Technical Report TR14-07 June, 2014

Agricultural Experiment Station

Colorado State University

College of Agricultural Sciences

Department of Bioagricultural Sciences and Pest Management

2013 Colorado Field Crop Insect Management and Demonstration Trials

2013 Colorado Field Crop Insect Management Research and Demonstration Trials[1]

Frank B. Peairs[2]
Jeff Rudolph[2]
Terri L. Randolph[2]

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

[2]Department of Bioagricultural Sciences and Pest Management, Colorado State University

TABLE OF CONTENTS

CONTROL OF BIOTYPE RWA2 RUSSIAN WHEAT APHID IN WINTER WHEAT WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2013

Jeff Rudolph, Terri Randolph, Frank Peairs, Darren Cockrell, Claire Tovrea, Ty Hammons, and Michael Mayfield, Department of Bioagricultural Sciences and Pest Management

CONTROL OF BIOTYPE RWA2 RUSSIAN WHEAT APHID IN WINTER WHEAT WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2013: Treatments were applied on 14 May 2013 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 were clear, calm and 73°F during the time of treatment. Plots were six 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 late stem elongation (Zadoks 37). The crop had been infested with greenhouse-reared aphids on 11 March 2013.

Treatments were evaluated for Russian wheat aphid control 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 2.7 Russian wheat aphids per tiller.

A naturally occurring brown wheat mite infestation was evaluated by taking two, five-second subsamples per plot with a Vortis suction sampler and placing the collected material in Berlese funnels for 48 h to extract mites into alcohol for counting. Each subsample was collected from an area approximately 0.2 m^2 in size. The brown wheat mite precounts taken the day before treatment averaged 136.4 mites per sample.

Aphid counts were transformed by the square root + 0.5 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 1. Mite counts were transformed by the log + 1 method prior to similar analysis. Original means are presented in Table 2. Total aphid days per tiller were calculated according to the method of Ruppel (Journal of Economic Entomology 76: 375-7, 1983), transformed by the square root + 0.5 method, 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 much lower than in 2012, with approximately 38 aphid days/tiller in the untreated control 21 DAT (Table 1) compared to 235 aphid days/tiller 22 DAT in 2012. Crop condition was excellent. Treatments containing Lorsban Advanced, Cobalt Advanced, Endigo ZCX 2.71 ZC, Stallion and dimethoate 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 much greater than in 2012, with ca. 363 mites/sample in the untreated control 4 DAT compared to ca. 7 mites/sample 5 DAT in 2012. The Lorsban Advanced, Cobalt Advanced, and dimethoate treatments had fewer mites than the untreated control (Table 2). No phytotoxicity was observed with any treatment.

Field History

Pest:	Russian wheat aphid, *Diuraphis noxia* (Kurdjumov) Brown wheat mite, *Petrobia latens* (Müller)
Cultivar:	'Thunder CL'
Planting Date:	19 September 2012
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Fallow in 2012
Herbicide:	Huskie at 13 fl oz/A with ammonium sulfate at 1.33 lb/A and Nonionic Surfactant 90 at 16 fl oz/A on 13 May 2013
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) (N40.65380, W104.99767)

Table 1. Control of Biotype RWA2 Russian wheat aphid in winter wheat with hand-applied insecticides, ARDEC, Fort Collins, CO. 2013.

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
Lorsban Advanced, 16 fl oz	0.1 ± 0.1 C	0.5 ± 0.4 B	0.4 ± 0.3 B	5.4 ± 2.8 C	86
Cobalt Advanced, 11 fl oz	0.1 ± 0.0 C	0.6 ± 0.3 B	0.5 ± 0.2 B	6.3 ± 2.0 C	83
Endigo ZCX 2.71 ZC, 4 fl oz/acre + COC 1% v/v	0.5 ± 0.2 BC	0.5 ± 0.2 B	0.5 ± 0.1 B	6.9 ± 1.4 C	82
Stallion, 11.75 fl oz	0.1 ± 0.0 C	0.6 ± 0.3 B	0.9 ± 0.6 AB	7.5 ± 3.5 C	80
dimethoate 267, 16 fl oz	0.3 ± 0.1 BC	0.9 ± 0.4 AB	1.6 ± 0.9 AB	12.8 ± 5.8 BC	66
Sulfoxaflor 1.5 oz + COC 1% v/v	1.1 ± 0.5 AB	1.0 ± 0.3 AB	1.2 ± 0.3 AB	15.1 ± 3.6 ABC	60
Sulfoxaflor 0.75 oz + COC 1% v/v	0.7 ± 0.1 ABC	1.9 ± 0.9 AB	0.8 ± 0.1 AB	18.1 ± 6.3 ABC	52
Warrior II 2.09 CS, 1.92 fl oz/acre	0.4 ± 0.1 BC	1.2 ± 0.2 AB	2.4 ± 0.9 AB	18.4 ± 2.9 ABC	51
Baythroid XL, 2.4 fl oz/acre	0.8 ± 0.3 ABC	1.5 ± 0.3 AB	1.5 ± 0.4 AB	18.4 ± 3.0 ABC	51
MustangMax, 4 fl oz	0.8 ± 0.3 ABC	2.2 ± 0.3 AB	3.2 ± 0.5 A	29.4 ± 4.4 AB	22
Untreated control	1.8 ± 0.5 A	2.6 ± 0.2 A	3.7 ± 1.3 A	37.6 ± 6.5 A	—
F value	6.46	3.53	3.82	6.06	
p>F	<0.0001	0.0014	0.0007	<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 2. Control of brown wheat mite four DAT in winter wheat with hand-applied insecticides, ARDEC, Fort Collins, CO. 2013.

PRODUCT, FL OZ/ACRE	BROWN WHEAT MITES PER 0.4 M^2 IN 5 SEC[1] ± SE		% REDUCTION IN MITES
Lorsban Advanced, 16 fl oz	20.8 ± 8.5	C	94
Cobalt Advanced, 11 fl oz	29.2 ± 6.8	BC	92
dimethoate 267, 16 fl oz	32.2 ± 9.0	BC	91
Warrior II 2.09 CS, 1.92 fl oz/acre	69.0 ± 16.9	ABC	81
Stallion, 11.75 fl oz	114.3 ± 77.1	ABC	69
Endigo ZCX 2.71 ZC, 4 fl oz/acre + COC 1% v/v	209.2 ± 121.9	AB	42
Baythroid XL, 2.4 oz/acre	253.0 ± 82.1	AB	30
MustangMax, 4 fl oz	270.5 ± 37.6	A	26
Sulfoxaflor 0.75 oz + COC 1% v/v	348.8 ± 129.8	A	4
Untreated control	363.3 ± 111.7	A	—
Sulfoxaflor 1.5 oz + COC 1% v/v	451.7 ± 197.8	A	—
F value	7.39		
p>F	0.0000		

[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).

CONTROL OF BIOTYPE RWA2 RUSSIAN WHEAT APHID IN SPRING BARLEY WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2013

Jeff Rudolph, Terri Randolph, Frank Peairs, Jack Mangels, Ty Hammons and Michael Mayfield, Department of Bioagricultural Sciences and Pest Management

CONTROL OF BIOTYPE RWA2 RUSSIAN WHEAT APHID IN SPRING BARLEY WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2013: Treatments were applied on 3 June 2013 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 74°F with wind at 0 - 3 mph from the southwest and 25% cloud cover. Plots were six 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 late stem elongation (Zadoks 33). The crop had been infested with greenhouse-reared aphids on 13 May 2013.

Treatments were evaluated for Russian wheat aphid control by collecting 20 symptomatic tillers along the middle four rows of each plot -4, 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 -4 DAT averaged 13.2 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 3. 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 3. Reductions in insect days were calculated by Abbott's (1925) formula: (percent reduction = ((untreated-treated)/untreated) X 100).

Aphid pressure was higher than in 2012, with approximately 172 and 320 aphids/tiller in the untreated control 21 DAT (Table 3) in 2012 and 2013, respectively. Crop condition was excellent. The Endigo ZCX 2.71 ZC, 4 fl oz, Cobalt Advanced, 11 fl oz, EXF2636, 12 fl oz, Sulfoxaflor, 1.5 oz, and Warrior II 2.09 CS, 1.92 fl oz treatments had fewer aphids 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. No phytotoxicity was observed with any treatment.

Field History

Pest:	Russian wheat aphid, *Diuraphis noxia* (Kurdjumov)
Cultivar:	'Voyager'
Planting Date:	20 March 2013
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Field corn in 2012
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 Rd, Fort Collins, CO 80524 (Block 1080 N) (N40.65582, W104.99665)

Table 3. Control of Biotype RWA2 Russian wheat aphid in spring barley with hand-applied insecticides, ARDEC, Fort Collins, CO. 2013.

	APHIDS PER TILLER ± SE[2]			APHID DAYS/TILLER ± SE[2]	% REDUCTION IN
PRODUCT, FL OZ/ACRE	**7 DAT**	**14 DAT**	**21 DAT**		**APHID DAYS**
Endigo ZCX 2.71 ZC, 4 fl oz[1]	8.9 ± 2.2 ABC	15.9 ± 4.0 B	41.4 ± 14.5 E	408.8 ± 81.7 E	78
Cobalt Advanced, 11 fl oz	2.9 ± 0.6 C	22.8 ± 2.8 AB	43.2 ± 22.2 E	409.4 ± 55.4 DE	78
EXF2636, 12 fl oz	7.5 ± 2.3 BC	21.1 ± 6.3 AB	46.1 ± 11.3 DE	449.5 ± 68.6 DE	76
Sulfoxaflor, 1.5 oz[1]	13.8 ± 6.2 ABC	21.3 ± 5.5 AB	79.9 ± 20.2 CDE	625.5 ± 148.4 CDE	67
Warrior II 2.09 CS, 1.92 fl oz[1]	19.8 ± 5.6 AB	35.3 ± 8.9 AB	110.4 ± 48.2 BCDE	884.6 ± 224.6 BCDE	53
Besiege 1.25 ZC, 9 fl oz[1]	14.0 ± 5.0 AB	32.9 ± 6.8 AB	178.8 ± 45.9 ABC	1054.6 ± 208.2 ABC	46
Quilt Xcel 2.2 SE, 12 fl oz + Warrior II 2.09 CS, 1.92 fl oz[1]	11.3 ± 3.4 ABC	41.7 ± 9.8 AB	182.4 ± 63.6 ABC	1104.5 ± 305.8 ABC	41
Sulfoxaflor 0.75 oz[1]	14.7 ± 3.3 AB	41.9 ± 7.9 AB	177.1 ± 21.3 ABC	1118.5 ± 133.1 ABC	40
Baythroid XL, 2.4 fl oz[1]	16.1 ± 3.9 AB	42.2 ± 9.7 AB	183.9 ± 44.0 ABC	1155.8 ± 216.8 ABC	38
Headline 2.09 SC, 9 fl oz[1] + Baythroid XL, 2.4 fl oz[1]	26.0 ± 8.9 AB	68.2 ± 19.9 AB	234.2 ± 39.0 ABC	1603.3 ± 241.4 AB	15
Untreated control	28.1 ± 9.3 A	78.4 ± 18.9 A	284.4 ± 45.6 AB	1869.6 ± 248.2 A	—
Quilt Xcel 2.2 SE, 12 fl oz[1]	15.2 ± 3.6 AB	78.5 ± 20.7 A	320.1 ± 62.3 A	1879.8 ± 362.6 A	0
F value	4.97	3.15	10.24	10.89	
p>F	<0.0001	0.0023	<0.0001	<0.0001	

[1]plus crop oil concentrate 1% 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).

[2]Total aphid days per tiller calculated by the Ruppel method.

EFFECT OF WINTER WHEAT VARIETY AND MITICIDE TREATMENT AND TIMING ON BROWN WHEAT MITE ARDEC, FORT COLLINS, CO, 2013

Jeff Rudolph, Terri Randolph, Thia Walker, Frank Peairs, Darren Cockrell, Claire Tovrea, Ty Hammons, and Michael Mayfield, Department of Bioagricultural Sciences and Pest Management

EFFECT OF WINTER WHEAT VARIETY AND MITICIDE TREATMENT AND TIMING ON BROWN WHEAT MITE, ARDEC, FORT COLLINS, CO, 2013: The experiment consisted of 'Hatcher' and 'Snowmass' winter wheats treated with three miticides in the fall and/or the spring. Fall treatments were applied on 6 November 2012 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 were clear, calm and 73°F during the time of treatment. Plots were six rows (5.0 ft) by 28.0 ft and were arranged in six replicates of a three-way (variety, miticide and miticide timing) factorial design. Crop stage at the fall application was tillering (Zadoks 23-25). The spring treatments were applied at spring regrowth in the same manner on 20 March 2013. Conditions at the time of treatment were clear, calm and 61°F.

Treatments were evaluated for brown wheat mite abundance by collecting two, five-second samples per plot with a Vortis suction sampler at 0, 3 and 7 days after treatment (DAT) in the fall and -2, 2 and 9 DAT in the spring. Each five-second sample was taken from an area of approximately 0.2 m^2. Suction samples were placed on paper plates, which, in turn, were placed in Berlese funnels for 48 hours to extract mites into alcohol for counting.

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 means are presented in Tables 4 and 5. Fall infestation data were analyzed as a two-way factorial (variety and miticide treatment), while spring counts were analyzed as a three-way factorial with treatment timing (fall vs fall and spring treatment) as the additional factor. Preliminary analysis indicated that there were no interactions among factors. Total mite days were calculated by 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.

Mite pressure was similar to an adjacent trial. Mite abundance in the latter was much greater than in a similar trial in 2012, with ca. 363 mites/sample in the untreated control 4 DAT compared to ca. 7 mites/sample 5 DAT in 2012. Fewer mites were observed on Snowmass in the fall precounts, while the reverse was seen in the spring precount and 9 DAT count. In the fall, fewer mites 3 and 7 DAT and fewer mite days were recorded for dimethoate. In the spring, fewer mites and mite days were observed in the dimethoate treatment. No differences were observed in the spring between fall and fall + spring treatment timings.

Field History

Pest:	Brown wheat mite, *Petrobia latens* (Müller)
Cultivar:	'Snowmass' and 'Hatcher'
Planting Date:	19 September 2012
Irrigation:	Post planting, linear move sprinkler with drop nozzles
Crop History:	Fallow in 2012
Herbicide:	Huskie at 13 fl oz/A with ammonium sulfate at 1.33 lb/A and Nonionic Surfactant 90 at 16 fl oz/A on 13 May 2013
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) (N40.65380, W104.99767)

Table 4. Effect of winter wheat variety and fall miticide treatment on brown wheat mite, ARDEC, Fort Collins, CO. 2013.

	BROWN WHEAT MITES ± SE[1]			
TREATMENT	**PRECOUNTS**	**3 DAT**	**7 DAT**	**TOTAL MITE DAYS**
Hatcher	110.5 ± 10.7 A	111.6 ± 18.2	70.0 ± 13.9	696.2 ± 91.7
Snowmass	144.5 ± 14.7 B	121.1 ± 22.6	70.9 ± 15.3	782.4 ± 122.4
F value	4.31	0.40	0.29	0.81
p>F	0.0446	0.5310	0.5905	0.3742
Dimethoate 267, 16 fl oz/acre	125.8 ± 14.8	17.8 ± 4.6 B	6.3 ± 2.0 B	263.7 ± 33.1 B
Oberon 4SC, 5 fl oz/acre	114.8 ± 17.0	131.2 ± 29.1 A	74.4 ± 21.2 A	780.1 ± 152.0 A
Onager 1E, 10 fl oz/acre	124.0 ± 18.8	138.0 ± 21.2 A	101.4 ± 20.6 A	871.8 ± 121.7 A
Untreated control	143.1 ± 23.2	174.8 ± 30.3 A	97.6 ± 19.4 A	1021.5 ± 167.8 A
F value	0.43	81.31	57.15	36.50
p>F	0.7302	<0.0001	<0.0001	<0.0001

[1]Collected in 5 sec from 0.4 m^2 with a Vortis suction sampler, SE = standard error of the mean. Means in the same section of the same column followed by the same letter are not statistically different, Tukey's HSD (∝=0.05)

Table 5. Effect of winter wheat variety and fall or fall + spring miticide treatment on brown wheat mite, ARDEC, Fort Collins, CO. 2013.

	BROWN WHEAT MITES ± SE[1]			
TREATMENT	**PRECOUNTS**	**2 DAT**	**9 DAT**	**TOTAL MITE DAYS**
Hatcher	198.0 ± 19.5 A	341.0 ± 35.5	316.3 ± 39.7 A	2839.9 ± 275.2
Snowmass	149.0 ± 12.4 B	327.9 ± 35.2	214.3 ± 23.8 B	2374.6 ± 215.8
F value	4.72	0.51	4.27	2.90
p>F	0.0326	0.4781	0.0418	0.0925
Dimethoate 267, 16 fl oz/acre	132.5 ± 16.7 B	124.3 ± 14.2 B	69.5 ± 8.7 B	935.3 ± 82.2 B
Oberon 4SC, 5 fl oz/acre	164.6 ± 19.0 AB	405.7 ± 50.3 A	312.3 ± 35.9 A	3083.4 ± 296.5 A
Onager 1E, 10 fl oz/acre	216.0 ± 29.4 A	403.3 ± 42.3 A	395.4 ± 62.8 A	3414.5 ± 348.4 A
Untreated	181.0 ± 24.9 AB	404.7 ± 56.1 A	284.0 ± 37.3 A	2995.9 ± 356.1 A
F value	3.70	27.61	37.38	43.11
p>F	0.0148	<0.0001	<0.0001	<0.0001
Fall	176.8 ± 16.0	362.0 ± 38.8	270.0 ± 29.3	2751.1 ± 253.8
Fall + Spring	170.3 ± 17.4	306.9 ± 31.1	260.5 ± 37.4	2463.4 ± 243.5
F value	0.19	1.73	1.09	2.17
p>F	0.6680	0.1913	0.3004	0.1447

[1]Collected in 5 sec from 0.4 m^2 with a Vortis suction sampler, SE = standard error of the mean. Means in the same section of the same column followed by the same letter are not statistically different, Tukey's HSD ($\propto$=0.05)

CONTROL OF WHEAT STEM SAWFLY ADULTS IN WINTER WHEAT, NEW RAYMER, CO, 2013

Frank Peairs, Terri Randolph, Jeff Rudolph, Jack Mangels, Darren Cockrell, Chrissy Ward, Ty Hammans, and Michael Mayfield, Department of Bioagricultural Sciences and Pest Management, Cole and Jim Mertens, Mertens Brothers, Inc.

CONTROL OF WHEAT STEM SAWFLY ADULTS IN WINTER WHEAT, NEW RAYMER, CO, 2013: Treatments at Zadoks 30-32 were applied on 6 May 2013 using an ATV-mounted sprayer calibrated to apply 12 gpa at 32 psi through six 8002 (XR T-Jet 2VS) nozzles mounted on a 10 ft boom at 5 mph. Plots were 10 ft by 30 ft and arranged in six replicates of a randomized complete block design. Conditions at the time of this treatment were 70°F with 0 - 3 mph wind from the south and 50% cloud cover. Treatments at wheat stem sawfly pupation were applied in the same manner on 23 May 2013. At this time, a second set of treatments were applied to stubble in the same manner, to determine if adult emergence could be reduced. Conditions at the time of this treatment were 65 - 70°F with 15 mph wind from the SE and 100% cloud cover.

Treated stubble was observed for adult mortality on 27 June 2013. This evaluation method was deemed ineffective and stubble treatments were not evaluated further. Foliar treatments were evaluated for infested stems on 10 July 2013 by collecting all tillers in a 0.5 row meter in each plot. These were placed in coolers and returned to the laboratory for subsequent evaluation. Tillers were counted and then dissected to determine the presence or absence of living and dead wheat stem sawfly larvae. On the same date, all stems in 1 row-meter per plot were counted, as were the number of lodged stems. Percentage infested stems, percentage infested stems with live larvae and percentage lodged stems were analyzed by ANOVA and subsequent mean separation by Tukey's HSD test (α=0.05). Means are presented in Table 6.

No treatment differed from the untreated control in terms of percentage infested stems, percentage infested stems with live larvae or percentage lodged stems. For the second year, treatments involving early treatment with Warrior II followed by retreatment at the first observation of adult females tended to have fewer cut stems, which may merit further investigation.

Field History

Pest:	Wheat stem sawfly, *Cephus cinctus* Norton
Cultivar:	'Hatcher'
Planting Date:	10 September 2012
Plant Population:	Not available
Irrigation:	Dryland
Crop History:	Fallow in 2012
Insecticide:	None prior to experiment
Soil Type:	Sandy loam
Location:	Weld CR 123, 1 mile S of Co Hwy 14 (N40.58311, W103.89796)

Table 6. Control of wheat stem sawfly larval infestation and stem damage with foliar insecticide and plant growth regulator treatments, New Raymer, CO. 2013.

PRODUCT, FL OZ/ACRE	TOTAL STEMS PER 0.5 M ± SE[1]	% INFESTED STEMS ± SE[1]	% INFESTED STEMS WITH LIVE LARVAE ± SE[1]	TOTAL STEMS PER 1.0 M ± SE[2]	% LODGED STEMS ± SE[2]
Warrior II 2.09 CS 1.92 fl oz[2], at pupation	46.8 ± 6.6	63.3 ± 10.7	57.5 ± 13.7	238.2 ±50.9	49.6 ± 11.9
Palisade 2.1 EC, 7 fl oz, at Feekes 5-7	61.8 ± 6.7	50.6 ± 12.9	53.3 ± 11.0	220.2 ± 26.8	33.2 ± 14.5
Endigo ZCX 2.71 ZC, 4.5 fl oz[2], at Feekes 5-7, repeated at pupation	51.0 ± 8.1	35.5 ± 10.1	34.9 ± 18.1	200.0 ± 18.9	32.2 ± 11.6
Untreated	51.2 ± 9.1	31.3 ± 8.6	49.1 ± 12.9	209.7 ± 17.0	30.5 ± 12.1
Palisade 2.1 EC, 7 fl oz + Endigo ZCX 2.71ZC, 4.5 fl oz[2], at Feekes 5-7, Endigo repeated at pupation	60.3 ± 8.5	45.6 ± 11.7	46.7 ± 14.9	205.7 ± 11.3	26.8 ± 11.4
Endigo ZCX 2.71 ZC, 4.5 fl oz[2], at pupation	49.0 ± 8.5	28.1 ± 6.5	47.6 ± 16.8	222.7 ± 19.5	24.3 ± 8.9
Lorsban Advanced, 16 fl oz, at pupation	57.8 ± 3.3	27.7 ± 10.9	28.4 ± 11.2	194.8 ± 22.1	22.2 ± 11.9
Palisade 2.1 EC, 7 fl oz + Warrior II 2.09 CS 1.92 fl oz[2], at Feekes 5-7, Warrior repeated at pupation	49.5 ± 6.9	32.7 ± 11.4	29.1 ± 14.2	166.2 ± 15.8	21.3 ± 7.9
Cobalt Advanced, 25 fl oz, at pupation	62.0 ± 8.1	41.5 ± 11.5	38.5 ± 13.0	193.8 ± 7.1	18.3 ± 7.0
Warrior II 2.09 CS 1.92 fl oz[2], at Feekes 5-7, repeated at pupation	40.0 ± 5.9	19.2 ± 9.2	0.0 ± 0.0	208.2 ± 20.4	7.6 ± 3.5
F value	—	1.66	1.47	—	1.34
p>F	—	0.1282	0.1899	—	0.2455

[1]SE, standard error of the mean.
[2]+ crop oil concentrate 1% v/v

CONTROL OF ALFALFA INSECTS IN ALFALFA WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2013

Jeff Rudolph, Terri Randolph, Frank Peairs, Jack Mangels, Darren Cockrell, Chrissy Ward, Ty Hammons, Michael Mayfield and Claire Tovrea, Department of Bioagricultural Sciences and Pest Management

CONTROL OF ALFALFA INSECTS IN ALFALFA WITH HAND-APPLIED INSECTICIDES, ARDEC, FORT COLLINS, CO, 2013: Early treatments were applied on 6 May 2013 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 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 4 June 2013. Conditions for the early treatments were 60°F with 5 - 8 mph wind from the north and 15% cloud cover, and 70°F with 0 - 3mp wind from the southeast and 25 % cloud cover during 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 fl oz/acre, plots were replicated 12 times for a more accurate comparison of treatment effects on yield (insect counts from six replications of each treatment were included in the analyses described below). The crop was six inches in height at the time of early treatments and 18 inches 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, 14, 21 and 28 days after the later treatments (DAT). Alfalfa weevil larvae, alfalfa weevil adults and pea aphids were counted. A pretreatment sample on 29 May 2013 comprised 100, 180° sweeps across the experimental area. This sample averaged 8.4 and 18.2 alfalfa weevil larvae and pea aphids per sweep, respectively. Alfalfa weevil adult counts were transformed by the square root + 0.5 method to correct for nonadditivity and all counts were subjected to analysis of variance and mean separation by Tukey's HSD procedure (α=0.05). Original means are presented in Tables 7-9. Total alfalfa weevil larval days and pea aphid 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. Yields were measured on 2 July 2013 by hand harvesting a 0.5 m^2 area 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 densities were greater and alfalfa weevil larval densities were lower than those observed in 2012. Alfalfa weevil days averaged ca. 223 and 825 in 2013 and 2012, respectively. Pea aphid days averaged 15,385 and 2022 in 2013 and 2012, respectively. Adult alfalfa weevils were not abundant, and, while statistical differences were noted at 7 and 21 DAT, no clear pattern of control was observed (Table 8). All treatments, except Beseige 1.25 ZC, 9 fl oz, Cobalt Advanced, 24 fl oz, and Lorsban Advanced 32 fl oz, had fewer alfalfa weevil larvae than the untreated control at 7 DAT. At 28 DAT, all treatments except Mustang Max 0.8EC, 4 fl oz, Warrior II, 1.92 fl oz, early, and Cobalt Advanced, 24 fl oz, had fewer alfalfa weevil larvae per sweep than the untreated control (Table 7), however larval abundance in all treatments was low by this point. All treatments had fewer alfalfa weevil days than the untreated control. Only the Baythroid XL, 2.8 fl oz treatment had fewer pea aphid days than the untreated control (Table 9). No phytotoxicity was observed with any treatment. Yield was reduced

7.7%, which was not significant (DF=11, t=-0.57, p=0.5777). Yield reductions measured since 1995 have averaged 6.9%, with a range of 0.0% to 23.9%.

Field History

Pests:	Alfalfa weevil, *Hypera postica* (Gyllenhal)
	Pea aphid, *Acyrthosiphon pisum* (Harris)
Cultivar:	Dekalb DKA41-18RR
Plant Stand:	Good
Irrigation:	Flood
Crop History:	Alfalfa since August, 2011
Herbicide:	None
Insecticide:	None prior to experiment
Fertilization:	None
Soil Type:	Sandy clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (SW corner of Bee Circle) (N40.66864, W104.99976)

Table 7. Control of alfalfa weevil larvae with hand-applied insecticides, ARDEC, Fort Collins, CO. 2013.

PRODUCT, FL OZ/ACRE	ALFALFA WEEVIL LARVAE PER 180° SWEEP ± SE[1] 7 DAT	14 DAT	21 DAT	28 DAT	WEEVIL DAYS[2] ± SE	REDUCTION IN DAYS
Mustang Max 0.8EC, 4 fl oz + Steward, 4 oz	0.1 ± 0.1 B	0.0 ± 0.0	0.1 ± 0.0 AB	0.3 ± 0.1 B	7.7 ± 0.8 B	97
Stallion 3EC, 11.75 fl oz + Steward 4 fl oz	0.1 ± 0.1 B	0.3 ± 0.1	0.1 ± 0.1 AB	0.1 ± 0.0 B	9.2 ± 1.8 B	96
Stallion 3EC, 11.75 fl oz	0.1 ± 0.1 B	0.2 ± 0.1	0.3 ± 0.2 AB	0.4 ± 0.1 B	10.6 ± 2.3 B	95
Mustang Max 0.8EC, 4 fl oz	0.4 ± 0.1 B	0.2 ± 0.1	0.3 ± 0.2 AB	0.6 ± 0.3 AB	15.1 ± 1.4 B	93
Cobalt Advanced, 19 fl oz, early, repeat at conventional timing	0.2 ± 0.1 B	0.5 ± 0.3	0.7 ± 0.4 AB	0.4 ± 0.2 B	16.9 ± 5.0 B	92
Warrior II, 1.92 fl oz	0.1 ± 0.1 B	1.4 ± 1.2	0.1 ± 0.0 AB	0.3 ± 0.1 B	18.0 ± 8.5 B	92
Warrior II, 1.92 fl oz, early, repeat at conventional timing	0.1 ± 0.0 B	1.4 ± 0.9	0.1 ± 0.1 AB	0.3 ± 0.1 B	18.1 ± 6.4 B	92
Baythroid XL, 2.8 fl oz, early, repeat at conventional timing	0.1 ± 0.0 B	1.5 ± 1.0	0.2 ± 0.1 AB	0.4 ± 0.2 B	19.1 ± 7.6 B	91
Cobalt Advanced, 19 fl oz, early	0.7 ± 0.3 B	0.4 ± 0.2	0.6 ± 0.3 AB	0.4 ± 0.2 B	20.3 ± 5.1 B	91
Mustang Max 0.8EC, 4 fl oz, early	0.6 ± 0.3 B	0.6 ± 0.2	0.5 ± 0.2 AB	0.5 ± 0.2 B	20.3 ± 3.1 B	91
Steward EC, 11.3 fl oz	0.2 ± 0.1 B	1.5 ± 0.7	0.5 ± 0.3 AB	0.3 ± 0.1 B	22.9 ± 8.0 B	90
Endigo ZCX 2.71 ZC, 4 fl oz	0.1 ± 0.1 B	2.6 ± 1.8	0.0 ± 0.0 B	0.5 ± 0.2 B	26.3 ± 12.3 B	88
Warrior II, 1.92 fl oz, early	0.3 ± 0.1 B	3.0 ± 2.3	0.5 ± 0.2 AB	0.6 ± 0.1 AB	34.5 ± 16.9 B	85
Mustang Max 0.8EC, 4 fl oz, early, repeat at conventional timing	3.0 ± 2.9 B	1.1 ± 0.9	0.1 ± 0.0 AB	0.4 ± 0.1 B	44.9 ± 28.7 B	80
Baythroid XL, 2.8 fl oz, early	3.5 ± 3.0 B	0.5 ± 0.1	0.4 ± 0.1 AB	0.5 ± 0.2 B	48.3 ± 30.3 B	78
Beseige 1.25 ZC, 9 fl oz	5.1 ± 5.0 AB	0.2 ± 0.1	0.4 ± 0.2 AB	0.2 ± 0.1 B	61.7 ± 51.7 B	72
Lorsban Advanced 32 fl oz	5.1 ± 3.3 AB	0.6 ± 0.2	0.5 ± 0.2 AB	0.4 ± 0.1 B	65.5 ± 34.7 B	71
Cobalt Advanced, 24 fl oz	6.0 ± 3.7 AB	0.1 ± 0.0	0.1 ± 0.1 AB	0.6 ± 0.3 AB	68.8 ± 37.4 B	69
Baythroid XL, 2.8 fl oz	3.5 ± 3.3 B	3.7 ± 2.8	0.2 ± 0.1 AB	0.5 ± 0.2 B	69.1 ± 33.7 B	69
Untreated control	16.6 ± 4.7 A	5.6 ± 3.8	1.1 ± 0.4 A	1.4 ± 0.4 A	222.8 ± 52.5 A	—
F value	3.05	1.15	1.96	2.42	3.78	
p>F	0.0002	0.3519	0.0181	0.0026	0.0000	

[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 weevil days, calculated by the Ruppel method.

Table 8. Control of alfalfa weevil adults with hand-applied insecticides, ARDEC, Fort Collins, CO. 2013.

	ALFALFA WEEVIL ADULTS PER 180° SWEEP ± SE[1]			
PRODUCT, FL OZ/ACRE	**7 DAT**	**14 DAT**	**21 DAT**	**28 DAT**
Mustang Max 0.8EC, 4 fl oz	1.8 ± 0.7 AB	4.0 ± 0.8 A	0.7 ± 0.2 ABC	0.6 ± 0.1 A
Stallion 3EC, 11.75 fl oz + Steward 4 fl oz	0.5 ± 0.2 AB	1.7 ± 0.5 A	1.0 ± 0.2 ABC	0.6 ± 0.2 A
Mustang Max 0.8EC, 4 fl oz, early, repeat at conventional timing	1.1 ± 0.9 AB	1.6 ± 0.4 A	0.4 ± 0.1 C	0.8 ± 0.3 A
Baythroid XL, 2.8 fl oz, early	0.8 ± 0.5 AB	2.0 ± 1.1 A	0.4 ± 0.1 C	0.8 ± 0.3 A
Cobalt Advanced, 19 fl oz, early	0.6 ± 0.3 AB	1.2 ± 0.4 A	0.8 ± 0.2 ABC	0.8 ± 0.2 A
Warrior II, 1.92 fl oz, early	0.6 ± 0.4 AB	1.8 ± 0.6 A	1.0 ± 0.5 ABC	0.9 ± 0.3 A
Stallion 3EC, 11.75 fl oz	0.9 ± 0.6 AB	2.6 ± 0.4 A	1.2 ± 0.4 ABC	1.0 ± 0.2 A
Endigo ZCX 2.71 ZC, 4 fl oz	0.7 ± 0.6 AB	1.5 ± 0.2 A	0.9 ± 0.2 ABC	1.0 ± 0.2 A
Mustang Max 0.8EC, 4 fl oz, early	0.7 ± 0.3 AB	2.5 ± 1.0 A	0.9 ± 0.1 ABC	1.0 ± 0.1 A
Baythroid XL, 2.8 fl oz, early, repeat at conventional timing	0.6 ± 0.5 AB	3.4 ± 1.3 A	0.8 ± 0.3 ABC	1.1 ± 0.4 A
Cobalt Advanced, 19 fl oz, early, repeat at conventional timing	2.1 ± 1.3 A	2.1 ± 0.9 A	1.0 ± 0.3 ABC	1.1 ± 0.3 A
Steward EC, 11.3 fl oz	0.3 ± 0.2 B	1.8 ± 0.6 A	0.5 ± 0.0 BC	1.1 ± 0.3 A
Mustang Max 0.8EC, 4 fl oz + Steward, 4 oz	0.4 ± 0.1 B	2.3 ± 0.5 A	1.2 ± 0.2 ABC	1.2 ± 0.6 A
Warrior II, 1.92 fl oz	0.7 ± 0.3 AB	3.5 ± 0.8 A	1.9 ± 0.7 A	1.3 ± 0.4 A
Warrior II, 1.92 fl oz, early, repeat at conventional timing	0.4 ± 0.3 B	1.1 ± 0.3 A	0.7 ± 0.1 ABC	1.5 ± 0.4 A
Cobalt Advanced, 24 fl oz	1.4 ± 0.4 AB	3.6 ± 0.8 A	1.4 ± 0.3 ABC	1.5 ± 0.4 A
Beseige 1.25 ZC, 9 fl oz	1.7 ± 0.8 AB	3.4 ± 1.0 A	1.5 ± 0.2 ABC	1.6 ± 0.4 A
Lorsban Advanced 32 fl oz	1.6 ± 0.5 AB	1.2 ± 0.3 A	0.8 ± 0.1 ABC	1.9 ± 0.6 A
Baythroid XL, 2.8 fl oz	1.2 ± 0.9 AB	3.9 ± 1.1 A	1.7 ± 0.3 A	1.9 ± 0.5 A
Untreated control	2.1 ± 0.7 A	2.2 ± 0.5 A	0.9 ± 0.3 ABC	2.8 ± 0.7 A
F value	2.79	1.75	2.8	1.72
p>F	0.0005	0.0411	0.0005	0.0458

[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).

Table 9. Control of pea aphids with hand-applied insecticides, ARDEC, Fort Collins, CO. 2013.

	PEA APHIDS PER 180° SWEEP ± SE[1]				TOTAL
PRODUCT, FL OZ/ACRE	**7 DAT**	**14 DAT**	**21 DAT**	**28 DAT**	**APHID DAYS**
Baythroid XL, 2.8 fl oz	70.7 ± 13.6 B	487.1 ± 85.6 AB	265.0 ± 69.1	258.0 ± 153.4 DE	8059.4 ± 1470.5 B
Baythroid XL, 2.8 fl oz, early	94.6 ± 21.2 B	548.6 ± 93.7 AB	354.0 ± 83.5	572.6 ± 127.4 ABCDE	10454.0 ± 1330.6 AB
Baythroid XL, 2.8 fl oz, early, repeat at conventional timing	90.2 ± 8.4 B	546.9 ± 56.0 AB	404.9 ± 56.9	674.2 ± 105.9 ABCDE	11109.0 ± 611.3 AB
Beseige 1.25 ZC, 9 fl oz	80.8 ± 11.4 B	509.1 ± 82.8 AB	471.4 ± 59.5	660.2 ± 50.8 ABCDE	11167.0 ± 960.2 AB
Cobalt Advanced, 19 fl oz, early	218.2 ± 60.7 AB	557.9 ± 108.3 AB	393.9 ± 51.8	438.8 ± 43.0 BCDE	11566.0 ± 1457.3 AB
Cobalt Advanced, 19 fl oz, early, repeat at conventional timing	144.9 ± 30.1 AB	447.2 ± 78.7 B	485.2 ± 99.9	750.6 ± 93.3 ABCD	11787.0 ± 1252.9 AB
Cobalt Advanced, 24 fl oz	167.4 ± 30.7 AB	507.2 ± 64.4 AB	423.9 ± 42.6	709.7 ± 64.6 ABCDE	11861.0 ± 666.1 AB
Endigo ZCX 2.71 ZC, 4 fl oz	171.4 ± 67.3 AB	566.9 ± 34.7 AB	462.9 ± 53.0	691.5 ± 78.1 ABCDE	12528.0 ± 853.8 AB
Lorsban Advanced 32 fl oz	219.7 ± 59.0 AB	579.6 ± 52.9 AB	391.1 ± 64.8	695.3 ± 169.1 ABCDE	12611.0 ± 1383.3 AB
Mustang Max 0.8EC, 4 fl oz	94.4 ± 26.7 B	577.3 ± 106.3 AB	448.4 ± 48.2	978.6 ± 124.8 A	12734.0 ± 792.6 AB
Mustang Max 0.8EC, 4 fl oz + Steward, 4 oz	237.3 ± 29.8 AB	573.1 ± 63.7 AB	460.8 ± 60.9	600.4 ± 171.6 ABCDE	12897.0 ± 695.2 AB
Mustang Max 0.8EC, 4 fl oz, early	110.1 ± 21.3 B	617.2 ± 108.4 AB	465.4 ± 87.4	885.3 ± 88.7 AB	12962.0 ± 1426.7 AB
Mustang Max 0.8EC, 4 fl oz, early, repeat at conventional timing	137.7 ± 32.1 AB	614.2 ± 68.6 AB	457.5 ± 38.8	836.6 ± 57.6 ABC	12992.0 ± 561.8 AB
Stallion 3EC, 11.75 fl oz	167.4 ± 29.0 AB	512.9 ± 40.7 AB	522.1 ± 72.0	833.3 ± 97.5 ABC	13021.0 ± 1049.9 AB
Stallion 3EC, 11.75 fl oz + Steward 4 fl oz	159.7 ± 37.6 AB	622.6 ± 68.4 AB	469.8 ± 59.1	768.7 ± 57.0 ABCD	13119.0 ± 1050.3 AB
Steward EC, 11.3 fl oz	330.1 ± 68.1 A	724.0 ± 151.1 AB	439.2 ± 42.8	211.8 ± 77.3 E	13370.0 ± 1731.3 A
Warrior II, 1.92 fl oz	218.7 ± 60.1 AB	708.6 ± 51.6 AB	465.3 ± 98.3	607.5 ± 116.0 ABCDE	13715.0 ± 1312.0 A
Warrior II, 1.92 fl oz, early	323.5 ± 66.8 A	849.2 ± 73.1 AB	381.3 ± 59.0	319.8 ± 88.4 CDE	14153.0 ± 972.1 A
Warrior II, 1.92 fl oz, early, repeat at conventional timing	312.0 ± 72.4 A	698.7 ± 73.2 AB	467.3 ± 39.8	656.1 ± 119.6 ABCDE	14763.0 ± 949.4 A
Untreated control	241.4 ± 41.4 AB	863.0 ± 164.4 A	458.8 ± 79.7	724.0 ± 141.4 ABCDE	15385.0 ± 1343.5 A
F value	4.42	1.98	0.98	3.89	2.56
p>F	0.0000	0.0164	0.4880	0.0000	0.0015

[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 weevil 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, 2013

Jeff Rudolph, Terri Randolph, Frank Peairs, Rachael Sitz, Darren Cockrell, Claire Tovrea, Ty Hammons, Michael Mayfield and Chrissy Ward, Department of Bioagricultural Sciences and Pest Management

CONTROL OF WESTERN CORN ROOTWORM IN FIELD CORN WITH PLANTING-TIME SOIL INSECTICIDES, SEED TREATMENTS, AND PLANT-INCORPORATED PROTECTANTS, ARDEC, FORT COLLINS, CO, 2013: All treatments were planted on 17 May 2013. 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 a.i./kernel Cruiser 5FS to the seed used in the 2K591 (Cruiser 0.25) treatment. At growth stage V2-3, each plant to be rated was infested with ca. 1000 western corn rootworm eggs obtained from Dr. Bruce Hibbard, USDA-ARS, Plant Genetics Research Unit, Columbia, MO. Eggs were suspended in 0.15% agar and placed in a hole approximately three inches deep next to each plant.

Treatments were evaluated by digging three plants per plot on 16 July 2013. 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 (18) having a root rating of 0.25 or lower.

Due to the artificial infestation, western corn rootworm pressure was higher than observed in 2012 (Table 10). The average rating in an adjacent uninfested trial was 0.12, with only one root having a rating of 0.5. Damage rating in the untreated control averaged 1.07 and 0.11 in 2013 and 2012, respectively. All treatments, except the Cruiser 0.25 treatment, were less damaged than the untreated control treatment. No phytotoxicity was observed with any treatment.

Field History

Pest:	Western corn rootworm, *Diabrotica virgifera virgifera* LeConte
Cultivar:	2K591 (RR), unless otherwise indicated
Planting Date:	17 May 2013
Plant Population:	28,700
Irrigation:	Center pivot sprinkler
Crop History:	Corn in 2012
Insecticide:	None prior to experiment
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524 (northern part of Block 3100) (N40.66595, W104.996557)

Table 10. Commercial and experimental treatments for control of western corn rootworm, ARDEC, Fort Collins, CO. 2013.

TREATMENT AND/OR EVENT	IOWA 0-3 ROOT RATING[1]	EFFICIENCY[2]
Force CS, 0.46 fl oz/1000 ft, in-furrow on Smartstax	0.10B	100
Herculex XTRA	0.10B	100
Cruiser 1.25	0.11B	100
Agrisure Duracade	0.11B	100
Capture LFR, 0.49 fl oz/1000 ft, in-furrow on Smartstax	0.11B	100
Capture LFR, 0.98 fl oz/1000 ft, in-furrow on Smartstax	0.11B	100
SmartStax	0.11B	100
Aztec 2.1G, 6.7 oz/1000 ft	0.12B	94
Capture LFR, 0.23 fl oz/1000 ft, in-furrow on Smartstax	0.12B	100
H6629	0.12B	94
Counter 15G, 8 oz/1000 ft	0.13B	89
Lorsban 15G, 8 oz/1000 ft	0.14B	83
Force 3G, 5 oz/1000 ft	0.32B	83
Cruiser 0.25	0.69AB	50
Untreated	1.07A	6
F value	5.07	
p>F	<0.0001	

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

CONTROL OF SPIDER MITES IN CORN WITH HAND-APPLIED INSECTICIDES AND MITICIDES, ARDEC, FORT COLLINS, CO, 2013

Terri Randolph, Jeff Rudolph, Jack Mangels, Darren Cockrell, Claire Tovrea, Michael Mayfield, Brandyn Davis and Frank Peairs, Department of Bioagricultural Sciences and Pest Management

CONTROL OF SPIDER MITES IN CORN WITH HAND-APPLIED INSECTICIDES AND MITICIDES, ARDEC, FORT COLLINS, CO, 2013: Early treatments were applied on 26 July 2013 using a two row boom sprayer mounted on a backpack calibrated to deliver 17.8 gal/acre at 32 psi with three XR8002VS nozzles. All other treatments were applied in the same manner on 13 August 2013. Conditions were clear, 65 to 75° F with northerly winds at 0 to 3 mph at the time of early treatments. Conditions were partly cloudy, calm and 55 to 68° F at the time of late treatments. A 0.33 inch irrigation was applied three hours after the late application. 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 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 28 June 2013 by laying mite infested corn leaves, collected earlier that day in Mesa County, CO, across the corn plants on which mites were to be counted. On 1 July 2013, the experimental area was treated with permethrin 3.2E, 0.25 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 1-4 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 (229 twospotted spider mites were collected from 960 samples) so only total mites counts were analyzed. Grain yields in both trials were estimated for the Oberon 4SC, 5 fl oz, Onager 1E, 12 fl oz, Brigade, 6.4 fl oz + dimethoate 400, 16 fl oz, 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 square root + 0.5 (Trial 1) or log + 1 (Trial 2) method to address nonadditivity issues. Total mite days were calculated by the method of Ruppel (Journal of Economic Entomology 76: 375-7, 1983). Transformed counts and total mite days were subjected to analysis of variance and mean separation by Tukey's HSD method (α=0.05), with original means presented in Tables 11 and 12. 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 were compared with analysis of variance.

Mite abundance was greater than observed in 2011 or 2012 in both experiments, however, approximately three times more mite days were accumulated in the untreated control in Trial 1 than in Trial 2 (Tables 11 and 12). In Trial 1, the Brigade 6.4 fl oz + dimethoate 4E, 16 fl oz, Experimental B1, Oberon 4SC, 5 fl oz, and Oberon 4SC, 6 fl oz, treatments had fewer mite days than the untreated control. In Trial 2, Oberon 4SC, 5 fl oz (early), Portal, 32 fl oz (late), Agri-Mek SC, 3.0 fl oz (late), and Brigade 6.4 fl oz + dimethoate 4E, 16 fl oz (late) had fewer mite days than the untreated control. Yields were very low due to drought stress and uneven emergence and did not differ among treatments (df=11, 33, F=2.42, p>F=0.0840). Estimated yields were Brigade + dimethoate 4E (68 bu/acre), Oberon 4SC, 5 fl oz (52 bu/acre), Onager 1E, 12 fl oz (46 bu/acre), and the untreated control (58 bu/acre).

Field History:

Pest:	Banks grass mite, *Oligonychus pratensis* (Banks) Twospotted spider mite, *Tetranychus urticae* Koch
Cultivar:	Golden Harvest 6629 3000GT
Planting Date:	16 May 2013
Plant Population:	28,000
Irrigation:	Center pivot sprinkler
Crop History:	Corn in 2012
Herbicide:	RoundUp PowerMax, 32 fl oz (22 May) and Celebrity Plus, 4.7 fl oz (9 June)
Fertilization:	150 N 60 P
Soil Type:	Clay loam
Location:	ARDEC, 4616 North Frontage Road, Fort Collins, CO 80524, Field 3100 Trial 1 (N 40.66707, W 104.99710) and Trial 2 (N 40.66707, W 104.99754)

Table 11. Control of spider mites in field corn with hand-applied miticides (Trial 1), ARDEC, Fort Collins, CO. 2013.

	MITES PER LEAF ± SE[1]				TOTAL MITE	% REDUCTION
TREATMENT, PRODUCT/ACRE	**-4 DAT**	**7 DAT**	**14 DAT**	**21 DAT**	**DAYS ± SE[2]**	**IN MITE DAYS**
Brigade 2EC, 6.4 fl oz + dimethoate 4E, 16 fl oz*^	18.6 ± 3.5	17.6 ± 7.9 D	25.1 ± 10.2 B	33.1 ± 13.5	2062.8 ± 433.0 D	70
Experimental B2***	8.5 ± 3.7	27.8 ± 7.1 CD	49.8 ± 36.4 AB	36.8 ± 6.5	2585.1 ± 344.5 CD	62
Oberon 4SC, 5 fl oz**	8.5 ± 1.8	28.8 ± 7.0 BCD	30.4 ± 28.5 AB	50.4 ± 25.3	2930.2 ± 688.4 CD	57
Oberon 4SC, 6 fl oz**	13.7 ± 4.5	22.8 ± 2.4 CD	49.5 ± 37.2 AB	41.5 ± 26.6	3256.4 ± 637.1 CD	53
Oberon 4SC, 4 fl oz, + Requiem EC, 32 fl oz	16.6 ± 5.0	47.6 ± 10.3 ABCD	26.3 ± 16.3 B	28.3 ± 3.7	3368.7 ± 795.8 BCD	51
Zeal, 2 fl oz*	16.3 ± 5.3	42.8 ± 13.1 ABCD	30.4 ± 24.5 AB	38.3 ± 10.8	3460.2 ± 593.4 BCD	50
Experimental B3***	18.1 ± 10.1	24.3 ± 7.5 CD	60.4 ± 32.4 AB	49.4 ± 10.4	3525.3 ± 667.6 BCD	49
Oberon 4SC, 4 fl oz**	22.2 ± 10.0	35.6 ± 5.9 ABCD	60.4 ± 34.7 AB	34.4 ± 7.7	3529.4 ± 816.6 BCD	49
Onager 1E, 12 fl oz*	18.3 ± 4.3	45.5 ± 10.1 ABCD	53.1 ± 61.0 AB	42.0 ± 14.1	4285.8 ± 1283.4 ABCD	38
Oberon 4SC, 5 fl oz + dimethoate 16 fl oz*	13.8 ± 3.7	37.9 ± 14.0 ABCD	110.9 ± 38.4 A	40.6 ± 15.1	4443.0 ± 941.9 ABCD	35
dimethoate 4E, 16 fl oz*^	24.4 ± 7.6	43.3 ± 14.2 ABCD	75.3 ± 46.3 AB	53.6 ± 14.7	4735.6 ± 1005.0 ABCD	31
Experimental A3**	24.8 ± 7.9	51.3 ± 10.4 ABCD	71.6 ± 42.3 AB	39.7 ± 5.7	5071.9 ± 864.7 ABCD	26
Oberon 4SC, 6 fl oz, + Experimental A1**	30.8 ± 9.9	49.6 ± 13.8 ABCD	84.4 ± 95.6 AB	46.6 ± 14.9	5378.6 ± 1829.7 ABCD	22
Experimental B1***	9.0 ± 2.0	33.3 ± 9.7 BCD	82.8 ± 61.2 AB	93.9 ± 41.8	5418.8 ± 1334.4 ABCD	21
Requiem EC, 96 fl oz	23.5 ± 4.6	55.9 ± 11.3 ABCD	106.0 ± 90.0 AB	54.4 ± 11.1	5924.7 ± 1797.4 ABC	14
Experimental A2**	22.1 ± 4.7	62.5 ± 14.6 ABCD	92.1 ± 69.6 AB	63.2 ± 14.9	6376.5 ± 1423.0 ABC	7
Oberon 4SC, 4 fl oz, + Experimental A1**	17.7 ± 5.2	72.8 ± 30.8 ABC	54.2 ± 31.5 AB	41.5 ± 7.3	6566.1 ± 1801.4 ABC	5
Requiem EC, 64 fl oz	23.3 ± 9.4	88.6 ± 31.8 ABC	62.9 ± 35.6 AB	37.7 ± 13.4	6776.6 ± 1533.5 ABC	2
Untreated	20.2 ± 3.6	129.7 ± 35.4 A	44.7 ± 26.7 AB	49.7 ± 18.2	6882.2 ± 1298.6 AB	—
Experimental A1**	35.7 ± 12.1	73.8 ± 20.2 AB	109.4 ± 91.1 AB	59.7 ± 24.1	7474.2 ±2110.0 A	-9
F value		3.94	2.64	0.79	4.8	
p>F		0.0000	0.0010	0.7154	0.0000	

*applied with nonionic surfactant 0.25% v/v; **applied with methylated soybean oil 0.25% v/v; ***applied with crop oil concentrate 1% v/v; ^late treatment.

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

[2]Total mite days, calculated by the Ruppel method.

Table 12. Control of spider mites in field corn with hand-applied miticides (Trial 2), ARDEC, Fort Collins, CO. 2013.

	MITES PER LEAF ± SE[2]				TOTAL MITE	% REDUCTION
TREATMENT, PRODUCT/ACRE[1]	-1 DAT	7 DAT	14 DAT	21 DAT	DAYS ± SE[3]	IN MITE DAYS
Oberon 4SC, 5 fl oz (early)	12.9 ± 3.3	36.8 ± 8.0 AB	31.4 ± 10.0 B	41.7 ± 25.2	692.7 ± 126.0 D	74
Portal, 32 fl oz (late)	25.4 ± 5.8	33.3 ± 5.1 AB	27.4 ± 5.8 B	48.0 ± 8.4	711.2 ± 86.8 CD	73
Agri-Mek SC, 3.0 fl oz (late)	27.3 ± 6.0	55.5 ± 14.5 AB	33.7 ± 11.9 B	21.7 ± 9.0	837.0 ± 166.8 BCD	69
Brigade 2EC, 6.4 fl fl oz + dimethoate 4E, 16 fl oz (late)	18.7 ± 5.6	23.6 ± 10.8 B	74.7 ± 53.8 AB	31.8 ± 8.8	885.8 ± 458.0 BCD	67
dimethoate 4E, 16 fl oz (late)	20.6 ± 1.7	43.1 ± 14.0 AB	46.1 ± 15.4 AB	63.2 ± 16.0	949.3 ± 167.9 ABCD	65
Agri-Flex, 8.5 fl oz (late)	31.2 ± 7.5	55.8 ± 10.6 AB	56.6 ± 27.7 AB	17.3 ± 4.8	999.9 ± 235.0 ABCD	63
Agri-Mek SC, 2.5 fl oz (late)	26.9 ± 6.2	63.1 ± 29.2 AB	51.3 ± 13.2 AB	26.3 ± 5.2	1031.9 ± 252.2 ABCD	62
Onager 1E, 12 fl oz (early)	11.3 ± 3.1	83.1 ± 21.7 A	54.2 ± 16.4 AB	44.2 ± 25.3	1202.9 ± 260.5 ABCD	55
Onager 1E, 10 fl oz (early)	14.5 ± 3.6	76.6 ± 17.4 A	67.2 ± 28.3 AB	31.2 ± 4.8	1211.6 ± 306.8 ABCD	55
GWN-1708, 20 fl oz (late)	22.0 ± 7.7	95.0 ± 14.1 A	38.4 ± 11.9 AB	44.1 ± 12.8	1223.2 ± 157.3 ABCD	54
Portal, 32 fl oz (early)	14.5 ± 2.6	78.3 ± 19.5 A	61.0 ± 22.8 AB	55.5 ± 18.1	1267.1 ± 230.6 ABCD	53
GWN-1708, 24 fl oz (late)	16.5 ± 4.9	77.4 ± 20.9 A	78.0 ± 43.7 AB	37.5 ± 9.9	1323.7 ± 370.4 ABCD	51
GWN-10290, 12 fl oz (late)	28.6 ± 4.5	105.9 ± 23.7 A	53.3 ± 17.7 AB	24.9 ± 5.2	1369.4 ± 176.3 ABCD	49
Onager 1E, 14 fl oz (early)	15.4 ± 4.1	111.2 ± 33.7 A	64.6 ± 29.2 AB	26.2 ± 5.0	1439.8 ± 297.0 ABCD	46
GWN-10290, 10 fl oz (late)	21.3 ± 4.3	111.4 ± 34.0 A	62.7 ± 20.9 AB	29.3 ± 9.7	1462.1 ± 375.8 ABCD	45
GWN-10290, 10 fl oz (early)	37.7 ± 15.4	92.0 ± 20.0 A	84.2 ± 32.9 AB	43.8 ± 12.3	1583.1 ± 350.1 ABC	41
GWN-1708, 20 fl oz (early)	16.2 ± 5.1	127.6 ± 43.0 A	68.6 ± 17.2 AB	43.2 ± 13.6	1653.6 ± 394.8 ABC	38
GWN-1708, 24 fl oz (early)	35.0 ± 11.3	107.0 ± 33.5 A	91.6 ± 29.6 AB	22.8 ± 2.5	1663.6 ± 427.3 ABC	38
GWN-10290, 12 fl oz (early)	23.1 ± 4.7	132.8 ± 38.0 A	60.1 ± 16.0 AB	58.3 ± 22.1	1713.1 ± 254.7 AB	36
Untreated	20.6 ± 7.7	185.6 ± 101.7 A	143.7 ± 65.6 A	57.5 ± 20.4	2681.6 ± 892.0 A	—
F value		4.38	2.16	1.20	3.72	
p>F		0.0000	0.0079	0.2742	0.0000	

[1]all treatments applied with nonionic surfactant 0.25% v/v

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

[3]Total mite days, calculated by the Ruppel method.

2013 PEST SURVEY RESULTS

Table 13. 2013 pheromone trap catches at ARDEC, Fort Collins, CO.

	ARDEC – 1070	
Species	**Total Caught[2]**	**Trapping Period**
Army cutworm	283 (–)	5/20 - 11/1
Banded sunflower moth	8 (33)	5/27 - 9/4
European corn borer (IA)[1]	10 (5)	5/27 - 10/17
Fall armyworm	277 (142)	5/20 - 10/17
Pale western cutworm	101 (–)	8/12 - 11/1
Sunflower moth	18(24)	5/27 - 8/27
Western bean cutworm	4 (4)	5/27 - 8/27
Wheat head armyworm	18 (22)	5/20 - 10/17

[1] IA, Iowa strain
[2]–, not trapped. Number in () is 2012 total catch for comparison

2013 wheat stem sawfly survey. Jack Mangels, Claire Tovrea, Chrissy Ward, and Terri Randolph, Department of Bioagricultural Sciences and Pest Management.

The wheat stem sawfly, *Cephus cinctus* Norton, is a major pest of wheat and other cereals and also infests a wide range of noncultivated grasses. Areas where winter wheat is damaged include the northern Great Plains region, from Montana and the Dakotas to southeastern Wyoming and the Nebraska panhandle.

In 2010, the wheat stem sawfly was found damaging winter wheat near New Raymer. In 2011, losses of 40% were incurred in this area due to lodging from the sawfly. This triggered a survey of wheat stem sawfly throughout the wheat producing areas in eastern Colorado.

The number of samples collected from each eastern Colorado county in 2012 was based on the number of acres in wheat production in 2010. The 2013 samples were collected near the 2012 sites for comparison purposes. Distances between sites was a minimum of 10 miles to allow appropriate mapping and to provide a better sample of each county. Each site consisted of a wheat field sharing a field edge with a field that had been in wheat the previous year.

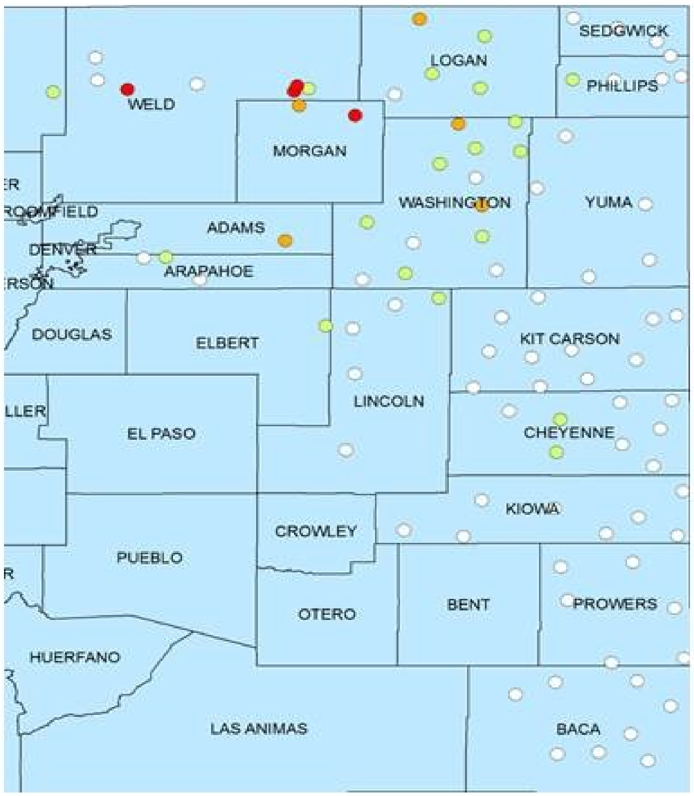
GPS coordinates were recorded at each location using a Garmin model GPSmap76S. A hand drawn map was then made for ease of returning to sites. Data on previous crop, presence of adjacent noncultivated grasses, tillage type, stubble/residue percent cover, irrigation, and wheat growth stage were recorded. Wheat stem sawfly presence and abundance was determined using two methods. Adults were collected in 100 180-degree sweeps with a standard insect sweep net within growing wheat adjacent to fallow. Samples were frozen until they could be counted. At the sites where sawfly adults had been were collected, 100 tillers after anthesis were collected along the wheat/stubble border by cutting as them as close to the ground as possible. Tillers were later dissected to determine percentage larval infestation. 2012 and 2013 results are shown in the figure below and indicate that this pest has increased in incidence and intensity over the past two years.

Wheat stem sawfly: Survey Results

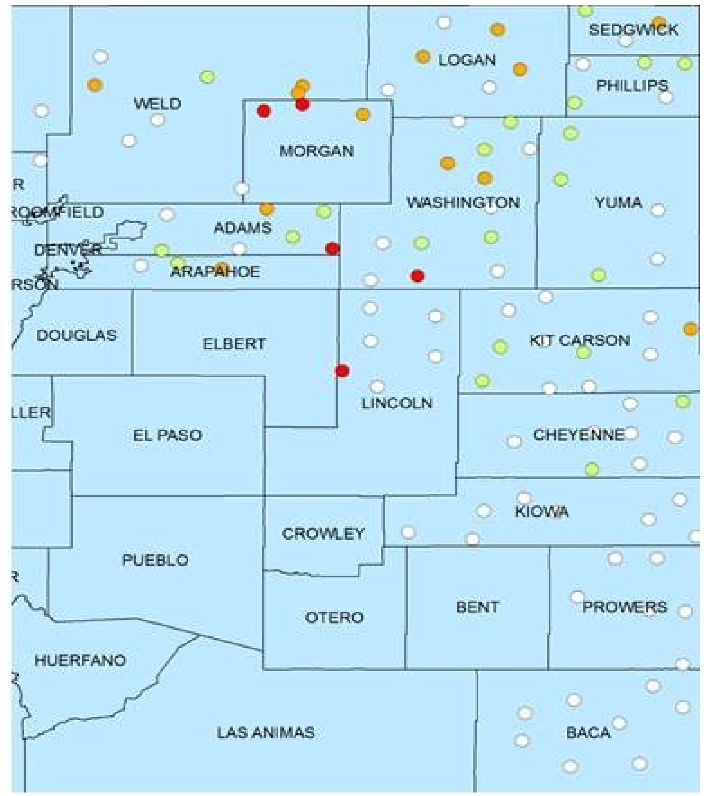
Infestation Intensity

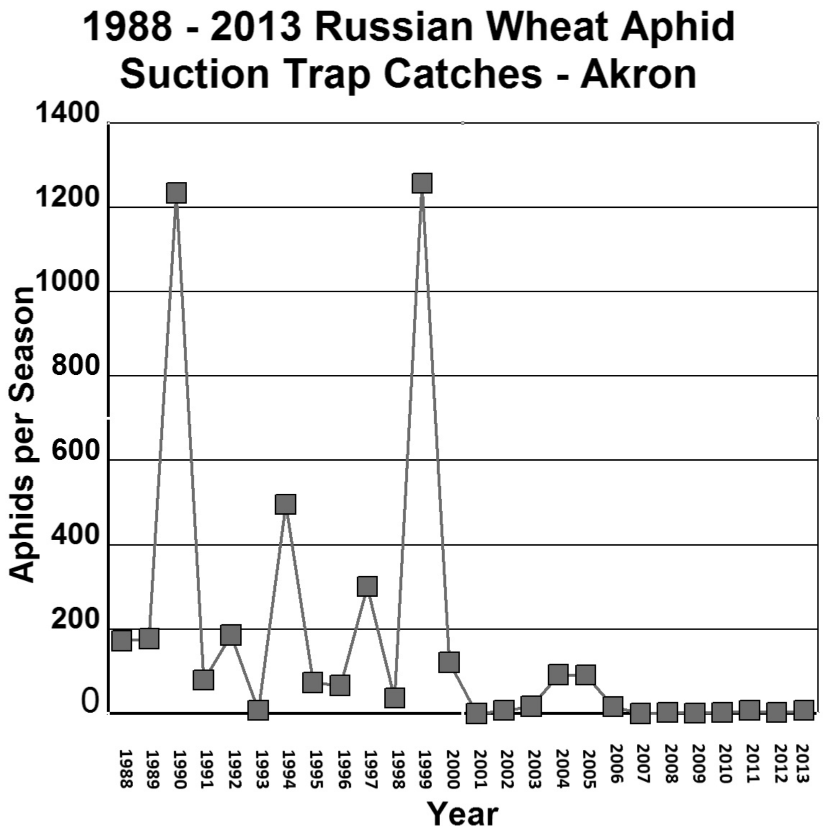
- None
- 1-5 Sawfly Adults (or <10 % infested tillers)
- 6-20 Sawfly Adults (or 11-50 % infested tillers)
- 21+ Sawfly Adults (or >50 % infested tillers)

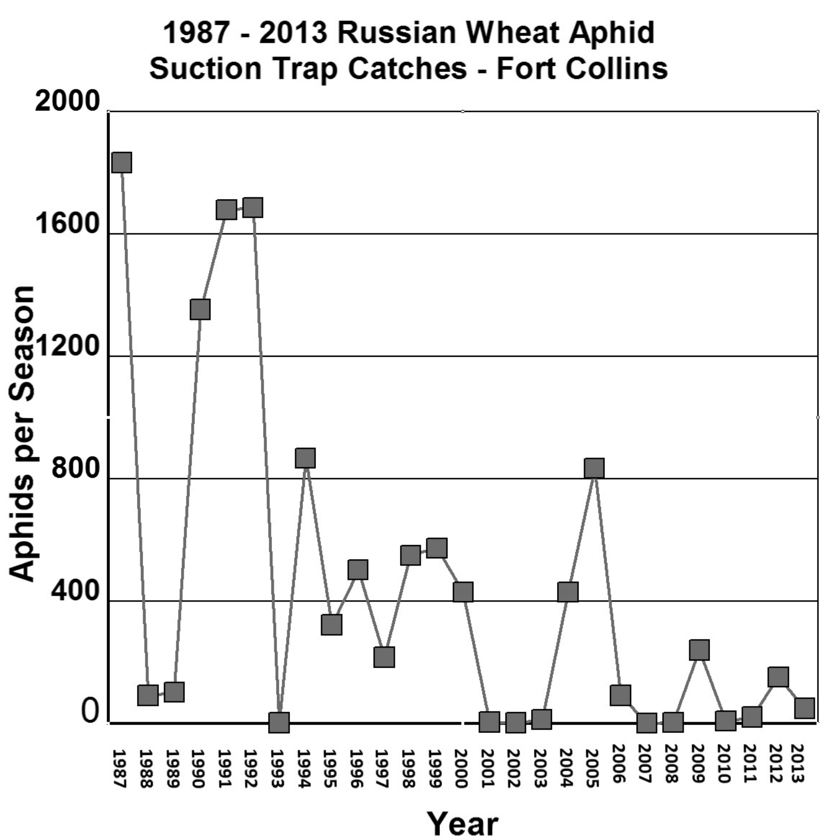
2012

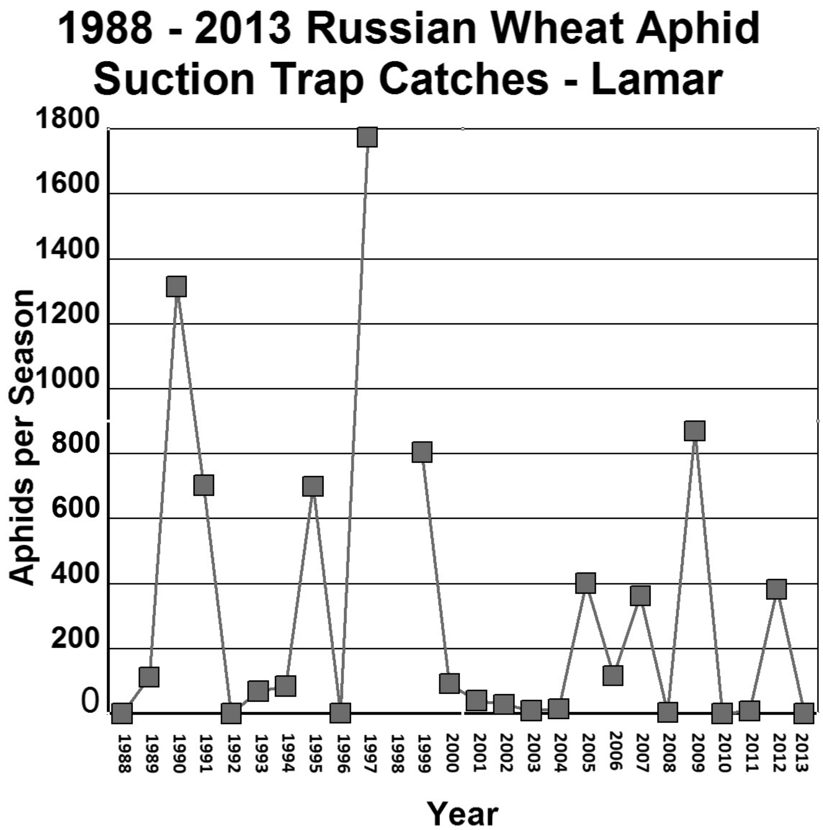


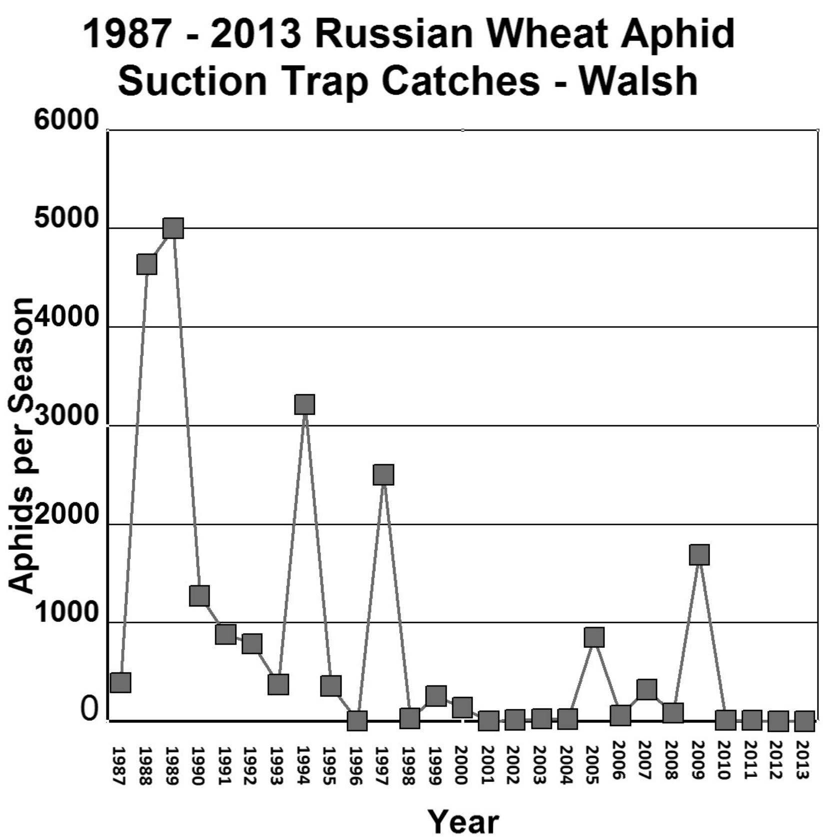
2013




1988 - 2013 Russian Wheat Aphid
Suction Trap Catches - Akron
Aphids per Season
1400
1200
1000
800
600
400
200
0
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Year


1987 - 2013 Russian Wheat Aphid
Suction Trap Catches - Fort Collins
Aphids per Season
2000
1600
1200
800
400
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Year


1988 - 2013 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 2009 2010 2011 2012 2013
Year


1987 - 2013 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 2009 2010 2011 2012 2013
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 2013.

Table 14. Performance of planting-time insecticides against western corn rootworm, 1987-2013, in northern Colorado.

INSECTICIDE	0 -3 ROOT RATING[1]
AGRISURE RW	0.16 (6)
AZTEC 2.1G	0.06 (34)
COUNTER 15G	0.06 (37)
CRUISER, 1.25 mg (AI)/seed	0.06 (10)
FORCE 1.5G (8 OZ) or 3G (4 OZ)	0.06 (32)
FORCE 3G (5 OZ)	0.07 (11)
FORTRESS 5G	0.08 (14)
HERCULEX RW or xTRA	0.13 (5)
LORSBAN 15G	0.11 (30)
PONCHO 600, 1.25 mg (AI)/seed	0.04 (8)
SMARTSTAX	0.05 (3)
THIMET 20G	0.50 (15)
UNTREATED CONTROL	1.10 (39)

[1]Rated on the node damage scale of 0-3, where 0 is least damaged, and 3 is 3 root nodes completely damaged. Ratings taken prior to 2006 were based on the Iowa 1-6 scale and approximated to the 0-3 scale. Number in parenthesis is number of times the product was tested in 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 + OIL	I	72 (14)
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, 1984-2013, in northern Colorado.

PRODUCT	LB (AI)/ACRE	% CONTROL AT 2 WK[1]
BAYTHROID XL	0.022	94 (19)
BAYTHROID XL	0.022 (early)[3]	93 (10)
COBALT OR COBALT ADVANCED	19 fl oz	90 (7)
LORSBAN 4E	0.75	93 (23)
LORSBAN 4E	1.00	89 (10)
LORSBAN 4E	0.50	83 (10)
MUSTANG MAX	0.025	92 (9)
MUSTANG MAX	0.025 (early)[3]	89 (11)
PERMETHRIN [2]	0.10	67 (7)
PERMETHRIN [2]	0.20	80 (4)
STALLION	11.75 FL OZ	95 (3)
STEWARD EC	0.065	80 (7)
STEWARD EC	0.110	84 (9)
WARRIOR 1E or T or II	0.02	92 (18)
WARRIOR II	0.03 (early)[3]	91 (5)
WARRIOR 1E or T or II	0.03	92 (12)

[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, 1986-2013[1].

		TESTS WITH > 90%		
LORSBAN 4E	0.50	29	50	58
COBALT ADVANCED	13 FL OZ	3	5	60
BAYTHROID XL	0.019	0	7	0
DIMETHOATE 4E	0.375	9	42	21
ENDIGO 2.71 ZCX	4.0 FL OZ	2	4	50
MUSTANG MAX	0.025	2	11	18
LORSBAN 4E	0.25	10	27	37
LORSBAN 4E	0.38	5	6	83
WARRIOR 1E	0.03	4	19	21

[1]Includes data from several states.

Table 21. Control of spider mites in artificially-infested corn, ARDEC, 1993-2013.

PRODUCT	LB (AI)/ACRE	% REDUCTION IN TOTAL MITE DAYS[1]
CAPTURE 2E	0.08	47 (18)
CAPTURE 2E + DIMETHOATE 4E	0.08 + 0.50	65 (20)
COMITE II	1.64	17 (17)
COMITE II	2.53	37 (9)
COMITE II + DIMETHOATE 4E	1.64 + 0.50	55 (13)
DIMETHOATE 4E	0.50	43 (18)
OBERON 4SC	0.135	50 (8)
OBERON 4SC	0.156	77 (4)
OBERON 4SC	0.188	63 (3)
ONAGER 1E	0.094	69 (9)

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

Table 22. Control of sunflower stem weevil, 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)
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

2013 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, Bruce Hibbard
Western bean cutworm control	ARDEC, Fort Collins	Chris Fryrear, Mark Collins, Larry Appel
Corn spider mite control	ARDEC, Fort Collins	Chris Fryrear, Mark Collins, Bob Hammon
Russian wheat aphid control	ARDEC, Fort Collins	Chris Fryrear, Mark Collins
Wheat stem sawfly control	New Raymer	Jim and Cole Mertens
Brown wheat mite control	ARDEC, Lamar	Chris Fryrear, Mark Collins, 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