WHITE GRUB CONTROL IN SUGARBEET USING GRANULAR, LIQUID, AND SEED TREATMENT INSECTICIDES

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Introduction:

White grub larvae are sporadic pests of sugarbeet in the Red River Valley (RRV) growing area. Although a few different species can infest and cause injury to the crop, *Phyllophaga implicita* is the species that has been most often documented as damaging sugarbeet in the RRV. The sporadic nature of white grub infestations in RRV sugarbeet fields has made it very difficult to conduct research on their control in the region. This is also the case in many other growing areas in North America. As a result, little is known regarding the relative efficacy of various insecticidal materials for controlling white grub larvae. This research was carried out to compare the performance of planting-time granular, liquid, and seed treatment insecticides at controlling natural field infestations of white grub larvae in sugarbeet.

Materials and Methods:

This experiment was planted on 21 May at a field site near Fairmount (Richland County), ND. All seed treatment insecticides were applied to seed by a third-party custom seed-coating company (Germains Seed Technology, Fargo, ND). The same seed variety (Betaseed 87RR38; glyphosate-resistant) and seed lot were used for all treatments (i.e., seed treatments, conventional insecticide entries, and the untreated check) in the experiment. Plots were planted using a six-row John Deere 71 Flex planter adjusted to plant at a depth of 1¼ inch and a rate of one seed every 4½ inches of row. Individual treatment plots were two rows (22-inch spacing) wide and 35 ft long, and 25-ft plant-free tilled alleys were maintained between replicates. The experiment was arranged in a randomized complete block design with four replications of the treatments.

To avoid cross-contamination of seed between treatment applications, planter seed hoppers were completely disassembled, cleaned, and re-assembled after the application of each seed treatment. Counter 20G was used as the planting-time granular insecticide standard in the experiment, and it was applied at 4.5 and 7.5 lb product/ac using either band or spoon placement. Also included, was Mustang Max, which was applied at its high labeled rate of 4 oz/ac with and without 10-34-0 starter fertilizer. Planting-time liquid applications were carried out using a CO_2 spray system mounted on the planter. Mustang-based treatments were all applied directly into the seed furrow by using either a microtube application system or a pressurized nozzle system, and the latter was achieved by using TeeJet 6501E nozzles calibrated to deliver 5 gallons of finished spray system per acre. Insecticidal seed treatments in the experiment included Poncho Beta, Cruiser 5FS and Nipsit Inside.

Efficacy of the treatments in this experiment was assessed by conducting counts of surviving plants. Treatment performance was also compared on the basis of sugarbeet yield parameters. This trial was harvested on 30 September, 2010. Foliage was removed from plots immediately before harvest by using a commercial-grade mechanical defoliator. All beets from the 4 center rows of each plot were lifted using a mechanical harvester, and weighed in the field using a digital scale. A representative subsample of 12-18 beets was collected from each plot and sent to the American Crystal Sugar Company Quality Tare Laboratory (East Grand Forks, MN) for sucrose content and quality analysis.

Data analysis: All data from root injury ratings and harvest samples 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:

The results from this trial should be interpreted with discretion because the white grub larval infestation that developed at this site was rather low. In fact, the heightened level of June beetle (white grub adult stage) activity observed in the field during our planting operations suggested that their progeny (white grub larvae) may be more significant during the 2011 growing season.

Stand count means from this trial ranged from 150 to 180 surviving plants/100 ft in this experiment; however, there were no significant differences between treatments in this experiment (Table 1). This probably was, in part, due to the somewhat light white grub larval infestation that developed in the plot area. Another factor could have been the date at which these counts were made. Despite the lack of statistical differences, some interesting trends were apparent in the stand count comparisons. For example, most plots treated with entries that included Mustang Max had some of the highest stand counts in this trial. Another pattern evident in the stand count data from this trial was that banded applications of Counter 20G tended to result in higher stands (12 to 14 more plants/100 ft) than spoon applications of this material, regardless of the Counter application rate. This could have been associated with increased plant safety from using band rather than spoon placement to apply Counter 20G; however, it is possible that the slightly higher plant stands in band-treated plots also could have resulted from better grub control. Band placement of Counter granules results in a wider swath (i.e., zone of insecticide toxicant) than spoon, thus, the killing zone surrounding individual plants within rows would have been larger. Also, banded applications of granular insecticides for control of soil insects typically perform well during wet years, and multiple rainfall events occurred at this site during the 2010 growing season.

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

Treatment/form.	Placement[a]	Rate (product/ac)	Rate (lb ai/ac)	Stand count (plants / 100 ft)
Mustang Max 0.8EC	IF-microtube	4 fl oz	0.025	180 a
Counter 20G	B	4.5 lb	0.9	172 a
Mustang Max 0.8EC	IF-nozzle	4 fl oz	0.025	170 a
Mustang Max 0.8EC + 10-34-0 starter fertilizer	IF-microtube	4 fl oz	0.025	164 a
Counter 20G	B	7.5 lb	1.5	164 a
Cruiser 5FS	Seed		60 g a.i./ unit seed	163 a
Check	---	----	---	162 a
Counter 20G	S	4.5 lb	0.9	160 a
Poncho Beta	Seed		68 g a.i./ unit seed	158 a
Mustang Max 0.8EC + 10-34-0 starter fertilizer	IF-nozzle	4 fl oz	0.025	154 a
NipsIt Inside	Seed		60 g a.i./ unit seed	154 a
Counter 20G	S	7.5 lb	1.5	150 a
LSD (0.05)				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; S = spoon; IF = direct in-furrow

Analyses of harvest data indicated that there were only a few significant impacts of the treatments in this trial with respect to yield parameters. However, the study produced encouraging results regarding white grub control in sugarbeet. The highest recoverable sucrose yield and root tonnage in this experiment were produced by plots protected with Mustang Max when the insecticide was applied in a solution that included 10-34-0 starter fertilizer (Table 2). This mixture appeared to be most effective at managing white grubs and enhancing yields when it was applied by using the microtube application system, although it was not significantly better than when the mixture was applied using conventional spray nozzles. One major factor influencing the yield enhancement provided by these treatments was the fertility increase as a result of the starter fertilizer.

Poncho Beta insecticidal seed treatment also resulted in a significant increase in recoverable sucrose yield over that of the untreated check. Plots protected by NipsIt Inside seed treatment produced a significantly higher root tonnage yield than the check, but the recoverable sucrose yield in plots protected by NipsIt Inside was not statistically greater than that in the untreated checks, which was apparently related to a slight reduction in percent sucrose content in NipsIt Inside-treated beets. Plots treated with Counter 20G also had numerical increases in recoverable sucrose and root yields when compared with the untreated check plots, although the increases were not statistically significant.

Table 2. *Yield parameters* in comparison of planting-time granules, liquids, and seed treatments for white grub control, Fairmount, 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)
Mustang Max 0.8EC + 10-34-0 starter fertilizer	IF-microtube	4 fl oz	0.025	9548 a	30.0 a	17.25 a	1503
Mustang Max 0.8EC + 10-34-0 starter fertilizer	IF-nozzle	4 fl oz	0.025	8595 ab	27.0 abc	17.23 a	1350
Poncho Beta	Seed		68 g a.i./ unit seed	8473 bc	27.0 abc	17.03 a	1311
NipsIt Inside	Seed		60 g a.i./ unit seed	8172 bcd	27.9 ab	16.30 a	1175
Cruiser 5FS	Seed		60 g a.i./ unit seed	8153 bcd	25.1 bc	17.55 a	1310
Mustang Max 0.8EC	IF-microtube	4 fl oz	0.025	7998 bcd	24.8 bc	17.43 a	1275
Counter 20G	B	7.5 lb	1.5	7887 bcd	24.9 bc	17.23 a	1233
Counter 20G	S	4.5 lb	0.9	7797 bcd	24.7 bc	17.20 a	1217
Mustang Max 0.8EC	IF-nozzle	4 fl oz	0.025	7638 bcd	25.2 bc	16.68 a	1142
Counter 20G	S	7.5 lb	1.5	7525 cd	23.3 c	17.48 a	1202
Counter 20G	B	4.5 lb	0.9	7378 d	23.0 c	17.28 a	1168
Check	---	----	---	7317 d	23.5 c	17.00 a	1124
LSD (0.05)				1027	4.1	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 = seed treatment; S = spoon; IF = direct in-furrow

One interesting trend in this experiment was that Counter 20G appeared to provide slightly better grub control when applied in a band at the higher rate of 7.5 lb product/ac. The average recoverable sucrose yield dropped by over 500 lb/ac when Counter was applied at a lower (4.5 lb product/ac) rate using the same (band) placement. However, when spoon placement was used to apply Counter 20G in this study, plots treated at the higher (7.5 lb) rate averaged 272 lb/ac less recoverable sucrose yield than those treated at the low (4.5 lb) rate, although the difference was not significant. These patterns also could have been influenced by the exceptionally rainy patterns that persisted for much of the 2010 growing season. During rainy growing seasons, granular formulations like Counter 20G typically perform better against soil-dwelling insects if applied using band placement because rainfall activates the insecticide from its carrier and moves the active ingredient downward through the soil profile to create a swath of protection. Conversely, the use of spoon or modified in-furrow placement sometimes results in diminished control during wet years, because rain water moving down the soil profile can move the material out of the target zone for protecting roots from insect feeding. Placing granules in closer proximity to the seed (such as that resulting from spoon or modified in-furrow placement) can also result in varying levels of plant toxicity and associated yield losses. These impacts are usually minimal, and will be most noticeable under low to nonexistent insect pest damage.

Reference Cited:

SAS Institute. 2008. The SAS System for Windows. Version 9.2. SAS Institute Inc., 2002-2008. Cary, NC.