SINGLE AND SPLIT APPLICATIONS OF POSTEMERGENCE LIQUID INSECTICIDES FOR SUGARBEET ROOT MAGGOT CONTROL

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Introduction:

Sugarbeet producers in many areas of the Red River Valley are annually plagued with moderate to severe infestations of the sugarbeet root maggot, (SBRM) *Tetanops myopaeformis* (Röder). Typically, the successful management of these infestations requires a control regime that employs a planting-time insecticide application (e.g., granular or seed treatment), combined with at least one application a postemergence rescue insecticide. Postemergence options currently available to producers for SBRM control include both granular and liquid insecticide products. This experiment was carried out to achieve the following objectives with regard to sugarbeet root maggot control: 1) determine the value postemergence rescue insecticide applications; 2) assess the impact of application rate on performance of liquid insecticides; 3) compare full single applications with split applications of Lorsban 4E and Vydate C-LV; 4) compare band versus broadcast placement of Lorsban 4E; and 5) evaluate the performance of GF-2153, an experimental insecticide formulation.

Materials and Methods:

This study was planted on 5 June at a field site near Auburn (Walsh County), ND. Plots were planted using a 6-row John Deere 71 Flex planter set to plant at a depth of 1¼ inch and a rate of one seed every 4½ inches of row. Plots were 6 rows (22-inch spacing) wide with the 4 centermost rows treated. The outer row on each side served as an untreated buffer. Each plot was 35 feet long, and 25-foot tilled alleys were maintained between replicates. The experiment was arranged in a randomized complete block design with four replications of the treatments. Counter 15G was used as the planting time product in all insecticide treatments, and it was applied at either the standard (10 lb product/ac) or its highest (11.9 lb) labeled rate. All planting-time applications of Counter were applied as 5-inch bands over rows by using Gandy^{TM} row banders.

Postemergence rescue applications of Lorsban 4E, Vydate C-LV, and GF-2153 were applied in 7-inch bands by using a tractor-mounted CO_2 spray system that delivered a finished spray volume of 10 GPA using TeeJet 8001EVS nozzles. The same system was also used to apply a broadcast application of Lorsban 4E, but TeeJet 11001VS nozzles were used to achieve broadcast delivery of the insecticides. Postemergence applications were either made at 2 days before (i.e., 24 June) or 4 days after (i.e., 30 June) peak activity of sugarbeet root maggot flies at the site. Plots slated to receive postemergence liquid insecticides were 3 tractor passes wide, and the liquid sprays were applied to the entire 3-pass area to avoid edge effects from one treatment to another. All assessments of treatment performance were conducted within the centermost four rows of the central tractor pass of those plots.

Root injury: Root maggot feeding injury was assessed on 11 August by randomly collecting ten beet roots per plot (five from each of the outer two treated rows), hand-washing them, and rating them in accordance with the 0 to 9 root injury scale (0 = no scarring, and 9 = over ¾ of the root surface blackened by scarring or dead beet) of Campbell et al. (2000). Treatment performance was also compared on the basis of sugarbeet yield parameters.

Harvest: On 23 September, all foliage was removed from plots immediately before harvest by using a commercial-grade mechanical defoliator. Shortly thereafter, 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.

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, 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:

A moderately high root maggot infestation was present for this study, as is evidenced by the strong degree of larval feeding injury (i.e., 6.88 on the 0 to 9 scale) that occurred in the untreated check plots (Table 1). All insecticide regimes, whether they consisted of stand-alone planting-time granule treatments or dual insecticide (at-plant plus postemergence) programs, provided significant reductions in root maggot feeding injury when compared with the untreated check.

Insecticide programs that included postemergence liquid sprays tended to provide better root protection from SBRM feeding injury than the stand-alone applications of Counter 15G, although the differences were not always significant. Excellent root protection was provided by the dual program consisting of Counter 15G (10 lb product/ac) plus a postemergence application of Lorsban 4E at 2 pts product/ac and a similar treatment regime comprised of Counter 15G (10 lb) plus 2 split applications of Vydate at 17 fl oz product/ac. Both of these programs were significantly better than stand-alone applications of Counter at either 10 or 11.9 lb/ac.

Similar to our findings from previous years, there was no difference in performance between banded and broadcast applications of Lorsban 4E when the material was applied at a relatively low (1 pt product/ac) rate. Unlike findings from our previous research, no statistically significant advantage was observed by applying Lorsban 4E or Vydate as split applications. However, root maggot feeding injury in plots treated with two split applications of Vydate was slightly lower than the feeding injury observed in plots treated with the single, full rate of Vydate.

Table 1. *Larval feeding injury* in evaluation of postemergence liquid insecticides for sugarbeet root maggot control, Auburn, ND, 2009

Treatment/form.	Placement[a]	Rate (product/ac)	Rate (lb a.i./ac)	Root Injury (0-9)
Counter 15G + Lorsban 4E	B 2 d pre-peak 7" Post B	10 lb 2 pts	1.5 1.0	2.60 d
Counter 15G + Vydate C-LV + Vydate C-LV +	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 17 fl oz 17 fl oz	1.5 0.5 0.5	2.63 d
Counter 15G + Lorsban 4E + Lorsban 4E	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 1.0 pt 1.0 pt	1.5 0.5 0.5	3.03 cd
Counter 15G + Vydate C-LV	B 2 d pre-peak 7" Post B	10 lb 34 fl oz	1.5 1.0	3.13 bcd
Counter 15G + GF-2153 + GF-2153	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 1.0 pt 1.0 pt	1.5 0.5 0.5	3.33 bcd
Counter 15G + GF-2153 + GF-2153	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 0.5 pt 0.5 pt	1.5 0.25 0.25	3.40 bcd
Counter 15G + Lorsban 4E	B 2 d pre-peak Post Broadcast	10 lb 1 pt	1.5 0.5	3.43 bcd
Counter 15G + Lorsban 4E	B 2 d pre-peak 7" Post B	10 lb 1 pt	1.5 0.5	3.65 bcd
Counter 15G	B	11.9 lb	1.8	3.90 bc
Counter 15G	B	10 lb	1.5	4.08 bc
Counter 15G + Lorsban 4E + Lorsban 4E	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 0.5 pt 0.5 pt	1.5 0.25 0.25	4.13 b
Check	---	---	---	6.88 a
LSD (0.05)				1.05

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

[a]B = band; Post B = postemergence band

As observed in other trials at this site, yields were generally low in this experiment, which was largely due to the late planting date, cool weather during much of the growing season, and early harvest. However, yield results corresponded well with root maggot feeding injury data. All entries in the study that received insecticide protection produced significantly higher recoverable sucrose and root yields, and generated a higher percent sucrose than the untreated check (Table 2). Additionally, the insecticide regimes resulted in revenue increases

ranging from $200 to $305 per acre when compared to the revenue from the untreated check plots. These figures would easily justify the use of any of the postemergence liquid insecticide regimes tested, irrespective of whether they involved single or split applications. Similar to the root injury rating results, there were no differences between single and split applications of the insecticides. The top-yielding treatments in this experiment were treated with a high rate of either postemergence Vydate C-LV (34 oz/ac) or Lorsban 4E (2 pts/ac). Overall, yield benefits from postemergence liquid insecticide applications in this study were not as apparent as those observed in most previous years. In fact, although economic returns were often substantially better in plots protected by postemergence liquid insecticides, there were no differences between recoverable sucrose yields or root tonnage between stand-alone planting-time treatments and plots that received additional postemergence liquid insecticide applications. This is also likely a result of the late planting date and early harvest. Further study should be carried out on these root maggot control strategies, because postemergence tools will likely be vital to effective SBRM management with the advent of moderately performing seed treatment insecticides, which have been shown to require additive insecticide protection under moderately high to severe root maggot pressure (Boetel et al. 2009).

Table 2. *Yield parameters* in evaluation of postemergence liquid insecticides for sugarbeet root maggot control, Auburn, ND, 2009

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 15G + Vydate C-LV	B 2 d pre-peak 7" Post B	10 lb 34 fl oz	1.5 1.0	5416 a	22.2 a	13.53 a	475
Counter 15G + Lorsban 4E	B 2 d pre-peak 7" Post B	10 lb 2 pts	1.5 1.0	5164 ab	21.7 a	13.30 ab	431
Counter 15G + Vydate C-LV + Vydate C-LV +	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 17 fl oz 17 fl oz	1.5 0.5 0.5	5060 abc	21.5 ab	13.15 ab	409
Counter 15G + Lorsban 4E + Lorsban 4E	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 0.5 pt 0.5 pt	1.5 0.25 0.25	4950 a-d	21.5 ab	12.93 b	381
Counter 15G	B	10 lb	1.5	4931 a-d	21.6 ab	12.88 b	371
Counter 15G + Lorsban 4E	B 2 d pre-peak Post Broadcast	10 lb 1 pt	1.5 0.5	4895 bcd	20.4 abc	13.40 ab	415
Counter 15G + Lorsban 4E + Lorsban 4E	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 1.0 pt 1.0 pt	1.5 0.5 0.5	4813 bcd	20.4 abc	13.35 ab	392
Counter 15G + Lorsban 4E	B 2 d pre-peak 7" Post B	10 lb 1 pt	1.5 0.5	4760 bcd	20.4 abc	13.10 ab	378
Counter 15G	B	11.9 lb	1.8	4756 bcd	20.5 abc	13.03 ab	372
Counter 15G + GF-2153 + GF-2153	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 1.0 pt 1.0 pt	1.5 0.5 0.5	4593 cd	19.5 bc	13.20 ab	370
Counter 15G + GF-2153 + GF-2153	B 2 d pre-peak 7" Post B 4 d post-peak 7" Post B	10 lb 0.5 pt 0.5 pt	1.5 0.25 0.25	4480 d	18.8 c	13.15 ab	374
Check	---	---	---	2851 e	13.5 d	12.05 c	170
LSD (0.05)				517	2.1	0.54	

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

[a]B = band; Post B = postemergence band

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