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Agricultural Experiment Station

Colorado State University

College of Agricultural Sciences

Department of Bioagricultural Sciences and Pest Management

2011 Colorado Field Crop Insect Management Research and Demonstration Trials

2011 Colorado Field Crop Insect Management Research and Demonstration Trials[1]

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[1]Mention of a trademark or proprietary product does not constitute endorsement by the Colorado Agricultural Experiment Station.

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CONTROL OF BIOTYPE 2 RUSSIAN WHEAT APHID IN WINTER WHEAT WITH SEED TREATMENTS, ARDEC, FORT COLLINS, CO, 2011

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CONTROL OF RUSSIAN WHEAT APHID IN WINTER WHEAT WITH SEED TREATMENTS, ARDEC, FORT COLLINS, CO, 2011: Treated seeds were planted on 16 September 2010 using a small plot precision cone planter. 'Hawken' winter wheat seed had been treated by Syngenta Seeds, Stanton, MN. Plots were 6 rows (5.0 ft) by 10 ft and were arranged in six replicates of a randomized, complete block design. Two 1-m rows per plot were infested with greenhouse-reared aphids on 24 March 2011.

Treatments were evaluated for Russian wheat aphid control by collecting 20 tillers at random from the eastern infested row of each plot on 28 April 2011. Tiller samples were placed in Berlese funnels for 24 hours to extract aphids into alcohol for counting. Plots were harvested on 22 July 2011 by collecting the heads from the western infested meter-row per plot. Heads were subsequently counted, threshed and total grain weight and 500 seed weight were recorded.

Aphid counts were transformed by the square root + ½ method to correct for nonadditivity, and transformed counts were used for analysis of variance and mean separation by Tukey's HSD test ($\alpha=0.05$). Original means are presented in Table 1. The number of heads per plot, grain yield in bushels per acre and 500 seed weight were analyzed in a similar manner (Table 1).

Aphid pressure was lower than generally observed in winter wheat at this location, with approximately two aphids per tiller. However, an adjacent screening of foliar insecticides in winter wheat had similar aphid abundance in the untreated control. There were no differences among treatments. Crop condition was excellent, and no phytotoxicity was observed with any treatment.

Field History

Pest:	Russian wheat aphid, *Diuraphis noxia* (Kurdjumov)
Cultivar:	'Hawken'
Planting Date:	16 September 2010
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Fallow in 2009, no-till
Herbicide:	Huskie, 13 oz + 1 lb ammonium sulfate/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 SW)

Table 1. Russian wheat aphids per tiller in 'Hawken' wheat with insecticidal seed treatments, ARDEC, Fort Collins, CO, 2010-2011.

TREATMENT	RUSSIAN WHEAT APHIDS/TILLER ± SE[1]	HEAD/M^2 ± SE[1]	BU/AC ± SE[1]	500 SEED WT (g) ± SE[1]
Dividend Xtreme 0.96 FS, 3.0 + STP19183, 0.051	1.9 ± 0.5	229.2 ± 17.8	54.6 ± 5.3	19.6 ± 1.1
Dividend Xtreme 0.96 FS, 3.0 + Cruiser 5 FS, 0.51 + STP19183, 0.051	2.4 ± 0.7	230.2 ± 21.4	53.4 ± 3.7	19.5 ± 0.5
Cruiser Maxx Cereals 0.62 FS, 4.97 + STP19183, 0.051 + Apron XL 3 LS, 0.11 + Cruiser 5 FS, 0.256	1.7 ± 0.6	237.2 ± 30.1	53.5 ± 8.6	18.8 ± 0.7
A16874, 2.78 + STP19183, 0.051 + Apron XL 3 LS, 0.66 + Cruiser 5 FS, 0.51	2.0 ± 0.5	255.5 ± 11.6	55.0 ± 4.1	19.1 ± 0.2
A16874, 2.78 + STP19183, 0.051 + Maxim 4 FS, 0.08 + Cruiser 5 FS, 0.51	1.4 ± 0.4	241.2 ± 13.2	55.1 ± 5.0	19.7 ± 0.7
A17511, 4.93 + STP19183, 0.051 + Apron XL 3 LS, 0.66	2.5 ± 0.6	209.7 ± 26.4	47.8 ± 7.2	18.4 ± 0.5
A17511, 4.93 + STP19183, 0.051 + Apron XL 3 LS, 0.066 + Cruiser 5 FS, 0.256	2.0 ± 0.2	258.2 ± 29.9	59.1 ± 5.5	18.5 ± 0.5
A17511, 4.93 + Apron XL 3 LS, 0.066 + Maxim 4 FS, 0.08 + Cruiser 5 FS, 0.256	2.1 ± 0.5	225.3 ± 28.1	49.3 ± 5.8	19.6 ± 0.6
Proceed MD 0.205 FS, 5.0 + Gaucho 600 FS, 0.51	2.3 ± 0.6	244.5 ± 15.3	53.0 ± 5.3	18.5 ± 0.5
F value	0.61	0.49	0.35	0.90
p>F	0.7624	0.8566	0.9413	0.5262

[1]SE, standard error of the mean.

CONTROL OF BIOTYPE 2 RUSSIAN WHEAT APHID AND BROWN WHEAT MITE IN WINTER WHEAT WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2011

Jeff Rudolph, Terri Randolph, Frank Peairs, Jack Mangles, Laurie Kerzicnik, Anthony Peairs, and Cheryl Bowker, Department of Bioagricultural Sciences and Pest Management

CONTROL OF RUSSIAN WHEAT APHID AND BROWN WHEAT MITE IN WINTER WHEAT WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2011: Treatments were applied on 28 April 2011 with a 'rickshaw-type' CO_2 powered sprayer calibrated to apply 20 gal/acre at 3 mph and 32 psi through three 8002 (LF2) nozzles and a swath width of 4.5 ft. Conditions were clear and calm with temperatures of 50°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 stem elongation (Zadoks 33). The crop had been infested with greenhouse-reared aphids on 15 and 24 March 2011.

Treatments were evaluated for Russian wheat aphid control by collecting 20 symptomatic tillers along the middle four rows of each plot 8, 19 and 26 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 2.7 Russian wheat aphids per tiller.

A naturally occurring brown wheat mite infestation was evaluated by taking five five-second subsamples per plot with a Vortis suction sampler and placing the collected material in Berlese funnels for 48 hours to extract mites into alcohol for counting. The brown wheat mite precounts taken the day before treatment averaged 1320.3 mites per sample.

Aphid and mite counts were transformed by the log + 1 method to correct for nonadditivity, and transformed counts were used for analysis of variance and mean separation by Tukey's HSD test (α=0.05). Original Russian wheat aphid and brown wheat mite means are presented in Tables 2 and 3, respectively. Total aphid days per tiller and mite days per sample for each treatment were calculated according to the method of Ruppel (Journal of Economic Entomology 76: 375-7, 1983), transformed by the log + 1 method, and analyzed in the same manner, with original means presented in Tables 2 and 3. Reductions in insect days were calculated by Abbott's (1925) formula: (percent reduction = ((untreated-treated)/untreated) X 100).

Aphid pressure was substantially lower than in 2010, with approximately 1.6 aphids/tiller in the untreated control 26 DAT (Table 2) compared to more than 200 aphids per tiller 21 DAT in 2010. Crop condition was good. All treatments, except Transform, 0.70 oz + MSO Concentrate 0.25% v/v, Transform, 0.70 oz + Agri-Dex COC 1.0% v/v, Transform, 0.70 oz + Widespread Max 0.1% v/v, Transform, 0.50 oz, Transform, 0.70 oz, and Transform, 0.33 oz had fewer aphid days than the untreated control. No treatment reduced total aphid days over three weeks by 90% or more, the level of performance observed by the more effective treatments in past experiments. Brown wheat mite abundance was greater than in 2009, the only other year such data were collected, with 6871 total mite days over a 14 day period compared to 5469 total mite days over a 21 day period in 2009. No treatment had fewer mite days than the untreated control (Table 3). No phytotoxicity was observed with any treatment.

Field History

Pest:	Russian wheat aphid, *Diuraphis noxia* (Kurdjumov)
	Brown wheat mite, *Petrobia latens* (Müller)
Cultivar:	'Snowmass'
Planting Date:	16 September 2010
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Fallow in 2009, no-till
Herbicide:	Huskie, 13 oz + 1 lb ammonium sulfate/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 SW)

Table 2. Control of Russian wheat aphid in winter wheat with hand-applied insecticides, ARDEC, Fort Collins, CO. 2011.

PRODUCT, FL. OZ/ACRE	APHIDS PER TILLER ± SE[1] 8 DAT	19 DAT	26 DAT	APHID DAYS PER TILLER[2] ± SE	% REDUCTION IN APHID DAYS
Lorsban Advanced, 16 fl oz	0.11 ± 0.06 H	0.08 ± 0.04 C	0.11 ± 0.04 DE	12.96 ± 0.90 D	79
dimethoate 267, 16 fl oz	0.13 ± 0.04 GH	0.11 ± 0.02 C	0.13 ± 0.08 DE	13.48 ± 0.57 D	79
Transform, 0.50 oz + Warrior II, 0.96 fl oz	0.27 ± 0.10 EFGH	0.21 ± 0.07 C	0.18 ± 0.05 BCDE	15.85 ± 1.10 CD	75
Warrior II, 1.28 fl oz	0.38 ± 0.08 DEFG	0.19 ± 0.03 BC	0.15 ± 0.08 DE	16.69 ± 0.76 CD	74
Warrior II, 0.96 fl oz	0.46 ± 0.12 CDEFG	0.27 ± 0.07 BC	0.08 ± 0.04 DE	17.85 ± 1.17 CD	72
Transform, 0.50 oz + Warrior II, 1.28 fl oz	0.55 ± 0.14 CDEF	0.17 ± 0.08 C	0.19 ± 0.06 CDE	18.20 ± 0.89 CD	71
Cobalt Advanced, 11 fl oz	0.27 ± 0.11 FGH	0.51 ± 0.33 BC	0.10 ± 0.04 DE	18.26 ± 2.74 CD	71
Transform, 0.33 oz + Warrior II, 1.28 fl oz	0.55 ± 0.23 CDEFG	0.24 ± 0.05 BC	0.15 ± 0.07 CDE	18.73 ± 2.16 CD	70
Transform, 0.33 oz + Warrior II, 0.96 fl oz	0.63 ± 0.19 CDEFG	0.21 ± 0.07 BC	0.30 ± 0.17 CDE	19.74 ± 2.14 CD	69
Endigo, 4.5 fl oz + COC 1% v/v	0.78 ± 0.28 ABCDE	0.23 ± 0.08 BC	0.01 ± 0.01 E	20.22 ± 3.22 CD	68
Transform, 0.70 oz + Activator 90 0.5% v/v	0.65 ± 0.17 BCDEF	0.81 ± 0.11 AB	0.36 ± 0.10 ABCD	25.50 ± 1.89 BC	60
Transform, 0.70 oz + MSO Concentrate 0.25% v/v	1.05 ± 0.29 ABCD	1.64 ± 0.50 A	1.03 ± 0.25 A	39.17 ± 4.83 AB	38
Transform, 0.70 oz + Agri-Dex COC 1.0% v/v	1.18 ± 0.22 ABCD	1.57 ± 0.27 A	1.28 ± 0.56 AB	40.55 ± 4.61 AB	36
Transform, 0.70 oz + Widespread Max 0.1% v/v	1.29 ± 0.22 ABC	1.53 ± 0.47 A	1.48 ± 0.37 A	42.03 ± 3.71 A	34
Transform, 0.50 oz	1.43 ± 0.32 ABC	1.63 ± 0.25 A	1.58 ± 0.25 A	44.55 ± 3.78 A	30
Transform, 0.70 oz	1.85 ± 0.31 A	1.75 ± 0.51 A	0.80 ± 0.27 ABC	46.93 ± 4.53 A	26
Transform, 0.33 oz	1.76 ± 0.42 AB	2.41 ± 0.69 A	1.91 ± 0.54 A	55.86 ± 9.54 A	12
Untreated Control	1.98 ± 0.55 A	3.11 ± 0.76 A	1.65 ± 0.63 A	63.39 ± 12.75 A	0
F value	15.57	15.54	11.68	29.59	
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]Total aphid days per tiller calculated by the Ruppel method.

Table 3. Control of brown wheat mite in winter wheat with hand-applied insecticides, ARDEC, Fort Collins, CO. 2011.

PRODUCT, FL. OZ/ACRE	BROWN WHEAT MITES PER SAMPLE ± SE[1] 7 DAT		14 DAT		TOTAL MITE DAYS ± SE[1]		% REDUCTION IN MITE DAYS
dimethoate 267, 16 fl oz	15.7 ± 8.8	C	16.7 ± 8.6	D	3452.3 ± 76.2	C	50
Lorsban Advanced, 16 fl oz	15.3 ± 5.7	BC	24.2 ± 4.7	BCD	3476.6 ± 41.0	C	49
Cobalt Advanced, 11 fl oz	33.2 ± 11.3	BC	30.8 ± 10.8	BCD	3606.9 ± 75.9	BC	48
Transform, 0.50 oz + Warrior II, 0.96 fl oz	120.2 ± 37.9	ABC	49.2 ± 9.8	ABCD	4193.1 ± 221.5	ABC	39
Transform, 0.50 oz + Warrior II, 1.28 fl oz	133.3 ± 45.5	ABC	109.2 ± 56.4	ABCD	4482.1 ± 348.5	ABC	35
Warrior II, 0.96 fl oz	206.7 ± 127.8	BC	40.8 ± 23.0	CD	4682.9 ± 844.6	ABC	32
Warrior II, 1.28 fl oz	229.2 ± 121.4	BC	30.0 ± 12.0	BCD	4780.0 ± 723.8	ABC	30
Transform, 0.33 oz + Warrior II, 0.96 fl oz	189.0 ± 133.9	ABC	110.8 ± 34.0	ABC	4821.9 ± 768.4	ABC	30
Endigo, 4.5 fl oz + COC 1% v/v	229.2 ± 117.3	ABC	71.7 ± 18.3	ABCD	4925.8 ± 679.2	ABC	28
Transform, 0.33 oz + Warrior II, 1.28 fl oz	240.3 ± 181.6	ABC	53.3 ± 16.6	ABCD	4928.7 ± 1095.3	ABC	28
Transform, 0.70 oz + Activator 90 0.5% v/v	204.3 ± 73.0	ABC	144.2 ± 56.2	ABC	5030.6 ± 551.8	ABC	27
Transform, 0.70 oz + Widespread Max 0.1% v/v	202.0 ± 75.2	ABC	221.7 ± 109.0	ABC	5287.8 ± 660.8	ABC	23
Transform, 0.70 oz + MSO Concentrate 0.25% v/v	284.0 ± 151.0	ABC	88.3 ± 28.2	ABCD	5313.2 ± 913.6	ABC	23
Transform, 0.50 oz	237.5 ± 94.8	ABC	246.7 ± 75.7	AB	5588.3 ± 700.9	AB	19
Transform, 0.70 oz	268.0 ± 104.0	ABC	195.8 ± 56.7	ABC	5593.4 ± 664.4	AB	19
Transform, 0.33 oz	313.7 ± 208.6	ABC	124.2 ± 35.6	ABC	5616.6 ± 1337.7	AB	18
Transform, 0.70 oz + Agri-Dex COC 1.0% v/v	236.2 ± 125.5	A	269.2 ± 60.5	A	5659.1 ± 849.5	AB	18
Untreated Control	454.2 ± 294.0	ABC	241.7 ± 172.4	ABC	6870.8 ± 1834.4	A	0
F value	3.51		4.10		3.64		
p>F	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]Total mite days per tiller calculated by the Ruppel method.

CONTROL OF BIOTYPE 2 RUSSIAN WHEAT APHID IN SPRING WHEAT WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2011

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CONTROL OF RUSSIAN WHEAT APHID IN SPRING WHEAT WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2011: Treatments were applied on 1 June 2011 with a 'rickshaw-type' CO_2 powered sprayer calibrated to apply 20 gal/acre at 3 mph and 32 psi through three 8002 (LF2) nozzles with a swath width of 4.5 ft. Conditions during treatment were 52°F at the start, 62°F at the finish, hazy with 50% cloud cover, and NW wind at 0-3 mph. 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 stem elongation (Zadoks 31). The crop had been infested with greenhouse-reared aphids on 28 April and 16 May 2011.

Treatments were evaluated for Russian wheat aphid control by collecting 20 symptomatic tillers from the middle four rows of each plot -1, 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 -1 DAT averaged 4.5 Russian wheat aphids per tiller.

Aphid counts were transformed by the log + 1 method to correct for nonadditivity, and transformed counts were used for analysis of variance and mean separation by Tukey's HSD test ($\alpha=0.05$). Original means are presented in Table 4. Total aphid days per tiller for each treatment were calculated according the method of Ruppel (Journal of Economic Entomology 76: 375-7, 1983), transformed by the log + 1 method, and analyzed in the same manner, with original means presented in Table 4. Reductions in insect days were calculated by Abbott's (1925) formula: (percent reduction = ((untreated-treated)/untreated) X 100).

Aphid abundance was similar to a 2010 spring barley study, with approximately 105 aphids/tiller in the untreated control 21 DAT (Table 4) compared to more than 119 aphids per tiller 21 DAT in 2010. Abundance was greater than an adjacent barley trial in which there were approximately 58 aphids/tiller in the untreated control 21 DAT. Crop condition was excellent. There were application equipment problems with replicates 2-4 of the Transform, 0.70 oz, and the Transform, 0.70 oz + Agri-Dex COC 1.0% v/v, treatments, so the performance of these likely is underestimated. All treatments except these two and Transform, 0.33 oz, and Transform, 0.50 oz, had fewer aphid days than the untreated control. The Endigo, 4.5 fl oz + COC 1% v/v, Cobalt Advanced, 11 fl oz, and Lorsban Advanced, 16 fl oz, 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:	AgriPro 02S0091-9 2010 BDSD
Planting Date:	17 March 2011
Irrigation:	Post planting and as needed, linear move sprinkler with drop nozzles
Crop History:	Field corn in 2010
Herbicide:	Huskie, 12 oz + 1 lb ammonium sulfate/acre
Insecticide:	None prior to experiment
Fertilization:	None
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (Block 1080 north)

Table 4. Control of Russian wheat aphid in spring wheat with hand-applied insecticides, ARDEC, Fort Collins, CO. 2011.

PRODUCT, FL. OZ/ACRE	**APHIDS PER TILLER ± SE[1]**			**APHID DAYS PER TILLER[2] ± SE**	**% REDUCTION IN APHID DAYS**
	7 DAT	**14 DAT**	**21 DAT**		
Endigo, 4.5 fl oz + COC 1% v/v	2.7 ± 1.3 DE	1.9 ± 0.8 E	1.3 ± 0.7 F	67.8 ± 10.0 E	92
Cobalt Advanced, 11 fl oz	2.5 ± 1.1 DE	2.5 ± 1.0 DE	1.6 ± 0.7 EF	71.1 ± 9.6 E	92
Lorsban Advanced, 16 fl oz	1.4 ± 0.7 E	4.8 ± 1.8 CDE	1.6 ± 0.6 EF	79.6 ± 14.0 DE	91
Transform, 0.50 oz + Warrior II, 1.28 fl oz	5.5 ± 2.3 BCDE	6.5 ± 2.2 BCDE	5.6 ± 1.8 CDEF	128.7 ± 35.3 DE	85
Transform, 0.33 oz + Warrior II, 0.96 fl oz	6.2 ± 1.1 ABCDE	6.3 ± 1.8 BCDE	6.6 ± 2.9 EF	141.8 ± 23.5 DE	84
Warrior II, 1.28 fl oz	5.6 ± 1.9 ABCDE	7.6 ± 2.3 ABCDE	5.7 ± 1.8 CDEF	143.4 ± 21.3 DE	83
dimethoate 267, 16 fl oz	3.1 ± 1.5 CDE	9.7 ± 2.2 ABCDE	6.5 ± 2.2 DEF	143.9 ± 24.8 DE	83
Transform, 0.33 oz + Warrior II, 1.28 fl oz	4.4 ± 1.7 ABCDE	9.0 ± 3.0 ABCDE	11.1 ± 3.7 BCDEF	163.5 ± 34.2 DE	81
Transform, 0.50 oz + Warrior II, 0.96 fl oz	5.4 ± 1.0 ABCDE	7.7 ± 2.3 ABCDE	14.1 ± 6.1 BCDEF	171.7 ± 35.5 CDE	80
Transform, 0.70 oz + Widespread Max 0.1% v/v	4.5 ± 0.8 ABCDE	10.8 ± 3.2 ABCDE	13.7 ± 3.7 ABCDE	186.2 ± 32.0 CDE	78
Transform, 0.70 oz + Activator 90 0.5% v/v	5.3 ± 1.1 ABCDE	10.6 ± 2.3 ABCD	16.7 ± 6.4 ABCDE	200.8 ± 39.3 CDE	77
Transform, 0.70 oz + MSO Concentrate 0.25% v/v	4.4 ± 1.3 ABCDE	13.1 ± 5.1 ABCD	13.6 ± 4.5 ABCDE	201.5 ± 38.7 BCDE	77
Warrior II, 0.96 fl oz	7.7 ± 1.3 ABCD	12.9 ± 1.0 ABC	10.5 ± 3.6 BCDEF	212.1 ± 24.3 BCD	75
Transform, 0.70 oz + Agri-Dex COC 1.0% v/v	16.8 ± 3.4 AB	20.2 ± 6.5 ABC	55.9 ± 14.9 ABC	485.3 ± 102.1 ABC	44
Transform, 0.33 oz	17.9 ± 5.8 AB	31.9 ± 8.2 AB	44.7 ± 7.4 ABCD	535.9 ± 77.5 ABC	38
Transform, 0.50 oz	13.6 ± 4.5 ABC	26.2 ± 8.0 ABC	74.0 ± 29.3 ABC	568.2 ± 186.7 ABC	34
Transform, 0.70 oz	23.3 ± 7.8 A	39.0 ± 5.0 A	81.5 ± 21.9 AB	752.2 ± 142.6 A	13
Untreated Control	21.3 ± 3.4 A	44.9 ± 15.5 A	105.2 ± 22.3 A	862.3 ± 193.1 A	—
F value	6.02	6.28	9.11	13.13	—
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]Total mite days per tiller calculated by the Ruppel method.

CONTROL OF BIOTYPE 2 RUSSIAN WHEAT APHID IN SPRING BARLEY WITH SEED TREATMENTS, ARDEC, FORT COLLINS, CO, 2011

Jeff Rudolph, Terri Randolph, Frank Peairs, Laurie Kerzicnik, Jack Mangles, Cheryl Bowker, and Anthony Peairs, Department of Bioagricultural Sciences and Pest Management

CONTROL OF RUSSIAN WHEAT APHID IN SPRING BARLEY WITH SEED TREATMENTS, ARDEC, FORT COLLINS, CO, 2011: Treated seeds were planted on 17 March 2011 using a small plot precision cone planter. 'Innovation' spring barley seed had been treated by Syngenta Seeds, Stanton, MN. Plots were 6 rows (5.0 ft) by 10 ft and were arranged in six replicates of a randomized, complete block design. Two 1-m rows per plot were infested with greenhouse-reared aphids on 28 April 2011.

Treatments were evaluated for Russian wheat aphid control by collecting 20 tillers at random from the eastern infested row of each plot on 10 June 2011. Tiller samples were placed in Berlese funnels for 24 hours to extract aphids into alcohol for counting. Plots were harvested on 25 July 2011 by collecting the heads from the western infested meter-row per plot. Heads were subsequently counted, threshed and total grain weight and 500 seed weight were recorded. Plant height in cm also was recorded at the time of harvest.

Aphid counts were transformed by the log + 1 method to correct for nonadditivity, and transformed counts were used for analysis of variance and mean separation by Tukey's HSD test (α=0.05). Original means are presented in Table 5. Plant height, heads per m^2, grain yield and estimated 1000 seed weight were analyzed in a similar manner.

Aphid abundance was similar to that in an adjacent screening of foliar insecticides at this location. Treatments containing A9765 had fewer aphids than the commercial standards in combination with STP15255. There were no differences among treatments for plant height, heads per m^2, grain yield and 1000 seed weight. Crop condition was excellent, and no phytotoxicity was observed with any treatment.

Field History

Pest:	Russian wheat aphid, *Diuraphis noxia* (Kurdjumov)
Cultivar:	'Innovation'
Planting Date:	17 March 2011
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Corn in 2010
Herbicide:	Huskie, 12 oz/acre + 1 lb ammonium sulfate/acre
Insecticide:	None prior to experiment
Fertilization:	None
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (Block 1080 north)

Table 5. Russian wheat aphids per tiller in 'Innovation' spring barley with insecticidal seed treatments, ARDEC, Fort Collins, CO, 2011.

TREATMENT	RUSSIAN WHEAT APHIDS/TILLER ± SE[1]		PLANT HT. (cm) AT HARVEST ± SE[1]	HEAD/M² ± SE[1]	500 SEED WT (g) ± SE[1]	BU/AC ± SE[1]
A9765	0.0 ± 0.0	C	63.8 ± 2.8	248.7 ± 21.8	18.3 ± 0.4	43.4 ± 2.0
A9765 + A17511 + STP19183	0.0 ± 0.0	C	69.2 ± 3.8	206.7 ± 17.9	18.2 ± 0.4	43.0 ± 4.6
A9765 + A12532 + A16148	0.2 ± 0.2	C	71.7 ± 2.0	204.0 ± 15.6	18.1 ± 0.1	40.7 ± 4.9
A9765 + A16874	0.2 ± 0.2	C	66.3 ± 3.7	217.3 ± 8.9	18.5 ± 0.2	47.3 ± 3.8
A9765 + A17511	0.2 ± 0.2	C	66.5 ± 3.6	253.3 ± 26.3	18.5 ± 0.3	50.1 ± 6.7
A9765 + A12532	0.5 ± 0.5	BC	67.0 ± 2.5	180.7 ± 42.6	18.1 ± 0.3	41.6 ± 7.1
Charter PB + STP15255	8.0 ± 4.0	AB	70.3 ± 2.5	247.3 ± 23.8	17.5 ± 0.5	48.9 ± 3.6
Proceed MD + STP15255	19.7 ± 10.4	A	69.3 ± 1.8	234.0 ± 24.5	17.3 ± 0.5	47.2 ± 7.6
F value	7.27		0.41	0.69	2.22	0.44
p>F	0.0000		0.8904	0.6775	0.0564	0.8732

[1]SE, standard error of the mean.

CONTROL OF BIOTYPE 2 RUSSIAN WHEAT APHID IN SPRING BARLEY WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2011

Jeff Rudolph, Terri Randolph, Frank Peairs, Jack Mangles, Laurie Kerzicnik, Anthony Peairs, Mariana Chapela, and Cheryl Bowker, Department of Bioagricultural Sciences and Pest Management

CONTROL OF RUSSIAN WHEAT APHID IN SPRING BARLEY WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2011: Treatments were applied on 1 June 2011 with a 'rickshaw-type' CO_2 powered sprayer calibrated to apply 20 gal/acre at 3 mph and 32 psi through three 8002 (LF2) nozzles mounted on a 4.0 ft boom. Conditions during treatment were 52°F at the start, 62°F at the finish, hazy with 50% cloud cover, and NW wind at 0-3 mph. 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 stem elongation (Zadoks 31). The crop had been infested with greenhouse-reared aphids on 28 April and 16 May 2011.

Treatments were evaluated for Russian wheat aphid control by collecting 20 symptomatic tillers from the middle four rows of each plot -1, 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 -1 DAT averaged 6.4 Russian wheat aphids per tiller.

Aphid counts were transformed by the log + 1 method to correct for nonadditivity, and transformed counts were used for analysis of variance and mean separation by Tukey's HSD test (α=0.05). Original means are presented in Table 6. Total aphid days per tiller for each treatment were calculated according to the method of Ruppel (Journal of Economic Entomology 76: 375-7, 1983), transformed by the log + 1 method, and analyzed in the same manner, with original means presented in Table 6. Reductions in insect days were calculated by Abbott's (1925) formula: (percent reduction = ((untreated-treated)/untreated) X 100).

Aphid abundance was lower than in 2010, with approximately 58 aphids/tiller in the untreated control 21 DAT (Table 6) compared to more than 119 aphids per tiller 21 DAT in 2010. All treatments had fewer aphid days than the untreated control. The Endigo 2.06 ZC 4 fl oz + COC 1.0% v/v, Lorsban Advanced, 16 fl oz, Endigo, 4.5 fl oz + COC 1% v/v, Endigo 2.71 ZCX 4 fl oz + COC 1.0% v/v, and Actara 25 WDG 5.5 oz + COC 1.0% v/v 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. Crop condition was excellent, and no phytotoxicity was observed with any treatment.

Field History

Pest:	Russian wheat aphid, *Diuraphis noxia* (Kurdjumov)
Cultivar:	'Innovation'
Planting Date:	17 March 2011
Irrigation:	Post planting and as needed, linear move sprinkler with drop nozzles
Crop History:	Field corn in 2010
Herbicide:	Huskie, 12 oz + 1 lb ammonium sulfate/acre
Insecticide:	None prior to experiment
Fertilization:	None
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (Block 1080 north)

Table 6. Control of Russian wheat aphid in spring barley with hand-applied insecticides, ARDEC, Fort Collins, CO. 2011.

PRODUCT, FL. OZ/ACRE	APHIDS PER TILLER ± SE[1] 7 DAT	14 DAT	21 DAT	APHID DAYS PER TILLER[2] ± SE	% REDUCTION IN APHID DAYS
Endigo 2.06 ZC 4 fl oz + COC 1.0% v/v	1.0 ± 0.3 BC	0.2 ± 0.1 E	1.1 ± 0.7 CD	34.6 ± 7.6 D	91
Lorsban Advanced, 16 fl oz	0.7 ± 0.3 C	0.4 ± 0.1 DE	1.8 ± 0.8 BCD	36.3 ± 6.1 CD	91
Endigo, 4.5 fl oz + COC 1% v/v	1.2 ± 0.3 BC	0.6 ± 0.3 DE	0.4 ± 0.3 D	36.4 ± 5.9 CD	91
Endigo 2.71 ZCX 4 fl oz + COC 1.0% v/v	1.4 ± 0.6 BC	0.7 ± 0.5 DE	1.3 ± 0.6 CD	41.7 ± 9.0 CD	90
Actara 25 WDG 5.5 oz + COC 1.0% v/v	1.3 ± 0.3 BC	1.3 ± 0.5 BCDE	0.5 ± 0.1 CD	42.0 ± 7.1 CD	90
Cobalt Advanced, 16 fl oz	0.9 ± 0.4 BC	0.8 ± 0.4 CDE	2.4 ± 1.9 BCD	42.8 ± 10.6 CD	89
Warrior II, 1.92 fl oz	2.3 ± 0.6 BC	2.8 ± 0.9 BCD	1.8 ± 0.8 BCD	64.5 ± 12.0 CD	84
Warrior II, 1.92 fl oz + COC 1.0% v/v	2.0 ± 0.8 BC	3.9 ± 1.4 ABC	4.8 ± 2.6 BC	80.7 ± 21.1 BC	80
Baythroid XL 2.4 fl oz + COC 1.0% v/v	4.8 ± 1.5 AB	6.0 ± 2.1 AB	11.5 ± 5.3 AB	138.3 ± 30.4 B	66
Untreated Control	13.0 ± 2.5 A	12.1 ± 0.8 A	57.9 ± 12.5 A	400.8 ± 53.5 A	—
F value	6.30	11.38	12.68	31.71	—
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]Total mite days per tiller calculated by the Ruppel method.

CONTROL OF ALFALFA INSECTS IN ALFALFA WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2011

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CONTROL OF ALFALFA INSECTS IN ALFALFA WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2011: Early treatments were applied on 6 May 2011 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 27 May 2011. Conditions were partly cloudy, with temperatures of 70°F at the time of early treatments. Conditions were partly cloudy and temperatures of 65 - 68°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. The untreated control and Warrior II, 1.92 oz./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 6 inches in height at the time of early treatments. The crop was in the prebloom stage at the time of the later treatments.

Treatments were evaluated by taking ten 180° sweeps per plot with a standard 15 inch diameter insect net 7, 17 and 21 days after the later treatments (DAT). Alfalfa weevil larvae, alfalfa weevil adults and pea aphids were counted. A pretreatment sample was taken four days prior to the later treatments by taking 100, 180° sweeps across the experimental area. This sample averaged 1.6 and 2.8 alfalfa weevil larvae and pea aphids per sweep, respectively. Insect counts were transformed by the log + 1 method to correct for nonadditivity and then subjected to analysis of variance and mean separation by Tukey's HSD procedure (α=0.05). Original means are presented in Tables 7 and 8. Total insect days for each treatment were calculated according to the method of Ruppel (Journal of Economic Entomology 76: 375-7, 1983), transformed by the log + 1 method, and analyzed in the same manner, with original means presented in the tables. Yields were measured on 17 June 2011 by hand harvesting two 0.1 m^2 areas per plot. Samples were weighed wet and dry and converted to lbs of dry hay per acre prior to comparing yields of treated plots to those of untreated plots using a paired t-test.

Pea aphid and alfalfa weevil larval densities were similar to those observed in 2010. Alfalfa weevil abundance averaged 30.9 and 32.3 larvae per sweep 21 DAT in 2011 and 2010, respectively. Pea aphid abundance averaged 93.5 and 92.9 aphids per sweep 21 DAT in 2011 and 2010, respectively. Adult alfalfa weevil were rare (58 adults collected in 2520 sweeps), and counts were not analyzed. All treatments had fewer alfalfa weevil larvae than the untreated control at 7 DAT. All treatments except Lorsban Advanced, 32 fl oz, had fewer alfalfa weevil larvae per sweep 14 DAT and fewer weevil days than the untreated control. All treatments except Cobalt Advanced, 19 fl oz, early, Steward EC, 11.3 fl oz, Cobalt Advanced, 19 fl oz, and Lorsban Advanced, 32 fl oz, had fewer alfalfa weevil larvae per sweep 21 DAT than the untreated control (Table 7). Mustang Max 0.8EC, 4 fl oz, early, and Baythroid XL, 2.8 fl oz, early, had more pea aphids per sweep 21 DAT and more aphid days than the untreated control (Table 8). No phytotoxicity was observed with any treatment. The plots treated with Warrior II, 1.92 fl. oz./acre, yielded 14.8% less than the untreated control. This difference was not significant (T=-1.96, DF=11, P=0.0753). Yield reduction measured since 1995 has averaged 6.9%, with a range of 0.0% to 20.9%.

Field History

Pests:	Alfalfa weevil, *Hypera postica* (Gyllenhal)
	Pea aphid, *Acyrthosiphon pisum* (Harris)
Cultivar:	Dekalb DKA41-18RR
Plant Stand:	Good
Irrigation:	Flood, not irrigated in 2010
Crop History:	Alfalfa since 2005
Herbicide:	None
Insecticide:	None prior to experiment
Fertilization:	None
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO, 80524 (Weber triangle)

Table 7. Control of alfalfa weevil larvae with hand-applied insecticides, ARDEC, Fort Collins, CO. 2011.

PRODUCT, FL. OZ/ACRE	ALFALFA WEEVIL LARVAE PER 180° SWEEP ± SE[1] 7 DAT	17 DAT	21 DAT	WEEVIL DAYS ± SE	% REDUCTION IN WEEVIL DAYS
Stallion 3EC, 11.75 fl oz	0.1 ± 0.1 B	0.2 ± 0.0 D	0.5 ± 0.1 CD	8.8 ± 1.0 D	97
Warrior II, 1.92 fl oz	0.1 ± 0.1 B	0.4 ± 0.3 D	0.4 ± 0.2 D	10.0 ± 2.0 D	97
F9114 0.8EC, 4 fl oz	0.1 ± 0.0 B	0.7 ± 0.4 CD	0.5 ± 0.2 D	12.1 ± 2.8 CD	96
Warrior II, 1.92 fl oz, early	0.1 ± 0.0 B	0.6 ± 0.4 CD	0.8 ± 0.2 CD	12.4 ± 2.9 CD	96
Mustang Max 0.8EC, 4 fl oz	0.1 ± 0.1 B	0.8 ± 0.2 BCD	1.0 ± 0.2 CD	14.2 ± 1.2 CD	96
Stallion 3EC, 8 fl oz	0.3 ± 0.1 B	0.8 ± 0.1 BCD	0.9 ± 0.2 CD	15.5 ± 1.9 CD	96
Baythroid XL, 2.8 fl oz, early	0.3 ± 0.1 B	0.7 ± 0.3 BCD	1.5 ± 0.5 BCD	16.9 ± 2.1 CD	95
Baythroid XL, 2.8 fl oz	1.1 ± 0.9 B	0.6 ± 0.3 CD	0.7 ± 0.2 CD	20.9 ± 6.7 BCD	94
Cobalt Advanced, 19 fl oz, early	0.2 ± 0.1 B	2.2 ± 0.7 BCD	4.7 ± 1.8 ABCD	31.9 ± 8.5 BCD	91
Steward EC, 11.3 fl oz	0.2 ± 0.1 B	3.3 ± 0.5 ABC	5.9 ± 2.9 ABC	42.3 ± 8.3 BCD	88
Mustang Max 0.8EC, 4 fl oz, early	3.6 ± 3.2 B	1.1 ± 0.4 BCD	1.9 ± 0.5 BCD	47.5 ± 27.4 BCD	86
Cobalt Advanced, 19 fl oz	1.4 ± 1.2 B	5.6 ± 4.6 BCD	5.8 ± 4.4 ABCD	68.3 ± 50.1 BCD	80
Lorsban Advanced, 32 fl oz	0.6 ± 0.2 B	5.0 ± 1.3 AB	14.9 ± 7.6 AB	75.4 ± 17.7 AB	78
Untreated control	7.1 ± 1.8 A	31.3 ± 7.6 A	30.9 ± 6.6 A	346.7 ± 70.9 A	—
F value	5.56	7.09	6.34	10.66	
p>F	<0.0001	<0.0001	<0.0001	<0.0001	

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

[2]% reduction in total weevil days, calculated by the Ruppel method.

Table 8. Control of pea aphid with hand-applied insecticides, ARDEC, Fort Collins, CO. 2011.

	PEA APHIDS PER 180° SWEEP ± SE[1]				**% REDUCTION**
PRODUCT, FL. OZ/ACRE	**7 DAT**	**17 DAT**	**21 DAT**	**APHID DAYS ± SE**	**IN APHID DAYS**
Lorsban Advanced, 32 fl oz	0.7 ± 0.2 F	16.5 ± 3.5 D	40.5 ± 7.3 C	212.0 ± 28.4 F	31
Warrior II, 1.92 fl oz	1.7 ± 0.6 CDEF	18.2 ± 2.4 CD	42.2 ± 8.1 C	236.2 ± 23.2 EF	23
Cobalt Advanced, 19 fl oz	2.2 ± 1.4 CDEF	18.2 ± 2.5 CD	42.6 ± 4.5 C	241.1 ± 20.9 DEF	21
Stallion 3EC, 11.75 fl oz	1.4 ± 0.4 CDEF	20.8 ± 3.0 CD	43.7 ± 9.1 C	254.4 ± 22.7 DEF	17
Stallion 3EC, 8 fl oz	0.9 ± 0.5 EF	20.8 ± 2.8 CD	49.7 ± 8.5 BC	262.7 ± 23.0 DEF	14
Untreated control	6.5 ± 1.5 ABCD	21.9 ± 5.7 CD	43.7 ± 11.3 C	305.4 ± 56.6 CDEF	—
F9114 0.8EC, 4 fl oz	3.6 ± 1.1 ABCDEF	23.1 ± 2.9 BCD	52.9 ± 12.5 ABC	307.0 ± 20.0 CDEF	-1
Baythroid XL, 2.8 fl oz	3.0 ± 1.0 BCDEF	29.8 ± 5.5 ABCD	51.6 ± 8.3 ABC	347.0 ± 42.1 CDEF	-14
Steward EC, 11.3 fl oz	6.2 ± 0.8 ABC	28.2 ± 3.6 ABCD	51.1 ± 7.0 ABC	361.8 ± 23.3 BCDE	-18
Mustang Max 0.8EC, 4 fl oz	3.6 ± 0.9 ABCDE	35.5 ± 7.8 ABC	57.9 ± 7.8 ABC	404.4 ± 50.4 BCD	-32
Cobalt Advanced, 19 fl oz, early	4.6 ± 1.4 ABCDE	34.5 ± 6.5 ABC	59.6 ± 8.6 ABC	409.3 ± 55.5 BCD	-34
Warrior II, 1.92 fl oz, early	8.8 ± 2.1 AB	34.5 ± 8.0 ABC	72.0 ± 14.7 ABC	470.1 ± 70.9 ABC	-54
Mustang Max 0.8EC, 4 fl oz, early	9.1 ± 2.5 ABC	48.2 ± 7.4 AB	77.4 ± 14.5 AB	579.0 ± 45.5 AB	-90
Baythroid XL, 2.8 fl oz, early	12.9 ± 2.8 A	51.4 ± 8.9 A	93.5 ± 21.2 A	665.4 ± 75.8 A	-118
F value	7.71	5.74	4.82	11.47	
p>F	<0.0001	<0.0001	<0.0001	<0.0001	

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

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

CONTROL OF WESTERN CORN ROOTWORM IN FIELD CORN WITH PLANTING-TIME SOIL INSECTICIDES, SEED TREATMENTS, AND PLANT-INCORPORATED PROTECTANTS, ARDEC, FORT COLLINS, CO, 2011

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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, 2011: All treatments were planted on 17 May 2011. 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. Seed for the "washed" treatment was rinsed with tap water to remove the Cruiser 0.25. The Cruiser 1.25 treatment was developed by adding 1.0 mg/kernel Cruiser 5FS to the seed used in the 2K591 (Cruiser 0.25) treatment.

Treatments were evaluated by digging three plants per plot on 18 July 2011. 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. Yields for the SmartStax, Cruiser 1.25, and untreated control were evaluated by hand harvesting 0.001 acre, and determining grain yield in bu/acre at 15.5% moisture.

Western corn rootworm pressure was much higher than observed for the past two years. Damage rating in the untreated control (washed Cruiser 0.25) averaged 0.53 and 0.05 in 2009 and 2010, respectively, and 1.7 in 2011 (Table 9). The 2K591 (Cruiser 1.25) and 2K594 (SmartStax) treatments were less damaged than the washed Cruiser treatment. There were no differences in yield among the untreated control (208 bu/acre), Cruiser 1.25 (225 bu/acre) and the SmartStax (217 bu/acre) (df=2,10, F=0.36, p>F=0.7057). No phytotoxicity was observed with any treatment.

Field History

Pest:	Western corn rootworm, *Diabrotica virgifera virgifera* LeConte
Cultivar:	H-6873GT/CB/LL, unless otherwise indicated
Planting Date:	17 May 2010
Plant Population:	28,700
Fertilizer:	160 N, 40 P
Irrigation:	furrow
Crop History:	Silage corn in 2010
Insecticide:	None prior to experiment
Herbicide:	Glyphosate 38.4 oz + 36 oz Harness + 64 oz liquid ammonium sulfate
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (northern part of Block 3100)

Table 9. Commercial and experimental treatments for control of western corn rootworm, ARDEC, Fort Collins, CO. 2011.

TREATMENT	ROOT RATING[1]		EFFICIENCY[2]
2K591 (Cruiser 0.25)	2.00	A	0
2K591 (washed)	1.69	AB	22
Counter 15G, 8 oz/1000 ft	1.03	ABC	11
Agrisure RW	0.89	ABC	17
Force 3G, 4 oz/1000 ft	0.86	ABC	28
Lorsban 15G, 8 oz/1000 ft	0.63	ABC	39
2K592 (Herculex XTRA RR)	0.41	BC	50
Aztec 2.1G, 6.7 oz/1000 ft	0.33	BC	50
2K591 (Cruiser 1.25)	0.09	C	89
2K594 (SmartStax)	0.03	C	100
F value	4.48		
p>F	0.0003		

[1] Means in the same column followed by the same letters(s) are not statistically different, Tukey's HSD ($\propto$=0.05).
[2]% total plants (18) per treatment having a root rating of 0.25 or lower.

CONTROL OF WESTERN BEAN CUTWORM IN FIELD CORN HYBRIDS WITH COMMERCIAL Bt EVENTS, ARDEC, FORT COLLINS, CO, 2011

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CONTROL OF WESTERN BEAN CUTWORM IN FIELD CORN HYBRIDS WITH COMMERCIAL Bt EVENTS, ARDEC, FORT COLLINS, CO, 2011: The experiment was planted on 17 May 2011. 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 Appel Crop Consulting, Grant, NE. Plants were infested on two consecutive days during the period 3 - 9 August with an average of 12 larvae per primary ear per day. Approximately one week later, infested ears were covered with tassel bags to exclude birds, corn earworm and rootworm adults. Plots consisted of three 20-ft rows, and 10 plants in the middle of each treatment row were infested. The experiment was replicated six times.

On 16 September 2011 the primary ear of each infested plant was examined for damage and larvae. The damaged area on each ear then was determined by estimating the cm^2 of ear fed upon. Percentage damaged ears and area damaged are presented in Table 10.

Only one larva was recovered in the 240 ears examined, likely because larvae had matured more quickly and exited the ear earlier than usual due to warmer than average temperatures. The three traits all were highly effective against western bean cutworm feeding.

Field History

Pest:	Western bean cutworm, *Striacosta albicosta* (Smith)
Cultivar:	Experimentals
Planting Date:	17 May 2011
Plant Population:	28,700
Fertilizer:	160 N, 40 P
Irrigation:	furrow
Crop History:	Silage corn in 2010
Insecticide:	None prior to experiment
Herbicide:	Glyphosate 38.4 oz + 36 oz Harness + 64 oz liquid ammonium sulfate
Soil Type:	Clay loam
Location:	ARDEC, 4616 N. Frontage Road, Fort Collins, CO 80524 (Block 3100 N)

Table 10. Western bean cutworm ear damage on corn with commercial Bt events, ARDEC, Fort Collins, CO. 2011.

TRAIT	CM^2 FEEDING DAMAGE[a]	% DAMAGED EARS
SmartStax	0.00 B	0
Viptera	0.00 B	0
HxTRA	0.05 B	<1
No trait	5.03 A	78
F value	24.42	—
p>F	<0.0001	—

[a] Means in the same column followed by the same letters(s) are not statistically different, Tukey's HSD (∝=0.05).

CONTROL OF SPIDER MITES IN CORN WITH HAND-APPLIED INSECTICIDES AND MITICIDES, ARDEC, FORT COLLINS, CO, 2011

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CONTROL OF SPIDER MITES IN CORN WITH HAND-APPLIED INSECTICIDES AND MITICIDES, ARDEC, FORT COLLINS, CO, 2011: Early treatments were applied on 28 July 2011 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 11 August 2011. Conditions were calm, partly - mostly cloudy, 64 - 80°F at the time of early treatments. Conditions were partly cloudy, calm, 65 - 75°F 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. Because of the large number of treatments, two experiments, containing several treatments in common, were planted. Plots were separated from neighboring plots by a single buffer row. Plots were infested on 8 July 2011 by laying mite-infested corn leaves, collected earlier that day in Prowers County, CO, across the corn plants on which mites were to be counted. On 19 July 2011, the experimental area was treated with permethrin 3.2E, 0.2 lb (AI)/acre to control beneficial insects 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 1-2 days prior to and 7, 14 and 21 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. Most were Banks grass mite (98.4%) so only total mite counts were analyzed. Grain yields were estimated for the Oberon 4SC, 4 fl oz + 32 fl oz COC (early), Onager 1E, 10 fl oz (early), and the untreated control treatments by harvesting the ears from 0.001 acre per plot, drying and shelling the ears, weighing the dried grain, and converting yields to bu/acre at 15.5% moisture. Mite counts were transformed by the log + 1 method to correct for nonadditivity. Total mite days were calculated by the method of Ruppel (J. Econ. Entomol. 76: 375-377). Counts and total mite days were subjected to analysis of variance and mean separation by Tukey's HSD method (α=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. Grain yields also were compared by analysis of variance. Untransformed counts for total mites at -1 or -2, 7, 14 and 21 DAT are presented in Tables 11 and 12.

Mite densities were higher than 2007-2009, but lower than the severe damage years of 2006 and 2010. In the first trial (Table 11) there were no differences among treatments in total mite days. This trial was severely affected by western corn rootworm, which likely introduced sufficient variability to prevent observing treatment differences. In the second trial (Table 12) the Agrimek 0.70 SC, 2.5 fl oz and Agrimek 0.70 SC, 2 fl oz treatments had fewer total mite days than the untreated control. The Oberon 4SC, 4 fl oz + 32 fl oz COC (early) (173 bu/acre) and the Onager 1E, 10 fl oz (early) treatments (175 bu/acre) outyielded the untreated control (159 bu/acre) by 8.1 and 9.1%, respectively. However, these differences were not significant (df=2, 10; F=2.69, p>F=0.1161). Some phytotoxicity was observed in treatments containing nonionic surfactant.

Field History:

Pest:	Banks grass mite, *Oligonychus pratensis* (Banks) Twospotted spider mite, *Tetranychus urticae* Koch
Cultivar:	Garst 88K05 GT
Planting Date:	3 May 2011
Plant Population:	28,000
Irrigation:	Linear move sprinkler
Crop History:	Corn in 2010 (Part 1) and spring barley in 2010 (Part 2)
Herbicide:	Roundup UltraMax, 23 fl.oz./acre + 1% ammonium sulphate on
Fertilization:	160 N, 40 P
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (Part 1, Block 1030, east side; Part 2, Block 1080, north end)

Table 11. Control of spider mites in field corn with hand-applied miticides (Part 1), ARDEC, Fort Collins, CO, 2011.

	BANKS GRASS MITES PER LEAF ± SE[1]				TOTAL MITE	% REDUCTION IN
PRODUCT, AMOUNT PER ACRE	**-2 DAT**	**7 DAT**	**14 DAT**	**21 DAT**	**DAYS ± SE[1]**	**TOTAL MITE DAYS**
Zeal 72WS, 3.0 oz, + NIS** 0.15% v/v*	0.9 ± 0.3 AB	7.1 ± 1.8	20.1 ± 9.1 A	19.2 ± 7.8 AB	260.9 ± 97.8 A	75
Brigade 2 EC, 6.4 fl oz + dimethoate 4E, 16 fl oz	5.2 ± 1.7 AB	13.7 ± 7.0	15.7 ± 6.9 A	21.9 ± 9.4 AB	300.6 ± 121.4 A	72
Zeal 72WS, 2.5 oz, + NIS** 0.15% v/v*	0.9 ± 0.2 AB	12.3 ± 3.4	23.5 ± 7.3 A	22.7 ± 6.7 AB	332.5 ± 83.4 A	69
Zeal 72WS, 1.0 oz, + NIS 0.1% v/v*	0.7 ± 0.2 AB	13.4 ± 5.2	18.7 ± 8.5 A	30.8 ± 21.3 B	334.9 ± 162.8 A	68
Oberon 4SC, 4 fl oz + 32 fl oz COC**	4.7 ± 1.7 AB	22.9 ± 14.0	15.9 ± 5.4 A	14.8 ± 5.2 AB	340.2 ± 142.1 A	68
Comite II 6E (4067-01), 36 fl oz, + dimethoate 4E, 16 fl oz*	0.3 ± 0.1 B	7.6 ± 3.1	32.7 ± 14.5 A	25.7 ± 14.4 AB	373.2 ± 132.2 A	65
Oberon 4SC, 6 fl oz + dimethoate 4E, 16 fl oz	10.4 ± 5.9 A	11.7 ± 4.8	27.7 ± 16.4 A	18.9 ± 5.7 AB	378.2 ± 143.3 A	64
Oberon 4SC, 4 fl oz + dimethoate 4E, 16 fl oz	5.8 ± 3.3 AB	11.5 ± 3.6	24.3 ± 6.3 A	38.4 ± 10.0 AB	405.1 ± 71.3 A	62
Onager 1E, 10 fl oz*	1.1 ± 0.4 AB	25.1 ± 11.1	23.2 ± 10.7 A	24.4 ± 11.0 AB	427.3 ± 182.8 A	60
Zeal 72WS, 2.0 oz, + NIS** 0.15% v/v*	2.8 ± 1.6 AB	18.9 ± 7.7	35.4 ± 14.0 A	22.1 ± 7.7 AB	466.9 ± 167.0 A	56
Oberon 4SC, 6 fl oz + 32 fl oz COC*,**	4.6 ± 2.0 AB	19.4 ± 9.6	36.5 ± 17.5 A	24.2 ± 11.3 AB	492.0 ± 228.7 A	54
Onager 1E, 10 fl oz	5.9 ± 3.5 AB	27.6 ± 15.8	36.7 ± 14.9 A	24.7 ± 11.8 AB	556.8 ± 225.3 A	47
Comite II 6E (4067-01), 36 fl oz*	2.1 ± 0.7 AB	19.3 ± 8.1	48.3 ± 29.3 A	23.4 ± 8.9 AB	562.0 ± 272.5 A	47
Oberon 4SC, 6 fl oz + 32 fl oz COC**	10.9 ± 8.5 AB	27.7 ± 10.4	39.0 ± 19.4 A	26.9 ± 11.0 AB	598.7 ± 235.6 A	44
Zeal 72WS, 1.5 oz, + NIS** 0.1% v/v*	6.4 ± 3.1 AB	19.9 ± 6.8	46.0 ± 13.6 A	34.1 ± 12.7 AB	603.4 ± 153.0 A	43
dimethoate 4E, 16 fl oz	4.9 ± 1.7 AB	10.6 ± 1.7	60.8 ± 38.1 A	26.4 ± 7.3 AB	609.0 ± 301.7 A	43
Oberon 4SC, 4 fl oz + 32 fl oz COC*,**	1.5 ± 0.6 AB	29.4 ± 12.4	42.5 ± 15.6 A	33.3 ± 7.6 AB	625.7 ± 210.0 A	41
GWN-1708, 24 fl oz	3.3 ± 1.2 AB	39.3 ± 22.2	54.6 ± 27.9 A	33.2 ± 23.5 AB	784.8 ± 389.0 A	26
Untreated	5.2 ± 4.3 AB	46.9 ± 19.1	71.6 ± 30.0 A	60.6 ± 14.0 A	1060.2 ± 349.3 A	0
Brigade 2 EC, 6.4 fl oz	6.5 ± 2.7 AB	71.4 ± 28.6	70.0 ± 23.0 A	47.9 ± 19.1 AB	1180.0 ± 393.4 A	-11
F value	1.78	1.29	1.8	1.82	2.02	—
p>F	0.0369	0.2108	0.0330	0.0310	0.0137	—

*Treated early, 13 days days prior to the late treatments (0 DAT).

**NIS, nonionic surfactant (Silwet-77), COC, crop oil concentrate

[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).

Table 12. Control of spider mites in field corn with hand-applied miticides (Part 2), ARDEC, Fort Collins, CO, 2011.

PRODUCT, AMOUNT PER ACRE	BANKS GRASS MITES PER LEAF ± SE[1] -1 DAT	7 DAT	14 DAT	21 DAT	TOTAL MITE DAYS ± SE[1]	% REDUCTION IN TOTAL MITE DAYS
Agrimek 0.70 SC, 2.5 fl oz**	6.8 ± 2.1	7.2 ± 1.3	6.5 ± 2.1 C	6.2 ± 2.6 C	141.8 ± 32.0 B	85
Agrimek 0.70 SC, 2 fl oz**	5.2 ± 1.4	11.1 ± 4.1	10.8 ± 3.4 ABC	4.1 ± 1.1 C	186.0 ± 25.8 B	81
Agri-Flex 1.55 SC, 8.5 fl oz**	7.1 ± 2.4	33.4 ± 15.5	9.2 ± 2.8 ABC	10.5 ± 2.0 BC	359.9 ± 120.2 AB	63
Onager 1E, 10 fl oz*	3.3 ± 0.6	22.3 ± 6.0	34.8 ± 11.1 ABC	18.0 ± 4.3 BC	474.3 ± 98.4 AB	51
Exp M (high rate)*	3.0 ± 1.2	26.7 ± 8.8	25.3 ± 9.2 ABC	33.7 ± 12.2 ABC	492.7 ± 117.3 AB	49
fenpyroximate EC, 32 fl oz*,**	5.5 ± 1.2	35.9 ± 8.4	25.3 ± 8.4 ABC	28.8 ± 7.2 ABC	549.0 ± 97.4 AB	44
fenpyroximate EC, 16 fl oz*,**	2.8 ± 0.6	26.3 ± 7.1	33.4 ± 10.6 ABC	36.8 ± 14.1 ABC	556.5 ± 151.8 AB	43
Brigade 2 EC, 6.4 fl oz	6.1 ± 1.2	28.5 ± 6.4	33.3 ± 9.2 ABC	40.4 ± 12.1 ABC	594.7 ± 98.0 AB	39
Exp M (intermediate rate)*	4.9 ± 2.0	40.5 ± 13.7	27.9 ± 8.2 ABC	33.6 ± 9.2 AB	613.4 ± 163.8 AB	37
fenpyroximate EC, 24 fl oz**	5.3 ± 1.5	34.3 ± 11.4	39.6 ± 14.8 ABC	26.5 ± 4.2 BC	628.5 ± 117.3 AB	36
fenpyroximate EC, 32 fl oz**	8.8 ± 1.9	40.9 ± 7.7	31.8 ± 7.4 ABC	35.6 ± 5.3 ABC	663.6 ± 66.8 AB	32
Oberon 4SC, 4 fl oz + 32 fl oz COC*	4.9 ± 1.7	30.1 ± 6.7	35.9 ± 11.2 ABC	57.8 ± 10.7 AB	681.5 ± 128.3 AB	30
fenpyroximate EC, 24 fl oz*,**	2.2 ± 0.6	28.1 ± 4.1	54.3 ± 27.5 ABC	29.0 ± 5.2 ABC	686.4 ± 219.4 AB	30
Untreated	1.7 ± 0.5	37.8 ± 9.8	70.7 ± 19.4 AB	60.0 ± 20.2 AB	975.2 ± 163.0 A	0
Exp M (low rate)*	6.5 ± 3.0	42.3 ± 11.2	104.5 ± 67.5 AB	77.3 ± 13.6 AB	1321.3 ± 462.2 A	-35
Comite II, 48 fl oz*,**	4.5 ± 1.4	49.4 ± 10.0	86.3 ± 29.3 A	104.4 ± 35.7 A	1330.6 ± 385.3 A	-36
F value	1.55	1.56	2.65	4.62	3.43	—
p>F	0.1092	0.1056	0.0028	0.0000	0.0002	—

*Treated early, 13 days days prior to the late treatments (0 DAT).

**+ nonionic surfactant (Silwet L-77) 0.25% v/v

[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).

2011 PEST SURVEY RESULTS

Table 13. 2011 pheromone trap catches at ARDEC and Briggsdale.

	ARDEC – 1070	
Species	**Total Caught[2]**	**Trapping Period**
Army cutworm	114 (40)	8/12 - 10/28
Banded sunflower moth	22 (45)	6/6 - 9/16
European corn borer (IA)[1]	18 (15)	5/16 - 10/14
Fall armyworm	158 (860)	5/6 - 10/28
Pale western cutworm	25 (181)	8/12 - 10/28
Sunflower moth	5 (29)	6/6 - 9/9
Western bean cutworm	0 (20)	6/6 - 8/20
Wheat head armyworm	13 (22)	4/8 - 10/21

[1] IA, Iowa strain
[2]–, not trapped. Number in () is 2010 total catch for comparison

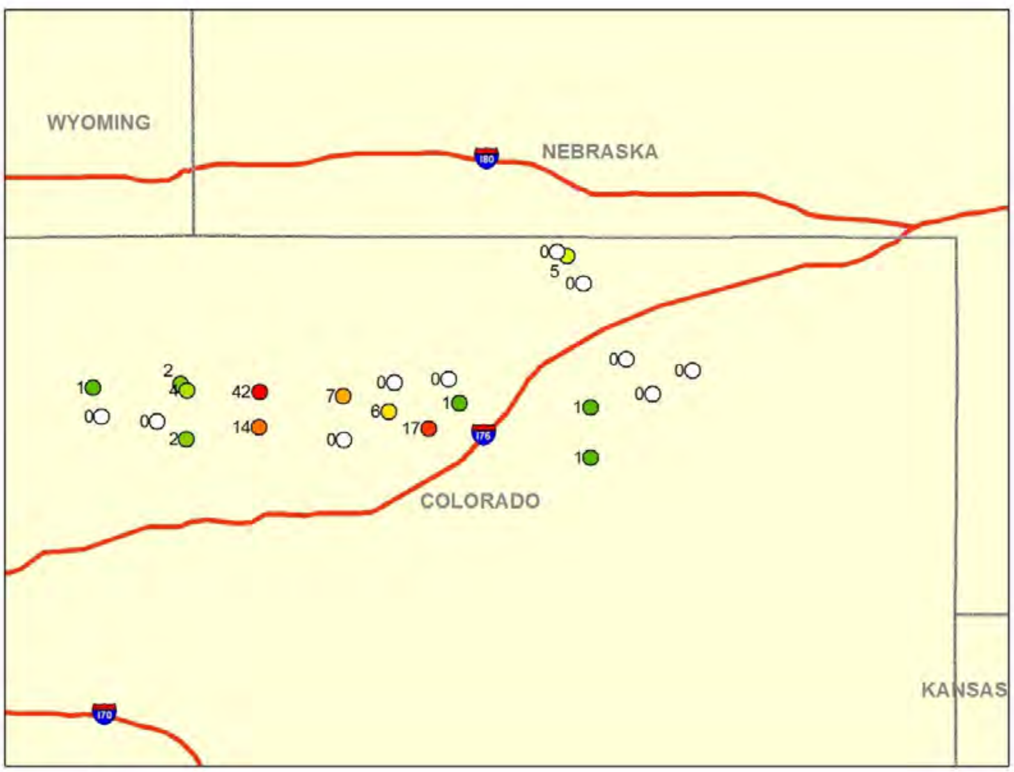
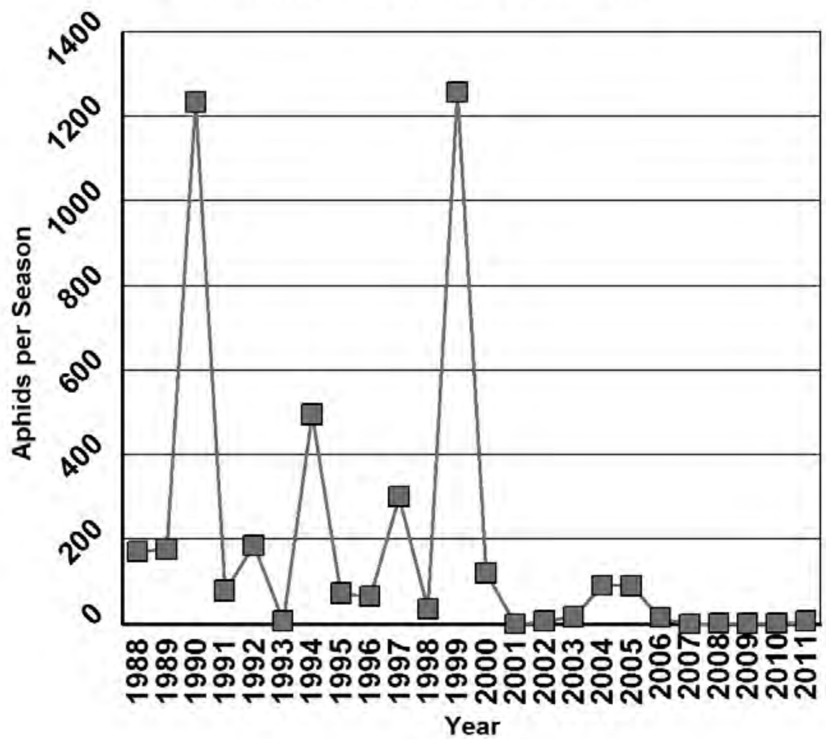
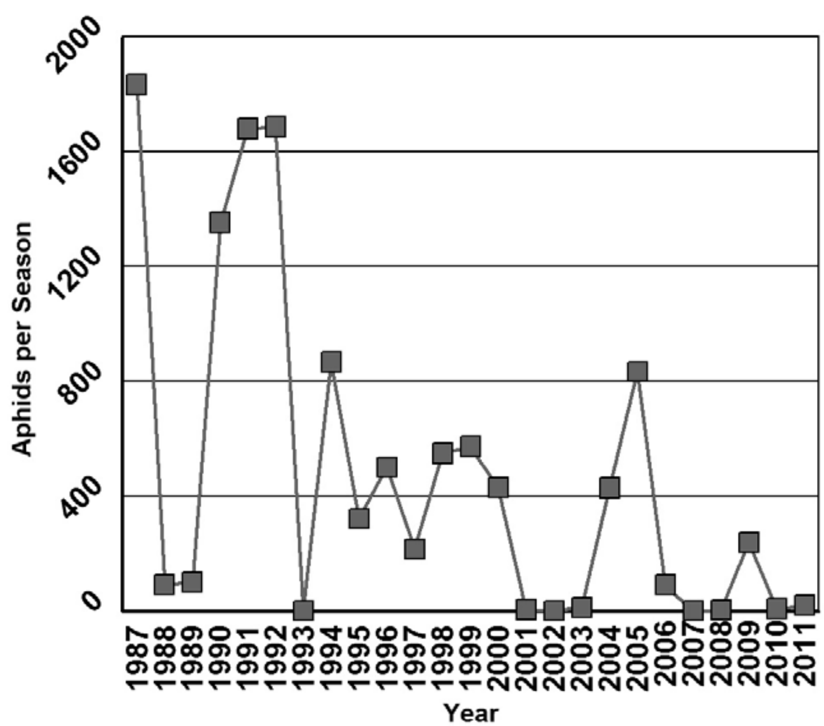


Figure 1. Wheat stem sawfly adults per 100 sweeps, 9 June 2011.

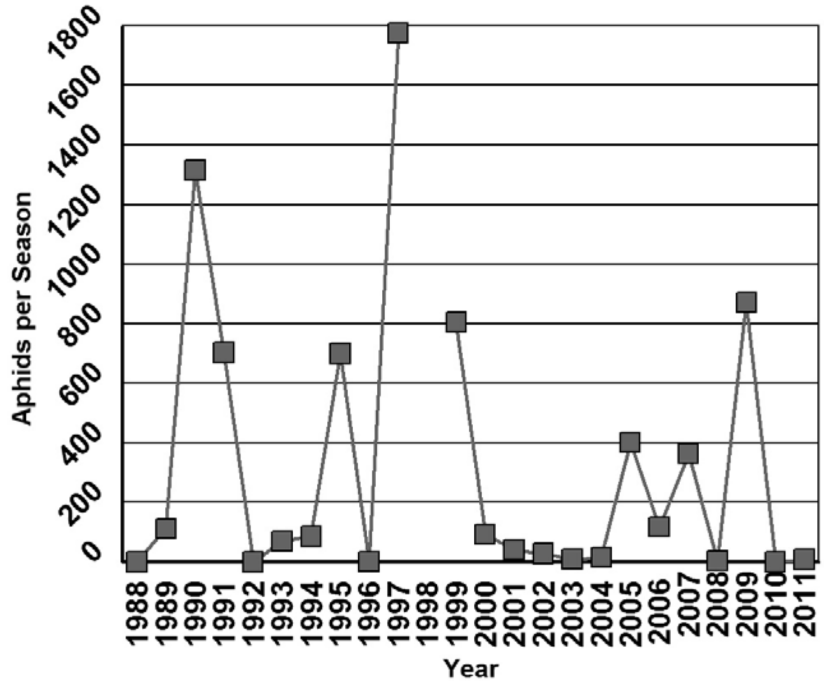
1988 - 2011 Russian Wheat Aphid Suction Trap Catches - Akron



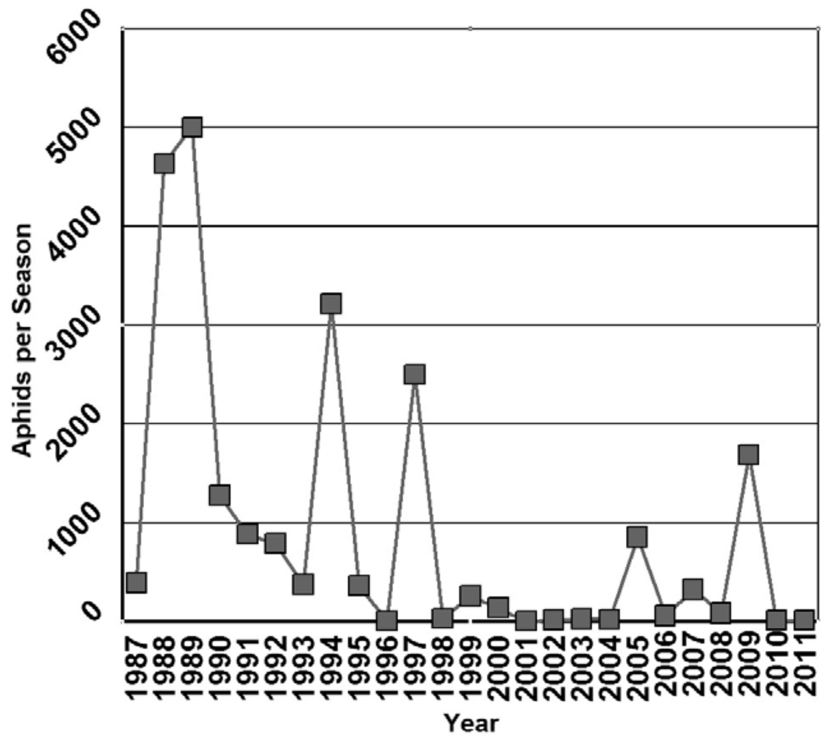
1987 - 2011 Russian Wheat Aphid Suction Trap Catches - Fort Collins



1988 - 2011 Russian Wheat Aphid Suction Trap Catches - Lamar



1987 - 2011 Russian Wheat Aphid Suction Trap Catches - Walsh



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 2011.

Table 14. Performance of planting-time insecticides against western corn rootworm, 1987-2011, in northern Colorado

INSECTICIDE	IOWA 1-6 ROOT RATING[1]
AZTEC 2.1G	2.6 (32)
COUNTER 15G	2.6 (34)
CRUISER, 1.25 mg (AI)/seed	2.6 (9)
FORCE 1.5G (8 OZ) or 3G (4 OZ)	2.6 (31)
FORCE 3G (5 OZ)	2.4 (10)
FORTRESS 5G	2.8 (14)
LORSBAN 15G	3.0 (28)
PONCHO, 1.25 mg (AI)/seed	2.4 (8)
THIMET 20G	3.4 (15)
UNTREATED CONTROL	4.1 (38)

[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 15. 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 16. 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 17. 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 18. 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 19. Performance of hand-applied insecticides against alfalfa weevil larvae, 1984-2011, in northern Colorado.

PRODUCT	LB (AI)/ACRE	% CONTROL AT 2 WK[1]
BAYTHROID XL	0.022	97 (17)
BAYTHROID XL	0.022 (early)[3]	96 (8)
COBALT OR COBALT ADVANCED	19 fl oz	89 (5)
LORSBAN 4E	0.75	93 (23)
LORSBAN 4E	1.00	91 (8)
LORSBAN 4E	0.50	83 (10)
MUSTANG MAX	0.025	93 (7)
MUSTANG MAX	0.025 (early)[3]	90 (9)
PERMETHRIN [2]	0.10	67 (7)
PERMETHRIN [2]	0.20	80 (4)
STEWARD	0.065	80 (7)
STEWARD	0.110	85 (7)
WARRIOR 1E or T or II	0.02	92 (18)
WARRIOR II	0.03 (early)[3]	96 (3)
WARRIOR 1E or T or II	0.03	94 (10)

[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 20. Control of Russian wheat aphid with hand-applied insecticides in winter wheat, 1986-2011[1].

PRODUCT	LB (AI)/ACRE	TESTS WITH > 90% CONTROL 21 DAT	TOTAL TESTS	% TESTS
LORSBAN 4E	0.50	28	48	58
COBALT	13 FL OZ	2	4	50
DIMETHOATE 4E	0.375	8	40	20
MUSTANG MAX	0.025	2	8	25
LORSBAN 4E	0.25	10	27	37
LORSBAN 4E	0.38	5	6	83
WARRIOR 1E	0.03	4	18	22

[1]Includes data from several states.

Table 21. Control of spider mites in artificially-infested corn with hand-applied insecticides, ARDEC, 1993-2011.

PRODUCT	LB (AI)/ACRE	% REDUCTION IN TOTAL MITE DAYS[1]
CAPTURE 2E	0.08	47 (16)
CAPTURE 2E + DIMETHOATE 4E	0.08 + 0.50	65 (15)
COMITE II	1.64	17 (16)
COMITE II	2.53	37 (9)
COMITE II + DIMETHOATE 4E	1.64 + 0.50	55 (12)
DIMETHOATE 4E	0.50	42 (15)
OBERON 4SC	0.135	50 (6)
ONAGER 1E	0.094	76 (6)

[1]Number in () indicates number of tests represented in average. 2009 data not included.

Table 22. 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[2]	0.75	CULTIVATION	61 (3)
FURADAN 4F[2]	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.
[2]No longer registered

ACKNOWLEDGMENTS

2011 COOPERATORS

PROJECT	LOCATION	COOPERATORS
Alfalfa insecticides	ARDEC, Fort Collins	Chris Fryrear, Mark Collins
Barley insecticides	ARDEC, Fort Collins	Chris Fryrear, Mark Collins
Corn rootworm control	ARDEC, Fort Collins	Chris Fryrear, Mark Collins
Western bean cutworm control	ARDEC, Fort Collins	Chris Fryrear, Mark Collins, Larry Appel
Corn spider mite control	ARDEC, Fort Collins	Chris Fryrear, Mark Collins, Thia Walker
Russian wheat aphid control	ARDEC, Fort Collins	Chris Fryrear, Mark Collins
Brown wheat mite control	ARDEC, Lamar	Chris Fryrear, Mark Collins, Jeremy Stulp, Thia Walker
Pheromone traps	ARDEC, Fort Collins	Chris Fryrear, Mark Collins
Suction trap	ARDEC, Fort Collins	Chris Fryrear, Mark Collins
Suction trap	Akron (Central Great Plains Research Station)	Dave Poss, Merle Vigil
Suction trap	Lamar	Jeremy Stulp, Wilma Trujillo, Thia Walker
Suction trap	Walsh (Plainsman Research Center)	Deb Harn, Kevin Larson,

PRODUCT INDEX