# SPRINGTAIL CONTROL IN SUGARBEET: A COMPARISON OF GRANULAR, SPRAYABLE LIQUID, AND SEED-APPLIED INSECTICIDES

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**Introduction:**

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. Subterranean (soil-dwelling) springtails have been recognized as a serious pest threat of sugarbeet for many growers in the central and southern Red River Valley (RRV) of Minnesota and North Dakota since the late-1990s. 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).

Although subterranean springtails are present in many fields throughout the RRV, they only occasionally become a major pest problem. 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. We conducted a field experiment to evaluate the performance of a conventional granular insecticide, an experimental at-plant liquid insecticide, and three insecticidal seed treatments for springtail control in sugarbeet.

**Materials & Methods:**

This experiment was established on the NDSU experiment farm near Prosper, ND. Plots were planted on 19 May, 2017 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. A smaller test area increases the likelihood of having a sufficiently uniform springtail infestation among plots within each block.

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. Manticor LFR was applied in 3-inch T-bands over 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 through TeeJet™ 400067E nozzles.

Treatment efficacy was compared by using plant stand counts and yield parameters because subterranean springtails cause stand losses that lead to yield reductions. Stand counts involved counting all living plants within each 25-ft long row. Plant stand counts were taken on June 1, 15 and 29, as well as 7 July, which were 13, 27, 41, and 49 days after planting (DAP), respectively. Raw stand counts were converted to plants per 100 linear row ft for the analysis. Plots were harvested on 18 September by using a 2-row mechanical harvester to collect all beets from both rows of each plot. 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:**

Plant stand count data for this trial are presented in Table 1. At the initial stand count date (13 DAP), the insecticide-protected plots had numerically greater numbers of surviving plants per 100 ft of row, but there were no significant differences among treatments, including the untreated check. However, at 27 DAP, all insecticide treatments except Cruiser 5FS resulted in significantly greater plant stands than the untreated check. The following treatments had significantly greater plant stands than both Cruiser and the check at 27 DAP: 1) Poncho Beta; 2) Counter 20G at 4.5 lb product/ac; and 3) Manitcor LFR applied at 19 fl oz/ac.

Stand count comparisons for both 41 and 49 DAP generated the same results in that all insecticide treatments provided significant levels of protection from stand loss associated with springtail feeding injury when compared to the untreated check, irrespective of whether a granular, sprayable liquid, or seed treatment insecticide was used. Additionally, there were no significant differences among insecticide treatments at either 41 or 49 DAP.

**Table 1.** ***Plant stand counts*** **from evaluation of planting-time granular, liquid, and seed treatment insecticides for springtail control, Prosper, ND, 2017**

| Treatment/form. | Placement[a] | Rate (product/ac) | Rate (lb ai/ac) | Stand count[b] (plants / 100 ft) | | | |
|---|---|---|---|---|---|---|---|
| | | | | 13 DAP[c] | 27 DAP[c] | 41 DAP[c] | 49 DAP[c] |
| Poncho Beta | Seed | | 68 g a.i./ unit seed | 166 a | 176 a | 198 a | 203 a |
| Counter 20G | B | 4.5 lb | 0.9 | 159 a | 171 a | 191 a | 183 a |
| Counter 20G | B | 5.9 lb | 1.2 | 158 a | 169 ab | 184 a | 190 a |
| Manticor LFR (bifenthrin + pyraclostrobin) | 3” T-band | 19 fl oz | 0.2 lb bifenthrin + 0.1 lb pyraclostrobin | 141 a | 172 a | 196 a | 199 a |
| Cruiser 5FS | Seed | | 60 g a.i./ unit seed | 122 a | 129 bc | 172 ab | 169 ab |
| Check | --- | ---- | --- | 117 a | 127 c | 150 b | 148 b |
| LSD (0.05) | | | | NS | 39.7 | 30.7 | 34.6 |

Means within a column sharing a letter are not significantly ($P = 0.05$) different from each other (Fisher’s Protected LSD test).
[a]B = banded at planting; T-band = 3” swath over open seed furrow at planting; Seed = insecticidal seed treatment
[b]Surviving plant stands were counted on June 1, 15, and 29, and on July 7, 2017 (i.e., 13, 27, 41, and 49 days after planting, respectively).
[c]DAP = Days after planting

Yield results from this experiment are presented in Table 2. General treatment performance patterns were similar to those observed in stand count results. Both rates of Counter 20G, as well as Poncho Beta seed treatment, resulted in significantly greater recoverable sucrose yield than the untreated check, and there were no significant differences among these three treatments with regard to recoverable sucrose. Cruiser 5FS seed treatment and Manticor LFR were the only treatments that did not provide a significant increase in recoverable sucrose yield when compared to the untreated check. However, there were no significant differences in recoverable sucrose yield or root yield between Poncho Beta and Cruiser. Plots protected with the moderate rate of Counter 20G (5.9 lb product/ac) generated the highest tonnage in the trial, but that treatment was not significantly superior to the lower rate of 4.5 lb/ac. Additionally, both Counter 20G treatments were the only entries in this experiment that resulted in significant increases in root yield when compared to the untreated check.

**Table 2.** ***Yield parameters*** **from evaluation of planting-time granular, liquid, and seed treatment insecticides for springtail control, Prosper, ND, 2017**

| Treatment/form. | Placement[a] | Rate (product/ac) | Rate (lb a.i./ac) | Sucrose yield (lb/ac) | Root yield (T/ac) | Sucrose (%) | Gross return ($/ac) |
|---|---|---|---|---|---|---|---|
| Counter 20G | B | 5.9 lb | 1.2 | 11,139 a | 34.9 a | 17.65 a | 1,377 |
| Counter 20G | B | 4.5 lb | 0.9 | 9,927 ab | 31.9 ab | 17.18 a | 1,192 |
| Poncho Beta | Seed | | 68 g a.i./ unit seed | 9,725 abc | 28.1 bc | 18.55 a | 1,321 |
| Manticor LFR (bifenthrin + pyraclostrobin) | 3” T-band | 19 fl oz | 0.2 lb bifenthrin + 0.1 lb pyraclostrobin | 8,979 bcd | 26.6 bc | 18.28 a | 1,189 |
| Cruiser 5FS | Seed | | 60 g a.i./ unit seed | 8,278 cd | 23.8 c | 18.68 a | 1,130 |
| Check | --- | ---- | --- | 8,266 d | 23.9 c | 18.63 a | 1,122 |
| LSD (0.05) | | | | 1,452.8 | 6.65 | NS | |

Means within a column sharing a letter are not significantly ($P = 0.05$) different from each other (Fisher’s Protected LSD test).
[a]B = banded at planting; T-band = 3” swath over open seed furrow at planting; Seed = insecticidal seed treatment

Gross economic return results followed similar patterns to those for recoverable sucrose and root yields; however, percent sucrose influenced these patterns. Plots treated with the moderate rate of Counter 20G (5.9 lb product/ac) generated $1,377/ac in gross revenue, which was $185/ac greater than that from plots treated with the low (4.5 lb) rate of Counter. Similarly, plots treated with the 5.9-lb rate of Counter generated $56/ac more gross revenue than Poncho Beta plots, and $247/ac more revenue than plots planted with Cruiser-treated seed. An additional positive finding from this trial was that plots protected with the experimental material, Manticor LFR, generated an average revenue increase of $67/ac when compared to the untreated check plots. The increases in yield and revenue generated by insecticide treatments tested in this experiment show that effective tools are available for managing subterranean springtails in sugarbeet. These findings also demonstrate the significance of subterranean springtails as serious economic pests of sugarbeet and demonstrate the importance of effectively managing them.

**References Cited:**

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