ECONOMIC BENEFITS OF ADDITIVE INSECTICIDE APPLICATIONS FOR ROOT MAGGOT CONTROL IN REPLANTED SUGARBEET

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Introduction:

Occasionally, early season plant stand losses can occur as a result of frost injury, wind damage, or insect feeding. Sugarbeet replanting can be a very expensive operation due to the costs of seed, fuel, wear-and-tear on equipment, and labor time. Yield losses can also be incurred as a result of sugarbeet replanting because later-emerging replanted fields tend to produce less root yield and reduced sucrose concentrations than earlier-planted fields. Later-planted sugarbeets will also have smaller tap roots, thus rendering them more susceptible to injury caused by sugarbeet root maggot (SBRM), *Tetanops myopaeformis* (Röder) larvae. This experiment was carried out to address 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 during the second planting operation, will a postemergence rescue treatment provide adequate control?

Materials and Methods:

This study was established on 16 May, 2008 near St. Thomas, ND. It was arranged in a randomized block design with four replications. Each plot was 35 feet long, and 25-foot tilled alleys were maintained between replicates throughout the growing season. To allow for simulation of a replanting situation for all plots in this experiment, seed was excluded 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. To ensure that all plots were treated in the same manner, the empty planter was also run through the untreated control plots during the simulated first planting. Planting-time insecticides in the experiment were Counter 15G and Lorsban 15G, the two most common planting-time granular materials used for sugarbeet root maggot control in the Red River Valley (Carlson et al. 2008). Counter and Lorsban granules were applied at their high labeled rates (11.9 and 13.4 lb product/ac, respectively) during the simulated first planting operation. Counter was applied via modified in-furrow (M) and spoon (S) placement (Boetel et al. 2006), and Lorsban 15G was applied in a band (B). Modified in-furrow placement involved dropping granules down a tube over the row but directing output back away from the seed drop zone and in front of the rear press wheel. This allowed some soil to cover 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 insecticide granules laterally to fall immediately outside the seed furrow.

To reflect a typical replanting date in the Red River Valley, the actual planting of seed (Van der Have 46519) for this study was done on 2 June. Plots receiving Counter 15G or Lorsban 15G at replanting were treated at the moderate (10 lb product/acre) labeled rate for sugarbeet. Counter was applied in 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 is 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 20 June using a toolbar-mounted CO_2 spray system delivering a finished spray volume of 10 GPA through TeeJet 8001EVS nozzles.

Root maggot feeding injury was assessed in this experiment on 6 and 7 August 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 16 September. 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 12-18 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 root injury ratings 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 from this experiment are presented in Table 1. The root maggot infestation that developed in this study was relatively light, which was demonstrated by the low level of feeding injury (i.e., 3.53 on the 0 to 9 scale) recorded for the untreated check plots. The single at-plant application of Lorsban 15G at the simulated initial planting was the only insecticide treatment in the study that did not result in a significant reduction in root maggot feeding injury when compared with the untreated plots. In plots initially established with Lorsban 15G at its high (13.4 lb product/ac) labeled rate, an additive replant application of Counter 15G at 10 lb product/ac resulted in a significant reduction in root maggot feeding injury. Similarly, when Counter 15G (spoon placement) was used as the initial insecticide, a replant application of Lorsban 15G (10 lb product/ac) led to a reduction in root maggot injury. Additive applications of postemergence Lorsban 4E were not as effective as granular materials in this trial. This could have occurred as a result of asynchrony between sugarbeet root maggot fly activity and timing of the Lorsban sprays.

Table 1. *Larval feeding injury* in evaluation of insecticides for sugarbeet root maggot control in replanted sugarbeet, St. Thomas, ND, 2008

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	0.93 f
Counter 15G + Lorsban 15G at replant	S S	11. 9 lb 10 lb	1.8 1.5	1.00 ef
Counter 15G ---	M ---	11.9 lb ---	1.8 ---	1.20 def
Counter 15G + Lorsban 15G at replant	M B	11.9 lb 10 lb	1.8 1.5	1.30 c-f
Counter 15G + --- Lorsban 4E Post	M --- 4 d pre-peak 7" Post B	11.9 lb --- 1.0 pt	1.8 --- 0.5	1.50 c-f
Counter 15G + Lorsban 15G at replant	S S	10 lb 10 lb	1.5 1.5	1.90 cde
Counter 15G ---	S ---	11.9 lb ---	1.8 ---	2.07 bcd
Lorsban 15G + --- Lorsban 4E Post	B --- 4 d pre-peak 7" Post B	13.4 lb --- 1.0 pt	2.0 --- 0.5	2.20 bc
Lorsban 15G ---	B ---	13.4 lb ---	2.0 ---	2.83 ab
Check	---	---	---	3.53 a
LSD (0.05)				0.93

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

Yield, percent sucrose, and gross economic return data from this trial are presented in Table 2. Plots treated with Lorsban 15G as the initial at-plant insecticide and treated again with a replant application of Counter 15G (10 lb product/ac) produced significantly greater recoverable sucrose yields and root yield than those that did not receive a second insecticide. Similarly, plots initially established with an at-plant application of spoon-applied Counter 15G that also received an application of Lorsban 15G at replanting yielded significantly more recoverable sucrose yield and root tonnage than those that only received the initial planting-time application of Counter. Gross economic return benefits from additive replant applications of granular insecticides in this trial ranged from $27 to $62 per acre. Although the economic return benefits in this trial were much lower than those observed in previous years, the increases easily justify the cost of the additive insecticide material. It should also be pointed out that there would be no additive application costs associated with replant applications of granular insecticides because they are applied with planter-mounted delivery equipment as the area is being replanted.

Table 2. *Yield parameters* in evaluation of insecticides for sugarbeet root maggot control in replanted sugarbeet sugarbeet, St. Thomas, ND, 2008

Treatment/form.	Placement[a]	Rate (product/ac)	Rate (lb ai/ac)	Sucrose yield (lb/ac)	Root yield (T/ac)	Sucrose (%)	Gross return ($/ac)
Counter 15G + Lorsban 15G at replant	S S	11. 9 lb 10 lb	1.8 1.5	4803 a	18.8 ab	14.20 a	492
Counter 15G + Lorsban 15G at replant	M B	11.9 lb 10 lb	1.8 1.5	4756 ab	18.7 abc	14.25 a	486
Lorsban 15G **+** Counter 15G at replant	B B	13.4 lb 10 lb	2.0 1.5	4730 ab	19.1 a	13.85a	463
Counter 15G + --- Lorsban 4E Post	M --- 4 d pre-peak 7” Post B	11.9 lb --- 1.0 pt	1.8 --- 0.5	4461 abc	17.5 a-d	14.15 a	455
Counter 15G ---	S ---	11.9 lb ---	1.8 ---	4362 a-d	16.6 c-f	14.50 a	465
Counter 15G + Lorsban 15G at replant	S S	10 lb 10 lb	1.5 1.5	4278 b-e	16.8 b-e	14.25 a	438
Counter 15G ---	M ---	11.9 lb ---	1.8 ---	4203 cde	15.9 d-g	14.68 a	451
Lorsban 15G + --- Lorsban 4E Post	B --- 4 d pre-peak 7” Post B	13.4 lb --- 1.0 pt	2.0 --- 0.5	3871 def	14.9 efg	14.30 a	407
Lorsban 15G ---	B ---	13.4 lb ---	2.0 ---	3796 ef	14.5 fg	14.48 a	401
Check	---	---	---	3498 f	13.9 g	14.00 a	353
LSD (0.05)				522	2.1	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; M = modified in-furrow; S = spoon

The findings of this study and those from previous years suggest that replanted sugarbeet fields in areas of high risk for root maggot attack be either treated prophylactically with a second planting-time material or a postemergence insecticide if fly populations warrant the application.

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