EVALUATION OF REGISTERED SEED TREATMENT INSECTICIDES FOR SUGARBEET ROOT MAGGOT CONTROL

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Introduction:

Three insecticidal seed treatment materials have recently received Environmental Protection Agency registration for use in sugarbeet to manage insect pests. This experiment was conducted to compare the relative efficacy of Cruiser 5FS, NipsIt Inside, and Poncho Beta insecticidal seed treatments under low and high sugarbeet root maggot infestations. Other objectives included comparing seed treatment alternatives with Counter 20G granular insecticide, and evaluating the impact of application rate on the performance of Counter 20G.

Materials and Methods:

Two commercial grower fields near St. Thomas (Pembina County) and Forest River (Walsh County), ND were chosen as sites to conduct this experiment. Seed treatment insecticides were applied to seed by a custom seed-coating company (Germains Seed Technology, Fargo, ND). Respective planting dates for Forest River and St. Thomas were 19 and 26 May, 2011. Plots were established using a 6-row John Deere™ 71 Flex planter. The planter was adjusted to plant at a depth of 1¼ inch and a rate of one seed every 4¾ inches of row. SES VanderHave 36812RR, a glyphosate-resistant seed variety, was used for all treatment plots at both locations. Each plot was 6 rows (22-inch spacing) wide with the 4 centermost rows treated. The outer "guard" row to 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 each seed treatment was applied.

Counter 20G served as a planting-time granular insecticide standard the seed treatments. Granules were applied by using band (B) placement. Banded applications consisted of 5-inch swaths of granules that were achieved by using Gandy™ row banders. Granular output rates used in these experiments were regulated by using planter-mounted Noble™ metering units.

<u>Root injury ratings</u>: Root maggot feeding injury was assessed on 2 and 3 August at Forest River and St. Thomas, respectively. Ratings consisted of 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. Plots at Forest River and St. Thomas were harvested on 26 and 27 September, respectively. Immediately before harvest, the foliage was removed from all treatment plots by using a commercial-grade mechanical defoliator. After defoliation, 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 sucrose content and quality analysis.

<u>Data analysis</u>: 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:

St. Thomas (high SBRM pressure). Sugarbeet root maggot feeding injury data for this trial are presented in Table 1. Root injury ratings from the untreated check plots averaged 7.45on the 0 to 9 scale of Campbell et al. (2000), suggesting that a relatively high SBRM infestation was present. Counter 20G, applied at either 7.5 or 8.9 lb product/ac, was the only crop protection material that provided significant reductions in SBRM feeding injury at this location. The levels of root protection provided by Cruiser and Poncho Beta seed treatments were intermediate because, although they were not significantly outperformed by Counter 20G at the 8.9-lb rate, they were not statistically better than the untreated check. As observed with Poncho Beta and Cruiser, NipsIt Inside also failed to provide significant reductions in root maggot feeding injury when compared to the untreated check at St. Thomas.

Table 1. *Larval feeding injury* in comparison of registered seed treatments for sugarbeet root maggot control, St. Thomas, ND, 2011

Treatment/form.	Placement[a]	Rate (product/ac)	Rate (lb a.i./ac)	Root injury (0-9)
Counter 20G	B	7.5 lb	1.5	5.63 c
Counter 20G	B	8.9 lb	1.8	5.83 bc
Poncho Beta	Seed		68 g a.i./ unit seed	7.08 ab
Cruiser 5FS	Seed		60 g a.i./ unit seed	7.10 ab
NipsIT Inside	Seed		60 g a.i./ unit seed	7.35 a
Check	---	----	---	7.45 a
LSD (0.05)				1.36

Means within a column sharing a letter are not significantly (P = 0.05) different from each other (Fisher's Protected LSD).
[a]B = band; Seed = insecticidal seed treatment

The highest recoverable sucrose yield in this trial at St. Thomas was achieved by using the moderate (7.5 lb product/ac) rate of Counter 20G; however, the sucrose yields from those plots were not significantly different from plots treated with the high (8.9 lb product/ac) rate of Counter or Cruiser seed treatment. Cruiser was the only seed treatment entry in this trial that provided a significant increase in sucrose yield in comparison to the untreated check at St. Thomas. There were no statistical differences among treatments with regard to sugarbeet root tonnage; however, applying planting-time protection by using Counter 20G provided increases in root yield of up to 4.2 tons/ac and gross revenue increases ranging from $182 to $197/ac. Although the seed treatment plots tended to provide lower yields than Counter-treated plots, Cruiser and Poncho Beta plots generated relatively high sucrose percentages. As a result of this increased in quality, Cruiser and Poncho Beta imparted gross revenue increases of $216 and $73/ac, respectively, over that of the untreated check. Also, NipsIt Inside seed treatment resulted in a revenue increase of $33/ac when compared to the check.

Table 2. *Yield parameters* in comparison of registered seed treatments for sugarbeet root maggot control, St. Thomas, ND, 2011

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	B	7.5 lb	1.5	5380 a	20.7 a	14.68 a	688
Counter 20G	B	8.9 lb	1.8	5215 ab	19.4 a	14.98 a	703
Cruiser 5FS	Seed		60 g a.i./ unit seed	5168 ab	18.8 a	15.28 a	722
Poncho Beta	Seed		68 g a.i./ unit seed	4395 bc	16.6 a	14.95 a	579
NipsIT Inside	Seed		60 g a.i./ unit seed	4197 c	16.1 a	14.63 a	539
Check	---	----	---	4173 c	16.5 a	14.33 a	506
LSD (0.05)				900	NS	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; Seed = insecticidal seed treatment

Forest River (low SBRM pressure). Root injury ratings in the untreated check plots at Forest River averaged 3.53 on the 0 to 9 scale of Campbell et al. (2000), thus indicating a low root maggot infestation at this site (Table 3). All insecticide-protected plots provided significant reductions in SBRM feeding injury, irrespective of whether a planting-time granule or insecticidal seed treatment was used. Trends with regard to protection from root maggot feeding injury tended to follow the same general patterns as those observed at the St. Thomas site. For example, the best overall root protection was provided by Counter 20G at its moderate (7.5 lb product/ac) rate. This entry resulted in significantly lower SBRM feeding injury than any seed treatment at Forest River. There were no significant differences in root protection between seed treatments at this site.

Table 3. *Larval feeding injury* in comparison of registered seed treatments for sugarbeet root maggot control, Forest River, ND, 2011				
Treatment/form.	**Placement[a]**	**Rate (product/ac)**	**Rate (lb a.i./ac)**	**Root injury (0-9)**
Counter 20G	B	7.5 lb	1.5	2.10 c
Counter 20G	B	8.9 lb	1.8	2.45 bc
Cruiser 5FS	Seed		60 g a.i./ unit seed	2.85 b
Poncho Beta	Seed		68 g a.i./ unit seed	2.88 b
NipsIT Inside	Seed		60 g a.i./ unit seed	2.90 b
Check	---	----	---	3.53 a
LSD (0.05)				0.52

Means within a column sharing a letter are not significantly (*P* = 0.05) different from each other (Fisher's Protected LSD).
[a]B = band; Seed = insecticidal seed treatment

Yield results from Forest River are presented in Table 4. Yields at Forest River were much higher than those observed at St. Thomas. Performance patterns with regard to yield tended to be similar among the two locations, although there were no statistical differences between any of the treatments in regard to sucrose yield, root tonnage, or sucrose percentage. As observed at St. Thomas, plots treated with at-plant applications of Counter 20G tended to provide higher yields than those protected using insecticidal seed treatments. As a result of the low root maggot pressure at this location, gross economic returns from all treatments were negligible. Similar to the results at St. Thomas, the highest revenue occurred in plots treated with Counter 20G at the moderate (7.5 lb product/ac); however, the Counter application only increased revenue by $5/ac when compared to the revenue value generated by the untreated check. Obviously, this small increase would not have paid a positive return on investment for purchase of the insecticide.

Table 4. *Yield parameters* in comparison of registered seed treatments for sugarbeet root maggot control, Forest River, ND, 2011							
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	B	7.5 lb	1.5	7924 a	29.6 a	15.20 a	1063
Counter 20G	B	8.9 lb	1.8	7860 a	29.9 a	14.83 a	1024
NipsIT Inside	Seed		60 g a.i./ unit seed	7712 a	28.5 a	15.03 a	1049
Poncho Beta	Seed		68 g a.i./ unit seed	7618 a	28.7 a	14.83 a	1007
Cruiser 5FS	Seed		60 g a.i./ unit seed	7561 a	29.1 a	14.63 a	963
Check	---	----	---	7553 a	27.4 a	15.28 a	1058
LSD (0.05)				NS	NS	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; Seed = insecticidal seed treatment

The results of this trial suggest that Counter 20G provides better root maggot control than all registered insecticidal seed treatments when high infestations of this pest are present. However, the seed treatment materials tend to allow for slightly higher sucrose percentages, and the increased quality provided by seed treatments can offset the impacts of lower root maggot control performance. Continued research involving these crop protection materials should focus on optimizing at-plant protection rather than maximizing it (to enhance yield quality), as well as determining the most efficacious means of augmenting root maggot control by using postemergence rescue insecticide applications.

References Cited:

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