IMPACTS OF APPLICATION TIMING AND RATE ON PERFORMANCE OF THIMET 20G FOR POSTEMERGENCE CONTROL OF SUGARBEET ROOT MAGGOT

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Introduction:

The recent introduction and relatively high grower adoption of seed treatment insecticides for control of insect pests in sugarbeet has prompted additional research on optimization of postemergence tools for management of the sugarbeet root maggot (SBRM), *Tetanops myopaeformis* (Röder). The key objective of this experiment was to assess the impacts of application timing and rate on the performance of Thimet 20G as a postemergence rescue insecticide for SBRM control in the Red River Valley growing area. A secondary objective was to compare moderate and high rates of Counter 20G (i.e., 7.5 and 8.9 lb product/acre, respectively) as planting-time tools in dual-insecticide (i.e., planting-time + postemergence) regimes for root maggot control.

Materials and Methods:

This study was planted on 13 May at a field site near St. Thomas (Pembina 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 20G was used as planting time insecticide for all treatments, and was applied at either the standard (7.5 lb product/ac) or the highest (8.9 lb) labeled rate. All planting-time treatments were applied using Noble metering units, and delivery of granules in 5-inch bands over the rows was achieved by using Gandy™ row banders.

Postemergence Thimet 20G granules were applied at either one day before and 3 days after peak fly activity (i.e., June 03 or 07 June), and rates of Thimet 20G included 4.9 and 7 lb product/ac. Granular output was regulated by using Noble™ metering units, and placement of insecticide in 4-inch bands was achieved by using Kinze™ row banders attached to a tractor-mounted tool bar. Granules were incorporated using two pairs of rotary tines that straddled each row. A paired set of tines was positioned ahead of each bander, and a second pair was mounted behind the granular drop zone.

For comparative purposes, a treatment of Lorsban Advanced, applied at 1 pt product/ac using TeeJet 11002 VS nozzels in a broadcast application, was also included in this experiment. The Lorsban Advanced was applied on 14 June, which was 10 days after peak fly activity. To avoid confounding effects from neighboring treatments that did not receive a treatment capable of killing SBRM flies, plots treated with Lorsban Advanced were three tractor passes wide rather than the standard single pass. However, all treatment assessments were carried out in the inner four rows of the center tractor pass as with standard-sized plots.

<u>Root injury ratings</u>: Root maggot feeding injury was assessed on 28 July 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). Performance was also compared using sugarbeet yield parameters.

<u>Harvest</u>: All foliage was removed from plots immediately before harvest on 6 October by using a commercial-grade mechanical defoliator. On the same day, all beets from the center 2 rows of each plot were lifted from soil by 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 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, 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:

Root rating during the 2010 growing season was more difficult than any of the previous 12+ years. This was likely due to a couple of factors. First, the warm conditions that persisted during the early portion of the growing season led to a slightly early onset and peak of SBRM fly activity. As a result, larval feeding injury occurred slightly earlier than normal. Second, 2010 was a year characterized by nearly optimal growing conditions (i.e., cycles of frequent rainfall events followed by warm weather) that persisted throughout much of the growing season. This enabled sugarbeet seedlings to develop quickly and outgrow or shed some of the scarring that had occurred during the early larval feeding period. This made it a major challenge to accurately quantify the extent of SBRM scarring injury on the healed/recovered roots.

Results from root maggot feeding injury assessments for this trial are presented in Table 1. All insecticide regimes in the experiment, whether consisting of a single planting-time treatment or a dual (planting-time plus postemergence) insecticide program, provided significant reductions in SBRM feeding injury when compared to the untreated check, however, there were no significant differences between any of the insecticide treatments.

Table 1. *Larval feeding injury* in evaluation of the impacts of application timing and rate on performance of Thimet 20G for postemergence control of sugarbeet root maggot, St. Thomas, ND, 2010

Treatment/form.	Placement[a]	Rate (product/ac)	Rate (lb a.i./ac)	Root injury (0-9)
Counter 20G + Lorsban Advanced	B 10 d post-peak Broadcast	7.5 lb 1 pt	1.5 0.5	3.93 b
Counter 20G	B	7.5 lb	1.5	4.10 b
Counter 20G + Thimet 20G	B 3 d post-peak Post B	7.5 lb 7 lb	1.5 1.4	4.23 b
Counter 20G + Thimet 20G	B 3 d post-peak Post B	8.9 lb 7 lb	1.8 1.4	4.53 b
Counter 20G + Thimet 20G	B 1 d pre-peak Post B	8.9 lb 7 lb	1.8 1.4	4.55 b
Counter 20G + Thimet 20G	B 1 d pre-peak Post B	7.5 lb 7 lb	1.5 1.4	4.70 b
Counter 20G + Thimet 20G	B 3 d post-peak Post B	7.5 lb 4.9 lb	1.5 1.0	4.95 b
Counter 20G	B	8.9 lb	1.8	4.95 b
Counter 20G + Thimet 20G	B 1 d pre-peak Post B	7.5 lb 4.9 lb	1.5 1.0	5.05 b
Check	-----	----	-----	6.65 a
LSD (0.05)				1.28

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

Yield data from this experiment are presented in Table 2. There were no significant differences among treatments with regard to recoverable sucrose yield or root tonnage. This may have been partially a result of the previously mentioned optimal growing conditions that persisted through much of the 2010 growing season. Another factor could have been the frequent and sometimes heavy rainfall events that occurred at this study site. Unfortunately, these weather patterns led to some plots having standing water on them for long periods during the growing season, which could have added unwanted variability associated with SBRM egg laying, larval activity, and the resulting yield measurements.

Despite the lack of statistical differences between treatments in this experiment, some interesting trends were observed. For example, plots treated earlier with postemergence applications of Thimet 20G tended to produce numerically more recoverable sucrose yield and gross economic return than those that received later postemergence granule applications. Although application timing has not played a major role in the efficacy of postemergence Thimet treatments in previous testing, it should be noted that the postemergence applications of Thimet during this run of the experiment were carried out much later in relation to peak SBRM fly activity than in previous years because rainy weather patterns precluded us from making the applications at preplanned timings.

Even though the results of this trial do not permit us to declare statistically significant yield benefits from postemergence Thimet applications made at one day before or three days after peak SBRM fly activity, it should be pointed out that economic returns from dual-insecticide (i.e., planting-time Counter 20G + postemergence Thimet 20G) programs in this year's trial provided gross revenue increases of $110 to $433/ac when compared to single, planting-time-only insecticide programs. Delayed applications that result in postemergence Thimet treatment at or shortly after peak SBRM fly activity are not recommended under most circumstances, but may still be economically beneficial in some situations, especially when a grower has no other choice.

Table 2. *Yield parameters* from evaluation of the impacts of application timing and rate on performance of Thimet 20G for postemergence control of sugarbeet root maggot, St. Thomas, 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)
Counter 20G + Thimet 20G	B 1 d pre-peak Post B	7.5 lb 4.9 lb	1.5 1.0	7404 a	21.6 a	18.40 ab	1245
Counter 20G + Thimet 20G	B 1 d pre-peak Post B	8.9 lb 7 lb	1.8 1.4	7381 a	22.0 a	18.20 abc	1221
Counter 20G + Thimet 20G	B 3 d post-peak Post B	7.5 lb 7 lb	1.5 1.4	7193 a	21.3 a	18.10 abc	1196
Counter 20G + Thimet 20G	B 1 d pre-peak Post B	7.5 lb 7 lb	1.5 1.4	7118 a	21.3 a	18.07 abc	1174
Counter 20G + Thimet 20G	B 3 d post-peak Post B	8.9 lb 7 lb	1.8 1.4	6772 a	19.5 a	18.57 a	1152
Counter 20G	B	8.9 lb	1.8	6436 a	19.6 a	17.77 bcd	1042
Counter 20G + Lorsban Advanced	B 10 d post-peak Broadcast	7.5 lb 1 pt	1.5 0.5	6333 a	19.3 a	17.90 a-d	1026
Check	-----	----	-----	6319 a	19.0 a	18.00 a-d	1036
Counter 20G + Thimet 20G	B 3 d post-peak Post B	7.5 lb 4.9 lb	1.5 1.0	6295 a	19.6 a	17.53 cd	1001
Counter 20G	B	7.5 lb	1.5	5231 a	16.6 a	17.30 d	812
LSD (0.05)				NS	NS	0.71	

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

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