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Colorado State University

College of Agricultural Sciences

Department of Bioagricultural Sciences and Pest Management

Extension

2007 Colorado Field Crop Insect Management Research and Demonstration Trials

2007 Colorado Field Crop Insect Management Research and Demonstration Trials[1]

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CONTROL OF BIOTYPE 2 RUSSIAN WHEAT APHID IN WINTER WHEAT WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2007

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CONTROL OF RUSSIAN WHEAT APHID IN WINTER WHEAT WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2007: Treatments were applied on 20 April 2007 with a 'rickshaw-type' CO_2 powered sprayer calibrated to apply 20 gal/acre at 3 mph and 32 psi through three 8004 (LF4) nozzles mounted on a 5.0 ft boom. Conditions were clear and calm with temperatures of 50°F at the time of treatment. Plots were 6 rows (5.0 ft) by 28.0 ft and were arranged in six replicates of a randomized, complete block design. Crop stage at application was early jointing (Zadoks 30). The crop had been infested with greenhouse-reared aphids on 6 March 2007.

Treatments were evaluated by collecting 20 symptomatic tillers along the middle four rows of each plot 10, 14 and 21 days after treatment (DAT). Tiller samples were placed in Berlese funnels for 24 hours to extract aphids into alcohol for counting. Symptomatic tiller samples taken the day before treatment averaged 3.6 ± 0.2 Russian wheat aphids per tiller. Aphid counts transformed by the log +1 method were used for analysis of variance and mean separation by Tukey's HSD test (α=0.05). Original means are presented in the tables. Total insect days for each treatment were calculated according the method of Ruppel (Journal of Economic Entomology 76: 375-7, 1983) and analyzed in the same manner, with original means presented in Table 1. Reductions in insect days were calculated by Abbott's (1925) formula: (percent reduction = ((untreated-treated)/untreated) X 100).

Aphid pressure was less severe than in past artificially-infested winter wheat experiments, with about 27 aphids/tiller in the untreated control 21 DAT (Table 1) compared to 114.0 ± 15.9 in 2006. Crop condition was excellent with vigorous growth, which may explain the reduced aphid abundance. All treatments except Lannate LV, 0.45 lb (AI)/acre, had fewer aphids than the untreated control 10, 14 and 21 DAT. All treatments had fewer aphid days than the untreated control. The GF1846, the two higher rates of Lorsban 4E and the Warrior treatments reduced total aphid days over three weeks by 90% or more, the level of performance observed by the more effective treatments in past experiments. No phytotoxicity was observed with any treatment.

Field History

Pest:	Russian wheat aphid, *Diuraphis noxia* (Kurdjumov)
Cultivar:	'Vona'
Planting Date:	20 September 2006
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Fallow in 2006
Herbicide:	2/3 pint 2,4-D + 2.5 oz Harmony Extra on 4 April 2007
Insecticide:	None prior to experiment
Fertilization:	None
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (Block 1030 SW)

Table 1. Control of Russian wheat aphid with hand-applied insecticides, ARDEC, Fort Collins, CO. 2007.

	APHIDS PER TILLER ± SE[1]				
PRODUCT, LB (AI)/ACRE	**10 DAT**	**14 DAT**	**21 DAT**	**TOTAL APHID DAYS PER TILLER ± SE[1]**	**% REDUCTION IN APHID DAYS[2]**
GF1846, 13 oz	0.1 ± 0.0 E	0.3 ± 0.1 E	0.5 ± 0.2 DEF	22.8 ± 1.2 F	93
Warrior, 0.03	0.2 ± 0.1 DE	0.5 ± 0.2 DE	0.7 ± 0.4 EF	24.9 ± 2.8 EF	92
Lorsban 4E-SG, 0.38	0.3 ± 0.1 DE	1.2 ± 0.3 CDE	0.4 ± 0.2 F	28.3 ± 2.6 DEF	91
Lorsban 4E-SG, 0.5	0.2 ± 0.1 DE	0.8 ± 0.1 CDE	1.2 ± 0.4 CDEF	28.6 ± 2.2 DEF	91
Lorsban 4E-SG, 0.25	0.8 ± 0.2 CD	1.1 ± 0.5 CDE	2.2 ± 0.7 CDE	37.5 ± 5.2 CDEF	88
Mustang Max 0.8 E, 0.025	1.0 ± 0.3 CD	1.5 ± 0.4 CD	2.1 ± 0.5 BCD	40.7 ± 2.0 CDE	88
Baythroid XL, 0.019	1.3 ± 0.4 BC	1.6 ± 0.3 C	2.9 ± 0.9 BC	46.1 ± 6.6 CD	86
Mustang Max 0.8 E, 0.02	1.3 ± 0.3 C	3.0 ± 0.9 BC	3.2 ± 0.7 BC	55.2 ± 5.8 C	83
Dimethoate 4E 0.38	1.5 ± 0.3 BC	3.3 ± 0.7 BC	4.7 ± 1.2 BC	63.4 ± 8.6 C	80
Lannate LV, 0.45	5.1 ± 1.0 AB	11.4 ± 2.1 AB	13.7 ± 4.0 AB	164.5 ± 23.8 B	50
Untreated control	11.9 ± 1.7 A	23.4 ± 5.5 A	27.2 ± 7.0 A	325.8 ± 60.2 A	–
F Value	19.09	18.55	14.62	46.40	–
p>F	<0.0001	<0.0001	<0.0001	<0.0001	–

[1]SE, standard error of the mean. Means in the same column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).

[2]% reduction in total aphid days per tiller, calculated by the Ruppel method.

CONTROL OF BIOTYPE 2 RUSSIAN WHEAT APHID IN SPRING BARLEY WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2007

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CONTROL OF RUSSIAN WHEAT APHID IN SPRING BARLEY WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2007: Treatments were applied on 18 May 2007 with a 'rickshaw-type' CO_2 powered sprayer calibrated to apply 20 gal/acre at 3 mph and 32 psi through three 8004 (LF4) nozzles mounted on a 5.0 ft boom. Conditions were clear and calm with temperatures of 65°F (start) to 72°F (finish) at the time of treatment. The second Lannate treatment was applied on 23 May 2007. The same sprayer was used, and conditions were overcast, light northerly wind, and 65°F. Plots were 6 rows (5.0 ft) by 28.0 ft and were arranged in six replicates of a randomized, complete block design. Crop stage at application was tillering (Zadoks 20). The crop had been infested with greenhouse-reared aphids on 16 April 2007.

Treatments were evaluated by collecting 20 symptomatic tillers along the middle four rows of each plot 7, 14 and 21 days after treatment (DAT). Tiller samples were placed in Berlese funnels for 24 hours to extract aphids into alcohol for counting. Symptomatic tiller samples collected four days before treatment averaged 4.1 ± 0.8 Russian wheat aphids per tiller. Aphid counts were subjected to analysis of variance and mean separation by Tukey's HSD test (α=0.05). Aphid counts were transformed by the log +1 method prior to analysis. Original means are presented in the tables. Total insect days for each treatment were calculated according the method of Ruppel (Journal of Economic Entomology 76: 375-7, 1983) and analyzed in the same manner, with original means presented in Table 2. Reductions in insect days were calculated by Abbott's (1925) formula: (percent reduction = ((untreated-treated)/untreated) X 100).

Aphid pressure was less severe than in past artificially-infested spring barley experiments, with about 32 aphids/tiller in the untreated control 21 DAT (Table 2) compared to 184 aphids/tiller in the same experiment in 2006. All treatments had fewer aphids per tiller than the untreated control 7 and 14 DAT, and all treatments except Mustang Max, 0.025 lb (AI)/acre, had fewer aphids than the untreated control 21 DAT. All treatments had fewer aphid days than the untreated control. Only Lorsban 4E, 0.5 lb (AI)/acre, provided greater than 90% reduction in aphid days, which is considered good control of Russian wheat aphid in winter wheat. No phytotoxicity was observed with any treatment.

Field History

Pest:	Russian wheat aphid, *Diuraphis noxia* (Kurdjumov)
Cultivar:	'Baroness'
Planting Date:	21 March 2007
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Alfalfa in 2006
Herbicide:	Harmony Extra, 0.5 oz/acre + 2,4-D 32 oz product/acre
Insecticide:	None prior to experiment
Fertilization:	None
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (SE Block 1060)

Table 2. Control of Russian wheat aphid in spring barley with hand-applied insecticides, ARDEC, Fort Collins, CO. 2007.

PRODUCT, LB (AI)/ACRE	APHIDS PER TILLER ± SE[1] 7 DAT	14 DAT	21 DAT	TOTAL APHID DAYS PER TILLER ± SE[1]	% REDUCTION IN APHID DAYS[2]
Lorsban 4E-SG, 0.5	0.2 ± 0.1 D	1.0 ± 0.4 C	0.9 ± 0.2 D	34.2 ± 3.5 D	95
Lannate LV, 0.45, repeat at 5 DAT	1.1 ± 0.3 CD	4.0 ± 1.2 BC	4.1 ± 1.0 CD	75.1 ± 7.1 C	89
Warrior, 0.03	1.6 ± 0.5 CD	4.9 ± 1.2 BC	5.4 ± 1.6 CD	90.2 ± 15.4 C	86
Lannate LV, 0.45	4.1 ± 1.1 BCD	14.0 ± 3.7 BC	11.4 ± 2.3 BCD	196.5 ± 33.8 B	71
Baythroid XL, 0.019	8.6 ± 2.9 BC	10.3 ± 1.5 BC	13.2 ± 3.7 BC	218.7 ± 36.6 B	67
Mustang Max 0.8 E, 0.025	11.9 ± 1.9 B	17.2 ± 2.8 B	20.7 ± 3.6 AB	322.0 ± 41.2 B	52
Untreated control	24.2 ± 3.5 A	45.0 ± 6.8 A	32.3 ± 5.3 A	668.1 ± 75.1 A	—
F Value	24.73	32.46	27.27	52.59	—
p>F	<0.0001	<0.0001	<0.0001	<0.0001	—

[1]SE, standard error of the mean. Means in the same column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).
[2]% reduction in total aphid days per tiller, calculated by the Ruppel method.

CONTROL OF ALFALFA INSECTS IN ALFALFA WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2007

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CONTROL OF ALFALFA INSECTS IN ALFALFA WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2007: Early treatments were applied on 20 April 2007 with a 'rickshaw-type' CO_2 powered sprayer calibrated to apply 20 gal/acre at 3 mph and 30 psi through six XR8002VS nozzles mounted on a 10.0 ft boom. Early treatments were made approximately when army cutworm treatments are applied in the region. This was done to determine the effect of army cutworm treatment in alfalfa on subsequent alfalfa weevil larval densities. All other treatments were applied in the same manner on 18 May 2007. Conditions were clear and calm, with temperatures of 52°F at the time of early treatments. Conditions were clear with calm winds and temperatures of 65-72°F at the time of the later treatments. Plots were 10.0 ft by 25.0 ft and arranged in five replicates of a randomized, complete block design. Untreated control and Warrior 1E, 0.03 lb (AI)/acre, plots were replicated 10 times for a more accurate comparison of treatment effects on yield (insect counts from five reps of each treatment were included in the analyses described below). The crop was 2-3 inches in height at the time of early treatments. Crop height at the time of late treatments was 12-18 inches.

Treatments were evaluated by taking ten 180° sweeps per plot with a standard 15 inch diameter insect net 7, 14 and 21 days after the later treatments (DAT). Alfalfa weevil larvae, alfalfa weevil adults and pea aphids were counted. A pretreatment sample was taken two days prior to the later treatments by taking 200, 180° sweeps across the experimental area. This sample averaged 0.2 alfalfa weevil adults, 29 alfalfa weevil larvae and 4 pea aphids per sweep. Alfalfa weevil larvae counts alfalfa weevil adult counts, and pea aphid counts transformed by the square root + 0.5 method were used for analysis of variance and mean separation by Tukey's HSD procedure (α=0.05). Original means are presented in the tables. Yields were taken in the Warrior 1E, 0.03 lb (AI)/acre, and untreated control plots on 25 June 2007 with a Carter forage harvester. Yields were converted to tons of dry matter per acre using an oven-dried subsample to adjust for moisture. Treated plots were compared to the untreated control using a two-tailed t-test with assumed equal variance (α=0.05).

Alfalfa weevil larval densities were greater than in 2006, while pea aphid abundance 21 DAT was less than observed in 2006. All treatments had fewer alfalfa weevil larvae than the untreated control at 7 and 14 DAT, and all treatments except Mustang Max 0.8EC, 0.025, early, had fewer larvae than the untreated control at 21 DAT (Table 3). No treatment had fewer alfalfa weevil adults than the untreated control at any evaluation date (Table 4). No treatment had fewer pea aphids that the untreated control at 7, 14 and 21 DAT (Table 5). The early treatments, the Baythroid XL, 0.0125 lb (AI)/acre, treatment and the Steward, 0.065 lb (AI)/acre, treatment had more pea aphids than the untreated control at 21 DAT (Table 5). No phytotoxicity was observed with any treatment. The plots treated with Warrior 1E, 0.03 lb (AI)/acre, yielded 1.46 tons/acre, 7.1% more than the untreated plots which yielded 1.10 tons/acre. The difference was significant (paired t-test, t=2.56, df=9, $p(t>t_{0.05})$=0.0308). Yield reduction measured since 1995 has averaged 7.1%, with a range of 0.0% to 20.9%.

Field History

Pests:	Alfalfa weevil, *Hypera postica* (Gyllenhal) and pea aphid, *Acyrthosiphon pisum* (Harris)
Cultivar:	Unknown
Plant Stand:	Thin, dry conditions
Irrigation:	Linear move sprinkler with drop nozzles
Crop History:	Alfalfa since 2002
Herbicide:	None
Insecticide:	None prior to experiment
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO, 80524 (SW Block 1060)

Table 3. Control of alfalfa weevil larvae, ARDEC, Fort Collins, CO, 2007.

PRODUCT, LB (AI)/ACRE	ALFALFA WEEVIL LARVAE PER SWEEP ± SEM[1] 7 DAT	14 DAT	21 DAT
Baythroid XL + Lorsban 4E, 0.0155 + 0.25	2.8 ± 1.4 B	0.3 ± 0.1 E	0.1 ± 0.0 F
Mustang Max 0.8EC, 0.025	4.5 ± 3.6 B	0.4 ± 0.1 E	0.1 ± 0.1 EF
Baythroid XL, 0.022	0.9 ± 0.3 B	0.3 ± 0.1 E	0.2 ± 0.1 EF
Baythroid XL, 0.0155	1.2 ± 0.7 B	0.3 ± 0.1 E	0.3 ± 0.2 EF
Baythroid XL, 0.0125	3.5 ± 2.2 B	0.5 ± 0.1 E	0.3 ± 0.2 EF
Warrior 1E, 0.02	0.6 ± 0.2 B	0.6 ± 0.1 CDE	0.5 ± 0.1 CDEF
Warrior 1E, 0.03	1.3 ± 0.6 B	0.6 ± 0.2 DE	0.5 ± 0.3 DEF
Warrior 1E, 0.03, early	8.4 ± 7.8 B	1.0 ± 0.2 BCDE	0.9 ± 0.2 BCDE
Lorsban 4F, 0.75	4.8 ± 2.5 B	0.8 ± 0.3 CDE	1.0 ± 0.1 BCDE
Baythroid XL, 0.0125, early	13.8 ± 11.1 B	2.5 ± 0.5 BC	2.1 ± 0.8 BCD
Steward EC, 0.065	2.5 ± 0.5 B	2.7 ± 0.8 BCD	2.5 ± 0.4 BC
Mustang Max 0.8EC, 0.025, early	4.1 ± 1.0 B	3.4 ± 0.6 B	5.3 ± 3.1 AB
Untreated control	52.1 ± 18.8 A	38.2 ± 3.8 A	19.3 ± 6.0 A
F value	4.37	84.37	16.07
p>F	0.0001	<0.0001	<0.0001

[1]SEM, standard error of the mean. Means in the same column followed by the same letter(s) are not statistically different, Tukey's HSD (α=0.05).

Table 4. Control of alfalfa weevil adults, ARDEC, Fort Collins, CO, 2007.

PRODUCT, LB (AI)/ACRE	ALFALFA WEEVIL ADULTS PER SWEEP ± SEM[1]		
	7 DAT	14 DAT	21 DAT
Warrior 1E, 0.03, early	0.2 ± 0.1 AB	0.1 ± 0.1	0.0 ± 0.0 A
Mustang Max 0.8EC, 0.025, early	0.2 ± 0.1 AB	0.2 ± 0.2	0.0 ± 0.0 A
Baythroid XL, 0.022	0.0 ± 0.0 B	0.3 ± 0.3	0.1 ± 0.0 A
Baythroid XL, 0.0125, early	0.3 ± 0.1 A	0.2 ± 0.2	0.1 ± 0.0 A
Steward EC, 0.065	0.0 ± 0.0 B	0.0 ± 0.0	0.1 ± 0.0 A
Lorsban 4F, 0.75	0.1 ± 0.0 AB	0.4 ± 0.4	0.1 ± 0.1 A
Untreated control	0.2 ± 0.0 AB	0.1 ± 0.1	0.1 ± 0.1 A
Mustang Max 0.8EC, 0.025	0.1 ± 0.0 AB	0.2 ± 0.2	0.2 ± 0.1 A
Baythroid XL + Lorsban 4E, 0.0155 + 0.25	0.1 ± 0.1 AB	0.3 ± 0.1	0.2 ± 0.1 A
Warrior 1E, 0.03	0.0 ± 0.0 B	0.2 ± 0.2	0.2 ± 0.1 A
Baythroid XL, 0.0125	0.0 ± 0.0 B	0.4 ± 0.4	0.3 ± 0.0 A
Baythroid XL, 0.0155	0.0 ± 0.0 B	0.3 ± 0.3	0.3 ± 0.1 A
Warrior 1E, 0.02	0.1 ± 0.0 AB	0.4 ± 0.4	0.3 ± 0.2 A
F value	3.98	1.22	2.52
p>F	0.0003	0.2960	0.0116

[1]SEM, standard error of the mean. Means in the same column followed by the same letter(s) are not statistically different, Tukey's HSD (α=0.05).

Table 5. Control of pea aphids in alfalfa, ARDEC, Fort Collins, CO, 2007.

PRODUCT, LB (AI)/ACRE	PEA APHID PER SWEEP ± SEM[1]		
	7 DAT	14 DAT	21 DAT
Untreated control	15.3 ± 5.5 ABCD	18.4 ± 9.4 DE	6.3 ± 2.4 B
Warrior 1E, 0.03	2.8 ± 0.8 D	10.1 ± 3.2 E	10.5 ± 3.1 AB
Baythroid XL, 0.022	7.3 ± 1.7 CD	25.9 ± 3.4 CDE	14.3 ± 3.3 AB
Mustang Max 0.8EC, 0.025	15.3 ± 4.5 ABCD	36.1 ± 8.3 CD	14.4 ± 2.9 AB
Baythroid XL, 0.0155	17.2 ± 3.3 ABCD	45.5 ± 16.2 CD	14.5 ± 2.2 AB
Warrior 1E, 0.02	11.7 ± 3.4 BCD	23.3 ± 6.8 DE	14.7 ± 5.4 AB
Baythroid XL + Lorsban 4E, 0.0155 + 0.25	26.1 ± 21.4 ABCD	29.2 ± 7.7 CDE	16.8 ± 3.8 AB
Lorsban 4F, 0.75	3.0 ± 1.1 D	24.3 ± 4.7 DE	17.7 ± 3.8 AB
Warrior 1E, 0.03, early	40.9 ± 19.9 ABCD	108.8 ± 12.8 A	20.5 ± 1.9 A
Baythroid XL, 0.0125	13.3 ± 3.3 ABCD	40.2 ± 8.9 CD	20.7 ± 3.4 A
Mustang Max 0.8EC, 0.025, early	50.0 ± 10.6 AB	88.0 ± 18.6 AB	21.6 ± 4.5 A
Baythroid XL, 0.0125, early	62.2 ± 22.1 A	103.1 ± 10.4 AB	21.7 ± 5.3 A
Steward EC, 0.065	37.2 ± 13.3 ABC	59.1 ± 12.1 BC	23.2 ± 4.3 A
F value	4.65	18.88	2.69
p>F	<0.0001	<0.0001	0.0076

[1]SEM, standard error of the mean. Means in the same column followed by the same letter(s) are not statistically different, Tukey's HSD (α=0.05).

CONTROL OF WESTERN CORN ROOTWORM IN FIELD CORN WITH PLANTING-TIME SOIL INSECTICIDES, SEED TREATMENTS, AND PLANT-INCORPORATED PROTECTANTS, ARDEC, FORT COLLINS, CO, 2007

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CONTROL OF WESTERN CORN ROOTWORM IN FIELD CORN WITH PLANTING-TIME SOIL INSECTICIDES, SEED TREATMENTS, AND PLANT-INCORPORATED PROTECTANTS, ARDEC, FORT COLLINS, CO, 2007: All treatments were planted on 24 May 2007. Granular insecticides were applied with modified Wintersteiger meters mounted on a two-row John Deere Maxi-Merge planter. T-band granular applications were applied with a 4-inch John Deere spreader located between the disk openers and the press wheel. Plots were one 25-ft row arranged in six replicates of a randomized complete block design.

Treatments were evaluated by digging three plants per plot on 10 July 2007. The roots were washed and the damage rated on the 0-3 node injury scale (http://www.ent.iastate.edu/pest/rootworm/nodeinjury/nodeinjury.html). Plot means were used for analysis of variance and mean separation by Tukey's HSD method (α=0.05). Treatment efficiency was determined as the percentage of total plants per treatment having a root rating of 0.25 or lower.

Western corn rootworm pressure was somewhat higher than in 2006 (3.1 untreated control rating on the Iowa 1-6 scale), with the untreated control rating 0.78 (Table 6). All treatments were less damaged than the untreated control. No phytotoxicity was observed with any treatment.

Field History

Pest:	Western corn rootworm, *Diabrotica virgifera virgifera* LeConte
Cultivar:	Garst 8881RR (except for Agrisure RW and YieldGard Rootworm treatments)
Planting Date:	24 May 2007
Plant Population:	30,000
Irrigation:	furrow
Crop History:	Corn in 2001-2006
Fertilizer:	100 lb N, sidedressed
Herbicide:	Accent, 1 oz product/acre
Insecticide:	None prior to experiment
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (northern Block 3100)

Table 6. Control of western corn rootworm with planting-time insecticides, seed treatments, and plant-incorporated protectants, ARDEC, Fort Collins, 2007

PRODUCT, OZ/1000 ROW FT[3]	ROOT RATING[1]	EFFICIENCY[2]
Agrisure RW	0.02 B	100.0
Counter 15G, 8 oz	0.06 B	100.0
Maxim/Apron + Poncho 1.25	0.08 B	100.0
Cruiser 1.25	0.09 B	100.0
Maxim/Apron + EXP 4C	0.10 B	100.0
YieldGard Rootworm	0.11 B	94.5
Maxim/Apron + Aztec 2.1G 6.7 oz/1000 ft	0.12 B	100.0
Maxim/Apron + Aztec 2.1G 8.0 oz/1000 ft	0.12 B	83.3
Maxim/Apron + Poncho 0.25 + Aztec 2.1G 6.7 oz/1000 ft	0.13 B	83.3
Lorsban 15G, 8 oz	0.13 B	83.3
Maxim/Apron + EXP 4C + Aztec 2.1G 6.7 oz/1000 ft	0.15 B	94.5
Force 3G, 5 oz	0.17 B	89.0
Cruiser 0.25	0.25 B	83.3
Maxim/Apron (untreated control)	0.78 A	27.8
F value	5.25	—
p>F	<0.0001	—

[1]0-3 node damage scale. Means followed by the same letter(s) are not statistically different, Tukey's HSD (α=0.05).
[2]Percentage of 18 plants (total in 6 replicates of a treatment) with a rating of 0.25 or less.
[3]Seed treatment rates given in active ingredient (mg) per seed

CONTROL OF WESTERN CORN ROOTWORM IN FIELD CORN WITH THE AGRISURE RW TRAIT, ARDEC, FORT COLLINS, CO, 2007

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CONTROL OF WESTERN CORN ROOTWORM IN FIELD CORN WITH THE AGRISURE RW TRAIT, ARDEC, FORT COLLINS, CO, 2007: All treatments were planted on 24 May 2007. Granular insecticides were applied with modified Wintersteiger meters mounted on a two-row John Deere Maxi-Merge planter. T-band granular applications were applied with a 4-inch John Deere spreader located between the disk openers and the press wheel. Plots were four 25-ft rows arranged in six replicates of a randomized complete block design.

Treatments were evaluated by digging three plants from the second row per plot on 10 July 2007. The roots were washed and the damage rated on the 0-3 node injury scale (http://www.ent.iastate.edu/pest/rootworm/nodeinjury/nodeinjury.html). Plot means were used for analysis of variance and mean separation by Tukey's HSD method (α=0.05). Treatment efficiency was determined as the percentage of total plants per treatment having a root rating of 0.25 or lower. Ears from 17.5 ft of the third row in each plot were harvested on 2 October 2007, and grain yields were analyzed in the same manner as root ratings.

Western corn rootworm pressure was somewhat higher than in 2006 (3.1 untreated control rating on the Iowa 1-6 scale). Also, more damage was observed in this study than in the other 2007 study, with average damage in Cruiser 0.25 treatments of 0.98 and 0.25 in this study and the other 2007 study, respectively. The Agrisure RW treatments were superior to the conventional treatments in terms of root damage, root protection efficiency, and yield in the case of Hybrid D (Tables 7 and 8). No phytotoxicity was observed with any treatment.

Field History

Pest:	Western corn rootworm, *Diabrotica virgifera virgifera* LeConte
Cultivar:	various
Planting Date:	24 May 2007
Plant Population:	30,000
Irrigation:	furrow
Crop History:	Corn in 2001-2006
Fertilization:	100 lb N, sidedressed
Herbicide:	Accent, 1 oz product/acre
Insecticide:	None prior to experiment
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (northern Block 3100)

Table 7. Control of western corn rootworm with the Agrisure RW trait, ARDEC, Fort Collins, 2007

TRAIT AND INSECTICIDE TREATMENTS[3]	ROOT RATING[1]	EFFICIENCY[2]
Agrisure RW (Hybrid A) + Cruiser, 0.25 mg	0.02 B	100
Agrisure RW (Hybrid B) + Cruiser, 0.25 mg	0.06 B	100
Conventional (Hybrid C) + Cruiser, 0.25 mg + Force 3G, 3 oz/1000 ft	1.12 A	4.2
Conventional (Hybrid D) + Cruiser, 0.25 mg	1.18 A	8.3
Conventional (Hybrid E) + Cruiser, 0.25 mg	0.79 A	4.2
F value	12.44	—
p>F	0.0003	—

[1]0-3 node damage scale. Means followed by the same letter(s) are not statistically different, Tukey's HSD (α=0.05).
[2]Percentage of 18 plants (total in 6 replicates of a treatment) with a rating of 0.25 or less.
[3]Seed treatment rates given in active ingredient (mg) per seed

Table 8. Corn grain yields for Agrisure RW and conventional hybrids, ARDEC, Fort Collins, 2007

TRAIT AND INSECTICIDE TREATMENTS	BU/ACRE AT 15.5% ± SEM[1]
Agrisure RW (Hybrid A) + Cruiser, 0.25 mg	206.7 ± 2.3 A
Agrisure RW (Hybrid B) + Cruiser, 0.25 mg	203.3 ± 1.2 A
Conventional (Hybrid E) + Cruiser, 0.25 mg	193.6 ± 8.3 AB
Conventional (Hybrid C) + Cruiser, 0.25 mg + Force 3G, 3 oz/1000 ft	186.8 ± 5.5 AB
Conventional (Hybrid D) + Cruiser, 0.25 mg	180.1 ± 3.0 B
F Value	5.68
P>F	0.0084

[1]SEM, standard error of the mean. Means followed by the same letter(s) are not statistically different, Tukey's HSD (α=0.05).

INFESTATION METHODS FOR WESTERN BEAN CUTWORM IN FIELD CORN, ARDEC, FORT COLLINS, CO, 2007

Frank Peairs, Terri Randolph, Jeff Rudolph, and Scott Merrill, Department of Bioagricultural Sciences and Pest Management

INFESTATION METHODS FOR WESTERN BEAN CUTWORM IN FIELD CORN, ARDEC, FORT COLLINS, CO, 2007: The experiment was planted on 8 May 2007. Plants were infested during the green silk stage by using a Davis insect inoculator (Davis, F. M. and T. G. Oswalt. 1979. Hand inoculator for dispensing lepidopterous insects. Agricultural Research [Southern Region], Science and Education Administration, USDA, New Orleans, LA. Southern Series 9) to place neonate western bean cutworm larvae mixed with corn cob grits on the silks. Larvae were hatched from field-collected egg masses purchased from Larry Appel Consulting. Treatments were: infested once, infested on two consecutive days, infested on three consecutive days, and an uninfested control. One week after the last infestation, ears were covered with paper bags to prevent infestation by other insects and bird predation. A fifth treatment of three consecutive infestations with the ears left unbagged was included. Infestations were accomplished on July 25 (12 larvae per plant), July 26 (15 larvae per plant), and July 27 (14 larvae per plant). Plots consisted of five consecutive plants within a row, separated by one uninfested row, arranged in four replicates of a randomized complete block design.

Treatments were evaluated on 28 August 2007 by opening the husks of the primary ear of each of the infested plants and counting damaged ears and larvae. Larvae generally were fully grown, and a few had already left the ears. Plot means were used for analysis of variance and mean separation by Tukey's HSD method (α=0.05). Larval counts were transformed by the square root + 0.5 method prior to analysis, and untransformed means are reported in Table 9.

Infesting on two and three consecutive days resulted in 95 to 100% infested ears. Larval densities increased with the number of infestations (Table 9). Greater densities might result from additional infestations or infesting with more larvae. Larval movement was observed, but not assessed systematically. As many as 12 infested plants in the plot row, including the five treated plants, were noted. Also, up 80% infestations were observed in the 10 plants separating plots. Bagging ears did not affect percentage infestation or larval density, however the level of bird damage in the plot area was much less than observed in previous years.

Field History

Pest:	Western bean cutworm, *Striacosta albicosta* (Smith)
Cultivar:	Garst 8881RR
Planting Date:	8 May 2007
Plant Population:	29,000
Irrigation:	Linear move sprinkler
Crop History:	Winter wheat in 2006
Insecticide:	None prior to experiment
Herbicide:	Roundup UltraMax, 23 fl.oz.product/acre + 1% ammonium sulphate + Harness, 40 fl. oz. product/acre on 25 May 2007
Fertilization:	Manure
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (NE Block 1030)

Table 9. Western bean cutworm larvae per ear and percentage damaged ears resulting from one, two and three consecutive infestations with neonate larvae, ARDEC, Fort Collins, CO, 2007.

INFESTATION METHOD	LARVAE PER EAR ± SEM[1,2]				% DAMAGED EARS[1]	
Infested three times (unbagged)	1.75	±	0.24	A	100	A
Infested three times	1.70	±	0.41	A	95	A
Infested two times	1.30	±	0.21	AB	95	A
Infested one time	0.65	±	0.05	B	65	B
Uninfested	0.05	±	0.05	C	5	C
F value	21.53				106.33	
p>F	<0.0001				<0.0001	

[1]Means in this column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).
[2]SEM, standard error of the mean.

CONTROL OF WESTERN BEAN CUTWORM IN TRANSGENIC FIELD CORN HYBRIDS, ARDEC, FORT COLLINS, CO, 2007

Frank Peairs, Terri Randolph, Jeff Rudolph, and Scott Merrill, Department of Bioagricultural Sciences and Pest Management

CONTROL OF WESTERN BEAN CUTWORM IN TRANSGENIC FIELD CORN HYBRIDS, ARDEC, FORT COLLINS, CO, 2007: The experiment was planted on 9 May 2007. Plants were infested during the green silk stage by using a Davis insect inoculator (Davis, F. M. and T. G. Oswalt. 1979. Hand inoculator for dispensing lepidopterous insects. Agricultural Research [Southern Region], Science and Education Administration, USDA, New Orleans, LA. Southern Series 9) to place neonate western bean cutworm larvae mixed with corn cob grits on the silks. Infestations were accomplished on July 26 (22 larvae per plant) and July 27 (14 larvae per plant). Larvae were hatched from field-collected egg masses purchased from Haarburg Consulting, Joes, CO. Ten consecutive plants were infested in each of the two center rows per plot. The plants in the west infested row were evaluated for western bean cutworm abundance, while the ears in the east row were evaluated for ear damage and harvested for subsequent mycotoxin evaluation. Treatments were Herculex CB, YieldGard Corn Borer, and three hybrids (A, B and C) containing an experimental Monsanto trait. One week after the second infestation, ears were covered with paper bags to prevent infestation by other insects and bird predation. Plots consisted of four 25-foot rows arranged in four replicates of a randomized complete block design.

Treatments were evaluated for larval abundance on 28 August by opening the husks of the primary ear of the infested plants in the west row and counting damaged ears and larvae. Larvae generally were fully grown, and a few had already left the ears. Damage to the primary ear on infested plants in the east row was evaluated on 21 September by placing a grid of $0.26 cm^2$ squares, printed on a transparency, over the ear tip and counting the squares subtended by damaged ear surface. Plot means were used for analysis of variance and mean separation by Tukey's HSD method (α=0.05). Larval counts were transformed by the square root + 0.5 method prior to analysis, and untransformed means are reported in Table 10.

The Herculex I traited hybrid had fewer larvae per ear and fewer infested ears than the other hybrids (Table 10). The Herculex I traited hybrid had fewer damaged ears than Hybrids B and C, and less area damaged per ear than Hybrid B (Table 11).

Field History

Pest:	Western bean cutworm, *Striacosta albicosta* (Smith)
Cultivar:	Five Monsanto experimental hybrids
Planting Date:	9 May 2007
Plant Population:	29,000
Irrigation:	Linear move sprinkler
Crop History:	Spring barley in 2006
Insecticide:	None prior to experiment
Herbicide:	Roundup UltraMax, 23 fl.oz.product/acre + 1% ammonium sulphate + Harness, 40 fl. oz. product/acre on 25 May 2007
Fertilization:	120 N
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (SE Block 1080)

Table 10. Western bean cutworm larvae per ear and percentage damaged ears resulting from two consecutive infestations with neonate larvae, ARDEC, Fort Collins, CO, 2007.

TRAIT	WBC LARVAE PER EAR ± SEM[1,2]	% INFESTED EARS[1]
Herculex I	0.1 ± 0.0 B	10 ± 0.0 B
Hybrid A	0.8 ± 0.2 A	62 ± 13.2 A
Hybrid B	0.9 ± 0.2 A	62 ± 16.5 A
YieldGard Corn Borer	1.2 ± 0.4 A	70 ± 14.7 A
Hybrid C	1.3 ± 0.2 A	88 ± 4.8 A
F value	12.23	11.96
p>F	0.0003	0.0004

[1]Means in this column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).
[2]SEM, standard error of the mean.

Table 11. Ear surface damaged by western bean cutworm larvae resulting from two consecutive infestations with neonate larvae, ARDEC, Fort Collins, CO, 2007.

TRAIT	% DAMAGED EARS[1,2]	SQ. CM DAMAGE PER EAR[1,2]	SQ. CM DAMAGE PER DAMAGED EAR[1,2]
Hybrid A	47.5 ± 11.1 AB	1.61 ± 0.14 AB	4.09 ± 1.1
Hybrid B	72.5 ± 15.5 A	3.48 ± 0.85 A	4.78 ± 0.3
YieldGard Corn Borer	52.5 ± 13.2 AB	2.15 ± 0.69 AB	3.85 ± 0.3
Hybrid C	72.5 ± 14.4 A	2.46 ± 0.65 AB	3.27 ± 0.5
Herculex I	15.0 ± 6.5 B	0.46 ± 0.27 B	1.92 ± 0.9
F Value	3.60	0.69	2.28
p>F	<0.0001	0.0351	0.1209

[1]Means in this column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).
[2]SEM, standard error of the mean.

CONTROL OF SPIDER MITES IN CORN WITH HAND-APPLIED INSECTICIDES AND MITICIDES, ARDEC, FORT COLLINS, CO, 2007

Terri Randolph, Jeff Rudolph, Frank Peairs, Scott Merrill, Sam Gray, Ben Horne, Tyler Keck, and Lucas Rael, Department of Bioagricultural Sciences and Pest Management

CONTROL OF SPIDER MITES IN CORN WITH HAND-APPLIED INSECTICIDES AND MITICIDES, ARDEC, FORT COLLINS, CO, 2007: Early treatments were applied on 23 July 2007 using a 2 row boom sprayer mounted on a backpack calibrated to deliver 17.8 gal/acre at 32 psi with five XR8002VS nozzles. All other treatments were applied in the same manner on 8 August 2007. Conditions were clear, calm winds and 76 - 82°F temperature at the time of early treatments. Conditions were calm winds and 73 - 76°F temperature at the time of late treatments. Early treatments were applied at tassel emergence and late treatments were applied at brown silk. Plots were 25 ft by two rows (30 inch centers) and were arranged in six replicates of a randomized complete block design. Plots were separated from neighboring plots by a single buffer row. An infestation on 10 July 2007, with mites from Mesa County, CO was unsuccessful. On 12 July 2007, the experimental area was treated with permethrin 3.2E, 0.2 lb (AI)/acre to control beneficial insects and promote spider mite abundance. Plots were reinfested on 19 July 2007 by laying mite infested corn leaves, collected earlier that day at Mead, CO, across the corn plants on which mites were to be counted.

Treatments were evaluated by collecting three leaves (ear leaf, 2nd leaf above the ear, 2nd leaf below the ear) from two plants per plot 1 day prior and 13, 19 and 26 days after the later treatments (DAT). Corn leaves were placed in Berlese funnels for 48 hours to extract mites into alcohol for counting. Extracted mites were identified as Banks grass mite or twospotted spider mite and counted. Banks grass mite 19 DAT, twospotted spider mite 26 DAT and total mites 19 DAT were not transformed prior to analysis. The remaining counts were transformed due to significant Tukey's single df tests for nonadditivity. Banks grass mite 26 DAT, twospotted spider mite 19 DAT and total mites 26 DAT were transformed by the square root + 0.5 method prior to analysis. Remaining mite counts and total mite days (calculated by the method of Ruppel, J. Econ. Entomol. 76: 375-377) were transformed by the log + 1 method. Counts, percentage twospotted spider mite and total mite days were subjected to analysis of variance and mean separation by Tukey's HSD method ($\propto$=0.05). Reductions in mite days were calculated by Abbott's (1925) formula: (percent reduction = ((untreated-treated)/untreated) X 100) using the average accumulated mite days of the untreated control. Untransformed counts for Banks grass mite, twospotted spider mite and total mites at 0, 13, 19 and 26 DAT are presented in Tables 12-14. Proportion twospotted spider mite at 13, 19 and 26 DAT and mite days accumulated at 26 DAT are presented in Table 15.

Mite densities were high and substantially higher than 2006, with 8372 mite days accumulated over 26 days vs. 2287 mite days accumulated in 21 days in 2006. Banks grass mite was the predominant species for most counts, however, twospotted spider mites were observed to increase rapidly after sampling was completed. A similar increase was reported in many commercial corn fields in the region. Additionally, severe stalk rot was noted throughout the experimental area, which seemed to be related to the presence of spider mites but not to miticide treatment. Onager 1E, 12 oz product + surfactant (early), Onager 1E, 10 oz product (early), and Onager 1E + dimethoate 4E, 10 oz product + 0.50 had fewer accumulated mite days than the untreated control (Table 15). Treatment effects were greater for Banks grass mite than twospotted spider mite (Tables 12-13). There tended to be a lower percentage twospotted spider mite among the early treatments (Table 15). There was no phytotoxicity observed for any treatment.

Field History:

Pest:	Banks grass mite, *Oligonychus pratensis* (Banks)
	Twospotted spider mite, *Tetranychus urticae* Koch
Cultivar:	Garst '8802' RR
Planting Date:	8 May 2007
Plant Population:	29,000
Irrigation:	Linear move sprinkler

Crop History:	Winter wheat in 2006
Herbicide:	Roundup UltraMax, 23 fl.oz.product/acre + 1% ammonium sulphate + Harness, 40 fl. oz. product/acre on 25 May 2007
Fertilization:	Manure
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (Block 1030, south end)

Table 12. Control of Banks grass mite in field corn with hand-applied miticides, ARDEC, Fort Collins, CO, 2007.

	BANKS GRASS MITES PER 6 LEAVES ± SEM[1]			
PRODUCT, LB (AI)/ACRE	**0 DAT**	**13 DAT**	**19 DAT**	**26 DAT**
Onager 1E + dimethoate 4E, 10 oz product + 0.50	4.7 ± 1.4	20.7 ± 10.5 BCD	47.8 ± 10.6 A	74.8 ± 20.8 C
Onager 1E, 10 oz product (early)	2.3 ± 0.8	21.0 ± 8.4 ABCD	79.7 ± 17.6 A	78.3 ± 24.5 C
Onager 1E, 12 oz product + surfactant[2] (early)	3.5 ± 0.8	7.5 ± 1.7 CD	68.3 ± 9.3 A	140.7 ± 67.1 BC
Oberon 4SC + dimethoate 4E, 0.135 + 0.50	8.5 ± 4.5	10.2 ± 6.5 D	64.5 ± 11.7 A	170.5 ± 53.3 BC
Capture 2E + dimethoate 4E, 0.08 + 0.50	20.2 ± 14.3	19.0 ± 6.1 BCD	154.7 ± 58.6 A	183.8 ± 27.6 BC
Dimethoate 4E, 0.50	11.3 ± 4.9	37.2 ± 12.8 ABCD	203.2 ± 74.0 A	245.8 ± 63.5 BC
Onager 1E, 12 oz product (early)	2.7 ± 0.5	6.3 ± 1.5 D	269.4 ± 138.3 A	255.2 ± 135.1 BC
Oberon 4SC, 0.09 (early)	2.7 ± 0.9	70.3 ± 21.2 ABCD	280.8 ± 50.5 A	359.7 ± 73.4 ABC
Acramite 4SC, 0.75 + surfactant[2] (early)	33.3 ± 20.4	215.8 ± 33.5 AB	359.3 ± 114.4 A	361.7 ± 102.2 BC
Acramite 4SC, 0.50 + surfactant[2] (early)	11.2 ± 5.5	80.2 ± 15.3 ABC	174.8 ± 55.5 A	420.0 ± 79.5 ABC
Oberon 4SC, 0.135 + surfactant[2] (early)	15.2 ± 8.0	218.7 ± 98.1 AB	165.0 ± 33.2 A	420.3 ± 106.3 ABC
Comite II 6E + dimethoate 4E, 1.69 + 0.50	2.3 ± 1.0	67.8 ± 25.4 ABCD	182.2 ± 81.4 A	447.2 ± 196.8 ABC
Capture 2E, 0.08	7.5 ± 3.9	121.0 ± 59.1 ABCD	249.2 ± 99.9 A	491.0 ± 118.3 ABC
Oberon 4SC, 0.135 (early)	6.7 ± 3.5	106.2 ± 74.6 ABCD	231.2 ± 68.3 A	536.7 ± 149.3 ABC
Onager 1E, 8 oz product (early)	18.5 ± 15.5	25.0 ± 14.6 ABCD	220.3 ± 125.3 A	545.0 ± 209.8 ABC
Acramite 4SC, 0.75 (early)	9.8 ± 6.2	229.8 ± 189.5 ABCD	240.2 ± 57.0 A	550.7 ± 140.1 ABC
Acramite 4SC. 0.375 + surfactant[2] (early)	4.7 ± 1.7	150.0 ± 74.6 AB	231.2 ± 66.9 A	618.5 ± 88.4 AB
Comite II, 2.25	7.7 ± 5.2	222.0 ± 66.0 A	303.2 ± 82.5 A	654.2 ± 195.4 AB
Untreated control	30.5 ± 18.8	191.5 ± 87.8 AB	424.3 ± 1.0 A	788.7 ± 354.9 AB
Comite II 6E, 1.69 (early)	26.0 ± 21.3	117.7 ± 58.0 ABCD	389.8 ± 143.0 A	1192.3 ± 262.0 A
F Value	0.68	4.90	1.77	4.56
p>F	0.8282	<0.0001	0.0374	<0.0001

[1]SEM, standard error of the mean. Means in the same column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).

[2]Silwet L-77 2 fl. oz/100 gal

Table 13. Control of twospotted spider mite in field corn with hand-applied miticides, ARDEC, Fort Collins, CO, 2007.

	TWOSPOTTED SPIDER MITES PER 6 LEAVES ± SEM[1]			
PRODUCT, LB (AI)/ACRE	**0 DAT**	**13 DAT**	**19 DAT**	**26 DAT**
Onager 1E, 12 oz product + surfactant[2] (early)	0.2 ± 0.2	1.3 ± 0.7	30.7 ± 8.2	41.5 ± 21.4 A
Onager 1E, 10 oz product (early)	0.0 ± 0.0	3.0 ± 1.4	54.3 ± 27.4	49.0 ± 13.2 A
Oberon 4SC, 0.135 + surfactant[2] (early)	0.3 ± 0.3	4.2 ± 1.0	21.8 ± 5.5	54.5 ± 20.2 A
Oberon 4SC, 0.135 (early)	0.0 ± 0.0	6.2 ± 2.9	38.8 ± 11.9	60.3 ± 12.0 A
Oberon 4SC, 0.09 (early)	1.0 ± 0.8	4.7 ± 1.4	57.0 ± 12.7	64.8 ± 6.0 A
Dimethoate 4E, 0.50	0.0 ± 0.0	4.2 ± 1.4	48.8 ± 28.7	71.8 ± 23.8 A
Oberon 4SC + dimethoate 4E, 0.135 + 0.50	0.5 ± 0.3	6.5 ± 1.8	76.7 ± 42.1	78.0 ± 27.4 A
Onager 1E + dimethoate 4E, 10 oz product + 0.50	0.3 ± 0.2	15.7 ± 10.8	48.0 ± 10.7	88.0 ± 26.2 A
Onager 1E, 12 oz product (early)	0.3 ± 0.3	2.3 ± 1.1	55.8 ± 11.7	91.8 ± 26.8 A
Acramite 4SC, 0.75 (early)	0.7 ± 0.5	8.0 ± 2.3	84.7 ± 40.5	94.3 ± 18.2 A
Acramite 4SC, 0.75 + surfactant[2] (early)	2.2 ± 1.8	0.5 ± 6.4	51.7 ± 13.1	100.2 ± 38.4 A
Acramite 4SC, 0.50 + surfactant[2] (early)	0.5 ± 0.5	39.7 ± 15.4	73.8 ± 28.5	104.3 ± 22.7 A
Capture 2E + dimethoate 4E, 0.08 + 0.50	1.0 ± 0.5	10.8 ± 7.3	42.3 ± 8.5	105.0 ± 28.0 A
Untreated control	2.0 ± 2.0	9.0 ± 3.9	41.7 ± 8.2	133.3 ± 38.8 A
Acramite 4SC. 0.375 + surfactant[2] (early)	0.2 ± 0.2	7.2 ± 2.4	74.8 ± 29.2	138.8 ± 50.9 A
Capture 2E, 0.08	0.8 ± 0.8	13.7 ± 8.6	58.8 ± 23.9	142.2 ± 40.7 A
Onager 1E, 8 oz product (early)	1.5 ± 1.3	16.8 ± 13.5	73.8 ± 27.6	144.0 ± 60.9 A
Comite II 6E, 1.69 (early)	1.5 ± 1.0	15.7 ± 7.4	77.7 ± 14.3	146.5 ± 26.3 A
Comite II 6E + dimethoate 4E, 1.69 + 0.50	0.0 ± 0.0	3.3 ± 1.6	40.8 ± 12.3	177.7 ± 45.3 A
Comite II, 2.25	0.3 ± 0.2	8.5 ± 3.5	46.2 ± 6.5	220.8 ± 83.2 A
F Value	0.92	1.3	0.88	1.78
p>F	0.5641	0.2	0.6044	0.0366

[1]SEM, standard error of the mean. Means in the same column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).

[2]Silwet L-77 2 fl. oz/100 gal

Table 14. Combined control of Banks grass mite and twospotted spider mite in field corn with hand-applied miticides, ARDEC, Fort Collins, CO, 2007.

	TOTAL BANKS GRASS MITES AND TWOSPOTTED SPIDER MITES PER 6 LEAVES ± SEM[1]						
PRODUCT, LB (AI)/ACRE	**0 DAT**	**13 DAT**		**19 DAT**		**26 DAT**	
Onager 1E, 10 oz product (early)	2.3 ± 0.8	24.0 ± 9.5	BCDE	134.0 ± 29.4	A	127.3 ± 36.6	E
Onager 1E + dimethoate 4E, 10 oz product + 0.50	5.0 ± 1.4	36.3 ± 13.0	ABCDE	95.8 ± 20.8	A	162.8 ± 43.0	DE
Onager 1E, 12 oz product + surfactant[2] (early)	3.7 ± 0.9	8.8 ± 2.3	DE	99.0 ± 13.1	A	182.2 ± 73.9	CDE
Oberon 4SC + dimethoate 4E, 0.135 + 0.50	9.0 ± 4.8	16.7 ± 6.3	CDE	141.2 ± 43.3	A	248.5 ± 79.2	BCDE
Capture 2E + dimethoate 4E, 0.08 + 0.50	21.2 ± 14.2	29.8 ± 10.8	ABCDE	197.0 ± 55.9	A	288.8 ± 48.9	BCDE
Dimethoate 4E, 0.50	11.3 ± 4.9	41.3 ± 11.8	ABCDE	252.0 ± 80.4	A	317.7 ± 80.4	BCDE
Onager 1E, 12 oz product (early)	3.0 ± 0.6	8.7 ± 2.3	E	325.2 ± 146.7	A	347.0 ± 142.8	BCDE
Oberon 4SC, 0.09 (early)	3.7 ± 1.1	75.0 ± 21.5	ABCDE	337.8 ± 50.8	A	424.5 ± 70.1	BCDE
Acramite 4SC, 0.75 + surfactant[2] (early)	35.5 ± 21.3	226.3 ± 132.9	AB	411.0 ± 114.0	A	461.8 ± 109.9	ABCDE
Oberon 4SC, 0.135 + surfactant[2] (early)	15.5 ± 8.3	222.8 ± 98.5	AB	186.8 ± 38.2	A	474.8 ± 121.1	ABCDE
Acramite 4SC, 0.50 + surfactant[2] (early)	11.7 ± 5.7	119.8 ± 20.1	ABC	248.7 ± 66.7	A	524.3 ± 91.3	ABCDE
Oberon 4SC, 0.135 (early)	6.7 ± 3.5	112.3 ± 77.3	ABCDE	270.0 ± 77.5	A	597.0 ± 158.4	ABCDE
Comite II 6E + dimethoate 4E, 1.69 + 0.50	2.3 ± 1.0	71.2 ± 25.0	ABCDE	223.0 ± 93.1	A	624.8 ± 204.2	ABCDE
Capture 2E, 0.08	8.3 ± 3.8	134.7 ± 58.1	ABC	308.0 ± 114.9	A	633.2 ± 113.0	ABCDE
Acramite 4SC, 0.75 (early)	10.5 ± 6.1	237.8 ± 190.1	ABCD	324.8 ± 61.6	A	645.0 ± 148.3	ABCDE
Onager 1E, 8 oz product (early)	20.0 ± 15.3	41.8 ± 17.8	ABCDE	294.2 ± 137.6	A	689.0 ± 223.6	ABCDE
Acramite 4SC. 0.375 + surfactant[2] (early)	4.8 ± 1.9	157.2 ± 73.8	ABC	306.0 ± 80.2	A	757.3 ± 121.1	ABC
Comite II, 2.25	8.0 ± 5.3	230.5 ± 67.4	A	349.3 ± 83.3	A	875.0 ± 225.9	AB
Untreated control	32.5 ± 18.5	200.5 ± 89.3	ABC	466.0 ± 106.5	A	922.0 ± 383.9	ABCD
Comite II 6E, 1.69 (early)	27.5 ± 22.3	133.3 ± 60.7	ABCD	467.5 ± 141.5	A	1338.8 ± 271.4	A
F Value	0.74	4.96		1.72		4.51	
p>F	0.7668	<0.0001		0.0454		<0.0001	

[1]SEM, standard error of the mean. Means in the same column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).

[2]Silwet L-77 2 fl. oz/100 gal

Table 15. Percentage twospotted spider mite and total mite days in field corn treated with hand-applied miticides, ARDEC, Fort Collins, CO, 2007.

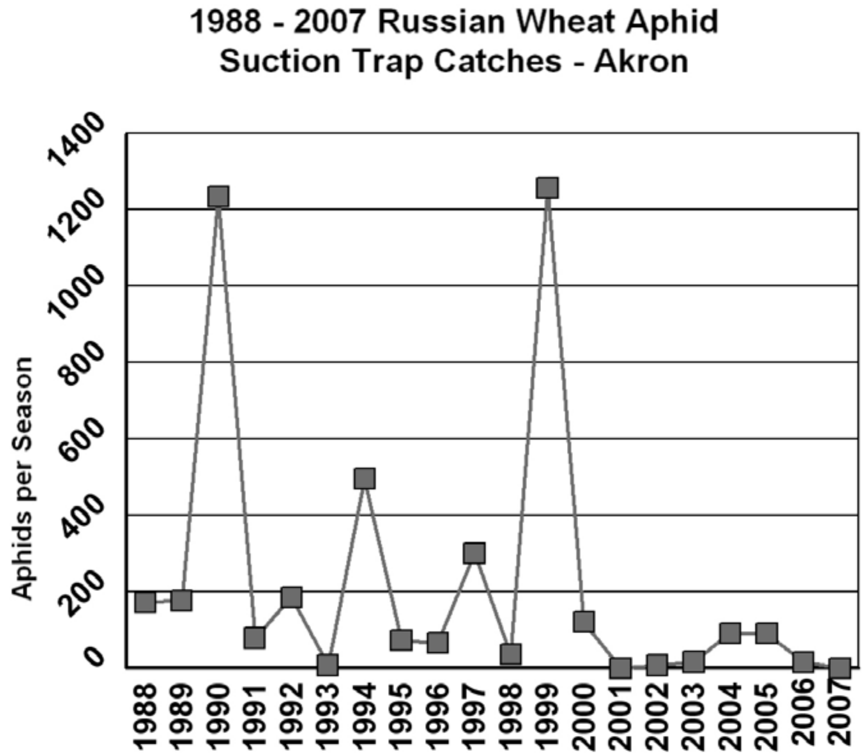
	PERCENTAGE TWOSPOTTED SPIDER MITES ± SEM[1]				
PRODUCT, LB (AI)/ACRE	**13 DAT**	**19 DAT**	**26 DAT**	**TOTAL MITE DAYS[3]**	**% REDUCTION IN MITE DAYS**
Onager 1E, 12 oz product + surfactant[2] (early)	10.6 ± 5.7 AB	29.5 ± 5.2 AB	23.9 ± 8.0 AB	1389 ± 354 C	83
Onager 1E, 10 oz product (early)	10.9 ± 6.8 AB	33.9 ± 9.9 AB	39.4 ± 4.4 AB	1560 ± 242 C	81
Onager 1E + dimethoate 4E, 10 oz product + 0.50	29.3 ± 15.9 AB	49.8 ± 1.9 A	48.9 ± 6.3 A	1571 ± 367 C	81
Oberon 4SC + dimethoate 4E, 0.135 + 0.50	56.4 ± 11.1 A	44.1 ± 9.3 AB	30.7 ± 3.7 AB	2004 ± 537 BC	76
Capture 2E + dimethoate 4E, 0.08 + 0.50	37.3 ± 15.1 AB	33.2 ± 9.8 AB	35.0 ± 5.0 AB	2712 ± 507 BC	68
Dimethoate 4E, 0.50	20.1 ± 9.0 AB	19.8 ± 6.8 AB	23.7 ± 6.2 AB	3216 ± 712 ABC	62
Onager 1E, 12 oz product (early)	23.9 ± 6.9 AB	31.2 ± 8.4 AB	38.4 ± 6.2 AB	3297 ± 1415 ABC	61
Comite II 6E + dimethoate 4E, 1.69 + 0.50	21.5 ± 15.9 AB	25.3 ± 4.5 AB	37.3 ± 9.9 AB	4328 ± 1167 ABC	48
Oberon 4SC, 0.09 (early)	9.9 ± 5.6 AB	18.3 ± 4.4 AB	18.5 ± 4.0 B	4418 ± 576 ABC	47
Acramite 4SC, 0.50 + surfactant[2] (early)	29.2 ± 9.3 AB	30.4 ± 6.6 AB	20.5 ± 3.1 AB	4666 ± 687 ABC	44
Onager 1E, 8 oz product (early)	22.7 ± 15.4 AB	34.8 ± 7.4 AB	25.1 ± 7.4 AB	4851 ± 1854 ABC	42
Oberon 4SC, 0.135 (early)	13.9 ± 8.0 AB	14.1 ± 2.3 B	12.1 ± 2.5 B	4955 ± 1629 ABC	41
Oberon 4SC, 0.135 + surfactant[2] (early)	4.3 ± 2.0 B	11.5 ± 2.2 B	13.4 ± 4.2 B	5094 ± 940 ABC	39
Capture 2E, 0.08	14.9 ± 11.1 AB	20.9 ± 8.0 AB	26.1 ± 9.1 AB	5552 ± 1502 ABC	34
Acramite 4SC. 0.375 + surfactant[2] (early)	8.5 ± 2.8 AB	30.7 ± 8.7 AB	17.3 ± 3.9 B	6164 ± 966 ABC	26
Acramite 4SC, 0.75 + surfactant[2] (early)	9.3 ± 4.4 AB	18.2 ± 6.4 AB	21.1 ± 7.9 AB	6669 ± 1198 ABC	20
Acramite 4SC, 0.75 (early)	19.4 ± 9.8 AB	26.7 ± 9.4 AB	17.3 ± 3.8 B	6697 ± 2304 ABC	20
Comite II, 2.25	6.0 ± 2.1 B	17.1 ± 3.9 AB	25.2 ± 7.7 AB	7575 ± 1637 ABC	10
Untreated control	13.9 ± 10.9 AB	13.7 ± 5.0 B	21.3 ± 7.3 AB	8372 ± 2087 AB	—
Comite II 6E, 1.69 (early)	22.8 ± 11.4 AB	21.8 ± 6.2 AB	12.9 ± 2.7 B	9170 ± 2058 A	-10
F Value	1.7	2.24	3.01	3.39	
p>F	0.0493	0.0057	0.0002	<0.0001	

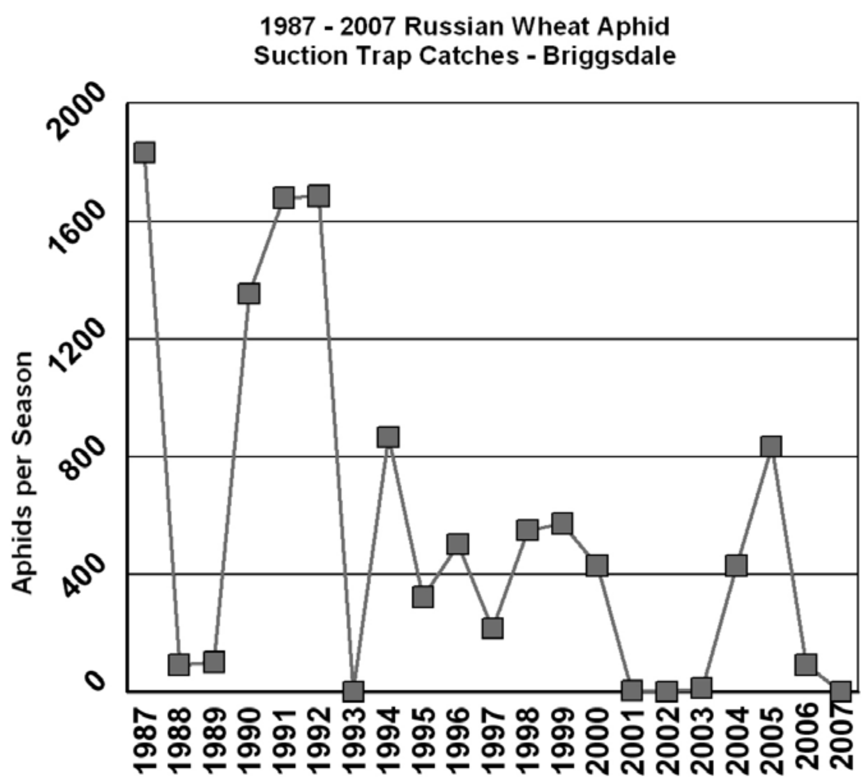
[1]SEM, standard error of the mean. Means in the same column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).
[2]Silwet L-77 2 fl. oz/100 gal
[3]Total mite days calculated by the Ruppel method.

Table 16. 2007 pheromone trap catches at Akron, ARDEC and Briggsdale.

	Location							
	ARDEC – 1070		ARDEC – Kerble		Akron		Briggsdale[3]	
Species	**Total Caught**[2]	**Trapping Period**	**Total Caught**[2]	**Trapping Period**[2]	**Total Caught**[2]	**Trapping Period**[2]	**Total Caught**[2]	**Trapping Period**[2]
Army cutworm	23 (14)	9/18 - 10/8	64 (21)	9/18 - 10/8	23 (41)	9/3 - 10/12	134 (130)	9/3 - 10/8
Banded sunflower moth	52 (189)	6/25 - 9/3	57 (214)	6/25 - 9/3	–	–	–	–
Corn earworm	1 (1)	7/2 - 9/3	12 (0)	7/2 - 9/3	–	–	–	–
European corn borer (IA)[1]	12 (6)	5/21 - 9/18	51 (7)	5/21 - 9/18	–	–	–	–
Fall armyworm	24 (46)	7/2 - 9/18	116 (72)	7/2 - 9/18	–	–	–	–
Pale western cutworm	123 (196)	9/18 - 10/8	267 (351)	9/18 - 10/8	6 (1)	9/3 - 10/12	875 (512)	9/3 - 10/8
Southwestern corn borer	(0)	5/26 - 8/17	(0)	5/26 - 8/17	–	–	–	–
Sunflower moth	14 (0)	6/25 - 9/3	49 (1)	6/25 - 9/3	–	–	–	–
Western bean cutworm	9 (5)	6/25 - 8/13	38 (50)	6/25 - 8/13	–	–	–	–

[1] IA, Iowa strain
[2] –, not trapped. Number in () is 2006 total catch for comparison
[3] Briggsdale counts are the average of two traps


1988 - 2007 Russian Wheat Aphid
Suction Trap Catches - Akron
Aphids per Season
0
200
400
600
800
1000
1200
1400
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007


1987 - 2007 Russian Wheat Aphid
Suction Trap Catches - Briggsdale
Aphids per Season
0
400
800
1200
1600
2000
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007


1988 - 2007 Russian Wheat Aphid
Suction Trap Catches - Lamar
Aphids per Season
0
200
400
600
800
1000
1200
1400
1600
1800
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Year


1987 - 2007 Russian Wheat Aphid
Suction Trap Catches - Walsh
Aphids per Season
0
1000
2000
3000
4000
5000
6000
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Year

INSECTICIDE PERFORMANCE SUMMARIES

Insecticide performance in a single experiment can be quite misleading. To aid in the interpretation of the tests included in this report, long term performance summaries are presented below for insecticides that are registered for use in Colorado and that have been tested at least three times. These summaries are complete through 2007.

Table 17. Performance of planting-time insecticides against western corn rootworm, 1987-2007, in northern Colorado

INSECTICIDE	IOWA 1-6 ROOT RATING[1]
AZTEC 2.1G	2.6 (30)
COUNTER 15G	2.6 (31)
CRUISER, 1.25 mg (AI)/seed	2.3 (6)
FORCE 1.5G (8 OZ) or 3G (4 OZ)	2.7 (29)
FORCE 3G (5 OZ)	2.5 (8)
FORTRESS 5G	2.8 (14)
LORSBAN 15G	3.0 (26)
PONCHO, 1.25 mg (AI)/seed	2.3 (7)
REGENT 4SC, 3-5 GPA	3.0 (5)
THIMET 20G	3.4 (15)
UNTREATED CONTROL	4.1 (37)

[1]Rated on a scale of 1-6, where 1 is least damaged, and 6 is most heavily damaged. Number in parenthesis is number of times tested for average. Planting time treatments averaged over application methods.

Table 18. Performance of cultivation insecticide treatments against western corn rootworm, 1987-2005, in northern Colorado.

INSECTICIDE	IOWA 1-6 ROOT RATING[1]
COUNTER 15G	2.8 (21)
FORCE 3G	3.3 (8)
FURADAN 4F, 2.4 OZ, BANDED OVER WHORL	3.2 (12)
FURADAN 4F, 1.0, INCORPORATED	3.3 (3)
LORSBAN 15G	3.1 (17)
THIMET 20G	2.9 (19)
UNTREATED CONTROL	4.2 (24)

[1]Rated on a scale of 1-6, where 1 is least damaged, and 6 is most heavily damaged. Number in () is number of times tested for average. Planting time treatments averaged over application methods.

Table 19. Insecticide performance against first generation European corn borer, 1982-2002, in northeast Colorado.

MATERIAL	LB/ACRE	METHOD[1]	% CONTROL[2]
DIPEL ES	1 QT + OIL	I	91 (4)
LORSBAN 15G	1.00 (AI)	A	77 (5)
LORSBAN 15G	1.00 (AI)	C	80 (6)
LORSBAN 4E	1.0 (AI)	I	87 (9)
POUNCE 3.2E	0.15 (AI)	I	88 (11)
POUNCE 1.5G	0.15 (AI)	C	87 (4)
POUNCE 1.5G	0.15 (AI)	A	73 (7)
THIMET 20G	1.00 (AI)	C	77 (4)
THIMET 20G	1.00 (AI)	A	73 (3)
WARRIOR 1E	0.03 (AI	I	85 (4)

[1]A = Aerial, C = Cultivator, I = Center Pivot Injection. CSU does not recommend the use of aerially-applied liquids for control of first generation European corn borer.
[2]Numbers in () indicate that percent control is the average of that many trials.

Table 20. Insecticide performance against western bean cutworm, 1982-2002, in northeast Colorado.

MATERIAL	LB (AI)/ACRE	METHOD[1]	% CONTROL[2]
CAPTURE 2E	0.08	A	98 (5)
CAPTURE 2E	0.08	I	98 (5)
LORSBAN 4E	0.75	A	88 (4)
LORSBAN 4E	0.75	I	94 (4)
POUNCE 3.2E	0.05	A	97 (7)
POUNCE 3.2E	0.05	I	99 (5)
WARRIOR 1E (T)	0.02	I	96 (2)

[1]A = Aerial, I = Center Pivot Injection
[2]Numbers in () indicated that percent control is average of that many trials.

Table 21. Insecticide performance against second generation European corn borer, 1982-2002, in northeast Colorado.

MATERIAL	LB (AI)/ACRE	METHOD[1]	% CONTROL[2]
DIPEL ES	1 QT PRODUCT	I	56 (16)
CAPTURE 2E	0.08	A	85 (8)
CAPTURE 2E	0.08	I	86 (14)
FURADAN 4F	1.00	A	62 (6)
LORSBAN 4E	1.00	A	41 (6)
LORSBAN 4E	1.00 + OIL	I	72 (14)
PENNCAP M	1.00	A	74 (7)
PENNCAP M	1.00	I	74 (8)
POUNCE 3.2E	0.15	I	74 (11)
WARRIOR 1E	0.03	A	81 (4)
WARRIOR 1E	0.03	I	78 (4)

[1]A = Aerial, I = Center Pivot Injection

[2]Numbers in () indicate how many trials are averaged.

Table 22. Performance of hand-applied insecticides against alfalfa weevil larvae, 1984-2007, in northern Colorado.

PRODUCT	LB (AI)/ACRE	% CONTROL AT 2 WK[1]
BAYTHROID 2E (or XL equivalent rate)	0.025	97 (14)
BAYTHROID 2E (or XL equivalent rate)	0.025 (early)[3]	96 (4)
FURADAN 4F	0.25	87 (15)
FURADAN 4F	0.50	91 (28)
FURADAN 4F+DIMETHOATE 4E	0.50 + 0.25	90 (9)
LORSBAN 4E	0.75	93 (21)
LORSBAN 4E	1.00	96 (6)
LORSBAN 4E	0.50	83 (10)
MUSTANG MAX	0.025	92 (5)
MUSTANG MAX	0.025 (early)[3]	93 (5)
PENNCAP M	0.75	84 (11)
PERMETHRIN [2]	0.10	67 (7)
PERMETHRIN [2]	0.20	80 (4)
STEWARD	0.065	77 (6)
STEWARD	0.110	83 (4)
WARRIOR 1E or T	0.02	92 (18)
WARRIOR 1E or T	0.02 (early)[3]	68 (5)
WARRIOR 1E or T	0.03	94 (7)

[1]Number in () indicates number of years included in average.

[2]Includes both Ambush 2E and Pounce 3.2E.

[3]Early treatment timed for control of army cutworm

Table 23. Control of Russian wheat aphid with hand-applied insecticides in winter wheat, 1986-2007[1].

PRODUCT	LB (AI)/ACRE	TESTS WITH > 90% CONTROL 21 DAT	TOTAL TESTS	% TESTS
LORSBAN 4E	0.50	27	43	63
DIMETHOATE 4E	0.375	8	37	22
MUSTANG MAX	0.025	2	5	40
PENNCAP M	0.75	3	18	17
LORSBAN 4E	0.25	10	25	40
LORSBAN 4E	0.38	5	6	83
WARRIOR 1E	0.03	4	15	27

[1]Includes data from several states.

Table 24. Control of spider mites in artificially-infested corn with hand-applied insecticides, ARDEC, 1993-2006.

PRODUCT	LB (AI)/ACRE	% REDUCTION IN TOTAL MITE DAYS[1]
CAPTURE 2E	0.08	52 (14)
CAPTURE 2E + DIMETHOATE 4E	0.08 + 0.50	65 (14)
CAPTURE 2E + FURADAN 4F	0.08 + 0.50	66 (4)
COMITE II	1.64	18 (14)
COMITE II	2.53	49 (6)
COMITE II + DIMETHOATE 4E	1.64 + 0.50	53 (9)
DIMETHOATE 4E	0.50	45 (14)
FURADAN 4F	1.00	41 (13)
FURADAN 4F + DIMETHOATE 4E	1.00 + 0.50	46 (8)
OBERON	0.09	54 (4)

[1]Number in () indicates number of tests represented in average.

Table 25. Control of sunflower stem weevil with planting and cultivation treatments, USDA Central Great Plains Research Station, 1998-2002.

PRODUCT	LB (AI)/ACRE	TIMING	% CONTROL[1]
BAYTHROID 2E	0.02	CULTIVATION	57 (3)
BAYTHROID 2E	0.03	CULTIVATION	52 (3)
FURADAN 4F	0.75	CULTIVATION	61 (3)
FURADAN 4F	1.0	PLANTING	91 (3)
FURADAN 4F	1.0	CULTIVATION	83 (3)
WARRIOR 1E	0.02	CULTIVATION	63 (3)
WARRIOR 1E	0.03	CULTIVATION	61 (3)

[1]Number in () indicates number of tests represented in average.

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2007 COOPERATORS

PROJECT	LOCATION	COOPERATORS
Alfalfa insecticides	ARDEC, Fort Collins	Reg Koll, Chris Fryrear, Mark Collins
Barley insecticides	ARDEC, Fort Collins	Reg Koll, Chris Fryrear, Mark Collins
Corn rootworm control	ARDEC, Fort Collins	Reg Koll, Chris Fryrear, Mark Collins
Western bean cutworm control	ARDEC, Fort Collins	Reg Koll, Chris Fryrear, Mark Collins, Larry Appel, Randy Haarburg
Corn spider mite control	ARDEC, Fort Collins	Reg Koll, Chris Fryrear, Mark Collins, Kent Davis
Russian wheat aphid control	ARDEC, Fort Collins	Reg Koll, Chris Fryrear, Mark Collins
Pheromone traps	ARDEC, Fort Collins	Reg Koll, Chris Fryrear, Mark Collins
Pheromone traps	Briggsdale	Justin Herman, Stan Cass
Suction trap	Briggsdale	Justin Herman, Stan Cass
Suction trap	Akron (Central Great Plains Research Station)	Mike Koch, Merle Vigil
Suction trap	Lamar	Jeremy Stulp, Thia Walker
Suction trap	Walsh (Plainsman Research Center)	Deb Harn, Kevin Larson

PRODUCT INDEX