REPLANTED SUGARBEET: IS AN ADDITIONAL INSECTICIDE NEEDED TO PREVENT ROOT MAGGOT FEEDING INJURY & YIELD LOSS?

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Introduction:

Frost damage or wind damage to sugarbeet seedlings can cause significant reductions in plant stands and thus, necessitate the replanting of a sugarbeet field. Replanting is an expensive endeavor because of the costs of seed, fuel, wear-and-tear on equipment, and labor time. Additional costs are often incurred in the form of yield losses because later-emerging replanted fields tend to produce less raw yield and have reduced sucrose concentrations than those planted earlier. Replanted sugarbeet plants will also have smaller tap roots and be significantly more vulnerable to attack by sugarbeet root maggot (SBRM), *Tetanops myopaeformis* (Röder) larvae. This experiment was carried out to answer the following questions:

1) Do replanted sugarbeet fields need additional insecticide protection to prevent economic losses caused by the sugarbeet root maggot?
2) If so, will a second planting-time insecticide achieve acceptable control?
3) If an insecticide was <u>not</u> applied at replanting, will a postemergence rescue treatment provide
adequate control?

Materials and Methods:

This experiment was established on May 5, 2006 near St. Thomas, ND. The experiment was arranged in a randomized block design with four replications of the treatments. Each plot was 35 feet long, and 25-foot tilled alleys were maintained between replicates throughout the growing season. To simulate a replanting situation for all plots in this experiment, no seed was applied when the plots were initially established. Plots that received a planting-time insecticide were established in the same manner they would have been if actually planting except no seed was being dispensed at the time. Planting-time insecticides used were Counter 15G and Lorsban 15G, and each was applied at its high label rate (11.9 and 13.4 lb product/ac, respectively) during the simulated early planting operation. Counter was applied modified using in-furrow (M) and spoon (S) placement, and Lorsban 15G was applied in a band (B). Modified in-furrow placement involved dropping granules down a tube over the row but directing them back away from the seed drop zone and in front of the rear press wheel. This allowed some soil to cover the seed before granules entered the furrow so as to avoid direct insecticide/seed contact. Banded applications consisted of 5-inch swaths of granules that were achieved by using Gandy™ row banders. The spoon 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) was 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 to fall immediately outside of the seed furrow.

The actual planting of seed (Van der Have 46519) for this study was done on May 24 to reflect a typical date for replanting in the Red River Valley. Plots receiving Counter 15G at replanting were treated at the moderate (10 lb product/acre) labeled rate for sugarbeet. Planting-time applications of Lorsban 15G were also made at the 10 lb rate. Counter was applied as a band at replanting to plots that had been initially treated with Lorsban 15G. Plots initially established with Counter 15G at simulated first planting were treated with Lorsban granules at replanting using either band or spoon placement. This alternation from one product to the other between simulated initial planting and replanting was done to comply with label requirements because each of these products are restricted to one application per year for a given field. The use of postemergence liquid insecticides was also tested as a possible option for protecting replanted fields. Postemergence Lorsban 4E was applied in 7-inch bands over the row to plots on June 12 using a toolbar-mounted CO_2 spray system delivering 10 GPA through TeeJet 6501E nozzles.

Root maggot feeding injury was assessed in this experiment on August 2 by randomly collecting ten beet roots per plot (five from each of the outer two treated rows), hand-washing them, and scoring them in accordance with the 0 to 9 root injury rating scale (0 = no scarring, and 9 = over ¾ of the root surface blackened by scarring or dead beet) of Campbell et al. (2000).

Insecticide efficacy was also compared on the basis of sugarbeet yield parameters. Plots were harvested on September 19. Foliage was removed from all plots immediately before harvest by using a commercial-grade mechanical defoliator. On the same day, all beets from the center 2 rows of each plot were lifted using a mechanical harvester, and weighed in the field using a digital scale. A representative subsample of 12-16 beets was collected from each plot and sent to the American Crystal Sugar Company Tare Laboratory (East Grand Forks, MN) for analysis of sugar content and quality. All data from damage rating and harvest samples were subjected to analysis of variance (ANOVA) using the general linear models (GLM) procedure (SAS Institute, 1999), and treatment means were separated using Fisher's protected least significant difference (LSD) test at a 0.05 level of significance.

Results and Discussion:

Root injury rating data are presented in Table 1. A high infestation of sugarbeet root maggot larvae developed in these plots. This was demonstrated by the high (7.18) average root injury ratings recorded for the untreated check plots in this experiment. Despite the high feeding pressure in the study, all insecticide treatments provided significant reductions in root maggot feeding injury when compared with the untreated plots. Applying a second insecticide at replanting resulted in improved root maggot control in most instances. For example, plots initially established with an at-plant application of Lorsban 15G and re-treated with Counter 15G at replant had an average root maggot feeding injury rating of 1.65, whereas root feeding injury in at-plant Lorsban-only plots averaged 2.78. Similarly, plots that received Counter 15G as the initial at-plant treatment and Lorsban 15G at replanting also had significantly lower root maggot feeding injury than those that were not re-treated at replanting. One interesting result was that using the moderate (10 lb product/ac) rate of Counter at initial planting was not superior to the high (11.9 lb) rate in these scenarios.

Table 1. *Sugarbeet root maggot feeding injury* in replanted sugarbeet, St. Thomas, ND, 2006				
Treatment/form.	**Placement[a]**	**Rate (product/ac)**	**Rate (lb ai/ac)**	**Root injury (0-9)**
Lorsban 15G + Counter 15G at replant	B B	13.4 lb 10 lb	2.0 1.5	1.65 g
Counter 15G + Lorsban 15G at replant	S S	11. 9 lb 10 lb	1.8 1.5	1.83 fg
Counter 15G + Lorsban 15G at replant	M B	11.9 lb 10 lb	1.8 1.5	2.10 efg
Counter 15G + Lorsban 15G at replant	S S	10 lb 10 lb	1.5 1.5	2.45 def
Lorsban 15G ---	B ---	13.4 lb ---	2.0 ---	2.78 cde
Counter 15G + --- Lorsban 4E Post	M --- 7” Post B	11.9 lb --- 1.0 pt	1.8 --- 0.5	2.80 cd
Counter 15G ---	M ---	11.9 lb ---	1.8 ---	3.28 bc
Lorsban 15G + --- Lorsban 4E Post	B --- 7” Post B	13.4 lb --- 1.0 pt	2.0 --- 0.5	3.38 bc
Counter 15G ---	S ---	11.9 lb ---	1.8 ---	3.55 b
Check	---	---	---	7.18 a
LSD (0.05)				0.68

Means within a column sharing a letter are not significantly (P = 0.05) different from each other (Fisher’s Protected LSD).
[a]B = Band; S = Spoon; M = Modified in-furrow

Yield results corresponded closely with the root maggot damage rating data. All chemical insecticide treatments resulted in significant increases in root and recoverable sucrose yield when compared to the untreated check (Table 2). The top-yielding treatment combination consisted of Counter 15G, applied at initial (simulated) planting at 11.9 lb product/ac via modified in-furrow placement, plus a replant application of Lorsban 15G that was banded at 10 lb. Adding the replant application of Lorsban in this treatment resulted in numerically more recoverable sucrose and root tonnage, and the gross economic return benefit was $62/ac; however, the yield improvements were not statistically significant. Similar numerical increases in recoverable sucrose yields and root yields were observed with other treatments that included a planting-time application at replanting, although statistical differences were again not detectable.

There also was generally no significant yield benefit from applying Lorsban 4E to replanted beets in this study.

Table 2. *Yield impacts* from sugarbeet root maggot feeding injury in replanted sugarbeet, St. Thomas, ND, 2006							
Treatment/form.	**Placement[a]**	**Rate (product/ ac)**	**Rate (lb ai/ac)**	**Re-coverable sucrose (lb/ac)**	**Root yield (T/ac)**	**Sucrose (%)**	**Gross return ($/ac)**
Counter 15G + Lorsban 15G at replant	M B	11.9 lb 10 lb	1.8 1.5	7780 a	29.4 a	14.93 a	732
Counter 15G + Lorsban 15G at replant	S S	10 lb 10 lb	1.5 1.5	7769 a	29.8 a	14.73 a	714
Counter 15G + Lorsban 15G at replant	S S	11. 9lb 10 lb	1.8 1.5	7733 a	29.1 ab	14.98 a	732
Lorsban 15G + Counter 15G at replant	B B	13.4 lb 10 lb	2.0 1.5	7520 ab	28.3 abc	14.93 a	710
Counter 15G ---	M ---	11.9 lb ---	1.8 ---	7440 ab	28.8 ab	14.63 a	670
Counter 15G + --- Lorsban 4E Post	M --- 7” Post B	11.9 lb --- 1.0 pt	1.8 --- 0.5	7125 ab	26.8 abc	14.95 a	676
Counter 15G ---	S ---	11.9 lb ---	1.8 ---	6956 ab	26.0 abc	15.05 a	665
Lorsban 15G ---	B ---	13.4 lb ---	2.0 ---	6771 ab	25.1 bc	15.10 a	656
Lorsban 15G + --- Lorsban 4E Post	B --- 7” Post B	13.4 lb --- 1.0 pt	2.0 --- 0.5	6525 b	24.4 c	15.00 a	625
Check	---	---	---	4190 c	16.2 d	14.58 a	381
LSD (0.05)				1201	4.2	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; S = Spoon; M = Modified in-furrow

Yield benefits from replant and postemergence insecticide applications in this trial followed similar trends to those observed in previous years; however, the differences were not as noteworthy. This was probably the result of the early and short-lived period of root maggot fly activity that occurred in 2006 and the relative lack of rainfall after both replanting and postemergence Lorsban applications. Peak fly activity developed before the Lorsban 4E applications could be made. Therefore, because only low numbers of adult root maggot flies were present during applications, reduced levels of fly mortality probably occurred as a result of these postemergence treatments. Also, the infrequent and low rainfall amounts during June may have been insufficient to result in adequate incorporation of insecticides into the target zone (upper one inch of soil adjacent to the row). Another factor that may have added variability to the results of this trial was the presence of a significant wireworm infestation, which postemergence applications of Lorsban 4E could not have controlled. The experiment is planned to be repeated in the future.

References Cited:

Campbell, L. G., J. D. Eide, L. J. Smith, and G. A. Smith. 2000. Control of the sugarbeet root maggot with the fungus *Metarhizium anisopliae*. J. Sugar Beet Res. 37: 57–69.

SAS Institute. 1999. SAS/STAT user's guide for personal computers, version 8.0. SAS Institute, Inc., Cary, NC.