Field Evaluation of Insecticide Application Strategies for Colorado Potato Beetle Control (2015)

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BACKGROUND:
The Colorado potato beetle (CPB) (*Leptinotarsa decemlineata)* is a major economic insect pest of potato production in Manitoba. The ability of this insect to develop resistance to insecticides further adds to the challenges of effective management. In the 1990's the neonicotinoid class of insecticides (Group 4) was introduced and provided a very effective insecticide for CPB. In 2012 suspicion of reduced efficacy of the neonicotinoid chemistry was observed in the field and later confirmed by Dr. Ian Scott of Agriculture and Agri-Food Canada. Now that resistance to the neonicotinoid insecticides has been documented in Manitoba, it is important that growers evaluate new strategies for CPB and insect management in general. Since the introduction of neonicotinoid insecticides, spinosyns (Group 5) and the diamides (Group 28) have been registered. These insecticides have not gained widespread use in the potato industry, likely due to factors such as concerns about efficacy, precision of timing, narrow pest spectrum and cost. This research will provide knowledge on effective strategies to manage CPB and assist growers in implementing an effective insect management strategy.

OBJECTIVE
The objective of this three-year project is to evaluate insecticide management strategies, including a combination of registered seed treatments, in-furrow, and/ or foliar insecticides for the control of Colorado potato beetle and other potato pests like aphids and leafhoppers. The strategies will be assessed for efficacy against these pests, the impact on potato yield and quality, the cost, and ease of implementation at the farm level.

METHODS
The project was conducted at the Peak of the Market Research Site in Winkler, MB, where a CPB population with mixed resistance to neonicotinoids is located. The trial was a 15 treatment randomized complete block design using the red potato variety Sangre.

Each "treatment", with the exception of the untreated control, was an insect management strategy that included a combination of registered seed treatment, in-furrow, and/ or foliar insecticides.

During the growing season, the decision of when and what foliar insecticides (if any) to apply was determined by considering the results of regular insect assessments, environmental conditions, and pest stage present. Decisions were also based on resistance management practices such as rotation of insecticide groups within a treatment program, and no use of the same insecticide group if it was used as a seed or in-furrow treatment in the same year.

Procedure:

Plot size:	4 rows by 6 m (Assessments conducted on 2 centre rows)
Trial design:	RCB 4 replicates
Location:	Peak of the Market Research Site, Winkler
Soil type:	Reinland Fine Sandy Loam
Crop:	Potatoes
Variety:	Sangre
Row spacing:	1 metre / 39”
Planting date:	May 1
Foliar insecticide app. dates:	June 29, July 7
Topkill / Harvest dates:	Aug 20 / Sept 9
Treatments:	Table 1.

Table 1. List of insecticide treatments.

	At Plant Strategy				Foliar Insecticide
Trt	Product	Method	Group	Rate	Group Options
1	Titan	IF	4	2.0 ml/ha	3 / 5 / 28
2	Titan	IF	4	3.3 ml/ha	3 / 5 / 28
3	Titan	ST	4	10.4 ml/100 kg	3 / 5 / 28
4	Titan	ST	4	20.8 ml/100 kg	3 / 5 / 28
5	Actara	IF	4	3.4 ml/100 m	3 / 5 / 28
6	Actara	IF	4	4.4 ml/100 m	3 / 5 / 28
7	Actara	ST	4	18 ml/100 m	3 / 5 / 28
8	Actara	ST	4	23.2 ml/100 kg	3 / 5 / 28
9	Verimark	IF	28	6.75 ml/100 m	3 / 5
10	Verimark	IF	28	9 ml/100 m	3 / 5
11	Verimark	ST	28	45 ml/100 kg	3 / 5
12	Minecto Duo	IF	4/28	4.4 g/100 m	3 / 5
13	Minecto Duo	IF	4/28	7.5 g/100 m	3 / 5
14	None	-	-	-	3 / 5 / 28
15	Untreated Check	-	-	-	

Colorado Potato Beetle Assessments: In-field assessments of the CPB population was done by counting the number of CPB adults; and $1^{st}/2^{nd}$, $3^{rd}/4^{th}$ instar larvae on 10 plants per plot. Assessments began on June 29 and were conducted weekly until Aug. 17. An estimation of percent defoliation was conducted 10 times throughout the field season. This trial did not become infested with potato leafhopper or aphids, so no other insect counts or damage were assessed in this year of the trial

Application decisions: The foliar insecticide groups were considered and chosen based on the stage of the beetles and weather conditions. If a group was used as a seed or in-furrow treatment, it was not used in the foliar program. Group 5 insecticides are best targeted to egg hatch or small larvae. Group 3 were to be used if weather conditions were conducive (less effective at high temperatures). Resistance is also known to exist to Gr 3 insecticides. The groups were to be rotated accordingly and as population demanded.

Foliar Application Method

Equipment:	Tractor mounted pneumatic sprayer
Nozzle Type:	Tee-Jet 80-02 Flat Fan
Nozzle Spacing:	50 cm
Nozzle Height:	45 cm
Pressure:	30 psi (207 kPa)
Volume:	225 L/ha

Pest Management

No insecticides were used other than the test substances indicated above. A glyphosate burnoff application was completed on May 25, Prism/Sencor were applied on June 24. The fungicide program consisted of weekly application of Bravo, with one application of Luna Tranquility for additional early blight control.

Phytotoxicity

All plots were monitored to determine if any of the treatments caused phytotoxic effects. No such effects were detected at any point during the season. Consequently, all plots received a rating of 0% phytotoxicity (complete tolerance) for all of the assessment dates.

Tuber Yield and Grade

Gross yield was determined at harvest and later samples were graded for size profile.

RESULTS

CPB Larvae

Initial CPB counts were made on June 29, larvae data are presented in Tables 2, 3 and 4. Since the patterns are similar with the different larval stages, discussion will refer to the total combined larvae rather than breakdown by instar stages. Delegate was applied to treatment 14 (Foliar only) on June 29. By July 7, there were no longer any larvae in treatment 14, demonstrating that Delegate was very effective in controlling larvae (mostly small,1^{st} and 2^{nd} instar larvae). Also on July 7, larvae numbers in the Verimark treatments warranted an application, so Delegate was applied to treatments 9, 10, and 11. On July14, there were very few larvae in the Verimark treatments, once again indicating good control of all larval stages with Delegate. Larvae numbers were beginning to increase by the July 24 assessment, particularly in the low rate of Titan IF (treatment 1), the low rate of Actara IF (treatment 5) and the high rate of Actara Seed Treatment. By Aug 10, the lowest rate of Titan IF and the Verimark IF treatments (plus Delegate foliar) were reaching high CPB larvae numbers again but it was too late in the season to justify a foliar application. No other applications were made.

CPB Adults
In an average season, two generations of adult Colorado potato beetles occur in Manitoba potato fields – the over wintering and new (summer) adults. The over wintering adults originate from the previous growing season - these were counted on the same assessment dates as the larvae. In Manitoba, by the time the larvae begin to emerge, adult numbers are very low and variable. The number of over-wintering adults was particularly low at this site by the time counts were conducted, so the early adult numbers are not particularly meaningful. The summer adults started to emerge by the July 21 assessment. The number of adults tend to reflect the control of larvae earlier in the season. The untreated check had the most adults, followed by the Verimark treatments. By July 31, many of the other IF and seed treatments showed an increase in adults, particularly the low rate of Titan. By the last assessment on Aug. 17, adult numbers began to build in the foliar treatment (14).

Defoliation
Defoliation never reached 5% of the foliage of any insecticide treatments until the last assessment on Aug 17. Top killing of the trial was imminent, so this level of defoliation was not likely to affect yield. Defoliation in the untreated check was over 40%.

Application Decisions: As indicated, only two subsequent foliar applications were made in this trial during the 2015 season. After the initial CPB counts on June 29, treatment 14 (foliar only) was sprayed with Delegate (Group 5). After the July 7 counts, Treatments 9, 10 and 11 (Verimark treatments) were sprayed with Delegate. In both cases, insect numbers warranted spraying, and predicted daytime temperatures were too high to spray a pyrethroid (Group 3). No other foliar applications were made.

Tuber Yield and Grade:
The trial was harvested on Sept 9 and subsequently graded (Table 7). The untreated check was the lowest yielding treatment (206 cwt/ac), with all insecticide treatments yielding in the 250-300 cwt/ac range. Yield generally reflects defoliation, and the high defoliation in the check resulted in significant yield loss. Some other treatment differences were present, but this was likely due to confounding issues in the trial, particularly poor stand in some areas. Under cool soil conditions, Sangre can be susceptible to little tuber disorder, resulting in delayed emergence and poor stand. The poor stand experienced in this trial also allowed for significant weed pressure, predominantly from nightshade. Despite hand-weeding operations, this late and variable flush of nightshade may have had some effect on yield.

Table 2. Effect of insecticide treatment on number of 1st and 2nd instar CPB larvae.

	Treatment	1st and 2nd Instar Larvae on Ten Plants													
		29-Jun		7-Jul		14-Jul		21-Jul		31-Jul		5-Aug		10-Aug		17-Aug	
1	Titan IF 2.0 mL	0.0	c	0.3	c	1.0	bc	2.2	b	0.5	a	1.0	a	17.1	a	3.4	a
2	Titan IF 3.3 mL	0.3	c	0.0	c	0.2	c	0.2	bc	0.0	a	0.0	a	2.0	a	1.5	a
3	Titan ST 10.4 mL	0.0	c	0.0	c	0.9	bc	0.4	bc	0.1	a	0.0	a	0.9	a	5.2	a
4	Titan ST 20.8 mL	0.0	c	0.0	c	0.0	c	0.3	bc	0.0	a	0.0	a	1.0	a	1.1	a
5	Actara IF 3.4 mL	0.0	c	0.5	c	0.7	bc	1.5	bc	0.1	a	0.5	a	7.3	a	7.4	a
6	Actara IF 4.4 mL	0.0	c	0.0	c	1.1	bc	1.5	bc	0.0	a	0.4	a	1.7	a	8.7	a
7	Actara ST 18 mL	0.0	c	0.0	c	0.2	c	0.4	bc	0.0	a	0.2	a	1.4	a	2.0	a
8	Actara ST 23.2 mL	0.0	c	0.7	c	3.5	ab	1.7	bc	0.0	a	1.1	a	4.0	a	4.6	a
9	Verimark IF 6.75 mL	9.0	b	11.8	b	0.0	c	0.0	c	0.1	a	2.9	a	4.9	a	4.8	a
10	Verimark IF 9 mL	9.7	b	6.8	b	0.4	c	0.3	bc	0.3	a	0.0	a	11.9	a	4.1	a
11	Verimark ST 45 mL	7.4	b	13.5	b	0.2	c	0.0	c	0.0	a	1.2	a	6.7	a	2.4	a
12	Minecto Duo IF 4.4 g	0.3	c	0.0	c	0.4	c	0.7	bc	0.1	a	0.0	a	2.0	a	2.7	a
13	Minecto Duo IF 7.5 g	0.0	c	0.0	c	0.0	c	0.2	bc	0.0	a	0.8	a	1.8	a	3.9	a
14	Foliar	32.2	a	0.0	c	1.2	bc	0.8	bc	0.3	a	0.0	a	3.8	a	5.6	a
15	Untreated Check	41.7	a	31.0	a	7.5	a	13.4	a	0.0	a	0.9	a	16.5	a	9.6	a
CV		50.3		63.3		126.7		120		252.1		213.9		93.3		68.5	
Treatment Prob(F)		0.0001		0.0001		0.0037		0.0017		0.4564		0.4546		0.2973		0.7115	

Table 3. Effect of insecticide treatment on number of 3rd and 4th instar CPB larvae.

	Treatment	3rd and 4th Instar Larvae on Ten Plants													
		29-Jun		7-Jul		14-Jul		21-Jul		31-Jul		5-Aug		10-Aug		17-Aug	
1	Titan IF 2.0 mL	0.0	b	0.2	c	1.5	bcd	0.8	b	0.2	bc	1.0	a	3.5	abc	10.5	a
2	Titan IF 3.3 mL	0.0	b	0.0	c	0.5	cde	0.1	b	0.0	c	0.0	a	0.2	d	6.6	a
3	Titan ST 10.4 mL	0.0	b	0.0	c	0.4	cde	0.1	b	0.0	c	0.0	a	0.0	d	3.8	a
4	Titan ST 20.8 mL	0.0	b	0.0	c	0.0	e	0.0	b	0.0	c	0.0	a	0.6	cd	2.1	a
5	Actara IF 3.4 mL	0.0	b	0.0	c	3.1	b	0.4	b	1.0	b	1.8	a	0.6	cd	11.1	a
6	Actara IF 4.4 mL	0.0	b	0.0	c	0.3	cde	0.6	b	0.1	bc	0.0	a	1.4	bcd	7.3	a
7	Actara ST 18 mL	0.0	b	0.0	c	0.0	e	0.3	b	0.3	bc	0.0	a	0.7	cd	7.6	a
8	Actara ST 23.2 mL	0.0	b	0.0	c	1.6	bc	0.8	b	0.0	c	0.0	a	1.0	bcd	19.1	a
9	Verimark IF 6.75 mL	0.3	b	2.1	b	0.0	e	0.0	b	0.1	bc	2.3	a	5.3	ab	12.4	a
10	Verimark IF 9 mL	0.3	b	6.2	a	0.3	cde	0.1	b	0.1	bc	2.0	a	1.1	bcd	15.8	a
11	Verimark ST 45 mL	0.0	b	5.4	a	0.0	e	0.0	b	0.0	c	0.0	a	2.1	bcd	12.6	a
12	Minecto Duo IF 4.4 g	0.0	b	0.0	c	0.4	cde	0.4	b	0.1	bc	0.0	a	0.7	cd	7.3	a
13	Minecto Duo IF 7.5 g	0.0	b	0.0	c	0.2	de	0.1	b	0.0	c	1.3	a	0.6	cd	3.4	a
14	Foliar	0.5	b	0.0	c	0.2	de	0.1	b	0.3	bc	4.0	a	0.7	cd	14.4	a
15	Untreated Check	5.6	a	8.2	a	13.2	a	12.7	a	6.5	a	6.5	a	8.8	a	11.3	a
CV		174.8		94.2		102.8		107.4		133.9		219.2		99.5		34.4	
Treatment Prob(F)		0.0001		0.0001		0.0001		0.0001		0.0001		0.0572		0.0147		0.063	

Table 4. Effect of insecticide treatment on total number of CPB larvae.

	Treatment	Visually Estimated Defoliation (% Leaf Area)													
		29-Jun		7-Jul		14-Jul		21-Jul		31-Jul		5-Aug		10-Aug		17-Aug	
1	Titan IF 2.0 mL	0.0	d	0.0	d	0.2	d	0.4	de	1.1	bc	1.8	bc	3.9	b	5.4	b
2	Titan IF 3.3 mL	0.0	d	0.0	d	0.0	d	0.0	e	0.0	d	0.0	e	0.6	def	1.9	cde
3	Titan ST 10.4 mL	0.0	d	0.0	d	0.0	d	0.0	e	0.0	d	0.0	e	0.3	ef	1.4	e
4	Titan ST 20.8 mL	0.0	d	0.0	d	0.0	d	0.2	de	0.3	cd	0.3	e	0.4	def	0.8	e
5	Actara IF 3.4 mL	0.0	d	0.0	d	0.4	d	1.4	bc	2.0	b	2.6	b	2.1	bcd	4.7	bcd
6	Actara IF 4.4 mL	0.0	d	0.0	d	0.2	d	0.3	de	0.3	cd	0.7	cde	1.8	b-e	4.2	bcd
7	Actara ST 18 mL	0.0	d	0.0	d	0.0	d	0.0	e	0.0	d	0.2	e	0.3	ef	1.9	cde
8	Actara ST 23.2 mL	0.0	d	0.0	d	0.2	d	0.9	cd	1.2	b	2.0	b	2.9	bc	5.2	b
9	Verimark IF 6.75 mL	1.4	b	3.0	bc	1.6	c	2.7	b	1.7	b	2.8	b	4.8	b	6.6	b
10	Verimark IF 9 mL	1.2	bc	3.5	bc	2.0	bc	1.6	bc	1.7	b	1.4	bcd	3.0	bc	4.7	bc
11	Verimark ST 45 mL	0.6	c	5.5	b	3.0	b	2.2	b	1.4	b	2.1	b	2.8	bc	4.1	bcd
12	Minecto Duo IF 4.4 g	0.0	d	0.0	d	0.0	d	0.2	de	0.2	d	0.4	de	0.7	c-f	1.8	de
13	Minecto Duo IF 7.5 g	0.0	d	0.0	d	0.0	d	0.0	e	0.0	d	0.3	e	0.1	f	1.8	de
14	Foliar	7.9	a	2.0	cd	2.7	bc	1.4	bc	1.2	b	1.7	bc	1.8	b-e	5.0	b
15	Untreated Check	7.9	a	15.0	a	19.4	a	24.5	a	30.6	a	35.7	a	41.2	a	46.2	a
CV		71.4		99.8		50.8		47.8		51.6		43.6		39.5		26.5	
Treatment Prob(F)		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001	

Table 5. Effect of insecticide treatment on CPB Adults.

	Treatment	Total Adult CPB on Ten Plants															
		29-Jun		7-Jul		14-Jul		21-Jul		31-Jul		5-Aug		10-Aug		17-Aug	
1	Titan IF 2.0 mL	0.1	ab	0.0	a	0.0	a	0.0	e	2.6	b	1.1	b	1.8	a	1.6	bcd
2	Titan IF 3.3 mL	0.7	a	0.0	a	0.3	a	0.0	e	0.9	bcd	1.2	b	0.5	a	0.7	b-e
3	Titan ST 10.4 mL	0.9	a	0.0	a	0.0	a	0.2	de	0.2	cd	0.3	bc	0.4	a	0.3	cde
4	Titan ST 20.8 mL	0.9	a	0.0	a	0.0	a	0.0	e	0.2	cd	0.0	c	0.5	a	0.0	e
5	Actara IF 3.4 mL	0.4	ab	0.0	a	0.5	a	0.0	e	1.2	bc	0.8	bc	0.9	a	2.1	bc
6	Actara IF 4.4 mL	0.3	ab	0.0	a	0.3	a	0.0	e	0.2	cd	0.4	bc	0.1	a	0.3	cde
7	Actara ST 18 mL	0.1	ab	0.0	a	0.0	a	0.0	e	0.2	cd	0.0	c	0.1	a	1.6	bcd
8	Actara ST 23.2 mL	0.0	b	0.0	a	0.0	a	0.4	cde	1.0	bcd	0.4	bc	1.5	a	0.6	b-e
9	Verimark IF 6.75 mL	0.0	b	0.0	a	0.0	a	2.1	b	0.2	cd	0.0	c	0.4	a	0.0	e
10	Verimark IF 9 mL	0.0	b	0.3	a	0.0	a	1.2	bc	0.8	bcd	0.0	c	0.4	a	0.4	cde
11	Verimark ST 45 mL	0.6	a	0.0	a	0.0	a	0.7	cd	0.0	d	0.7	bc	0.5	a	0.2	de
12	Minecto Duo IF 4.4 g	0.0	b	0.0	a	0.0	a	0.2	de	0.2	cd	1.0	bc	1.0	a	1.5	bcd
13	Minecto Duo IF 7.5 g	0.3	ab	0.0	a	0.3	a	0.0	e	0.3	cd	0.6	bc	0.1	a	0.6	b-e
14	Foliar	0.0	b	0.0	a	0.0	a	0.2	de	0.0	d	0.8	bc	0.3	a	2.6	b
15	Untreated Check	0.0	b	0.0	a	0.0	a	10.2	a	13.3	a	6.6	a	1.9	a	11.2	a
CV		137.1		774.6		416.8		88.4		94.2		99.7		101.5		92.7	
Treatment Prob(F)		0.0273		0.4708		0.6744		0.0001		0.0001		0.0012		0.5208		0.0002	

Table 6. Effect of insecticide treatment on foliar defoliation by CPB.

	Treatment	Visually Estimated Defoliation (% Leaf Area)															
		29-Jun		7-Jul		14-Jul		21-Jul		31-Jul		5-Aug		10-Aug		17-Aug	
1	Titan IF 2.0 mL	0.0	d	0.0	d	0.2	d	0.4	de	1.1	bc	1.8	bc	3.9	b	5.4	b
2	Titan IF 3.3 mL	0.0	d	0.0	d	0.0	d	0.0	e	0.0	d	0.0	e	0.6	def	1.9	cde
3	Titan ST 10.4 mL	0.0	d	0.0	d	0.0	d	0.0	e	0.0	d	0.0	e	0.3	ef	1.4	e
4	Titan ST 20.8 mL	0.0	d	0.0	d	0.0	d	0.2	de	0.3	cd	0.3	e	0.4	def	0.8	e
5	Actara IF 3.4 mL	0.0	d	0.0	d	0.4	d	1.4	bc	2.0	b	2.6	b	2.1	bcd	4.7	bcd
6	Actara IF 4.4 mL	0.0	d	0.0	d	0.2	d	0.3	de	0.3	cd	0.7	cde	1.8	b-e	4.2	bcd
7	Actara ST 18 mL	0.0	d	0.0	d	0.0	d	0.0	e	0.0	d	0.2	e	0.3	ef	1.9	cde
8	Actara ST 23.2 mL	0.0	d	0.0	d	0.2	d	0.9	cd	1.2	b	2.0	b	2.9	bc	5.2	b
9	Verimark IF 6.75 mL	1.4	b	3.0	bc	1.6	c	2.7	b	1.7	b	2.8	b	4.8	b	6.6	b
10	Verimark IF 9 mL	1.2	bc	3.5	bc	2.0	bc	1.6	bc	1.7	b	1.4	bcd	3.0	bc	4.7	bc
11	Verimark ST 45 mL	0.6	c	5.5	b	3.0	b	2.2	b	1.4	b	2.1	b	2.8	bc	4.1	bcd
12	Minecto Duo IF 4.4 g	0.0	d	0.0	d	0.0	d	0.2	de	0.2	d	0.4	de	0.7	c-f	1.8	de
13	Minecto Duo IF 7.5 g	0.0	d	0.0	d	0.0	d	0.0	e	0.0	d	0.3	e	0.1	f	1.8	de
14	Foliar	7.9	a	2.0	cd	2.7	bc	1.4	bc	1.2	b	1.7	bc	1.8	b-e	5.0	b
15	Untreated Check	7.9	a	15.0	a	19.4	a	24.5	a	30.6	a	35.7	a	41.2	a	46.2	a
CV		71.4		99.8		50.8		47.8		51.6		43.6		39.5		26.5	
Treatment Prob(F)		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001		0.0001	

Table 7. Effect of insecticide on potato yield and grade.

		Yield (cwt / ac)									
Treatment		<2"		2-2.25"		2.25-3"		>3"		Total	
1	Titan IF 2.0 mL	41.5	a	57.9	a	188.0	a	11.4	a	298.9	a
2	Titan IF 3.3 mL	39.2	a	53.6	a	147.7	a	8.5	a	249.0	bc
3	Titan ST 10.4 mL	39.6	a	54.0	a	182.0	a	11.5	a	287.1	ab
4	Titan ST 20.8 mL	40.7	a	45.5	a	170.4	a	17.2	a	273.8	ab
5	Actara IF 3.4 mL	36.3	a	49.1	a	172.0	a	7.3	a	264.6	ab
6	Actara IF 4.4 mL	42.1	a	60.3	a	142.9	a	11.7	a	257.0	ab
7	Actara ST 18 mL	38.1	a	53.5	a	156.7	a	8.9	a	257.1	ab
8	Actara ST 23.2 mL	39.8	a	54.9	a	172.2	a	13.2	a	280.2	ab
9	Verimark IF 6.75 mL	38.3	a	52.6	a	145.8	a	17.2	a	253.9	b
10	Verimark IF 9 mL	31.2	a	36.7	a	186.8	a	11.2	a	265.9	ab
11	Verimark ST 45 mL	39.9	a	56.6	a	166.7	a	9.3	a	272.5	ab
12	Minecto Duo IF 4.4 g	48.4	a	61.2	a	168.1	a	5.3	a	283.0	ab
13	Minecto Duo IF 7.5 g	43.6	a	43.7	a	160.8	a	14.8	a	262.9	ab
14	Foliar	37.3	a	50.8	a	149.3	a	8.2	a	245.6	bc
15	Untreated Check	33.7	a	40.5	a	126.9	a	5.3	a	206.5	c
LSD P=.05		ns		ns		ns		ns		43.2	
CV		26.7		24.4		18.2		83.7		11.5	
Treatment Prob(F)		0.8565		0.2542		0.1981		0.7632		0.0361	

CONCLUSIONS

The CPB pressure in this trial was low, however, there were significant larvae present to warrant a foliar insecticide treatment to the foliar only strategy. Most strategies (treatments) included in this trial had either a seed treatment or in-furrow applied insecticide. These at-planting treatments provided good early season control of CPB. However, by June 29 all treatments with Verimark had significantly more CPB larvae compared to those treatments that contained a neonicotinoid insecticide. The results from this trial clearly demonstrate that the neonicotinoid insecticides remained effective at controlling the resident population of CPB in 2015. Because of these results, it is likely that the strength of the Minecto Duo treatments was a result of the thiamethoxam, a neonicotinoid, in this insecticide.

Delegate was used as the foliar insecticide option in the foliar only treatment, as well as the Verimark treatments. When this product was applied, most of the larvae were 1st and 2nd instar, and very good control was achieved. It is also worth noting that some 3rd and 4th instar larvae were present for the July 7 application to the Verimark treatments. Very low presence of late instar larvae and adults during the July 14 and July 21 assessments suggests that Delegate was also effective at controlling 3rd and 4th instar larvae.

One objective of this trial was to assess the economic cost of the different insect management strategies. However, this aspect of the trial was not completed due to the concerns regarding the quality of the yield data. This objective of the trial will be addressed in future years of the trial.

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