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Colorado State University

College of Agricultural Sciences

Department of Bioagricultural Sciences & Pest Management

2008 Colorado Field Crop Insect Management Research and Demonstration Trials

2008 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, 2008

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CONTROL OF RUSSIAN WHEAT APHID IN WINTER WHEAT WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2008: Treatments were applied on 23 April 2008 with a 'rickshaw-type' CO_2 powered sprayer calibrated to apply 20 gal/acre at 3 mph and 32 psi through three XR8002VS nozzles mounted on a 5.0 ft boom. Conditions were clear and calm with temperatures of 50 - 60°F during 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 20 March 2008.

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 taken the day before treatment averaged 5.0 Russian wheat aphids per tiller. Aphid counts transformed by the square root + ½ method were used for analysis of variance and mean separation by Tukey's HSD test (α=0.05). Original means are presented in Table 1. 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 20 aphids/tiller in the untreated control 21 DAT (Table 1) compared to 114 and 27 in 2006 and 2007, respectively. Crop condition was excellent with vigorous growth, which may explain the reduced aphid abundance. All treatments except Lannate LV, 0.45, Ultor, 4 oz + Dyne-Amic, and Ultor, 2 oz + Dyne-Amic had fewer aphid days than the untreated control. No 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:	'Hatcher'
Planting Date:	12 Sept 2007
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Fallow in 2006
Herbicide:	12 oz 2,4-D + 0.5 oz Harmony Extra/acre
Insecticide:	None prior to experiment
Fertilization:	None
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (Block 1030)

Table 1. Control of Russian wheat aphid with hand-applied insecticides, ARDEC, Fort Collins, CO. 2008.

PRODUCT, FLUID OUNCES/ACRE	APHIDS/TILLER ± SE[1] 7 DAT	14 DAT	21 DAT	APHID DAYS/TILLER ± SE[1]	% CONTROL[2]
Cobalt, 13 oz	0.8 ± 0.3 E	0.1 ± 0.1 D	0.6 ± 0.2 E	25.8 ± 1.6 E	88
Lorsban 4E-SG, 8 oz	0.6 ± 0.2 E	0.5 ± 0.3 CD	0.8 ± 0.4 DE	28.2 ± 4.8 DE	87
Lorsban 4E-SG, 16 oz	0.9 ± 0.6 E	0.5 ± 0.2 CD	0.5 ± 0.2 E	28.8 ± 4.4 DE	87
Warrior, 0.03	1.8 ± 0.5 DE	3.2 ± 0.6 BC	6.1 ± 0.9 CDE	73.7 ± 5.4 CD	66
Dimethoate 4E, 12 oz	2.6 ± 0.6 CDE	3.6 ± 1.0 BC	7.5 ± 0.8 BC	86.8 ± 8.6 BC	60
Ultor, 2 oz + Dyne-Amic + Baythroid XL, 1.8 oz	2.6 ± 0.3 CDE	4.1 ± 0.5 AB	7.0 ± 2.2 BCD	89.0 ± 11.0 BC	59
Mustang Max 0.8 E, 0.025	3.1 ± 1.0 CDE	4.4 ± 1.1 AB	9.3 ± 1.8 ABC	102.0 ± 19.3 BC	53
Ultor, 6 oz + Dyne-Amic	4.4 ± 0.9 BCD	4.7 ± 0.9 AB	6.2 ± 2.2 CDE	102.6 ± 17.6 BC	53
Ultor, 2 oz + Dyne-Amic + UAN 28%	5.2 ± 1.1 ABC	4.4 ± 0.2 AB	5.4 ± 0.4 CDE	103.2 ± 9.9 BC	53
Baythroid XL, 1.8 oz + Dyne-Amic	3.9 ± 0.6 BCD	3.4 ± 0.9 BC	10.8 ± 2.3 ABC	106.1 ± 15.8 BC	52
Baythroid XL, 2.4 oz	3.3 ± 0.3 BCD	5.5 ± 0.9 AB	13.2 ± 1.6 ABC	125.4 ± 10.6 BC	43
Ultor, 4 oz + Dyne-Amic + Baythroid XL 1.8 oz	3.7 ± 0.9 BCD	6.8 ± 2.1 AB	11.6 ± 4.2 ABC	131.1 ± 33.5 BC	40
Lannate LV, 0.45	2.6 ± 0.6 CDE	5.6 ± 1.2 AB	16.6 ± 2.3 AB	132.9 ± 14.7 ABC	39
Ultor, 4 oz + Dyne-Amic	5.2 ± 0.5 ABC	7.8 ± 1.1 AB	10.6 ± 1.4 ABC	146.1 ± 10.4 AB	33
Ultor, 2 oz + Dyne-Amic	6.6 ± 1.3 AB	7.4 ± 1.1 AB	9.2 ± 2.1 ABC	147.7 ± 21.4 AB	33
Untreated control	8.8 ± 1.3 A	10.0 ± 1.8 A	19.9 ± 3.6 A	218.9 ± 26.8 A	–
F value	12.94	10.62	10.96	14.45	–
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 RUSSIAN WHEAT APHID BIOTYPE 2 IN SPRING BARLEY WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2008

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CONTROL OF RUSSIAN WHEAT APHID BIOTYPE 2 IN SPRING BARLEY WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2008: Treatments were applied on 21 May 2008 with a 'rickshaw-type' CO2 powered sprayer calibrated to apply 20 gal/acre at 3 mph 32 psi through three XR8002VS nozzles mounted on a 5.0 ft boom. Conditions were overcast and calm with a temperature of 60 F (start) to 60 F (finish) at the time of treatment. The Actara 4oz product comprising the Warrior, 0.03, Actara 4oz product treatment was applied on 10 June 2008. The same sprayer was used and conditions were clear, with wind 7 mph from the south, and 76 F. Plots were 6 rows (5.0 ft) by (20 ft) and were arranged in five replicates of a randomized, complete block design. Crop stage at application was 4 leaf (Zadoks 14). The crop had been infested with greenhouse-reared aphids on 29 April 2008.

Treatments were evaluated by collecting 20 symptomatic tillers along the middle four rows of each plot 8, 20, and 31 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 4.88 ± 0.75 Russian wheat aphids per tiller. Aphid counts were subjected to analysis of variance and mean separation by Tukey's HSD test (=0.05). Aphid counts at 8, 20, and 31 DAT were transformed by the log + 0.01 method prior to analysis. Original means are presented in Table 2. Total insect days for each treatment were calculated according to 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 much less severe than past artificially-infested spring barley experiments, with about 3 aphids/tiller in the untreated control 31 DAT. The Baythroid XL, 2.4 oz treatment had fewer aphids than the untreated control 8 DAT. The Actara 4oz + Warrior 0.03 and Warrior 0.03+ Actara 4oz (applied at three weeks) treatments had fewer aphids than the untreated control 20 DAT. Only Warrior 0.03+ Actara 4oz product (applied at three weeks) had fewer aphids than the untreated control 31 DAT. All treatments but Ultor 6oz + Dyne-Amic had fewer aphid days than the untreated control. No treatment provided 90% reduction in aphid days, which is considered good control of Russian wheat aphid in winter wheat.

Field History

Pest:	Russian wheat aphid, *Diuraphis noxia* (Kurdjumov)
Cultivar:	'Otis'
Planting Date:	12 March 2008
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Corn in 2007
Herbicide:	Harmony Extra, 0.5oz/acre + 2, 4-D 16 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 (south end of Block 1080)

Table 2. Control of Russian wheat aphid in spring barley with hand-applied insecticides, ARDEC, Fort Collins, CO. 2008

PRODUCT, FLUID OZ/ACRE	APHIDS PER TILLER ± SE[1] 8 DAT	20 DAT	31 DAT	TOTAL APHID DAYS PER TILLER ± SE	% REDUCTION IN APHID DAYS
Actara, 4.0 oz + Warrior, 1.92 oz	0.3 ± 0.3 AB	0.2± 0.1 BC	0.6 ± 0.2 AB	28.1 ± 3.12 B	49
Baythroid XL, 2.4 oz	0.0 ± 0.0 B	0.4 ± 0.2 ABC	0.8 ± 0.2 AB	28.9 ± 1.8 B	48
Actara, 4.0 oz	0.2 ± 0.1 AB	0.5 ± 0.2 ABC	0.4 ± 0.1 AB	29.2 ± 2.6 B	48
Warrior, 1.92 oz, Actara 4.0 oz at 3 weeks	1.3 ± 1.1 AB	0.1± 0.1 C	0.1 ± 0.8 B	33.2 ± 11.1 AB	40
Warrior, 1.92 oz	1.0 ± 0.8 AB	0.3 ± 0.1 ABC	0.5 ± 0.2 AB	35.6 ± 8.1 AB	36
Untreated control	0.5 ± 0.1 A	1.7 ± 0.6 A	3.0 ± 0.7 A	55.6 ± 7.3 A	—
Ultor, 6.0 oz + Dyne-Amic	1.2 ± 0.6 AB	1.0 ± 0.1 AB	2.6 ± 0.8 A	57.6 ± 5.6 A	0
F Value	2.81	4.74	3.87	4.86	—
p > F	0.0323	0.0026	0.0087	0.0027	—

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

CONTROL OF BROWN WHEAT MITE *PETROBIA LATENS* (MÜLLER) IN WINTER WHEAT WITH DIMETHOATE 4E APPLIED AT THREE GROWTH STAGES. LAMAR, CO 2008

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CONTROL OF BROWN WHEAT MITE *PETROBIA LATENS* (MÜLLER) IN WINTER WHEAT WITH DIMETHOATE 4E APPLIED AT THREE GROWTH STAGES. LAMAR, CO 2008: Dimethoate 4E (8 fl oz/acre) was applied to 'Hatcher' winter wheat on 4 April (Feekes 3), 14 April (Feekes 4-5), or 24 April (Feekes 6-7) using a 'rickshaw-type' $C0_2$ sprayer calibrated to apply 16 gpa through 6 TeeJet Al 11002 VS nozzles mounted on a 10 foot boom at 30 psi and 2.4 mph. Induce pH®, a wetter/spreader and buffering/conditioning agent, was added at 0.25% v/v. Conditions at the time of treatment were 51-54°F air temperature and 7-8 mph wind speed, 53-58°F air temperature and 4-5 mph wind speed, and 68-73°F air temperature and 2-3 mph wind speed for the first, second and third treatments, respectively. Plots were 10 x 50 feet and were arranged in eight replicates of a randomized complete block design.

Brown wheat mite abundance was evaluated with a Vortis insect suction sampler (Burkard Manufacturing Co., Rickmansworth, England). Plots were sampled at 10, 20 and 27 days after the first treatment (DAT). Five five-second samples were taken per plot. Samples were combined and placed in Berlese funnels for 24 hours to extract mites into alcohol for counting. Mite counts were transformed by the log+1 method prior to ANOVA and mean separation by Tukey's HSD ($\propto$=0.05). Untransformed means are presented in Table 3. 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 3. Reductions in insect days were calculated by Abbott's (1925) formula: (percent reduction = ((untreated-treated)/untreated) X 100). Yields were evaluated by combining a 7 x 45 foot area per plot. Yields were converted to bushels per acre at 13% moisture for statistical analysis.

Precounts, taken one day before the Feekes 3 treatment averaged 647 mites per 25 seconds of sampling. All treatments reduced mite abundance and accumulated mite days. The Feekes 3 treatment had fewer mites than the untreated control for the duration of the experiment, which also was the case for the Feekes 4-5 and Feekes 6-7 treatments once they were applied. Yields and test weights were not affected by treatment.

Pest:	Brown wheat mite, *Petrobia latens* (Müller)
Cultivar:	'Hatcher'
Planting Date:	20 August 2007
Irrigation:	None
Crop History:	Fallow in 2006
Herbicide:	0.10 oz/acre Ally XP
Insecticide:	None prior to experiment
Fertilization:	30 lbs N top-dressed in spring 2008
Soil Type:	Sandy silt loam
Location:	Prowers County, NE1/4 SEC 31 T23S R46W, Stulp Farms

Table 3. Control of brown wheat mite in winter wheat with dimethoate 4E applied at different growth stages, Lamar, CO, 2008.

Growth Stage Treated	Brown Wheat Mites Per 25 Seconds ± SEM[1]								
	10 DAT[2,3]		20 DAT[2,3]		27 DAT[2,3]		Total Mite Days ± SEM[1,3]		Reduction in Total Mite Days	Bushels Per Acre @13%	Test Weight (lbs)
Feekes 3	14 ± 3	B	132 ± 30	BC	156 ± 32	B	5049 ± 372	B	65	49.6	60.7
Feekes 4-5	180 ± 69	A	81 ± 26	C	73 ± 12	C	5981 ± 733	B	58	45.9	61.4
Feekes 6-7	208 ± 38	A	418 ± 80	AB	23 ± 5	D	8947 ± 931	B	38	45.5	61.1
Untreated	171 ± 52	A	893 ± 232	A	526 ± 96	A	14376 ± 2653	A	—	45.3	61.5
F Value	15.13		9.93		48.13		9.74		—	1.59	2.21
p>F	<0.0001		0.0003		<0.0001		0.0003		—	0.2218	0.1174

[1]SEM, standard error of the mean.
[2]DAT, days after Feekes 3 treatment.
[3]Means in the same column followed by the same letter are not statistically different, Tukey's HSD (∝=0.05).

CONTROL OF ALFALFA INSECTS IN ALFALFA WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2008

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CONTROL OF ALFALFA INSECTS IN ALFALFA WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2008: Early treatments were applied on 18 April 2008 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 21 May 2008. Conditions were clear and calm, with temperatures of 52°F at the time of early treatments. Conditions were cloudy and calm temperatures of 60°F at the time of the later treatments. Plots were 10.0 ft by 25.0 ft and arranged in six replicates of a randomized, complete block design. Untreated control and Warrior 1E, 0.03 lb (AI)/acre, plots were replicated 12 times for a more accurate comparison of treatment effects on yield (insect counts from six reps of each treatment were included in the analyses described below). The crop was 3 inches in height at the time of early treatments. Crop height at the time of late treatments was 10 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 7.0 and 3.5 alfalfa weevil larvae and pea aphids per sweep, respectively. Insect 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, 1.92 fl. oz./acre, and untreated control plots on 9 June 2008 with a Carter forage harvester. Yields were converted to lbs of dry hay per acre, using a subsample to determine moisture content. Treated plots were compared to the untreated control using one way analysis of variance (α=0.05).

Pea aphid and alfalfa weevil larval densities were generally lower than in 2007. All treatments had fewer alfalfa weevil larvae than the untreated control 7, 14 and 14 DAT (Table 4). No treatment had fewer alfalfa weevil adults than the untreated control at any evaluation date (Table 5). The early Baythroid XL treatment had more pea aphids than the untreated control 7 DAT, and both Baythroid XL treatments had more pea aphids that the untreated control 21 DAT (Table 6). No phytotoxicity was observed with any treatment. The plots treated with Warrior 1E, 1.92 fl. oz./acre, yielded 1611 lbs/acre, and the untreated plots yielded 1708 lbs/acre. The difference was not significant (df=1,22; F=3.55; p>F=0.0729). 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)
	Pea aphid, *Acyrthosiphon pisum* (Harris)
Cultivar:	Unknown
Plant Stand:	Thin, vole damage, dry conditions
Irrigation:	Linear move sprinkler with drop nozzles
Crop History:	Alfalfa since 2002
Herbicide:	None
Insecticide:	None prior to experiment
Fertilization:	None
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO, 80524 (Block 1060 south)

Table 4. Control of alfalfa weevil larvae, ARDEC, Fort Collins, CO, 2008.

	ALFALFA WEEVIL LARVAE PER 180° SWEEP ± SEM[1]		
PRODUCT, FLUID OUNCES/ACRE	**7 DAT**	**14 DAT**	**21 DAT**
Warrior 1E, 1.92 oz	0.0 ± 0.0 B	0.2 ± 0.1 C	0.1 ± 0.1 C
Cobalt, 19 oz	0.1 ± 0.0 B	0.5 ± 0.2 C	0.1 ± 0.1 C
Baythroid XL, 2.8 oz	5.4 ± 5.2 B	0.2 ± 0.1 C	0.2 ± 0.1 C
Mustang Max 0.8EC, 4.0 oz	0.1 ± 0.1 B	0.2 ± 0.1 C	0.3 ± 0.2 C
Cobalt, 38 oz	0.0 ± 0.0 B	0.3 ± 0.3 C	0.4 ± 0.1 C
Baythroid XL, 2.8 oz, early	0.6 ± 0.2 B	0.5 ± 0.1 C	0.6 ± 0.2 C
Steward EC, 6.7 oz	0.0 ± 0.0 B	0.8 ± 0.3 C	1.3 ± 0.9 BC
Warrior 1E, 1.92 oz, early	0.5 ± 0.2 B	0.8 ± 0.3 C	1.6 ± 0.7 BC
Cobalt, 38 oz, early	1.3 ± 0.3 B	3.5 ± 1.8 BC	1.8 ± 0.5 BC
Lorsban 4F, 24.0 oz	0.1 ± 0.0 B	0.4 ± 0.1 C	1.8 ± 0.4 BC
Mustang Max 0.8EC, 4.0 oz, early	2.7 ± 0.8 B	6.4 ± 2.5 B	3.6 ± 1.3 B
Untreated control	22.5 ± 1.9 A	19.2 ± 2.4 A	20.7 ± 3.0 A
F value	19.89	24.63	35.41
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 5. Control of alfalfa weevil adults, ARDEC, Fort Collins, CO, 2008.

	ALFALFA WEEVIL ADULTS PER 180° SWEEP ± SEM[1]		
PRODUCT, FLUID OUNCES/ACRE	**7 DAT**	**14 DAT**	**21 DAT**
Mustang Max 0.8EC, 4.0 oz, early	0.1 ± 0.1 A	0.2 ± 0.1 A	0.0 ± 0.0 B
Cobalt, 38 oz, early	0.1 ± 0.0 A	0.1 ± 0.1 A	0.1 ± 0.0 B
Lorsban 4F, 24.0 oz	0.1 ± 0.0 A	0.2 ± 0.1 A	0.1 ± 0.1 AB
Untreated control	0.0 ± 0.0 A	0.2 ± 0.1 A	0.1 ± 0.0 AB
Baythroid XL, 2.8 oz, early	0.2 ± 0.1 A	0.2 ± 0.1 A	0.1 ± 0.1 AB
Warrior 1E, 1.92 oz, early	0.0 ± 0.0 A	0.1 ± 0.0 A	0.1 ± 0.0 AB
Steward EC, 6.7 oz	0.0 ± 0.0 A	0.1 ± 0.0 A	0.2 ± 0.2 AB
Cobalt, 19 oz	0.1 ± 0.1 A	0.6 ± 0.3 A	0.3 ± 0.2 AB
Mustang Max 0.8EC, 4.0 oz	0.1 ± 0.0 A	0.7 ± 0.3 A	0.3 ± 0.1 AB
Cobalt, 38 oz	0.1 ± 0.0 A	1.4 ± 0.9 A	0.3 ± 0.1 AB
Baythroid XL, 2.8 oz	0.1 ± 0.1 A	0.2 ± 0.1 A	0.5 ± 0.1 A
Warrior 1E, 1.92 oz	0.1 ± 0.0 A	0.7 ± 0.3 A	0.6 ± 0.2 A
F value	1.58	2.14	3.28
P>F	0.1294	1.92 oz20	0.0016

[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 6. Control of pea aphids, ARDEC, Fort Collins, CO, 2008.

PRODUCT, FLUID OUNCES/ACRE	**PEA APHIDS PER 180° SWEEP ± SEM[1]**					
	7 DAT		**14 DAT**		**21 DAT**	
Untreated control	5.0 ± 0.9	ABCD	5.7 ± 1.5	A	18.7 ± 3.7	C
Cobalt, 38 oz product	0.5 ± 0.2	E	8.3 ± 2.7	A	22.7 ± 5.5	BC
Lorsban 4F, 0.75	1.4 ± 0.5	DE	17.9 ± 6.3	A	30.0 ± 6.2	ABC
Steward EC, 0.065	6.3 ± 1.9	ABCD	18.3 ± 5.1	A	31.7 ± 8.6	ABC
Cobalt, 19 oz product	1.8 ± 0.9	DE	13.2 ± 2.4	A	32.3 ± 2.3	ABC
Warrior 1E, 0.03	3.2 ± 1.2	CDE	18.5 ± 3.7	A	35.4 ± 6.9	ABC
Mustang Max 0.8EC, 0.025, early	13.0 ± 3.7	ABC	14.4 ± 3.7	A	37.8 ± 9.1	ABC
Cobalt, 38 oz product, early	9.2 ± 1.8	ABC	23.6 ± 9.9	A	44.1 ± 5.9	AB
Warrior 1E, 0.03, early	10.0 ± 3.0	ABC	27.0 ± 7.6	A	49.3 ± 9.1	AB
Mustang Max 0.8EC, 0.025	3.3 ± 1.0	BCDE	16.8 ± 5.1	A	52.4 ± 13.8	AB
Baythroid XL, 0.022, early	15.0 ± 2.7	A	29.9 ± 8.1	A	53.8 ± 11.9	AB
Baythroid XL, 0.022	2.7 ± 0.8	CDE	27.8 ± 8.5	A	57.8 ± 10.4	A
F value	9.90		1.81		3.69	
p>F	<0.0001		0.0750		0.0006	

[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, 2008

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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, 2008: All treatments were planted on 12 or 14 May 2008. 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 in the first experiment were one 25-ft row arranged in six replicates of a randomized complete block design, while plots in the second experiment were four 25-ft rows arranged in four replicates of a randomized complete block design.

Treatments in the first experiment were evaluated by digging three plants per plot on 10 July 2008. 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). Treatments in the second experiment were evaluated in the same manner, except three plants were taken from both the first and fourth row of the plot. 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.

Yield was evaluated in the second experiment by hand-harvesting the center two rows of the plot. Plot weights were converted to bushels per acre at 15.5% moisture and analyzed as described above.

Western corn rootworm pressure was somewhat higher than in 2007 (0.78 untreated control rating), with the untreated controls rating 0.94 and 1.18 in the first and second experiments, respectively. In the first experiment, EXP 7 + Y Bt Trait A, Bt Trait A, Bt Trait B, Poncho 0.25 mg (AI)/seed + Aztec 2.1G 6.7 oz/1000 ft, Poncho 1.25 mg (AI)/seed, and EXP 5B treatments were less damaged than the untreated control (Table 7). In the second experiment, all treatments except the conventional hybrid treated with the low rate of Poncho were less damaged than the untreated control (Table 8). No treatment effects on yield were observed. No phytotoxicity was observed with any treatment.

Field History

Pest:	Western corn rootworm, *Diabrotica virgifera virgifera* LeConte
Cultivar:	N40T
Planting Date:	12 May 2008
Plant Population:	29,000
Irrigation:	Furrow
Crop History:	Corn in 2007
Fertilizer:	125 N, 40 lb P
Herbicide:	4.7 oz Celebrity Plus + 32 oz 2,4-D/ 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. Commercial and experimental treatments for control of western corn rootworm, ARDEC, Fort Collins, CO. 2008.

TREATMENT	ROOT RATING[1]		EFFICIENCY[2]
EXP 7 + Bt Trait A	0.00	B	100
Bt Trait A	0.00	B	100
Bt Trait B	0.01	B	100
Poncho 0.25 mg (AI)/seed + Aztec 2.1G 6.7 oz/1000 ft	0.01	B	100
Poncho 1.25 mg (AI)/seed	0.12	B	89
EXP 5B	0.14	B	78
Bt Trait C	0.16	AB	78
Force 3G, 5 oz/1000 ft	0.19	AB	89
Counter 15G, 8 oz/1000 ft	0.21	AB	83
Cruiser, 1.25 mg (AI)/seed	0.48	AB	56
Lorsban 15G, 8 oz/1000 ft	0.57	AB	50
Untreated Control	0.94	A	50
F value	3.12		—
p>F	0.0025		—

[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 24 plants (total in 4 replicates of a treatment) with a rating of 0.25 or less.

Table 8. Agrisure RW for control of western corn rootworm, ARDEC, Fort Collins, CO. 2008.

TREATMENT	ROOT RATING[1]		EFFICIENCY[2]	BUSHELS PER ACRE @15.5%
Poncho 0.25 + Force 3G, 4 oz/1000 row ft	0.01	B	100	134.0
Agrisure RW + Cruiser 0.25	0.02	B	100	124.6
Agrisure CB + Cruiser 0.25 + Force 3G,	0.15	B	71	118.2
Poncho 0.25 (conventional hybrid)	0.50	AB	54	136.3
Agrisure CB + Cruiser 0.25	1.18	A	38	115.6
F value	6.07		—	0.97
p>F	0.0062		—	0.4589

[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 24 plants (total in 4 replicates of a treatment) with a rating of 0.25 or less.

CONTROL OF SPIDER MITES IN CORN WITH HAND-APPLIED INSECTICIDES AND MITICIDES, ARDEC, FORT COLLINS, CO, 2008

Terri Randolph, Jeff Rudolph, Frank Peairs, Anthony Longo-Peairs, Lucas Rael, and Marie Stiles, Department of Bioagricultural Sciences and Pest Management

CONTROL OF SPIDER MITES IN CORN WITH HAND-APPLIED INSECTICIDES AND MITICIDES, ARDEC, FORT COLLINS, CO, 2008: Early treatments were applied on 24 July 2008 using a 2 row boom sprayer mounted on a backpack and calibrated to deliver 17.8 gal/acre at 32 psi with five XR8002VS nozzles. All other treatments were applied in the same manner on 6 August 2008. Conditions were clear, calm and 75 - 85°F temperature at the time of early treatments. Conditions were clear, calm and 65 - 75°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 five replicates of a randomized complete block design. Plots were separated from neighboring plots by a single buffer row. Plots were infested on 1 July 2008 by laying mite infested corn leaves, collected earlier that day at Eaton, CO, across the corn plants on which mites were to be counted. On 8 July 2008, the experimental area was treated with permethrin 3.2E, 0.2 lb (AI)/acre to control mite predators and promote spider mite abundance.

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 7 and 14 days after the later treatments (DAT). Corn leaves were placed in Berlese funnels for 24 hours to extract mites into alcohol for counting. Extracted mites were identified as Banks grass mite or twospotted spider mite and counted, however, twospotted spider mites did not exceed 2% of the total mites collected on any date and were not considered in the analysis. The -1 DAT and 14 DAT mite counts were transformed by the square root + 0.5 method prior to analysis, while the 7 DAT counts were transformed by the log + 1 method. Counts were subjected to analysis of variance and mean separation by Tukey's HSD method ($\propto$=0.05). Untransformed mite counts at -1, 7 and 14 DAT are presented in Table 9.

Mite densities were low. On 14 August 2008 (9 DAT) the experiment received a large amount of hail followed by more than four inches of rain over the next several days. Hail defoliation was approximately 50%, and the experiment was terminated after the 14 DAT sample. Results are generally inconclusive, given the low mite abundance and severe weather experienced 9 DAT. There was no phytotoxicity observed for any treatment.

Field History:

Pest:	Banks grass mite, *Oligonychus pratensis* (Banks)
Cultivar:	N40T
Planting Date:	May 2008
Plant Population:	28,000
Irrigation:	Linear move sprinkler
Crop History:	Field corn in 2007
Herbicide:	Roundup, 23 oz + 1% ammonium sulphate/acre on 13 June 2008
Fertilization:	120 N , 80 P
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (Block 1030, east)

Table 9. Control of Banks grass mite in field corn with hand-applied miticides, ARDEC, Fort Collins, CO, 2008.

PRODUCT, FLUID OUNCES/ACRE	BANKS GRASS MITES PER LEAF ± SEM[1]		
	-1 DAT	7 DAT	14 DAT
Oberon 4SC + dimethoate 4E, 6 oz + 16 oz	2.0 ± 1.0 AB	1.9 ± 0.9 AB	0.8 ± 0.1 A
Oberon 4SC, 6 oz (early)	0.4 ± 0.2 B	1.1 ± 0.5 AB	1.1 ± 0.7 A
Onager 1E, 10 oz (early)	0.4 ± 0.3 AB	0.8 ± 0.5 B	1.2 ± 0.2 A
Onager 1E, 10 oz + COC, 32 oz (early)	0.3 ± 0.1 B	2.0 ± 1.2 AB	1.3 ± 0.7 A
Zeal 2.0 oz (early)	1.9 ± 1.2 B	5.3 ± 3.1 AB	1.6 ± 0.8 A
Oberon 4SC, 6 oz + COC, 32 oz (early)	2.1 ± 1.5 AB	3.6 ± 1.2 AB	2.0 ± 1.1 A
Zeal 1.5 oz (early)	0.9 ± 0.4 AB	3.8 ± 2.5 AB	2.3 ± 0.5 A
Zeal 1.0 oz (early)	1.3 ± 0.5 B	4.5 ± 2.0 AB	2.4 ± 1.0 A
Zeal 3.0 oz (early)	2.6 ± 1.8 AB	2.1 ± 1.2 AB	2.5 ± 1.4 A
Onager 1E + dimethoate 4E, 10 oz + 16 oz	3.0 ± 1.0 B	3.8 ± 0.9 AB	2.6 ± 1.3 A
Oberon 4SC, 4 oz + COC, 32 oz (early)	2.5 ± 0.7 AB	4.5 ± 1.3 AB	2.8 ± 1.1 A
Zeal 2.5 oz (early)	1.1 ± 0.4 AB	2.4 ± 1.8 AB	3.3 ± 2.2 A
Acramite 4SC, 24 oz + Silwet L-77, 2 oz/100 gal (early)	2.5 ± 0.8 AB	14.2 ± 5.1 A	3.8 ± 1.2 A
Acramite 4SC, 24 oz + COC, 32 oz (early)	2.3 ± 0.7 AB	6.0 ± 2.1 AB	4.0 ± 1.1 A
Comite II 6E + dimethoate 4E, 36 oz + 16 oz	2.7 ± 1.6 AB	3.1 ± 0.7 AB	4.6 ± 1.9 A
GWN 2106, 2.25 oz (early)	3.4 ± 1.0 AB	3.4 ± 0.8 AB	5.0 ± 1.8 A
Untreated control	2.2 ± 0.5 AB	12.3 ± 3.8 AB	5.2 ± 1.4 A
GWN 1708, 8 oz	5.1 ± 2.6 AB	9.0 ± 3.8 AB	6.1 ± 3.9 A
GWN 2106, 2.7 oz (early)	2.7 ± 1.8 AB	6.0 ± 5.2 AB	6.4 ± 5.3 A
Oberon 4SC, 4 oz + COC, 32 oz + 2.5% v/v UAN, 48 oz	0.4 ± 0.1 B	4.2 ± 2.3 AB	6.4 ± 3.3 A
dimethoate 4E, 16 oz	3.7 ± 1.8 AB	10.4 ± 3.4 AB	7.9 ± 2.1 A
Hero + dimethoate 4E, 10.3 oz + 16 oz	4.9 ± 1.3 AB	2.9 ± 0.6 AB	8.1 ± 4.7 A
GWN 1708, 24 oz	8.4 ± 2.3 A	8.3 ± 2.9 AB	8.5 ± 4.0 A
Comite II 6E, 36 oz (early)	5.4 ± 2.0 AB	12.1 ± 7.5 AB	13.3 ± 5.6 A
F value	2.56	2.28	1.46
P>F	0.0008	0.0030	0.1041

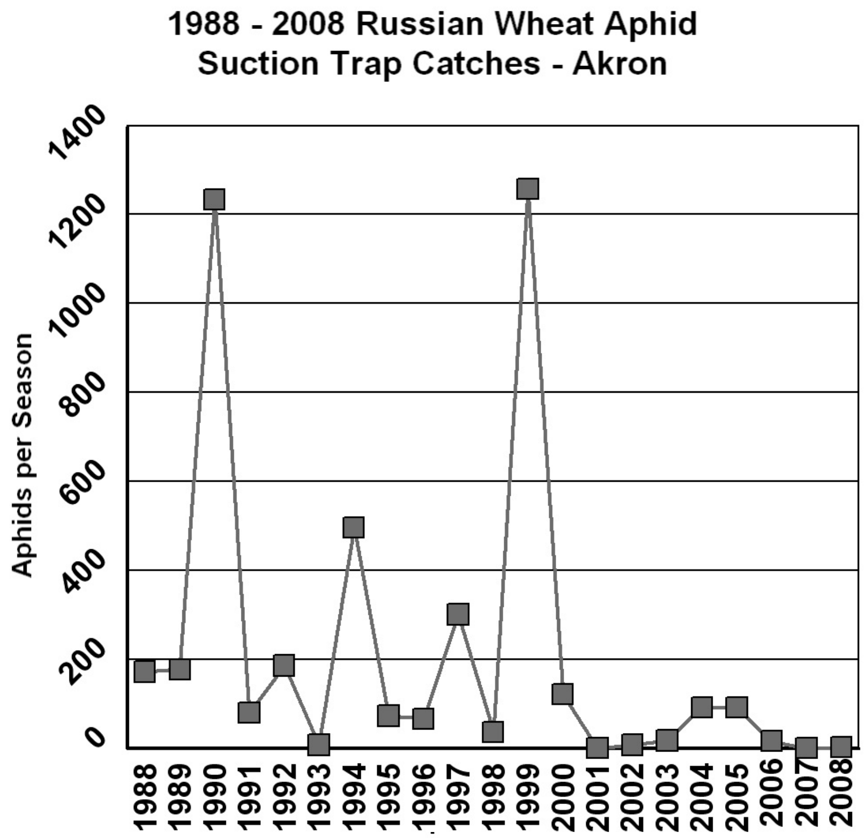
[1] SEM, standard error of the mean. Means in the same column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).

2008 PEST SURVEY RESULTS

Table 10. 2008 pheromone trap catches at ARDEC, Briggsdale, and Lamar.

Species	Location							
	ARDEC – 1070		ARDEC – Kerble		Briggsdale[3]		Lamar	
	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	21 (23)	8/23 - 11/3	–	–	142 (134)	8/29 - 10/31	40	8/18 - 11/1
Banded sunflower moth	0 (52)	7/18 - 8/29	13 (57)	7/18 - 8/29	–	–	–	–
Corn earworm	1 (1)	7/2 - 9/3	12 (0)	7/2 - 9/3	–	–	–	–
European corn borer (IA)[1]	54 (12)	6/6 - 10/13	81 (51)	6/6 - 10/13	–	–	–	–
Fall armyworm	80 (24)	7/18 - 11/3	113 (116)	7/18 - 11/3	–	–	–	–
Pale western cutworm	94 (123)	8/23 - 11/3	–	–	144 (875)	8/29 - 9/16	116	8/18 - 11/1
Southwestern corn borer	(0)	5/26 - 8/17	(0)	5/26 - 8/17	–	–	–	–
Sunflower moth	1 (14)	7/18 - 8/29	2 (49)	7/18 - 8/29	–	–	–	–
Western bean cutworm	3 (9)	7/18 - 8/8	3 (38)	7/18 - 8/8	–	–	–	–
Wheathead armyworm	56	6/13 - 11/3	–	–	70	6/20 - 10/31		

[1] IA, Iowa strain
[2] –, not trapped. Number in () is 2007 total catch for comparison
[3] Briggsdale counts are the average of two traps


1988 - 2008 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
2008


1987 - 2008 Russian Wheat Aphid
Suction Trap Catches - Briggsdale
Aphids per Season
0
400
800
1200
1600
2000
1987
1988
1989
1990
1991
1992
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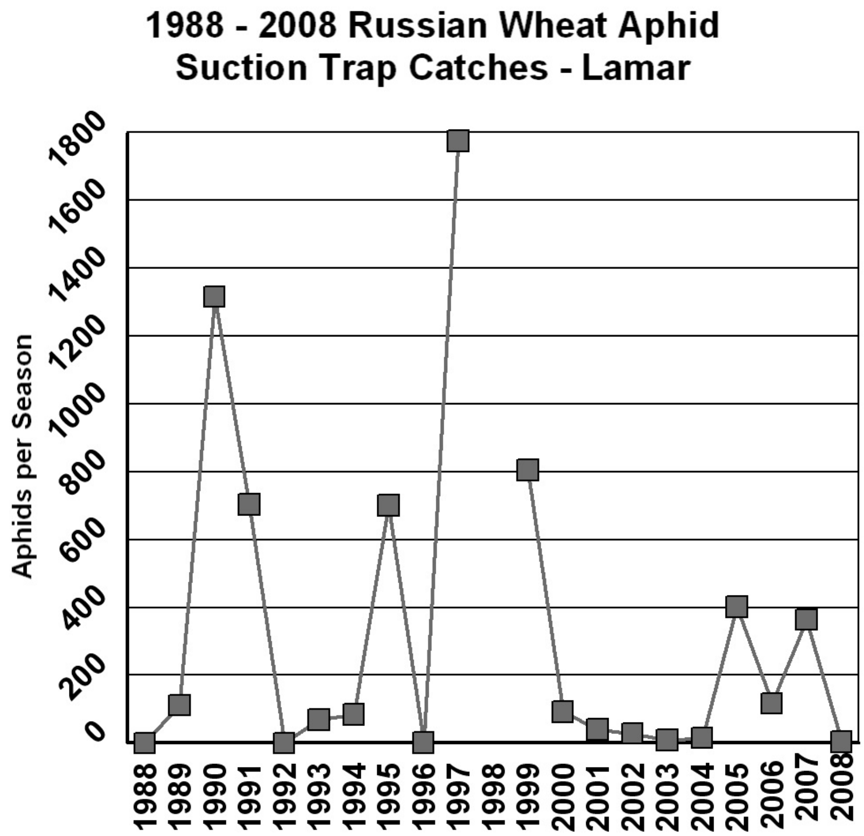
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year


1988 - 2008 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
2008


1987 - 2008 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
2008
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 2008.

Table 11. Performance of planting-time insecticides against western corn rootworm, 1987-2008, in northern Colorado

INSECTICIDE	IOWA 1-6 ROOT RATING[1]
AZTEC 2.1G	2.6 (30)
COUNTER 15G	2.6 (32)
CRUISER, 1.25 mg (AI)/seed	2.5 (7)
FORCE 1.5G (8 OZ) or 3G (4 OZ)	2.7 (29)
FORCE 3G (5 OZ)	2.6 (9)
FORTRESS 5G	2.8 (14)
LORSBAN 15G	3.0 (27)
PONCHO, 1.25 mg (AI)/seed	2.4 (8)
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 12. 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)
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 13. 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 14. 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 15. 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)
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 16. Performance of hand-applied insecticides against alfalfa weevil larvae, 1984-2008, in northern Colorado.

PRODUCT	LB (AI)/ACRE	% CONTROL AT 2 WK[1]
BAYTHROID 2E (or XL equivalent rate)	0.022	97 (15)
BAYTHROID 2E (or XL equivalent rate)	0.022 (early)[3]	96 (5)
LORSBAN 4E	0.75	93 (22)
LORSBAN 4E	1.00	96 (6)
LORSBAN 4E	0.50	83 (10)
MUSTANG MAX	0.025	92 (5)
MUSTANG MAX	0.025 (early)[3]	89 (6)
PENNCAP M	0.75	84 (11)
PERMETHRIN [2]	0.10	67 (7)
PERMETHRIN [2]	0.20	80 (4)
STEWARD	0.065	80 (7)
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 17. Control of Russian wheat aphid with hand-applied insecticides in winter wheat, 1986-2008[1].

PRODUCT	LB (AI)/ACRE	TESTS WITH > 90% CONTROL 21 DAT	TOTAL TESTS	% TESTS
LORSBAN 4E	0.50	27	44	61
DIMETHOATE 4E	0.375	8	38	21
MUSTANG MAX	0.025	2	6	33
PENNCAP M	0.75	3	18	17
LORSBAN 4E	0.25	10	26	38
LORSBAN 4E	0.38	5	6	83
WARRIOR 1E	0.03	4	16	25

[1]Includes data from several states.

Table 18. Control of spider mites in artificially-infested corn with hand-applied insecticides, ARDEC, 1993-2008.

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)
COMITE II	1.64	14 (14)
COMITE II	2.53	49 (6)
COMITE II + DIMETHOATE 4E	1.64 + 0.50	53 (10)
DIMETHOATE 4E	0.50	42 (14)
OBERON 4SC	0.135	55 (3)
ONAGER 1E	0.094	86 (3)

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

Table 19. 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.

ACKNOWLEDGMENTS

2008 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
Brown wheat mite control	Lamar	Jeremy Stulp, Thia Walker
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