EFFECTIVE SPRINGTAIL MANAGEMENT IN SUGARBEET WITH GRANULAR, SPRAYABLE LIQUID, AND SEED-APPLIED INSECTICIDES

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Introduction:

Subterranean (soil-dwelling) springtails have been recognized as serious pests of sugarbeet in the Red River Valley (RRV) of Minnesota and North Dakota since the late-1990s. In the past three to five years, producers in western ND and eastern Montana have also experienced serious crop damage associated with springtail feeding injury. Springtails belong to the order Collembola, an order of organisms that is so unique that they are considered by many experts to belong to a separate taxonomic group from that of true insects. These tiny, nearly microscopic, blind, and wingless insects spend their entire lives below the soil surface (Boetel et al. 2001).

Although subterranean springtails are present in many fields throughout the sugarbeet production areas of ND, MN, and eastern MT, they only occasionally become a major pest problem. These pests thrive in heavy soils with high levels of soil organic matter. Cool and wet weather can be conducive to springtail infestation buildups, because such conditions slow sugarbeet seed germination and seedling development, which renders plants extremely vulnerable to attack by springtails. Unfortunately, pest species of springtails do not appear to be negatively impacted by cool temperatures. Therefore, these pests can cause major plant stand and yield losses. This research was conducted to evaluate the performance of a conventional granular insecticide, an at-plant liquid insecticide, and three neonicotinoid insecticidal seed treatments for springtail control in sugarbeet.

Materials & Methods:

This field experiment was established on the NDSU Experiment Farm near Prosper, ND. Plots were planted on 16 May, 2018 using a 6-row Monosem NG Plus 7x7 planter set to plant at a depth of 1¼ inch and a rate of one seed every 4½ inches of row length. Betaseed 89RR52, a glyphosate-tolerant seed variety, was used for all treatments. Individual treatment plots were two rows (22-inch spacing) wide and 25 feet long, and 20-ft wide tilled alleys were maintained between replicates throughout the growing season. The experiment was arranged in a randomized complete block design with four replications of the treatments. Two-row plots are the preferred experimental unit size in springtail trials because infestations of these pests are typically patchy in distribution. Therefore, a smaller test area increases the likelihood of having a sufficiently uniform springtail infestation among plots within each testing replicate.

Insecticidal seed treatment materials were applied to seed by Germain's Technology Group (Fargo, ND). Granular insecticide treatments were applied by using band placement (Boetel et al. 2006), which consisted of 5-inch swaths that were delivered through Gandy™ row banders. Output rates of the planting-time standard granular material used this experiment were regulated by using a planter-mounted SmartBox™ computer-controlled insecticide delivery system that was calibrated on the planter immediately before all applications. Mustang Maxx was applied as a dribble in-furrow (DIF) application through microtubes directed into the open seed furrow by using a planter-mounted, CO_2-propelled spray system calibrated to deliver a finished spray volume output of 5 GPA. Teejet® No. 20 orifice plates were installed inline within check valves to achieve the correct spray output volume. Poncho Beta seed insecticidal treatment was also combined with a planting-time application of Mustang Maxx to comprise a single entry in the trial.

Treatments were compared by using plant stand counts and yield parameters because subterranean springtails can cause stand reductions that can lead to yield loss. Stand counts involved counting all living plants within each 25-ft long row. Plant stand counts were taken on 5 and 28 June, and 5 July, which were 20, 43, and 50 days after planting (DAP), respectively. Raw stand counts were converted to plants per 100 linear row ft for the analysis. Harvest operations, which were conducted on 18 September, involved initially removing the foliage from all plots by using a commercial-grade mechanical defoliator immediately (i.e., between 10 and 60 minutes) beforehand. Plots were harvested by using a 2-row mechanical harvester to collect all beets from both rows of each plot. Representative subsamples of 12-18 randomly selected beets were sent to the American Crystal Sugarbeet

Quality Laboratory (East Grand Forks, MN) for quality analyses. All stand and yield data were subjected to analysis of variance (ANOVA) using the general linear models (GLM) procedure (SAS Institute, 2012), and treatment means were separated using Fisher's protected least significant difference (LSD) test at a 0.1 level of significance.

Results and Discussion:

Plant stand count data for this trial are presented in Table 1. Results from all stand count dates indicated that the higher rate (5.9 lb product/ac) of Counter 20G, all three insecticidal seed treatments, and the combination treatment consisting of Poncho Beta-treated seed plus Mustang Maxx, resulted in significantly greater numbers of surviving plants per 100 ft of row than the untreated check. There were no significant differences in plant stand protection among these treatments, irrespective of stand count date, throughout the growing season. The only treatments that did not provide significant levels of protection from springtail-associated stand losses were the lower (4.5 lb/ac) rate of Counter 20G and the Mustang Maxx treatment, and those deficiencies were consistent among stand count dates. However, it should be noted that there were no statistical differences in stand protection between the 5.9- and 4.5-lb application rates of Counter 20G at any of those dates.

Table 1. ***Plant stand counts*** **from evaluation of planting-time granular, liquid, and seed treatment insecticides for springtail control, Prosper, ND, 2018**

Treatment/form.	Placement[a]	Rate (product/ac)	Rate (lb a.i./ac)	Stand count[b] (plants / 100 ft)		
				20 DAP[c]	43 DAP[c]	50 DAP[c]
Nipslt Inside	Seed		60 g a.i./ unit seed	178.3 a	194.2 a	194.6 a
Poncho Beta	Seed		68 g a.i./ unit seed	176.7 a	173.8 ab	191.7 a
Cruiser 5FS	Seed		60 g a.i./ unit seed	172.1 a	174.2 abc	183.3 a
Counter 20G	B	5.9 lb	1.2	176.7 a	174.2 abc	182.9 a
Poncho Beta + Mustang Maxx	Seed DIF	 4 fl oz	68 g a.i./ unit seed 0.025	171.3 a	182.9 ab	182.5 a
Counter 20G	B	4.5 lb	0.9	152.5 ab	157.9 bcd	165.4 ab
Check	---	----	---	137.9 b	138.8 d	143.8 bc
Mustang Maxx	DIF	4 fl oz	0.025	127.5 b	142.5 cd	130.0 c
LSD (0.1)				31.07	32.55	30.58

Means within a column sharing a letter are not significantly (P = 0.1) different from each other (Fisher's Protected LSD test).
[a]B = 5-inch band; DIF = dribble in-furrow; Seed = insecticidal seed treatment
[b]Surviving plant stands were counted on 5 and 28 June, and on 5 July, 2018 (i.e., 20, 43, and 50 days after planting, respectively).
[c]DAP = Days after planting

Yield results from this experiment are presented in Table 2. The top-performing treatment, with regard to recoverable sucrose, root yield, and percent sucrose, was the combination involving Poncho Beta-treated seed plus Mustang Maxx applied via dribble-in-furrow placement. Other treatments in the study that produced recoverable sucrose and root yields that were not statistically different from this entry included the following: 1) Cruiser; 2) NipsIt Inside; 3) Poncho Beta; and 4) Mustang Maxx. As observed in stand count results, there were no significant differences between Counter 20G application rates for any of the measured yield parameters. Overall, the only entries in the experiment that resulted in significant increases in both recoverable sucrose yield and root tonnage were the combination treatment of Poncho Beta seed plus Mustang Maxx, Cruiser, and NipsIt Inside.

Table 2. ***Yield parameters*** **from evaluation of planting-time granular, liquid, and seed treatment insecticides for springtail control, Prosper, ND, 2018**

Treatment/form.	Placement[a]	Rate (product/ac)	Rate (lb a.i./ac)	Sucrose yield (lb/ac)	Root yield (T/ac)	Sucrose (%)	Gross return ($/ac)
Poncho Beta + Mustang Maxx	Seed DIF	 4 fl oz	68 g a.i./ unit seed 0.025	11,957 a	40.8 a	16.03 a	1,375
Cruiser 5FS	Seed		60 g a.i./ unit seed	11,340 ab	40.0 ab	15.70 a	1,236
Nipslt Inside	Seed		60 g a.i./ unit seed	11,025 ab	38.9 ab	15.78 a	1,202
Poncho Beta	Seed		68 g a.i./ unit seed	10,817 abc	38.0 ab	15.80 a	1,186
Mustang Maxx	DIF	4 fl oz	0.025	10,756 abc	38.1 ab	15.65 a	1,167
Counter 20G	B	5.9 lb	1.2	10,521 bc	36.6 bc	15.85 a	1,174
Counter 20G	B	4.5 lb	0.9	10,079 bc	36.1 bc	15.53 a	1,069
Check	---	----	---	9,680 c	33.3 c	15.90 a	1,102
LSD (0.1)				1,304.0	4.01	NS	

Means within a column sharing a letter are not significantly (P = 0.1) different from each other (Fisher's Protected LSD test).
[a]B = 5-inch band; DIF = dribble in-furrow; Seed = insecticidal seed treatment

Gross economic return results from this trial followed similar patterns to those for recoverable sucrose and root yields. The Mustang-alone treatment generated $1,167 in gross economic return, which was a revenue gain of $65/ac over that of the untreated check; however, combining Mustang with Poncho Beta-treated seed generated $1,375/ac in gross revenue, which was $273/ac more revenue than the untreated check and $189/ac more than that from plots protected solely by Poncho Beta-treated seed, and $208/ac more revenue than the Mustang-only plots.

Insecticidal seed treatments (i.e., Cruiser, NipsIt Inside, or Poncho Beta) produced revenue gains that ranged from $84 to $134/ac when compared to the untreated check plots. Plots treated with the 5.9-lb rate of Counter 20G generated $72/ac more gross revenue than the untreated check plots; however, there was no net gain in gross revenue from plots treated with the lower rate (4.5 lb product/ac) of Counter.

Collectively, the yield and gross revenue increases generated by insecticide treatments in this experiment clearly demonstrate that effective tools are available to producers for managing subterranean springtails in sugarbeet. These findings also illustrate the economic significance of subterranean springtails as sugarbeet pests and demonstrate the benefits that can be achieved by effectively managing them, even under moderate springtail infestations such as that which was present for this experiment.

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