES DES ÉTUDES: 310-1452-8504

CULTURE: Rutabaga, cv. Laurentian

RAVAGEUR: Mouche du chou, *Delia radicum* (L.)

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TITRE: UTILISATION DE LORSBAN 15 G ET LORSBAN 50 W DANS L'ÉRADICATION DE LA MOUCHE DU CHOU CHEZ LE RUTABAGA

PRODUITS: LORSBAN 15 G, 50 W (Chlorpyrifos).

MÉTHODES: L'étude fut réalisée selon un plan à blocs complets aléatoires contenant 21 traitements répétés 4 fois. Chaque parcelle comptait 4 rangs de 3,9 m de long espacés de 90 cm. Les rutabagas furent mis en terre le 30 juin 1993 à raison de 25 plants/rang espacés de 15 cm. Une application d'herbicide trifluralin (TREFLAN 545 EC, 2.0 L/ha; 206 kPa) fut effectuée le 14 juin.

Les traitements comprenaient en plus d'un témoin sans application d'insecticide:

A) LORSBAN 15 G ajouté au terreau, en serre, avant la mise en terre des graines aux doses équivalentes à 1) 0,6 g/m; 2) 1,0 g/m 3) 2,0 g/m de rang et les mêmes doses pour les traitements 4, 5 et 6 qui furent suivis 2 semaines plus tard d'un arrosage copieux en champ de LORSBAN 50 W à une dose équivalente à 2,25 kg/ha.

B) LORSBAN 15 G appliqué en bande de 8 cm de large sur le champ lors de la transplantation aux doses équivalentes à 7) 0,6 g/m; 8) 1,0 g/m; 9) 2,0 g/m de rang et les mêmes doses pour les traitements 10, 11 et 12 qui furent suivis deux semaines plus tard d'un arrosage copieux en champ de LORSBAN 50 W à une dose équivalente à 2,25 kg/ha.

C) LORSBAN 50 W appliqué directement dans les cellules de transplantation en serre avant la mise en terre des graines, 4 semaines avant la transplantation en champ aux doses équivalentes à 13) 1,1 kg/ha et 14) 2,2 kg/ha et aux mêmes doses équivalentes pour les traitements 15 et 16 qui furent suivis 2 semaines plus tard d'un arrosage copieux en champ de LORSBAN 50 W à une dose équivalente à 2,25 kg/ha.

D) LORSBAN 50 W appliqué aux cellules de transplantation en serre 2 jours seulement avant la transplantation aux doses équivalentes à 17) 1,1 kg/ha et 18) 2,2 kg/ha et aux mêmes doses équivalentes pour les traitements 19 et 20 qui furent suivis 2 semaines plus tard d'un arrosage copieux en champ de LORSBAN 50 W à une dose équivalente à 2,25 kg/ha.

Le dépistage de la mouche du chou sur 5 plants choisis au hasard dans les 2 rangs de centre de chaque parcelle fut effectué à toutes les semaines pour un total de 8 dépistages. La récolte se fit le 3 septembre. Le poids, le diamètre et la qualité commerciale de 8 rutabagas choisis au hasard dans les rangs du centre de chaque parcelle furent enregistrés. Les dommages furent évalués selon l'échelle 0-4 où 0 = sans dommage; 1 = dommages légers, 2 = dommages modérés et 4 = dommages sérieux. Les rutabagas avec un indice égal ou supérieur à 1 étaient considérés non-commercialisables.

RÉSULTATS: Voir tableau ci-dessous.

CONCLUSIONS: Seul le diamètre des rutabagas a présenté une différence significative entre les traitements. Les traitements Lorsban 15G et 50W ajoutés au terreau ont donné dans l'ensemble les plus forts diamètres. Bien que la qualité commerciale n'est pas significativement différente entre les traitements, le Lorsban 50W appliqué aux cellules deux jours avant la transplantation a donné, avec une qualité commerciale moyenne de 64.2%, les meilleurs contrôles. En effet, la qualité commerciale la plus élevée (75%) a été obtenue avec l'application de la dose maximum recommandée (2.2. kg/ha) de Lorsban 50W ajoutée aux cellules 2 jours avant la transplantation et suivi par un arrosage copieux en champ 2 semaines plus tard. Le Lorsban 50W appliqué aux cellules 4 semaines avant la transplantation semble donner un meilleur résultat lorsqu'il est suivi par un arrosage copieux 2 semaines plus tard (moy. = 49.9% vs moy. = 65.7%). Le Lorsban 15G appliqué au champ avec (moy. = 44.9%) ou sans (moy. = 43.9%) arrosage copieux a présenté, avec le Témoin (37.5%), les qualités commerciales les plus faibles. Aucun des traitements n'a réussi à protéger les plants à 100%.

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Tableau 1. Productivité du rutabaga suite à l'utilisation de Lorsban 15G et 50W.

	Traitements	Poids (g)	Diamètre (cm)	Qualité*** (%)
	Témoin	566.6	10.4cd**	37.5
	LORSBAN 15G. Terreau			
1.	0,6 g/m	607.3	11.0abc	40.8
2.	1,0 g/m	603.3	11.1abc	62.5
3.	2,0 g/m	682.2	11.6a	53.0
4.	0,6 g/m + a.c.*	631.3	11.1abc	59.5
5.	1,0 g/m + a.c.	576.2	10.7bcd	53.3
6.	2,0 g/m + a.c.	650.9	11.3ab	50.5
	LORSBAN 15G. Champ			
7.	0,6 g/m	577.3	9.9e	43.8
8.	1,0 g/m	536.8	9.4e	40.8
9.	2,0 g/m	589.6	10.5cd	47.0
10.	0,6 g/m + a.c.	604.7	10.2cde	34.5
11.	1,0 g/m + a.c.	513.1	9.9e	62.8
12.	2,0 g/m + a.c.	597.2	10.1de	37.3
	LORSBAN 50W. Terreau			
13.	1,1 kg/ha	558.1	10.5cd	43.5
14.	2,2 kg/ha	678.8	11.5a	56.3
15.	1,1 kg/ha + a.c.	566.8	10.7bcd	65.8
16.	2,2 kg/ha + a.c.	583.6	10.8bcd	65.5
	LORSBAN 50W. Cellule			
17.	1,1 kg/ha	448.9	9.7e	72.0
18.	2,2 kg/ha	637.1	10.8bcd	65.8
19.	1,1 kg/ha + a.c.	685.7	11.4ab	44.0
20.	2,2 kg/ha + a.c.	516.8	10.1de	75.0

* a.c. = arrosage copieux

** Les valeurs suivies de la même lettre ne sont pas significativement différentes au seuil 5% (Duncan's Multiple Range Test).

*** Transformation arcsin (SQRT (%)) des données avant le test.

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#068

ICAR: 61006538

CROP: Soybean, cv. Conrad

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

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TITLE: INSECTICIDES FOR THE CONTROL OF SEED CORN MAGGOT IN SOYBEANS

MATERIALS: AC303,630 240SC; AGROX B3 (diazinon + lindane + captan); AGROX DL PLUS (diazinon + lindane + captan); FORCE 50EC (tefluthrin); TF3755 200ST (tefluthrin); UBI 2627 200ST (NTN33893); VITAFLO 280 (carbathiin + thiram)

METHODS: The crop was planted on 10 May, 1993 at Ridgetown, Ontario on a sandy loam soil near a manure pit, in 6 m rows spaced 0.76 m apart at 100 seeds/plot, using a John Deere Max-emerge planter which was fitted with a cone seeder. Plots were single rows, arranged in a randomized complete block design with four replicates. Plots were prepared on top of winter wheat (killed with glyphosate + ammonium sulfate + Agral 90) green manure ploughed in early May. Cattle manure was disced in four weeks prior to planting. Plots were planted when adults were numerous (monitored by yellow sticky cards). Seeds were treated in 200 g lots using a desk-top treater supplied by UNIROYAL CHEMICAL. Percent emergence was calculated by counting all the plants emerged per plot at the first leaf stage and relating that to the total number of seeds planted. Percent injury was calculated as the number of seedlings showing maggot injury over the number of seedlings dug up in a 2 m section of row. Non-emerged seeds/seedlings were included in the evaluation.

RESULTS: Results are presented in Table 1.

CONCLUSIONS: The standard seed treatment containing lindane and diazinon provided the best level of control.

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Table 1. Control of seed corn maggot in soybeans with seed treatment insecticides at Ridgetown, Ontario in 1993.

Treatment	Rate	Rate Units	Method	05/31 Percent Emergence	05/31 Percent Infestation
NON-TREATED				35 e*	24 a
VITAFLO 280	2.6	ml/kg	SEED TREAT.	42 cde	26 a
AGROX B3	3.2	g/kg	SEED TREAT.	65 a	23 a
VITAFLO 280 AGROX DL+	2.6 2.2	ml/kg g/kg	SEED TREAT. SEED TREAT.	63 ab	6 b
VITAFLO 280 UBI 2627	2.6 5.0	ml/kg ml/kg	SEED TREAT. SEED TREAT.	51 a-e	23 a
VITAFLO 280 UBI 2627	2.6 10.0	ml/kg ml/kg	SEED TREAT. SEED TREAT.	55 a-d	22 a
VITAFLO 280 UBI 2627	2.6 15.0	ml/kg ml/kg	SEED TREAT. SEED TREAT.	58 abc	23 a
VITAFLO 280 TF3755 200ST	2.6 3.0	ml/kg ml/kg	SEED TREAT. SEED TREAT.	59 abc	22 a
VITAFLO 280 TF3755 200ST	2.6 4.0	ml/kg ml/kg	SEED TREAT. SEED TREAT.	56 a-d	28 a
VITAFLO 280 FORCE 50EC	2.6 22.6	ml/kg ml/100 m row	SEED TREAT. IN-FURROW	47 b-e	33 a
VITAFLO 280 AC303,630 240SC	2.6 2.7	ml/kg ml/100 m row	SEED TREAT. IN-FURROW	40 de	31 a
CV % =				13.0	24.7

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

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#069

ICAR: 61006538

CROP: Soybean

PEST: Slugs, mixed species

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TITLE: SLUG PROBLEM IN NO-TILL SOYBEANS

MATERIALS: AC303,630 360SC; AGRAL 90; AMBUSH 500E (permethrin); BASIC H; LANNATE 215L (methomyl); LORSBAN 480E (chlorpyrifos); NTN33893 240FS

METHODS: On 16 June, 1993 I visited a soybean field, in Charing Cross, Ont., with severe slug problems. The field was planted to winter wheat and under-seeded to red clover two years ago. Last year the red clover was harvested for seed and the remaining plants were allowed to grow. The red clover was sprayed with glyphosate early in the spring and the soybeans were no-till-planted in the red clover stubble. Last year, wet conditions prevailed throughout the summer and into the fall. About 75% of the soybean plants were missing, and many of the remaining plants were severely defoliated. Unaffected plants were at the 4th trifoliate stage. The soil was a heavy clay, the surface was dry and cracks were forming. When soil lumps (each about 100 cm\2) were removed most slugs were found at the 10-15 cm depth at the moisture layer. The grower was advised to replant and did so on 17 June, again with a no-till drill in 18 cm rows. At first emergence (24 June) we set up a small trial in his field to evaluate rescue broadcast sprays. Plots were 3.7 m wide X 6 m long arranged in a randomized complete block with four replicates. Sprays were applied with two passes of a back-pack sprayer with a 1.85 m boom having 6 nozzles spaced 30 cm apart. Sprays were applied in 228 L/ha water under 210 kPa pressure, travelling at about 8 kph. Emergence was counted in 2 m**2 from the centre of each plot on 30 June. In the same area, emerged plants were assessed for slug damaged and damaged plants were expressed as a percentage of the total emergence. Slugs were about 1-1.5 cm in length, and there were about 10/100cm\2.

RESULTS: Most of the slug damage occurred below the soil surface on newly germinated seedlings. The effects of the various rescue treatments applied are listed in Table 1.

CONCLUSIONS: With most of the damage occurring under ground, in this field situation, it was unlikely that any rescue treatment would have worked. None of the materials tested improved emergence or reduced percent plants damaged by slugs. Perhaps applying the materials at the time of replanting may have been better. Molluscicides are needed to protect emerging soybeans in no-till situations. None that are economically viable are available. Because slug outbreaks are sporadic, testing candidates will be extremely difficult unless the plots are seeded with slugs. More importantly, the problem could be avoided by altering crop management practices. My recommendation is to avoid no-till planting beans in fields that had heavy crop cover or crop residue from the previous season, coupled with moist conditions during both the previous crop year and near the time of planting. Where the threat of slugs is great, perhaps some tillage may be required to expose the slugs to predation and drying before beans are planted. Under heavy cover crops, and crop residue, an assessment of slug populations should be made in the fall previous to planting beans.

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Table 1. Performance of rescue treatments for the control of slugs in soybeans, Charing Cross, Ontario 1993.

Treatment	Rate (L/ha)	Plants Emerging no./m\2	% emerged plants with slug damage
LORSBAN 480E	1.6	16.8 a*	32 ab
LORSBAN 480E	2.0	15.0 a	40 ab
LANNATE 215L	1.25	12.3 a	33 ab
LANNATE 215L	2.25	11.8 a	47 a
BASIC H	1.5	11.8 a	46 ab
AMBUSH 500E	0.28	13.8 a	40 ab
AC303,630 360SC + AGRAL 90 0.25% V/V	0.21	14.5 a	44 ab
NTN 33893 240FS	0.21	16.0 a	34 ab
NTN 33893 240FS	0.42	18.0 a	30 b
NTN 33893 240FS	0.82	16.3 a	34 ab
CONTROL		16.3 a	40 ab
CV (%)		35.85	15.70

* Means followed by same letter do not significantly differ (P=.05, Duncan's MRT)

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#070

ICAR: 61006538

CROP: Soybean, cv. RCAT Alliance, RCAT Persian, RCAT Angora, RCAT Tabby,
RCAT 9008

PEST: Two-spotted spider mite, *Tetranychus urticae* Koch.

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TITLE: YIELD RESPONSE OF SOYBEAN, NEAR MATURITY, UNDER HEAVY INFESTATION OF SPIDER MITES, TO A LATE RESCUE SPRAY OF DIMETHOATE

MATERIALS: CYGON 480E (dimethoate)

METHODS: The soybeans were planted at 407,500 seeds/ha, at 0.6 m row width on 30 May, 1993 at Ridgetown, Ontario on Burford gravelly loam soil. Each strip was divided into two drill widths, each measuring eight rows wide and 97 m long. Spider mites were first noticed around 1 August and populations were allowed to increase. On 25 August, paired plots, two rows wide by 3 m in length, were marked with wire flags in the centre of each drill run for each variety of soybean. One plot in each drill run was designated as a treated plot and the other plot, in the neighbouring drill run, was left non-treated. Paired plots were replicated four times down the length of the strip. Soybeans at this time were still green, but pods were filling rapidly. Mite populations were estimated from ten randomly selected trifoliates per plot from the centre of the crop canopy. Mite numbers were estimated by placing the trifoliates under a low power binocular microscope, and by counting the number of mites visible in a 2 cm hole of a card that was placed over the centre, underside of each leaflet. Average trifoliate area was estimated by tracing the outline of 20 representative trifoliates on graph paper and counting the squares. Then mite counts were extrapolated to numbers per trifoliate. Mite populations in each plot were estimated on the day prior to spraying (25 August), and then two and five days after spraying. Treated plots were sprayed with dimethoate at 0.48 kg/ha in 203 L/ha water at 241 kPa pressure, with a field sprayer, which had a 2 m boom with five TeeJet SS8003 nozzles spaced 0.5 m apart. Temperatures were warm (around 27/14.5 degrees C D/N) during the first thre weeks of August. Only 0.2, 0.2, 15, 12.2, 0.2, 0.8, 0.1, and 1.0 mm of precipitation fell on 6, 7, 11, 16, 17, 19, 20, and 23 August, respectively. The plots were harvested on 5 October, hung to dry, and threshed on 13 October. Yields were corrected to 14% moisture.

RESULTS: Dimethoate sprays significantly reduced mite populations (Table 1). Soybeans were near maturity when sprayed. Soybean varieties were arranged from the least to most mature in the field, where RCAT Alliance was the latest variety and RCAT 9008 was the earliest. The arrangement went from west to east, which was also the pattern of infestation by the mites with the most severe infestation in the west and the least severe in the east. Therefore, the difference in mite population likely had nothing to do with plant resistance. Rather, the level of infestation was related to the orientation of the soybean strips in the field. Mite populations declined in non-treated plots after 25 August.

CONCLUSIONS: Sprays of dimethoate when pods were still green but near full resulted in no significant economic return in early to late maturing soybeans.

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Table 1. Effect of late spray of dimethoate for the control of two-spotted spider mite on yield of soybean, Ridgetown, Ont. 1993.

		Mites per trifoliate			
Soybean	Dimethoate	Pre-spray	Post-spray		Yield
Variety	Spray	25 Aug	27 Aug	30 Aug	T/ha
RCAT Alliance	Treated	2083	10	40	1.696
	Non-treated	1491	45*	461*	1.575
RCAT Persian	Treated	1432	8	11	2.243
	Non-treated	1505	288*	297*	2.429
RCAT Angora	Treated	1130	18	9	3.289
	Non-treated	979	137*	142*	3.137
RCAT Tabby	Treated	554	14	16	3.946
	Non-treated	639	198*	294*	3.535
RCAT 9008	Treated	235	12	23	3.279
	Non-treated	311	94*	123*	3.683

* Significantly different from non-treated at p = 0.05; t-test.

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#071

CROP: Sugarbeet, var KW316

PEST: Sugarbeet root maggot, *Tetanops myopaeformis* Roder

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TITLE: EVALUATION OF INSECTICIDE TREATMENTS FOR CONTROL OF SUGARBEET ROOT MAGGOT

MATERIALS: TEMIK 10G (aldicarb); COUNTER 15G (terbufos); COUNTER 20G controlled release (terbufos); FORCE 1.5G (tefluthrin); GAUCHO seed coating (imidacloprid); GAUCHO 25EC (250 g ai/L) (imidacloprid); FURADAN 48FL (480 g ai/L) (carbofuran); DECIS 5EC (5 g ai/L) (deltamethrin)

METHODS: Plots, 7.6 m long by six rows wide (56-cm row spacing), were located at Taber, Alberta. The treatments and two checks were replicated eight times in a modified latin square. The treatments were applied to all six rows of each plot. Sugarbeets were planted to stand (15-cm spacing) on May 14, 1993. The granular treatments were applied onto the soil behind the V-style presswheel following seed furrows planted to uncoated seed. A light rake-like device attached behind each presswheel covered the insecticide with soil. The pelleted seed with insecticide incorporated into the pelleting material was supplied by Germain's U.K. Ltd. (Hansa Rd., King's Lynn, England, PE304LG). The liquid treatments were applied in-furrow prior to the seed furrow closing. Post-emergence treatments, adjusted for band width, were applied onto a 18-cm wide band centred over the beet row to cotyledon beets on June 2 and to 4-leaf beets on June 7. Drench treatments, not adjusted for band width, were applied onto a 8-cm wide band centred over the row on June 7 and 10. Overhead irrigation (50 mm) was applied on June 10, zero and three days after application of the drench treatments. Check plots and treatments receiving liquid insecticide were planted to untreated, uncoated seed. Beet stand counts were taken on June 30. Beet vigour scores were determined on July 2. On September 20 the beets were harvested, washed, weighed and samples taken for determination of sugar content.

RESULTS: Presented in the table.

CONCLUSIONS: The sugarbeet maggot infestation level was from moderate to high and many tap roots were severed. The expected stand losses, usually observed from such damage, did not occur because the regular timely rains throughout the summer promoted secondary root growth. Significant improvements in yield were associated with all treatments, except post-emergence DECIS. GAUCHO was effective when applied in-furrow, as a drench and in the coating of pelleted seed.

Treatment	Placement	Rate g ai/ha	# beets /15 m June 30	Beet vigor (0-9)	Beet yield (t/ha)	Extractable sugar (kg/ha)
Gaucho	Pellet	105	70	8.00	43.03	5569
Gaucho 25 EC	In-furrow	250	57	8.75	41.19	5467
Gaucho 25 EC	In-furrow	500	57	8.25	39.90	5349
Furadan 48 FL	Drench, 3 day	1120	62	7.63	38.27	5264
Force 1.5 G	Press-wheel	400	63	7.75	39.03	5253
Gaucho 25 EC	Drench, 0 day	500	59	7.88	39.25	5220
Gaucho 25 EC	Drench, 3 day	500	63	7.88	39.19	5120
Temik 10 G	Press-wheel	1120	56	8.00	37.85	5095
Counter 15 G	Press-wheel	1120	58	7.63	37.56	5028
Furadan 48 FL	Drench, 0 day	1120	60	7.63	38.04	4985
Counter 20 CR	Press-wheel	1120	57	8.13	37.32	4895
Decis 5 EC	Cotyledon	12	63	7.13	33.35	4330
Check	-	-	60	6.75	31.96	4165
Check	-	-	58	6.75	32.97	4160
Decis 5 EC	Coty + 2,4-l	12+12	57	6.63	32.09	4051
Decis 5 EC	2 to 4-leaves	12	57	6.38	31.76	3873
L.S.D. P = 0.05		0	8	0.66	3.61	623

#072

ICAR: 61002036

CROP: Field tomato, cv. Heinz 9478

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

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TITLE: TOMATO INSECT CONTROL USING FOSTHIAZATE 900EC I

MATERIALS: FOSTHIAZATE 900EC (fosthiazate); ADMIRE 240FS (imidacloprid); GUTHION, 240 SC (azinphos-methyl)

METHODS: Tomatoes were planted on May 14 in two, twin row plots spaced 1.65 m apart at Ridgetown. Plots were 8 m in length, replicated four times in a randomized complete block design. The broadcast and 60cm band treatments were sprayed onto the plots using an Oxford precision boom sprayer, applying 200 L/ha of water prior to transplanting. The foliar insecticides were applied on June 25 with a back pack airblast sprayer at 240 L/ha of water. Assessments were taken by counting Colorado potato beetles (CPB) larvae per plot on June 25 and July 5, foliage damage ratings on July 28 and yields on August 31. In addition plant parasitic nematodes and *Verticillium dahliae* were counted with sampling taken on May 23 and July 4.

RESULTS: As presented in the tables.

CONCLUSIONS: Colorado potato beetle populations were not high enough to determine the relative effectiveness of the various insecticidal treatments. There was no significant differences in either insect counts, foliar damage, or yields. Populations of root-lesion nematodes were well below the action threshold of 2000/kg of soil with no treatment trends observable. Verticillium numbers were, however, high. The data would suggest that increasing the rate of Fosthiazate 900EC to 248 ml product/100 m reduces Verticillium populations. The data would also suggest, although a little difficult to believe, that both foliar insecticide applications also reduced Verticillium counts.

Table 1. Colorato potato beetle counts and yield results.

Treatments	Rate ml prod/100m	Application	Foliar Damage Ratings CPB Larval Counts (0-10)* June 26	July 5	July 28	Yield T/ha Aug 31
Fosthiazate 900EC	92.0	broadcast-ppi	3.8a**	2.3a	7.8a	30.47ab
Fosthiazate 900EC	115.0	broadcast-ppi	3.8a	3.5a	6.7a	23.63b
Fosthiazate 900EC	248.0	broadcast-ppi	8.8a	4.8a	7.7a	27.70ab
Fosthiazate 900EC;	46.0	broadcast-ppi				
Fosthiazate 900EC	46.0	band - 60cm	6.3a	1.8a	7.3a	29.03ab
Fosthiazate 900EC;	63.0	broadcast-ppi				
Fosthiazate 900EC	63.0	band - 60cm	2.5a	2.3a	7.8a	25.30ab
ADMIRE 240FS	1.7	foliar spray	0.0a	0.0a	8.3a	35.77a
GUTHION 240SC	28.9	foliar spray	0.0a	3.8a	8.3a	28.43ab
Control			0.0a	2.5a	7.7a	30.37ab

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

** Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

Table 2. Nematode and *Verticillium* counts.

Treatments	Rate ml prod/100m	Application	Root-Lesion Nematodes*** May 28	July 4	Verticillium**** May 28	July 4
Fosthiazate 900EC	92.0	broadcast-ppi	0	60	10	14
Fosthiazate 900EC	115.0	broadcast-ppi	100	0	20	28
Fosthiazate 900EC	248.0	broadcast-ppi	0	40	6	8
Fosthiazate 900EC;	46.0	broadcast-ppi				
Fosthiazate 900EC	46.0	band - 60cm	0	40	8	12
Fosthiazate 900EC;	63.0	broadcast-ppi				
Fosthiazate 900EC	63.0	band - 60cm	0	0	18	12
ADMIRE 240FS	1.7	foliar spray	0	20	2	10
GUTHION 240SC	28.9	foliar spray	0	0	10	4
Control			0	200	16	20

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

** Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

*** Root-Lesion Nematode-counts number per/kg of soil.

**** *Verticillium dahliae*-counts number of colonies/g of soil.

INSECTS OF CEREAL AND FORAGE CROPS /
INSECTES DES CÉRÉALES ET CULTURES FOURRAGÈRES

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

#073 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 61002030

CROP: Field corn, hybrid Pioneer 3737

PEST: Black cutworm, *Agrotis ipsilon* (Hufnagel)

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TITLE: CONTROL OF BLACK CUTWORM IN FIELD CORN WITH INSECTICIDES

MATERIALS: AC303,630 240SC; AGRAL 90; AMBUSH 500EC (permethrin); FORCE 1.5G (tefluthrin); LORSBAN 15G, 480E (chlorpyrifos); RIPCORD 400EC (cypermethrin)

METHODS: The crop was planted on 12 May, 1993 at Ridgetown Ontario using a John Deere Max-emerge planter at 25 seeds/plot with a 0.76 m row spacing. The experiment was arranged in a randomized complete block design with four replicates, with 2-row plots 2 m long bounded by an aluminum siding barrier (1.8 x 1.8 m) sticking 15 cm above ground and buried 5 cm into the ground. Granular insecticides were applied at planting with plot-scale Noble applicators mounted on the planter. Plots were infested on 8 June in the evening at 40 4-5th instars per plot at the 3-5 leaf stage of crop of devlopment. About 1 kg of well-rotted bark mulch was spread in each plot to provide cover for the cutworms. Rescue sprays were applied at 206 kPa pressure in 327 L/ha water with an Oxford backpack sprayer 40 h after infesting with larvae early in the morning. Broadcast sprays were applied with a 1 m wide boom with 4 - 00 nozzles. Banded treatments were applied with a single 00 nozzle in a 25 cm band over the row. Each day after treatment cut plants were counted and marked. Feeding ceased by 23 June which was at the 6-7 leaf stage of the crop. Plant stand was assessed on the day prior to treatment and again on 2 July. Results from plots with rescue treatments were adjusted to take into account plants cut before spray.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: Rescue applications of AMBUSH or RIPCORD provided the best relief from cutting and plant loss. It made no difference whether RIPCORD was broadcast or banded. Banding AMBUSH or LORSBAN provided poorer control than broadcast applications. Rescue treatments of AMBUSH or RIPCORD were better than insurance applications of insecticide at planting.

Table 1. Efficacy of insecticides for the control of black cutworm in field corn at Ridgetown, Ontario, 1993.

Treatment	Rate*	Method	Timing	Percent plants cut	Percent plants lost
FORCE 1.5G	1.125	T-BAND	AT PLANTING	18 bcd**	5 cd
FORCE 1.5G	1.125	IN-FURROW	AT PLANTING	41 a	20 a
LORSBAN 15G	11.25	T-BAND	AT PLANTING	28 ab	15 abc
AMBUSH 500EC	0.15	RESCUE BROADCAST	EARLY AM***	12 d	0 d
AMBUSH 500EC	0.15	RESCUE BANDED	EARLY AM	24 bc	5 cd
RIPCORD 400EC	0.07	RESCUE BROADCAST	EARLY AM	14 cd	4 cd
RIPCORD 400EC	0.07	RESCUE BANDED	EARLY AM	20 bcd	0 d
LORSBAN 480EC	1.15	RESCUE BROADCAST	EARLY AM	11 d	11 abc
LORSBAN 480EC	1.15	RESCUE BANDED	EARLY AM	32 ab	19 ab
AC303,630+ AGRAL 90 0.25% V/V	0.075	RESCUE BROADCAST	EARLY AM	28 ab	6 bcd
CHECK				27 bc	11 abc
CV (%)				19.7	45.8

* At planting and rescue treatment rates are in g/100 row and kg/ha, respectively.

** Means followed by the same letter are not significantly different (P<0.05, Duncan's Multiple Range Test). Data transformed to arcsine square root before analysis, means reported are untransformed.

*** Sprayed at dawn 40 hr after infestation.

#074

ICAR: 61002030

CROP: Field corn, Funks G4106; G4148 (1992), Pioneer 3790 (1993)

PEST: European corn borer, *Ostrinia nubilalis*

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TITLE: OVERWINTERING MORTALITY OF EUROPEAN CORN BORER (ECB) UNDER DIFFERENT TILLAGE PRACTICES AND RESIDUE MANAGEMENT, 1992-1993

MATERIALS: Tillage; stalk management.

METHODS: In spring, 1992, field corn was planted on 11 May at a 0.76 m row width, and at 45,000 seeds/ha under conventional tillage. The crop was fertilized and maintained using provincial recommendations. The experiment was arranged as a 4 X 2 split-plot design with four replicates. The main plots were tillage and the split plots were residue management. The levels for tillage were spring or fall chisel plough, fall mouldboard plough, and no-till. These main effects were split into plots which either had the crop residue chopped or left alone. Sub-plots were 21 m wide and 8 m long. To ensure an overwintering ECB population, an area of 4.5 m wide and 5 m long was marked out in the middle of each sub-plot and these plants were artificially inoculated with ECB eggs. Egg masses were obtained from the RCAT rearing program. On 28 July, 4, 11, and 18 August 1992, 2 wax paper discs, each containing about 25 eggs which were near eclosion (black head stage), were placed in the ear axil of each plant in the marked area of each sub-plot. The crop was harvested on 17 November 1992 leaving stubble about 0.5 m high. Plots requiring chopping, were chopped on 18 November, 1992 leaving stubble about 0.2 m high, using one pass of a flail mower. Plots were tilled between 1 and 15 December (fall tillage), or 7 May 1993 (spring tillage). Tilled plots were also disced and cultivated once in the spring, just prior to planting. Field corn was planted with a no-till planter on 12 May, 1993, at a 0.76 m row spacing with the rows placed exactly between rows from the previous year. On 3 June, four emergence cages (there were three different cages sizes in each plot, 1 at 60 X 67 cm, 1 at 60 X 95 cm and 2 at 45 X 60 cm for a total area of 1.5 m^2 per plot) were placed in between the new corn rows and centred over the old corn rows. Shortly after the cages were placed (3 June), exposed or partially exposed residue was collected from a non-caged , 5 m**2 area in each plot and placed in cold storage at 5 degrees C until the samples could be examined. The residue samples were examined thoroughly for mature larvae and pupae, and these were grouped into healthy or moribund/dead groups. Emergence cages were checked for newly emerged moths, each day.

RESULTS: Results are presented in Table 1.

CONCLUSIONS: Chopping stalks after harvest significantly reduced overwintering populations of European corn borer larvae in no-till plots only.

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Table 1. The effect of tillage practice and crop residue chopping on remaining amount of crop residue and emergence of European corn borer adults.

Primary tillage practice	No. adults emerged /2 sq. m		Crop residue recovered kg/ 2 sq. m	
	chopped	non-chopped	chopped	non-chopped
No-till	1.8	10.3	2.28	2.08
Chisel plough - spring	1.5	0.8	1.26	1.88
Chisel plough - fall	1.5	0.5	1.52	1.38
Mouldboard plough - fall	1.0	0.8	0.22	0.60
LSD (P = 0.05)		4.9		0.49

#075

ICARE: 61002030

CROP: Field corn, inbred C0220; hybrid Pioneer 3737

PEST: Western corn rootworm (75 %), *Diabrotica virgifera virgifera* Leconte; Northern corn rootworm (25%), *Diabrotica barberi* Smith and Lawrence

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TITLE: AN ATTEMPT TO IMPROVE THE EFFECTIVENESS OF FORCE 50EC INJECTED WITH ADDITIVES FOR CONTROL OF CORN ROOTWORMS IN NATURALLY INFESTED PLOTS

MATERIALS: FORCE 1.5G; 50EC (tefluthrin); Molasses; 28% urea ammonium nitrate (UAN)

METHODS: The crop was planted at 75,000 seeds/ha with a 0.76 m row spacing, on 13 May 1993 at Ridgetown, Ontario. Plots were double rows, 20 m in length placed in a randomized complete block design with four replicates and split into 2 single rows one planted with the inbred line and the other planted with the hybrid line. The granular material was applied using plot-scale Noble applicators in a T-band application placed in a 15 cm band over the open seed furrow. Liquid insecticides were applied with a slot-injector mounted on a 3 point hitch. On both sides of each row (at 12.5 cm from centre) a fluted-coulter, 3 m thick and 44.5 cm in diameter, opened the slot 7.5 cm deep and a straight-stream nozzle (Teejet No. 20) injected the insecticide directly behind the coulter into the open slot at 3448 kPa in 234 L of water or 28% UAN liquid fertilizer/ha. Molasses was applied at 6.6 L/ha. Injections were done on 25 June, or six weeks after planting, at the V5 stage of crop growth. Four roots per plot were dug, washed and scored for root injury using the Iowa 1-6 root injury scale (1 = no feeding scars, 6 = 3 or more root nodes missing) on 3 August and again on 20 October, by counting plants leaning more than 30 degrees from vertical over the total number of plants in the row. The hybrid rows were harvested on 22 October and yield was corrected to 15.5% moisture.

RESULTS: Results are presented in Table 1.

CONCLUSIONS: Injecting either 28% UAN or molasses along with FORCE 50EC did not significantly improve control of corn rootworms nor did it affect plant lodging or yield.

Table 1. The effect of adding molasses (50 ml/100 m) and/or 28% urea ammonium nitrate (UAN) (1.8 L/100 m) when injecting FORCE 50EC insecticide for the control of corn rootworm larvae. Ridgetown, Ont. 1993.

		---Inbred Corn --		----------Hybrid Corn-----------			
Treatment	Method	Root Injury (1-6)	Percent Lodging 3 Aug	Root Injury (1-6)	Percent Lodging 3 Aug	Percent Lodging 22 Oct	Yield Tonne /ha
FORCE 1.5G AT PLANTING	T-BAND	1.98c*	1.5e	1.25c	0.0 c	0.3b	9.87a
MOLASSES	INJECTED	2.85ab	34.4a	2.03abc	1.3 a	1.8ab	9.27a
28% UAN	INJECTED	2.75abc	22.2abc	2.08ab	0.1 bc	1.9ab	9.11a
FORCE 50EC	INJECTED	2.28abc	7.3cde	1.88bc	0.1 bc	6.3ab	8.23a
FORCE 50EC+ MOLASSES	INJECTED	2.50abc	14.5bcd	2.20ab	0.0 c	9.9a	8.30a
MOLASSES+ 28% UAN	INJECTED INJECTED	2.98a	27.8ab	2.75a	0.0 c	2.0ab	8.88a
FORCE 50EC+ 28% UAN	INJECTED	2.23abc	4.6de	1.80bc	0.0 c	0.4b	9.57a
FORCE 50EC+ MOLASSES+ 28% UAN	INJECTED	2.15bc	12.1bcd	1.88bc	0.1 bc	0.6b	8.90a
CHECK		2.48abc	42.4a	2.20ab	0.9 ab	1.5ab	9.86a
CV % =		19.9	34.9	24.5	138.4	100.7	13.4

* Means followed by same letter do not significantly differ (P=.05, Duncan's MRT)

#076

ICAR: 61002030

CROP: Field corn, inbred C0220; hybrid Pioneer 3737

PEST: Western corn rootworm (75 %), *Diabrotica virgifera virgifera* Leconte;
Northern corn rootworm (25%), *Diabrotica barberi* Smith and Lawrence

NAME AND AGENCY:
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TITLE: INSECTICIDES FOR SLOT INJECTION FOR CONTROL OF CORN ROOTWORMS IN NATURALLY INFESTED PLOTS

MATERIALS: FORCE 1.5G; 50EC (tefluthrin); BASUDIN 500EC (diazinon) LORSBAN 480EC (chlorpyrifos); NTN 33893 240FS

METHODS: The crop was planted at 75,000 seeds/ha and a 0.76 m row spacing, on 13 May 1993 at Ridgetown, Ontario. Plots were double rows, 20 m in length placed in a randomized complete block design with four replicates and split into two single rows; one planted to the inbred line and the other planted to the hybrid line. The granular material was applied using plot-scale Noble applicators in a T-band application placed in a 15 cm band over the open seed furrow. Liquid insecticides were applied with a slot-injector mounted on a three point hitch. On both sides of each row (at 12.5 cm from centre) a fluted-coulter, 3 m thick and 44.5 cm in diameter, opened the slot 7.5 cm deep and a straight-stream nozzle (Teejet No. 20) injected the insecticide directly behind the coulter into the open slot at 3448 kPa in 234 L of water/ha. Injections were done on 25 June (6 week after planting)at the V5 stage of crop growth. Four roots per plot were dug, washed, and scored for root injury using the Iowa 1-6 root injury scale (1 = no feeding scars; 2 = 3 or more root nodes missing) on 4 August. Percent lodging was assessed on 3 August and again on 20 October, by counting plants leaning more than 30 degrees from vertical over the total number of plants in the row. The hybrid rows were harvested on 22 October and yield was corrected to 15.5% moisture.

RESULTS: Results are presented in Table 1.

CONCLUSIONS: FURADAN, NTN33893, and FORCE injected as liquids when rootworm larvae were active provided control equivalent to FORCE 1.5G applied at planting. Rootworm pressure was not high enough to result in a yield loss in plots planted with the corn hybrid.

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Table 1. Control of corn rootworm with injected liquid insecticides applied when larvae were actively feeding. Ridgetown, Ont., 1993.

		Inbred Corn		Hybrid Corn			
Treatment	Rate (g ai/100m)	Root Injury (1-6)	Percent Lodging 3 Aug	Root Injury (1-6)	Percent Lodging 3 Aug	Percent Lodging 22 Oct	Yield Tonne /ha
		T-band at planting					
FORCE 1.5G	1.125	1.98ab*	1.5c	1.25cd	0.0b	0.3b	9.87a
.							
		Injected 22 June					
FORCE 50EC	1.125	2.28ab	7.3bc	1.88abc	0.1b	6.3a	8.23a
BASUDIN 500EC	11.2	2.43ab	5.2bc	2.13ab	0.0b	1.0ab	9.08a
LORSBAN 480EC	11.2	2.60a	16.2b	2.03ab	0.0b	3.0ab	9.24a
FURADAN 480EC	11.2	2.00ab	1.8bc	1.10d	0.0b	0.1b	10.33a
NTN33893 240FS	10.4	1.95b	3.9bc	1.53bcd	0.0b	1.1ab	9.83a
CHECK		2.48ab	42.4a	2.20a	0.9a	1.5ab	9.86a
CV % =		17.2	58.4	23.4	176.0	100.0	14.9

* Means followed by same letter do not significantly differ (P=.05, Duncan's MRT)

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#077

ICAR: 61002030

CROP: Field corn, inbred C0220; hybrid Pioneer 3737.

PEST: Western corn rootworm (75 %), *Diabrotica virgifera virgifera* Leconte; Northern corn rootworm (25%), *Diabrotica barberi* Smith and Lawrence

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TITLE: TIMING OF FORCE 50EC INJECTED FOR CONTROL OF CORN ROOTWORMS IN NATURALLY INFESTED PLOTS

MATERIALS: FORCE 1.5G; 50EC (tefluthrin)

METHODS: The crop was planted at 75,000 seeds/ha with a 0.76 m row spacing, on 13 May, 1993 at Ridgetown, Ontario. Plots were double rows, 20 m in length placed in a randomized complete block design with four replicates and split into two single rows one planted with the inbred line and the other planted with the hybrid line. The granular material was applied using plot-scale Noble applicators in a T-band application placed in a 15 cm band over the open seed furrow. The liquid insecticide was applied with a slot-injector mounted on a 3 point hitch. On both sides of each row (at 12.5 cm from centre) a fluted-coulter, 3 m thick and 44.5 cm in diameter, opened the slot

7.5 cm deep and a straight-stream nozzle (Teejet No. 20) injected the insecticide directly behind the coulter into the open slot at 3448 kPa in 234 L of water/ha. Injections were done on 4, 11, 18, 25 June, or 2 July (or three to six, or seven weeks after planting, respectively), at the V2, V3, V4, V5 and V7 stages of crop growth. Four roots per plot were dug, washed and scored for root injury using the Iowa 1-6 root injury scale (1 = no feeding scars, 6 = 3 or more root nodes eaten) on 4 August. Percent lodging was assessed on 3 August and on 20 October, by counting plants leaning more than 30 degrees from vertical over the total number of plants in the row. The hybrid rows were harvested on 22 October and corrected to 15.5% moisture.

RESULTS: Results are presented in Table 1.

CONCLUSIONS: The lowest root injury ratings and the least lodging for injected treatments occurred when FORCE was injected between 8-22 June. Rootworm pressure was not high enough to result in yield loss in the plots planted with a corn hybrid.

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Table 1. Timing of injected FORCE 50EC insecticide applied at 1.125 g ai/100 m when larvae were actively feeding for the control of western corn rootworm with Ridgetown, Ont. 1993.

		---Inbred Corn --		----------Hybrid Corn-----------			
Timing	Method	Root Injury (1-6)	Percent Lodging 3 Aug	Root Injury (1-6)	Percent Lodging 3 Aug	Percent Lodging 22 Oct	Yield Tonne /ha
		FORCE 1.5G					
AT PLANTING	T-BAND	1.98a*	1.5d	1.25d	0.0b	0.3a	9.87a
		FORCE 50EC					
1 JUNE	INJECTED	2.28a	24.2ab	1.70bcd	0.0b	9.9a	8.33a
8 JUNE	INJECTED	2.15a	4.1cd	1.45cd	0.1ab	0.4a	10.26a
15 JUNE	INJECTED	1.98a	5.7cd	1.58cd	0.4ab	6.0a	10.31a
22 JUNE	INJECTED	2.28a	7.3cd	1.88abc	0.1ab	6.3a	8.23a
29 JUNE	INJECTED	2.60a	18.4bc	2.33a	0.1ab	0.4a	8.83a
CHECK		2.48a	42.4a	2.20ab	0.9a	1.5a	9.86a
CV %	=	18.3	42.2	19.8	134.6	110.2	13.96

* Means followed by same letter do not significantly differ (P=.05, Duncan's MRT)

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#078

ICAR: 61002030

CROP: Field corn, inbred variety C0220

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

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TITLE: CANDIDATE INSECTICIDES FOR THE CONTROL OF CORN ROOTWORMS, 1993

MATERIALS: COUNTER 15G; COUNTER 20CR (terbufos); CYGARD 15G (terbufos plus phorate); DYFONATE II 20G (fonofos); FORCE 1.5G (tefluthrin); LORSBAN 15G (chlorpyrifos); THIMET 15G (phorate)

METHODS: The crop was planted on 11 and 13 May, 1993 at Birr and Ridgetown using a John Deere Max-emerge planter at 64,000 seeds/ha with a 0.76 m row spacing. Plots were single rows 10 m in length placed in a randomized complete block design with four replicates. The plots were fertilized and maintained by the grower using commercially acceptable practices. The granular materials were applied using plot-scale Noble applicators. T-band applications were placed in a 15 cm band over the open seed furrow. In-furrow applications were placed directly into the seed furrow. The number of emerged plants were counted for each plot. For each plot, the number of lodged plants per plot were counted. Four roots per plot were dug, washed and scored for root injury using the Iowa 1-6 root injury scale (1 = no feeding scars; 6 = 3 or more root nodes severely damaged).

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: In-furrow applications of COUNTER 15G resulted in reduced plant emergence at both locations. In-furrow applications of Counter 20CR did not reduce emergence. All materials provided equivalent control of corn rootworm larvae.

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Table 1. Corn rootworm insecticide efficacy tests at Ridgetown (RCAT) and Birr, Ontario.

			Emergence No./10 m row		Percent Lodging		Root injury Iowa 1-6	
			6/17	6/11	8/03	8/10	8/04	8/11
Treatment	Rate*	Method	RCAT	Birr	RCAT	Birr	RCAT	Birr
COUNTER 15G	75	T-BAND	33 ab**	37 abc	1 b	0 a	2.4 b	1.1 b
COUNTER 15G	75	IN-FURROW	29 b	32 c	0 b	1 a	1.6 b	1.1 b
COUNTER 20CR	56	IN-FURROW	38 ab	37 abc	2 b	1 a	2.3 b	1.1 b
COUNTER 20CR	42	IN-FURROW	36 ab	44 ab	0 b	1 a	1.7 b	1.1 b
FORCE 1.5G	75	T-BAND	38 ab	46 a	3 b	3 a	2.1 b	1.1 b
FORCE 1.5G	75	IN-FURROW	42 a	38 abc	1 b	1 a	2.4 b	1.1 b
CYGARD 15G	75	T-BAND	40 a	33 c	3 b	1 a	2.4 b	1.2 b
DYFONATE II 20G	55	T-BAND	37 ab	36 bc	1 b	3 a	2.0 b	1.1 b
THIMET 15G	75	T-BAND	37 ab	39 abc	0 b	1 a	2.6 b	1.0 b
LORSBAN 15G	75	T-BAND	39 a	41 abc	6 b	0 a	2.1 b	1.1 b
CHECK			40 a	40 abc	29 a	0 a	4.4 a	2.0 a
CV %	=		17	15	188	209	25	21

* Rates are in g product/100 m row.

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

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#079

CROP: Wheat, soft white winter, (#2CEWW)

PEST: Indian meal moth (IMM), *Plodia interpunctella*; rusty grain beetle (RGB), *Cryptolestes ferrugineus*

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TITLE: CONTROL OF STORED GRAIN INSECTS IN WHEAT WITH NON-TRADITIONAL INSECTICIDES

MATERIALS: Malathion 25%D; INSECTAGONE (Diatomaceous earth); DIPEL LDM (*Bacillus thuringiensis* var *kurstaki* 0.88 BIU/kg)

METHODS: The experimental units consisted of mini grain storage bins, which were constructed from 200 L fibreboard drums fitted with sealable steel lids. Two holes, 11.3 cm in diameter, were cut in the lids and these were covered with 52 mesh saran. The edges were sealed using silicone caulking. The bins were filled about 1/3 full with 80 kg of #2CEWW soft white winter wheat. If the whole pile was treated with insecticide all the grain was tumbled for one minute in a cement mixer. If only the top of the pile was treated, 70 kg of clean grain was placed in the bin first and then top-dressed with a treated layer consisting of 10 kg of grain. The treated layer was about 6 cm deep. IMM moths were collected from a contaminated grain sample obtained near Ridgetown. They were reared on a diet consisting of 45% wheat grain, 15% wheat bran, 30% wheat germ, 5% yeast hydrolysate, 2.5% honey, and 2.5% glycerol. RGB beetles were obtained from Agriculture Canada, Winnipeg. They were reared on 50% wheat grain, 17% wheat bran, and 33% wheat germ. Bins were treated on 22 October 1992. The bins were first infested with 30 wandering stage larvae of the IMM per bin on 23 October 1992. The bins were stored in a heated room which was maintained at 24±5 degrees C. The bins were checked on 5 April 1993 and 25 more IMM larvae were added per bin. We also added RGB populations at this time. Several colonies of RGB were combined into one container and tumbled. This material was equally divided such that 35 g were placed on top of each grain pile. It was assumed that each sample of RGB was uniform, and contained about 30 adults. The bins were left sealed and kept at 24±5 degrees C until the were opened on 22 September 1993. At this time, the grain piles were scored from 1-5 for amount of silk matting caused by IMM where 1 was no matting and 5 was the whole pile covered with matting. A grain probe (3.1 cm diameter) was used to draw 9 vertical samples at random from each bin. The piles were probed to the bottom each time taking a total of 1 kg of grain from each bin. Samples were sent to the Canada Grain Commission grain grading laboratory (CGC) for grading and extraction of insects. The insects were extracted using berlese funnels. Both larvae and adults of RGB were extracted, while only the larvae of IMM were extracted. The CGC assessed the percent kernels which were damaged (ie damaged or missing germ and bran), and the sample grade from 1-5 (where 1 is #1CEWW, 2 is #2CEWW, 3 is #3CEWW, 4 is CE FEED and 5 is SAMPLE). Log and arcsine transformations were used on insect counts and percentages, respectively, before analysis of variance.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: Malathion controlled RGB but did not control IMM. Both DIPEL and diatomaceous earth controlled RGB and IMM applied either as a top dress or whole pile treatment. The use of DIPEL did not lower grain quality. Diatomaceous earth applied as a top dress lowered the quality of the grain because the percentage of kernels damaged was low while the quality of grain was poor.

^

Table 1. Control of Indian meal moth (IMM) and rusty grain beetle (RGB) with non-traditional insecticides.

Treatment	Product rate (g /1,000 kg)	Insects /kg* IMM	Insects /kg* RGB	Grain Matting IMM 1-4**	Percent Kernels Damaged	Sample Grade 1-5\2
INSECTAGONE (pile)	250	3.8 ab***	0.0 d	1.2 b	1.3 b	2.0 b
INSECTAGONE (top dress)	500	0.2 b	2.1 bcd	1.3 b	1.1 b	5.0 a
INSECTAGONE (top dress)	250	0.7 b	4.4 bc	1.5 b	1.5 b	5.0 a
DIPEL LDM (top dress)	125	2.6 ab	7.5 b	1.6 b	2.6 b	2.3 b
DIPEL LDM (pile)	125	0.3 b	10.0 b	1.2 b	0.5 b	2.0 b
MALATHION 25D (pile)	80	15.8 a	0.2 cd	3.5 a	83.5 a	4.8 a
CHECK		5.4 ab	99.0 a	3.8 a	77.4 a	4.5 a
CV (%)		86.2	60.4	24.6	27.6	9.3

* Only larvae of IMM were counted. Both larvae and adults of RGB were counted.

** See text for explanation of scale.

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

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BASIC STUDIES / ÉTUDES DE BASE

Section Editor / Réviseur de section : S.A. Hilton

#080 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 306-1261-9019

CROP: Apple

PEST: Pharaoh ant (*Monomosium pharaonis*), aphids (*Aphis* spp.), blow fly (*Calliphoridae* spp.), millipede (*Diplopoda* spp.)

NAME AND LOCATION:
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NEIL K A
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TITLE: TOXICITY OF INSECOLO TO ANTS, APHIDS, BLOW FLIES AND MILLIPEDES

MATERIALS: INSECOLO (baited diatomaceous earth)

METHODS: Adults obtained from the field were used within 24 hours of collection. The toxicity test unit consisted of 10 insects in a 100 mm diameter plastic petri dish. The Potter spray tower was calibrated to deliver the recommended rate of 75 kg/ha in 10 mL to the petri dish for the wet treatment; distilled water was the control. Ants and blow flies were added to the petri dish following INSECOLO application. A leaf containing 10 aphids in the petri dish was sprayed. Millipedes in the petri dish were sprayed. A weighed amount of product was added to the petri dish for the dry treatment. A petri dish was the control. Moistened cotton was added to each petri dish following INSECOLO application. Mortality was recorded after 24 and 48 hours exposure at 22ºC and 16 hour photoperiod. Each test was repeated 4 times. Data analysis was conducted using binomial distribution and logit function.

RESULTS: Results are shown in Table 1. There was no 24 hour control mortality (CM) and no 48 hour wet treatment CM for aphids, millipedes, or ants. Abbotts correction was applied to the 48 hour dry treatment mortality for blow fly (CM 40.0%) and for ants (CM 10.0%).

CONCLUSIONS: There was high 48 hour blow fly mortality with either wet or dry INSECOLO application. Aphid mortality was higher after 48 hours using dry compared with wet INSECOLO.

^

Table 1. Percent mortality of selected arthropods following wet or dry INSECOLO application.

Insect	Rate (kg/ha)	% Mortality (SEM) 24 h wet	48 h wet	24 h dry	48 h dry
Pharaoh ant	75	10.0 (4.74)	27.5 (7.06)	17.5 (6.01)	16.7 (6.85)
Rosy apple aphid	75	0.0 (0.04)	0.0 (0.06)	25.0 (6.85)	40.0 (7.75)
bean aphid	75	0.0 (0.04)	7.5 (4.16)	15.0 (5.65)	47.5 (7.90)
millipede	75	0.0 (0.04)	0.0 (0.06)	7.5 (4.16)	15.0 (5.65)
blow fly	75	57.5 (7.82)	96.9 (2.47)	17.5 (6.01)	95.8 (2.47)

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#081

STUDY DATA BASE: 280-1252-9304

CROP: Potato

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

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TITLE: COMPARISON OF SUSCEPTIBILITY TO INSECTICIDES OF COLORADO POTATO BEETLE COLLECTED FROM 2 FARMS UNDER DIFFERENT PEST MANAGEMENT SYSTEMS

MATERIALS: Technical cypermethrin, azinphosmethyl, endosulfan, carbofuran, deltamethrin

METHODS: Insecticide susceptibility was measured in CPB collected from a mixed vegetable farm in southwestern Ontario using a certified organic pest management program and from a farm near Alliston, Ontario utilizing an integrated pest management system. Results were compared with susceptibility of a lab-reared susceptible CPB strain. Direct contact bioassays were done using a Potter spray tower and a range of serial concentrations (up to 1% solution) chosen to cause 0 to 100% mortality. A solvent CONTROL (19:1 acetone:olive oil) was included with each test. At each concentration, at least two replicates of ten third-instar larvae or adults were sprayed with 5.0 ml of insecticide solution. Fresh potato leaves were provided for food in clean containers and mortality was assessed after 18 hr at 27^{o}C and 65% R.H. To compare susceptibility, LC50 values for field-collected CPB were estimated by means of log-probit graphs, while LC50 values for the lab-reared strain were determined by probit analysis of regression lines.

RESULTS: CPB larvae from the certified organic farm demonstrated either no or very low (cypermethrin, azinphosmethyl) or moderate (endosulfan) insecticide resistance (Table 1). Resistance to the same insecticides ranged from moderate to high to extreme in CPB adults collected from the farm where insecticides were included in an integrated management system. Resistance to deltamethrin remained fairly low in all CPB tested.

CONCLUSIONS: With the exception of carbofuran, resistance levels were much lower in CPB from the organic vegetable farm than in those from the commercial farm. Measurement over several years of response of CPB populations to defined management systems will permit development of refined predictive models of resistance development.

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Table 1. Direct contact toxicity of insecticides to CPB from 2 farms under organic (ORG) or conventional (CON) pest management systems relative to 3rd-instar larvae (L) or adults (A) of a lab-reared susceptible strain (LAB-S).

Insecticide CPB Source (Stage)	Average % mortality (% solution) 0.001	0.0033	0.01	0.033	0.1	0.33	1.0	LC50*	Ratio**
cypermethrin									
ORG (L)	45	45	90	100				.0035	x2
LAB-S (L)								.0015	
ORG (A)	0	11	21	90				.015	x7
CON (A)	0	0	3	5	85	100		.082	x36
LAB-S (A)								.0023	
.									
azinphosmethyl									
ORG (L)			6	17	72	100		.06	x3
LAB-S (L)								.0195	
CON (A)				0	0	35	30	>1.0	> x15
LAB-S (A)								.068	
.									
endosulfan									
ORG (L)				15	50	35	90	.1	x19
LAB-S (L)								.0054	
CON (A)				10	5	0	10	>1.0	> x60
LAB-S (A)								.016	
.									
carbofuran									
ORG (A)							15	>1.0	> x100
CON (A)							0	>1.0	> x100
LAB-S (A)								.0098	
.									
deltamethrin	0.0001	.00033	.001	.0033	.01				
ORG (L)		95	100	100	100			.0001	x1
LAB-S (L)								.0001	
CON (A)		0	18	37	100			.004	x5
LAB-S (A)								.00075	

* LC50s of field-collected CPB are estimated from primary bioassay; LC50s of LAB-S strain are from probit analysis of regression lines;

** ratio of resistance measured for test strain/resistance measured for LAB-S strain.

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#082

STUDY DATA BASE: 306-1262-9020

CROP: Strawberry, cvs. Raritan and Honeoye

PEST: Two-spotted spider mite (TSSM), *Tetranychus urticae* Koch

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TITLE: EVALUATION OF TWO-SPOTTED SPIDER MITE RESISTANCE TO KELTHANE

MATERIALS: KELTHANE 35 WP (dicofol) TANGLETRAP (tanglefoot)

METHODS: Mites were obtained from a commercial strawberry field with mite control problems. The experimental unit was a 100 mm diameter plastic petri dish. Solutions of KELTHANE 35 WP (0.1, 0.5, 1.0, 5.0 and 10.0 kg ai/ha) in hexane were added to petri dishes and the hexane was allowed to evaporate in a fume hood. The rim of the petri dish was ringed with TANGLETRAP to prevent the escape of mites. Ten TSSM were added to each dish. The test was repeated 5 times. Covers were added and the dishes were placed in crispers to conserve moisture. The number of dead mites in the petri dish after 24 hours was counted. The number of mites trapped in TANGLETRAP was counted separately. Regression analysis of the number of dead mites was conducted using binomial distribution and logit function, and the LD50 was determined.

RESULTS: The LD50 for KELTHANE 35 WP was 0.32 kg ai/ha with 95% confidence limits of 0.317 and 1.92; the slope (standard error) was 2.070 (0.243). There was no control mortality in the petri dish; however, 15 of the 50 control mites (0 of the 250 treated mites) were trapped in TANGLETRAP.

CONCLUSIONS: The full rate of KELTHANE 35 WP (1.0 kg ai/ha) was effective in the control of TSSM in the laboratory. Thus, evidence of resistance of two-spotted spider mite to dicofol was not exhibited in this study.
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#083

STUDY DATA BASE: 280-1452-9305

CROP: Horticultural crops

PEST: Pathogens of horticultural crops

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Tel: (519) 645-4452 **Fax:** (519) 645-5476

TITLE: EFFECTS OF FUNGICIDES ON ACTIVITIES OF NITRIFICATION AND SULFUR OXIDATION IN SOIL

MATERIALS: Technical (>99.7% purity) captafol and chlorothalonil.

METHODS: Samples of sandy loam, a typical agricultural soil of southwestern Ontario, were collected to a depth of 15 cm depth in early spring and sifted through 2-mm mesh. The soil contained 1.8% organic matter, 0.62% Kjeldahl nitrogen, 46.8% moisture-holding capacity, and had a pH in water of 7.6. Sufficient amounts of fungicide were mixed with soil to give a final concentration of 10 :g/g active ingredient using a carrier sand. Soils treated with a nitrification inhibitor, nitrapyrin at 30:g/g, or an autoclaving were prepared to compare the effects of these treatments on activities of nitrification and sulfur oxidation in soil. Untreated soils were used for controls. Changes in oxidation of ammonium from soil organic nitrogen and sulfur were determined by nitrification and sulfur oxidation. Nitrite was analysed by a diazotization method with sulphanilic acid, "-naphthylamine hydrochloride and sodium acetate buffer and nitrate was determined by a phenoldisulphonic acid method. Sulphate was determined turbidimetrically.

RESULTS: Inhibitory effects on nitrification were observed with treatments of autoclaving and nitrification inhibitor, nitrapyrin, throughout the experimental period. Autoclaving also affected sulfur oxidation. Mineralization and oxidation of soil native organic sulfur was affected for eight weeks by autoclaving.

CONCLUSIONS: Nitrification was depressed by treatments of autoclaving and nitrapyrin for two weeks; however, no inhibitory effect was observed with treatments of fungicides. With the exception of autoclaving, oxidation of soil sulfur was not inhibited during the experiment. Although the reduction in nitrification and sulfur oxidation by autoclaving was significant, these effects were not deleterious to soil microbial activities important to soil fertility.

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Table 1. Microbial activities as related to different treatments of sandy loam.

Treatment	Nitrification :g(NO_2^-+NO_3^-)-N/g		S-oxidation :g $SO_4^=$-S/g	
	Period of incubation (wk)			
	1	2	4	8
Control	14.4 bc*	25.5 ab	57.6 abc	50.6 bc
Autoclaving	0.6 e	0.5 d	0.1 d	6.3 d
Nitrapyrin	6.8 d	6.5 c	62.2 abc	60.7 abc
Captafol	19.1 ab	19.0 b	57.4 abc	63.8 abc
Chlorothalonil	12.3 bc	14.3 bc	42.4 c	65.1 abc

* Within each column, mean values followed by the same letter are not significantly different at 5% level determined by Duncan's multiple range test.

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#084

STUDY DATA BASE: 280-1452-9305

CROP: Horticultural crops

PEST: Pathogens of horticultural crops

NAME AND AGENCY:
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TITLE: EFFECTS OF FUNGICIDES ON MICROBIAL RESPIRATION AND ACTIVITIES OF PHOSPHATASE IN SOIL

MATERIALS: Technical (>99.7% purity) captafol and chlorothalonil.

METHODS: Random samples of sandy soil were collected in early spring from a farm in southwestern Ontario known to have no history of pesticide treatment. Each sample was taken to a depth of 15 cm and sieved (<2 mm). Ten microgram active ingredient of fungicide per gram of soil were dissolved in pentaneacetone (1:1) mixture and incorporated with carrier sand. After the solvents had evaporated, the sand-funguicide mixture was incorporated with the soil by tumbling for 30 min. Soil moisture was maintained at 60% moisture-holding capacity. In soil respiration studies, triplicate samples of treated and untreated soil (8g) were placed in Warburg flasks. After equilibration at 30ºC for one hour, oxygen consumption was measured at intervals for 96 hrs using a Gilson differential respirometer. To test the effects of the treatments on phosphatase activity, 1 g soil in 20-ml serum bottles was added to p-nitrophenyl disodium orthophosphate and the hydrolysis was determined after 2 hr incubation at 28ºC. Controls with or without added substrate were included. All data were expressed on an oven-dry basis and were averages of triplicate determinations. Data were subjected to analysis of variance to determine the level of significance among means.

RESULTS: The effect of various treatments on respiration is shown as changes in total :l O_2 consumed per gram of soil. Fungicide treatments and nitrapyrin significantly increased oxygen consumption from the decomposition of organic matter indigenous to the soil, while an inhibitory effect was obvious with autoclaving. The respiratory study also indicated that after 96 hr of incubation, the sample treated with the fungicides, captafol and chlorothalonil consumed appreciably more oxygen than the control. This could be due to the fact that soil microorganisms can adapt to the fungicide and eventually oxidize the fungicides. After autoclaving, there was some oxygen consumption in the sample of sterilized soil. This behaviour of the autoclaved soil with regard to gaseous exchange has been noticed in other soils. The mineralization of soil organic phosphorus is of major agricultural and economic importance. Soil phosphatase has been accorded a major role in this mineralization process. With the exception of autoclaving, hydrolysis of an incorporated substance, p-nitrophenyl disodium orthophosphate, by the phosphatase was equal to that of control in the soil.

CONCLUSIONS: Fungicides, captafol and chlorothalonil, had no permanent deleterious effects on the processs of soil microbial respiration and activities of phosphatase. By contrast, the possibility of microbial degradation of the fungicides, captafol and chlorothalonil, in soil was indicated.

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Table 1. Effects of microbial respiration and activities of phosphatase as related to various treatments in sandy loam after incubation.

Treatment	Oxygen consumption :l O_2/g soil/96 hrs	Phosphatase activity x100 :g p-nitrophenol released/g soil/2 hrs
Control	141.45	11.58
Autoclaving	58.65*	3.68*
Nitrapyrin	172.50*	13.16
Captafol	203.55*	14.47
Chlorothalonil	210.45*	7.37

* Significantly different from control at 5% level.

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#085

STUDY DATA BASE: 280-1452-9305

CROP: Horticultural crops

PEST: Pathogens of horticultural crops

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TITLE: EFFECTS OF FUNGICIDES ON POPULATIONS OF MICROORGANISMS IN SANDY SOIL

MATERIALS: Technical (>99.7% purity) captafol and chlorothalonil.

METHODS: Random samples of sandy soil were collected in early spring from a farm in southwesten Ontario known to have no history of pesticide treatment. Each sample was taken to a depth of 15 cm and sieved (<2 mm). Ten micrograms active ingredient of fungicide per gram of soil were disolved in pentaneacetone (1:1) mixture and incorporated with carrier sand. After the solvents had evaporated, the sand-fungicide mixture was incorporated with the soil by tumbling for 30 min. Soil moisture was maintained at 60% moisture-holding capacity. Samples were incubated in the dark at 28°C for periods of one and two weeks after treatment. Soils treated with a nitrification inhibitor, nitrapyrin at 30 :g/g, or by autoclaving were prepared to compare the effects of these treatments on soil microbial activities with those of fungicides. Autoclaved samples were heated at 121°C for 7 h every day for five days and oven dried once at 105°C for 6 h. Untreated soils were used for controls. Changes in the soil microflora numbers were determined by soil dilution plate technique, using sodium albuminate agar for bacteria and actinomycetes and rose-bengal streptomycin agar for fungi. Plates were incubated at 28°C. Analysis of variance was used in statistical analysis of results and Duncan's multiple range test was used to determine the level of significance among means. All data are expressed on an oven-dry basis and are averages of triplicate determinations.

RESULTS: Plate counts indicated that bacterial counts were reduced with treatments of captafol and chlorothalonil one week after treatment, while a stimulatory effect was evident with nitrapyrin after two weeks. Fungal populations were inhibited for one week by captafol and chlorothalonil. Autoclaving resulted in inhibition of the microbial populations throughhout the experiment.

CONCLUSIONS: Microbial populations were equal to or greater than that of control after two weeks. These results suggest that there were no inhibitory effects of the fungicides on numbers or biomass of microorganisms.

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Table 1. Microbial numbers as related to different treatments of sandy loam.

Treatment	Bacteria ($x10^{-5}$)/g		Fungi ($x10^{-3}$)/g	
	Period of incubation (wk)			
	1	2	1	2
Control	199 a*	87 cde	56 a	19 abc
Autoclaving	1 f	1 f	1 f	1 d
Nitrapyrin	191 ab	143 ab	48 ab	24 ab
Captafol	88 e	62 de	26 cde	17 abc
Chlorothalonil	141 cd	113 bc	27 cde	23 ab

* Values within each column inidicated by the same letter are not significantly different at the 5% level.

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#086

STUDY DATA BASE: 280-1452-9305

CROP: Horticultural crops

PEST: Pathogens of horticultural crops

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TITLE: EFFECTS OF FUNGICIDE TREATMENTS ON ACTIVITIES OF DEHYDROGENASE AND UREASE

MATERIALS: Technical (>99.7% purity) captafol and chlorothalonil.

METHODS: Samples of a sandy loam of southwestern Ontario were collected to a depth of 15 cm in early spring and sifted through 2-mm mesh and analyzed. The two fungicides are broad-spectrum foliage protectants. Sufficient amounts of fungicide were mixed with soil to give a final concentration of 10 ug/g active ingredient using a carrier sand. Soils treated with nitrification inhibitor, nitrapyrin, at 30 :g/g, or an autoclaving were prepared to compare the effects of these treatments on soil enzymatic activities with those of fungicides. Untreated controls were included with all tests. Samples were incubated in the dark at 28ºC for appropriate periods after treatments. Soil moisture was maintained at 60% moisture-holding capacity. Soil dehydrogenase activity was measured by incubating the soil at 28ºC with 2,3,5-triphenyltetrazolium chloride (TTC) for the formation of formazan (2,3,5-triphenyltetrazolium formazan) (TTF). Activity of soil urease was determined using a steam distillation method after two and 14 days. All data were expressed on oven-dry basis and were averages of triplicate determinations. Data were subjected to analysis of variance and Duncan's multiple range test was used to determine the level of significance among means.

RESULTS: Dehydrogenase activity in soils provides correlative information on the biological activity in soil. This enzyme system has a role in the initial stages of oxidation of soil organic matter. Formazan production was inhibited significantly by captafol for four days and by autoclaving throughout the experiment. Nitrapyrin stimulated dehydrogenase activity for four days. Urease is the enzyme that catalyzes the hydrolysis of urea to carbon dioxide and ammonia. Due to the increased use of urea in agriculture as a fertilizer, this enzyme is unique among soil enzymes and has been studied extensively. In the treatment of sandy soil with autoclaving, urease activity was reduced for 14 days. No inhibitory effect was shown with the fungicidal treatments.

CONCLUSIONS: None of the fungicides inhibited activities of soil dehydrogenase after seven days nor urease which are important to soil fertility.

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Table 1. Effect of different treatments on soil dehydrogenase and urease activities in sandy loam.

Treatment	Dehydrogenase :g Formazan/g soil			Urease mg(NH_4^+-N)/g	
	Incubation Time (Days)				
	4	7	21	2	14
Control	13.2 bcd*	24.7 bcd	55.6 abc	1426 bcd	3557 ab
Autoclaving	1.3 f	10.1 g	23.4 d	619 e	533 c
Nitrapyrin	15.2 a	25.4 abc	50.3 b	1527 abcd	3672 a
Captafol	10.7 e	22.3 def	42.3 c	1411 cd	3586 a
Chlorothalonil	12.1 cde	24.1 cde	42.6 c	1757 ab	3456 ab

* Within each column, mean values followed by the same letter are not significantly different at 5% level.

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#087

STUDY DATA BASE: 280-1452-9305

CROP: Horticultural crops

PEST: Pathogens of horticultural crops

NAME AND AGENCY:
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TITLE: FUNGICIDAL EFFECTS ON ACTIVITIES OF INVERTASE AND AMYLASE IN SANDY SOIL

MATERIALS: Technical captafol (>99.7% purity) and chlorothalonil.

METHODS: Random samples of sandy soil were collected in early spring from a farm in southwestern Ontario known to have no history of pesticide treatment. Each sample was taken to a depth of 15 cm and sieved (<2 mm). Ten micrograms active ingredient of fungicide per gram of soil were disolved in pentaneacetone (1:1) mixture and incorporated with carrier sand. After the solvent had evaporated, the sand-fungicide mixture was incorporated with the soil by tumbling for 30 min. Soil moisture was maintained at 60% moisture-holding capacity. Samples were incubated in the dark at 28°C for periods of one and two days for invertase and one and three days for amylase. Soils treated for a nitrification inhibitor, nitrapyrin, at 30 :g/g, or an autoclaving were prepared to compare the effects of these treatments on soil microbial activities with those of fungicides. Some samples were heated by autoclaving at 121°C for 7h every day for five days and oven-dried once at 105°C for 6h. Triplicate samples of 2 g soil were allowed to stand with 0.6 ml toluene for 15 min before incubating with 4 ml acetone-phosphate buffer (0.5 M acetic acid - 0.5 M Na_2HPO_4) at pH 5.5 and 5 ml solution of 5% sucrose or 2% starch. After shaking, the samples were placed in the incubator at 28°C. Controls with or without added substrate were included. Enzyme activities were determined for the reducing sugar using the Prussian blue method of Folin and Malmros. Values for the hydrolysis of sucrose or starch by soil enzymes were corrected for the reducing sugars produced on incubation of soil with toluene and buffer without added substrate. Reducing sugars produced were estimated as glucose.

RESULTS: All treatments inhibited invertase activities at one day. With the exception of autoclaving, invertase activity recovered to equal to that of control and nitrapyrin treatment was significantly greater than that of control, after two days. Amylase activity was suppressed equally with the chemical treatments after one day. However, the inhibitory effect disappeared after three days. It is interesting to note that autoclaving stimulated amylase activities throughout the experimental period.

CONCLUSIONS: None of the fungicide treatments inhibited activities of soil invertase after 2 wk and amylase after 3 wk which is important to soil fertility.

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Table 1. Activities of invertase and amylase as related to different treatments of sandy loam.

Treatment	Invertase		Amylase	
	mg reducing sugar/g soil			
	Incubation period (Days)			
	1	2	1	3
Control	127 a*	167 bcde	36 b	32 bc
Autoclaving	45 g	55 f	43 a	47 a
Nitrapyrin	117 b	201 a	23 de	38 b
Captafol	113 bc	188 ab	28 cde	29 c
Chlorothalonil	95 def	156 de	22 ef	27 c

* Values within each column indicated by the same letter are not significantly different at 5% level determined by Duncan's multiple range test.

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#088

STUDY DATA BASE: CA60-93-P802

CROP: Wheat, spring, cv. Leader

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TITLE: CROP TOLERANCE OF LEADER WHEAT TO HEXACONAZOLE AS A SEED TREATMENT

MATERIALS: ICIA 0523 (Hexaconazole, 5 g/L, TF3770A)

METHODS: Seed was treated in 200 g lots using a mini-rotostat seed treater. The trial was seeded at a rate of 90 seeds/m row on 11 May 1993 at Lethbridge, Alberta. Each treatment was replicated three times in a complete randomized block design. Each plot consisted of four rows, 6 m in length. All plots were assessed for seedling emergence on 21 May and 3 June 1993. The 15 ppm rate will be the recommended treatment.

RESULTS: As presented in the table.

CONCLUSIONS: There were no statistical differences in emergence of wheat as the rates of HEXACONAZOLE were increased up to 20 g ai/kg seed.

TREATMENT	RATE ppm	EMERGENCE 21/05/93	03/06/93
CHECK	Nil	100a	100a
HEXACONAZOLE	10	100a	95a
HEXACONAZOLE	12.5	143a	131a
HEXACONAZOLE	15	114a	107a
HEXACONAZOLE	20	100a	110a
	Standard deviation	30.4	19.9
	CV	27.3	18.4

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

1993 PEST MANAGEMENT RESEARCH REPORT

DISEASES OF FRUIT CROPS / MALADIES DES FRUITS

Section Editor / Réviseur de section : R.W. Delbridge

#089 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Apple, cv. Spy

PEST: Apple scab, *Venturia inaequalis* (Cooke) Wint.

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TITLE: CONTROL OF APPLE SCAB USING COMBINATIONS OF NOVA/DITHANE AND NOVA/POLYRAM

MATERIALS: DITHANE DG 80% (mancozeb); POLYRAM 80 DF (metiram); N0VA 40 W (myclobutanil)

METHODS: An abandoned apple orchard in St. George, Ontario was used as the trial site. Treatments were assigned to single tree plots, replicated three times and arranged according to a randomized complete block design. Applications were made to treatments 2, 3, 4, 5 and 6 starting at green tip and continuing every seven to ten days until petal fall. POLYRAM DF cover sprays were applied to all treatments starting one week after petal fall and repeated every 10 to 14 days until two to three weeks before harvest. Applications to all treatments were dilute with a hand gun sprayer at 3000 L/ha (runoff). Sprayer pressure was 2760 kPa. Maintenance treatments of fenvalerate (0.100 kg ai/ha) were applied for control of insect pests. Leaf efficacy ratings were conducted on August 11 and fruit efficacy ratings on September 2 (pre-harvest). Percent disease was calculated by randomly choosing 200 leaves or fruit from each tree and counting those that were infected. Counts were converted to percent disease on the leaves and percent disease on the fruit.

RESULTS: As presented in the table.

CONCLUSIONS: All treatments significantly reduced the number of fruit and leaves infected with apple scab when compared to the untreated check. There was no significant difference between chemical treatments. There was no visual phytotoxicity or reduction in fruit quality caused by any of the treatments tested.

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Table 1. Mean percent apple scab on Spy apples, 1993.

Treatment	Formulation	Rate (kg ai/ha)	% Disease (leaves)	% Disease (fruit)
1. Untreated control	----	----	36.17 a*	89.83 a
2. NOVA 40 W + DITHANE DG	40% WP 80% DG	0.11 + 2.4	8.67 b	2.50 b
3. NOVA 40 W + DITHANE DG	40% WP 80% DG	0.136 + 2.4	1.83 b	0.00 b
4. NOVA 40 W + POLYRAM 80 DF	40% WP 80% DF	0.11 + 2.4	7.67 b	0.50 b
5. NOVA 40 W + POLYRAM 80 DF	40% WP 80% DF	0.136 + 2.4	2.50 b	0.33 b
6. POLYRAM 80 DF	80% DF	4.8	3.00 b	1.83 b

* Means followed by the same letter are not significantly different (P=0.05, Duncan's MRT).

#090

CROP: Apple, cv. Spy

PEST: Apple scab, *Venturia inaequalis* (Cooke) Wint.

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TITLE: CONTROL OF APPLE SCAB USING FLUAZINAM 500F AND BRAVO 500, 1993

MATERIALS: Fluazinam 500 F; BRAVO 500 SC (chlorothalonil 500); NOVA 40 W (myclobutanil); POLYRAM 80 DF (metiram)

METHODS: An abandoned apple orchard in St. George, Ontario was used as the trial site. Treatments were assigned to single tree plots, replicated three times and arranged according to a randomized complete block design. Applications were made to treatments 1, 2, 3 and 5 beginning at green tip and repeated every seven days to pink bloom. After pink bloom the interval was extended to ten days until terminal growth ceased. Cover sprays were applied at 14 day intervals until 30 days pre-harvest. Applications were made to treatment four beginning at green tip and repeated at 14 day intervals until petal fall. POLYRAM 80 DF cover sprays were applied, following petal fall, at ten day intervals until the cessation of terminal growth, followed by 14 day intervals until 30 days pre-harvest. Applications were made to treatments 6 and 7 following scab forecasting procedures as outlined in the OMAF 1992-1993 "Fruit Production Recommendations". Applications to all treatments were dilute with a hand gun sprayer at 3000 L/ha (runoff). Spray pressure was 2760 kPa. Maintenance treatments of fenvalerate (0.100 kg ai/ha) were applied for control of insect pests. Ratings were conducted on the apple leaves on August 11 and fruit on September 2 (pre-harvest). The percent apple scab on leaves and fruit was calculated by choosing 200 leaves or fruit at random from each tree and counting the number that were infected.

RESULTS: As presented in the table.

CONCLUSIONS: All treatments significantly reduced the number of fruit and leaves infected with apple scab when compared to the untreated check with the exception of the leaf rating for treatment 4. There was no visual damage to the fruit or foliage during the experiment. There did not appear to be any visual effect on fruit maturation caused by any of the treatments tested.

Table 1. Mean percent apple scab on Spy apples, 1993.

Treatment	Formulation	Rate	% Disease (Leaf)	% Disease (Fruit)
1. fluazinam	500 g/L SC	3.0 L/ha	3.17 c*	2.17 b
2. fluazinam	500 g/L SC	1.5 L/ha	1.83 c	6.00 b
3. fluazinam +	500 g/L SC	1.5 L/ha +	5.00 bc	5.83 b
BRAVO 500	500 g/L SC	3.0 L/ha		
4. BRAVO 500	500 g/L SC	4.0 L/ha	23.83 ab	3.17 b
5. POLYRAM	80% DF	6.0 kg/ha	3.00 c	1.83 b
6. fluazinam +	500 g/L SC	3.0 L/ha +	1.33 c	0.67 b
NOVA 40W	40% WP	0.136 kg ai/ha		
7. BRAVO 500 +	500 g/L SC	6.0 L/ha +	5.67 bc	1.83 b
NOVA 40 W	40% WP	0.136 kg ai/ha		
8. Untreated control	---	---	36.17 a	89.67 a

* Means followed by the same letter are not significantly different (P=0.05, Duncan's MRT)

#091

STUDY DATA BASE: 348-1261-4802

CROP: Apple, cv. Jerseymac

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: EVALUATION OF FUNGICIDES FOR THE CONTROL OF APPLE SCAB

MATERIALS: BRAVO 500 (chlorothalonil 500 g ai/L); FLUAZINAM 500 F (500 g ai/L); MANZATE 200 DF (mancozeb)

METHODS: Apple scab control was evaluated in an eleven-year-old orchard on M.26 rootstock. The treatments were assigned to two-tree plots and replicated four times using a randomized complete block design. The fungicides were sprayed to runoff (5-12 L/plot) using a hydraulic handgun attached to a truck-mounted Rittenhouse sprayer operating at 2415 kPa. Unsprayed guard trees were left between plots to reduce spray drift. A 2.4 x 3.7 m plastic tarp, supported by two 3.0 m x 4 x 9 cm boards, was placed around plots being sprayed, when necessary, in a further attempt to reduce spray drift. Treatments 2, 3, 4 and 5 were sprayed at approximately ten day intervals on May 3, 10, 17, 27, June 7, 17 and 28. Treatment 6 was sprayed at 14 day intervals on May 3, 17, June 1, 15 and 29. Mill's primary scab infection periods occurred on April 19-21, 29-30, May 14-15, 23-24, 31, June 5-6, 8-10, 11-12, 15, 19-21, 26, 27-28. The incidence of scab was assessed on July 9 by examining all the leaves and fruit on 20 fruiting clusters and all the leaves on ten randomly selected shoots per plot. On August 19, scab was assessed on all the leaves of 20 randomly selected shoots and on 100 fruit per plot.

RESULTS: The results are summarized in the table. Phytotoxicity on the leaves and fruit in the FLUAZINAM + BRAVO and FLUAZINAM (100 ml prod./100 L) plots was observed. In early July small black spots were seen on the fruit and older shoot leaves on the trees in these plots.

CONCLUSIONS: All fungicide treatments provided significant season long scab control on both the leaves and fruit as compared to the unsprayed check. The BRAVO treatment provided scab control equivalent to the other sprayed treatments with two fewer sprays.

		PERCENT WITH SCAB				
		JULY 9			AUGUST 19	
Treatment	Rate of product/ 100 L	cluster leaves	shoot leaves	fruit	shoot leaves	fruit
1. Check	---	23.4 a*	39.4 a	82.9 a	78.7 a	87.3 a
2. MANZATE 200 DF	200.0 g	1.3 b	4.7 b	2.5 b	5.7 b	0.3 b
3. FLUAZINAM 500 F	100.0 ml	1.2 b	6.5 b	0.0 b	10.4 b	0.0 b
4. FLUAZINAM 500 F	75.0 ml	1.2 b	4.7 b	6.5 b	8.9 b	0.5 b
5. FLUAZINAM 500 F + BRAVO 500	75.0 ml 100.0 ml	0.8 b	3.9 b	2.4 b	4.1 b	0.3 b
6. BRAVO 500	400.0 ml	1.8 b	7.4 b	0.0 b	8.1 b	0.3 b

* Means followed by the same letter in each column are not significantly different using Duncan's multiple range test (P=0.05). The data were analyzed following arcsin transformation.

1993 PEST MANAGEMENT RESEARCH REPORT

#092

STUDY DATA BASE: 348-1261-4802

CROP: Apple, cv. McIntosh

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: EVALUATION OF FUNGICIDE MIXES FOR THE CONTROL OF APPLE SCAB

MATERIALS: CAPTAN 75 WG (captan); DITHANE 75 DG (mancozeb); MANZATE 200 DF (mancozeb); NOVA 40 W (myclobutanil); NUSTAR 20 DF (flusilazole); RH0611 (60% mancozeb and 3% myclobutanil by weight)

METHODS: Apple scab control was evaluated in a seven-year-old orchard of McIntosh apples on M.26 rootstock. Treatments were assigned to three-tree plots and replicated four times using a randomized complete block design. The fungicides were sprayed to runoff (5-12 L/plot) using a hydraulic handgun attached to a truck-mounted Rittenhouse sprayer operating at 2415 kPa. Unsprayed guard trees were left between plots to reduce spray drift. A 2.4 x 3.7 m plastic tarp supported by two 3.0 m x 4 x 9 cm boards was placed around plots being sprayed, when necessary, in a further attempt to reduce spray drift. Treatment 2 was sprayed at seven to ten day intervals on April 28, May 4, 12, 20, 27, June 4, 11, 18 and 28. Treatment 3 was sprayed on May 6, 17, 27 and June 7. It was preceded by one application and followed by three applications of captan (133 g prod./100 L) on April 28, June 11, 18 and 28. Treatment 4 consisted of one spray of DITHANE (200 g prod./100 L) on April 28 followed by two sprays of NOVA (11.3 g prod./100 L) on May 6 and 17; two sprays of NOVA (11.3 g prod./100 L) + DITHANE (100 g prod./100 L) on May 27 and June 7; and three sprays of DITHANE (200 g prod./100 L) on June 11, 18 and 28. Treatments 5 and 6 were preceded by a spray of DITHANE (200 g prod./100 L) on April 28 and then sprayed on May 6, 17, 27, June 7, 17 and 28. Treatments 7 and 8 were sprayed at approximately ten day intervals on May 6, 17, 27 and June 7. Both treatments were preceded by one spray of mancozeb (200 g prod./100 L) on April 28 and followed by three sprays of mancozeb on June 11, 18 and 28. Mill's primary scab infection periods occurred on April 19-21, 29-30, May 14-15, 23-24, 31, June 5-6, 8-10, 11-12, 15, 19-21, 26, 27-28. The incidence of scab was assessed on July 5 by examining all the leaves and fruit on 20 fruiting clusters and all the leaves on 10 randomly selected shoots per plot. On August 26, scab was assessed on all the leaves of 20 randomly selected shoots and on 100 fruit per plot.

RESULTS: The results are summarized in the table.

CONCLUSIONS: All fungicide treatments provided significant scab control on both the leaves and fruit, throughout the season, as compared to the unsprayed check. As of August 26, the premix of NOVA + DITHANE (RH0611) and the CAPTAN + NOVA treatment provided better scab protection to the shoot leaves then did the NUSTAR + DITHANE treatment. There was no difference in scab control between the two treatments using NUSTAR. Likewise, there was no difference in scab control between the treatments using NOVA (Treatments 3-6).

		PERCENT WITH SCAB				
		JULY 5			AUGUST 26	
Treatment	Rate of product/ 100 L	cluster leaves	shoot leaves	fruit	shoot leaves	fruit
1. Check	---	2.1 a*	4.6 a	14.3 a	4.5 a	11.3 a
2. CAPTAN 75 WG	133.3 g	0.3 b	0.9 b	0.0 b	0.5 bc	0.0 b
3. CAPTAN 75 WG	66.7 g	0.3 b	0.2 b	0.0 b	0.0 c	0.3 b
+ NOVA 40 W	11.3 g					
4. NOVA 40 W	11.3 g	0.0 b	0.0 b	0.0 b	0.1 bc	0.0 b
5. RH0611	133.3 g	0.3 b	0.2 b	0.0 b	0.0 c	0.0 b
6. NOVA 40 W	11.3 g	0.0 b	0.4 b	0.0 b	0.1 bc	0.0 b
+ DITHANE 75 DG	100.0 g					
7. NUSTAR 20 DF	3.3 g	0.0 b	0.9 b	0.0 b	0.6 b	0.0 b
+ DITHANE 75 DG	100.0 g					
8. NUSTAR 20 DF	3.3 g	0.0 b	0.6 b	0.0 b	0.2 bc	0.0 b
+ MANZATE 200 DF	100.0 g					

* Means followed by the same letter in each column are not significantly different using Duncan's multiple range test (P=0.05). The data were analyzed following arcsin transformation.

#093

STUDY DATA BASE: 402 1461 8605

CROP: Apple, cv. McIntosh

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

NAME AND AGENCY:
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TITLE: BAS 490 02F FOR CONTROL OF PRIMARY APPLE SCAB, 1993

MATERIALS: BAS 490 02F (strobilurine analogue); NOVA 40 WP (myclobutanil); POLYRAM 80 DF (metiram)

METHODS: The experiment was conducted at Creston, B.C. in a seven-year-old McIntosh orchard leased by Agriculture Canada. The experimental design was a randomized complete block with five replicates. Each single tree replicate was separated by a barrier tree. The eight treatments were applied until run-off with a handgun operated at 689 kPa with the exception of the control. Four treatments were applied on a seven to ten day protectant schedule and were applied on May 14 (pink), May 24 (petal fall), June 1 (first cover), June 10 (second cover), June 18 (third cover), June 25 (fourth cover) and July 3 (fifth cover). Three treatments were applied on an eradicant schedule 72 to 89 hours after an infection period. Infection periods were monitored between April 30 and June 24 with a leaf-wetness recorder (Belfort Instruments Co., Baltimore, MD). Moderate infection periods were recorded on May 22, 26, 29 and 31 and June 9, 14 and 15. Heavy infection periods were recorded on May 12 and June 21. The eradicant treatments were applied on May 14, May 25, June 1, June 12 and June 24. Foliage scab was evaluated on July 5 on 10 randomly selected shoots from each single tree replicate. Fifteen leaves on each shoot were individually examined for lesions and number of lesions per leaf were counted. The number of lesions per leaf were estimated when more than 10 occurred on a single leaf. Apple foliage was also examined for signs of phytotoxicity such as leaf curling or burning. Apples (20 per single tree replicate) were harvested on September 2 and brought back to the laboratory for examination. Number of lesions and length and diameter of each fruit were recorded and each replicate of 20 apples was weighted.

RESULTS: BAS 490 at a rate of 6.7 g/100 L was as effective as the NOVA + POLYRAM tank-mix in controlling foliage scab (Table 1). BAS 490 at 6.7 g/100 L or greater applied as protectants were as effective as NOVA + POLYRAM tank-mix in controlling fruit scab. BAS 490 at 10.0 g/100 L applied as an eradicant was significantly more effective than NOVA applied as an eradicant in preventing fruit scab. BAS 490 did not significantly effect fruit shape. When applied seven times at 10 g/100 L it produced the lightest average fruit weight although this value was not significantly different from the average weight of fruit which had been treated with NOVA five times. Signs of foliage or fruit phytotoxicity were not observed at any time during this experiment.

CONCLUSIONS: BAS 490 at 10 g/100 L is slightly better than NOVA in preventing fruit scab, but slightly less effective in preventing foliage scab when used as an eradicant. When used as a protectant, BAS 490 at 6.7 g/100 L or higher is as effective as the NOVA + POLYRAM standard treatment in preventing fruit scab.

Table 1. Comparison of BAS 490 with registered fungicides applied on an eradicant (E) or protectant (P) schedule.

Treatment	Rate (product 100L)	Sch*	Infected Leaves (%)	Lesions/ Leaf	Infected Fruit (%)	Lesions/ Fruit	Fruit Shape (L/D)**	Fruit Wt. (g)
Control	---	---	58.8 A***	3.1 A	100.0 A	66.8 A	0.83A	78D
BAS 490	5.0g	P(7)	13.3 B	0.3 BC	10.0 B	0.2 B	0.85A	122BC
BAS 490	6.7g	P(7)	7.2 CD	0.1 BC	4.0 CD	0.1 B	0.86A	119BC
BAS 490	10.0g	P(7)	9.2 BC	0.2 BC	2.0 D	0.0 B	0.85A	114C
NOVA + POLYRAM	11.3g 100.0g	P(7)	3.6 D	0.1 C	2.0 D	0.0 B	0.84A	140A
BAS 490	6.7g	E(5)	12.7 B	0.4 B	4.0 CD	0.2 B	0.85A	121BC
BAS 490	10.0g	E(5)	8.7 BC	0.2 BC	2.0 D	0.0 B	0.87A	129AB
NOVA	11.3g	E(5)	2.8 D	0.1 C	7.0 BC	0.1 B	0.84A	122BC

* Sch = schedule where E is eradicant and P is protectant and () is the number of fungicide applications.

** (L/D) is the ratio of apple length to diameter which determines fruit shape.

*** Means within the same column followed by the same letter are not significantly different at P=0.05 as determined by the Waller-Duncan K-ratio t-test.

#094

STUDY DATA BASE: 402 1461 8605

CROP: Apple, cv. McIntosh

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: POLYRAM COMBINATIONS FOR PRIMARY APPLE SCAB CONTROL, 1993

MATERIALS: DITHANE M-45 80 WP (mancozeb); NOVA 40 WP (myclobutanil); POLYRAM 80 DF (metiram)

METHODS: The experiment was conducted at Creston, B.C. in a seven-year-old McIntosh orchard leased by Agriculture Canada. The experimental design was a randomized complete block with five replicates. Each single tree replicate was separated by a barrier tree. The six treatments were applied until run-off with a handgun operated at 689 kPa with the exception of the control. The treatments were applied on a seven to ten day protectant schedule and were applied on May 14 (pink), May 24 (petal fall), June 2 (first cover), June 10 (second cover), June 18 (third cover), June 25 (fourth cover) and July 3 (fifth cover). Infection periods were monitored between April 30 and June 24 with a leaf-wetness recorder (Belfort Instruments Co., Baltimore, MD). Moderate infection periods were recorded on May 22, 26, 29 and 31 and June 9, 14 and 15. Heavy infection periods were recorded on May 12 and June 21. Foliage scab was evaluated on July 5 on ten randomly selected shoots from each single tree replicate. Fifteen leaves on each shoot were individually examined for lesions and number of lesions per leaf were counted. The number of lesions per leaf were estimated when more than ten occurred on a single leaf. Apples (20 per single tree replicate) were harvested on September 2 and brought back to the laboratory for examination. Number of apple scab lesions on each fruit was recorded and each replicate of 20 apples were weighted.

RESULTS: There was no significant difference between NOVA + DITHANE and NOVA + POLYRAM tank mixes for the control of scab lesions on leaves and fruit (Table 1). POLYRAM alone was not as effective as the tank mixes in preventing foliage scab but provided as effective disease control on the fruit as the tank mixes.

CONCLUSIONS: NOVA + DITHANE and NOVA + POLYRAM tank mixes are equally effective in controlling apple scab and provide as effective control with the lower rate of NOVA as the higher rate. The standard POLYRAM treatment is slightly less effective than the tank mixes in controlling foliage scab.

Table 1. Comparison of different fungicide tank mixes applied as protectants on control of fruit and foliage apple scab.

Treatment	Rate (product/ 100L)	Infected Leaves (%)	Lesions/ Leaf	Infected Fruit (%)	Lesions/ Fruit	Av. Fruit Wt.
NOVA 40 WP + DITHANE	9.1g 100.0g	6.5 CD*	0.1 B	4.0 B	0.2 B	125g A
NOVA 40 WP + DITHANE	11.3g 100.0g	6.4 CD	0.1 B	9.0 B	0.3 B	140g A
NOVA 40 WP + POLYRAM	9.1g 100.0g	7.5 C	0.1 B	7.0 B	0.1 B	137g A
NOVA 40 WP + POLYRAM	11.3g 100.0g	2.4 D	0.0 B	4.0 B	0.0 B	136g A
POLYRAM DF	200.0g	14.4 B	0.4 B	7.0 B	0.1 B	136g A
Control	-----	62.0 A	3.2 A	100.0 A	67.2 A	80g B

* Means within the same column followed by the same letter are not significantly different at P=0.05 as determined by the Waller-Duncan K-ratio t-test.

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#095

STUDY DATA BASE: 1461-1630-8605

CROP: Apple, cv. McIntosh

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: PRIMARY APPLE SCAB DISEASE CONTROL WITH NUSTAR, 1993

MATERIALS: MANZATE 200 DF (mancozeb); NUSTAR 20 DF (flusilazole)

METHODS: The experiment was conducted at Kelowna, British Columbia in a three-year-old McIntosh orchard owned by Agriculture Canada. The experimental design was a randomized complete block with five replicates. Each single tree replicate was separated by a barrier tree. The three treatments were applied until run-off with a backpack sprayer on May 13, May 27 and June 10, 1993.
Foliage scab was evaluated on July 8 by counting each of 10 leaves on 5 randomly chosen shoots on each tree. Fruit harvested on September 1 was evaluated for scab by counting scab lesions on each of 20 fruits randomly picked from each tree.

RESULTS: MANZATE and the mixture of MANZATE and NUSTAR effectively controlled foliage and fruit scab under severe disease pressure (Table 1). NUSTAR tank mixed with MANZATE at half rate were as effective as MANZATE at full rate.

CONCLUSIONS: MANZATE at full rate or NUSTAR with MANZATE at half rate are equally effective in controlling primary apple scab.

Table 1. Percent apple scab and average number of lesions on McIntosh apple fruit and leaves treated with fungicides.

Treatment	Rate (product/ 100L)	Leaves (%)	Fruit (%)	Lesions/ leaf	Lesions/ fruit
Control	----	49.1 A*	96.0 A	3.2 A	39.8 A
MANZATE 200 WP	187.5g	15.2 B	16.8 B	0.4 B	1.1 B
NUSTAR 20 DF + MANZATE 200 WP	3.4g 93.8g	5.1 B	22.0 B	0.1 B	1.6 B

* Means within the same column followed by the same letter are not significantly different at P=0.05 as determined by the Waller-Duncan K-ratio t-test.

1993 PEST MANAGEMENT RESEARCH REPORT

#096

ICAR: 91000658

CROP: Apple, cv. Jersey Mac

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

NAME AND AGENCY:
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TITLE: EVALUATION OF NEW FUNGICIDES UNDER DIFFERENT APPLICATION SCHEDULES FOR THE CONTROL OF APPLE SCAB, 1993

MATERIALS: BAS 490 02 F - 50 DF; NOVA 40 WP (myclobutanil); POLYRAM 80 DF (metiram); DITHANE 75 DG (mancozeb); CAPTAN 80 WP (captan); RH-0611 62.25WP (myclobutanil - 2.25%, mancozeb - 60%)

METHODS: Trial was established in a ten year old plantation of Jersey Mac trees on EM7 rootstock, spaced 3.7 m X 5.5 m, using a R.C.B. design with two-tree plots and four replicates. Applications were made with a diaphram pump/handgun system, operating at 1380 kPa, and were made on a spray to run-off basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis. INFECTION PERIODS: 06/05 (light, tight cluster), 07/05 (light, tight cluster), 13/05 (light, pink), 21/05 (heavy, bloom), 25/05 (heavy, petal fall), 02/06 (heavy, apples 6-9 mm), 08/06(heavy, apples 9-12 mm), 16/06 (heavy, apples 12-16 mm), 19/06 (heavy, apples 16-22 mm), 22/06 (heavy, apples 19-25 mm). APPLICATIONS: Treatments 2-6 were to be on a 10 day schedule until bloom, and then on a 14-21 day interval. Treatment 7 was scheduled to be applied on a seven day interval, with treatment eight to be on a ten day interval. Treatments 9 and 10 were to be used on an eradicant basis with a minimum ten day interval. TREATMENT DATES (hours from start of infection, interval): TREATMENTS 2-6: 07/05 (30, 1st appl.), 16/05 (102, 9.25 days), 26/05 (54, 10 days), 16/06 (30, 21 days); TREATMENT 7: 07/05 (cover, 1st appl.), 16/05 (cover, 9.25 days), 23/05 (cover, 7 days), 30/05 (cover, 7 days), 06/06 (cover, 7 days), 13/06 (cover, 7 days), 24/06 (cover, 11.5 days); TREATMENT 8: 07/05 (cover, 1st appl.), 19/05 (cover, 11.75 days), 30/05 (cover, 11.25 days), 09/06 (cover, 9.5 days), 20/06 (cover, 11 days); TREATMENT 9-10: 09/05 (91.5, 1st appl.), 23/05 (95.25, 14.25 days), 04/06 (88, 11.25 days), 19/06 (89.5, 15 days) ASSESSMENTS: All leaves on 20 clusters and 20 terminals/plot were examined for primary scab lesions; 100 and 160 fruit per plot were examined for scab lesions, mid-season and at harvest respectively.

RESULTS: As presented in the table.

CONCLUSIONS: The season had ten primary infections, the last seven of which were heavy infections. Under the resulting heavy disease pressure, all treatments provided highly significant control of fruit and leaf scab. With the schedule used for treatments 2-6, no rate response was detected with the BAS 490 product, and the NOVA/POLYRAM tank mix worked as well as the tankmix of NOVA/DITHANE. These treatments were put to a severe test when a 21 day interval was used between petal fall and the 12-16 mm fruit stage, and all performed very well. During this 21 day period, two major infections occurred and 48 mm of rain fell. RH-0611, under both application schedules, resulted in excellent scab control, with no differences being seen between them. The RH-0611 product was unavailable at the time of the first application, and thus NOVA and DITHANE were used at rates providing the same quantities of the active ingredients as the 4.0 kg rate of the RH-0611 formulation. Slightly higher scab levels were present in treatments 9 and 10, which were applied on an eradicant schedule. The level of scab control was still very good with these treatments, applied at intervals between 11 and 15 days, and at after infection intervals of 88 to 95 hours. The results indicate that this product has both highly effective eradicant and protectant characteristics. There was a slight dose rate response with BAS 490 with these eradicant treatments, with treatment 9 differring significantly from the NOVA and RH-0611 based treatments for two of the assessments. All treatments received four summer maintenance applications: two of POLYRAM at 6 kg/ha, one of DITHANE at 5 kg/ha, and one of CAPTAN 80 at 3 kg/ha.

Treatment	Rate g ai/ha	% Fruit Scab 26/07	% Fruit Scab 17/08	% Terminal Leaf Scab - 26/07	% Cluster Leaf Scab - 26/07
1.Control	-	92.3a*	88.9a*	79.7a*	80.3a*
2.BAS 490 02 F	75	0.5bcd	0.4b	1.0b	0.0c
3.BAS 490 02 F	100	0.4bcd	0.5b	0.8b	0.1bc
4.BAS 490 02 F	150	1.5bc	0.9b	0.4b	0.3bc
5.NOVA+POLYRAM	136+2400	0.0d	0.4b	0.1b	0.0c
6.NOVA+DITHANE;	136+2250	0.0d	0.2b	0.3b	0.0c
7.RH-0611	90+2400	0.1d	0.2b	0.0b	0.0c
8.RH-0611	90+2400	0.1d	0.2b	0.3b	0.0c
9.BAS 490 02 F	100	2.0b	1.1b	0.6b	1.9b
10.BAS 490 02 F	150	1.5bc	0.6b	1.0b	0.7bc

* Means in same column, followed by same letter are not significantly different (P<.05,DMRT), data arcsin square root transformed before DMRT(detransformed data shown)

1993 PEST MANAGEMENT RESEARCH REPORT

#097

ICAR: 91000658

CROP: Apple, cv. Empire

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.

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TITLE: EVALUATION OF POLYRAM AS A COMPONENT OF TANKMIXES WITH NOVA AND NUSTAR USED FOR THE CONTROL OF APPLE SCAB, 1993

MATERIALS: NOVA 40 WP (myclobutanil); POLYRAM 80 DF (metiram); DITHANE 75 DG (mancozeb); NUSTAR 20 DF (flusilazole); MANZATE 75 DF (mancozeb); CAPTAN 80 WP (captan)

METHODS: Trial was established in a ten year old plantation of Empire trees on EM7 rootstock, spaced 3.7 m X 5.5 m, using a R.C.B. design with two-tree plots and four replicates. Applications were made with a diaphram pump/handgun system, operating at 1380 kPa, and were made on a spray to run-off basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis. INFECTION PERIODS: 06/05 (light, tight cluster), 07/05 (light, tight cluster), 13/05 (light, pink), 21/05 (heavy, bloom), 25/05 (heavy, petal fall), 02/06 (heavy, apples 6-9 mm), 08/06 (heavy, apples 9-12 mm), 16/06 (heavy, apples 12-16 mm), 19/06 (heavy, apples 16-22 mm), 22/06 (heavy, apples 19-25 mm). APPLICATIONS: Treatments 2-7 were to be on a ten day schedule through until the end of the primary infection season. Treatment 8 was included as a commercial standard, protectant-type program, and was to be applied on five to seven day intervals or as appropriate to the predominating weather conditions. TREATMENT DATES (hours from start of last infection, interval): TREATMENTS 2-7: 04/05 (cover, 1st appl.), 14/05 (36, 9.5 days), 23/05 (90, 10.5 days), 03/06 (60, 10.5 days), 13/06 (cover, 10.5), 23/06 (132, 10.5 days); TREATMENT 8: 04/05 (cover, 1st appl.), 10/05 (cover, 6 days), 16/05 (cover, 6 days), 21/05 (cover, 5 days), 27/05 (cover, 5.25 days), 04/06 (cover, 8 days), 13/06 (cover, 9 days), 19/06 (cover, 6 days), 24/06 (cover, 5 days) ASSESSMENTS: All leaves on 20 clusters and 20 terminals/plot were examined for primary scab lesions; 100 and 150 fruit per plot were examined for scab lesions, mid-season and at harvest respectively.

RESULTS: As presented in the table.

CONCLUSIONS: The season had ten primary infections, the last seven of which were heavy infections. Disease pressure was only moderate on these trees with a very open canopy. All treatments provided highly significant control of both fruit and leaf scab. With the schedule used for treatments 2-7, a total of six applications were made, versus the protectant schedule of treatment 8 which received nine applications. The NOVA/POLYRAM tank mixes provided the same levels of scab control as was obtained with the NOVA/DITHANE tankmixes. Similarly, the

NUSTAR/POLYRAM tankmix results were equal to those obtained with the NUSTAR/MANZATE tankmix. These results indicate that the extended interval schedule used with the tank mixes of a sterol inhibitor (NOVA or NUSTAR), and a protectant (POLYRAM, DITHANE or MANZATE), can achieve similar results to a straight protectant programme. All treatments received four summer maintenance applications: two of POLYRAM at 6kg/ha, one of DITHANE at 5kg/ha, and one of CAPTAN 80 at 3kg/ha.

Treatment	Rate g ai/ha	% Fruit Scab 29/07	% Fruit Scab 30/09	% Terminal Leaf Scab - 29/07	% Cluster Leaf Scab - 29/07
1.Control	-	29.3a*	23.6a*	24.4a*	27.8a*
2.NOVA+DITHANE;	109+2250	0.0b	0.6b	0.0b	0.0b
3.NOVA+DITHANE;	136+2250	0.0b	0.9b	0.0b	0.0b
4.NOVA+POLYRAM	109+2400	0.0b	0.1b	0.0b	0.0b
5.NOVA+POLYRAM	136+2400	0.0b	0.3b	0.0b	0.0b
6.NUSTAR+MANZATE	40+2250	0.0b	0.0b	0.0b	0.0b
7.NUSTAR+POLYRAM	40+2400	0.0b	0.7b	0.0b	0.0b
8.POLYRAM	4800	0.1b	1.0b	0.0b	0.0b

* Means in same column, followed by same letter are not significantly different (P<.05,DMRT), data arcsin square root transformed before DMRT(detransformed data shown).

#098

ICAR: 91000658

CROP: Apple, cv. Jersey Mac

PEST: Apple scab, *Venturia inaequalis* (Cke.) Wint.,
European red mite, *Panonychus ulmi* (Koch);
Twospotted spider mite, *Tetranychus urticae* Koch

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TITLE: EVALUATION OF FLUAZINAM AND BRAVO FUNGICIDE PROGRAMMES FOR THE CONTROL OF APPLE SCAB AND THEIR EFFECTS ON MITE POPULATIONS, 1993

MATERIALS: Fluazinam 500 F; BRAVO 500 F (chlorothalonil);
NOVA 40 WP (myclobutanil); DITHANE 75 DG (mancozeb); POLYRAM 80 DF (metiram); CAPTAN 80 WP (captan)

METHODS: Trial was established in a ten year old plantation of Jersey Mac trees on EM7 rootstock, spaced 3.7 m X 5.5 m, using a R.C.B. design with two-tree plots and four replicates. Applications were made with a diaphram pump/handgun system, operating at 1380 kPa, and were made on a spray to run-off basis. A full dilute rate of 3000 L/ha was assumed and treatment mixes were diluted on this basis. INFECTION PERIODS:

Primary: 06/05 (tight cluster), 07/05 (tight cluster), 13/05 (pink), 21/05 (bloom), 25/05 (petal fall), 02/06 (apples 6-9 mm), 08/06 (apples 9-12 mm), 16/06 (apples 12-16 mm), 19/06 (apples 16-22 mm), 22/06 (apples 19-25 mm); Secondary: 27/06, 03/07 (two infections), 08/07, 14/07, 20/07, 22/07, 26/07, 29/07. APPLICATIONS: Treatments 1-3 and 5 were to be on a ten day schedule to terminal budset, and then at a 14 day interval to 30 days before harvest; treatment 4 was to have BRAVO applied on a 14 day interval to petal fall, with a POLYRAM protectant programme to be used until 30 days before harvest; treatments 6 and 7 were to be applied on an eradicant basis, using a minimum seven day interval, until terminal budset, at which point a BRAVO protectant programme would be used until 30 days before harvest; Treatment 8 was to have been an untreated control, but in error received the 1st scheduled application of treatment 7; due to this fungicide application having been made on the intended control, treatment 9 has been included in the scab control table to indicate the level of disease pressure in a totally untreated control (it was an untreated, replicated treatment from an adjacent trial on the same cultivar, and has not been included in the statistical analyses). TREATMENT DATES (hours from start of infection, interval): TREATMENTS 2,3 & 5: 06/05 (79.5, 1st appl.), 16/05 (cover, 10.5 days), 27/05 (cover, 10.25 days), 06/06 (cover, 10.25 days), 17/06 (cover, 10.75), 28/06 (cover, 11.75 days), 08/07 (cover, 9.75 days), 22/07 (cover, 14.25 days); TREATMENT 4: BRAVO: 06/05 (cover, 1st appl.), 19/05 (cover, 13.25 days), 03/06 (cover, 14.75 days), POLYRAM: 17/06 (cover, 14 days), 20/06 (cover, 3.25 days), 28/06 (cover, 8.5 days), 08/07 (cover, 9.25 days), 22/07 (cover, 14.5 days); TREATMENTS 6-7: Eradicants: 09/05 (90.25, 1st appl.), 23/05 (91.25, 14 days), 04/06 (88, 11.25 days), 19/06 (89, 15 days), 08/07 (122.25, 19 days), BRAVO: 22/07 (cover, 14.5). ASSESSMENTS: Apple Scab: All leaves on 20 clusters and 20 terminals/plot were examined for primary scab lesions; 100 and 150 fruit per plot were examined for scab lesions, mid-season and at harvest respectively. Mites: 15 leaves per plot were sampled for both the Two Spotted Spider Mite and European Red Mite, and the total number of eggs and motile mites were counted.

RESULTS: As presented in the tables.

CONCLUSIONS: The season had ten primary infections, the last seven being heavy infections. Nine secondary infections occurred from the end of the primary infection season to the end of July. The resulting disease pressure was high. All treatments provided highly significant control of both fruit and leaf scab. The 750 g rate of fluazinam, when used alone, had marginally higher scab levels than did the 1500 g rate. All fluazinam and BRAVO based treatments, excepting treatment 7, gave statistically similar results to those of NOVA/ DITHANE (a commercial standard). Treatment 7, which in error did not receive its first scheduled application, developed low levels of early leaf scab which endured the subsequent applications and resulted in higher levels of fruit scab. With a single fungicide application, treatment 8 had a substantial level of scab control; the scheduled application for treatment 7 was applied on this intended control plot by error. All treatments received a late summer maintenance application of CAPTAN 80 at 3 kg/ha. The mite populations in the fluazinam based treatments were consistently lower than in the fungicide pro-grammes where it was not used. This trend, in both the Two Spotted Spider Mite and European Red Mite data, though, was not statistically significant.

Table 1. Scab control.

Treatment	Rate** g ai/ha	% Fruit Scab 28/07	% Fruit Scab 17/08	% Terminal Leaf Scab - 28/07	% Cluster Leaf Scab - 28/07
1.Fluazinam	1500	0.1c*	0.0c*	0.6bc*	0.27bc*
2.Fluazinam	750	1.0bc	0.2c	1.0b	1.32ab
3.Fluazinam+BRAVO	750+500	0.4c	0.0c	0.6bc	0.21bc
4.BRAVO; POLYRAM	500 4800	0.1c	0.0c	0.1bc	0.00c
5.NOVA+DITHANE; DITHANE	136+2250 4500	0.0c	0.0c	0.0c	0.00c
6.Fluazinam+NOVA; BRAVO	1500+136 1000	0.4c	0.1c	0.0c	0.01b
7.BRAVO+NOVA;*** BRAVO	1000+136 1000	4.6b	3.1b	0.6bc	1.07abc
8.Control****	-	28.0a	22.4a	19.8a	3.34a
9.Control	-	90.8	88.2	79.2	79.34

* Means in same column, followed by same letter are not significantly different (P<.05,DMRT), data arcsin square root transformed before DMRT(detransformed data shown).

** On May 9, the fluazinam rate for treatments 2-3 was 1125 g ai/ha, the BRAVO rate for treatment 3 was 1500 g ai/ha, and the BRAVO rate for treatment 7 was 3000 g ai/ha.

*** This treatment did not receive its first scheduled application.

**** Mistakenly received the first eradicant application of treatment 7.

Table 2. Fungicide programme effects on mite poulations.

Treatment	Rate** g ai/ha	TSSM (motile) 02/08	TSSM (eggs) 02/08	ERM (motile) 02/08	ERM (eggs) 02/08
1.Fluazinam	1500	0.2d*	0.2bc*	0.7ab*	1.0b*
2.Fluazinam	750	1.4d	0.0c	1.0ab	0.0b
3.Fluazinam+BRAVO	750+500	2.8cd	0.6bc	0.6ab	0.4b
4.BRAVO; POLYRAM	500 4800	14.1ab	4.3ab	7.9ab	5.5ab
5.NOVA+DITHANE; DITHANE	136+2250 4500	25.0a	10.6a	13.0ab	5.4ab
6.Fluazinam+NOVA; BRAVO	1500+136 1000	3.1cd	2.3ab	0.2b	0.6b
7.BRAVO+NOVA;*** BRAVO	1000+136 1000	9.3bc	2.1bc	18.0a	50.3a
8.Control****	-	2.7cd	0.5bc	4.2ab	2.6ab
9.Control	-	N/A	N/A	N/A	N/A

* Means in same column, followed by same letter are not signif.diff.(P<.05, DMRT), data square root transformed before DMRT (detransformed data shown)

** On May 9, the fluazinam rate for treatments 2-3 was 1125 g ai/ha, the BRAVO rate for treatment was 1500 g ai/ha, and the BRAVO rate for treatment 7 was 3000 g ai/ha.

*** This treatment did not receive its first scheduled application.

**** Mistakenly received the first eradicant application of treatment 7.

#099

STUDY DATA BASE: 348-1261-4802

CROP: Apple, cv. Golden Delicious

PEST: Cedar-apple rust (CAR), *Gymnosporangium juniperi-virginianae* Schw.; Quince rust (QR), *Gymnosporangium clavipes* (Cooke & Peck)

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TITLE: CONTROL OF RUST DISEASES ON APPLE

MATERIALS: MANZATE 200 DF (mancozeb); NOVA 40 W (myclobutanil); NUSTAR 20 DF (flusilazole)

METHODS: Control of CAR and QR was studied in a four year old orchard of trees on M.26 rootstock. Four tree plots were replicated five times using a randomized complete block design. Each plot consisted of one tree each of McIntosh, Empire, Red Delicious and Golden Delicious. The fungicides were sprayed to runoff (8-9 L/plot) using a hydraulic handgun attached to a truck-mounted Rittenhouse sprayer operating at 2415 kPa.

Unsprayed guard trees were left between plots to reduce spray drift. As well, a 2.4 x 3.7 m plastic tarp supported by two 3.0 m x 4 x 9 cm boards was placed around plots being sprayed, when necessary, in a further attempt to reduce spray drift. Treatments 2, 3 and 5 were sprayed on May 13 (pink), 25 (bloom) and June 4 (calyx). Treatment 4 was sprayed on May 25 (post-infection) and June 7. The incidence of rust was determined by sampling the Golden Delicious trees in each plot. On July 29, all CAR lesions on each leaf of ten shoots per plot were counted. All the fruit per plot, up to 100, were checked for CAR and QR infection on this same date. The most severe rust infection periods occurred on May 23-24 (bloom), May 31 (calyx), June 5-6 and June 8-10 (one week post calyx) in 1993.

RESULTS: The results are summarized in the table.

CONCLUSIONS: All sprayed treatments provided significant control of CAR on the shoot leaves as compared to the unsprayed check. The MANZATE and NOVA treatments provided better control of CAR on the shoot leaves than did the NUSTAR treatment. The two and three-spray programs of NOVA provided equivalent CAR control. There was no difference in the amount of CAR or QR on the fruit among the treatments.

Treatment	Rate of prod./ 100 L	% leaves infected with CAR	% fruit with CAR	% fruit with QR
1. Check	---	36.5 a*	1.3 a	0.5 a
2. MANZATE 200 DF (pink, bloom + calyx)	200.0 g	7.7 c	0.0 a	0.0 a
3. NOVA 40 W (pink, bloom + calyx)	11.3 g	3.0 d	0.0 a	0.5 a
4. NOVA 40 W (2 post infection sprays)	11.3 g	3.7 cd	0.0 a	0.0 a
5. NUSTAR 20 DF (pink, bloom + calyx)	3.3 g	17.1 b	0.0 a	0.0 a

* Means followed by the same letter in each column are not significantly different using Duncan's multiple range test (P=0.05). The data were analyzed following arcsin transformation.

1993 PEST MANAGEMENT RESEARCH REPORT

#100

STUDY DATA BASE: 1461-1630-8605

CROP: Apple, cv. Jonagold

PEST: Powdery mildew, *Podosphaera leucotricha* (Ell. and Ev.) Salm.

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TITLE: USE OF FUNGICIDES FOR POWDERY MILDEW CONTROL OF APPLE IN 1993

MATERIALS: KUMULUS S 80 WDG (sulphur); BAS 490 02 F (strobilurine analogue), NOVA 40 WP (myclobutanil)

METHODS: The experiment was conducted at the Summerland Research Station on 13-year-old Jonagold trees. Twenty-eight trees in two rows were separated into four blocks of seven random single tree replicates per block. The single tree replicates were separated from one another by a none-sprayed tree on each side. The seven treatments were applied until run-off with a handgun operated at 700 kPa. Treatments were applied on April 30 (tight cluster), May 7 (pink bud), May 19 (petal fall), June 1 (first cover) and June 15 (second cover). Secondary powdery mildew was evaluated on June 29 by randomly selecting 10 shoots on each single tree replicate and counting the number of leaves with mildew and the area of mildew on each infected leaf by estimating the percent area of the leaf covered by powdery mildew. Twenty fruit per replicate were harvested on September 21. Each fruit was examined for net russetting caused by powdery mildew. Each lot of 20 fruit were weighed and average weight per fruit was calculated. Shape was determined by measuring length and diameter for each fruit, calculating the average length and diameter for each lot of 20 fruit and defining shape as the ratio of the average length to the average diameter.

RESULTS: Two applications of NOVA at tight cluster on April 30 and pink on May 7 were not effective in controlling powdery mildew (Table 1). However, two applications at pink and petal fall on May 19 were effective, indicating that the petal fall spray was very important in the control of powdery mildew. BAS 490 02F and two sprays of KUMULUS were as effective as the standard NOVA treatment of two applications of NOVA and two cover sprays of KUMULUS. There was no significant difference between disease control provided by 6.7 and 13.3 g of BAS 490 02F. Furthermore fruit treated with any of the three concentrations of BAS 490 02F were not significantly different from the control fruit in weight and shape. Net russetting caused by powdery mildew was not significant.

CONCLUSIONS: NOVA provided better disease control when applied at pink and petal fall rather than when applied at tight cluster and pink. BAS 490 02F provided effective disease control at a concentration of 6.7 g and did not have any effect on fruit weight and shape at concentrations as high as 13.3 g.

Table 1. Percent leaves and leaf area with powdery mildew and effect of fungicides on fruit weight and shape.

Treatment	Rate (Product/ 100L)	Sprays*	Leaves (%)	Leaf Area (%)	Fruit Wt.(g)	Shape (L/D)**
Control	---	---	37.0 A***	8.4 A	227 AB	0.87 ABC
BAS 490 02F	6.7g	2	7.8 BC	1.2 A	246 A	0.89 A
+ KUMULUS S	200.0g	2				
BAS 490 02F	10.0g	2	5.8 C	0.4 A	221 AB	0.88 AB
+ KUMULUS S	200.0g	2				
BAS 490 02F	13.3g	2	6.5 C	2.3 A	204 B	0.86 ABC
+ KUMULUS S	200.0g	2				
NOVA 40 W	11.2g	2****	23.5 AB	4.0 A	206 B	0.86 BC
NOVA 40 W	11.2g	2	10.0 BC	1.1 A	215 B	0.85 BC
NOVA 40 W	11.2g	2	7.0 C	1.8 A	203 B	0.85 C
+ KUMULUS S	200.0g	2				

* Sprays refer to the number of fungicide applications.
** Shape is the ratio of apple length to its diameter.
*** Means within the same column followed by the same letter are not significantly different at P=0.05 as determined by the Waller-Duncan K-ratio t-test.
**** NOVA applied at tight cluster and pink in contrast to NOVA applied at pink and petal fall.

#101

CROP: Blueberry, cv. Bluecrop

PEST: Fruit rot, (*Botrytis cinerea* Pers. ex Fr.) *Penicillium* spp., *Glomerella cingulata* (Stoneman) Spauld. & H. Schrenk

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TITLE: EFFICACY OF SEVEN FUNGICIDE TREATMENTS AGAINST FRUIT ROT ON BLUEBERRIES, 1993

1993 PEST MANAGEMENT RESEARCH REPORT

MATERIALS: ROVRAL 50% WP (iprodione); FLUAZINAM 50% F; CAPTAN 80% WP; NOVA 40% WP (myclobutanil); BENLATE 50% WP (benomyl); FUNGINEX 190 EC(triforine)

METHODS: Plots consisting of one bush each were replicated six times in a randomized complete block design. Each treatment (Table 1) was repeated every seven to ten days beginning April 30. The number of applications for each treatment was dependent upon PHI ranging from one day to 60 days (Table 1). The sprays were applied with a C02 - back pack sprayer, single cone nozzle at 690 kPa and volume of 1000 L/ha. Berry samples were collected for incubation on four dates: July 19, August 2, 25, and September 8. The samples from each treatment were divided into two lots, (1) bulked (2) individually spaced, with 20 berries per container. Care was taken that no berry touched another in the second lot. Containers were held at approximately 100% humidity. Readings were made within ten days. The percentage of each fungus was estimated for the bulk samples, while the number of infected berries was recorded for each fungus for the spaced samples. Berries were harvested July 23, August 5, 24 and September 8.

RESULTS: Only Fluazinam reduced the numbers of berries infected with *Botrytis* and *Penicillium* (Table 1). Rovral reduced *Botrytis*. Rovral and Fluazinam provided significant reduction of total fruit rot. According to the bulk test (%) only Fluazinam provided significant reduction of *Botrytis, Penicillium* and *Glomerella* (Table 2). Rovral reduced *Penicillium* and Captan reduced *Glomerella*. Rovral, Fluazinam and Captan provided significant reduction of total fruit rot.

CONCLUSIONS: Fluazinam significantly reduced *Botrytis, Penicillium* and *Glomerella*. Rovral reduced *Penicillium* and *Botrytis* and Captan reduced *Glomerella* in blueberries. It would appear that *Botrytis* has developed resistance to Captan and Benlate in blueberries.

Table 1. Comparison of total numbers of berries infected (spaced samples) with *Botrytis, Penicillium* and total fruit rot following various fungicide sprays during the season - 1993.

Treatment	Rate kg ai/ha	PHI Days	*Botrytis* Number	*Penicillium* Number	Total Fruit rot Number
Rovral	1.0	1	10.7 bc	9.0 bcd	29.2 bcd
Fluazinam	0.25	2	10.3 bc	8.5 cde	30.7 abc
Fluazinam	0.50	2	6.7 cd	7.8 de	24.3 cd
Fluazinam	0.75	2	4.5 d	4.2 e	21.3 d
Captan	1.75	2	15.0 ab	12.5 bcd	31.8 abc
Nova	0.136	14	19.5 a	18.7 a	42.0 ab
Captan	1.75				
+ Nova	0.136	14	17.2 a	13.7 abc	35.2 abc
Benlate	0.56	2	18.3 a	10.8 bcd	39.7 ab
Funginex	0.57	60	16.5 a	14.2 ab	38.5 ab
Check	-	-	18.5 a	14.2 ab	44.0 a
ANOVA P<0.05			*	*	*

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

Table 2. Comparison of percentages of berries infected (bulked samples) with *Botrytis, Penicillium, Glomerella* and total fruit rot following various sprays during the season - 1993.

Treatment	Rate kg ai/ha	PHI Days	*Botrytis* Percent	*Penicillium* Percent	*Glomerella* Percent	Total Fruit rot Percent
Rovral	1.0	1	17.4 b	8.3 cd	6.8 ab	33.0 cd
Fluazinam	0.25	2	5.9 c	4.8 d	3.0 ab	20.4 de
Fluazinam	0.50	2	4.3 c	2.6 d	6.0 ab	15.7 ef
Fluazinam	0.75	2	1.5 c	0.8 d	0.3 b	4.5 f
Captan	1.75	2	21.1 b	18.8 ab	0.6 b	43.3 bc
Nova	0.136	14	25.4 b	20.3 ab	4.6 ab	54.1 ab
Captan	1.75					
+ Nova	0.136	14	24.9 b	15.3 bc	4.6 ab	45.5 abc
Benlate	0.56	2	35.5 a	7.6 cd	1.5 b	48.4 ab
Funginex	0.57	60	26.0 b	26.6 a	6.1 ab	61.1 a
Check	-	-	23.5 b	21.5 ab	14.1 a	59.3 a
ANOVA P<0.05			*	*	*	*

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

1993 PEST MANAGEMENT RESEARCH REPORT

#102

CROP: Blueberry, cv. Bluecrop

PEST: Mummy berry, (*Monilinia vaccinii-corymbosi* (Reade) Honey)

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TITLE: EFFICACY OF SEVEN FUNGICIDE TREATMENTS AGAINST SECONDARY MUMMY BERRY INFECTIONS ON BLUEBERRIES, 1993

MATERIALS: ROVRAL 50% WP (iprodione); FLUAZINAM 50% F; CAPTAN 80% WP; NOVA 40% WP (myclobutanil); BENLATE 50% WP (benomyl); FUNGINEX 190 EC (triforine)

METHODS: Plots consisting of one bush each were replicated six times in a randomized complete block design. The grower applied one application of Funginex at 0.6 kg ai/ha on the entire crop March 25. Each treatment (Table 1) was repeated every seven to ten days beginning April 30. The number of applications for each treatment was dependent upon PHI ranging from one day to 60 days (Table 1). The sprays were applied with a C02 - back pack sprayer, single cone nozzle at 690 kPa and volume of 1000 L/ha. Sprays were applied April 30, May 7, repeated May 11 due to heavy rains and May 18. Mummy berries were collected from all bushes on five dates, July 13, 15, 21, 22 and 31 and the total numbers recorded. Berries were harvested July 23, August 5, 24 and September 8.

RESULTS: See Table 1.

CONCLUSIONS: All treatments resulted in a significant reduction of secondary mummy berry infections but Funginex and Rovral were by far the most effective. Funginex, however, resulted in a significant yield decrease and caused some russetting on the berries.

Table 1. Comparison of total numbers of mummy berries and marketable yield following various fungicide sprays during the season - 1993.

Treatment	Rate kg ai/ha	PHI Days	Mummy berry Number	Marketable Yield kg/sq m
Rovral	1.0	1	83 de	12.3 ab
Fluazinam	0.25	2	285 b	15.5 a
Fluazinam	0.50	2	291 b	16.1 a
Fluazinam	0.75	2	192 bc	11.1 ab
Captan	1.75	2	188 bc	14.0 a
Nova	0.136	14	206 bc	14.4 a
Captan	1.75			
+ Nova	0.136	14	159 cd	14.6 a
Benlate	0.56	2	124 cd	16.1 a
Funginex	0.57	60	10 e	8.7 b
Check	-	-	395 a	12.5 ab
ANOVA P<0.05			*	*

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

#103

STUDY DATA BASE: 402-1461-8605

CROP: Peach, cv. Glohaven

PEST: Brown rot, *Monilinia fructicola* (Wint.) Honey

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TITLE: USE OF IPRODIONE FOR CONTROL OF BROWN ROT IN 1993

MATERIALS: CAPTAN 80 WP; EXP10295A 50 WG (iprodione); ROVRAL 50 WP (iprodione)

METHODS: The experiment was conducted at the Summerland Research Station on mature Glohaven peach trees. Twelve trees in two rows were separated into three blocks of four random single tree replicates per block. The treatments were applied until run-off with a handgun operated at 700 kPa. Treatments were applied on May 7 (blossom), May 12 (petal fall), August 5 (ripening fruit) and August 12 (one day before harvest).

Blossom blight was evaluated by visually counting the number of withered blossoms on each tree. Fruit rot was evaluated by picking twenty fruit from each tree and placing in cardboard trays with separate cups for each fruit. The fruit was placed in a 20 C temperature controlled room and covered with polyethylene liners in order to keep high humidity around the peaches. Number of fruit with brown rot decay was counted six days after harvest.

RESULTS: Blossom infection did not occur. ROVRAL and CAPTAN provided effective control of fruit brown rot (Table 1). EXP10295A, a new formulation of iprodione was not effective. Symptoms of phytotoxicity were not observed at any time during this experiment.

CONCLUSIONS: The new formulation of iprodione designated EXP10295 was not equal to the old formulation of iprodione in effectiveness and requires further testing before it replaces the old formulation.
Please note: Brown rot was very difficult to control in 1993 probably because many peaches had latent infections which developed at or just prior to harvest.

Table 1. Percent fruit brown rot on peaches six days after harvest.

Treatment	Rate (product/100L)	Fruit Brown Rot (%)
Control	----	25.0 A*
EXP10295A 50 WG	50.0g	18.3 AB
CAPTAN 80 WP	125.0g	5.0 BC
ROVRAL 50 WP	50.0g	3.3 C

* Mean values followed by the same letter are not significantly different at the 5% level according to Duncan's multiple range test.

#104

STUDY DATA BASE: 402-1461-8605

CROP: Peach, cv. Bailey

PEST: Powdery mildew, *Sphaerotheca pannosa* (Wallr. Fr.) Lev. var. *persicae* Woronichin

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TITLE: PEACH POWDERY MILDEW CONTROL WITH NOVA, 1993

MATERIALS: KUMULUS S 80 WDG (sulfur); NOVA 40 WP (myclobutanil)

METHODS: The experiment was conducted at the Summerland Research Station on mature Bailey peach trees. Fifteen trees in four rows were separated into five blocks of three random single tree replicates per block. The three treatments with the exception of the control, were applied until runoff with a handgun operated at 500 kPa. Nova was applied on May 7 (pink), May 19 (petal fall), June 1 (first cover) and June 15 (second

cover). Kumulus was applied on June 1 (husk fall) and June 15 (second cover).
Secondary powdery mildew was evaluated on leaves on June 29, 1993 by randomly selecting 10 shoots on each single tree replicate and counting the number of leaves with mildew and the area of mildew on each infected leaf. Fifty fruit per replicate were harvested on August 11, 1993. Each fruit was examined for white powdery spots.

RESULTS: The standard sulfur treatment (KUMULUS S) for the control of powdery mildew provided effective control (Table 1). Four applications of NOVA completely prevented leaf mildew and only allowed 0.2% of the fruit to become infected.

CONCLUSIONS: NOVA is an effective alternative to KUMULUS S for the control of powdery mildew on peaches.

Table 1. Percent leaves and leaf area and fruit with powdery mildew.

Treatment	Rate (product/ 100L)	Applications	Leaves (%)	Leaf Area (%)	Fruit (%)
KUMULUS S	200.0g	2	1.4 B*	2.0 B	18.0 B
NOVA 40 WP	11.2g	4	0.0 B	0.0 B	0.2 B
Control	---	---	11.8 A	10.8 A	49.6 A

* Means within the same column followed by the same letter are not significantly different at P=0.05 as determined by the Waller-Duncan K-ratio t-test.

#105

CROP: Saskatoon, *Amelanchier alnifolia*, cv. Smoky and Thiessen

PEST: Saskatoon-juniper rust, *Gymnosporangium nelsonii* Arth.; Brown rot, *Monilinia amelanchieris* (Reade) Honey; and *Entomosporium* leaf and berry spot, *E. mespili* (DC. ex Duby) Sacc.

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TITLE: TRIFORINE, METIRAM AND SULPHUR FOR CONTROL OF SASKATOON-JUNIPER RUST, BROWN ROT, AND *ENTOMOSPORIUM* LEAF AND BERRY SPOT, 1992 & 1993

MATERIALS: FUNGINEX 19% EC (triforine); POLYRAM DF 80% WDG (metiram); and MICROSCOPIC SULPHUR 92% WP (sulphur)

METHODS: The trial was conducted at two sites, Outlook and Saskatoon, in 1992 and at two sites, Outlook and Southey, in 1993. The saskatoon orchard at Outlook was comprised of the cultivar Smoky derived from rooted cuttings. The orchard at the Saskatoon site was comprised of the cultivar Thiessen derived from open-pollinated seedlings. The orchard at the Southey site was comprised of seedlings of the cultivar Smoky. The experimental design used at each site was a Randomized Complete Block Design of three replications, each having four treatments with three bushes per treatment. The treatments were color-coded and separated by a single bush. Five fruit clusters per bush were arbitrarily tagged for evaluation. The treatments consisted of: 1) Funginex (triforine; 1 application between flower bud break and white tip stage); 2) Polyram DF (metiram; 2 applications; the first application between flower bud break and the white tip stage and a second application at the completion of the bloom period, ten days later); 3) Microscopic Sulphur (sulphur; the first application between flower bud break and the white tip stage; subsequent applications at 10-14 day intervals to one day before harvest; 6 ml of AgSurf per 3 L fungicide was added as a surfactant); 4) Control (application of water only). In 1992, the sulphur treatment was also applied at 2X and 3X the label rates in order to assess potential phytotoxicity. Treatments were applied with a CO_2 pressurized (276 kPa) back pack sprayer (R&D Model G3S) using a wand with an 8002 nozzle; the chemical solutions were applied evenly to each bush to the point at which they started to drip from the foliage. Fruit clusters were harvested when 50% of the fruit per bush were fully ripe; these were cooled on site and evaluated later for the amount of infection. Fruit evaluation was based on the proportion of infected fruit to total fruit per cluster.

RESULTS: In 1992, *Entomosporium* leaf and berry spot was not observed at either site and the incidence of brown rot at both sites was too low (less than 1.2% of all fruit evaluated) to be able to test for fungicide efficacy. An analysis of variance for the incidence of saskatoon-juniper rust indicated significant differences between the sites ($p \leq 0.017$) and significant differences among the treatments ($p \leq 0.025$). Orthogonal contrasts for the treatment means (Table 1) indicated that all three fungicides provided a significant degree of control for the rust. The three concentrations of Microscopic Sulphur used did not differ from one another in efficacy. Observations made on June 11 and 12, 1992 indicated that 100% of all plants in all reps of the sulphur 1X, 2X, and 3X treatments had leaf bronzing. None of the plants in the remaining treatments displayed these bronze patches. During the first two weeks of July, just prior to fruit ripening, extensive leaf defoliation was evident in the sulphur 2X and 3X treatments at the Saskatoon site. The sulphur did not appear to have any effect on the fruit clusters.

In 1993, of the total fruit sampled in the control groups, the incidence of saskatoon-juniper rust varied from 0 to 4.9%, the incidence of *Entomosporium* leaf and berry spot varied from 2.9 to 19.6%, and the incidence of brown rot varied from 0.5 to 14.6%. As a consequence, *Entomosporium* leaf and berry spot the only disease for which efficacy data was meaningful. An analysis of variance for the incidence of *Entomosporium* leaf and berry spot indicated significant differences between sites ($p \leq 0.023$), and significant differences among the treatments ($p \leq 0.025$). Orthogonal contrasts for the treatment means (Table 2) indicated that all three fungicides reduced the incidence of this disease, but that the effects of the individual fungicides were not different. None of the analyses indicated a significant site by treatment interaction. All plants in all reps for the sulphur treatments at both sites had developed leaf bronzing. None of the plants in the remaining treatment groups displayed these bronze patches. The sulphur did not appear to have any effect on the fruit clusters but was noted to affect flower petals. Younger plants at the Southey site appeared to have been more affected than those at the Outlook site.

CONCLUSIONS: In 1992, there was sufficient disease pressure from saskatoon-juniper rust to make an adequate evaluation of efficacy. All three fungicides significantly reduced the number of rust-infected fruit per bush. Sulphur phytotoxicity, manifested by leaf bronzing at all application rates, and defoliation, at the 2X and 3X rates, was evident. In 1993, all three fungicides reduced the incidence of *Entomosporium* leaf and berry spot. Sulphur phytotoxicity, manifested by leaf bronzing, was evident at both sites.
None of the fungicides provided control for brown rot. The incidence of brown rot was measured by the incidence of mummified fruit within the sampled clusters. It is possible that the incidence of brown rot should be evaluated from the time of flowering, and over the following weeks of fruit development. A certain unknown percentage of the fruit infected abort and abscise from the fruit cluster at these early stages of fruit development. Data from both years demonstrate that these fungicides provide control for both saskatoon-juniper rust and *Entomosporium* leaf and berry spot.

Table 1. Site differences for mean percent total fruit infected with saskatoon-juniper rust, 1992.

Site	Treatment	Rate in 1000 L/ha	% Infection
Outlook	Control		5.3
	Funginex	570 g ai	0.7
	Polyram	4800 g ai	0.0
	Sulphur 1X	5980 g ai	1.0
	Sulphur 2X	11960 g ai	0.7
	Sulphur 3X	17940 g ai	1.3
	Site mean		1.5
	S.E.M.*		0.5
Saskatoon	Control		0.3
	Funginex	570 g ai	0.3
	Polyram	4800 g ai	0.0
	Sulphur 1X	5980 g ai	0.7
	Sulphur 2X	11960 g ai	0.0
	Sulphur 3X	17940 g ai	0.7
	Site mean		0.3
	S.E.M.*		0.1

* Standard error of mean.

Table 2. Site differences for mean percent total fruit infected with saskatoon-juniper rust, brown rot, and *Entomosporium* leaf and berry spot, 1993.

Site	Treatment	Rate in 1000 L/ha	% Rust	% Brown Rot	% *Entomosporium*
Outlook	Control		3.25	4.39	10.02
	Funginex	570 g ai	1.14	2.97	1.92
	Polyram	4800 g ai	1.30	1.93	0.00
	Sulphur	5980 g ai	0.61	7.37	2.22
	Site Mean		1.58	4.16	3.54
	S.E.M.*		0.45	0.86	1.63
.					
Southey	Control		0.00	6.95	2.22
	Funginex	570 g ai	0.00	2.62	0.00
	Polyram	4800 g ai	0.00	2.95	0.00
	Sulphur	5980 g ai	0.00	4.91	0.00
	Site Mean		0.00	4.36	0.56
	S.E.M.*		0.00	1.10	0.56

* Standard error of mean.

#106

CROP: Strawberry, cv. Redcoat

PEST: Gray mold, *Botrytis cinerea* Pers.

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TITLE: CONTROL OF GRAY MOLD IN STRAWBERRIES USING FLUAZINAM 500 AND BRAVO 500

MATERIALS: Fluazinam 500 F; BRAVO 500 SC (chlorothalonil); ROVRAL 50 WP (iprodione)

METHODS: A third year field of strawberries in Cambridge, Ontario was used as the trial site. Treatments were assigned to 2 m by 6 m plots, replicated four times and arranged according to a randomized complete block design. Plots were sprayed using a 2 m hand boom with a CO_2 powered sprayer at a water volume of 500 L/ha. Sprayer pressure at the source was 206 kPa. Efficacy ratings on June 28 consisted of a harvest of 100 berries per plot. Diseased berries from the 100 harvested were counted and a percent disease was calculated. The healthy berries were weighed in grams and reported as harvestable yield per 100 berries. Percent disease was calculated in the same manner on July 2.

RESULTS: Efficacy and yield data are presented in the table. There was no visual injury to the crop caused by any of the treatments tested.

CONCLUSIONS: Percent disease and yield ratings showed no significant difference between BRAVO alone, fluazinam alone or BRAVO/fluazinam tank mixed. All disease and yield ratings were significantly different than the untreated control, with the exception of the treatment #1 yield rating. Treatment #1 received the fewest number of applications during the experiment, which may have led to this result.

Table 1. Mean Percent Disease and Harvestable Yield on Strawberries, 1993.

Treatment	Rate (product/ha)	Percent Disease 28-June-93	Percent Disease 02-July-93	Harvestable Yield /100 berries (g) 28-June-93
1. BRAVO 500*	3.00 L	13.8 b**	12.0 b	543 bc
2. fluazinam***	1.00 L	8.3 bc	9.0 b	607 b
3. fluazinam****	1.00 L	5.5 bc	9.0 b	618 ab
4. BRAVO 500 + fluazinam***	3.00 L 1.00 L	7.0 bc	12.0 b	638 ab
5. ROVRAL 50 WP*****	2.00 kg	0.8 c	0.0 c	712 a
6. Untreated	----	23.1 a	29.6 a	497 c

* Two applications were made at 14 day intervals beginning at first flower (two applications)

** Means followed by the same letter are not significantly different (P=0.05, Duncan's MRT)

*** Applications were made at 14 day intervals beginning at first flower, to three days pre-harvest (three applications)

**** Applications were made at 14 day intervals beginning prior to first flow, to three days pre-harvest (four applications)

***** Applications were made at seven day intervals beginning at first flower, to three days pre-harvest (six applications)

1993 PEST MANAGEMENT RESEARCH REPORT

DISEASES OF VEGETABLE AND SPECIAL CROPS / MALADIES DES LÉGUMES ET CULTURES SPÉCIALES

Section Editor / Réviseur de section : P.D. Hildebrand

#107 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Snapbean, cv. Oregon 91-G

PEST: Gray mold, *Botrytis cinerea* Pers.:Fr.
White mold, *Sclerotinia sclerotiorum* (Lib.) de Bary

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TITLE: **EFFICACY OF SINGLE APPLICATIONS OF FUNGICIDES AT 10% BLOOM AGAINST GRAY AND WHITE MOLD OF SNAP BEANS**

MATERIALS: BRAVO 720F (chlorothalonil); FLUAZINAM 500 F (ISK Biotech Corp.); RONILAN DF (vinclozolin); ROVRAL 50W (iprodione)

METHODS: Five 6 m long plots were set out in a commercial planting of snap beans at Agassiz, British Columbia. There were six replications in a randomized complete block design. Fungicides were applied in a volume of 400 L/ha to the centre three rows using a hand-pumped back-pack sprayer on August 4, 1993 when the crop was at 10% bloom (10% of the plants had at least one open bloom). Numbers and weights of pod and stem infections and marketable yield were taken on August 27 from a 2 m length of the centre row of each plot.

RESULTS: The results are summarized in Table 1.

CONCLUSIONS: Gray mold was not a serious problem in this trial and none of the treatments had a significant effect. White mold was a significant problem, reducing marketable yield by about 2 T/ha. Ronilan gave best control and highest yield while Bravo gave no control and lowest yield. Fluazinam was intermediate and approximately equivalent to Rovral.

Table 1. Efficacy of fungicides on gray and white mold of snap beans at Agassiz, British Columbia 1993.

Treatment	Rate (product /ha)	Number of Infections/2 m of Row Gray Mold Pod	Gray Mold Stem	White Mold Pod	White Mold Stem	Marketable Yield (T/ha)
BRAVO 720F	3.55L	5.3a*	9.2ab	20.8a	58.5a	7.2 c
BRAVO 720F+	1.23L	4.5a	14.2a	10.5 bc	20.8 b	8.8ab
FLUAZINAM 500F	0.59L					
FLUAZINAM 500F	0.98L	4.8a	9.0ab	13.0abc	21.7 b	9.4ab
FLUAZINAM 500F	0.59L	3.5a	6.2 b	9.8 bc	21.8 b	9.0ab
RONILAN 50%DF	1.5 kg	2.5a	5.0 b	5.5 c	10.0 b	10.1a
ROVRAL 50W	1.5 kg.	6.5a	9.5ab	10.7 bc	24.2 b	8.6abc
UNSPRAYED	---	4.8a	8.7ab	18.5ab	36.8ab	8.3 bc

* Figures followed by the same letter are not significantly different at the 5% level of Duncan's Multiple Range Test

#108

STUDY DATA BASE: 375-1221-8177

CROP: Canola, *Brassica napus* L. cv Excel

PEST: Blackleg, *Leptosphaeria maculans*

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TITLE: EFFECT OF VITAVAX RS ON TOXICITY AND EFFICACY OF RAXIL FOR CONTROL OF EARLY BLACKLEG INFECTION

MATERIALS: RAXIL 2.6 F (tebuconazole 28.0%);
VITAVAX RS FL (carbathiin 4.5%, thiram 9.0%, lindane 67.5%)

METHODS: 200 gram seed lots of cv Excel were treated with RAXIL alone or with a RAXIL - VITAVAX mixture. The seed was immediately counted, packaged and stored at 20 °C one week before planting. The test, located on land which had abundant three year old Leptosphaeria - infected canola stubble, was arranged in a four replicate split plot design with RAXIL seed dressing as the main plot and combinations with VITAVAX RS as the subplot. Each subplot consisted of three 5 m rows with 200 seeds/row; all subplots were separated by three rows of barley to reduce interplot pycnidiospore spread. During planting, carbofuran at 200 g ai/ha was added to each row. The test area received abundant rainfall during June and July for disease initiation and spread. Emergence counts on the three rows of each plot were done four weeks after planting. At crop growth stage 3.3, all plants in row two of each plot were assessed for disease severity, and a disease rating (% DRAT) was then calculated for each plot (see Pesticide Research Report, 1982,

p. 233). Analysis of variance for emergence and percent DRAT was done; paired t tests were done on treatment means for emergence and disease severity to determine the effect of VITAVAX for each RAXIL dose. Linear and quadratic contrast analyses were also done to determine the dose - disease severity relationship for RAXIL with and without the addition of VITAVAX.
Location: Agriculture Canada research farm, Saskatoon

RESULTS: See the table.

CONCLUSIONS: The addition of Vitavax significantly improved emergence when RAXIL was used at 0 and 0.025 g ai/kg, but had no effect on emergence for RAXIL at 0.01 g ai/kg. At RAXIL dosages of 0.05 and 0.1 g ai/kg, the addition of VITAVAX significantly reduced emergence. The combination of VITAVAX and RAXIL affected disease severity only at the highest RAXIL dosage where there was a significant reduction in severity. This effect may have been a result of the significant difference in population between the 2 subplots.

A significant linear decrease in emergence and in disease severity occurred with increasing dosage of RAXIL, both with and without the addition of VITAVAX. There was also a significant quadratic relationship between disease severity and RAXIL dosage when VITAVAX was present in the seed dressing.

In conclusion Vitavax showed no tendency to reduce the phytotoxicity of RAXIL. There in fact appears to be a synergistic effect on emergence between VITAVAX and RAXIL at the highest doses. The reduction of disease severity relative to the check may be a reflection of plant stand differences.

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RAXIL Dose (g ai/kg)	VITAVAX Level (ml P/kg)	Emergence (%)	T-test Result	DRAT (%)	T-test Result
0	0	56.3	significant	41.8	no significant
0	22.5	68.6	difference	42.5	difference
0.01	0	57.6	no significant	36.3	no significant
0.01	22.5	55.3	difference	37.1	difference
0.025	0	38.3	significant	35.2	no significant
0.025	22.5	46.9	difference	34.4	difference
0.05	0	46.8	significant	35.0	no significant
0.05	22.5	38.0	difference	33.4	difference
0.1	0	44.0	significant	36.5	significant
0.1	22.5	23.3	difference	31.4	difference
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Standard Error of Subplot Means		1.7		0.7	

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RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#109

CROP: Canola, cv. Alto

PEST: *Rhizoctonia solani*, Blackleg, *Phoma lingam*; and Flea beetle, *Phyllotreta cruciferae*

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TITLE: PREMIER FOR CONTROL OF RHIZOCTONIA/BLACKLEG/FLEA BEETLES

MATERIALS: PREMIER PLUS (1.4% thiabendazole, 4.1% thiram, 35% lindane), 32 ml/kg seed; PREMIER (1.6% thiabendazole, 4.8% thiram, 40% lindane) formulated May 1992, 28 ml/kg seed; PREMIER formulated May 1993, 28 ml/kg seed

METHODS: The trial was established near Minto, Manitoba on May 28 in a randomized complete block design. Each plot consisted of a single row of treated canola seed at a seeding rate of 5 kg/ha. Phosphate was applied with the seed at a rate of 20 kg/ha. Flea beetle damage was assessed on a 0-4 scale: 0 - no leaf damage, 1 - up to 25% damage, 2 - up to 50% damage, 3 - up to 75% damage, 4 - plant mortality. First flower dates were recorded when 5% of the plants per row had their first open flower. Blackleg severity was rated on a 0-5 scale: 0 - no infection; 1 - approximately 1/4 of the stem circumference superficially lesioned; 2 - approximately 1/2 of the stem circumference lesioned with some penetration of the stem; 3 - approximately 3/4 of the stem circumference lesioned and significant penetration; 4 - stem completely girdled but intact at base and basal stem diameter normal; 5 - stem girdled at base, constricted, dry and brittle, may be completely severed, plant dead. Vigor was rated on a 0-10 scale. The effect of rhizoctonia was measured by counting emergence in 5 m of each row. The data were analyzed with Duncan's MRT at a 5% confidence interval.

RESULTS: The results are summarized in the table.

CONCLUSIONS: All PREMIER treatments reduced flea beetle damage, tended to increase plant populations and tended to decrease blackleg infection from that of the untreated check. The 1993 and 1992 formulations of PREMIER were not significantly different. The PREMIER PLUS treatment was significantly better than the PREMIER treatments for flea beetle control on June 21, and was not significantly better for any other observation.

Treatment	Flea Beetle Damage Jn 14 Cot-1lf	Jn 18 1-2lf	Jn 21 2-3lf	Plant Count Jn 18 1-2lf	Jn 28 4-5lf	1st Flower Date July	Vigor Jl 31 Midfl	Blackleg Au 26	Sp 22
Untreated	1.1a*	1.1a	1.0a	64a	82a	19a	9a	1.6a	2.0a
PREMIER 1993	0.5b	0.6b	0.5b	64a	90a	18ab	9a	1.3a	1.6a
PREMIER PLUS	0.4b	0.3b	0.3c	77a	100a	18b	9a	1.1a	1.6a
PREMIER 1992	0.5b	0.6b	0.5b	68a	88a	18b	9a	1.3a	1.8a

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

#110

STUDY DATA BASE: 375-1221-8177

CROP: Canola, *Brassica napus* L. cv Excel

PEST: Seed decay, Damping - off, Root Rot, *Rhizoctonia solani*, AG-2-1

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TITLE: EFFICACY OF SEED TREATMENT FUNGICIDES FOR CONTROL OF RHIZOCTONIA SEED ROT AND PRE-EMERGENCE DAMPING-OFF OF CANOLA, 1993

MATERIALS: VITAVAX RS FL (carbathiin 4.5 %, thiram 9.0 %, lindane 67.5 %); FLUAZINAM 500 F (50% ai);
CLOAK (carbathiin 4.5 %, thiram 9.0 %, lindane 53.3 %);
RAXIL (UBI 2584-1) (tebuconazole 0.8 %); APRON (UBI 2379) (metalaxyl 31.7%)

METHODS: 100 g seed lots of cv Excel were treated with the seed dressings; the seed was then counted, packaged and stored at 20 degrees C one week before planting. The test was arranged in a four replicate R C B design with two 6 m rows/plot and 200 seeds/row. Trifluralin pre-emergence herbicide at 1.0 kg ai/ha was applied to the test area two weeks prior to planting. During planting carbofuran granules at 200 g ai/ha and 200 kernels of rye grain infested with *Rhizoctonia solani* AG-2-1 were added to each row. In addition to the seed treatments, FLUAZINAM was applied as a foliar spray two weeks after emergence using an R&D plot sprayer at 276 kPa and 300 L solution/ha. A second test in which no *Rhizoctonia* inoculum was used was planted in an adjacent area. Emergence counts on all rows were done three weeks after emergence. At growth stage 4.1, plants in the check plots were examined for root rot; minimum amounts were found and no data was recorded. Analysis of variance for percent emergence, and, the Waller - Duncan k-ratio t test on treatment means, were done.
Location : Agriculture Canada research farm, Saskatoon

RESULTS: See table.

CONCLUSIONS: VITAVAX + APRON + RAXIL, and both FLUAZINAM treatments displayed significant phytotoxicity in the uninfested test. All carbathiin containing treatments and FLUAZINAM at 3.0 ml/kg significantly improved emergence in the infested test. The VITAVAX treatments and CLOAK were superior to FLUAZINAM at 3.0 ml/kg but this may have been a reflection of the phytotoxicity of FLUAZINAM. The addition of RAXIL to the VITAVAX-APRON combination reduced the efficacy against damping off but again this may have been due to the phytotoxicity of RAXIL. CLOAK was not as efficacious as VITAVAX RS despite similar formulations.

Treatment	Rate (ml P/kg seed)	Mean % Emergence Infested Test	Mean % Emergence Uninfested Test
VITAVAX RS FL	22.5	56.0 ab*	88.8 a
VITAVAX RS FL + APRON	22.5 + 1.2	59.4 a	84.8 a
VITAVAX RS FL + APRON + RAXIL	22.5 + 1.2 + 2.0	49.7 bc	72.0 b
CLOAK	22.5	42.8 c	86.5 a
FLUAZINAM	3.0	18.6 d	69.9 b
FLUAZINAM	6.0	14.1 de	54.9 c
FLUAZINAM	3.0 (+1.0 L/ha)	16.3 de	----
Check	----	10.7 e	83.9 a
Standard Error of Treatment Means		3.9	3.8

* Values within a column followed by the same letter are not significantly different according to the Waller Duncan k-ratio t test, P = 0.05.

#111

STUDY DATA BASE: 375-1221-8177

CROP: Canola, *Brassica napus* L. cv Excel

PEST: Sclerotinia stem rot, *Sclerotinia sclerotiorum*

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TITLE: A DOSE RESPONSE STUDY OF SEVERAL FUNGICIDES FOR CONTROL OF SCLEROTINIA STEM ROT IN CANOLA, 1993

MATERIALS: BENLATE 50 DF (benomyl 50.0%); SPORTAK 40 EC (prochloraz 40.0%); ANVIL (hexaconazole 5.0%); ELITE 45 DF (tebuconazole 45.0%); SAN 619 100 SL (cyproconazole 10.0%); TILT 250 EC (propiconazole 25.0%); RENEX (surfactant); ENHANCE (surfactant)

METHODS: The range of rates of application, 150 to 600 g ai/ha, was within the suggested experimental rates for the five unregistered fungicides. BENLATE which is registered for control of Sclerotinia stem rot of canola was used as the standard. A test site was established in an area where sclerotia of *S. sclerotiorum* were abundant in the soil. The test consisted of 3 m X 2 m plots arranged in a four replicate split plot design. Fungicide was the main plot effect, and rate of fungicide was the subplot effect. The test area had abundant rainfall to establish a dense canopy and to stimulate production of apothecia by *S. sclerotiorum.* At growth stage 3.3, multiple daily misting of the plots was begun to maintain leaf wetness and soil moisture. The fungicides were applied at growth stage 4.1 (25% bloom) using a R&D plot sprayer at 276 kPa and 350 L solution/ha. At growth stage 5.2, 100 plants/plot were categorized for disease severity and the numbers of plants in the 5 disease categories were used to calculate a disease rating (% DRAT) for each plot (see Pesticide Research Report, 1982, p. 238). Analysis of variance for percent DRAT, and linear, quadratic (quad) and cubic comparisons on rates for each fungicide were done.
LOCATION: Agriculture Canada Research farm, Saskatoon, Saskatchewan.

RESULTS: See the table.

CONCLUSIONS: BENLATE (the standard) and SAN 619 showed significant linear reduction in disease severity with increasing dose. The efficacy of SAN 619 was similar to that of BENLATE at all doses. ANVIL, SPORTAK, ELITE and TILT displayed no tendency to reduce Sclerotinia stem rot at the rates tested.

Fungicide	Rate (g ai/ha)	DRAT (%)	Orthogonal Comparison*
BENLATE 50 DF	0	33.4	
	150	31.1	linear: Pr>F = 0.01
	300	21.6	quad: Pr>F = 0.96
	450	20.8	
	600	13.6	
.			
SAN 619 100 SL	0	38.4	
	150	31.3	linear: Pr>F = 0.03
	300	31.4	quad: Pr>F = 0.74
	450	20.3	
	600	20.3	
.			
SPORTAK 40 EC	0	27.9	
(+ ENHANCE@150ml/ha)	150	21.6	linear: Pr>F = 0.75
	300	32.8	quad: Pr>F = 0.73
	450	29.9	cubic: Pr>F = 0.36
	600	26.8	
.			
ANVIL	0	41.6	
	150	50.8	linear: Pr>F = 0.03
	300	43.5	quad: Pr>F = 0.31
	450	48.8	cubic: Pr>F = 0.18
	600	63.3	
.			
ELITE	0	39.1	
(+ RENEX@150 ml/ha)	150	43.8	linear: Pr>F = 0.78
	300	38.3	quad: Pr>F = 0.83
	450	34.8	
	600	40.8	
.			
TILT	0	29.4	
	150	42.1	linear: Pr>F = 0.08
	300	39.4	quad: Pr>F = 0.52
	450	43.3	cubic: Pr>F = 0.47
	60	45.5	
.			
Standard Error of Subplot Means		6.0	

* Linear, quadratic and cubic comparison results from SAS computer program.

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1993 PEST MANAGEMENT RESEARCH REPORT

#112

ICAR: 86000190

CROP: Carrot, cv. Caropak

PEST: Sclerotinia white mold, *Sclerotinia sclerotiorum* (Lib.) de Bary

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TITLE: EVALUATION OF FUNGICIDES FOR THE CONTROL OF SCLEROTINIA ON CARROTS IN STORAGE

MATERIALS: FUNGINEX 190 EC (triforine); BRAVO 500 (chlorothalonil); ROVRAL 50 WP (iprodione); BENLATE 50 WP (benomyl); Javex 12 (chlorine 12-13%)

METHODS: On May 26, 1992, carrots were seeded in naturally infested soil at the Muck Research Station. Plots were four rows wide, 3.75 m in length and replicated four times in a randomized complete block design. The field treatments were applied September 23, 30 and October 7, 1992 using solid cone spray nozzles with 65 p.s.i. and 350 L of water/ha. Approximately 10 kg of carrots from each plot were harvested on November 10, 1992. Dip samples were washed and immersed in treatment solution for 5 seconds. All samples were placed in plastic containers and put in a Filacell storage where the temperature and relative humidity were kept at approximately 1 degree C and 90%, respectively.

The number of carrots with and without visible white mold were counted and those with mold were assessed for degree of disease on February 19 and April 23, 1993.

A number was assigned to the degree of disease, 5 represented no disease, 3.7 represented moderate disease and 1.0 represented severe disease such that the carrot was in a liquified state.

RESULTS: As presented in Table 1.

CONCLUSIONS: None of the fungicides reduced the percent disease compared to the untreated check and some treatments increased disease incidence. The chlorine dip increased the percent disease. The untreated check had very low levels of white mold on April 23, 1993 and there is no explanation as to why the number of carrots with white mold decreased during the storage period. There were no significant differences in the degree of disease among treatments.

Table 1. Control of Sclerotinia on carrots in storage in 1992-93.

Treatment	Field application (kg/ha product)	Post harvest dip (product per L/H_2O)	February 19, 1993 Percent disease	February 19, 1993 Degree of disease	April 23, 1993 Percent disease	April 23, 1993 Degree of disease
FUNGINEX 190 EC	2.25 L	-	2.2bcd*	3.4a	1.2def	3.0a
ROVRAL 50 WP	1.5	-	6.0ab	3.9a	3.0a-e	3.5a
Check	-	-	2.0cd	4.7a	0.5f	4.5a
BENLATE 50 WP	1.1	-	3.7a-d	3.8a	1.2def	4.1a
BRAVO 500	3.0 L	-	3.5abc	3.7a	3.2a-f	3.2a
Chlorine dip	-	1.0 ml	6.7a	4.4a	6.7a	3.6a
FUNGINEX 190 EC dip	-	4.5 ml	3.0 a-d	4.3a	6.0abc	4.1a
ROVRAL 50 WP dip	-	3 g	2.2bcd	4.0a	3.7a-d	4.2a
BENLATE 50 WP dip	-	2.2 g	2.2cd	4.8a	7.0ab	3.7a
BRAVO 500 dip	-	6 ml	1.0d	3.6a	1.5def	3.1a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Protected L.S.D. Test. Data on percent damage were subjected to an Arcsin transformation for analysis; untransformed data are presented in the table.

#113

ICAR: 86000190

CROP: Lettuce, cv. Ithaca

PEST: Lettuce drop, *Sclerotinia sclerotiorum* (Lib.), de Barry and *Sclerotinia minor*: Jagger

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TITLE: EFFICACY OF FUNGICIDES FOR THE CONTROL OF SCLEROTINIA DROP OF LETTUCE

MATERIALS: DITHANE DG (mancozeb 75%); FLUAZINAM 500 (ASC 66825 50%)

METHODS: Lettuce was direct seeded into naturally-infested soil at the Muck Research Station on May 18, 1993. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of eight rows, 5 m in length. DITHANE DG was used as a standard treatment for comparison with FLUAZINAM 500. FLUAZINAM 500 was applied at rates of 1.0 L, 0.5 L and 0.4 L product/ha. DITHANE DG was applied at 2.25 kg product/ha. FLUAZINAM 500 treatments at 1.0 L and 0.5 L product per ha were applied on May 25 at emergence and June 24 as a broadcast soil drench.

FLUAZINAM 500 at 0.4 L/ha plus DITHANE DG were applied as foliar sprays at 60 p.s.i. in 500 L/ha of water on May 25, June 24 and July 6 and 15. The number of lettuce heads infected with sclerotinia was assessed at harvest. The trial was harvested on July 29.

RESULTS: As presented in Table 1.

CONCLUSIONS: Levels of lettuce drop were low in the trial and no significant differences were found among any of the treatments.

Table 1. Evaluation of FLUAZINAM 500 and DITHANE DG for the control of lettuce drop in 1993.

Treatment	Rate (product/ha)	Percent marketable	Percent disease
FLUAZINAM 500*	1.0 L	68.8a***	4.38a
FLUAZINAM 500*	0.5 L	80.0a	3.13a
FLUAZINAM 500**	0.4 L	68.0a	5.00a
DITHANE DG**	2.25 kg	76.6a	5.63a

* Broadcast soil drench at emergence and repeated in three to four weeks.
** Broadcast spray at emergence and a ten day schedule to 14 days pre- harvest.
*** Numbers in a column followed by the same letter are not significantly different at P=0.05, Protected L.S.D. Test. Data were subjected to an Arcsin transformation for analysis; untransformed data are presented in the table.

#**114**

ICAR: 2090230B

CROP: Monarda, cv. Morden-3

PEST: Powdery mildew, *Erysiphe cichoracearum* DC.:Mérat

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TITLE: EFFICACY OF MICRO-NIASUL W FUNGICIDE AGAINST POWDERY MILDEW ON MONARDA, 1993

MATERIALS: MICRO-NIASUL W 92% WP (sulphur)

METHODS: The trial was conducted in an experimental plot of monarda (*Monarda fistulosa* L.) at the ASCHRC, Brooks. The rows were spaced 1.0 m apart and the spacing between plants within rows was 0.5 m. Each treatment (Table 1) was applied to four 20 m^2 subplots, each containing about 40 plants. A similar set of subplots was sprayed with tap water as a control. The treatments were arranged in a completely random design. The sprays were applied with a $C0_2$ propelled, hand-held boom sprayer equipped with two Tee Jet 8001 nozzles. The spray was directed onto the top and exposed sides of each row. The plants were 30-40 cm tall and had flower buds on June 18 when the first sprays were applied. The equivalent of 200 L/ha of spray mixture was applied to each subplot using a boom pressure of 250 kPa. Powdery mildew was just beginning to appear on the bottom leaves of the monarda plants at this time. Five rates of MICRO-NIASUL, ranging from 1.0 to 9.0 kg of product/ha, were used in this experiment. A second application of each treatment was made at the early bloom stage (July 8). From July 26-30, visual ratings of mildew severity were made by collecting 25 stems from each subplot and counting the number of leaves with mildew per stem. These counts were converted to percent infected leaves per stem, arcsin- or square-root-transformed and subjected to polynonial regression analysis. At full bloom (July 26), which is the optimum time for harvesting this crop, 2 kg of plant material was cut from each subplot. A 500 g subsample from each harvested lot was oven dried at 40 degrees C for 48 hr and the dry weight was determined. The remainder of the material was frozen at 20 degrees C immediately after cutting. Two weeks later, a 200-250 g subsample of frozen plants from each subplot was chopped and placed in a hydrodistillation flask where the essential oils were extracted, condensed and the volume measured. A small amount of each oil sample was subjected to gas-liquid chromatography to determine the percent geraniol, the principal essential oil in monarda. The oil and dry matter yields were also statistically analyzed.

RESULTS: See Table 1. MICRO-NIASUL provided statistically significant control of powdery mildew, compared to the untreated check, at all of the rates tested. The greatest disease control was provided by the 9 kg/ha rate. The high incidence of powdery mildew on the lower surface of the leaves indicated that the spray coverage was poor. Oil yields from all of the fungicide-treated subplots were significantly higher than the check, but there were no significant differences in percent geraniol between any of the treatments, including the check.

CONCLUSIONS: MICRO-NIASUL W provided significant control of powdery mildew under the conditions of this trial. Applying the fungicide with an overhead boom failed to achieve adequate coverage of the undersides of the leaves and the mildew incidence thereon remained high. For maximum efficacy, MICRO-NIASUL should be applied in a manner that will achieve thorough coverage of both the upper and lower surfaces of monarda leaves.

Table 1. Powdery mildew incidence, oil yield and percent geraniol in monarda sprayed with five rates of MICRO-NIASUL W fungicide at Brooks, AB in 1993*.

Treatment	Rate (product/ha)	Mildewed leaves (%) Upper** surface	Mildewed leaves (%) Lower*** surface	Oil yield (ml/100g oven dry wt.)	Geraniol (%)
MICRO-NIASUL	1.0 kg	86.8	99.3	2.70	96.5
MICRO-NIASUL	3.0 kg	37.2	97.4	3.04	96.6
MICRO-NIASUL	5.0 kg	19.1	95.5	3.17	96.4
MICRO-NIASUL	7.0 kg	33.9	91.0	3.03	96.7
MICRO-NIASUL	9.0 kg	9.4	84.3	3.04	97.0
Check (water only)	-	95.3	98.8	1.85	96.1

* Each value in this table is the mean of four replications.
** These data were arcsin transformed prior to regression analysis. The detransformed means are presented here.
*** These data were square root transformed prior to regression analysis and the detransformed means are reported here.
Regression equations and correlation coefficients were:
Mildewed leaves (upper surface):
$y = 81.71 - 24.03x + 3.96x^2 - 0.22x^3$
$r = 0.88^{**}$
Mildewed leaves (lower surface):
$y = 9.94 + 0.02x - 0.01x^2$
$r = 0.73^{**}$
Oil yield:
$y = 1.92 + 0.77x - 0.15x^2 + 0.01x^3$
$r = 0.71^{**}$

#115

ICAR: 86000190

CROP: Onion, yellow cooking, cv. Benchmark

PEST: Botrytis leaf blight, *Botrytis squamosa*: Walker

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TITLE: EFFICACY OF FUNGICIDES FOR CONTROL OF BOTRYTIS LEAF BLIGHT

MATERIALS: BRAVO 500 (chlorothalonil); ROVRAL 50 WP (iprodione); FLUAZINAM 500; ASC 67098

METHODS: Onions were seeded into organic soil at the Muck Research Station on May 14, 1993. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of four rows, 5 m in length. The treatments consisted of: 1) BRAVO 500 at 2.0 L/ha, 2) ROVRAL 50 WP at 1.5 kg/ha, 3) FLUAZINAM 500 at 0.4 L/ha plus BRAVO 500 at 2.0 L/ha, 4) ASC 67098 at 1.2 kg/ha, 5) ASC 67098 at 1.5 kg/ha, 6) FLUAZINAM 500 at 1.0 L/ha, and 7. untreated check. All fungicides were applied as foliar sprays using a solid cone spray nozzle at 80 p.s.i. and 500 L/ha water. Treatments one to five were applied on July 21, August 3, August 13, and August 26. Treatment six was applied August 26 only. Twenty five plants per replicate were sampled on September 8 and two leaves per plant with approximately 80% or more green leaf tissue were rated for percentage of leaf blight using the Manual of Assessment keys for Plant Diseases by Clive James, Key No 1.6.1. The number of green and dead leaves per plant were also recorded.

RESULTS: As presented in Table 1.

CONCLUSIONS: Significant differences in control of botrytis leaf blight were found. Application of FLUAZINAM 500 plus BRAVO 500 resulted in the lowest percentage of botrytis leaf blight and the lowest number of dead leaves/plant.

Table 1. Effect of fungicides on percent botrytis leaf blight and number of green and dead leaves per plant in Kettleby/Bradford, Ontario in 1993.

Treatment	Rate (product/ha)	Percent blight	# of Dead leaves/plant	# of Green leaves/plant
ROVRAL 50 WP	1.5 kg	28.8 a*	3.53 abc	5.24 bcde
FLUAZINAM 500	1.0 L	16.3 b	3.71 ab	5.75 bc
ASC 67098	1.2 kg	11.25 bcd	2.95 bcd	5.59 bcd
BRAVO 500	2.0 L	5.8 cde	2.79 cd	5.45 bcde
ASC 67098	1.5 kg	5.0 cde	2.79 cd	6.56 ab
FLUAZINAM 500 +	0.4 L			
BRAVO 500	2.0 L	2.5 e	2.38 d	7.28 a
Check	-	13.8 bc	4.27 a	4.2 e

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

1993 PEST MANAGEMENT RESEARCH REPORT

#116

ICAR: 86000190

CROP: Onion, yellow cooking, cv. Benchmark

PEST: Botrytis leaf blight, *Botrytis squamosa*: Walker

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TITLE: EFFICACY OF TWO FORMULATIONS OF IPRODIONE AND DITHANE DG FOR THE CONTROL OF BOTRYTIS LEAF BLIGHT

MATERIALS: ROVRAL 50 WP (iprodione); DITHANE DG (mancozeb 75%); EXP 10370A 50 WG (iprodione)

METHODS: Onions were seeded into organic soil at the Muck Research Station on May 7 and 9, 1993. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of eight rows, 5 m in length. ROVRAL 50 WP and EXP 10370A were applied singly at 1.5 kg product/ha and at a rate of 0.75 product/ha in combination with DITHANE DG at 2.0 kg product/ha. DITHANE DG was applied singly at a rate of 2.0 kg product/ha. An untreated check was also included. Treatments were applied on July 9, 22, August 3 and 13, 1993, as foliar sprays at 60 p.s.i in 500 L of water. Twenty-five plants per replicate were harvested on August 24, 1993. The three lowest leaves on each plant with approximately 80% or more non-necrotic tissue were rated for percent green leaf area using the Manual of Assessment Keys for Plant Disease by Clive James, Key No 1.6.1. The number of green and dead leaves on each plant was also recorded.

RESULTS: As presented in Table 1.

CONCLUSIONS: All fungicide treatments increased the percentage of green leaf tissue and reduced the number of dead leaves/plant, except DITHANE DG applied alone. None of the treatments increased the number of green leaves compared to the untreated check. Onions in the untreated check lodged two to three days earlier than those treated with fungicide. Control of botrytis leaf blight with EXP 10370A 50 WG was equivalent to that of ROVRAL 50 WP.

Table 1. Evaluation of iprodione and DITHANE DG for the control of botrytis leaf blight of onions in 1993.

Treatment	Rate (kg product/ha)	Percent green tissue	# of Dead leaves/plant	# Green leaves/plant
ROVRAL 50 WP	1.5	82.5ab*	2.40a	7.44 a
ROVRAL 50 WP + DITHANE DG	0.75 + 2.0	85.0ab	2.33a	7.23 a
EXP 10370A 50 WG	1.5	87.5a	2.42a	7.10 a
EXP 10370A 50 WG + DITHANE DG	0.75 + 2.0	90.0a	2.30a	7.01 a
DITHANE DG	2.0	77.5bc	3.14b	6.96 a
Check	---	71.3c	3.47b	6.01 a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Protected L.S.D. Test. Data on percent green tissue were subjected to an Arcsin transformation for analysis; untransformed data are presented in the table.

#117

ICAR: 86000190

CROP: Onion, yellow cooking

PEST: White rot, *Sclerotium cepivorum*: Berk.

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TITLE: EVALUATION OF FUNGICIDES FOR THE CONTROL OF WHITE ROT IN MUCK SOILS

MATERIALS: BRAVO 500 (chlorothalonil) 3.0 L/ha; FLUAZINAM 500 (fluazinam) 0.5 L plus 1.0 L/ha; FUNGINEX (triforine) 3.0 L/ha; ROVRAL 50 WP (iprodione) 1.5 kg/ha

METHODS: Plots were established on each of four farms with known histories of white rot in the Holland Marsh. A plot was also established in an enclosed area, artificially infested with white rot sclerotia, at the Muck Research Station (MRS). On site one a, the cv. Norstar was seeded March 1 and transplanted into the field May 12. Fungicides were applied as a soil drench on May 17 and again on June 15. At site one b, on the same farm, BOTRAN (dichloran) was applied before planting; the same cv. and planting times were used. Fungicides were applied on June 2 and July 5. On site two, cv. Fortress was seeded April 30 and fungicides applied on May 18 and June 17. On site three, the cv. Eskimo was seeded May 1 and the fungicides applied on May 21 and June 22. On site four, the cv. Rocket was seeded April 30 and fungicides applied May 21 and June 22.

Plot sizes at all sites except the Muck Research Station were four 4 m rows and replicated six times. Trials were arranged in a randomized complete block design. Fungicide treatments were applied using a back-pack sprayer and directed at the base of the plant. At sites two, three and four, the fungicides were applied at the flag stage, using 1000 L/ha of water.

At the Muck Research Station, FLUAZINAM was applied at 1.0 and 0.5 L ai/ha and replicated three times. Cultivar Fortress was seeded May 14 with a V-belt seeder in six rows 4 m long spaced 40 cm apart.

RESULTS: As presented in Table 1. The check on site five was badly damaged by onion maggot.

CONCLUSIONS: The fungicide applications did not reduce white rot compared to the untreated check. The levels of white rot were relatively low at all of the sites.

Table 1. Evaluation of fungicides for the control of onion white rot in 1993.

Treatment	Rate (ai/ha)	Percent White Rot Infection Site 1a	Site 1b (BOTRAN)	Site 2	Site 3	Site 4	Site 5 (MRS)
FLUAZINAM 500	1.0 L	4.67a*	19.45a	8.83a	1.91a	4.28a	9.02a
FLUAZINAM 500	0.5 L	3.65a	16.13a	8.96a	3.38a	4.12a	4.40a
BRAVO 500	3.0 L	2.78a	13.57a	8.18a	2.27a	2.97a	
FUNGINEX	3.0 L	4.33a	24.77a	8.26a	3.79a	1.74a	
ROVRAL 50WP	1.5 kg	8.08a	19.97a	11.27a	2.60a	3.22a	
Check		7.71a	20.22a	10.62a	4.81a	4.85a	

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

#118

STUDY DATA BASE: 362-1241-9301

CROP: Field pea, cv. Radley and AC Tamor

PEST: Ascochyta blight, *Mycosphaerella pinodes* (Berk. & Blox.)

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TITLE: CONTROL OF ASCHOCHYTA BLIGHT OF FIELD PEA BY FUNGICIDE APPLICATIONS

MATERIALS: BENLATE (Benomyl 50%); ROVRAL 4F (Iprodione 41.6%); BRAVO (Chlorothlonil 50%); TILT (propiconazole 25%).

METHODS: Experiments were conducted at Morden and Darlingford, Manitoba in 1993. Field pea (*Pisum sativum* L.) was planted in four row plots with a row length of 3 m, 0.3 m spacing between rows, and 1.2 m between plots. Seeding rate was 75 seeds/m^2. The experiment was arranged in a split plot design with four replicates; cultivar as main plot and fungicide treatment as subplot. AC Tamor and Radley were the two cultivars used. Dates of seeding were 14 May at Morden and 20 May at Darlingford; harvest dates were 1 September at Morden and 17 September at Darlingford.
Fungicides rates (in kg ai/ha) were as follows: Benlate, 0.763; Bravo, 2.00; Rovral 4F, 0.600; and TILT, 0.125. Fungicide treatments were applied either once, twice or three times. The initial application was made just prior to flowering; the second application at mid-flowering; the third application at late flowering. The fungicides were applied in a water volume of 300 L/ha at 276 kPa using a hand-held boom. Plots were assessed for *M. pinodes* symptoms at each spray date and three weeks after the final application. Symptoms were visually estimated as the percent of foliage area infected, using a 0-8 scale where 0=no infection and 8=>80% of foliage area infected.

RESULTS: The effect of four fungicides on the control of Ascochyta blight of field pea in 1993 is summarized in Table 1. The effect of the fungicide treatments was similar on the two cultivars tested so results were combined. All fungicide treatments significantly reduced the severity of Ascochyta blight at the Darlingford site, as did all treatments except the single application of Rovral 4F and one or two applications of TILT at the Morden site. Several of the fungicide treatments also increased the yield of field peas. At Morden, all Bravo and Benlate treatments significantly increased yield. At Darlingford, all Bravo and Benlate treatments except the single application of Bravo significantly increased yield. None of the Rovral 4F treatments enhanced yield. Of the TILT treatments, yield was only increased when applied three times at the Darlingford site. The greatest yield increases at Morden (68%) and Darlingford (153%) occured when Bravo was applied three times.

CONCLUSIONS: Based on results obtained in 1993 at two locations in Manitoba, the fungicides Bravo and Benlate were effective in reducing the severity of Ascochyta blight and increasing the yield of field pea. TILT and Rovral treatments were less effective in reducing disease severity than Bravo or Benlate, and were ineffective in enhancing yield. We plan to repeat this experiment in 1994.

Table 1. Effect of four fungicides on the control of Ascochyta blight on field pea in 1993.

Treatment	No. of applications	Disease severity*,** D***	Disease severity*,** M	Yield (kg/ha) D	Yield (kg/ha) M
Control	-	7.4 a	7.0 a	717 e	1111 e
Benlate	1	6.1 cd	6.5 bc	1099 cd	1498 bc
Benlate	2	6.0 d	6.4 bc	1326 b	1646 ab
Benlate	3	4.9 e	6.5 bc	1786 a	1688 ab
Bravo	1	6.5 bc	6.4 bc	862 e	1456 bcd
Bravo	2	6.0 d	6.1 c	1275 bc	1708 ab
Bravo	3	5.0 e	6.1 c	1817 a	1861 a
Rovral 4F	1	6.9 b	6.6 ab	777 e	1104 e
Rovral 4F	2	6.4 cd	6.5 bc	811 e	1213 de
Rovral 4F	3	6.5 bc	6.4 bc	741 e	1173 e
Tilt	1	6.5 bc	6.8 ab	737 e	1298 cde
Tilt	2	6.5 bc	6.8 ab	906 de	1298 cde
Tilt	3	6.4 cd	6.4 bc	1080 cd	1329 cde
.					
C.V.		5.9	6.1	19.3	16.5

* Only the final disease severity ratings are presented.
** Means within a column followed by the same letter are not significantly different according to Duncan's Multiple Range Test (P<0.05).
*** D=Darlingford site, M=Morden site.

#119

STUDY DATA BASE: 362-1221-8902

CROP: Sunflower, cv MRS-42

PEST: Rust, *Puccinia helianthi* Schw.

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TITLE: CONTROL OF SUNFLOWER RUST BY FUNGICIDE APPLICATIONS

MATERIALS: BENOMYL 50% (Benlate T); MYCLOBUTANIL 40% WP (RH-3866); Mancozeb 80% (Dithane M-45); EXPERIMENTAL ROHM & HAAS CANADA (RH-7592 2F 23%);
ISK-BIOTCH 50% (Fluazinam); CHLOROTHALONIL 50% (Bravo);
PROPICONAZOLE 25% (Tilt); (SAN 371 F 25% WP);
OCTYLPHENOXYPOLYETHOXYETHANOL (Triton XR, Emulsifier)

METHODS: Trials were conducted at the Agriculture and Agri-Food Research Station at Morden, Manitoba in 1991-1992. Sunflower (*Helianthus annuus*

L.) was planted in 6 m rows at 0.75 m spacing between rows and 0.15 m spacing between plants within rows. Each treatment was applied on four row plots. The treatments were arranged in a randomized complete block design with four replicates.

Seeding was done in the 3rd week of May and harvesting was completed in the last week in September. Two rows, one of each of the susceptible cultivars Commander and S-37, were planted as rust-spreaders after every four plots. All rows of the two susceptible rust-spreader cultivars were artificially inoculated with rust at the seedling stage for early infections and development of the disease.

Each fungicide was applied either in one application at flowering, or in two applications, one at flowering and a second two weeks later. The rates used for the individual fungicides are those recommended by the producing and marketing company and are presented in Table 1. The emulsifier Triton XR was used with RH-7592 at the rate of 2.5 ml/L as recommended by the producing company. The fungicides were applied in water 200 L/ha using a knap-sack sprayer. Plots were assessed for rust severity at the end of the season. Rust severity was visually estimated as the percentage leaf area infected in the 4-row plots.

RESULTS: Dithane-M45 in two applications gave the best control of sunflower rust, followed by two applications of Fluazinam. One application of Dithane-M45, Fluazinam, and Tilt as well as two applications of Bravo also significantly reduced the rust severity (Table 1). However, only the two applications of Dithane-M45 and Tilt resulted in significant yield increase. Neither one or two applications of the fungicides RH-3866, RH-7592, and Benlate significantly reduced rust severity but each, when used in one application at flowering, resulted in significant increase in yield over the control treatment. None of the fungicides used had any significant effects on oil content. Only two applications of Tilt resulted in significant increase in kernel weight. Only two applications of Fluazinam resulted in significant increase in kernel density. SAN 371 showed no significant effects neither on reducing rust nor on increasing the yield.

CONCLUSIONS: One application of Dithane-M45, Fluazinam, Tilt, or two applications of Bravo were equally effective in significantly reducing the rust severity in comparison with the control treatment. Two applications of these fungicides are more effective in reducing rust severity and yield losses.

Table 1. A comparison of the effects of several applications of fungicides on sunflower rust at Morden, MB in 1991 and 1992 .

Fungicide (Applications)		Rate (kg ai/ha)	Rust	Yield kg/ha
Control-check			2.3	3097.1
Dithane-M45	(1)	1.6	1.7*	3363.1
Dithane-M45	(2)	1.6	0.5*	3441.9*
RH-3866	(1)	0.3	2.2	3476.1*
RH-3866	(2)	0.3	1.9	3291.0
RH-7592	(1)	0.15	2.5	3462.6*
RH-7592	(2)	0.15	1.9	3363.0
Fluazinam	(1)	1.0	1.7*	3236.1
Fluazinam	(2)	1.0	1.0*	3161.8
Tilt	(1)	0.12	1.7*	3212.4
Tilt	(2)	0.12	1.4*	3438.8*
SAN-371	(1)	0.2	2.0	3314.3
SAN-371	(2)	0.2	2.3	3112.3
Benlate	(1)	1.0	2.4	3517.0*
Benlate	(2)	1.0	2.0	3322.5
Bravo	(1)	1.0	2.1	3230.1
Bravo	(2)	1.0	1.7*	3260.6
.				
C.V.			27.9	9.1
L.S.D.			0.5	299.6

* Significantly different from the control treatment (LSD, P=0.05).

#120

ICAR: 61002036

CROP: Field tomato, cv. Heinz 9478

PEST: Bacterial canker, *Corynebacterium michiganensis subsp. michiganensis* (Smith) Davis et al.; Early blight, *Alternaria solani* (Ell. & Mart.) L.R.Jones & Grout, and Septoria leaf spot, *Septoria lycopersici* Speg.

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TITLE: BACTERIAL DISEASE CONTROL IN FIELD TOMATOES I

MATERIALS: BRAVO 500 (chlorothalonil); DITHANE 75DF (mancozeb);
BRAVO C/M (27% chlorothalonil + 27% copper + 5.4% maneb);
BRAVO 825 (chlorothalonil); MANZATE 75DF (mancozeb);
DACOBRE DG (27% chlorothalonil + 27% copper)

METHODS: Tomatoes were transplanted on May 14 in two, twin row plots spaced 1.65 m apart in Ridgetown. Plots were 8 m in length, replicated four times in a randomized complete block design. Spray applications were made with a back pack airblast sprayer at 240 L/ha of water spraying only one twin row leaving the other exposed to natural infection. Fungicides were applied on a ten day spray schedule on June 30, July 9, 19, 29, Aug. 9 and 19. Foliar disease was assessed on July 28 by counting blighted areas caused by the bacterial canker pathogen or fungal pathogens. Foliar visual ratings on a whole plot basis regardless of type of disease, bacterial or fungal, were assessed on Aug. 10 and 21. Yields were taken on Aug. 31.

RESULTS: As presented in the table.

CONCLUSIONS: Under moderate bacterial canker pressures neither of the two products containing copper, BRAVO C/M nor DACOBRE DF had any significant benefits in controlling foliar bacterial disease symptoms. Fungal diseases were effectively controlled by all of the materials tested in this trial. It was however interesting to note the reduction in the numbers of bacterial disease areas in the BRAVO C/M and DACOBRE DG treated plots, although the values were not statistically significant over the other treatments. All of the fungicide/bactericide treatments significantly increased total yields by approximately 57%.

Table 1.

		# of Disease Areas*		Foliar Disease Rating (0-10)**		Yield T/ha
Treatments	Rate prod/ha	Fungal July 28	Bacterial July 28	Aug. 10	Aug. 21	Aug. 31
BRAVO 500	2.8 L	3.8b***	10.3a	9.0a	7.6abc	52.5ab
BRAVO 825	1.8 kg	4.5b	10.0a	8.9a	7.4abc	55.9ab
DITHANE 75DF	3.2 kg	5.0b	6.0a	8.9a	7.0bc	59.4a
MANZATE 75DF	3.2 kg	5.3b	9.3a	8.5a	6.8c	60.7a
BRAVO C/M	4.5 kg	2.5b	4.8a	9.0a	8.0ab	60.4a
BRAVO C/M	6.7 kg	4.0b	2.8a	9.3a	8.0ab	69.0a
DACOBRE DG	4.0 L	1.5b	2.0a	9.0a	8.0ab	63.8a
DACOBRE DG	5.7 L	3.3b	2.8a	9.0a	8.1a	59.2a
Control		23.3a	5.3a	4.5b	3.0d	40.5b

* Number of Disease Areas - the average number of disease cluster points per plot. The lower the number the more effective the treatment.

** Foliar Disease Rating (0-10) - 0, no control, foliage severely damaged; 10, complete control.

*** Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

1993 PEST MANAGEMENT RESEARCH REPORT

121

ICAR: 61002036

CROP: Field tomato, cv. CC164

PEST: Bacterial canker, *Corynebacterium michiganensis* subsp. *michiganensis* (Smith) Davis et al.; Early blight, *Alternaria solani* (Ell. & Mart.) L.R. Jones & Grout, and Septoria leaf spot, *Septoria lycopersici* Speg.

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DICK J A., Nabisco Brands Ltd., Dresden, Ontario
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TITLE: BACTERIAL DISEASE CONTROL IN FIELD TOMATOES II

MATERIALS: BRAVO C/M (27% chlorothalonil + 27% copper + 5.4% maneb); BRAVO 825; BRAVO 500 (chlorothalonil); MANZATE 75DF; DITHANE 75DF (mancozeb);
DACOBRE DG (27% chlorothalonil + 27% copper);
BL-1104 (experimental bactericide)

METHODS: Tomatoes were transplanted on May 7 in two row plots spaced 1.65 m apart in a grower's field near Dresden. Plots were 8 m in length, replicated 4 times in a randomized complete block design. Spray applications were made with a back pack airblast sprayer at 240 L/ha of water.

Fungicides/bactericides were applied on a ten day spray schedule on June 30, July 9, 19, 29 and Aug. 9. Foliar disease was assessed by counting areas of foliar blighting caused by bacterial canker on July 16 and 24. Foliar visual ratings on a whole plot basis regardless of type of disease, bacterial or fungal, were assessed on July 30 and Aug. 9. Yields were taken on Aug. 13.

RESULTS: As presented in the table.

CONCLUSIONS: Delaying the bactericide control materials until June 30, under this year's moderate to high bacterial canker disease pressures, resulted in the lack of significant disease control with any of the candidate materials with the exception of the higher rate of DACOBRE DG early in the season. Foliar disease ratings including both fungal and bacterial, were significantly reduced by all but the BL-1104 experimental bactericide material. BL-1104 was not effective for the control of either tomato bacterial nor fungal diseases. The highest level of foliar disease control was achieved using the higher rates of BRAVO C/M and DACOBRE DG. The highest yield was achieved with the 5.7 L prod/ha rate of DACOBRE DG.

The initial spray timing of these materials was ten days later than what TOM-CAST would have recommended for the geographical area - June 21. Bacterial control was not achieved whereas fungal diseases were more effectively controlled.

Treatments	Rate prod/ha	# of Bacterial Disease Areas* July 16	July 24	Foliar Disease Ratings (0-10)** July 30	Aug. 9	Yield T/ha Aug. 13
BRAVO 500	2.8 L	13.6ab***	21.8a	6.1bc	6.0cd	39.45bcd
BRAVO 825	1.8 kg	11.8ab	27.0a	6.8abc	6.1cd	40.97bc
DITHANE 75DF	3.2 kg	15.8ab	26.1a	6.0c	6.0cd	36.88cde
MANZATE 75DF	3.2 kg	12.5ab	22.5a	5.3c	5.0d	39.15bcd
BRAVO C/M	4.5 kg	10.8ab	18.5ab	6.8abc	6.5bc	44.10abc
BRAVO C/M	6.7 kg	9.8ab	25.1a	7.9a	7.8a	44.97ab
DACOBRE DG	4.0 L	10.6ab	19.9ab	6.5abc	6.1cd	40.83bc
DACOBRE DG	5.7 L	8.3b	20.3ab	7.8ab	7.4ab	50.50a
BL-1104	4.0%	17.3a	19.3ab	3.0d	1.0e	32.58de
Control		16.3a	12.0b	3.3d	1.5e	30.23e

* Number of Bacterial Disease Areas - the average number of disease cluster points per plot. The lower the number the more effective the treatment.

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

*** Means followed by the same letter are not significantly different ($P<0.05$ Duncan's multiple range test).

#122

ICAR: 61002036

CROP: Field tomato, cv. Heinz 9478

PEST: Bacterial canker, *Corynebacterium michiganensis* subsp. *michiganensis* (Smith) Daviset al.; Early blight, *Alternaria solani* (Ell. & Mart.) L.R. Jones & Grout, and Septoria leaf spot, *Septoria lycopersici* Speg.

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TITLE: BACTERIAL DISEASE CONTROL IN TOMATOES USING KOCIDE FORMULATIONS AND COMBINATIONS I

1993 PEST MANAGEMENT RESEARCH REPORT

MATERIALS: KOCIDE 50WP, 40DF (copper); DITHANE 75DF; MANZATE 75DF (mancozeb)

METHODS: Tomatoes were transplanted on May 14 in single, twin row plots spaced 1.65 m apart in Ridgetown. Plots were 8 m in length, replicated four times in a randomized complete block design. Spray applications were made with a back pack airblast sprayer at 240 L/ha of water. Fungicides were applied on a ten day spray schedule on June 30, July 9, 19, 29, Aug. 9 and 19. Foliar disease assessments were made by counting areas of bacterial and fungal foliar blighting on July 28. Foliar visual ratings on a whole plot basis were assessed on Aug. 10, 16 and 21. Yields were taken on Aug. 30.

RESULTS: As presented in the table.

CONCLUSIONS: Improved foliar disease control was observed when the mancozeb products were added to either KOCIDE formulation. This resulted in overall higher foliar disease ratings and numerical yields. KOCIDE 40DF showed a consistant reduction in foliar disease, although not always statistically significant when compared to KOCIDE 50WP. A trend was noticed that MANZATE 75DF improved disease control when mixed with KOCIDE 50WP while MANZATE 75DF was less effective when mixed with KOCIDE 40DF. The reciprocal comment could also be made that DITHANE 75DF worked better with KOCIDE 40DF than it did with KOCIDE 50WP. Tomato yields were increased on average by 33% with chemical treatments.

Treatments	Rate kg ai/ha	# of Disease Areas* July 28	Foliar Disease Ratings (0-10)** Aug. 10	Aug. 16	Aug. 21	Yield T/ha Aug. 30
KOCIDE 50WP	1.125	19.5ab***	6.9d	5.6c	5.3c	45.75a
KOCIDE 40DF	0.90	11.8bc	7.6c	6.3bc	5.6bc	46.15a
KOCIDE 50WP + DITHANE 75DF	1.125 2.25	8.0bc	8.0bc	7.1ab	6.5ab	46.20a
KOCIDE 50WP + MANZATE 75DF	1.125 2.25	10.5bc	8.5ab	7.5a	7.1a	50.35a
KOCIDE 40DF + DITHANE 75DF	1.125 2.45	5.0c	8.9a	7.4a	7.0a	50.38a
KOCIDE 40DF + MANZATE 75DF	1.125 2.25	18.0ab	8.3b	7.3a	6.4ab	50.70a
Control		26.8a	4.8e	2.5d	2.0d	36.70b

* # of disease Areas - the average number of diseases, fungal and bacterial per plot. The lower the number the more effective the treatment.

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

*** Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#123

ICAR: 61002036

CROP: Field tomato, cv. CC164

PEST: Bacterial canker, *Corynebacterium michiganensis* subsp. *michiganensis* (Smith) Davis et al.; Early blight, *Alternaria solani* (Ell. & Mart.) L.R. Jones & Grout, and Septoria leaf spot, *Septoria lycopersici* Speg.

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TITLE: BACTERIAL DISEASE CONTROL IN FIELD TOMATOES USING KOCIDE FORMULATIONS AND COMBINATIONS II

MATERIALS: KOCIDE 50WP, 40DF (copper); DITHANE 75DF; MANZATE 75DF (mancozeb)

METHODS: Tomatoes were transplanted on May 7 in three row plots spaced 1.65 m apart in a grower's field near Dresden. Plots were 8 m in length, replicated four times in a randomized complete block design. Spray applications were made with a back pack airblast sprayer at 240 L/ha of water. Fungicides/bactericides were applied on a ten day spray schedule on June 30, July 9, 19, 29 and Aug. 9. Foliar disease assessments were made by counting areas of foliar blighting caused by bacterial canker on July 16 and 24. Foliar visual ratings on a whole plot basis regardless of type of disease, bacterial or fungal, were assessed on July 30 and Aug. 9. Yields were taken on Aug. 11.

RESULTS: As presented in the table.

CONCLUSIONS: KOCIDE formulations 50WP and 40DF when applied alone or in combination with mancozeb formulations did not reduce or control bacterial canker in field tomatoes when applied on a ten day schedule beginning on June 30. Mancozeb formulations of DITHANE 75DF and MANZATE 75DF were needed to reduce the foliar blighting caused by fungal disease organisms. KOCIDE 50WP and KOCIDE 40DF were unable to sustain foliar disease control throughout the season.

The June 30 initial spray date was ten days after when TOM-CAST would have recommended beginning a spray program for this growing area.

Treatments	Rate prod/ha	# of Bacterial Disease Areas* July 16	# of Bacterial Disease Areas* July 24	Foliar Disease Ratings (0-10)** July 30	Foliar Disease Ratings (0-10)** Aug. 9	Yield T/ha Aug. 11
KOCIDE 50WP	1.125	10.9a***	23.3a	5.3a	3.8b	33.8a
KOCIDE 40DF	0.90	10.5a	19.9a	5.4a	3.5b	34.5a
KOCIDE 50WP + DITHANE 75DF	1.125 2.25	9.7a	18.9a	6.3a	5.8a	39.9a
KOCIDE 50WP + MANZATE 75DF	1.125 2.25	12.3a	21.9a	6.5a	6.5a	40.6a
KOCIDE 40DF + DITHANE 75DF	1.125 2.25	14.9a	25.8a	5.5a	6.8a	38.7a
KOCIDE 40DF + MANZATE 75DF	1.125 2.25	13.1a	22.3a	5.6a	5.3a	35.4a
Control		14.8a	18.3a	3.0b	2.8b	30.4a

* Number of Bacterial Disease Areas - the average number of disease cluster points per plot. The lower the number the more effective the treatment.

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

*** Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

#124

ICAR: 61002036

CROP: Field tomato, cv. Heinz 9478

PEST: Bacterial canker, *Corynebacterium michiganensis* subsp. *michiganensis* (Smith) Davis et al; Early blight, *Alternaria solani* (Ell. & Mart.) L.R. Jones & Grout, and Septoria leaf spot, *Septoria lycopersici* Speg.

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TITLE: TIMING OF BACTERIAL CONTROL MATERIALS IN FIELD TOMATOES I

MATERIALS: BRAVO 825 (chlorothalonil); DITHANE 75DG (mancozeb); KOCIDE 40DG (copper)

METHODS: Tomatoes were transplanted on May 14 in single, twin row plots spaced 1.65 m apart. Plots were 8 m in length, replicated four times in a randomized complete block design. Spray applications were made with a back pack airblast sprayer at 240 L/ha of water. Fungicides were applied on a ten day spray schedule on June 15, 28, July 6, 19, 26, Aug. 5 and 15. Foliar disease was assessed on July 28 by counting blighted areas caused by the bacterial canker pathogen or fungal pathogens. Foliar visual ratings on a whole plot basis regardless of type of disease, bacterial or fungal were assessed on Aug. 10 and 21. Yields were taken on Aug. 30.

RESULTS: As presented in the table.

CONCLUSIONS: Under relatively high bacterial canker and foliar fungal disease pressures the early application of the bactericide combination KOCIDE 40DF + DITHANE 75DG had no additional significant improvement in either fungal or bacterial disease control than using a straight fungicide program throughout the season. Although not statistically significant, it appears that yields were increased numerically at least when the early bactericidal treatments were combined with subsequent applications of BRAVO 825.

		# of Disease Areas*		Foliar Disease Ratings (0-10)**		Yield T/ha
Treatments***	Rate kg prod/ha	Fungal July 28	Bacterial July 28	Aug. 10	Aug. 21	Aug. 30
BRAVO 825	1.8	0.8b****	11.8a	8.1a	6.0ab	50.15a
DITHANE 75DG	3.2	8.3b	5.0ab	8.1a	5.8b	53.61a
KOCIDE 40DF +	2.25					
DITHANE 75DG	2.25	3.8b	6.3ab	8.3a	6.0ab	51.09a
KOCIDE 40DF +	2.25					
DITHANE 75DG;	2.25					
BRAVO 825	1.8	7.8b	3.0b	8.4a	6.6a	57.68a
KOCIDE 40DF +	2.25					
DITHANE 75DG;	2.25					
BRAVO 825	1.8	6.3b	2.5b	8.5a	6.5ab	57.32a
Control		21.5a	7.8ab	6.3b	3.0c	36.06b

* Number of Disease Areas - the average number of disease cluster points per plot. The lower the number the more effective the treatment.

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

*** Treatments: initial sprays were applied on June 15, and repeated every ten days. BRAVO 825 was applied after Aug. 1 and July 6 in treatments 4 and 5, respectively.

**** Means followed by the same letter are not significantly different ($P<0.05$ Duncan's multiple range test).

1993 PEST MANAGEMENT RESEARCH REPORT

#125

ICAR: 61002036

CROP: Field tomato, cv. CC164

PEST: Bacterial canker, *Corynebacterium michiganensis* subsp. *michiganensis* (Smith) Davis et al.; Early blight, *Alternaria solani* (Ell. & Mart.) L.R. Jones & Grout, and Septoria leaf spot, *Septoria lycopersici* Speg.

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TITLE: TIMING OF BACTERIAL CONTROL MATERIALS IN FIELD TOMATOES II

MATERIALS: DITHANE 75DF (mancozeb); BRAVO 825 (chlorothalonil); KOCIDE 40DF (copper)

METHODS: Tomatoes were transplanted on May 7 in three row plots spaced 1.65 m apart in a grower's field near Dresden. Plots were 8 m in length, replicated four times in a randomized complete block design. Spray applications were made with a back pack airblast sprayer at 240 L/ha of water. Fungicides/bactericides were applied on a ten day spray schedule on June 15, 25, July 5, 15, 25, and Aug. 5. Foliar disease assessments were made by counting areas of foliar blighting caused by bacterial canker on July 16 and 24. Foliar visual ratings on a whole plot basis regardless of type of disease, bacterial or fungal, were assessed on July 30 and Aug. 9. Yields were taken on Aug. 11.

RESULTS: As presented in the table.

CONCLUSIONS: Early season control of bacterial canker was achieved when KOCIDE 40DF plus DITHANE 75DG were used. This combination sustained foliar blight control whether bacterial or fungal throughout the season. BRAVO 825 and DITHANE 75DG were unable to reduce bacterial blighting of the foliage, however, BRAVO 825 in particular was able to keep other blighting organisms in check giving an equal foliar disease rating later in the season, Aug. 9, equal to those compounds with greater bacterial control capacities.

Under heavy bacterial canker pressures, the use of an effective fungicide program was just as effective in sustaining tomato yields than the use of a more specific bactericidal spray program of KOCIDE 40DF + DITHANE 75DG. The fungicide DITHANE 75DG failed to provide adequate control under the conditions of this fungal/bacterial disease complex.

Treatments***	Rate prod/ha	# of Bacterial Disease Areas* July 16	July 24	Foliar Disease Ratings (0-10)** July 30	Aug. 9	Yield T/ha Aug. 11
BRAVO 825	1.8	11.5a****	20.7a	7.5ab	8.0a	42.88ab
DITHANE 75DG	3.2	11.3a	21.2a	6.5b	6.0b	38.23bc
KOCIDE 40DF + DITHANE 75DG	2.25 2.25	3.6b	9.8ab	7.8ab	8.8a	43.63ab
KOCIDE 40DF + DITHANE 75DG; BRAVO 825	2.25 2.25 1.8	2.8b	5.9b	8.3a	8.8a	48.45ab
KOCIDE 40DF + DITHANE 75DG; BRAVO 825	2.25 2.25 1.8	2.1b	7.3b	8.9a	8.8a	53.10a
Control		11.1a	10.8ab	3.3c	2.0c	26.90c

* Number of Bacterial Disease Areas - the average number of disease cluster points per plot. the lower the number the more effective the treatment.

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

*** Treatments: initial sprays were applied on June 15, and repeated every ten days. BRAVO 825 was applied after Aug. 1 and July 6 in treatments 4 and 5, respectively.

**** Means followed by the same letter are not significantly different P<0.05 Duncan's multiple range test).

#126

ICAR: 61002036

CROP: Field tomato, cv. Heinz 9478

PEST: Early blight, *Alternaria solani* (Ell. & Mart.) L.R. Jones & Grout; and
Septoria leaf spot, *Septoria lycopersici*, Speg.

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TITLE: EVALUATION OF TOMATO FUNGICIDES

MATERIALS: BRAVO 500 (chlorothalonil); FOLPAN 50W (folpet); CAPTAN 75WG (captan); MANZATE 75DG (mancozeb); DITHANE 75DG (mancozeb); RHC-378 (surfactant); DITHANE M-45 (80% mancozeb)

1993 PEST MANAGEMENT RESEARCH REPORT

METHODS: Tomatoes were transplanted on May 4 in two twin row plots spaced 1.65 m apart. Plots were 8 m in length, replicated four times in a randomized complete block design. Spray applications were made with a back pack airblast sprayer at 240 L/ha of water spraying only one twin row leaving the other exposed to natural infection. Fungicides were applied based on TOM-CAST on June 28, July 8, 14, 26, Aug. 9 and 16. Foliar disease assessments were made on Aug. 10 and 21. Plots were harvested Aug. 25.

RESULTS: As presented in the table.

CONCLUSIONS: Under severe early blight and septoria leaf spot pressures, all of the candidate fungicides provided significant fungal disease control compared to the non-sprayed check. This was also reflective in an average 45% increase in tomato yields. The most consistant product showing the highest numerical foliar disease ratings and yield was BRAVO 500.

Table 1.

Treatments	Rate prod/ha	Foliar Disease Ratings (0-10)* Aug. 10	Aug. 16	Aug. 21	Yield T/ha Aug. 26
BRAVO 500	2.8 L	9.0a***	8.5a	7.6a	63.53a
FOLPAN 50W	2.5 kg	8.5ab	8.1a	7.5a	56.21a
CAPTAN 75WG	4.0 kg	8.0b	8.0a	6.8a	58.45a
MANZATE 75DG	3.2 kg	8.5ab	7.5a	7.4a	58.48a
DITHANE 75DG	3.2 kg	8.5ab	8.0a	7.1a	52.88a
DITHANE 75DG + RHC-387	3.2 kg 100.0 ml	8.9ab	7.3a	6.5b	54.95a
DITHANE 75DG + RHC-387**; BRAVO 500	3.2 kg 100.0 ml 2.8 L	8.9ab	7.5a	7.0ab	57.65a
DITHANE M-45 (80WP)	3.25 kg	9.0a	7.9a	7.0ab	51.67a
DITHANE M-45 (80WP) + RHC-387	3.25 kg 100.0 ml	9.0a	7.5a	7.0ab	54.67a
Control		5.5c	3.3b	3.0c	38.45b

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

** Treatment 7 - DITHANE 75DG + RHC-378 was applied for the first 3 applications, then followed by BRAVO 500 until the end of the season.

*** Means followed by the same letter are not significantly different (P<0.05 Duncan's multiple range test).

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

DISEASES OF POTATO / MALADIES DES POMMES DE TERRE

Section Editor / Réviseur de section : R.P. Singh

#127 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Norchip

PEST: *Alternaria solani* (Ell. & Martin) Sor.

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TITLE: EFFICACY OF CHEMICAL CONTROL OF POTATO EARLY BLIGHT - 1992

MATERIALS: Chlorothalonil (Bravo 500, 40 % F at 1.6 or 2.4 L/ha;
Bravo 825, 82.5 % DG at 1.0 or 1.5 kg/ha);
experimentals (ASC66897, 42 % F at 1.6 or 2.4 L/ha);
Gaozhimo (Masbrane 1 L in 200 L water);
Mancozeb (Dithane M45, 80 % WP at 2.3 kg/ha) and $ZnSO_4$ (0.27 kg/ha)

METHODS: For each treatment, four replicate plots consisting of five rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1992. All five-row plots were separated by two buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20SN, 2.25 L/ha).
Plant emergence counts on the center row of each five-row plot were made 40-50 days post-planting. To the foliage of plants in the two outer rows of each five-row plot, a sporangial suspension (pathogen, Alternaria solani cultured on potato dextrose agar) of approx. 5 * 10**3 spores/ml was applied two to three days after the first fungicide application and two to three weeks later as required. Disease severity ratings (0=no symptoms, 1=slight leaf spotting, 2=moderate and 3=severe with 25% or more of the foliage having many lesions) of plants in the center row of each five-row plot were made during August and September.
Fungicide applications (tractor-mounted sprayer modified to spray only the center three rows with three hollow-cone nozzels/row, 780 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top dessicant was applied about mid-September, two weeks prior to plot harvest.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Cool, wet conditions delayed onset of early blight but enhanced earliness and severity of late blight.

CONCLUSIONS: Several entries demonstrated early blight control efficacy initially when disease pressure was low (24 and 27 August). However, early blight severity remained slight with three treatments: ASC66897, Dithane and Dithane plus Gaozhimo. The remaining treatments had moderate early blight severity ratings. Further studies are recommended to confirm these results.

Table 1. Effects of foliar fungicide treatment on potato early blight development - 1992

Treatment Rate/ Spray Interval	Foliar Disease Severity (0-3) (Day/Month) 24/8	27/8	31/8	17/9
Non-treated control	0.4	1.5	*	*
Bravo 500 1.6F/7d	0.3	0.6	1.3	1.6
Bravo 500 1.6F/14d	0.1	0.2	0.5	2.0
Bravo 500 2.4F/7d	0.4	0.7	1.2	2.1
Bravo 500 2.4F/10d	0.3	0.6	1.3	1.7
Bravo 500 2.4F + ZNSO4/10d	0.4	0.8	1.3	1.6
Bravo 825 1.0G/7d	0.1	0.6	1.2	1.8
Bravo 825 1.5G/7d	0.2	0.9	2.0	1.9
ASC66897 1.6/7d	0.1	0.5	1.0	1.2
ASC66897 2.4/7d	0.2	0.3	0.7	1.3
Gaozhimo 1L/200L water + Bravo 500 1.6F/7d	0.1	0.4	0.8	2.0
Gaozhimo 1L/200L water + Bravo 500 1.6F/14d	0.1	O.2	1.0	1.6
Gaozhimo 1L/200L water + Bravo 500 1.6F/21d	0.1	0.4	1.0	1.5
Dithane M45 2.3W/7d	0.1	0.2	0.7	0.6
Gaozhimo 1L/200L water + Dithane M45 2.3W/7d	0.2	0.3	0.6	0.6
Lsd (P=0.05)	0.23	0.45	0.76	0.72

* Data not available due to severe late blight damage.

#128

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Green Mountain

PEST: *Alternaria solani* (Ell. & Martin) Sor. and *Botrytis cinerea* Pers.

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TITLE: POTATO EARLY BLIGHT AND GRAY MOLD CHEMICAL CONTROL EFFICACIES - 1992

MATERIALS: *Bacillus thuringiensis* (*BT*, 7 L/ha);
Chlorothalonil (Bravo 500, 40% F at 1.6 or 2.0 L/ha and Bravo 825, 82.5% DG at 1.0 kg/ha); experimentals (ASC66825 at 0.4 L/ha; RH5598 at 2.0 L/ha;
RH7281 at 0.5 and 2.0 L/ha); Gaozhimo (Masbrane 1 L in 200 L water);
Mancozeb (Dithane M45, 80% WP at 2.3 kg/ha);

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Metalaxyl/mancozeb (Ridomil/MZ, 72% WP at 2.4 kg/ha)

METHODS: For each treatment, four replicate plots consisting of five rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1992. All five-row plots were separated by two buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20SN, 2.25 L/ha).

Plant emergence counts on the center row of each five-row plot were made 40-50 days post-planting. Natural inooculum sources were relied upon for disease initiation. Plots were mist irrigated (3-5 mm/hr for 2-4 hr periods) during August to maintain the disease in the inoculated rows. Disease severity (index: 0 = no symptoms, 1 = slight, 2 = moderate, 3 = severe with at least 25% of foliage having many lesions) in plants in the center row of each five-row plot were made throughout August and September.

Fungicide applications (tractor-mounted sprayer modified to spray only the center three rows with three hollow-cone nozzels/row, 780 L/ha volume, 860 KPa) were first made during the third week of July and then according to the treatment schedule. Top dessicant was applied about mid-September, two weeks prior to plot harvest.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Due to severe late blight damage early blight and gray mold assessments could not be accurately made late in the season.

CONCLUSIONS: During August almost all foliar treatments significantly reduced early blight levels relative to the non-treated plots. However, as the disease development continued in September, only Bravo 500 in combination with ASC66825 significantly reduced foliar disease damage. Efficacies of Bravo 500 and Dithane M45 were not affected by addition of Gaozhimo and BT, respectively. Gray mold severity was not significantly affected by foliar treatments. Further studies are required to confirm these results.

EFFECTS OF FOLIAR FUNGICIDE TREATMENT ON POTATO EARLY BLIGHT AND GRAY MOLD DEVELOPMENT - 1992

Treatment Rate/ Spray Interval	Early Blight Severity (0-3) (Day/Month) 24/8	28/8	01/9	04/9	09/9	Gray Mold Severity (0-3) 24/8
Non-treated control	0.3	NA	NA	NA	NA	1.0
Dithane M45 2.3W/7d	0.1	1.0	1.8	1.8	NA	0.8
Bravo 500 1.6F/7d	0.1	1.5	2.3	2.7	2.8	0.9
Bravo 825 1.0G/7d	0.1	1.0	2.0	2.3	2.7	0.8
ASC66825 0.4F/7d	0.2	1.3	2.1	NA	NA	1.0
Bravo 500 1.6F and ASC66825 0.4F alternating spray dates/7d	0.2	1.4	2.3	NA	NA	0.8
Bravo 500 1.6F for 3 sprays then ASC66825 0.4F for remaining sprays/7d	0.2	1.2	2.1	2.3	2.7	0.8
Bravo 500 1.6F and ASC66825 0.4F tank mix/7d	0.1	0.8	1.2	1.5	1.7	0.7
Bravo 500 1.6F for 1st spray, Ridomil MZ for 2nd and 3rd sprays, Bravo 500 1.6F for remaining sprays/7d	0.1	0.8	1.5	1.9	2.7	0.8
RH5598 2.0F/7d	0.1	1.7	2.5	NA	NA	0.8
RH7281 0.5F/7d	0.1	1.8	2.5	NA	NA	0.8
RH7281 2.0F/7d	0.2	1.6	2.5	2.5	NA	1.0
Gaozhimo 1/200L + Bravo 500 1.6F/7d	0.1	1.4	2.4	2.8	NA	0.9
Dithane M45 2.3W/7d + BT	0.1	0.9	1.8	1.9	NA	0.6
Lsd (P=0.05)	0.10	0.52	NS	0.99	NS	NS

NS Not significant.
NA Not available.

#129

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Norchip

PEST: *Alternaria solani* (Ell. & Martin) Sor., *Botrytis cinerea* Pers., *Phytophthora infestans* (Mont.) deBary

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TITLE: EFFECTS OF CHEMICAL CONTROL OF FOLIAR POTATO DISEASES ON YIELDS AND TUBER ROTS - 1992

MATERIALS: Chlorothalonil (Bravo 500, 40 % F at 1.6 or 2.4 L/ha, Bravo 825, 82.5 % DG at 1.0 or 1.5 kg/ha);
experimentals (ASC66897, 42 % F at 1.6 or 2.4 L/ha);

Gaozhimo (Masbrane 1 L in 200 L water);
Mancozeb (Dithane M45, 80 % WP at 2.3 kg/ha) and ZnSO4 (0.27 kg/ha)

METHODS: For each treatment, four replicate plots consisting of five rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1992. All five-row plots were separated by two buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20SN, 2.25 L/ha). Plant emergence counts on the center row of each five-row plot were made 40-50 days post-planting. Fungicide applications (tractor-mounted sprayer modified to spray only the center three rows with three hollow-cone nozzels/row, 780 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top dessicant was applied about mid-September, two weeks prior to plot harvest when tubers were graded for yield and tuber diseases.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Cool, wet conditions delayed the onset of early blight but enhanced the earliness and severity of late blight.

CONCLUSIONS: Almost all Chlorothalonil and ASC66897 treatments reduced the incidence of bacterial soft rot while all Gaozhimo treatments and Bravo 500 1.6F/14d had increased scab. Black scurf, fusarium rot and late blight tuber rot incidences were similar for all treatments. Yield of small (0-55 mm) tubers in treated plots were not increased relative to non-treated plots. However, all foliar treatments significantly increased marketable (>55 mm) yields and total yields compared to the non-treated except for total yield in Gaozhimo plus Bravo 500 (21 day schedule) which had a high late blight incidence. Further studies are recommended to confirm these results.

EFFECTS OF FOLIAR FUNGICIDE TREATMENT ON POTATO YIELDS AND TUBER ROTS - 1992.

Treatment Rate/ Spray Interval	Bacterial Soft Rot Index	Common Scab Index	Black Scurf Index	Fusarium Dry Rot Index	Late Blight Rot Index	Yield t/ha) <55	>55	All
Non-treated control	1.5	1.0	1.0	0.2	0.2	25.1	8.0	33.1
Bravo 500 1.6F/7d	0.2	0.7	1.0	0.5	1.0	24.7	19.6	44.4
Bravo 500 1.6F/14d	0.2	2.0	0.7	0.2	0.0	26.9	11.8	38.7
Bravo 500 2.4F/7d	0.2	1.0	1.2	0.5	0.5	23.5	18.0	41.4
Bravo 500 2.4F/10d	0.5	1.0	1.2	0.7	0.2	21.0	17.8	38.8
Bravo 500 2.4F + ZNSO4/7d	0.2	1.2	0.7	0.5	0.5	23.6	17.7	41.3
Bravo 825 1.0G/7d	0.7	1.2	0.7	0.5	0.0	24.7	16.6	41.4
Bravo 825 1.5G/7d	0.7	1.2	0.7	0.7	0.2	22.8	19.0	41.8
ASC66897 1.6/7d	0.2	1.2	0.5	0.7	0.0	24.4	18.6	43.0
ASC66897 2.4/7d	0.5	1.2	0.5	0.2	0.5	24.9	17.1	42.1
Gaozhimo 1L/200L water + Bravo 500 1.6F/7d	0.7	2.0	0.0	0.7	0.2	28.0	15.7	43.7
Gaozhimo 1L/200L water + Bravo 500 1.6F/14d	0.7	2.0	0.5	0.5	0.0	29.2	12.2	41.4
Gaozhimo 1L/200L water + Bravo 500 1.6F/21d	1.5	2.0	0.7	0.2	0.0	26.0	11.6	37.6
Dithane M45 2.3W/7d	1.2	1.7	0.7	0.5	0.2	24.7	16.0	40.6
Gaozhimo 1L/200L water + Dithane M45 2.3W/7d	1.2	2.0	0.2	0.5	0.2	26.9	15.1	42.0
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Lsd (P=0.05)	0.87	0.66	NS	NS	NS	4.19	5.42	5.05

NS Not significant.
Note: Reported tuber yields related to graded sizes of 0-55 mm, >55 mm and yield of all tubers.
Tuber disorder indices based on 0 = no symptoms, 1 = slight, 2 = moderate, 3 = severe.

#130

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Norchip

PEST: *Botrytis cinerea* Pers.

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TITLE: EFFICACY OF CHEMICAL CONTROL OF POTATO GRAY MOLD - 1992

1993 PEST MANAGEMENT RESEARCH REPORT

MATERIALS: Chlorothalonil (Bravo 500, 40% F at 1.6 or 2.4 L/ha, Bravo 825, 82.5% DG at 1.0 or 1.5 kg/ha);
experimentals (ASC66897, 42% F at 1.6 or 2.4 L/ha);
Gaozhimo (Masbrane 1 L in 200 L water);
Mancozeb (Dithane M45, 80% WP at 2.3 kg/ha) and ZnSO4 (0.27 kg/ha)

METHODS: For each treatment, four replicate plots consisting of five rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1992. All five-row plots were separated by two buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20SN, 2.25 L/ha). Plant emergence counts on the center row of each five-row plot were made 40-50 days post-planting. Natural inoculum sources were relied upon for disease initiation. Disease severity ratings (0=no symptoms, 1=slight leaf spotting, 2=moderate and 3=severe with 25% or more of the foliage having many lesions) of plants in the center row of each five-row plot were made during August and September.

Fungicide applications (tractor-mounted sprayer modified to spray only the center three rows with three hollow-cone nozzels/row, 780 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top dessicant was applied about mid-September, two weeks prior to plot harvest.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Cool, wet conditions enhanced the earliness and severity of late blight.

CONCLUSIONS: No significant differences in gray mold severity among the entries were demonstrated when disease pressure was low (24 August). However, gray mold severity remained slight with ASC66897 at 2.4 L/ha while the remaining treatments had moderate gray mold severity ratings. Further studies are recommended to confirm these results.

EFFECTS OF FOLIAR FUNGICIDE TREATMENT ON POTATO GRAY MOLD DEVELOPMENT - 1992.

Treatment Rate/ Spray Interval	Foliar Disease Severity (0-3) (Day/Month) 24/8	27/8
Non-treated control	1.7	2.5
Bravo 500 1.6F/7d	1.7	2.4
Bravo 500 1.6F/14d	1.5	2.0
Bravo 500 2.4F/7d	1.5	1.9
Bravo 500 2.4F/10d	1.7	2.1
Bravo 500 2.4F + ZNSO4/10d	1.7	2.3
Bravo 825 1.0G/7d	1.2	1.6
Bravo 825 1.5G/7d	1.7	2.1
ASC66897 1.6/7d	1.4	1.9
ASC66897 2.4/7d	1.6	1.4
Gaozhimo 1L/200L water + Bravo 500 1.6F/7d	1.1	1.9
Gaozhimo 1L/200L water + Bravo 500 1.6F/14d	1.7	2.3
Gaozhimo 1L/200L water + Bravo 500 1.6F/21d	1.5	2.1
Dithane M45 2.3W/7d	1.7	2.3
Gaozhimo 1L/200L water + Dithane M45 2.3W/7d	1.9	2.5
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Lsd (P=0.05)	NS	0.52

NS Not significant.

1993 PEST MANAGEMENT RESEARCH REPORT

#131

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Norchip

PEST: *Phytophthora infestans* (Mont.) deBary

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TITLE: EFFICACY OF CHEMICAL CONTROL OF POTATO LATE BLIGHT - 1992

MATERIALS: Chlorothalonil (Bravo 500, 40% F at 1.6 or 2.4 L/ha, Bravo 825, 82.5% DG at 1.0 or 1.5 kg/ha);
experimentals (ASC66897, 42% F at 1.6 or 2.4 L/ha);
Gaozhimo (Masbrane 1 L in 200 L water);
Mancozeb (Dithane M45, 80% WP at 2.3 kg/ha) and ZnSO4 (0.27 kg/ha)

METHODS: For each treatment, four replicate plots consisting of five rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1992. All five-row plots were separated by two buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20SN, 2.25 L/ha). Plant emergence counts on the center row of each five-row plot were made 40-50 days post-planting. Natural inoculum sources were relied upon for disease initiation. Disease damage ratings (portion of potato foliage with late blight symptoms as percent of total foliage) of plants in the center row of each five-row plot were made throughout August and September.
Fungicide applications (tractor-mounted sprayer modified to spray only the center three rows with three hollow-cone nozzels/row, 780 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top dessicant was applied about mid-September, two weeks prior to plot harvest.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Cool, wet conditions enhanced the earliness and severity of late blight.

CONCLUSIONS: All treatments effectively controlled throughout the season relative to the non-treated plots except Gaozhimo plus Bravo 500 (21 day schedule) on 17 September. In September, ASC66897 treatments had the least amount of disease. Further studies are recommended to confirm these results.

EFFECTS OF FOLIAR FUNGICIDE TREATMENT ON POTATO LATE BLIGHT DEVELOPMENT - 1992

Treatment Rate/ Spray Interval	Foliar Disease Damage (%) (Day/Month) 24/8	27/8	31/8	05/9	17/9
Non-treated control	15.0	70.0	90.0	100.0	100.0
Bravo 500 1.6F/7d	0.5	1.0	1.4	2.5	20.0
Bravo 500 1.6F/14d	0.0	0.9	1.3	4.8	32.5
Bravo 500 2.4F/7d	0.0	0.0	0.5	4.0	23.8
Bravo 500 2.4F/10d	0.5	1.9	2.4	4.3	31.3
Bravo 500 2.4F + ZNSO4/7d	0.0	1.3	2.3	4.3	35.0
Bravo 825 1.0G/7d	0.5	0.6	1.3	1.8	17.5
Bravo 825 1.5G/7d	0.4	0.5	1.0	2.8	45.0
ASC66897 1.6/7d	0.3	0.8	1.4	1.8	16.3
ASC66897 2.4/7d	0.0	1.1	1.1	2.5	13.8
Gaozhimo 1L/200L water + Bravo 500 1.6F/7d	0.0	0.1	0.4	2.0	20.0
Gaozhimo 1L/200L water + Bravo 500 1.6F/14d	0.0	0.9	3.0	8.8	71.3
Gaozhimo 1L/200L water + Bravo 500 1.6F/21d	0.0	5.3	36.3	75.0	100.0
Dithane M45 2.3W/7d	0.7	2.3	3.5	22.3	28.8
Gaozhimo 1L/200L water + Dithane M45 2.3W/7d	0.2	0.8	1.0	2.5	20.0
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Lsd (P=0.05)	3.44	3.08	3.52	13.51	21.35

#132

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Green Mountain

PEST: *Phytophthora infestans* (Mont) de Bary, *Alternaria solani* (Ell. & Martin) Sor. and *Botrytis cinerea* Pers.

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TITLE: FOLIAR DISEASE CONTROL EFFECTS ON POTATO YIELD - 1992

MATERIALS: *Bacillus thuringiensis* (*BT*, 7 L/ha);
Chlorothalonil (Bravo 500, 40% F at 1.6 or 2.0 L/ha and Bravo 825, 82.5% DG at 1.0 kg/ha); experimentals (ASC66825 at 0.4 L/ha; RH5598 at 2.0 L/ha;
RH7281 at 0.5 and 2.0 L/ha); Gaozhimo (Masbrane 1 L in 200 L water);

Mancozeb (Dithane M45, 80% WP at 2.3 kg/ha);
Metalaxyl/mancozeb (Ridomil/MZ, 72% WP at 2.4 kg/ha)

METHODS: For each treatment, four replicate plots consisting of five rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1992. All five-row plots were separated by two buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20SN, 2.25 L/ha).

Plant emergence counts on the center row of each five-row plot were made 40-50 days post-planting. Fungicide applications (tractor-mounted sprayer modified to spray only the center three rows with three hollow-cone nozzels/row, 780 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top dessicant was applied about mid-September, two weeks prior to plot harvest when tuber yields and late blight tuber rot occurrence (% by tuber weight) were determined.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see table). All plots had 100% emergence and foliar disease damage increased during the course of the season. Late blight tuber rot incidences were minimal probably due to the dry weather conditions after top dessication.

CONCLUSIONS: The various foliar fungicide treatments tested did not affect the yield of small (0-55 mm) tubers. However, Dithane M45, Dithane M45 in combination with BT, Bravo 500 (1.6F), Bravo 825 (1.0G), RH7281 (2.0F) and Bravo 500 in combination with 3 sprays of ASC66825, tank mixed with ASC66825, with Ridomil MZ and with Gaozhimo significantly increased marketable (>55 mm) yield. Further studies are required to confirm these results.

EFFECTS OF FOLIAR FUNGICIDE TREATMENT ON POTATO YIELDS - 1992

Treatment Rate/ Spray Interval	Tuber Yields (t/ha) 0-55 mm	>55 mm
Non-treated control	18.3	20.9
Dithane M45 2.3W/7d	19.6	32.3
Bravo 500 1.6F/7d	20.1	31.9
Bravo 825 1.0G/7d	19.5	31.4
ASC66825 0.4F/7d	18.8	24.1
Bravo 500 1.6F and ASC66825 0.4F alternating spray dates/7d	22.0	24.5
Bravo 500 1.6F for 3 sprays then ASC66825 0.4F for remaining sprays/7d	20.4	27.5
Bravo 500 1.6F and ASC66825 0.4F tank mix/7d	17.9	30.0
Bravo 500 1.6F for 1st spray, Ridomil MZ for 2nd and 3rd sprays, Bravo 500 1.6F for remaining sprays/7d	19.5	36.2
RH5598 2.0F/7d	21.8	25.8
RH7281 0.5F/7d	22.0	26.4
RH7281 2.0F/7d	22.1	27.4
Gaozhimo 1/200L + Bravo 500 1.6F/7d	19.7	27.7
Dithane M45 2.3W/7d + BT	18.7	30.9
.		
Lsd (P=0.05)	NS	6.23

NS Not significant.

1993 PEST MANAGEMENT RESEARCH REPORT

#133

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Green Mountain

PEST: *Phytophthora infestans* (Mont) de Bary

NAME AND AGENCY:
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TITLE: POTATO LATE BLIGHT CHEMICAL CONTROL EFFICACY - 1992

MATERIALS: *Bacillus thuringiensis* (*BT*, 7 L/ha);
Chlorothalonil (Bravo 500, 40% F at 1.6 or 2.0 L/ha and Bravo 825, 82.5% DG at 1.0 kg/ha);
experimentals (ASC66825 at 0.4 L/ha; RH5598 at 2.0 L/ha; RH7281 at 0.5 and 2.0 L/ha); Gaozhimo (Masbrane 1 L in 200 L water);
Mancozeb (Dithane M45, 80% WP at 2.3 kg/ha);
Metalaxyl/mancozeb (Ridomil/MZ, 72% WP at 2.4 kg/ha)

METHODS: For each treatment, four replicate plots consisting of five rows (7.5 m in length, spaced 0.9 m apart) were established in a randomized complete block design in 1992. All five-row plots were separated by two buffer rows for tractor operations. Whole (35-55 mm), greensprouted, Elite 3 seed tubers were hand-planted 30 cm apart and recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75 DF, 0.73 kg/ha; insecticides-endosulfan 400 EC, 1.5 L/ha and deltamethrin 2.5 EC, 0.25 L/ha; top desiccant-diquat 20SN, 2.25 L/ha).

Plant emergence counts on the center row of each five-row plot were made 40-50 days post-planting. To the foliage of plants in the two outer rows of each five-row plot, a sporangial suspension (pathogen, Phytophthora infestans (races 1,4) cultured on leaves of Green Mountain) of approx. 5 * 10**3 spores/ml was applied two to three days after the first fungicide application and then two to three weeks later as required. Plots were mist irrigated (3-5 mm/hr for 2-4 hr periods) during August to maintain the disease in the inoculated rows. Disease damage (amount of disease foliar tissue as a percent of total plant foliage) in plants in the center row of each five-row plot were made throughout August and September.

Fungicide applications (tractor-mounted sprayer modified to spray only the center three rows with three hollow-cone nozzels/row, 780 L/ha volume, 860 kPa) were first made during the third week of July and then according to the treatment schedule. Top dessicant was applied about mid-September, two weeks prior to plot harvest.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see table). All plots had 100% emergence and foliar disease damage increased during the course of the season.

CONCLUSIONS: During August almost all foliar treatments significantly reduced late blight levels relative to the non-treated plots. However, as the epidemic continued in September, only Bravo 500 (1.6F/7d), Bravo 825 (1.0G/7d) and Bravo 500 in combination with either ASC66825 or Ridomil MZ significantly reduced foliar disease damage. Gaozhimo and Bravo 500 combination reduced the efficacy of Bravo 500 while Dithane M45 efficacy was not affected by addition of BT. Further studies are required to confirm these results.

EFFECTS OF FOLIAR FUNGICIDE TREATMENT ON POTATO LATE BLIGHT DEVELOPMENT - 1992

Treatment Rate/ Spray Interval	Foliar Disease Damage (%) (Day/Month)					
	24/8	25/8	28/8	01/9	04/9	09/9
Non-treated control	81	91	99	100	100	100
Dithane M45 2.3W/7d	2	19	49	69	83	90
Bravo 500 1.6F/7d	1	9	29	55	68	79
Bravo 825 1.0G/7d	1	8	23	43	60	73
ASC66825 0.4F/7d	19	53	70	86	93	96
Bravo 500 1.6F and ASC66825 0.4F alternating spray dates/7d	9	45	73	91	96	99
Bravo 500 1.6F for 3 sprays then ASC66825 0.4F for remaining sprays/7d	2	22	58	79	89	94
Bravo 500 1.6F and ASC66825 0.4F tank mix/7d	3	24	43	65	76	86
Bravo 500 1.6F for 1st spray, Ridomil MZ for 2nd and 3rd sprays, Bravo 500 1.6F for remaining spray dates/7d	1	7	24	41	56	69
RH5598 2.0F/7d	8	55	83	98	100	100
RH7281 0.5F/7d	6	48	79	94	100	100
RH7281 2.0F/7d	1	26	60	85	91	96
Gaozhimo 1/200L + Bravo 500 1.6F/7d	20	45	80	94	96	100
Dithane M45 2.3W/7d + BT	2	14	45	71	84	90
.						
Lsd (P=0.05)	12.9	19.4	19.1	15.8	14.0	11.0

1993 PEST MANAGEMENT RESEARCH REPORT

#134

STUDY DATA BASE: 303-1451-9002

CROP: Potato, cv. Kennebec

PEST: *Rhizoctonia solani* Kuhn (AG 3), *Verticillium* spp., *Fusarium* spp., *Colletotrichum coccodes* (Wallr.) Hughes

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TITLE: EFFICACY OF CHEMICAL CONTROL OF POTATO DISEASES CAUSED BY SOIL-BORNE FUNGAL PATHOGENS-1992

MATERIALS: Thiophanate-methyl (EASOUT-10 D: 5 gm/kg seed), ISK-Biotech Ltd. experimentals (ASC67089, ASC67090, ASC67091, ASC67092, ASC67093), Gaozhimo (Masbrane 1 L/200 L water).

METHODS: Elite 3 seed was used that had received no post-harvest fungicide except the seed which had either a Gaozhimo or water "Fall" treatment prior to storage. Immediately after cutting and just before planting, the seed was treated with fungicides. Fungicide treatments were applied by shaking in a plastic bag for 3-5 min. the seed and fungicide treatment. As controls, some seed received fungicide treatment. Immediately after treating, the seed was hand-planted in 3.0 m rows with 30 cm in-row and 0.9 m between-row spacings in a randomized complete block design with four replicate blocks in 1992. Gaozhimo was also applied as a foliar spray to the potato hill (until soil appeared moist, about 200 ml/plant) with a hand-held 5 L "garden-sprayer" after planting (GaozhimoP), after planting and at flowering (GaozhimoP&F) and after planting, at flowering and two weeks post-flowering (GaozhimoP&F&2F). Recommended crop management practices were followed (fertilizer 17-17-17 at 800 kg/ha; herbicides-metribuzin 75WP, 0.73 kg/ha; fungicides-chlorothalonil 40F, 2.1 L/ha; insecticides-endosulfan 400EC 1.5 L/ha; top desiccant-diquat 20SN, 2.25 L/ha). Plant emergence, vigor, and disease determinations were made throughout the season. Top desiccant was applied about mid-September and plots were harvested two weeks later.

RESULTS: All data was subjected to analysis of variance and mean separation tests (see tables).

CONCLUSIONS: Among the various treatments tested, ASC67089, ASC67093, Easout, GaozhimoP and GaozhimoP&F&2F enhanced various plant growth characteristics while "Fall" treatments did not affect these characteristics. Seed-piece diseases and plant wilt were reduced with ASC67091, ASC67093 and Easout but not with the other "spring" and "Fall" treatments. Plant maturity was not affected by the treatments examined. Yields of small (0-55 mm) tubers and total yields were significantly improved with Easout among the "spring" treatments but no significant differences were found among the "Fall" treatments. Further studies are required to confirm these results.

EFFECTS OF TUBER AND SOIL TREATMENTS ON POTATO GROWTH - 1992.

Treatment	Plant Vigor 23/6	Healthy Plants 08/7	Weak Plants 08/7	Spindly Stems 08/7	Plant Stand 08/7
Non-inoculated	78.3	73.3	11.7	10.0	85.0
ASC67089	90.0	86.7	6.7	1.7	93.3
ASC67090	63.3	71.7	6.7	16.7	78.3
ASC67091	71.7	75.0	10.0	8.3	85.0
ASC67092	75.0	78.3	1.7	5.0	80.0
ASC67093	66.7	76.7	13.3	1.7	90.0
EASOUT	91.7	96.7	0.0	1.7	96.7
GaozhimoP	70.0	70.0	21.7	5.0	91.7
GaozhimoP&F	65.0	70.0	16.7	11.7	86.7
GaozhimoP&F&2F	85.0	78.3	15.0	0.0	93.3
Fall Gaozhimo	96.7	98.3	0.0	0.0	98.3
Fall Water	93.3	95.0	3.3	0.0	98.3
.					
Lsd (P=0.05)	17.0	16.2	10.2	8.0	10.0

Note: For gaozhimo treatments P=planting, F=flowering, 2F = two weeks post-flowering. All values record percentage data.

EFFECTS OF TUBER AND SOIL TREATMENTS ON POTATO DISEASES - 1992

Treatment	Seed-Piece Diseases (%) 08/7	Plant Wilt (%) 11/8	Plant Wilt (%) 24/8	Plant Wilt (%) 08/9
Non-inoculated	15.0	5.8	19.2	30.8
ASC67089	6.7	3.5	21.0	51.2
ASC67090	21.7	0.0	15.7	33.6
ASC67091	15.0	0.0	1.9	14.3
ASC67092	20.0	0.0	10.5	29.0
ASC67093	10.0	0.0	7.1	26.9
EASOUT	3.3	1.8	21.3	33.1
GaozhimoP	8.3	1.9	9.8	25.5
GaozhimoP&F	13.3	7.7	25.2	35.0
GaozhimoP&F&2F	6.7	8.6	30.8	54.6
Fall Gaozhimo	1.7	3.5	0.0	1.7
Fall Water	1.7	0.0	0.0	0.0
.				
Lsd (P=0.05)	10.06	NS	NS	33.82

Note: For gaozhimo treatments P=planting, F=flowering, 2F = two weeks post-flowering. NS = not significantly different.

EFFECT OF TUBER AND SOIL TREATMENTS ON POTATO MATURITY AND YIELD-1992

Treatment	Plant Maturity Index (0-5) 24/8	01/9	08/9	Tuber Yield (T/ha) 0-55mm	>55mm	Total
Non-inoculated	3.0	3.0	3.2	10.2	25.0	35.2
ASC67089	1.5	3.2	5.0	8.4	29.3	37.7
ASC67090	1.2	1.2	5.3	10.2	27.2	37.4
ASC67091	1.0	1.2	1.2	12.4	25.5	37.9
ASC67092	1.0	1.0	3.0	10.0	26.0	36.0
ASC67093	1.0	1.0	3.0	6.7	27.8	34.5
EASOUT	3.0	3.0	3.2	16.3	25.8	42.1
GaozhimoP	1.2	1.2	3.0	8.4	25.5	34.0
GaozhimoP&F	3.0	3.2	3.2	9.1	24.8	33.9
GaozhimoP&F&2F	1.2	5.3	5.5	10.8	24.5	35.3
Fall Gaozhimo	2.2	2.7	3.0	15.9	18.7	34.6
Fall Water	2.0	2.2	3.0	13.8	18.0	31.8
.						
Lsd (P=0.05)	NS	NS	NS	3.36	6.13	5.17

Note: For gaozhimo treatments P=planting, F=flowering, 2F = two weeks post-flowering. Plant Maturity index: 1 = active growth...5 = extensive foliar senescence. NS = not significantly different.

DISEASES OF CEREAL AND FORAGE CROPS / MALADIES DES CÉRÉALES ET CULTURES FOURRAGÈRES

Section Editors / Réviseurs de section : R.A. Martin, H.W. Johnston, P. Thomas

#135 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: CA60-93-P800

CROP: Spring barley, cv. Brier

PEST: Covered smut, *Ustilago hordei*

NAME AND AGENCY:
LINDGREN D K
Zeneca Agro, 6-2135 32 Ave. N. E. Calgary, Alberta, T2E 6Z3
Tel: (403) 250-2872 **Fax:** (403) 291-5549

TITLE: CROP TOLERANCE AND COVERED SMUT CONTROL WITH HEXACONAZOLE AS A SEED TREATMENT IN BRIER BARLEY

MATERIALS: ICIA 0523 (Hexaconazole, 5 g/L, TF3770A)

METHODS: Seed was treated in 200 g lots using a mini-rotostat seed treater. The trial was seeded at a rate of 90 seeds/m row on 11 May 1993 at Lethbridge, Alberta. Each treatment was replicated three times in a complete randomized block design. Each plot consisted of four rows, 6 m in length. All plots were assessed for seedling emergence on 22 May and 3 June 1993 and for Covered smut percent control on 22 August 1993.

RESULTS: As presented in the table. Please note that the check had 15 diseased heads/m row.

CONCLUSIONS: Only the 20 ppm rate significantly reduced emergence. All HEXACONAZOLE treatments provided control of Covered smut.

TREATMENT	RATE ppm	EMERGENCE 21/05/93	03/06/93	COVERED SMUT 22/08/93
CHECK	Nil	100a	100ab	0b
HEXACONAZOLE	10	85ab	88ab	96a
HEXACONAZOLE	12.5	76b	86ab	100a
HEXACONAZOLE	15	101a	102a	100a
HEXACONAZOLE	20	81ab	70b	100a
.				
Standard deviation		10.4	15.4	3.4
CV		11.7	17.3	4.2

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

1993 PEST MANAGEMENT RESEARCH REPORT

#136

STUDY DATA BASE: CA60-93-P806

CROP: Spring barley, cv. Brier

PEST: Loose smut, *Ustilago nuda*

NAME AND AGENCY:
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Zeneca Agro, 6-2135 32 Ave. N. E., Calgary, Alberta, T2E 6Z3
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TITLE: CROP TOLERANCE AND LOOSE SMUT CONTROL WITH HEXACONAZOLE AS A SEED TREATMENT IN BRIER BARLEY

MATERIALS: ICIA 0523 (Hexaconazole, 5 g/L, TF3770A)

METHODS: Seed was treated in 200 g lots using a mini-rotostat seed treater. The trial was seeded at a rate of 90 seeds/m row on 25 May 1993 at Lethbridge, Alberta. Each treatment was replicated three times in a complete randomized block design. Each plot consisted of four rows, 6 m in length. All plots were assessed for seedling emergence on 03 June and 14 June 1993 and for Loose smut percent control on 20 August 1993.

RESULTS: As presented in the table. Please note that the check had 5 infected heads/ m row.

CONCLUSIONS: Only the 12.5 ppm rate significantly reduced emergence at eight days after planting. All rares provided good control of loose smut.

TREATMENT	RATE ppm	EMERGENCE 03/06/93	EMERGENCE 14/06/93	LOOSE SMUT 20/08/93
CHECK	Nil	100a	100a	0.0c
HEXACONAZOLE	10	97a	111a	91.7b
HEXACONAZOLE	12.5	83b	110a	100a
HEXACONAZOLE	15	100a	127a	100a
HEXACONAZOLE	20	102a	124a	100a
.				
Standard deviation		3.4	14.1	3.4
CV		3.5	12.3	4.3

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

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#137

STUDY DATA BASE: CA60-93-P808

CROP: Spring barley, cv. Johnson

PEST: Loose smut, *Ustilago nuda*

NAME AND AGENCY:
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TITLE: CROP TOLERANCE AND LOOSE SMUT CONTROL WITH HEXACONAZOLE AS A SEED TREATMENT IN JOHNSON BARLEY

MATERIALS: ICIA 0523 (Hexaconazole, 5 g/L, TF3770A)

METHODS: Seed was treated in 200 g lots using a mini-rotostat seed treater. The trial was seeded at a rate of 90 seeds/m row on 18 May 1993 at Lethbridge, Alberta. Each treatment was replicated three times in a complete randomized block design. Each plot consisted of four rows, 6 m in length. All plots were assessed for seedling emergence on 07 June 1993 and for Loose smut percent control on 03 September 1993.

RESULTS: As presented in the table.

CONCLUSIONS: There were no statistical differences in the percent emergence of any of the treatments. Loose smut control was good regardless of the rate of HEXACONAZOLE used.

TREATMENT	RATE ppm	EMERGENCE 07/06/93	LOOSE SMUT 03/09/93
CHECK	Nil	100a	0b
HEXACONAZOLE	10	87.3a	86.7a
HEXACONAZOLE	12.5	104.3a	100a
HEXACONAZOLE	15	108.3a	100a
HEXACONAZOLE	20	90.3a	100a
	Standard deviation	20.5	10.3
	CV	20.9	13.3

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

1993 PEST MANAGEMENT RESEARCH REPORT

#138

STUDY DATA BASE: CA40-93-P800

CROP: Spring barley, cv. Johnson

PEST: Loose smut; *Ustilago nuda*

NAME AND AGENCY:
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TITLE: HEXACONAZOLE: FUNGICIDE SEED TREATMENT IN SPRING BARLEY, EFFECTS ON CONTROL OF LOOSE SMUT AND SEEDLING EMERGENCE, 1993

MATERIALS: ICIAO523 (hexaconazole; 5 g/L; TF 3770A); VITAVAX (carbathiin; 230 g/L).

METHODS: Naturally infected seed, obtained from a grower in Saskatchewan, was separated into 200 gram lots and treated using a mini-rotostat seed treater. The treatments were seeded at a rate of 33 seeds/m row, using a Kincaid Precision Cone-Seeder, into sandy soil, near Carman, Manitoba, on May 5, 1993. Each treatment consisted of four rows, 6 m in length. Each treatment was replicated three times in a Complete Randomized Block Design field plot. All treatments were assessed for seedling emergence, on 12/05 (seven Days After Planting (DAP)), 20/05 (15 DAP) and 26/05 (21 DAP). Heads/m row (mrow) and smutted heads/m row were conducted on 13/08 (100 DAP).

RESULTS: As presented in the Table 1.

CONCLUSIONS: None of the treatments had a negative effect on emergence. All treatments increased emergence at 26/05, but not significantly. HEXACONAZOLE at 10 g ai/kg seed had significantly more heads/mrow than the CHECK. HEXACONAZOLE at 20 g ai/kg seed had significantly fewer heads/mrow than the other treatments, but not the CHECK. All HEXACONAZOLE treatments provided complete control of Loose Smut and was superior to the control provided by VITAVAX.

Table 1.

TREATMENT	RATE g ai/ kg seed	Seedling counts (mrow) 12/05	20/05	26/05	Heads/mrow 13/08	Smutted heads/mrow 13/08
CHECK		27 a	21 a	17 a	73 bc	18 a
VITAVAX	0.55	28 a	20 a	22 a	76 b	6 b
TF3770A	0.010	24 a	21 a	22 a	83 a	0 b
TF3770A	0.0125	20 a	20 a	22 a	76 ab	0 b
TF3770A	0.015	22 a	18 a	20 a	75 b	0 b
TF3770A	0.020	29 a	22 a	22 a	66 c	0 b
LSD (.05)					7	7

Means followed by same letter do not significantly differ (Duncan's MRT, P=.05)

#139

STUDY DATA BASE: CA40-93-P801

CROP: Spring barley, cv. Johnson

PEST: Loose smut; *Ustilago Nuda*

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TITLE: HEXACONOZOLE: FUNGICIDE SEED TREATMENT IN SPRING BARLEY,EFFECTS ON CONTROL OF LOOSE SMUT AND SEEDLING EMERGENCE, 1993

MATERIALS: ICIAO523 (hexaconazole; 5 g/L; TF 3770A);
VITAVAX (carbathiin; 230 g/L)

METHODS: Naturally infected seed, obtained from a grower in Saskatchewan, was separated into 200 gram lots and treated using a mini-rotostat seed treater. The treatments were seeded at a rate of 33 seeds/m row, using a Kincaid Precision Cone-Seeder, into heavy clay, near Carman, Manitoba, on May 5, 1993. Each treatment consisted of four rows, 6 m in length. Each treatment was replicated three times in a Complete Randomized Block Design field plot. All treatments were assessed for seedling emergence, on 16/05 (11 Days After Planting (DAP)), 20/05 (15 DAP) and 26/05 (21 DAP). Heads/m row (mrow) and smutted heads/plot were conducted on 13/08 (100 DAP).

RESULTS: As presented in the Table 1.

CONCLUSIONS: Emergence was not effected by any treatment. There were no statistical differences in Heads/mrow counts. All treatments provided complete control of Loose smut.

Table 1.

TREATMENT	RATE g ai/kg seed	Seedling counts (mrow) 16/05	20/05	26/05	Heads/mrow 13/08	Smutted heads/plot 13/08
CHECK		15 a	16 a	18 a	53 a	33 b
VITAVAX	0.550	14 a	15 a	17 a	48 a	0 a
TF3770A	0.010	20 a	18 a	18 a	55 a	0 a
TF3770A	0.0125	18 a	18 a	19 a	61 a	0 a
TF3770A	0.015	13 a	16 a	21 a	53 a	0 a
	0.020	19 a	17 a	22 a	56 a	0 a
LSD (.05)						6

Means followed by same letter do not significantly differ (Duncan's MRT, P=.05)

#140

STUDY DATA BASE: 385-1412-8203

CROP: Barley, cv. Galt

PEST: Loose smut, *Ustilago nuda*

NAME AND AGENCY:
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TITLE: THE EFFECT OF SEED DRESSINGS ON LOOSE SMUT OF BARLEY - 1993

MATERIALS: TF 3770 A (5 g ai hexaconazole), UBI 2092 (VITAFLOW 250), UBI 2454-1 (50 g ai/L myclobutanil), UBI 2568 (60 g ai/L triadimenol), UBI 2584-1 (8.33 g ai/L tebuconazole).

METHODS: Galt barley naturally infected with loose smut was treated in a small batch laboratory treater with the chemicals and rates listed in Table 1. The seed was air dried and seeded May 18 into four row plots, 5.5 m in length and replicated four times in a randomized complete block design. Emergence was counted in two 1 m lengths from the center rows and averaged for each plot. Smut was recorded as the number of smutted heads in the two centre rows. The total number of heads were determined and a figure for percent control calculated. At maturity, the two centre rows were harvested and grain yield and 1000 kernel weights were taken. Data was subjected to analysis of variance and treatment means were compared using least significant difference.

RESULTS: Results are presented in Table 1. There were no significant differences in emergence although all treatments had lower emergence counts than the untreated check. Smut levels were about 1% in the untreated check but all treatments had significantly lower smut counts than the untreated check. UBI 2568 and UBI 2584-1 at the lower rate had 100% control of loose smut. Yields were lower than the untreated check, with the exception of UBI 2584-1 at the lower rate, while 1000 kernel weights tended to be higher, with the exception of UBI 2092 and UBI 2092 plus UBI 2454-1.

CONCLUSIONS: Although all treatments significantly reduced smut counts, UBI 2568 and UBI 2584-1 at the lower rate controlled loose smut completely. There were no increases in grain yield, although 1000 kernel weights were increased for these two treatments.

Table 1. A comparison of emergence, percent smutted heads, seed yield and 1000 kernel weights on barley treated with fungicide seed treatments at Lacombe, 1993.*

Treatment	Rate g ai/kg	Emergence (#/m)	% Control (Smut)	kg/ha	1000 Kernel Wt.
TF 3770 A	.01	31	48b	3007	34.9
TF 3770 A	.0125	35	43b	3143	34.6
TF 3770 A	.015	29	81bc	2878	34.6
UBI 2092	.56	34	71bc	3060	33.6
UBI 2092	.56				
+ UBI 2454-1	+ .06	33	81bc	2989	33.8
UBI 2568	.15	32	100c	3239	35.4
UBI 2584-1	.02	34	100c	3258	34.6
UBI 2584-1	.15	30	76bc	3018	34.4
Untreated	--	37	0a	3241	34.2
		ns		ns	ns

* Figures are the means of four replications. Numbers followed by the same letter are not significantly different according to an LSD test ($p<0.05$).

#141

STUDY DATA BASE: 303-1412-8907

CROP: Barley, cv. Birka;
Wheat, cv. Max

PEST: Net Blotch, *Pyrenophora teres*

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TITLE: CHITOSAN AS A BARLEY AND WHEAT SEED TREATMENT, 1988

MATERIALS: VITAFLO 280 (carbathiin, 167 g ai/L; thiram, 148 g ai/L), Y.E.A. (chitosan, yield enhancing agent, 2.5% ai)

METHODS: Barley and wheat seed were treated with the above materials at the rates listed in the table. Plots were established in 1988. Each plot was 5 m long and eight rows wide, 17.8 cm between rows. Each barley plot was separated by an equal size plot of wheat, and the wheat plots by barley. Emergence counts were based on counts of 2 m of row. Net blotch was the principal foliar disease and was rated on the penultimate leaf at Zadok's Growth Stage 65. Yields were determined on the harvest of the centre seven rows of each plot using a Hege small plot combine.

RESULTS: Results are presented in the table. With the exception of barley emergence, there were no significant effects at a 0.05 level of probability. Seedling blight severity was too low to warrant rating.

CONCLUSIONS: Chitosan had no significant effect on disease control, foliar, or on yield in either wheat or barley. Chitosan did appear to have a phytotoxic effect on barley, as evident from the significant reductions in emergence from two of the chitosan rates. While the difference was not significant, the reduction in yield of wheat compared to increase with Vitaflo 280 may be an indication of potential problems with chitosan.

Treatment	Rate (g ai/kg) seed	Emergence (per m^2)	Total foliar disease 2nd Leaf (%)	Yield (kg/ha)	1000-Kernel weight (g)
		Barley			
Control	0	147	29.1	2341	37.85
Vitaflo 280	1.03	132	31.2	2437	37.75
Chitosan	0.13	147	25.3	2424	38.17
Chitosan	0.26	127	29.4	2322	37.67
Chitosan	0.39	136	28.2	2292	37.81
Chitosan	0.52	127	29.7	2365	37.95
LSD (0.05)		15.0	NS	NS	NS
.					
		Wheat			
Control	0	202	-	2606	34.81
Vitaflo 280	1.03	209	-	3284	34.91
Chitosan	0.13	181	-	2469	34.67
Chitosan	0.26	204	-	2515	34.24
Chitosan	0.39	195	-	2463	33.63
Chitosan	0.52	175	-	2488	34.73
LSD (0.05)		NS	-	NS	NS

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#142

STUDY DATA BASE: 303-1412-8907

CROP: Barley, cv. Albany

PEST: Net blotch, *Pyrenophora teres*; scald, *Rhynchosporium secalis*

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TITLE: INFLUENCE OF FOLIAR FUNGICIDES ON DISEASE AND YIELD OF BARLEY, 1993

MATERIALS: TILT (propiconazole 250EC), BAYLETON 50WP (triadimefon 50WP), FOLICUR 144EC (hexaconazole), FOLICUR 45DF (hexaconazole)

METHODS: Barley plots, cv Albany, were established May 27, 1993 at a seeding rate of 300 viable seeds per m^2. Each plot was ten rows wide by 5 m long with 17.8 cm between each row. Foliar fungicide treatments were replicated four times in a complete randomized block design. Treatments were applied at ZGS 43 (Zadok's Growth Stage) and at the rates listed in the following table, using a CO_2 backpack sprayer. Net blotch ratings were taken on the second leaf at ZGS 62 and net blotch plus scald ratings on the second leaf at ZGS 82. Yields were determined following harvest with a Hege small plot combine.

RESULTS: Effects of the foliar fungicide treatment on disease and yield of barley as well as the effects on lodging and thousand kernel weights are listed in the following table.

CONCLUSIONS: There was no significant effects of fungicide application at the first disease rating (ZGS 62) even though ratings for Tilt and Folicur were lower than the control. Folicur did result in reduced symptom expression at a later stage (ZGS 82) reducing disease by 35 to 55%. This reduction was reflected in a significant yield increase from Folicur of 45 to 54%, and in thousand kernel weight. The yield advantage from Folicur was probably also as a result of significant reduction on lodging. Tilt did result in a significant but small yield benefit. Neither rate of Bayleton had any impact on diseasse, lodging or yield.

Treatment	Rate (g ai/ha)	Net blotch ZGS 62 (%)	Net blotch and scald ZGS 82 (%)	Lodging***	Yield kg/ha)	1000-Kernel weight (g)
Untreated	0	12.5	95.9	22.8	2615	30.8
Tilt	125	9.5	88.0	15.5	3498	36.9
Bayleton (50WP)	125	17.3	96.9	20.0	2608	30.9
Bayleton (50WP)	250	19.1	95.6	19.0	2515	31.8
Folicur 144EC	125	7.1	62.3	9.0	3800	38.1
Folicur 45DF	125	9.1	42.1	11.0	4038	39.6
SEM*		2.12	4.38	2.36	110.0	0.84
LSD**		6.39	13.2	7.12	331.5	2.52

* Standard Error of Mean
** Value at 0.05 Level of Probability
*** Belgian scale (0-45) where 45 is a flat plot.

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#143

STUDY DATA BASE: 303-1412-8907

CROP: Barley, cv. 2 Row
(Albany, Morrison, Helena, Iona, Micmac, Winthrop, Lester)

PEST: Net Blotch, *Pyrenophora teres*; scald, *Rhynchosporium secalis*

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TITLE: TWO-ROW BARLEY CULTIVAR RESPONSES TO TIME FOLIAR APPLICATION OF TILT

MATERIALS: VITAFLO 280 (carbathiin, 167 g ai/L; thiram, 148 g ai/L), TILT (propiconazole 250 g ai/L)

METHODS: Albany, Morrison, Helena, Iona, Micmac, Winthrop, and Lester barley seed was treated in a small plot seed treater with Vitaflo 280 at the rate of 1.03 g ai/kg seed. The seed was planted on June 3, 1993 at a seeding rate of 300 seeds m^2. Each plot was eight rows wide by 5 m long with 17.8 cm between each row. Two rows of Belvedere wheat separated each plot. Cultivar and treatments of Tilt were replicated four times in a split block design. Tilt was applied with a CO_2 backpack sprayer at the rate of 125 g ai/ha at two timings, when the 4th leaf from the top was 10% diseased and at ZGS (Zadok's Growth Stage) 45. Disease ratings were taken on the penultimate leaf at ZGS 65 and ZGS 80 using the Horsfall-Barratt Rating System. Lodging was also assessed on the Belgian Scale at ZGS 92. Yield and thousand kernel weight were determined from the harvest of seven rows of each plot using a small plot combine.

RESULTS: Results are presented in the table. There were no significant interactions at a 1% level in any treatment. While there was an interaction at the 5% level in the first disease rating, none of the other ratings resulted in interactions and only the main effects are presented.

CONCLUSIONS: The two highest yielding cultivars, Lester and Morrison, were also the two cultivars with the lowest susceptibility to disease. In 1993, the disease complex of net blotch and scald was present with net blotch predominating. The high lodging in Micmac, Winthrop and Iona was probably partly responsible for relatively low yields. Relative to Tilt treatment, there was no difference, in 1993 whether applied at a specific disease or growth stage. Tilt did result in a significant disease control, lodging and yield effect. Yield was increased by an average of 740 kg/ha (25.8%). Application based on disease level resulted in early disease control which tended to disappear at later stages. The growth stage application had more effect on later disease levels during grain filling stages.

Table 1. Effects of timed Tilt applications at 125 g ai/ha on disease, lodging and yield in barley cultivars.

	Penultimate Leaf Foliar disease (%) ZGS 65	ZGS 80	Lodging (0-45)	Yield (kg/ha)	1000-kernel weight (g)
Cultivar					
Albany	39.3	80.3	29	3307	34.6
Morrison	28.0	76.9	30	3892	35.1
Helena	35.5	90.6	31	3135	29.3
Iona	29.3	85.0	35	3328	32.4
Micmac	34.6	84.5	40	2635	27.4
Winthrop	45.6	88.5	40	2766	27.0
Lester	28.1	77.4	29	4397	37.2
.					
SEM**	1.65	1.85	1.32	153.8	0.46
LSD***	5.07	5.70	4.14	73.9	1.42
.					
Treatment*					
Untreated	44.2	98.4	35	2859	28.8
Tilt (10%)	16.9	82.3	31	3671	33.2
Tilt (ZGS 45)	42.0	69.2	33	3524	33.5
.					
SEM	1.41	1.31	0.7	63.7	0.30
LSD	4.09	3.79	1.9	184.5	0.87

* Tilt applied when foliar disease on penultimate leaf was 10% or at ZGS 45.
** SEM = Standard Error of Mean.
*** LSD at 0.05 level of probability.

#144

STUDY DATA BASE: 303-1412-8907

CROP: Barley, cv. 6 Row
(Chapais, Duke, Etienne, Leger, Mascot, Sabina, OAC Kippen)

PEST: Net Blotch, *Pyrenophora teres*; scald *Rhynchosporium secalis*

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TITLE: SIX-ROW BARLEY CULTIVAR RESPONSES TO TIMED TILT APPLICATIONS

MATERIALS: VITAFLO 280 (carbathiin, 167 g ai/L; thiram, 148 g ai/L), TILT (propiconazole 250, g ai/L)

METHODS: Chapais, Duke, Etienne, Leger, Mascot, Sabina and OAC Kippen barley seed was treated in a small plot seed treater with Vitaflo 280 at the rate of 1.03 g ai/kg seed. The seed was planted on June 3, 1993 at a seeding rate of 300 seeds m^2. Each plot was eight rows wide by 5 m long with 17.8 cm between each row. Two rows of Belvedere wheat separated each plot. Cultivar and treatments of Tilt were replicated four times in a split block design. Tilt was applied with a CO_2 backpack sprayer at the rate of 125 g ai/ha when the 4th leaf from the top was 10% diseased or at ZGS (Zadok's Growth Stage) 45. Disease ratings were taken on the second and third leaf at ZGS 80 using the Horsfall-Barratt Rating System. Lodging was also assessed on the Belgian Scale at ZGS 80. Yield and thousand kernel weight were determined from the harvest of seven rows of each plot using a Hege small plot combine.

RESULTS: Results are presented in the table. Significant interactions occurred between treatment and cultivars in disease response, as such all effects are presented.

CONCLUSIONS: Duke demonstrated the lowest disease level, along with Chapais and Mascot. Both Leger and Sabina had high disease levels. In the six-row barleys, the ZGS 45 application timing tended to be the most effective in suppressing disease where disease pressure was low. However, in the highly susceptible cultivars Leger and Sabina, the 10% disease timing for spray appears to be optimum; although significant only in Leger. There was a significant correlation between disease and yield (R^2=0.52) but only with Tilt at ZGS 45 on Duke and both timings on Sabina was the yield increases significant. With Chapais, Leger and OAC Kippen, there was almost no numerical difference in Tilt versus control yields. It would appear that there are greater differences in cultivar responses in the six-row barleys than in two-row cultivars (reported elsewhere in this publication). In the 2-row barleys, each cultivar tested, benefited from Tilt application while in this test, positive response was limited to Duke and Sabina.

Table 1. Effect of timed Tilt applications at 125 g ai/ha on disease lodging and yield in barley cultivars.

Cultivar	Treatment*	Lodging (0-45)	Total disease ZGS 80 2nd Leaf	Total disease ZGS 80 3rd Leaf	Yield (g)	1000-kernel weight
Chapais	Untreated	13	13.1	25.2	5437	41.7
	Tilt (10%)	14	11.4	28.6	5370	42.2
	Tilt (ZGS 45)	9	11.0	22.6	5395	41.5
Duke	Untreated	3	9.2	23.5	5337	33.6
	Tilt (10%)	2	4.3	10.2	5688	36.6
	Tilt (ZGS 45)	1	2.2	10.2	5999	36.6
Leger	Untreated	19	42.2	67.7	4095	32.8
	Tilt (10%)	15	21.0	42.7	4222	32.7
	Tilt (ZGS 45)	22	46.0	65.2	4145	34.5
Mascot	Untreated	7	19.6	38.1	4637	35.0
	Tilt (10%)	2	8.4	19.5	5223	38.5
	Tilt (ZGS 45)	5	3.9	11.8	4499	38.4
Sabina	Untreated	14	47.8	68.9	4037	33.1
	Tilt (10%)	10	13.0	28.5	4915	35.7
	Tilt (ZGS 45)	10	14.4	37.6	5112	37.0
OAC Kippen	Untreated	28	25.2	48.9	4541	35.0
	Tilt (10%)	25	12.7	27.9	4648	36.3
	Tilt (ZGS 45)	26	2.6	7.1	4557	36.5
SEM**		2.5	3.75	6.07	193.8	1.14
LSD***		8.0	11.81	19.13	610.6	3.59

* Treatment: Tilt applied when foliar disease on the penultimate leaf was 10% or at ZGS 45.
** SEM = Standard Error of Mean
*** LSD at 0.05 Level of Probability

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#145

STUDY DATA BASE: 303-1412-8907

CROP: Barley, cv. Albany

PEST: Scald, *Rhynchosporium secalis*

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TITLE: EFFECTS OF FUNGICIDE SEED TREATMENTS ON DISEASE AND YIELD OF BARLEY, 1993

MATERIALS: VITAFLO 280 (carbathiin, 167 g ai/L; thiram, 148 g ai/L);
VITAFLO 250 (carbathiin, 254 g ai/L);
UBI-2454 (RH-3866, Sisthane, myclobutanil, 50 g ai/L);
UBI-2584 (tebuconazole, 8.3 g ai/L); TF-3770 (hexaconazole, 12.5 g ai/L);
TF-3770-A (hexaconazole, 5.0 g ai/L); TF-3794 (paclobutrazol, 2.0 g ai/L)

METHODS: Albany barley seed was treated in a small plot seed treater with the above materials at the rates listed in the following table. The seed was planted on June 3, 1993 at a seeding rate of 300 viable seeds per m^2. Each plot was eight rows wide by 5 m long with 17.8 cm between each row and plots were separated with two rows of Belvedere wheat guards. Treatments were replicated four times in a complete randomized block design. Emergence counts were taken on two 1 m row/plot and seeding blight ratings taken on 15 plants/ plot. Disease ratings were taken on the third leaf at ZGS (Zadok's Growth Stage) 62, using the Horsfall-Barratt Rating System. Lodging ratings were taken on all plots at heading and shortly before harvest. Yield and thousand kernel weights were determined from the harvest of seven rows of each plot, using a Hege small plot combine.

RESULTS: Listed in the following table.

CONCLUSIONS: There were no significant differences in any disease ratings for any treatments. There was also no significant difference in thousand kernel weight however, there was a significant increase in yield for treatment TF3794 (.004 g ai/kg seed). The late planting probably had an effect on decreasing potential seed treatment benefits.

Treatment	Rate (g ai/kg) seed	Emergence (plants/m²)	Seedling blight (0-9)	Scald (%)	Yield (kg/ha)	1000-Kernel weight (g)
Untreated	0	116	1.3	56.8	2931	32.4
Vitaflo 280	1.03	112	1.1	55.2	2995	31.2
Vitaflo 250	0.49	110	0.9	60.6	2917	34.5
Vitaflo 2504 + UBI2454	0.49+0.06	123	1.1	56.2	2918	33.8
UBI 2454	0.06	104	1.1	60.6	3182	33.1
UBI 2454	0.12	119	1.2	49.7	3039	33.4
UBI 2584	0.16	105	1.1	56.2	2836	34.1
UBI 2584	0.20	113	1.1	58.6	3110	31.8
Vitaflo 250 + UBI 2584	0.49+0.16	119	1.1	55.9	3068	32.9
TF3770	0.015	79	1.3	56.7	2900	33.5
TF3770-A	0.10	90	1.3	51.7	3150	33.8
TF3770-A	0.15	116	1.2	54.9	3278	32.0
TF3794	0.004	98	1.0	56.5	3372	33.0
TF3794	0.007	105	1.1	58.1	2702	32.0
TF3794	0.01	98	1.3	51.2	2723	35.1
TF3794+ Vitaflo 280	0.01+1.03	117	1.1	62.3	2864	32.7
TF3770+ Vitaflo 280	+1.03	121	1.4	48.4	3109	33.9
.						
SEM*		10.2	0.2	4.81	1297	0.86
LSD**		N.S.	N.S.	N.S.	368.3	N.S.

* Standard error of mean.
** Value at 0.05 level of probability.
N.S. Not Significant at P<0.05.

#146

STUDY DATA BASE: 385-1412-8203

CROP: Barley

PEST: Scald, *Rhynchosporium secalis*

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TITLE: THE EFFECT OF SCALD INOCULUM AND TILT ON SIX BARLEY CULTIVARS, LACOMBE 1993

MATERIALS: TILT (250 g ai/L propiconazole)

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

METHODS: AC Lacombe, Brier, Harrington, Jackson, Leduc and Manley were selected for their varying resistance to scald. A split-split plot was set up with either artificial or natural inoculum as the main plot and the application of TILT at 125 g ai/ha as the sub plot. The cultivars were randomized within each chemical treatment. Plots were seeded May 18 into barley silage stubble and were four rows 5.5 m in length with 23 cm spacing. Two rows of wheat were seeded between plots to limit disease spread. Scald inoculum was prepared by growing one isolate of *R. secalis* on wheat germ agar at 17 degrees C and 14 h daylight. After a 21 day incubation, the spores were scraped off and a suspension was prepared to give 5 x 10^4 spores/ml. TWEEN 20 was added as a surfactant. Spores were applied to run off using compressed air sprayers during the evening of June 28. TILT was applied using a CO2 back pack sprayer on July 7. An early disease score was made July 8 using a 0-9 scale with nine rating greater than 50% disease on each of the lower, middle and upper leaf canopies. Prior to maturity, 20 flag and 20 penultimate leaves from each plot were collected and rated for percent leaf area diseased (PLAD). At maturity, plots were harvested and grain yields and 1000 kernel weights taken.

RESULTS: The results are presented in Table 1. While scald was the most predominant disease, plots sprayed with TILT exhibited more net blotch (*Pyrenophora teres*). Cool and damp weather contributed to the spread of scald and resulted in no significant differences between either artificial or natural inoculum, although the artificial inoculum had higher PLAD for both the flag and penultimate and lower yields and 1000 kernel weights. There were significant differences between cultivars for score and PLAD on both the flag and penultimate leaves with Jackson and Harrington having higher disease levels than the other cultivars. As well, there were significant interactions between cultivar and TILT application for PLAD of both leaves. There were no significant differences for yields although cultivar yields increased when sprayed with TILT. Harrington and Manley, when sprayed with TILT, gave the highest yields. Brier had the lowest yield when not sprayed and ranked lowest among the sprayed cultivars. There were cultivar differences for 1000 kernel weights with Harrington and Manley having significantly higher weights than the other cultivars.

CONCLUSIONS: During the growing season of 1993 in Lacombe, there were no significant differences between natural and artificial scald inoculum for any of the variables tested. The application of TILT lowered PLAD for both the flag and penultimate leaves and raised yields and 1000 kernel weights for each cultivar tested. The magnitude of the changes was cultivar dependent.

Table 1. The effect of artificial or natural scald inoculum and TILT on six barley cultivars, Lacombe 1993.

Inoculum	Chem.	Cult.	Jul 8 Score	Flag PLAD	Penu PLAD	kg/ha	1000 Kernel Wt (g)
Sprayed	No	Ac Lacombe	3	4	18	3801	41.0
		Brier	2	4	10	3309	40.1
		Harrington	3	13	43	3726	44.2
		Jackson	3	41	72	3191	35.4
		Leduc	3	6	10	4000	42.4
		Manley	3	7	20	3988	45.0
Sprayed	TILT	Ac Lacombe	3	1	2	4164	43.8
		Brier	2	2	1	3375	41.8
		Harrington	4	3	6	4327	46.2
		Jackson	3	8	11	4020	40.6
		Leduc	2	2	2	4043	42.8
		Manley	3	2	2	4247	45.7
Natural	No	Ac Lacombe	2	5	17	4128	42.6
		Brier	3	4	9	3255	40.8
		Harrington	3	16	56	3972	44.0
		Jackson	3	14	22	3467	37.6
		Leduc	2	6	10	3734	41.4
		Manley	3	9	18	3837	44.1
Natural	TILT	Ac Lacombe	2	2	2	4673	44.6
		Brier	2	1	2	4486	42.1
		Harrington	4	3	6	4982	47.3
		Jackson	3	4	6	4359	40.0
		Leduc	2	1	2	4609	43.3
		Manley	3	2	3	4658	45.4
			ns	ns	ns	ns	ns

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#147

STUDY DATA BASE: 303-1412-8909

CROP: Oats, cv. Ultima;
Spring wheat, cv. Belvedere and Katepwa

PEST: Oats - speckled leaf blotch (*Septoria avenae*)
Wheat - powdery mildew (*Erysiphe graminis f. sp. tritici*), leaf and glume blotch (*Septoria nodorum*)

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TITLE: EFFICACY OF FOLIAR TREATMENTS FOR CONTROL OF COMMON LEAF DISEASES OF OATS AND WHEAT

MATERIALS: BRAVO (chlorothalonil 500 g/L), BAYLETON 50WP (triadimefon, 125 g/L), TILT EC (propiconazole, 250 g/L), SEAWEED EXTRACT (unknown)

METHODS: Field plots were established on 17 May 1993 by planting the oats and wheat in separate blocks using a randomized complete block design, the wheat as a split block design, treatments as main plots, cultivars as sub-plots. At Zadok's Growth Stage (ZGS) 39-45, foliar treatments were applied at the rates listed in the table using a tractor driven direct injection sprayer delivering 280 L/ha of water at 267 kPa pressure. Disease severity was rated on a 1-9 scale at ZGS 60 for powdery mildew on wheat and at ZGS 70-75 for the *Septoria* leaf diseases. Yield estimates were determined based on the harvest of the six centre rows of each plot using a Hege small plot combine. Harvest data was calculated on the basis of 14% moisture after drying sub-samples from each plot.

RESULTS: Powdery mildew did not occur on Belvedere but on Katepwa, symptom severity developed to a maximum level of 2.8 on the untreated plots and was reduced by TILT and BAYLETON alone, or in combination with BRAVO. Septoria leaf blotch was reduced in severity by application of BRAVO and TILT. Wheat yields were not significantly increased by foliar fungicides. Trends for increased wheat yield were evident, yield increases being significantly correlated with decreasing disease severity. None of the fungicide treatments influenced disease severity or yield of oats. The seaweed extract at the lower application rate had some beneficial effects on both oats and wheat and will be further evaluated.

CONCLUSIONS: Powdery mildew of wheat and the septoria leaf blotches of wheat and oats may be reduced in severity by a number of the materials evaluated. Yield may also be increased as disease control improves.

Spray	Rate g ai/ha	Septoria (AUDPC)* Belvedere	Katepwa	Yield(kg/ha) Belvedere	Katepwa
Check	nil	7.0	13.0	4844	3164
Bravo	1000	7.8	13.0	5329	3297
Bravo	2000	6.8	12.0	5107	3186
Tilt	125	7.3	12.5	5054	3406
Tilt	250	7.8	12.8	5387	3205
Bravo	1000				
+ Tilt	125	6.5	12.3	5723	3847
Bravo	2000				
+ Tilt	250	6.5	11.3	5341	3328
Bravo	2000				
+ Tilt	125	6.8	11.3	5343	3138
Seaweed	1000**	6.8	11.3	5994	3842
Seaweed	5000**	7.8	11.3	4776	2937
LSD (P=0.05)		0.80	0.80	NS	NS

* *Septoria nodorum* on wheat reported as AUDPC with 3 ratings, AUDPC - area under disease progression curve.
** Total product.

#148

STUDY DATA BASE: 375-1411-8719

CROP: Spring wheat, cv. Leader;
6 row Barley, cv. Brier

PEST: Common root rot, *Cochliobolus sativus*

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TITLE: EFFECT OF SEED TREATMENT FUNGICIDES ON EMERGENCE, COMMON ROOT ROT AND YIELD OF LEADER SPRING WHEAT AND BRIER BARLEY, 1993

MATERIALS: From Gustafson: UBI 2100-4 (carbathiin 230g/L); UBI 2100-4 + UBI 2454-1 (carbathiin 230g/L, sisthane 50g/L); UBI 2568 (triadimenol 30g/L); UBI 2584-1 (tebuconazole 8g/L); from Zeneca: AGROX FLOWABLE (maneb 300g/L); TF 3770A (hexaconazole 5g/L).

METHODS: The test was established at Saskatoon, Saskatchewan in 1993. Naturally occurring inoculum of *C. sativus* was relied upon for infection. Seed was treated in 1000 ml glass jars. Chemical treatments were dispersed over the glass surface, then for wheat 275g of seed was added and shaken, and for barley 350g of seed was added and shaken. To ensure uniform coverage of the seed, the first treated lot of seed was discarded and a second lot was packaged for seeding. Seed was treated on April 16 except for TF 3770A which was treated by the company. Wheat and barley were in separate tests. Each test was a randomized complete block design with six replicates. Plots had four rows; each row was 6 m long. Rows were 23 cm apart with 350 seeds planted in each row. Seeding and fertilizing (40 kg/ha with 11-55-0) took place May 11; emergence was recorded on May 31 for barley, and June 03 for wheat on 2 m of one of the center rows. Common root rot was recorded twice during the growing season for barley, at flowering (D.R. Tottman and H. Broad. Ann. Appl. Biol. 10: 441-454, 1987) on July 19, and at mid-to-hard dough on August 24 by rating 40 plants randomly selected from one row. Common root rot on wheat was measured on July 19 when plants were emerging from the boot but disease levels were not high enough to warrant rating the test at that time. Wheat was rated for common root rot on August 30 at the soft dough stage. Common root rot was determined by counting the number of plants with lesions covering greater than 50% of the subcrown internode. Percent common root rot was calculated by multiplying the field score by 2.5. Harvesting, three rows x 5 m long, of barley was done August 31, and wheat on September 18 with yield recorded as grams per plot.

RESULTS: The results are summarized in the tables.

CONCLUSIONS: For wheat, UBI 2568, UBI 2584-1, UBI 2400-4 + UBI 2454-1, and TF 3770A (0.0125 and 0.015 g ai/kg seed) were significantly (P=0.05) lower than the control for disease rating (Table 1). There was no significant difference from the control for emergence but yield was significantly lower with TF3770A (0.0125 g ai/kg). Treatment of wheat with UBI 2100-4 + UBI 2454-1, UBI 2568, UBI 2584-1 and TF3770A (0.0125 and 0.015 g ai/kg) thickened and shortened subcrown internodes. For barley, the July 19 disease rating for UBI-2568 and UBI 2100-4 + UBI 2454-1 were significantly lower (P=0.05) than the control (Table 2). There was no difference for barley between the control and any of the treatments for the August 24 disease rating or emergence but yield was significantly lower with TF3770A (0.015 g ai/kg).

Table 1. The effect of seed treatment fungicides on emergence, common root rot and yield of Leader spring wheat.

PRODUCT	RATE (g ai/kg seed)	EMERGENCE (plants/2 m)	CRR August 30	YIELD (g/plot)
Control	----	113a*	14a*	1637a*
AGROX-FLOWABLE	0.45	117a	9ab	1526ab
TF 3770A-1	0.0125	100a	7 b	1382 b
TF 3770A-2	0.015	109a	5 b	1448ab
UBI 2100-4	0.55	112a	10ab	1575ab
UBI 2100-4 + UBI 2454-1	0.55 + 0.06	100a	6 b	1441ab
UBI 2568	0.15	109a	4 b	1448ab
UBI 2584-1	0.02	116a	5 b	1530ab

* Values in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

Table 2. The effect of seed treatment fungicides on emergence, common root rot and yield of Brier 6 row barley.

PRODUCT	RATE (g ai/kg seed)	EMERGENCE (plants/2 m)	CRR July 19	CRR August 30	YIELD (g/plot)
Control	----	108ab*	11ab*	33ab*	2694ab*
AGROX-FLOWABLE	0.45	115a	8abc	28ab	2669abc
TF 3770A-1	0.0125	104ab	7abc	26 b	2578 bc
TF 3770A-2	0.015	108ab	7abc	24 b	2548 c
UBI 2100-4	0.55	106ab	12a	38a	2739a
UBI 2100-4 + UBI 2454-1	0.55 + 0.06	93 b	5 c	35ab	2685ab
UBI 2568	0.15	99ab	4 c	25 b	2627abc
UBI 2584-1	0.02	111ab	6 bc	32ab	2746a

* Values in the same column which are not followed by the same letter are significantly different at the 5% level of probability according to Duncan's Multiple Range Test.

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#149

STUDY DATA BASE: 375-1411-8719

CROPS: Canadian Western Red Spring Wheat, cv. Katepwa
Canada Prairie Spring Wheat, cv. Biggar
Canadian Western Amber Durum, cv. Sceptre
Soft White Spring Wheat, cv. Fielder

PEST: Naturally occuring foliar diseases

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TITLE: EFFECT OF APPLICATION OF TILT ON FOLIAR DISEASE AND YIELD OF SEVERAL CLASSES OF SPRING WHEAT, 1993

(This study was supported by the Irrigation Based Economic Development Fund, and the assistance of personnel at the Saskatchewan Irrigation Development Centre is gratefully acknowledged.)

MATERIALS: Ciba Geigy: TILT (propiconazole 250g/L)

METHODS: The test was performed at the Irrigation Development Centre, Outlook, Saskatchewan. In the spring 100 kg/ha of 34-0-0 was broadcast before seeding. During the growing season, water was applied when tensiometer readings measured -0.5 bar. A split-plot design was used with cultivars as main plots and treatments as subplots. Each subplot was made up of eight rows. Two rows of wheat were planted between subplots. Seeding and seed placement with 50 kg/ha of 11-55-0 fertilizer took place on May 6. Treatments were sprayed using a hand-held, CO_2 pressurized, 4 nozzle boom sprayer (nozzle size 0.01) that delivered 225 L/ha at 240 kPa. The foliage of eight rows was sprayed with Tilt at a rate of 125 g ai/ha. Control subplots were sprayed with water on July 27. Spraying took place four times on July 6 (G.S. 53-59, one quarter of inflorescence emerging to completely emerged) (D.R. Tottman and H. Broad. Ann. Appl. Biol. 10: 441-454, 1987), July 12 (G.S. 59-65, completion of inflorescence emergence to anthesis half way completed), July 27 (G.S. 65-71, anthesis half-way to watery ripe), and August 9 (G.S. 80-85, late milk to soft dough). Ten penultimate leaves were collected August 9 (Biggar and Sceptre G.S. 80-83, late milk to early dough; Fielder and Katepwa G.S. 83-85, late milk to soft dough) from randomly selected plants in the center two rows of each subplot and were stored at 5 degrees C until actual percent disease coverage was rated. Leaves from the control subplots were pressed and dried. They were scanned to determine the presence of obligate pathogens. Dried leaf pieces (4-6 cm) containing lesions were prepared and plated on water agar containing antibiotics. Sporulation was observed after about one week. Harvesting of five rows x 5 m long occurred September 02 with yield recorded as grams per subplot.

RESULTS: Results are summarized in the table. Cultivars were significantly (P=0.01) different for yield with Fielder averaging 2609 g/subplot, Sceptre 2438, Biggar 2187, and Katepwa 1791. The cultivar x treatment interaction was not significant for foliar disease or yield. A significant difference (P=0.01) was evident for timing of spray application for yield and percent disease. There were significantly (P=0.01) lower disease levels for the July 6 and July 12 spray times than the control. Yield for July 6 spray date was 13% higher than that of the control. In Sceptre, 35% of the leaf disease was caused by *Septoria nodorum*, 35% by *Pyrenophora tritici-repentis* (tan spot) and 30% by *Septoria tritici*. The major cause of leaf disease in Biggar was *S. nodorum* at 50% while *S. tritici* caused 35% and *P. tritici-repentis* 15%. In Fielder 80% of the leaf disease was caused by *S. nodorum*, 20% by *P. tritici-repentis* , and in Katepwa, *S. nodorum* caused 60%, while *S. tritici* 25%, and *P. tritici-repentis* 15%.

CONCLUSIONS: Treatment with Tilt on July 6 and July 12 showed a significant (P=0.01) reduction in foliar disease levels over the control. Yield was also significantly (P=0.01) improved by treatment with Tilt at the July 6 spray date with an average yield increase of 13% over the control.

SPRAY DATE	GROWTH STAGE	FOLIAR DISEASE (%)	YIELD (g/subplot)
Control		44a*	2197 bc*
July 06	53-59	20 b	2490a
July 12	59-65	22 b	2353ab
July 27	65-71	43a	2102 c
August 09	80-85	40a	2138 c

* Values for each variable in the same column which are not followed by the same letter are significantly different at the 1% level of probability according to Duncan's Multiple Range Test.

#150

STUDY DATA BASE: CA40-93-P804

CROP: Spring wheat, cv. Leader

PEST: Naturally occuring foliar diseases

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TITLE: CROP TOLERANCE WITH HEXACONOZOLE AS A SEED TREATMENT FUNGICIDES IN SPRING WHEAT I

MATERIALS: ICIAO523 (hexaconazole; 5 g/L; TF 3770A)

METHODS: Seed was separated into lots of 200 grama and treated using a mini-rotostat seed treater. The treatments were seeded at a rate of 33 seeds/m row, using a Kincaid Precision Cone-Seeder, into sandy soil, near Carman, Manitoba, on May 5, 1993. Each treatment consisted of four rows, 6 m in length. Each treatment was replicated three times in a Complete Randomized Block Design field plot. All treatments were assessed for seedling emergence, on 16/05 (seven Days After Planting (DAP)), 20/05 (15 DAP) and 26/05 (21 DAP). Heads/m row (mrow) counts were conducted on 13/08 (100 DAP).

RESULTS: As presented in the Table 1.

CONCLUSIONS: Emergence was not significantly effected with the use of HEXACONAZOLE. Heads/mrow increased, but not significantly, with the use of HEXACONAZOLE, at all rates tested.

Table 1.

TREATMENT	RATE g ai/kg seed	Seedling counts (mrow)			Heads/mrow
		16/05	20/05	26/05	13/08
CHECK		16 a	23 a	23 a	65 a
TF3770A	0.010	16 a	25 a	25 a	71 a
TF3770A	0.0125	19 a	25 a	27 a	69 a
TF3770A	0.015	16 a	25 a	22 a	71 a
TF3770A	0.015	16 a	26 a	29 a	72 a

Means followed by same letter do not significantly differ (Duncan's MRT, P=.05)

#151

STUDY DATA BASE: CA40-93-P805

CROP: Spring wheat, cv. Leader

PEST: Naturally occuring foliar diseases

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TITLE: CROP TOLERANCE WITH HEXACONOZOLE AS A SEED TREATMENT FUNGICIDES IN SPRING WHEAT II

MATERIALS: ICIAO523 (hexaconazole; 5 g/L; TF 3770A

METHODS: Seed was separated into 200 gram lots and treated using a mini-rotostat seed treater. The treatments were seeded at a rate of 33 seeds/m row, using a Kincaid Precision Cone-Seeder, into heavy clay, near Carman, Manitoba, on May 5, 1993. Each treatment consisted of four rows, 6 m in length. Each treatment was replicated three times in a Complete Randomized Block Design field plot. All treatments were assessed for seedling emergence, on 16/05 (11 Days After Planting (DAP)), 20/05 (15 DAP) and 26/05 (21 DAP). Heads/m row (mrow) counts were conducted on 13/08 (100 DAP).

RESULTS: As presented in Table 1.

CONCLUSIONS: Emergence was not effected with the use of HEXACONAZOLE. Heads/mrow decreased, but not significantly, with the use of HEXACONAZOLE.

Table 1.

TREATMENT	RATE g ai/kg seed	Seedling counts (mrow)			Heads/mrow
		16/05	20/05	26/05	13/08
CHECK		18 a	20 a	20 a	83 a
TF3770A	0.010	18 a	19 a	22 a	77 a
TF3770A	0.0125	17 a	21 a	21 a	76 a
TF3770A	0.015	19 a	20 a	22 a	77 a
TF3770A	0.020	16 a	20 a	19 a	80 a

Means followded by same letter do not significantly differ (Duncan's MRT, P=.05)

#152

STUDY DATA BASE: 303-1412-8909

CROP: Spring wheat, cv. Katepwa and Belvedere;
Oats, cv. Nova

PEST: Oats - speckled leaf blotch (*Septoria avenae*)
Wheat - powdery mildew (*Erysiphe graminis f. sp. tritici*), leaf and glume blotch (*Septoria nodorum*)

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TITLE: EFFECTS OF FUNGICIDE SEED TREATMENTS ON PERFORMANCE OF SPRING WHEAT ANDOATS

MATERIALS: TF 3770 (hexaconazole 12.5 g/L), TF 3770A (hexaconazole 5 g/L), TF 3794 (paclobutrazol 2.0 g/L), BAYTAN 30 (triadimenol 317 g/L), 80318 (paclobutrazol 0.2 g/L), UBI 2454-1 (sisthane 50 g/L), VITAFLO 280 (carbathiin 167 g/L + thiram 148 g/L), VITAFLO 250 (carbathiin 254 g/L).

METHODS: Certified seed of Katepwa and Belvedere spring wheat and Nova oats were treated with the above materials at rates listed in the table using a laboratory small batch rotary seed treater. Field plots were established on 18 May 1993 at Harrington, P.E.I. using for wheat a split-plot design, four replicates, with main plots as treatments and cultivars as sub-plots. Oats were seeded in a separate randomized complete block with four replicates. All plots were eight rows wide, 5 m long and separated by two rows of barley. Data were recorded on emergence, leaf disease severity and yield. Harvest was completed at crop maturity using a Hege small plot combine and data reported on the basis of 14% moisture.

RESULTS: Wheat emergence was improved by both Vitaflo 280 and Baytan. Mean mildew ratings were 4.0 for Belvedere which was significantly lower than the rating of 7.1 for Katepwa. TF3770A at the 0.15 rate and both rates of TF3794 reduced mildew on Katepwa but not on the more resistant Belvedere. Septoria leaf blotch was similar in severity on both cultivars and seed treatment applications did not alter severity. Wheat grain yield and seed weight were little affected by seed treatment, were negatively correlated with emergence and mildew severity, but not with the Septoria disease. Emergence, severity of *S. avenae* leaf blotch, and yield parameters of oats were not influenced by the seed treatments.

CONCLUSIONS: TF 3770A and TF3794 seed treatments may have potential for controlling powdery mildew of spring wheats, especially on the more susceptible cultivars. The *Septoria* diseases of oats and wheat, which appear later in the season than powdery mildew, do not appear to be controlled by seed treatments as used in this trial.

Table 1. Effect of fungicide seed treatments on disease severity and 1000 kernel weight of spring wheat.

		Wheat			1000 Kernel weights(g)		
	Rate	Mildew		Blotch*	Wheat		Oats
Treatment	g ai/kg	Belvedere	Katepwa		Belvedere	Katepwa	Ultima
Control	nil	3.6	7.5	3.6	36.7	30.7	31.9
TF 3770	15	4.0	7.0	3.8	36.7	29.5	31.5
TF 3770A	10	4.3	7.6	4.0	35.9	29.0	31.7
TF 3770A	15	3.9	6.8	4.1	35.9	29.3	30.9
TF 3794	0.01	3.8	6.4	4.0	34.7	29.7	31.3
TF 3794	0.02	3.3	5.8	4.2	35.4	30.0	30.6
Vitaflo 250 + UBI 2454-1	3.15*	4.0	7.0	4.3	35.8	30.6	32.0
80318	25	4.3	7.5	3.7	36.0	29.0	31.3
80318	50	4.1	7.9	3.9	35.5	28.9	31.8
80318	600	3.8	7.5	4.0	36.8	29.0	31.3
Vitaflo 280	3.3*	4.6	7.6	3.6	33.4	29.0	32.1
Baytan	30	4.4	7.3	4.1	34.5	29.0	31.5
LSD (0.05)		0.60	0.60	NS	NS	NS	NS

* Blotch, mean of both cultivars.
** Total ai/kg seed.

1993 PEST MANAGEMENT RESEARCH REPORT

#153

CROP: Winter wheat, cv. Absolvent and Borden

PEST: Powdery mildew, *Erysiphe graminis* D.C.: Merat f. sp. *tritici* Em. Marchal

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TITLE: RESISTANCE TO THE FUNGICIDE TRIADIMEFON IN POPULATIONS OF *ERYSIPHE GRAMINIS* F. SP. *TRITICI*

MATERIALS: BAYLETON 50 WP (triadimefon)

METHODS: Powdery mildew infected winter wheat plants (cvs. Borden and Absolvent) were collected from fields with and without a history of triadimefon treatment in both the Annapolis Valley and the Colchester County regions of Nova Scotia. Mildew from these plants was transferred to host plants growing in test tubes as follows. Wheat seedlings of the two cultivars were grown in capped 25 x 250 mm glass test tubes. Each test tube was filled with 20 mL of perlite and 10 mL of Hoagland's solution. Wheat seeds were surface sterilized, pregerminated for 12 hours, and transferred to the tubes by placing 5 pregerminated seeds on the surface of the perlite in each tube. The tubes were then incubated in a growth chamber at 18 degrees C and 12 h daylight at 15 000 - 20 000 Lux. The night temperature was 15 degrees C. Plants were inoculated as soon as the first leaf was fully expanded (about seven days). Inoculum was prepared by excising small sections of field-grown leaf, each bearing a single pustule, and adding this to each tube containing five seedlings. The tubes were capped and shaken on a rotary shaker to disseminate the conidia. The tubes were incubated as described previously. Approximately 14 days after inoculation, when pustules were sporulating, 30 isolates from both varieties, both treatments (fungicide and no fungicide) and both locations (240 isolates in total) were evaluated for sensitivity to triadimefon. Old spores on plants growing in test tubes were dislodged from the leaves by shaking the tubes one day before inoculating the plants to be used in the sensitivity tests. Plants to be used in the sensitivity tests were treated with either 0, 0.1, 1, 10 or 100 ppm active ingredient triadimefon. The fungicide had been diluted with a suspension of blank formulation of Bayleton and sprayed with an atomizer operated by compressed air onto seedlings with a fully expanded first leaf growing as above in test tubes. Twenty-four hours after spraying, these plants were inoculated by removing 20 leaf sections, each with 3-5 similar-sized mildew pustules from each of the 240 isolates to be tested, and placing two of these leaf sections into each of the tubes containing the sprayed plants (2 replicates x 5 fungicide concentrations). After inoculation, tubes were capped, shaken and incubated as described previously. After two weeks, sporulating pustules formed on the primary leaf were counted under an illuminated 2x magnifying lens. Mean numbers of pustules on the primary leaf of five seedlings per test tube (2 tubes/isolate) treated with the various doses of triadimefon were then recorded. In addition, standard area diagrams were used to estimate the proportion of leaf area infected with powdery mildew, and expressed as percentages of the control treatment.

RESULTS: At 10 ppm, the frequency of *E. graminis* isolates resistant to triadimefon was higher in samples collected from the triadimefon-treated Absolvent field in the Annapolis Valley (90%) than in samples from the untreated field in that region (63.3%). A similar trend occurred in Colchester County, but the frequency of resistant isolates from both treated and untreated fields was lower, 50 and 6.7% respectively. On Borden in the Annapolis Valley, 68.7% of isolates collected from a treated field were resistant, whereas only 53.3% of the isolates from an untreated field were resistant to 10 ppm triadimefon. At the same concentration in Colchester County, 3.85% of isolates collected from a treated Borden field were resistant and none of the isolates collected from an untreated field were resistant.

CONCLUSIONS: These results indicate that the populations of *E. graminis* f. sp. *tritici* from the Annapolis Valley, where triadimefon has been used intensively for several years, had a higher proportion of isolates resistant to triadimefon than those from Colchester County, where wheat culture is less intensive. In addition, the wheat cv. Absolvent was more susceptible to resistant isolates than cv. Borden, since lower percentages of resistant isolates were observed in Borden fields. There was a higher proportion of resistant isolates in fields sprayed with triadimefon than in unsprayed fields.

#154

CROP: Wheat, cv Katepwa

PEST: *Septoria* spp.

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TITLE: EARLY APPLICATION OF DITHANE DG ALONE AND TANKMIXED WITH DICLORPROP/2,4-D FOR CONTROL OF SEPTORIA IN HARD RED SPRING WHEAT

MATERIALS: DITHANE 75% DG (mancozeb), ESTAPROP 582 EC (diclorprop 300 g/L and 2,4-D ester 282 g/L)

MATERIALS: The trial was seeded to Katepwa spring wheat on May 19 at a rate of 110 kg/ha with 60 kg/ha of nitrogen (46-0-0) and 30 kg/ha of phosphate (11-51-0) applied with the seed. Seeding was with a Concord air seeder that had a row spacing of 25 cm, 5 cm wide seed band, and a seeding depth of 3 cm. The trial was a randomized complete block with four replicates and a plot size of 2 x 7.5 m. Fungicide treatments were applied on three separate dates, the first using a push type sprayer, and the second 2 using a backpack sprayer. All sprayers were powered by compressed air and delivered 100 L/ha at 275 kPa using Lurmark 80015 nozzles at 50 cm spacing. Applications were made June 18 at Zadoks 13-14/21 (plants disease free), July 23 at Zadoks 50-55 (lower leaves greater than 50% infected, flag leaf disease free), and August 6 at

Zadoks 65 (flag leaf approximately 10% infected). Fungicide applications on June 18 were tankmixed with Estaprop. Wheat plants in each plot were visually assessed for disease level on August 6, August 12 and August 25 and results recorded as percent flag leaf area infected. Plots were harvested on Sept. 17 with a small plot combine and yields reported at 14.5% moisture.

RESULTS: Results are presented in the table.

CONCLUSIONS: Dithane applications increased grain yields significantly, with the highest yields on plots recieving early and late applications. Early applications had less effect on yield than late applications. Tank mixing with Estaprop did not result in any phytotoxicity.

Table 1. Effects of fungicide application on levels of Septoria spp. in Katepwa wheat at Minto, Manitoba in 1993. *

Treatment	Rate kg/ha ai	Wheat Stage Zadoks	Wheat Phytotoxicity % control	% flag leaf infected Aug. 6	Aug. 12	Aug. 25	Wheat yield kg/ha
1. Estaprop	1.02	13-16	0 a	14 a	83 a	100 a	2173b
2. Estaprop/	1.02/	13-16					
Dithane **	0.84		0 a	9 b	83 a	100 a	2143b
3. Estaprop/	1.02/	13-16	0 a	6 b	23 b	88 a	2712a
Dithane **	0.84						
+Dithane	0.84	55-59					
+Dithane	0.84	65					
4. Estaprop	1.02	13-16	0 a	8 b	35 b	88 a	2624a
+Dithane	0.84	55-59					
+Dithane	0.84	65					

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

** Applied as a tank mix at Zadoks 13-16.

DISEASES OF ORNAMENTALS AND GREENHOUSE / MALADIES DES PLANTES ORNEMENTALES ET DE SERRE

Section Editor / Réviseur de section : G. Platford

#155 REPORT NUMBER / NUMÉRO DU RAPPORT

CROP: Creeping bentgrass, *Agrostis palustris* Huds.

PEST: Dollar spot, *Lanzia* or *Moellerodiscus sp.*

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TITLE: CHEMICAL TRIALS FOR DOLLAR SPOT DISEASE CONTROL, SUMMER, 1993

METHODS: Twenty-four treatments were evaluated on a 16-year-old sward of creeping bentgrass at the Cambridge research station of the University of Guelph near Cambridge, Ontario. Turfgrass cultural treatments were similar to those used for maintenance of golf course putting greens in Ontario. Experimental design consisted of a randomized complete blocks with 4 blocks. Each treatment plot measured 1 x 2 m. Control of dollar spot disease was evaluated. Inoculum was prepared by incubating the fungus on autoclaved cereal grains (chicken scratch) for two to three weeks. The inoculum was dried overnight and chopped with a mixer into small particles. Inocula from 5 strains of the fungus were mixed together, and 2 g were evely spread onto to each plot two days after fungicide applications. Fungicide treatments were first applied on 7 July 1993, with a wheel-mounted compressed air boom sprayer at 140 kPa. Fungicides were re-applied on a seven day, 14-day, 21-day, or 28-day schedule over a nine week period. Dollar spot disease was evaluated weekly for ten weeks, by estimating number of infection centres per 1 x 2 m plot. Significant yellowing due to phytotoxicity was noted if present. Analysis of variance was performed with PROC ANOVA in SAS®. When a significant treatment effect was found, mean separation was done with the test of least significant difference (LSD). Ten spots/2 m^2 was used as the criterion for efficacious control of dollar spot disease.

RESULTS: The latter part of the 1993 growing season was typical for southern Ontario, with a few extremely warm humid days interspersed among relatively mild days with highs between 20 degrees C and 25 degrees C. Counts for dollar spot disease in the 1 x 2 m plots are presented in Table 1. No phytotoxicity was observed. The first chemical applications were on 7 July, with fungal inoculations following two days later. The last chemical treatments were applied 25 August. For inoculated plots, disease pressure was extremely high from 11 July onward.

CONCLUSIONS: Among the standards, Rovral Green showed excellent control of disease throughout most of the trial. Daconil 2787 (180 mL - 14 days) suppressed disease levels but did not provide an aesthetically acceptable level of control until the later half of the test. Tersan

1991 surprisingly showed poor control of dollar spot disease for most of the test. Resistance to benzimidazoles in a location near these trial plots had been reported almost ten years ago, with little use of benzimidazoles since that time. For the ISK Biotech chemicals, Daconil 2787 (90 mL - 7 days) provided better control than the double rate at 14 days. Daconil 825 (54 g - 7 days) provided a similar level of control as the lower rate of Daconil 2787: both were acceptable for most of the test. Among the three rates of Fluazinam, the highest rate (45 mL - 28 days) provided the best control, and was acceptable through most of the test. The two lower rates were not able to contain the disease to within an aesthetically acceptable level for most of the test. The higher rate of the Daconil 2787 + Fluazinam combination (175 mL + 30 mL - 28 days) was able to acceptably suppress the disease for most of the test while the lower rate (120 mL + 20 mL - 21 days) did not. Scotts ProTurf was unable to control the disease to an acceptable level. The Fisons/Sun-Gro product, Banner 130 EC, was able to acceptably control the disease throughout the test after the first two weeks. Among all products tested Banner 130 EC provided the greatest efficacy, in achieving more "0" counts than any other treatment. The higher rate (58 mL) with the longest treatment interval (28 days) showed the least effective control, but it was still acceptable for most of the test. The Rohm & Haas product, Nova, was acceptable at the two higher rates (20 g - 14 days, 30 g - 21 days), but showed acceptable control on only half the days at the lowest rate (15 g - 14 days). Fore did not provide an acceptable level of control. The Sustane treatments were fertilizers. These formulations did not provide acceptable control of dollar spot disease, although in many cases, the disease level was less than half of that of the inoculated control.

Table 1. Treatment, application rate and schedule, and counts of dollar spot disease during nine weeks beginning 7 July, 1993. All chemically treated plots were inoculated two days after first treatment, and counts are expressed as number of infection centres in 1 m by 2 m plots based on four replicates.

Treatment	Rate (product /100 m2)	Interval (days)	Dollar spot counts Jul 7	Jul 14	Jul 21	Jul 28	Aug 4	Aug 11	Aug 18	Aug 25	Sep 1	Sep 8
Uninoculated			3	24	41	58	44	103	106	150	240	63
Inoculated	200 g		3	36	45	58	56	173	280	325	350	98
Daconil 2787	180 ml	14	2	21	11	22	15	18	7	2	3	14
Rovral Green	60 ml	14	2	20	10	11	3	3	0	2	0	28
Tersan 1991	30 g	21	3	16	20	28	28	45	40	66	83	2
Daconil 2787	90 ml	7	5	22	15	24	7	3	1	0	0	45
Daconil 825	54 g	7	7	24	22	31	14	6	1	0	0	14
Fluazinam	15 ml	14	5	20	12	26	12	10	4	6	6	17
Fluazinam	20 ml	21	2	16	11	17	18	8	3	28	22	2
Fluazinam	45 ml	28	1	16	2	3	1	17	4	1	3	1
Daconil 2787+	175 ml											
Fluazinam	30 ml	28	4	20	4	5	8	31	16	0	6	4
Daconil 2787+	120 ml											
Fluazinam	20 ml	21	5	22	12	20	23	9	2	14	11	11
Scotts ProTurf	660 g	14	9	31	41	44	59	101	70	130	185	63
Banner 130	31 ml	14	2	16	1	4	1	0	0	0	0	16
Banner 130	58 ml	14	2	22	4	1	0	0	0	0	0	1
Banner 130	31 ml	21	4	20	5	3	1	0	0	0	1	34
Banner 130	58 ml	21	4	16	7	6	4	2	0	0	0	0
Banner 130	58 ml	28	3	20	6	4	2	14	6	0	0	31
Nova	15 g	14	3	22	8	17	11	11	1	1	0	18
Nova	20 g	14	3	19	9	15	6	6	1	1	1	6
Nova	30 g	21	5	27	10	20	16	2	0	0	0	2
Fore	400 mL	7	5	29	33	40	29	37	19	53	93	18
Sustane 5-2-4	9.8 kg	28	3	28	20	21	30	120	45	160	153	30
Sustane 5-2-4	14.6 kg	28	3	26	33	43	50	128	101	245	300	83
Sustane 5-2-4	19.5 kg	28	4	36	40	40	61	156	118	160	225	50
Sustane 10-2-10	4.9 kg	28	5	32	25	25	33	110	36	145	200	46
PROTECTED LSD (P = 0.05)			-	-	18	21	17	33	39	41	80	30

1993 PEST MANAGEMENT RESEARCH REPORT

#156

CROP: Creeping bentgrass, *Agrostis palustris* Huds.

PEST: Gray snow mould *Typhula spp.;* pink snow mould, *Fusarium nivale*

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TITLE: CHEMICAL TRIALS FOR SNOW MOULD DISEASE CONTROL, DEC 1992 - APRIL 1993

METHODS: Chemical and control treatments were evaluated on a 15-year-old sward of creeping bentgrass at the Cambridge research station of the University of Guelph near Cambridge, Ontario. Turfgrass cultural treatments were similar to those used for maintenance of golf course putting greens in Ontario. Experimental design consisted of a randomized complete block design with six replications on 1 x 1.5 m plots. The snow mould diseases were evaluated in fungicide trials. Inoculum was prepared by incubating the fungi on autoclaved cereal grains (chicken scratch) for 1 month (pink) and 3 months (grey). The inoculum was dried overnight and chopped with a mixer into small particles. Inoculum from five strains of the grey snow mould fungus were mixed together, combined with another 9 parts dried, autoclaved and chopped cereal grains, and 15 g were evenly applied to each plot. Pink snow mould inocula was similarly formulated and applied. Inocula were applied three days after spraying. Water based-treatments were applied on 1 December 1992, with a wheel-mounted compressed air boom sprayer at 140 kPa and 10 L/100 m^2. Granular treatments were applied by hand. The diseases were evaluated after snow melt (late-March) by estimating percent area affected. A single treatment of Daconil 2787 + Fluazinam was applied twice, once before snowfall, and once after snowmelt. Ratings were repeated weekly for five weeks to evaluate disease severity, and green-up during the last two weeks. Analysis of variance was performed with PROC ANOVA in SAS®. When a significant treatment effect was found, mean separation was done with the test of least significant difference (LSD). Twenty percent area affected or less was used as the criterion for efficacious control of snow mould diseases.

RESULTS: A three-month uninterrupted snow cover during the 1992-93 season caused a greater disease pressure than normally experienced. Several treatments were inefficacious or borderline probably due to these conditions. Snow fall and snow cover are critical in the development of winter diseases, particularly grey snow mould. Tabulated results are presented in Table 1.

CONCLUSIONS: The standard chemicals for snow mould control were all found to reduce disease significantly with the exception of Tersan 1991 which showed failure in controlling snow mould damage. Tersan 1991 is recommended for control of pink snow mould, but not for grey snow mould. There was a great deal of grey snow mould damage on the Tersan plots as well as adjacent non-protected areas on the green. Rovral Green at a rate of 360 mL was found to have borderline control. Daconil 2787 at

240 mL alone or with Rovral Green at various rates showed acceptable to borderline control. Interestingly, Daconil 2787 (240 mL) plus Rovral Green (120 mL) applied twice (92/12/1, 93/4/7) gave much quicker recovery of the turf. Daconil 825 (145 g) plus Rovral Green (120 mL) showed a similar pattern of enhanced recovery. Daconil 2787 (240 mL) in combination with Fluazinam (60 mL) gave excellent control. Daconil 2787 (240 mL) combined with Fluazinam (90 mL) was the most effective among all the treatments. Banner 130EC provided excellent control at both rates. Sustane at 9.8 kg was effective in controlling snow mould damage, probably by enhancing recovery. Sustane at 14.6 had greater levels of damage right after snwomelt, but allowed recovery to an acceptable level by the fifth week. The effect of Sustane + Polyon was not considered satisfactory. Vigoro IBDU:Urea + 15.4% Quintozene and Vigoro IBDU:SCU + 15.4% Quintozene were efficacious in the control of snow moulds. Fore provided satisfactory snow mould control by the fifth week. Nova at both 15 and 30 g reduced disease significantly from control, but did not provide acceptable levels of control. The greenness of the plots was confounded by the amount of brown diseased tissue present, but in general, the Sustane products showed the highet levels of greenness and permitted significantly enhanced rates of recovery compared to inoculated or uninoculated controls.

Table 1. Area affected and green-up of snow mould patches after snow melt. All treated plots were inoculated with *Typhula* spp. or *Fusarium nivale* and disease counts are expressed as the mean of the estimated percent area affected in six replicate 1 m by 1.5 m plots.

Treatment	Rate (product /100 m2)	Percent area affected 3/31	4/7	4/14	4/21	4/28	Green-up* 4/21	4/28
inoculated check		81	71	69	43	40	2.2	1.8
uninoculated check		68	54	57	49	46	2.3	2.0
ARREST 75 W	250 g	40	25	25	13	14	2.3	2.0
DACONIL 2787	512 mL	19	18	23	13	8	1.7	1.5
ROVRAL GREEN	360 mL	37	39	38	21	19	2.0	2.2
SCOTTS FFII	1.55 kg	8	7	7	5	6	1.8	1.8
TERSAN 1991	125 g	79	67	68	54	45	2.2	2.3
DACONIL 2787 +FLUAZINAM	240 mL 60 mL	2	6	6	5	5	2.3	2.3
DACONIL 2787 +FLUAZINAM	240 mL 90 mL	0	2	1	2	2	2.7	1.8
DACONIL 2787 +ROVRAL GREEN	240 mL 240 mL	38	27	31	23	23	1.8	1.7
DACONIL 2787	240 mL	28	25	24	19	18	2.2	2.3
ROVRAL GREEN	360 mL	29	23	27	25	22	2.0	1.8
DACONIL 2787 +ROVRAL GREEN (PRE&POST SNOW)	240 mL 120 mL	24	16	21	12	12	2.2	1.8
DACONIL 825 +ROVRAL GREEN	145 mL 120 mL	23	21	28	16	15	1.8	2.0
BANNER 130 EC	168 mL	4	12	10	9	9	1.7	1.5
BANNER 130 EC	224 mL	5	9	9	8	7	1.8	2.5
SUSTANE (5-2-4)	9.8 kg	19	21	16	11	11	2.8	3.0
SUSTANE (5-2-4)	14.6 kg	48	45	43	23	20	2.8	2.7
SUSTANE (10-2-10) +POLYON	4.9 kg	46	48	44	25	25	2.2	2.3
VIGORO (+UREA)	1.5 kg	24	18	20	17	13	2.0	1.7
VIGORO (+SCU)	1.5 kg	8	9	8	7	7	2.0	2.2
NOVA	15 g	28	32	29	27	25	1.5	1.7
NOVA	30 g	46	43	40	28	23	2.5	2.5
FORE	250 g	30	32	30	23	17	2.2	1.8
PROTECTED LSD (P =0.05)		29	26	24	18	15	0.9	0.8

* GREEN-UP, 1 = low greenness, 2 = moderate greenness, 3 = high greenness

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

#157

CROP: Perennial ryegrass, *Lolium perenne* L.

PEST: Red thread, *Laetisaria fuciformis* (McAlp.) Burds.

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TITLE: CHEMICAL TRIALS FOR RED THREAD DISEASE CONTROL, SUMMER, 1993

METHODS: Eight chemical treatments were applied to a 3-year-old sward of perennial ryegrass at the Cambridge research station of the University of Guelph near Cambridge, Ontario. Turfgrass cultural treatments were similar to those used for maintenance of sports fields in Ontario. Experimental design consisted of a randomized complete block design with four replications. Each treatment plot measured 1 x 2 m. High levels of natural infection were seen in late spring and persisted into summer. Fungicide treatments were first applied on 12 August 1993, with a wheel-mounted compressed air boom sprayer at 140 kPa. Fungicides were re-applied on a seven day, 14-day, or 28-day schedule according to specifications over a five week period. Red thread disease was evaluated every week, by estimating percent area affected in each 1 x 2 m plot. Significant yellowing due to phytotoxicity was noted if present. Analysis of variance was performed with PROC ANOVA in SAS®. When a significant treatment effect was found, mean separation was done with the test of least significant difference (LSD). Ten percent area affected was considered an acceptable level of disease and was used as the criterion for efficacious control of red thread disease.

RESULTS: Heavy levels of red thread infection were seen in the summer of 1992 due to the extremely wet and cool conditions. This was atypical for southern Ontario which usually experiences red thread symptoms (if at all) in mid-fall. An increased incidence of red thread was again observed in 1993. The beginning of the 1993 growing season was extremely wet and cool, and thus provided much better conditions for red thread disease than normally encountered. The red thread infections persisted throughout the latter half of summer 1993 even though it was much warmer and drier. Counts for red thread disease in the 1 by 2 m plots are presented in Table 1. No phytotoxicity was observed. By the second week after spraying (25 August), all fungicide treatments showed general decreases in disease, and statistically significant reductions in disease were seen with the following treatments: Daconil 2787, Fluazinam, and Fore. By the fourth week (9 September) all remaining treatments (Banner 130EC, Dyrene, Nova, Rovral Green, and Tersan 1991) also showed statistically significant reductions from untreated control, and all chemical treatments were considered aesthetically acceptable. These statistically significant differences were again seen on the fifth week (15 September), at which time the experiment was terminated. Active ingredients which are registered and recommended for control of red thread in the U.S. include chlorothalonil, mancozeb and thiophanate-methyl. There are no chemicals registered for red thread control in Canada. For southern Ontario, cultural management of red thread is usually sufficient to contain the disease. Moderate levels of nitrogen are usually able to contain or mask the infections. However, the disease is known on well-fertilized turf, and is thought to be increasing in severity and distribution in the U.S.

CONCLUSIONS: All fungicides treatments were found to significantly reduce levels of red thread disease compared to untreated control. Aesthetically acceptable levels of disease were achieved three to four weeks after initial chemical applications.

Table 1. Percent area affected by red thread disease, application rate and spray schedule during five weeks beginning 12 August, 1993. Counts are derived from the mean of four replicate 1 m by 2 m plots.

Treatment	Rate (product /100 m^2)	Interval (days)	Percent area affected					
			8/12	8/20	8/25	9/4	9/9	9/15
BANNER 130 EC	31 mL	14	29	24	19	14	6	8
BANNER 130 EC	62 mL	14	24	14	13	8	6	8
DACONIL 2787	90 mL	7	30	26	12	10	4	4
DYRENE 4	162 g	14	28	21	20	16	8	9
FLUAZINAM	15 mL	14	26	18	11	4	1	6
FORE	400 g	7	21	11	10	4	7	2
NOVA	20 g	14	23	18	15	5	5	8
ROVRAL GREEN	60 mL	14	28	15	16	4	4	8
TERSAN 1991	30 g	14	28	28	19	19	8	8
untreated			26	24	24	21	24	23
.								
PROTECTED LSD (P=0.05)			11	19	12	14	8	8

NEMATODES / NÉMATODES

Section Editor / Réviseur de section : J.W. Potter

#158 REPORT NUMBER / NUMÉRO DU RAPPORT

ICAR: 86000190

CROP: Carrot, cv. Cellobunch

PEST: Root knot nematode, *Meloidogyne hapla*;
Pin nematode, *Paratylenchus* sp.

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TITLE: EVALUATION OF FOSTHIAZATE FOR NEMATODE CONTROL ON CARROTS

MATERIALS: FOSTHIAZATE 900 EC

METHODS: Carrots were seeded on May 8, 1993 in a commercial field with a history of root knot nematode infestation, in the Holland Marsh. A randomized complete block arrangement with four blocks per treatment was used. Each replicate consisted of four rows, 5 m in length. FOSTHIAZATE 900 EC was applied on June 22 at 2,4 and 6 kg ai/ha as a soil drench in 225 L/ha of water. An untreated check was also included. Soil samples were taken before seeding and at harvest October 7 and were analyzed for nematode populations at Agriculture Canada, Vineland Station, Ontario. Evaluation of nematode damage was done on October 14 on carrots in the center 2 m of row of each replicate. A root knot nematode gall index from 0 (no damage) to 5 (severe forking and galls) was used to estimate nematode damage. There was no sign of phytotoxicity after the FOSTHIAZATE 900 EC treatments were applied.

RESULTS: As presented in Table 1.

CONCLUSIONS: There were no significant differences among treatments although numerically the FOSTHIAZATE 900 EC 2.0 kg ai/ha had the lowest percent damage. No significant differences in yield were found, indicating that the FOSTHIAZATE 900 EC was not phytotoxic to carrots.

Table 1. Evaluation of FOSTHIAZATE as a nematicide when used as a drench on carrots.

Treatment	May 1993 nematodes/kg	Yield (kg)	Percent marketable	Percent damage	Gall index (0-5)
Check	180.0a*	15.2a	94.1a	3.8a	1.6a
FOSTHIAZATE 900 EC 2.0 kg ai/ha	80.0b	16.3a	95.6a	1.9a	1.4a
FOSTHIAZATE 900 EC 4.0 kg ai/ha	75.0b	16.1a	95.1a	2.6a	1.4a
FOSTHIAZATE 900 EC 6.0 kg ai/ha	57.5b	15.4a	92.7a	4.7a	1.4a

* Numbers in a column followed by the same letter are not significantly different at P=0.05, Protected L.S.D. Test. Data was subjected to an Arcsin transformation for analysis; untransformed data are presented in the table.

RAPPORT DE RECHERCHE SUR LA LUTTE DIRIGÉE 1993

RESIDUE STUDIES / ÉTUDES SUR LES RÉSIDUS

Section Editor / Réviseur de section : B.D. Ripley

#159 REPORT NUMBER / NUMÉRO DU RAPPORT

STUDY DATA BASE: 387-1431-8312

CROP: Groundwater (barley)

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TITLE: SEASONAL VARIATION IN HERBICIDES DETECTED IN SOUTHERN ALBERTA GROUNDWATER

MATERIALS: 2,4-D, MCPA, bromoxynil, diclofop-methyl, triallate.

METHODS: The study was conducted on a partially irrigated, continuously cropped (barley), 1-ha field at the Lethbridge Research Station. The soil is a clay loam. Because different rates of feedlot manure have been applied annually since 1973, the 0-15 cm organic matter content is 2-13%. MCPA, 2,4-D, bromoxynil, diclofop-methyl, and triallate had been applied at recommended rates over the previous six years. Mean annual rainfall is 405 mm; mean annual irrigation is 100 mm. The water table is at 0.5-3 m depth on the irrigated half of the field, and 3-5 m on the non-irrigated half. In 1992, 2,4-D was applied on June 23, the site was irrigated on July 15, bromoxynil/diclofop-methyl was applied on Sept. 28, and the site was irrigated again on Sept. 29/30. The groundwater (pH 7.8) was sampled from a grid of eight sites, with 6-m PVC and stainless steel wells at each site. Wells were purged and allowed to recharge with 'fresh' groundwater for 24-48 h before sampling with a baler. One liter samples were collected from four sites on June 17, eight sites on July 6, five sites on July 20, and five sites on October 8. Samples were held in glass bottles at 4 C until analysis one to two weeks later by Enviro-Test Labs, Edmonton, AB, using a MSD-GC with selected ion monitoring. The minimum quantifiable limits were 0.1-0.2 ppb with 70-132% method recovery.

RESULTS: See the Table. Seasonal variation is evident in the results. Most levels detected were well below the Environment Canada drinking water guidelines, except as noted for bromoxynil and diclofop-methyl.

CONCLUSIONS: High levels of herbicides can occur in the groundwater under a 'worst case' scenario where an irrigation or a heavy rainfall occurs immediately after a herbicide application.

Date	Detections, no. & levels*	Herbicides detected in the groundwater: MCPA	2,4-D	Bromoxynil	Diclofop**	Triallate
June 17	No. detections	0/4	0/4	0/4	0/4	0/4
	Levels (ppb)	nd	nd	nd	nd	nd
July 6	No. detections	0/8	3/8	3/8	2/8	3/8
	Levels (ppb)	nd	0.2-5.2	0.1-0.2	0.1-0.2	0.1-0.2
July 20	No. detections	1/5	3/5	0/5	0/5	0/5
	Levels (ppb)	0.2-0.3	0.1-0.8	nd	nd	nd
Oct. 8	No. detections	0/6	3/6	4/6	1/6	0/6
	Levels (ppb)	nd	0.1-3.1	0.1-8.4***	0.3-11***	nd

* No. detections expressed as no. sites with herbicide detected/total no. sites sampled.
** Diclofop-methyl was detected as the acid form, diclofop.
*** Some detections exceeded the drinking water guidelines of 5 ppb for bromoxynil and 9 ppb for diclofop-methyl.

#160

ICAR: 84100737

CROP: Chinese broccoli, var. Guy Lon

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TITLE: INSECTICIDE RESIDUE IN CHINESE BROCCOLI

MATERIALS: DIAZINON(R) 500 EC (diazinon), AMBUSH(R) 500 EC (permethrin), RIPCORD(R) 400 EC (cypermethrin).

METHODS: Chinese broccoli was transplanted on muck soil. Each plot consisted of three rows, 6 m long, replicated four times. The treatments were applied at the rate of 500 L of water/ha with a tractor-mounted sprayer. Diazinon, permethrin and cypermethrin were applied at the rate of 750, 70 and 50 g ai/ /ha, respectively. The crop was treated prior to harvest and sampled at various intervals when the crop was mature. Samples were analyzed for residue (methods of analyses available on request).

RESULTS: As presented in the table.

CONCLUSIONS: On day 14, the residue of diazinon was below the 0.1 mg/kg ("negligible") residue limit. By day eight, residue of permethrin and cypermethrin were below the maximum residue limit (MRL) of 0.5 mg/kg for broccoli. The residue of permethrin and cypermethrin decreased below 0.1 mg/kg ("negligible") residue limit by day 14 and 10, respectively.

Table 1. Residue of diazinon, permethrin and cypermethrin in Chinese broccoli when the insecticides were applied prior to harvest*.

	Residue in Chinese broccoli (mg/kg)**		
Days after application	diazinon	permethrin	cypermethrin
0	4.125a***	0.853a	0.753b
1	1.548bc	0.513b	0.523c
3	2.395b	1.150a	1.005a
8	0.153c	0.112c	0.123d
10	0.123c	0.121c	0.061d
14	0.021c	0.009c	0.013d

* Treated September 7, 1993, at the rate 750, 70 and 50 g ai/ha, respectively.
** Mean of four replicates.
*** Means followed by the same letter are not significantly different (P=0.05; LSD test).

#161

ICAR: 84100737

CROP: Chinese cabbage, var. Kasumi

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TITLE: FUNGICIDE RESIDUE IN CHINESE CABBAGE

MATERIALS: DITHANE(R) DG 75% (mancozeb)

METHODS: Chinese cabbage was transplanted at the Holland Marsh on muck soil. The plot consisted of four rows, 6 m long, replicated four times. The treatments were applied at the rate of 500 L/ha with a tractor-mounted sprayer. Mancozeb was applied three times at two week intervals at the rate of 2.4 kg ai/ ha. The crop was treated prior to harvest and sampled at various intervals when the crop was mature. Samples were analyzed for residue (method of analysis available on request).

RESULTS: As presented in the Table.

CONCLUSIONS: The residue of mancozeb (zineb eqivalent EBDC) decreased significantly by day 14 from the high residue deposit. By day eight, the EBDC residue was less than 7 mg/kg maximum residue limit (MRL) for cabbage. On day 19 the residue of mancozeb had not decreased below 0.1 mg/kg ("negligible") residue limit.

Residue of mancozeb (zineb equivalent EBDC) in Chinese cabbage when the fungicide was applied three times at two week intervals prior to harvest*.

Days after 3rd application	Residue in Chinese cabbage (mg/kg)** zineb eq. EBDC
0	21.3ab***
1	31.5a
5	12.0bc
8	3.75bc
14	0.395c
19	0.603c

* Treated July 28, August 10 and 25, 1993, at the rate of 2.6 kg ai/ha.
** Mean of four replicates.
*** Means followed by the same letter are not significantly different (P=0.05; LSD test).

#162

ICAR: 84100737

CROP: Onion, var. Northstar and Fortress

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TITLE: INSECTICIDE RESIDUE IN SOIL

MATERIALS: LORSBAN(R) 4E (chlorpyrifos)

METHODS: On site one, onions (Northstar) pre-treated with chlorpyrifos were transplanted in a grower's field on muck soil, April 26. Drench of chlorpyrifos was applied on the onions, May 27. On site two, onions (Fortress) were planted on muck soil with a Stan-Hay precision seeder in a bed of four double rows, 24 m long, replicated four times. Drench of chlorpyrifos was applied on the onions, June 1. For both sites the treatments were applied at the rate of 900 L water/ha with a tractor-mounted sprayer, with a flood jet 9 to 10 cm band. Chlorpyrifos was applied as a drench at the rate of 1.4 kg ai/ha. Soil was sampled with a core sampler 2 cm in diameter at five intervals after the drench treatment. For each sample date, eight samples were taken at two depths, 0 to 3 cm and 3 to 6 cm, replicated four times. Samples were analyzed for residue (method of analysis on request).

RESULTS: Residue data are presented in Table.

CONCLUSIONS: At site one, there was a difference in the residue of chlorpyrifos in the two soil sample depths by day 46; at 0-3 cm depth the residue decreased, 3-6 cm depth the residue increased. At site 2, there was no significant difference in the residue of chlorpyrifos at the 0-3 cm depth. By day 29, there was a significant increase in the residue at the 3-6 cm depth.

Table 1. Residue of chlorpyrifos in soil when the insecticide was applied as a drench treatment*.

	Residue in soil (mg/kg)**				
	Site 1***			Site 2****	
Days after 2nd drench	depth (cm) 0-3	3-6	Days after 2nd drench	depth (cm) 0-3	3-6
4	21.50ab*****	12.2b	1	20.00a	6.25c
11	25.25a	9.0b	8	18.25a	7.68cb
18	26.25a	11.25b	15	14.50a	10.40abc
33	13.83bc	10.98b	29	15.93a	13.75a
46	9.18c	19.50a	44	19.00a	11.50ab

* Treated at the rate of 1.4 kg ai/ha, drench treatment; Site one May 27, Site two June 1, 1992.
** Mean of four replicates.
*** Transplanted April 28, pre-treated prior to transplanting.
**** Seeded May 6.
***** Means followed by the same letter are not significantly different (P=0.05; LSD test).

1993 PEST MANAGEMENT RESEARCH REPORT

#163

ICAR: 84100737

CROP: Onion, var. Benchmark
Spanish onion, var. Cashe

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TITLE: DELTAMETHRIN RESIDUES IN ONIONS AND SPANISH ONIONS

MATERIALS: DECIS(R) 5.0 EC (deltamethrin).

METHODS: Three sites of onions (Benchmark) were planted on muck soil with a Stan-Hay precision seeder in a bed of four double rows, 15 m long, replicated four times. Two sites of Spanish onions (Cashe) were transplanted in a bed of four rows, 5 m long, replicated four times. The treatments were applied at a rate of 500 L water/ha with a tractor-mounted sprayer. Deltamethrin was applied at the rate of 10 g ai/ha. The crop was treated prior to harvest and sampled at various intervals during harvest maturity. Samples were analyzed for residue (method of analyses available on request).

RESULTS: Residue data are presented in table.

CONCLUSIONS: On day of application, the residue of deltamethrin was not detected below 0.001 mg/kg on onions (three sites) and Spanish onions (two sites).

Residue of deltamethrin in onions and Spanish onions when the insecticide was applied prior to harvest*.

Days after application	Residue (mg/kg)**			
	Onions***		Spanish Onions****	
	1992	1993	1992	1993
0	ND*****	ND	ND	ND
1	---	---	ND	ND
2	ND	ND	ND	ND
5	ND	ND	ND	ND
7	ND	ND	ND	ND
14	ND	ND	ND	ND

* Treated Sept. 8, 1992; Aug. 25, 1993, at the rate of 10 g a/ha.
** Mean of four replicates.
*** Two sites 1992; one site 1993.
**** One site 1992; one site 1993.
***** ND = not detected.

#164

ICAR: 84100737

CROP: Onion, var. Benchmark

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TITLE: FUNGICIDE RESIDUE IN ONIONS

MATERIALS: RIDOMIL MZ(R) 72 W (metalaxyl + mancozeb)

METHODS: The tests were done at the Holland Marsh on muck soil. For each site onions were planted with a Stan-Hay precision seeder in a bed of four double rows, 10 m long, replicated four times. The treatments were applied at the rate of 500 L water/ha with a tractor-mounted sprayer. Metalaxyl plus mancozeb was applied three times at weekly intervals at the rate of 0.156 and 1.24 kg ai/ha, respectively. The crop was treated prior to harvest and sampled at various intervals during harvest maturity. Samples were analyzed for residue (method of analyses available on request).

RESULTS: Residue data are presented in table.

CONCLUSIONS: The residue of metalaxyl was below 0.1 mg/kg ("negligible") residue limit by day nine (site one), and on day of application (site two). The residue of mancozeb (zineb equivalent EBDC) did not decrease significantly and was not below 0.1 mg/kg ("negligible") residue limit by day 14.

Table 1. Residue of metalaxyl and mancozeb (zineb equivalent EBDC) in onions when the fungicide were applied three times at weekly intervals prior to harvest*.

Days after 3rd application	Residue in onions (mg/kg)**			
	Site 1		Site 2	
	metalaxyl	zineb eq EBDC	zineb eq metalaxy	EBDC
2	ND***a****	3.550a	ND	1.500a
5	0.066a	2.950ab	ND	1.700a
7	0.128a	0.875c	0.018	0.575b
9	0.011a	0.926bc	ND	1.026ab
14	NDa	2.175abc	ND	1.275ab

* Treated August 24, 31 and September 9, 1992 at the rate of 0.156 and 1.24 kg ai/ha, respectively.
** Mean of four replicates.
*** ND = not detected.
**** Means followed by the same letter are not significantly different (P=0.05; LSD test).

#165

ICAR: 61006457

CROP: Snowpea, var. Ho Lohn Dow

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TITLE: PESTICIDE RESIDUE IN SNOWPEAS

MATERIALS: CYGON(R) 480E (dimethoate), MALATHION(R) 25% WP (malathion), DITHANE(R) M45 50 WP (mancozeb)

METHODS: Snowpeas were seeded in two-row plots 6 metres long, replicated four times. The treatment was applied at the rate of 800 L water/ha with a tractor-mounted sprayer. Dimethoate, malathion and mancozeb were applied at the rate of 1.7, 1.1 and 2.0 kg ai/ha. The crop was treated prior to harvest and sampled at various intervals during harvest maturity. Samples were analyzed for residue (methods of analysis available on request).

RESULTS: Residue data are presented in the table.

CONCLUSIONS: On day of application, the residue of dimethoate was below the maximum residue limit (MRL) of 1.0 mg/kg for peas and by day seven below 0.1 mg/kg ("negligible") residue limit. By day three, malathion was below the MRL of 2.0 mg/kg for peas and below 0.1 mg/kg ("negligible") residue limit. The residue of mancozeb (zineb equivalent EBDC) was not detected below 0.1 mg/kg by day 14.

Table 1. Residue of dimethoate, malathion and mancozeb (zineb equivalent EBDC) in snowpeas when the pesticides were applied prior to harvest*.

	Residue in snowpeas (mg/kg)**		
Days after application	dimethoate	malathion	EBDC
0	0.818a***	2.35a	25.25a
1	0.370b	2.35a	---
3	0.223b	0.178b	4.80b
7	0.052b	0.008b	1.73bc
10	0.048b	0.001b	1.83bc
14	ND****b	NDb	NDc

* Treated July 21, 1992, at the rate 1.7, 1.1 and 2.0 kg a i/ha.
** Mean of four replicates.
*** Means followed by the same letter are not significantly different (P=0.05; LSD test).
**** ND = not detected.

PESTICIDE AND CHEMICAL DEFINITION /

PESTICIDES ET DÉFINITIONS DES PRODUITS CHIMIQUES

PESTICIDE	ALTERNATIVE DESIGNATION(S)
1,3-dichloropropene	TELONE; TELONE II-B
2,4-D	2,4-D ACID; 2,4-D ACIDE; 2,4-D-ACID; 2,4-DICHLOROPHENOXYACETIC ACID; DESORMONE; DRIAMINE; FORMULA 40; UBI-2323
2,4-D dimethylamine	2,4-D-DIMETHYLAMINE
ABAMECTIN	avermectin b1
ABG-6263	*B. thuringiensis tenebrionis*
ABG-6271	*B. thuringiensis tenebrionis*
ABG-6275	*B. thuringiensis tenebrionis*
AC 303,630	confidential
AC 301,467	terbufos
ACECAP	acephate
acephate	ACECAP; ORTHENE; ORTHO-12-420
ACR-3675	pyrifenox
ACR-3815	mancozeb + pyrifenox
acrinathrin	RU-38702; RUFAST
ADMIRE	imidacloprid
AFUGAN	pyrazophos
AGRAL 90	nonylphenolethylene oxide
AGRI-MYCIN	streptomycin
AGRIDYNE	azadirachtin
AGRIKELP	seaweed
AGRISTREP	streptomycin
AGROSOL	captan + thiabendazole
AGROSOL POUR-ON	thiram + thiabendazole; AGROSOL T
AGROSOL T	thiram + thiabendazole
AGROX	maneb
AGROX B-3	B-3; captan + diazinon + lindane
AGROX D-L PLUS	captan + diazinon + lindane; AGROX DL PLUS
AGROX DB	maneb
AGROX DL PLUS	captan + diazinon + lindane
AGROX FLOWABLE	maneb
aldicarb	TEMIK
ALDRIN	HHDN
ALIETTE	fosetyl-al
allidochlor	RANDOX
ALPHA-CYPERMETHRIN	cypermethrin-alpha
AMAZE	isofenphos
AMBUSH	permethrin
amitraz	MITAC
ANCHOR	carbathiin + thiram; UBI-2359-2
anilazine	DYRENE
ANVIL	hexaconazole
APM	azinphos-methyl
APOLLO	clofentezine
APRON	metalaxyl
APRON-T	APRON-T 69
APRON-T 69	metalaxyl + thiabendazole; APRON-T

ARREST	carbathiin + oxycarboxin + thiram
ASC-66824	FOSTHIZATE
ASC-66825	experimental
ASC-66897	experimental
ASC-67089	experimental
ASC-67090	experimental
ASC-67091	experimental
ASC-67092	experimental
ASC-67093	experimental
ASC-67098	experimental
Ascophyllum nodosum extract	MICRO-MIST
ASIMICIN	Paw Paw bark extract
Asimina triloba extract	Paw Paw bark extract
ASSIST	adjuvant; ASSIST OIL; ASSIST OIL CONCENTRATE
ASSIST OIL	adjuvant
ASSIST OIL CONCENTRATE	adjuvant
atrazine	AATREX; ATRAMIX
ATROBAN	permethrin
ATROBAN DELICE POUR-ON	permethrin
avermectin b1	ABAMECTIN; AVID
AVID	avermectin b1
Azadirachta indica EXTRACT	azadirachtin
azadirachtin	AGRIDYNE; *Azadirachta indica* EXTRACT; AZADIRACHTIN SOLUTION 1; AZADIRACHTIN SOLUTION 2; MARGOSAN-O; NEEM; NEEM SOLUTION 1; NEEM SOLUTION 2; NEEMIX; SAFERS NEEM INSECTICIDE; SNI OIL
AZADIRACHTIN SOLUTION 1	azadirachtin
AZADIRACHTIN SOLUTION 2	azadirachtin
azinphos-methyl	APM; GUTHION
AZTEC	cyfluthrin + phostebupirim
B-3	captan + diazinon + lindane; AGROX B-3; CHIPMAN B-3
B. thuringiensis Berliner	*BACILLUS THURINGIENSIS*
B. thuringiensis israelensis	VECTOBAC
B. thuringiensis kurstaki	*BACILLUS THURINGIENSIS KURSTAKI*; BACTOSPEINE; CGA-237218; CONDOR; CUTLASS; DIPEL; EG-2371; FORAY; FUTURA; FUTURA XLV; JAVELIN; MYX-2284; ORGANIC INSECT KILLER LIQUID;
THURICIDE;	THURICIDE-HPC
B. thuringiensis san diego	M-ONE; M-ONE MYD; M-TRAK; MYX-9858
B. thuringiensis tenebrionis	ABG-6263; ABG-6271; ABG-6275; DITERA; NOVODOR; SAN-418; TRIDENT; TRIDENT II
BACILLUS THURINGIENSIS	*B. thuringiensis* Berliner
BACILLUS THURINGIENSIS KURSTAKI	*B. thuringiensis kurstaki*
BACTOSPEINE	*B. thuringiensis kurstaki*
BANISECT	chlorpyrifos
BANNER	propiconazole
BANVEL	dicamba
BAS-152	dimethoate
BAS-152-47	dimethoate
BAS-300	unknown

BAS-490	a strobilurine analogue
BAS-9082	fenpropathrin
BAS-9102	benfuracarb
BASIC H	unknown
BASF-152	dimethoate
BASUDIN	diazinon
BAY-HWG-1608	tebuconazole
BAY-MAT-7484	phostebupirim
BAY-NTN-19701	MONCEREN; PENCYCURON
BAY-NTN-33893	imidacloprid
BAYCOR	bitertanol
BAYLETON	triadimefon
BAYTAN	triadimenol
BAYTHROID	cyfluthrin
BELMARK	fenvalerate
benalaxyl	GALBEN; TF-3651; TF-3772; TF-3773
bendiocarb	TRUMPET
benfuracarb	BAS-9102; ONCOL
BENLATE	benomyl
benodanil	CALIRUS
BENOLIN R	benomyl + lindane + thiram
benomyl	BENLATE
bentazon	BAS-501-06; BASAGRAN; LADDOCK
BERET	CGA-142705
BERET MLX	CGA-142705 + metalaxyl
BHC	lindane
bifenthrin	BRIGADE; CAPTURE; TALSTAR
binderdispersion V-406	BINDERDISPERSION
BIODAC	adjuvant
BIRLANE	chlorfenvinphos
bitertanol	BAYCOR
BL-1104	Experimental bactericide
BORDEAUX MIXTURE	calcium hydroxide + copper sulphate
BOTRAN	dichloran
BOVAID	fenvalerate
BOVITECT	permethrin
BRAVO	chlorothalonil
BRAVO 500	chlorothalonil
BRAVO 90DG	chlorothalonil
BRAVO C/M	chlorothalonil + copper oxychloride + maneb
BRIGADE	bifenthrin
brodifacoum	VOLID
BROMINAL M	bromoxynil + MCPA; BUCTRIL M
bromoxynil	PARDNER
BUCTRIL M	bromoxynil + MCPA
BUTACIDE	piperonyl butoxide
butylate	SUTAN
calcium sulfate	GYPSUM
CALIRUS	benodanil
CANPLUS	CANPLUS 411; adjuvant
captafol	DIFOLATAN; SPRILLS; SULFONIMIDE
captan	ORTHOCIDE
CAPTURE	bifenthrin

carbaryl	SEVIMOL; SEVIN; SEVIN XLR; SEVIN XLR PLUS
carbathiin	CARBOXIN; UBI-2092; UBI-2100; UBI-2100-2; UBI-2100-4; VITAFLO 250; VITAVAX; VITAVAX SINGLE SOLUTION; VITAVAX SOLUTION
carbendazim	BAS-3460; BAVISTIN; BCM; DELSENE; DEROSAL; DPX-10; DPX-965; GRANANIT; HOE-17411; LIGNASAN-P; MBC; MCAB
carbofuran	FURADAN; FURADAN CR-10; UBI-2501
CARBOXIN	carbathiin
CARPOVIRUSINE	granulosis virus
CARZOL	formetanate
CASCADE	flufenoxuron; WL-115110
CATALYST	citric acid + fertilizers + molasses
CC-16238B	diniconazole
CC-16239	diniconazole
CC-16239A	diniconazole
CC-16348	diniconazole
CC-16359	diniconazole
CC-16378	diniconazole
CC-16394	diniconazole
CC-16395	diniconazole
CC-16461	diniconazole
CC-16462	diniconazole
CC-16464	diniconazole
CC-16481	diniconazole
CC-16488	diniconazole
CC-16553	diniconazole
CC-16555	diniconazole
CC-16557	diniconazole
CC-16558	diniconazole
CC-16681	diniconazole
CC-16683	diniconazole
CC-16685	diniconazole
CC-16687	diniconazole
CC-16688	diniconazole
CC-16696	diniconazole
CC-16697	diniconazole
CC-16698	diniconazole
CC-16699	diniconazole
CC-16700	diniconazole
CC-16859	diniconazole
CC-16860	diniconazole
CC-16862	diniconazole
CC-16864	diniconazole
CC-16865	diniconazole
CC-16866	diniconazole
CC-16867	diniconazole
CC-16882	diniconazole
CC-16896	diniconazole
CERONE	ethephon
CGA-12223	isazofos
CGA-142705	BERET
CGA-169374	DRAGAN
CGA-237218	*B. thuringiensis kurstaki*

CGA-453	A-7924-B
CGF-4280	flutolanil; NNF-136
CHARGE	cyhalothrin-lambda
chinomethionat	MORESTAN
CHIPMAN B-3	B-3; captan + diazinon + lindane
CHITOSAN	poly-d-glucosamine
chloranil	SPERGON
chlorbromuron	CHLOROBROMURON; MALORAN
chlordane	ASPON; BELT; CHLORDAN
chlorethoxyfos	DPX-42989; FORTRESS
chlorfenvinphos	BIRLANE
chlormequat	CYCOCEL
chloroneb	DEMOSAN; DPX-1823; PROTURF FII; SCOTTS PROTURF; TERSAN; TERSAN SP
chlorophacinone	ROZOL
chlorothalonil	BRAVO; BRAVO 500; BRAVO 90DG; DACONIL; DACONIL 2787
chlorpyrifos	BANISECT; DURSBAN; LORSBAN
CITOWETT	CITOWETT PLUS; adjuvant
cloak	carbathiin + lindane + thiram
cloethocarb	LANCE; UBI-2559; UBI-2562
clofentezine	APOLLO
codlemone	CODLING MOTH PHEROMONES
CODLING MOTH GRANULOSIS VIRUS	granulosis virus
CODLING MOTH PHEROMONES	codlemone
COMPANION	octylphenoxypolyethoxyethanol n-butanol
CONDOR	*B. thuringiensis kurstaki*
copper	COPAC
copper oxides	PERECOT
copper oxychloride	NIAGARA FIXED COPPER
copper salts of rosin & fatty acids	TENN-COP
copper sulphate	COPPER SULFATE
CORBEL	fenpropimorph
COUNTER	terbufos
CPGV	granulosis virus
cresol	M-CRESOL; META-CRESOL
CULTAR	paclobutrazol
cupric hydroxide	COPPER HYDROXIDE; KOCIDE
CUTLASS	*B. thuringiensis kurstaki*
CYCOCEL	chlormequat
cyfluthrin	BAYTHROID
CYGON	dimethoate
CYGUARD	phorate + terbufos; CYGARD
cyhalothrin	GRENADE; PP-563
cyhalothrin-lambda	CHARGE; ICIA-0321; KARATE; LAMBDA-CYHALOTHRIN; PP-321
CYMBUSH	cypermethrin
cypermethrin	CYMBUSH; RIPCORD
cypermethrin-alpha	ALPHA-CYPERMETHRIN; FASTAC
CYPREX	dodine
cyproconazole	SAN-619; UBI-2565; UBI-2575
cyromazine	TRIGARD
CYTHION	malathion

D-D	1,2-dichloropropane + 1,3-dichloro-propene

DACOBRE	chlorothalonil
DACONIL	chlorothalonil
DACONIL 2787	chlorothalonil
DANITOL	fenpropathrin
DASANIT	fensulfothion
DDT	ZEIDANE
DECIS	deltamethrin
deet	NERO INSECT REPELLENT SOLUTION; SKINTASTIK; ULTRATHON
delta-endotoxin of *B.t. kurstaki*	M-CAP; MVP BIOINSECTICIDE
delta-endotoxin of *B.t. kurstaki-teneb.*	FOIL
delta-endotoxin of *B.t. san diego*	M-ONE PLUS; MYX-1806; SPUD-CAP
deltamethrin	DECIS
DERITOX	rotenone
DEVRINOL	napropamide
DEXON	fenaminosulf
DI-SYSTON	disulfoton
diatomaceous earth	INSECTAGON; INSECTAWAY; SHELLSHOCK
diazinon	BASUDIN; UBI-2291
DIBROM	naled
dicamba	BANVEL
dichlone	PHYGON
dichloran	BOTRAN
dichlorprop	dichlorprop
dichlorvos	VAPO
diclofop-methyl	CHOE-190Q; DICHLOFOP METH; DICLOFOP; HOE-GRASS; HOELON; ILLOXAN
dicofol	KELTHANE
dieldrin	HEOD
dienochlor	PENTAC AQUAFLOW
diflubenzuron	DIMILIN
DIKAR	dinocap + mancozeb
dimethoate	BAS-152; BAS-152-47; BASF-152; CYGON; HOPPER-STOPPER; LAGON; SYSTEM
DIMILIN	diflubenzuron
diniconazole	CC-16238B; CC-16239; CC-16239A; CC-16348; CC-16359; CC-16378; CC-16394; CC-16395; CC-16461; CC-16462; CC-16464; CC-16481; CC-16488; CC-16553; CC-16555; CC-16557; CC-16558; CC-16681; CC-16683; CC-16685; CC-16687; CC-16688; CC-16696; CC-16697; CC-16698; CC-16699; CC-16700; CC-16859; CC-16860; CC-16862; CC-16864; CC-16865; CC-16866; CC-16867; CC-16882; CC-16896; SPOTLESS; XE-779
DINITRO	dinoseb
dinocap	KARATHANE
dinoseb	DINITRO
DIPEL	*B. thuringiensis kurstaki*
diphacinone	RAMIK BRUN
diquat	REGLONE
disulfoton	DI-SYSTON
DITERA	*B. thuringiensis tenebrionis*

DITHANE 480F	mancozeb
DITHANE DF	mancozeb
DITHANE DG	mancozeb
DITHANE F-45	mancozeb
DITHANE M-22	maneb
DITHANE M-45	mancozeb; DITHANE M45
diuron	DMU; KARMEX
dodine	CYPREX; EQUAL
DOWCO-429	DOWCO-429X; unknown
DOWCO-473	unknown; XRD-473
DPX-H6573	flusilazole
DRAGAN	CGA-169374
DUAL	metolachlor
DURSBAN	chlorpyrifos
DYFONATE	fonofos
DYFONATE II	fonofos
DYFONATE ST	fonofos
DYLOX	trichlorfon
DYRENE	anilazine
EASOUT	thiophanate-methyl
ECTIBAN	permethrin
EG-2371	*B. thuringiensis kurstaki*
EL-228	nuarimol
ELITE	tebuconazole
EMBARK	mefluidide
emulsifiable spray oil	SUNSPRAY
endosulfan	THIODAN
ENHANCE	surfactant
ESTAPROP	diclorprop + 2,4-D ester
EPIC	furmecyclox
EPTC	EPTAM
EQUAL	dodine
esfenvalerate	HALMARK
estraprop	2,4-D ester + dichlorprop
ethalfluralin	EDGE; EL-161; SONALAN
ethephon	CERONE
ethion	DIETHION; NIALATE
ETHOPROP	ethoprophos
ethoprophos	ETHOPROP
ETHYLTRIANOL	tebuconazole
etridiazole	TRUBAN
EVISECT	thiocyclam-hydrogenoxalate
EXP-10295A	iprodione
EXP-10370A	iprodione
EXP-2022C	copper oxychloride + fosetyl-al
EXP-2164B	iprodione
EXP-80318A	triticonazole
EXP-80430B	unknown
EXP-80511A	unknown
F020	Paw Paw bark extract
FASTAC	cypermethrin-alpha
fenaminosulf	DEXON; LESAN

fenamiphos	NEMACUR
fenapanil	SISTHANE
fenbutatin oxide	TORQUE; VENDEX
fenitrothion	SUMITHION
fenpropathrin	BAS-9082; DANITOL; S-3206
fenpropimorph	CORBEL; MISTRAL
fensulfothion	DASANIT
fenthion	PVC EAR TAG
fenvalerate	BELMARK; BOVAID
ferbam	FERMATE
fluazinam	B-1216; IKF-1216
flucythrinate	GUARDIAN
flufenoxuron	CASCADE; WL-115110
flusilazole	DPX-H6573; NUSTAR
flutolanil	CGF-4280; MONCUT; NNF-136
flutriafol	ICIA-0450; MINTECH; TF-3673; TF-3675; TF-3753; TF-3765; TF-3775
FOIL	delta-endotoxin of *B.t. kurstaki-teneb.*
FOLICOTE	tebuconazole
FOLICUR	tebuconazole
FOLPAN	folpet
folpet	PHALTAN; FOLPAN
fonofos	DYFONATE; DYFONATE II; DYFONATE ST
FORAY	*B. thuringiensis kurstaki*
FORCE	tefluthrin
FORE	mancozeb
formetanate	CARZOL
fosetyl-al	ALIETTE
FOSTHIAZATE	ASC-66824
FRANIXQUERRA	sodium dioctyl sulfosuccinate
FRIGATE	mineral oil
FUNGAFLOR	imazalil
FUNGINEX	triforine
FURADAN	carbofuran
FURADAN CR-10	carbofuran
furathiocarb	PROMET
furmecyclox	EPIC
FUTURA	*B. thuringiensis kurstaki*
FUTURA XLV	*B. thuringiensis kurstaki*
G-696	UBI-2563
GALBEN	benalaxyl
GALLEX	2,4-xylenol + cresol
GAMMA-BHC	lindane
GAOZHIMO	masbrane
GAUCHO	imidacloprid
glyphosate	ROUNDUP
granulosis virus	CARPOVIRUSINE; CODLING MOTH GRANULOSIS VIRUS; CPGV; UCB-87
GSX-8743	GXS-8743
GUARDIAN	flucythrinate
GUTHION	azinphos-methyl
GXS-8743	GSX-8743

GYPSUM	calcium sulfate
HALMARK	esfenvalerate
hexaconazole	ANVIL; ICIA-0523; JF-9480; TF-3770; TF-9480
hexythiazox	SAVEY
HHDN	ALDRIN
HOE-000522	teflubenzuron
HOE-00522	teflubenzuron
HOLLYSUL MICRO-SULPHUR	sulphur
HOPPER-STOPPER	dimethoate
HWG-1608	tebuconazole
hymexazol	TACHIGAREN; UBI-2631
ICIA-0321	cyhalothrin-lambda
ICIA-0450	flutriafol
ICIA-0523	hexaconazole
ICIA-0993	tefluthrin
imazalil	FUNGAFLOR; UBI-2420
imazethapyr	AC 263,499; AC-263499; PURSUIT
imidacloprid	BAY-NTN-33893; GAUCHO; NTN-33893; UBI-2627
IMIDAN	phosmet
INCITE	piperonyl butoxide
INSECOLO	silicon dioxide
INSECTAGON	diatomaceous earth
INSECTAWAY	diatomaceous earth
INSEGAR	RO-13-5223
ioxynil	ACTRIL; CERTOL; CERTROL; TORTRIL; TOTRIL
iprodione	EXP-10370A; EXP-2164B; ROVRAL; ROVRAL FLO; ROVRAL GREEN
isazofos	CGA-12223; TRIUMPH
ISOBUTYLIDENE DIUREA	fertilizer
isofenphos	AMAZE
ISOMATE C	pheromone
ivermectin	IVOMEC
IVOMEC	ivermectin
JAVELIN	*B. thuringiensis kurstaki*
JAVEX	sodium hypochlorite
JF-9480	hexaconazole
KARATE	cyhalothrin-lambda
KARATHANE	dinocap
KELTHANE	dicofol
KILLEX TURF HERBICIDE	2,4-D dimethylamine + dicamba-dimethyl-amine + mecoprop dimethylamine; KILMOR
KILMOR	KILLEX TURF HERBICIDE
KOCIDE 101	copper + cupric hydroxide
KORN OIL CONCENTRATE	korn oil

KORNTROL OIL	mineral oil
KRYOCIDE	sodium aluminum fluoride
KUMULUS	sulphur; KUMULUS S
LAGON	dimethoate
LAMBDA-CYHALOTHRIN	cyhalothrin-lambda
LANCE	cloethocarb
LANNATE	methomyl
LATRON	adjuvant; LATRON B-1956
LATRON B-1956	adjuvant; LATRON
leptophos	ABAR; PHOSVEL
LESAN	fenaminosulf
lindane	BHC; GAMMA-BHC; UBI-2599
linuron	AFALON; AFOLAN; LOROX
LIQUIDUSTER	permethrin
LORSBAN	chlorpyrifos
M-CAP	delta-endotoxin of *B.t. kurstaki*
M-ONE	*B. thuringiensis san diego*
M-ONE MYD	*B. thuringiensis san diego*
M-ONE PLUS	delta-endotoxin of *B.t. san diego*
M-TRAK	*B. thuringiensis san diego*
MAINTAIN	maleic hydrazide
malathion	CYTHION
maleic hydrazide	MAINTAIN; ROYAL MH
mancozeb	DITHANE 480F; DITHANE DF; DITHANE DG; DITHANE F-45; DITHANE M-45; DITHANE M45; MANZATE 200; MANZATE DF; TF-3710
maneb	AGROX; AGROX DB; AGROX FLOWABLE; DITHANE M-22; MANZATE; POOL NM; TF-3767; TF-3767B
MANZATE	maneb
MANZATE 75	mancozeb
MANZATE 200	mancozeb
MANZATE DF	mancozeb
MARGOSAN-O	azadirachtin
masbrane	GAOZHIMO
MAT-7484	phostebupirim
MCPA	AGRITOX; AGROXONE; CORNOX M; MCP
mefluidide	EMBARK
MERCURIC BICHLORIDE	mercuric chloride
mercuric chloride	MERCURIC BICHLORIDE
MERGAMMA FL	TF-3769
MERGAMMA NM	lindane + maneb
MERSIL	mercuric chloride + mercurous chloride
MERTECT	thiabendazole
MESUROL	methiocarb
metalaxyl	APRON; RIDOMIL; SUBDUE; UBI-2379
METASYSTOX-R	oxydemeton-methyl
methamidophos	MONITOR
methidathion	SUPRACIDE

methiocarb	MESUROL
methomyl	LANNATE
methoxychlor	MARLATE; METHOXY-DDT
methyl cellulose	CANOCOTE COMMERCIAL COAT; CANOCOTE MICROPELLET; HILLESHOG COMMERCIAL COAT; HILLESHOG MICROPELLET; METHOCEL A
15LV	
metiram	POLYRAM
metolachlor	DUAL
metribuzin	LEXONE; SENCOR; SENCOR 500; SENCOR
75DF	
MICRO-MIST	*Ascophyllum nodosum* extract
MICRO-NIASUL	sulphur
MICROSCOPIC SULPHUR	sulphur
MICROTHIOL SPECIAL	sulphur
mineral oil	FRIGATE; KORNTROL OIL; MINERAL SEAL
OIL	
MINERAL SEAL OIL	mineral oil
MINTECH	flutriafol
MISTRAL	fenpropimorph
MITAC	amitraz
MO-BAIT	molasses
MONCEREN	BAY-NTN-19701; pencycuron
MONCUT	flutolanil; NNF-136
MONITOR	methamidophos
monolinuron	AFESIN; ARESIN
MORESTAN	chinomethionat
MVP BIOINSECTICIDE	delta-endotoxin of *B.t. kurstaki*
myclobutanil	NOVA; RALLY; RH-3866; UBI-2454; UBI-2454-1; UBI-2454-2; UBI-2561
MYX-1806	delta-endotoxin of *B.t. san diego*
MYX-2284	*B. thuringiensis kurstaki*
MYX-9858	*B. thuringiensis san diego*
nabam	DITHANE D-14; PARZATE LIQUID
naled	DIBROM
napropamide	DEVRINOL
NEEM	azadirachtin
NEEM FORMULATED	azadirachtin + pyrethrum
NEEM SOLUTION 1	azadirachtin
NEEM SOLUTION 2	azadirachtin
NEEMIX	azadirachtin
NEMACUR	fenamiphos
NERO INSECT REPELLENT SOLUTION	deet
NIAGARA FIXED COPPER	copper oxychloride
nitrapyrin	DOWCO-163; N-SERVE
NNF-136	CGF-4280; flutolanil; MONCUT
nonylphenolethylene oxide	AGRAL 90
NOVA	myclobutanil
NOVODOR	*B. thuringiensis tenebrionis*
NTN-33893	imidacloprid
nuarimol	EL-228
NUSTAR	flusilazole

octylphenoxypolyethoxyethanol n-butanol	COMPANION
ofurace	RE-20615; VAMIN
OKANAGAN DORMANT OIL	okanagan oil
okanagan oil	OKANAGAN DORMANT OIL
OMITE	propargite
ONCOL	benfuracarb
ORBIT	propiconazole
ORGANIC INSECT KILLER LIQUID	*B. thuringiensis kurstaki*
ORTHENE	acephate
ORTHO-12-420	acephate
oxadixyl	GUS-371; GUS-4551; OXYDICIL; SAN-371; SANOFAN
oxamyl	VYDATE
oxycarboxin	HRC; PLANTVAX; UB-I2125; UB-I2216
oxydemeton-methyl	METASYSTOX-R
paclobutrazol	CULTAR; PP-333
paraformaldehyde	PARAFORM F POWDERED FUMIGANT
paraquat	GRAMOXONE; WEEDOL
parathion	AQUA; FOLIDOL; NIRAN; PENCAP E
PARDNER	bromoxynil
Paw Paw bark extract	ASIMICIN; *Asimina triloba* BARK EXTRACT; F020
PBO	piperonyl butoxide
PCNB	quintozene
penconazole	TOPAS
pencycuron	BAY-NTN-19701; MONCEREN
PENTAC AQUAFLOW	dienochlor
PENTACHLORONITROBENZENE	quintozene
PERECOT	copper oxides
permethrin	AMBUSH; ATROBAN; ATROBAN DELICE POUR-ON; BOVITECT; ECTIBAN; LIQUIDUSTER; POUNCE; SANBAR
petroleum oil	SAF-T-SIDE; SAFERS ULTRAFINE SPRAY OIL; SUNSPRAY OIL; SUPERIOR OIL; SUPERIOR OIL 70; SUPERIOR OIL CONCENTRATE; VOLCK DORMANT OIL; VOLCK OIL; VOLCK SUPREME OIL
phagostimulant	PHEAST
PHALTAN	folpet
PHEAST	phagostimulant
phorate	THIMET
phosalone	ZOLONE
phosmet	IMIDAN
phostebupirim	BAY-MAT-7484; MAT-7484
PHYGON	dichlone
PHYTOSOL	trichloronat
picloram	ACIDE PICLORAM; AMDON; PICLORAM ACID; TORDON; TORDON 10K
piperonyl butoxide	BUTACIDE; INCITE; PBO
pirimicarb	PIRIMOR
PIRIMOR	pirimicarb

poly-d-glucosamine	CHITOSAN
POLYON	polymer coated urea
POLYRAM	metiram
POOL NM	maneb
potassium oleate	SAFERS INSECTICIDAL SOAP; SAFERS SOAP
POUNCE	permethrin
PP-321	cyhalothrin-lambda
PP-333	paclobutrazol
PREMIERE	lindane + thiabendazole + thiram
PREMIERE PLUS	lindane + thiabendazole + thiram
PRO GRO	PRO GRO SYSTEMIC SEED PROTECTANT
PRO GRO SYSTEMIC SEED PROTECTANT	carbathiin + thiram; PRO GRO
prochloraz	SPORTAK
PROMET	furathiocarb
propargite	OMITE
propiconazole	BANNER; ORBIT; TILT
PVC EAR TAG	fenthion
pyrazophos	AFUGAN
pyrifenox	ACR-3675
quintozene	PCNB; PENTACHLORONITROBENZENE; SCOTTS LAWN DISEASE PREVENTER;
TERRACHLOR	
RALLY	myclobutanil
RAMIK BRUN	diphacinone
RAPCOL TZ	furathiocarb + metalaxyl + thiabendazole
RAXIL	tebuconazole
RE-20615	ofurace
REGLONE	diquat
RENEX	adjuvant; RENEX 36
RH-0611	myclobutanil + mancozeb
RH-3866	myclobutanil
RH-5598	confidential
RH-5849	1,2-DIBENZOYL-1-TERT-BUTYLHYDRAZINE; TERT-BUTYLBENZOHYDRAZIDE
RH-5992	confidential
RH-7281	unknown
RH-7592	unknown
RHC-378	surfactant
RHC-387	unknown
RIDOMIL	metalaxyl
RIDOMIL MZ	mancozeb + metalaxyl
RIPCORD	cypermethrin
RIZOLEX	tolclofos-methyl
RO-13-5223	INSEGAR
RONILAN	vinclozolin
ROTACIDE	rotenone
rotenone	DERITOX; ROTACIDE
ROUNDUP	glyphosate
ROVRAL	iprodione
ROVRAL FLO	iprodione
ROVRAL GREEN	iprodione
ROVRAL ST	iprodione + lindane

ROYAL MH	maleic hydrazide
ROZOL	chlorophacinone
RU-38702	acrinathrin
S-3206	fenpropathrin
SAF-T-SIDE	petroleum oil
SAFERS INSECTICIDAL SOAP	potassium oleate
SAFERS NEEM INSECTICIDE	azadirachtin
SAFERS SOAP	potassium oleate
SAFERS ULTRAFINE SPRAY OIL	petroleum oil
SAN-371	oxadixyl
SAN-418	*B. thuringiensis tenebrionis*
SAN-619	cyproconazole
SAN-658	captan + cyproconazole
SAN-683	cyproconazole + mancozeb
SANBAR	permethrin
SAVEY	hexythiazox
SCOTTS LAWN DISEASE PREVENTER	quintozene; SCOTTS FFII
SCOTTS PROTURF	chloroneb
SD-208304	DPX-43898
SEVIMOL	carbaryl
SEVIN	carbaryl
SEVIN XLR	carbaryl
SEVIN XLR PLUS	carbaryl
SHELLSHOCK	diatomaceous earth
silicon dioxide	INSECOLO
simazine	GESATOP; PRIMATOL S; PRINCEP; PRINCEP NINE-T
SISTHANE	fenapanil
skim milk powder	POWDERED SKIM MILK
SKINTASTIK	deet
SNI OIL	azadirachtin
sodium aluminum fluoride	KRYOCIDE
sodium dioctyl sulfosuccinate	FRANIXQUERRA
sodium hypochlorite	JAVEX
SOLACOL	validamycin a
SPORTAK	prochloraz
SPOTLESS	diniconazole
SPUD-CAP	delta-endotoxin of *B.t. san diego*
streptomycin	AGRI-MYCIN; AGRISTREP
SUBDUE	metalaxyl
SULFUR	sulphur
sulphur	HOLLYSUL MICRO-SULPHUR; KUMULUS; KUMULUS S; MICRO-NIASUL; MICROTHIOL SPECIAL; SULFUR COATED UREA
SUMITHION	fenitrothion
SUNSPRAY	emulsifiable spray oil
SUNSPRAY OIL	petroleum oil
SUPERIOR OIL	petroleum oil
SUPERIOR OIL 70	petroleum oil
SUPERIOR OIL CONCENTRATE	petroleum oil
SUPRACIDE	methidathion
SUSTANE	fertilizers
SYSTEM	dimethoate

TACHIGAREN	hymexazol; UBI-2631
TALSTAR	bifenthrin
tebuconazole	BAY-HWG-1608; ELITE; ETHYLTRIANOL; FOLICOTE; FOLICUR; HWG-1608; RAXIL; UBI-2584; UBI-2584-1; UBI-2611
teflubenzuron	HOE-000522; HOE-00522
tefluthrin	FORCE; ICIA-0993; TF-3754; TF-3755
TELONE	1,3-dichloropropene
TELONE II-B	1,3-dichloropropene
TEMIK	aldicarb
TENN-COP	copper salts of rosin and fatty acids
terbufos	AC-301467; COUNTER
TERRACHLOR	quintozene
TERSAN 1991	benomyl
TF-3480	triadimenol
TF-3607	lindane + thiabendazole + thiram
TF-3651	benalaxyl
TF-3656	imazalil + triadimenol
TF-3673	flutriafol
TF-3675	flutriafol
TF-3710	mancozeb
TF-3720	flutriafol + lindane
TF-3753	flutriafol
TF-3754	tefluthrin
TF-3755	tefluthrin
TF-3765	flutriafol
TF-3767	maneb
TF-3767B	maneb
TF-3769	lindane + maneb; MERGAMMA FL
TF-3770	hexaconazole; TF-3770A
TF-3772	benalaxyl
TF-3773	benalaxyl
TF-3775	flutriafol
TF-3790	hexaconazole + tefluthrin
TF-3791	tefluthrin + thiabendazole + thiram
TF-3794	paclobutrazol
TF-9480	hexaconazole
thiabendazole	MERTECT; UBI-2395-1; UBI-2531
THIMET	phorate
thiocyclam-hydrogenoxalate	EVISECT
THIODAN	endosulfan
thiodicarb	GUS-80502; LARVIN
thionazin	NEMAFOS; ZINOPHOS
thiophanate-methyl	EASOUT
thiram	UBI-2215; UBI-2233
THURICIDE	*B. thuringiensis kurstaki*
THURICIDE-HPC	*B. thuringiensis kurstaki*
TILT	propiconazole
TILT MZ	mancozeb + propiconazole
tolclofos-methyl	RIZOLEX
TOPAS MZ	mancozeb + penconazole
TORQUE	fenbutatin oxide
triadimefon	BAYLETON
triadimenol	BAYTAN; TF-3480; UBI-2383; UBI-2383-1; UBI-2541; UBI-2556; UBI-2568
trichlorfon	DYLOX

trichloronat	PHYTOSOL
TRIDENT	*B. thuringiensis tenebrionis*; TRIDENT II
triflumizole	UBI-2342
trifluralin	HERITAGE; HOE-FLURAN; JF-8679; RIVAL; TREFLAN; UBI-2309; UBI-2340
triforine	FUNGINEX
TRIGARD	cyromazine
trimethacarb	BROOT; LANDRIN; SD-8530; SD-8736; TF-3627; UC27-BF-32
triticonazole	EXP-80318A
TRITON B-1956	adjuvant; TRITON B 1956
TRITON XR	adjuvant
TRIUMPH	isazofos
TROUNCE	potassium salts of fatty acids + pyrethrins
TRUBAN	etridiazole
TRUMPET	bendiocarb

UAN	urea ammonium nitrate
UBI-2051	VITAFLO 280
UBI-2051-1	carbathiin + thiram
UBI-2092	carbathiin
UBI-2100	carbathiin
UBI-2100-2	carbathiin
UBI-2100-4	carbathiin
UBI-2106-1	carbathiin + lindane
UBI-2155	carbathiin + thiram
UBI-2215	thiram
UBI-2233	thiram
UBI-2236	carbathiin + lindane + thiram
UBI-2291	diazinon
UBI-2342	triflumizole
UBI-2359	carbathiin + thiram
UBI-2359-2	ANCHOR; carbathiin + thiram
UBI-2369-1	VITAVAX RS; carbathiin + lindane + thiram
UBI-2379	metalaxyl
UBI-2383	triadimenol
UBI-2383-1	triadimenol
UBI-2389	carbathiin + isofenphos
UBI-2390	carbathiin + thiram; UBI-2390-1
UBI-2390-1	UBI-2390
UBI-2393	carbathiin + thiabendazole; UBI-2393-2
UBI-2393-2	UBI-2393
UBI-2394	carbathiin + imazalil + thiabendazole; UBI-2394-2
UBI-2394-2	UBI-2394
UBI-2395-1	thiabendazole
UBI-2401	carbathiin + imazalil
UBI-2402	carbathiin + lindane + thiabendazole; UBI-2402-1
UBI-2402-1	UBI-2402
UBI-2413	carbathiin + isofenphos + thiram; UBI-2413-1

UBI-2413-1	UBI-2413
UBI-2417	carbathiin + lindane + metalaxyl; UBI-2417-1
UBI-2417-1	UBI-2417
UBI-2420	imazalil
UBI-2424	carbathiin + imazalil; UBI-2424-1
UBI-2424-1	UBI-2424
UBI-2450	metalaxyl + thiabendazole
UBI-2454	myclobutanil
UBI-2454-1	myclobutanil
UBI-2454-2	myclobutanil
UBI-2457	metalaxyl + thiabendazole
UBI-2484	tebuconazole
UBI-2501	carbofuran
UBI-2509	UBI-2509-1
UBI-2509-1	metalaxyl + thiram; UBI-2509
UBI-2511	carbathiin + cloethocarb + thiram; UBI-2511-1
UBI-2511-1	UBI-2511
UBI-2521	UBI-2521-1
UBI-2521-1	carbathiin + thiabendazole; UBI-2521
UBI-2529	carbathiin + cloethocarb
UBI-2530	carbathiin + isofenphos
UBI-2531	thiabendazole
UBI-2541	triadimenol
UBI-2550	G-696 + lindane + thiram
UBI-2554	carbathiin + cloethocarb + thiram; UBI-2554-1
UBI-2554-1	UBI-2554
UBI-2555	carbathiin + cloethocarb + thiram; UBI-2555-1
UBI-2555-1	UBI-2555
UBI-2556	triadimenol
UBI-2557	carbathiin + cloethocarb + thiram
UBI-2559	cloethocarb
UBI-2561	myclobutanil
UBI-2562	cloethocarb
UBI-2563	G-696
UBI-2564	carbathiin + G-696
UBI-2565	cyproconazole
UBI-2568	triadimenol
UBI-2573	G-696 + thiram
UBI-2575	cyproconazole
UBI-2584	tebuconazole
UBI-2584-1	tebuconazole
UBI-2599	lindane
UBI-2599-2	carbathiin + lindane + thiram
UBI-2608-1	carbathiin + imidacloprid + thiram
UBI-2611	tebuconazole
UBI-2617	carbathiin + lindane + thiram
UBI-2627	imidacloprid
UBI-2631	hymexazol; TACHIGAREN
UCB-87	granulosis virus
ULTRA-T	iodine + phosphoric acid
ULTRATHON	deet
urea ammonium nitrate	UAN

validamycin a	SOLACOL
VAMIN	ofurace
VAPO	dichlorvos
VECTOBAC	*B. thuringiensis israelensis*
VENDEX	fenbutatin oxide
VIGORO	isobutylidene diurea + quintozene + urea
vinclozolin	RONILAN
VITAFLO 250	carbathiin
VITAFLO 280	carbathiin + thiram; UBI-2051
VITAVAX	carbathiin
VITAVAX 200	carbathiin + thiram
VITAVAX DUAL SOLUTION	carbathiin + lindane
VITAVAX RS	carbathiin + lindane + thiram;
UBI-2369-1	
VITAVAX SINGLE SOLUTION	carbathiin
VITAVAX SOLUTION	carbathiin
VOLCK DORMANT OIL	petroleum oil
VOLCK OIL	petroleum oil
VOLCK SUPREME OIL	petroleum oil
VOLID	brodifacoum
VORLEX	1,3-dichloropropene + methyl isothio-cyanate
VYDATE	oxamyl
WL-115110	CASCADE; flufenoxuron
XE-779	diniconazole
XRD-473	DOWCO-473
zinc	ZINC SULPHATE
zineb	DITHANE Z-78; PARZATE; PARZATE C; PARZATE-C
ziram	ZERLATE
ZOLONE	phosalone

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