SPRINGTAIL MANAGEMENT IN SUGARBEET USING GRANULAR, LIQUID, AND SEED TREATMENT INSECTICIDES

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Introduction:

Subterranean (soil-dwelling) springtails are tiny, almost microscopic pests that frequently cause damage to seedling sugarbeet roots in the central and southern Red River Valley growing area. These unusual pests belong to the order Collembola, a group of organisms that is considered non-insects by many experts. Springtails have been a somewhat frequent pest problem for many growers in western Minnesota and eastern North Dakota for over a decade. Producers in western ND and eastern Montana also frequently have problems with springtails. These tiny, nearly microscopic, blind, and wingless insects spend their entire lives below the soil surface (Boetel et al. 2001).

Subterranean springtails thrive in heavy soils with high levels of soil organic matter. Cool and wet weather can be conducive to buildups of springtail infestations because such conditions slow sugarbeet seed germination and seedling development, which renders plants extremely vulnerable to attack by springtails that are not negatively impacted by cool temperatures. Therefore, these pests can cause major stand and yield losses. This research was carried out to evaluate the performance of planting time granular and liquid insecticides, as well as insecticidal seed treatments, for control of subterranean springtails in sugarbeet.

Materials & Methods:

This experiment was planted on the NDSU Prosper Research Farm near Prosper, ND. Plots were planted on 28 May, 2010 with Betaseed 87RR38 (glyphosate-resistant) seed using a 6-row John Deere 71 Flex planter; however, individual treatment plots were 2-rows wide. Two-row plots are the preferred experimental unit size in field trials on springtail control because the infestations are typically patchy and not uniform. Thus, a smaller test area increases the likelihood of having a sufficiently uniform springtail infestation among plots within each block. Seeds were planted at a depth of 1¼ inches, and seed spacing was every 4½ inches. Each plot was 35 ft long, and 25-ft plant-free tilled alleys were maintained between replicates throughout the season. Experiments were arranged in a randomized complete block design with four replications.

All seed treatment insecticides were applied to seed at labeled rates by a third-party custom seed-coating company (Germains Seed Technology, Fargo, ND). Granular insecticide treatments were applied by using either band (B) or spoon (S) placement (Boetel et al. 2006). Banded applications consisted of 5-inch swaths delivered through Gandy™ row banders. The spoon device is a galvanized metal spoon-like apparatus with flanges on the outside edge to direct the granules in a miniature band over the row. A steel bolt (no. 10 size) is inserted at the center of the spoon near its tip with two metal hexagonal nuts attached to the bolt to deflect most insecticide granules laterally so they fall immediately outside of the seed furrow. Output rates of the granular materials used in these experiments were regulated by using planter-mounted Noble™ metering units. Liquid treatments were applied using a planter-mounted CO_2-propelled spray system calibrated to deliver a finished spray output volume of 5 GPA. Delivery of the liquid materials was achieved by either TeeJet 6501E nozzles or plastic microtubes directed into the seed furrow.

Treatment efficacy was assessed by conducting plant stand counts and collecting yield data because subterranean springtails cause stand losses that can lead to yield reductions. Stand counts involved counting all living plants within each 35-ft long row. Counts were taken on 21 July and converted to plants per 100 linear row ft. Yield data were collected by harvesting both rows of each plot on 22 September using a 2-row mechanical harvester. Subsamples of 12-18 harvested beets were sent to the American Crystal Sugarbeet Quality Laboratory (East Grand Forks, MN) for quality analyses. All stand count and yield data were subjected to analysis of variance (ANOVA) using the general linear models (GLM) procedure (SAS Institute, 2008), and treatment means were separated using Fisher's protected least significant difference (LSD) test at a 0.05 level of significance.

Results and Discussion:

Stand count data from this trial are presented in Table 1. Plant stand increases in insecticide-treated plots in this trial ranged from 3 to 56 additional plants per 100 row feet, indicating a wide spectrum of treatment performance and the existence of a somewhat high springtail infestation. Treatments that provided statistically significant improvements in surviving plant stands included the following: 1) Counter 20G banded at 4.5 lb product/ac; 2) Poncho Beta; 3) Counter 20G, spoon placement at 4.5 lb product/ac; 4) NipsIt Inside; 5) Cruiser 5FS; 6) Counter 20G banded at 7.5 lb/ac; and 7) Counter 20G, spoon placement at 7.5 lb/ac. The only insecticide treatments that failed to provide significant levels of plant stand protection were those that included Mustang Max, and performance according to stand counts was not affected by placement (i.e., pressured nozzle vs. microtube) or whether the spray solution included 10-34-0 starter fertilizer.

Table 1. *Plant stand counts* from evaluation of planting-time granules, liquids, and seed treatments for springtail control, Prosper, ND, 2010

Treatment/form.	Placement[a]	Rate (product/ac)	Rate (lb ai/ac)	Stand count (plants / 100 ft)
Counter 20G	B	4.5 lb	0.9	260 a
Poncho Beta	Seed		68 g a.i./ unit seed	246 ab
Counter 20G	S	4.5 lb	0.9	244 ab
NipsIt Inside	Seed		60 g a.i./ unit seed	244 ab
Cruiser 5FS	Seed		60 g a.i./ unit seed	242 abc
Counter 20G	B	7.5 lb	1.5	241 abc
Counter 20G	S	7.5 lb	1.5	240 abc
Mustang Max 0.8EC + 10-34-0 starter fertilizer	IF-nozzle	4 fl oz	0.025	227 bcd
Mustang Max 0.8EC	IF-microtube	4 fl oz	0.025	226 bcd
Mustang Max 0.8EC + 10-34-0 starter fertilizer	IF-microtube	4 fl oz	0.025	218 cd
Mustang Max 0.8EC	IF-nozzle	4 fl oz	0.025	207 d
Check	---	----	---	204 d
LSD (0.05)				24

Means within a column sharing a letter are not significantly (P = 0.05) different from each other (Fisher's Protected LSD).

[a]B = band; seed = insecticidal seed treatment; S = spoon; IF = direct in-furrow; IF-microtube

Results of yield analyses for this trial are presented in Table 2. Overall, the yield data corresponded well with stand count means. For example, the following insecticide entries provided significant increases in recoverable sucrose yield under the relatively high springtail pressure that developed in this trial site: 1) Cruiser 5FS; 2) Poncho Beta; 3) NipsIt Inside; 4) Counter 20G, spoon placement at 4.5 lb product/ac; 5); Counter 20G, spoon placement at 7.5 lb/ac; and 6) Counter 20G banded at 7.5 lb/ac.

Interestingly, the highest gross economic returns in this test came from using insecticidal seed treatments. Cruiser, Poncho Beta, and NipsIt Inside entries increased gross revenue by $174, $130, and $159 per acre, respectively, when compared to the untreated check plots. Increases in gross returns (compared to the untreated check), ranging from $24 to 101 per acre, were also recorded for the various Counter 20G entries.

No significant sucrose or root yield differences were detected between Counter 20G placement methods; however, when the insecticide was applied at the higher (7.5 lb product/ac) rate in this study, the gross economic return was $56 greater per acre by using the spoon method rather than banding to deliver the granules. Similarly, when Counter 20G was applied at the low (4.5 lb/ac) rate, delivery of the granules via spoon applicator tips resulted in $57/ac more revenue than when the same rate was applied by using banders. Also, the higher (7.5 lb) rate tended to provide slightly better yield benefits than the low (4.5 lb) rate, although application rate did not impart significant differences with regard to recoverable sucrose yield or sugarbeet root yield. Banded applications of Counter 20G were inferior to the top-yielding treatment (Cruiser) with regard to recoverable sucrose yield at both 4.5- and 7.5-lb application rates. This finding differs slightly from results of our previous experiments on springtail management using the older, 15G formulation of Counter, because banding that material at its lowest labeled rate (i.e., the same amount of active ingredient as 4.5 lb product/ac of Counter 20G) provided excellent control (Boetel et al. 2009).

Table 2. ***Yield parameters*** **in comparison of planting-time granules, liquids, and seed treatments for springtail control, Prosper, ND, 2010**

Treatment/form.	Placement[a]	Rate (product/ac)	Rate (lb a.i./ac)	Sucrose yield (lb/ac)	Root yield (T/ac)	Sucrose (%)	Gross return ($/ac)
Cruiser 5FS	Seed		60 g a.i./ unit seed	7231 a	27.0 a	15.03 a	923
Poncho Beta	Seed		68 g a.i./ unit seed	7016 ab	26.5 ab	14.88 a	879
NipsIt Inside	Seed		60 g a.i./ unit seed	7006 ab	25.9 a-d	15.10 a	908
Counter 20G	S	7.5 lb	1.5	6900 abc	26.4 ab	14.78 a	850
Counter 20G	S	4.5 lb	0.9	6795 a-d	26.1 abc	14.70 a	830
Counter 20G	B	7.5 lb	1.5	6550 b-e	25.3 a-e	14.65 a	794
Counter 20G	B	4.5 lb	0.9	6422 c-f	24.9 b-e	14.58 a	773
Mustang Max 0.8EC	IF-microtube	4 fl oz	0.025	6393 c-f	24.2 def	14.83 a	800
Mustang Max 0.8EC + 10-34-0 starter fertilizer	IF-nozzle	4 fl oz	0.025	6300 def	24.0 efg	14.83 a	781
Check	---	----	---	6268 def	24.4 c-f	14.53 a	749
Mustang Max 0.8EC + 10-34-0 starter fertilizer	IF-microtube	4 fl oz	0.025	6058 ef	23.1 fg	14.75 a	748
Mustang Max 0.8EC	IF-nozzle	4 fl oz	0.025	5924 f	22.3 g	14.83 a	748
LSD (0.05)				565	1.7	NS	

Means within a column sharing a letter are not significantly ($P = 0.05$) different from each other (Fisher's Protected LSD).
[a] B = band; Seed = insecticidal seed treatment; IF = direct in-furrow; IF-microtube

Similar to the results from stand count comparisons in this trial, none of the Mustang Max entries produced significant yield increases, irrespective of the placement method used or whether it was applied in combination with 10-34-0 starter fertilizer. However, it should be noted that, on average across four replicates in this experiment, applying Mustang Max (no starter fertilizer) in-furrow via the microtube application system resulted in a gross revenue increase of $51 per acre over that of the untreated check. Similarly, plots treated with Mustang Max+10-34-0 starter fertilizer using standard, pressurized nozzles resulted in $32 per acre more revenue than the check.

Overall, the results of this trial reinforce our previous findings on springtail management in sugarbeet. Good control of moderate to high springtail infestations can be achieved by using the currently labeled seed treatment insecticides, Cruiser 5FS, NipsIt Inside, and Poncho Beta. The new, 20G formulation of Counter also provides good control of these pests, and it was not outperformed by any of the seed treatments if it was applied using spoon placement, regardless of whether it was used at the low (4.5 lb product/ac) or moderate (7.5 lb product/ac) application rate. Counter 20G did not appear to perform as well when applied in a band as its precursor, Counter 15G; however, it should be noted that this is a report on only one year of testing with Counter 20G and that further screening should be carried out to more comprehensively test the relative performance of this material.

References Cited:

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