CABBAGE: *Brassica oleracea* L. 'Bronco'
INSECTICIDAL CONTROL OF LEPIDOPTERAN PESTS IN MINNESOTA CABBAGE, 2002

R.L. Koch,
E.C. Burkness &
W.D. Hutchison
Department of Entomology
University of Minnesota
219 Hodson Hall
St. Paul, MN 55108
Phone: (612) 624-3670
Fax: (612) 625-5299
E-mail: koch0125@tc.umn.edu

Imported cabbageworm (ICW): *Pieris rapae* (L.)
Cabbage looper (CL): *Trichoplusia ni* (Hübner)
Diamondback moth (DBM): *Plutella xylostella* (L.)

'Bronco' was seeded 18 Jun at the University of Minnesota Agricultural Experiment Station at Rosemount, MN. Treatments were arranged in a RCB design with 4 replications. Plots consisted of 3 rows, 25 ft (7.6 m) long with 40 inch (1.02 m) row spacing. Each replicate was separated by a 5 ft (1.52 m) alley. Treatment applications were made with a CO_2 pressurized backpack sprayer using a 10 ft boom with 6 nozzles (XR-Teejet 8002 flat fan, with no screen). The sprayer was calibrated to deliver 20 gpa (187.04 l/ha) at 35 psi (242 kPa). Kinetic surfactant was added to all treatments, at a rate of 16 fl oz/100 gal (1.25 ml/liter) except for the Avuant 30WG treatments (0.045 and 0.065 lbs. of AI/ac), which received Freeway surfactant at 8 fl oz/100 gal (0.625 ml/liter). Treatments were applied on 26 Jul, 1, 8, 16 Aug. Treatments were evaluated for CL, ICW and DBM larval infestation 6 and 19 Aug. All larval counts were taken from the middle row of each plot. Plots were harvested 30 Aug. In each treatment, 10 consecutive heads, with 4 wrapper leaves on each head, were harvested from the middle row and evaluated for feeding damage using Greene's rating scale (J. Econ. Entomol. 1969 62: 798-800), where: 1= no feeding damage; 2= minor feeding damage on the wrapper leaves (0-1% eaten) with no head damage; 3= moderate feeding damage on the wrapper leaves (2-5% eaten) with no head damage; 4= moderate feeding damage on the wrapper leaves (6-10% eaten) and minor feeding scars on the head; 5= moderate to heavy feeding on the wrapper leaves (11-30% eaten) and moderate feeding scars on the head; 6= greater than 30% of the wrapper leaves eaten and numerous feeding scars on the head. The number of larval contaminants within the 4 wrapper leaves and head were also noted.

Preliminary larval counts were taken 22 Jul. Preliminary counts revealed 0.5 small CL and 1.5 total DBM per 10 heads. The first sample on 6 Aug was taken after 2 applications and the second sample was taken on 19 Aug after 4 applications. On the first sample date, for total ICW none of the treatments were significantly different compared with the untreated check except F1785 (0.036 lbs AI)/Dipel tank mix, which had significantly higher total densities of ICW. For total CL densities none of the treatments were significantly different from the untreated check except F1785 (0.072 lbs AI)/Dipel tank mix, which had significantly higher densities of total CL. There were no significant differences among treatments for total DBM compared with the untreated check. Proclaim (0.0075 lbs AI) had significantly higher aphid densities compared with the untreated check. For the second sample date, no ICW larvae were found in any treatment. Most treatments significantly reduced the number of total CL compared with the untreated check; however, F1785 (0.036 lbs AI)/Dipel tank mix

had significantly higher densities of total CL than the untreated check. All treatments significantly reduced densities of DBM compared with the untreated check and there were no significant differences in aphid densities among treatments compared with the untreated check. Most treatments had significantly fewer larval contaminants and a better marketability rating than the untreated check. However, due to light infestations of all pests even the untreated check would have a high percentage of marketable heads with an average marketability rating of 1.88 indicating only minor feeding on the wrapper leaves. No phytotoxicity was observed.

Treatment/formulation	Rate (lb AI / ac)	6 Aug Larval-pupal density (avg./10 heads) Total ICW[1]	Total CL[1]	Total DBM[1]	Aphids[2]
Avaunt 30WG	0.065	0.00 b	0.25 b	0.00	8.50 b
Avaunt 30WG	0.045	0.00 b	0.25 b	0.00	9.25 ab
Capture 2EC	0.040	0.00 b	0.00 b	0.00	1.00 b
SpinTor 2SC	0.067	0.00 b	0.25 b	0.00	5.50 b
Warrior 1CS	0.025	0.00 b	0.00 b	0.75	3.00 b
Proclaim 5SG / SpinTor 2SC / Avaunt 30WG / Avaunt 30WG[3]	0.0075 / 0.067 / 0.065 / 0.065	0.00 b	0.25 b	0.00	1.75 b
Proclaim 5SG / Warrior 1CS / SpinTor 2SC / SpinTor 2SC[3]	0.0075 / 0.025 / 0.067 / 0.067	0.00 b	0.00 b	0.25	0.00 b
Proclaim 5SG / Warrior 1CS / Avaunt 30WG / Avaunt 30WG[3]	0.0075 /0.025 / 0.065 / 0.065	0.00 b	0.00 b	0.25	3.25 b
Proclaim 5SG	0.01	0.00 b	0.00 b	0.25	4.25 b
Proclaim 5SG	0.0075	0.00 b	0.00 b	0.25	23.50 a
F0570 0.8EW	0.025	0.00 b	0.00 b	0.00	3.25 b
F1785 50DF + Dipel DF	0.036 + 0.75 lbs/ac	0.25 a	0.25 b	0.50	2.50 b
F1785 50DF + Dipel DF	0.072 + 0.75 lbs/ac	0.00 b	1.25 a	0.75	3.75 b
Untreated check	--	0.00 b	0.25 b	0.75	5.75 b
				NS	

Means within columns followed by the same letter are not significantly different (*P*=0.05); Least significant difference test (LSD). NS = not significant ANOVA.

[1]Total includes all larval instars and pupae.

[2]Aphid counts are on a per 10 head basis.

[3]Treatments are indicated in the order of application (i.e., Proclaim was 1st application) from 1st to 4th application.

Treatment/formulation	Rate (lbs AI / ac)	19 Aug Larval-pupal density (avg./10 heads) Total ICW[1]	Total CL[1,2]	Total DBM[1]	Aphids[3]	30 Aug (Harvest) Avg. larval contaminant/ 10 heads[4]	Market-ability rating[5]
Avaunt 30WG	0.065	0.00	0.00 c	0.00 b	1.50 a	0.00 b	1.05 cd
Avaunt 30WG	0.045	0.00	0.00 c	0.25 b	0.75 ab	0.00 b	1.05 cd
Capture 2EC	0.040	0.00	0.00 c	0.00 b	0.50 ab	0.00 b	1.00 d
SpinTor 2SC	0.067	0.00	0.00 c	0.00 b	0.25 ab	0.00 b	1.08 bcd
Warrior 1CS	0.025	0.00	0.00 c	0.00 b	0.75 ab	0.00 b	1.03 cd
Proclaim 5SG / SpinTor 2SC / Avaunt 30WG / Avaunt 30WG[6]	0.0075 / 0.067 / 0.065 / 0.065	0.00	0.00 c	0.00 b	0.50 ab	0.00 b	1.00 d
Proclaim 5SG / Warrior 1CS / SpinTor 2SC / SpinTor 2SC[6]	0.0075 / 0.025 / 0.067 / 0.067	0.00	0.25 bc	0.00 b	0.25 ab	0.00 b	1.18 bcd
Proclaim 5SG / Warrior 1CS / Avaunt 30WG / Avaunt 30WG[6]	0.0075 /0.025 / 0.065 / 0.065	0.00	0.00 c	0.00 b	0.00 b	0.25 b	1.08 cd
Proclaim 5SG	0.01	0.00	0.00 c	0.25 b	0.50 ab	0.00 b	1.18 bc
Proclaim 5SG	0.0075	0.00	0.00 c	0.00 b	0.75 ab	0.75 ab	1.75 a
F0570 0.8EW	0.025	0.00	0.25 bc	0.25 b	0.75 ab	0.00 b	1.03 cd
F1785 50DF + Dipel DF	0.036 + 0.75 lbs/ac	0.00	3.25 a	0.50 ab	0.75 ab	0.75 ab	1.55 ab
F1785 50DF + Dipel DF	0.072 + 0.75 lbs/ac	0.00	0.50 bc	0.00 b	1.00 ab	0.25 b	1.35 ab
Untreated check	--	0.00	1.00 b	1.00 a	1.00 ab	1.75 a	1.88 a
		NS					

Means within columns followed by the same letter are not significantly different (*P*=0.05); Least significant difference test (LSD). NS = not significant ANOVA.

[1]Total includes all larval instars and pupae.

[2]Total cabbage looper data were transformed using the square root transformation to obtain mean separations using LSD (*P*=0.05); untransformed means are presented.

[3]Aphid counts are on a per 10 head basis.

[4]Larval contaminants include all larval instars and pupae of all three species (ICW, CL, and DBM) found within the head or 4 wrapper leaves.

[5]Greene's rating system; refer to text. Mean separation test run on rank transformed data; untransformed means are presented.

[6]Treatments are indicated in the order of application (i.e., Proclaim was 1st application) from 1st to 4th application.

Part II. Materials Tested for Arthropod Management

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Avaunt 30WG, (Ideno(1.2-e)(1,3,4)oxadiazine-4a (3H)-carboxylic acid, 7-chloro-2,5-carbonyl)-methyl ester), indoxacarb, DuPont

Capture 2EC, (2-Methyl-1(1,1'-biphenyl)-3yl)methyl cis-3-(2-chloro-3,3,3-trifluoro propenyl)-2, 2dimethyl cyclopropane carboxylate), bifenthrin, FMC

SpinTor 2SC, (2((6-Deoxy-2,3,4-tri-O-methyl-a-L-mannopyronaosyl)oxy)-13-((5-(dimethylamino)tetrahydro-6-methyl-2H-pyran-2-yl)oxy)-9-ethyl 2,3,2a,5a,5b,6,9,10,11,12,13,14,16a,16b-tetradecahydro-14-methyl-1H-as-indaceno(3,2,-d)oxacyclododecin-7,15-dione), spinosad, Dow AgroSciences

Warrior 1CS, (3-(2-Cloro-3,3,3-trifluoro-1-propenyl)-2,2dimethylcyclopropanecar-boxylate (S),(S)-cis-Z isomers, lambdacyhalothrin, Syngenta

F0570 0.8EW, Zetacypermetherin, FMC

Proclaim 5SG, (Epi-methylamino-4"-deoxy-avermectin B,hydrochloride and a maximum 20% 4"-epi-methylamino 4"-deoxyavermectin B benzoate), emamectin benzoate, Syngenta

F1785 50DF, Propietary Mixture, FMC

Dipel DF, *Bacillus thuringiensis*, subsp. *kurstaki*, protein toxins, Abbott Laboratories

Freeway, Silicon-polyether copolymer, alcohol ethoxylates, propylene glycol and dimethylpolysiloxane, Loveland Industries Inc.

Kinetic, Polyalkyleneoxide modified polydimethylsiloxane and non-ionic surfactants, Helena