# SEED TREATMENTS, PLANTING-TIME GRANULES, AND POSTEMERGENCE INSECTICIDES FOR SUGARBEET ROOT MAGGOT CONTROL

Mark A. Boetel, Associate Professor
Allen J. Schroeder and Robert J. Dregseth, Research Specialists

Department of Entomology, North Dakota State University, Fargo, ND

## Introduction:

The most important insect pest of sugarbeet in the Red River Valley (RRV) is the sugarbeet root maggot (SBRM), *Tetanops myopaeformis* (Röder). The most common methodology for SBRM control in the RRV for several decades has involved the use of granular insecticides applied at planting, followed by postemergence liquid sprays or banded insecticide granules on an as-needed basis. Over the course of the past two years, Poncho Beta (clothianidin+betacyfluthrin), NipsIt Inside (clothianidin), and Cruiser 5FS (thiamethoxam) insecticidal seed treatments have received federal registration for use in sugarbeet. Conventional granular insecticides continue to provide good control of the SBRM and several other soil-dwelling insect pests of sugarbeet. However, recently developed seed treatment technology may be a good addition to the current set of available insecticide options for insect management in sugarbeet because of the following benefits: 1) no on-farm calibration is needed to achieve the targeted application rate; 2) no tank mixing is required by grower (reduced likelihood of pesticide exposure); 3) no specialized application equipment is needed on planter; and 4) it allows for significant reductions in insecticide active ingredient applied per acre.

This investigation involved three seed treatment studies that were carried out during the 2009 growing season to accomplish the following objectives: 1) evaluate sugarbeet root maggot control strategies consisting of Poncho Beta seed treatment combined with postemergence liquid or granular insecticides; 2) compare the efficacy of Cruiser, NipsIt Inside, and Poncho Beta seed treatments as stand-alone tools for root maggot control; and 3) conduct preliminary screening on root maggot control efficacy of experimental seed treatment combinations involving Cruiser, Force, A14321, and the fungicidal seed treatment, Dynasty.

## Materials and Methods:

These experiments were established on a field site near Auburn (Walsh County), ND. Seed treatment insecticides were applied to seed by a custom seed-coating company (Germain's Technology Group, Inc., Fargo, ND). The same seed variety and lot were used for all treatments (i.e., seed treatments, conventional insecticide entries, and the untreated check) within each study. Plots were planted using a six-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 six rows (22-inch spacing) wide with the four centermost rows treated. The outer "guard" row on each side of the plot 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. 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 15G was used as the planting-time granular insecticide standard in all three experiments.

<u>Root injury ratings</u>: Sugarbeet root maggot feeding injury was assessed in all tests 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).

<u>Harvest</u>: Treatment performance was also compared on the basis of sugarbeet yield parameters. Foliage was removed from plots immediately before harvest by using a commercial-grade mechanical defoliator. 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 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, 1999), and treatment means were separated using Fisher's protected least significant difference (LSD) test at a 0.05 level of significance.

**Specific information on materials and methods for the three studies are respectively presented below.**

**Study I:** This experiment was planted on June 5, 2009 using BTS 86RR66 seed. Poncho Beta, a dual-insecticide seed treatment product applied at a rate of 60 and 8 g of clothianidin and betacyfluthrin per unit (100,000 seeds), respectively, was the only seed treatment entry in the study. Counter 15G, applied at planting time at 10 and 11.9 lb product/ac using band (B) placement (Boetel et al. 2006), was included in this study as an industry standard for comparative purposes. Banded applications consisted of 5-inch swaths of granules delivered through Gandy$^{TM}$ row banders. Granular application rates were regulated by using planter-mounted Noble$^{TM}$ metering units.

Postemergence insecticides used in Study I consisted of two granular materials (i.e., Counter 15G and Thimet 20G) and two liquid insecticides (i.e., Lorsban 4E and Vydate C-LV 3.77SL). Postemergence granular applications (Post B) were made on 22 June. Band placement of postemergence granules was achieved by using Kinze row banders, which were attached to a tractor-mounted tool bar and adjusted to a height needed to deliver the insecticides in 4-inch bands. As with at-plant applications, postemergence granular application rates were controlled by using planter-mounted Noble$^{TM}$ metering units.

Postemergence liquid insecticide applications were made on 24 June using a tractor-mounted $CO_2$ spray system equipped with TeeJet 8001EVS nozzles. The system was calibrated to deliver a finished spray volume of 10 GPA and nozzles were positioned at a height to achieve 7-inch bands. As with the planting-time treatments, the postemergence liquids were also applied to the inner four rows of each tractor pass; however, three passes were made per plot for the liquid treatments. This design was used to reduce the likelihood of flies exposed to a foliar liquid insecticide treatment in one plot moving into and colonizing a neighboring plot.

Postemergence insecticide granules were incorporated using two pairs of rotary tines that straddled each row on the tool bar. A paired set of tines was positioned ahead of the bander and a second pair was mounted behind the granular drop zone. This system effectively stirred soil around the bases of sugarbeet seedlings and incorporated granules as the unit passed through each plot.

All evaluations in these plots were made within the central four-row tractor pass of each three-pass plot. Root maggot feeding injury was assessed for this study on 11 August, and plots were harvested on 22 September.

**Study II:** This experiment was planted on 5 June, 2009 using Betaseed BTS86RR66 glyphosate-resistant seed. It was carried out to compare the efficacy of the following seed treatment insecticides for sugarbeet root maggot control: Poncho Beta (clothianidin+betacyfluthrin at 60+8 g a.i./unit seed), NipsIt Inside (60 g a.i./seed unit), and Cruiser 5FS (60 g a.i./seed unit). Counter 15G was applied at 10 and 11.9 lb product/ac by using band (B) placement. Root maggot feeding injury ratings were conducted on 11 August in this study, and the plots were harvested on 22 September.

**Study III: (test # 4)**This experiment was planted using Hilleshog 070017RR seed on June 4. It was designed to evaluate the performance of Cruiser 5FS seed treatment insecticide at 60 g a.i./unit seed and in combination with other companion insecticidal seed treatments and an additional fungicide seed treatment (i.e., Dynasty). Seed treatment materials evaluated in the experiment included Cruiser 5FS, Force, Poncho Beta, and A14321. Counter 15G, applied at 10 and 11.9 lb product/ac by using band placement, was included in the experiment as an industry standard. Root maggot feeding injury assessments for this study were conducted on 12 August, and plots were harvested on 22 September.

**Results and Discussion:**

**Study I:** Results from root injury rating assessments for Study I are presented in Table 1. Excellent root protection was provided by the following entries: Counter 15G at 11.9 lb product/ac, Counter 15G (10 lb product/ac) at planting + postemergence Thimet 20G (7 lb product/ac), Counter 15G applied at 10 lb product/ac, Counter 15G (10 lb product/ac) at planting + postemergence Thimet 20G (4.9 lb product/ac), Poncho Beta +

postemergence Vydate, and 10 lb of Counter 15G + postemergence Lorsban 4E. Treatments that were not successful in providing significant reductions in SBRM feeding injury when compared with injury sustained in the untreated check plots included the following: 1) Poncho Beta + postemergence Lorsban 4E; 2) the postemergence-only application of Lorsban 4E; 3) the stand-alone entry of Poncho Beta seed treatment; 4) stand-alone (no at-plant insecticide) postemergence Thimet 20G; and 5) stand-alone postemergence Vydate. Counter 15G, applied at either 10 or 11.9 lb product per acre provided statistically better root protection than Poncho Beta. Adding a postemergence application of Vydate to plots established with Poncho Beta-treated seed resulted in a significant reduction in SBRM feeding injury. In fact, the combination treatment of Poncho Beta + postemergence Vydate was not statistically outperformed with, respect to root protection, by any other treatment in Study I.

**Table 1. *Larval feeding injury* in an evaluation of seed treatments, at-plant granules, and postemergence insecticide options for sugarbeet root maggot control (Study I), Auburn, ND, 2009**

| Treatment/form. | Placement[a] | Rate (product/ac) | Rate (lb a.i./ac) | Root Injury (0-9) |
|---|---|---|---|---|
| Counter 15G | B | 11.9 lb | 1.8 | 2.55 f |
| Counter 15G +<br>Thimet 20G | B<br>4 d pre-peak Post B | 10 lb<br>7 lb | 1.5<br>1.4 | 2.63 f |
| Counter 15G | B | 10 lb | 1.5 | 2.70 ef |
| Counter 15G +<br>Thimet 20G | B<br>4 d pre-peak Post B | 10 lb<br>4.9 lb | 1.5<br>1.0 | 2.90 ef |
| Poncho Beta +<br>Vydate C-LV | Seed<br>2 d pre-peak 7” Post B | <br>34 fl oz | 68 g a.i./unit seed<br>1.0 | 2.95 ef |
| Counter 15G +<br>Lorsban 4E | B<br>2 d pre-peak 7” Post B | 10 lb<br>1 pt | 1.5<br>0.5 | 3.28 def |
| -----<br>Vydate C-LV | -----<br>2 d pre-peak 7” Post B | -----<br>34 fl oz | <br>1.0 | 3.73 cde |
| -----<br>Thimet 20G | -----<br>4 d pre-peak Post B | -----<br>7 lb | <br>1.4 | 4.28 bcd |
| Poncho Beta +<br>Lorsban 4E | Seed<br>2 d pre-peak 7” Post B | <br>1 pt | 68 g a.i./unit seed<br>0.5 | 4.43 abc |
| Check | --- | ---- | --- | 4.68 abc |
| -----<br>Lorsban 4E | <br>2 d pre-peak 7” Post B | <br>1 pt | <br>0.5 | 4.83 ab |
| Poncho Beta | Seed | | 68 g a.i./unit seed | 5.48 a |
| LSD (0.05) | | | | 1.09 |

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; Seed = insecticidal seed treatment

Excessively wet soil conditions during the spring of 2009 resulted in a very late planting date for this trial. As a result, yields for this study were generally quite low (Table 2). However, yield data corresponded well with root injury rating results. The top-yielding entry in Study I was the combination treatment comprised of Poncho Beta seed treatment + a postemergence application of Vydate C-LV. This entry also produced over $50/ac more economic return than any other treatment in the experiment and $130 more return than the postemergence-only entry of Vydate. It should be noted, however, that plots treated only with a postemergence application of Vydate produced an increase in revenue of $107 when compared to that from the untreated check plots.

The following treatments provided the best yields and economic returns in Study I: Poncho Beta + postemergence Vydate, Counter 15G + postemergence Thimet 20G (7 lb product/ac), Counter + postemergence Thimet (4.9 lb product/ac), Counter as a stand-alone treatment at planting time (at either 11.9 or 10 lb product/ac), and Counter + postemergence Lorsban 4E (1 pt/ac). Other entries producing significant yield increases over that of the untreated check included the postemergence-only treatments of Thimet 20G and Vydate C-LV. This finding corresponded with root rating data and thus, suggests that Thimet and Vydate appear to be effective postemergence insecticides for root maggot management; **however, it should be noted that growers should not rely solely on postemergence tools to control sugarbeet root maggot. Planting-time protection, in the form of either an at-plant granular material or an insecticidal seed treatment, is an absolute necessity for adequate control of the moderate to high root maggot infestations that commonly impact the Red River Valley production area.**

Although dual-insecticide programs (i.e., planting-time + postemergence applications) tended to perform better than some of the stand-alone entries in this study, it appeared that the planting-time insecticide component of these combinations was most impactful on SBRM control. This could have been a product of the atypically late planting date, which probably resulted in an unusually high amount of residual planting-time insecticide remaining in the soil at the time of peak SBRM larval feeding activity. These findings warrant further investigation during a more typical growing season.

**Table 2. *Yield parameters* from an evaluation of seed treatments, at-plant granules, and postemergence insecticide options for sugarbeet root maggot control (Study I), 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) |
|---|---|---|---|---|---|---|---|
| Poncho Beta +<br>Vydate C-LV | Seed<br>2 d pre-peak 7" Post B | <br>34 fl oz | 68 g a.i./unit seed<br>1.0 | 5032 a | 21.9 ab | 12.98 a | 383 |
| Counter 15G +<br>Thimet 20G | B<br>4 d pre-peak Post B | 10 lb<br>7 lb | 1.5<br>1.4 | 4816 ab | 22.6 a | 12.30 bcd | 295 |
| Counter 15G | B | 11.9 lb | 1.8 | 4812 ab | 21.8 ab | 12.60 ab | 330 |
| Counter 15G +<br>Thimet 20G | B<br>4 d pre-peak Post B | 10 lb<br>4.9 lb | 1.5<br>1.0 | 4794 ab | 22.1 a | 12.40 abc | 310 |
| Counter 15G | B | 10 lb | 1.5 | 4779 ab | 22.2 a | 12.38 abc | 301 |
| Counter 15G +<br>Lorsban 4E | B<br>2 d pre-peak 7" Post B | 10 lb<br>1 pt | 1.5<br>0.5 | 4663 ab | 21.2 ab | 12.53 abc | 317 |
| -----<br>Vydate C-LV | -----<br>2 d pre-peak 7" Post B | -----<br>34 fl oz | <br>1.0 | 4286 b | 20.3 ab | 12.15 bcd | 253 |
| -----<br>Thimet 20G | -----<br>4 d pre-peak Post B | -----<br>7 lb | <br>1.4 | 4221 bc | 19.4 bc | 12.48 abc | 277 |
| Poncho Beta +<br>Lorsban 4E | Seed<br>2 d pre-peak 7" Post B | <br>1 pt | 68 g a.i./unit seed<br>0.5 | 3576 cd | 17.0 cd | 12.00 bcd | 207 |
| -----<br>Lorsban 4E | <br>2 d pre-peak 7" Post B | <br>1 pt | <br>0.5 | 3486 d | 16.9 cd | 11.90 cd | 191 |
| Poncho Beta | Seed | | 68 g a.i./unit seed | 3408 d | 16.4 d | 11.90 cd | 191 |
| Check | --- | ---- | --- | 2970 d | 14.8 d | 11.68 d | 146 |
| LSD (0.05) | | | | 660 | 2.7 | 0.64 | |

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; Seed = insecticidal seed treatment

**<u>Study II</u>:** Root injury rating data for seed treatment Study II are presented in Table 3. The late planting date (5 June) also likely impacted the results of this trial. Plants were very small and vulnerable to attack and feeding injury by sugarbeet root maggot larvae. As a result, all plots sustained fairly high levels of SBRM feeding injury and there were no significant differences between any of the treatments. Trends suggest that Counter 15G provided slightly better protection, and that the seed treatment entries performed at similar levels to each other. However, no concrete conclusions can be made about these patterns due to the lack of statistical differences among treatments in this trial.

**Table 3. *Larval feeding injury* in an assessment of newly labeled seed treatments for sugarbeet root maggot control (Study II), Auburn, ND, 2009**

| Treatment/form. | Placement[a] | Rate (product/ac) | Rate (lb a.i./ac) | Root injury (0-9) |
|---|---|---|---|---|
| Counter 15G | B | 11.9 lb | 1.8 | 4.00 a |
| Counter 15G | B | 10 lb | 1.5 | 4.00 a |
| Cruiser | Seed | | 60 g a.i./unit seed | 4.95 a |
| Poncho Beta | Seed | | 68 g a.i./unit seed | 5.33 a |
| Check | --- | ---- | --- | 5.33 a |
| NipsIT Inside | Seed | | 60 g a.i./unit seed | 5.63 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 test).
[a] B = band; Seed = insecticidal seed treatment

Yield data from Study II indicated that Counter 15G, applied at either 10 or 11.9 lb product/ac provided significantly better SBRM control than any of the seed treatment entries (Table 4). This was the case for recoverable sucrose yield, root tonnage, and even percent sucrose. Applications of 11.9 and 10 lb Counter 15G provided the greatest gross economic returns per acre, which were respectively $311 and $252, greater than the return from untreated check plots. Those returns amounted to a minimum of $177/ac more revenue than any of the seed treatment entries. Poncho Beta was the only seed treatment entry to result in significantly greater recoverable sucrose and root yields than that of the untreated check plots, although there were no significant differences in yields among seed treatment entries in this study. It should be noted, however, that respective revenue increases provided by Poncho Beta, Cruiser, and NipsIT Inside were $75, $23, and $31 greater than revenue generated by the untreated check plots. As stated above regarding root injury data, the yield results from this study were also likely impacted by the extremely late planting date. Thus, this study should be repeated under more typical growing conditions.

**Table 4. *Yield parameters* in an assessment of newly labeled seed treatments for sugarbeet root maggot control (Study II), 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 | B | 11.9 lb | 1.8 | 4917 a | 19.8 a | 13.70 a | 446 |
| Counter 15G | B | 10 lb | 1.5 | 4505 a | 18.6 a | 13.50 a | 387 |
| Poncho Beta | Seed | | 68 g a.i./unit seed | 3276 b | 15.2 b | 12.28 b | 210 |
| Cruiser | Seed | | 60 g a.i./unit seed | 2821 bc | 13.6 bc | 11.98 b | 158 |
| NipsIT Inside | Seed | | 60 g a.i./unit seed | 2698 bc | 12.6 bc | 12.08 b | 166 |
| Check | --- | ---- | --- | 2466 c | 11.9 c | 11.78 b | 135 |
| LSD (0.05) | | | | 737 | 3.1 | 0.82 | |

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; Seed = insecticidal seed treatment

**<u>Study III</u>:** The results of root injury ratings for seed treatment Study III are presented in Table 5. A relatively high sugarbeet root maggot infestation developed for this trial, as was evidenced by the high level of root injury (6.85 on the 0 to 9 scale of Campbell et al., 2000) that occurred in the untreated check plots. All seed treatment entries and planting-time granular treatments in this study resulted in significant reductions in sugarbeet root maggot feeding injury when compared with the untreated check plots. Counter 15G, applied at either 11.9 or 10 lb product/ac, provided the greatest reductions in root maggot feeding injury. The seed treatment combination of Cruiser 5FS + Dynasty fungicide provided a level of root protection that was similar to, and not outperformed by either rate of Counter 15G. Poncho Beta provided a comparable level of protection to that of the Cruiser/Dynasty combination, but it was outperformed by both rates of Counter.

**Table 5. *Larval feeding injury* in a trial of registered and experimental seed treatment insecticides for sugarbeet root maggot control (Study III), Auburn, ND, 2009**

| Treatment/form. | Placement[a] | Rate (product/ac) | Rate (lb a.i./ac) | Root injury (0-9) |
|---|---|---|---|---|
| Counter 15G | B | 11.9 lb | 1.8 | 3.48 d |
| Counter 15G | B | 10 lb | 1.5 | 3.70 d |
| Cruiser 5FS +<br>Dynasty | Seed | | 60 g a.i./unit seed<br>2.5 g a.i./unit seed | 4.08 cd |
| Poncho Beta | Seed | | 68 g a.i./unit seed | 4.93 bc |
| Cruiser 5FS | Seed | | 60 g a.i./unit seed | 5.08 b |
| Cruiser 5FS +<br>Force +<br>A14321 | Seed | | 60 g a.i./unit seed +<br>8 g a.i./unit seed<br>0.2 mg/seed | 5.30 b |
| Cruiser 5FS +<br>Force +<br>A14321 +<br>Dynasty | Seed | | 60 g a.i./unit seed<br>8 g a.i./unit seed<br>0.2 mg/seed<br>2.5 g a.i./unit seed | 5.35 b |
| Check | --- | ---- | ---- | 6.85 a |
| LSD (0.05) | | | | 0.98 |

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; Seed = insecticidal seed treatment

Yield data indicated that Counter 15G provided the best control of sugarbeet root maggot in Study III, irrespective of whether it was applied at 11.9 or 10 lb product/ac (Table 6). There was no statistical difference between the two rates of Counter. Counter-treated plots produced yield advantages of more than 1,000 lb recoverable sucrose and over 4 tons more root yield than the seed treatment entries in this study. Plots established with Cruiser-treated seed produced a yield increase of 494 lb recoverable sucrose and 1.1 tons more root yield than that of the untreated check plots, but neither of those differences were significant.

**Table 6. *Yield parameters* from a trial of registered and experimental seed treatment insecticides for sugarbeet root maggot control (Study III), 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 | B | 10 lb | 1.5 | 5133 a | 22.3 a | 12.77 a | 392 |
| Counter 15G | B | 11.9 lb | 1.8 | 4773 a | 20.9 a | 12.67 a | 359 |
| Cruiser 5FS | Seed | | 60 g a.i./unit seed | 3725 b | 16.8 b | 12.47 a | 259 |
| Cruiser 5FS +<br>Force +<br>A14321 +<br>Dynasty | Seed | | 60 g a.i./unit seed<br>8 g a.i./unit seed<br>0.2 mg/seed<br>2.5 g a.i./unit seed | 3631 b | 16.4 b | 12.37 a | 249 |
| Poncho Beta | Seed | | 68 g a.i./unit seed | 3575 b | 16.3 b | 12.33 a | 239 |
| Cruiser 5FS +<br>Force +<br>A14321 | Seed | | 60 g a.i./unit seed +<br>8 g a.i./unit seed<br>0.2 mg/seed | 3536 b | 15.9 b | 12.37 a | 246 |
| Cruiser 5FS +<br>Dynasty | Seed | | 60 g a.i./unit seed<br>2.5 g a.i./unit seed | 3317 b | 15.8 b | 11.97 a | 194 |
| Check | --- | ---- | ---- | 3229 b | 15.7 b | 11.73 a | 172 |
| LSD (0.05) | | | | 672 | 2.8 | NS | |

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; Seed = insecticidal seed treatment

Similar to our findings from previous years, the results of these trials suggest that seed treatment insecticides can provide moderate levels of sugarbeet root maggot control. Seed treatments will likely provide adequate protection from low to moderate root maggot infestations; however, the currently labeled seed treatments should not be used as stand-alone treatments to control the high maggot populations that commonly infest some Red River Valley locations.

It should also be noted that failure to adequately control SBRM infestations in one growing season could set the stage for problems during the following year. Combining additive postemergence insecticides, in the form of postemergence liquid or granular materials, typically augments control. This strategy will likely be needed for adequate management of moderate to high SBRM infestations. Also, the use of seed treatment insecticide technology in areas at high risk of sugarbeet root maggot damage mandates careful monitoring of fly populations to allow for the application of postemergence insecticides. Finally, the results of these trials and those of previous years underscore the importance for growers to pay close attention to NDSU's fly activity forecast and additional updates regarding fly activity each year.

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