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ON-FARM COMPARISONS OF MUSTANG MAX AND CONVENTIONAL POSTEMERGENCE INSECTICIDES FOR SUGARBEET ROOT MAGGOT CONTROL

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Introduction:

The 2001 registration of Mustang insecticide for use in sugarbeet sparked a substantial amount of interest regarding its potential for use as a tool to manage the sugarbeet root maggot and other insect pests of the crop. Interest and optimism regarding the product were further fueled because of its relative cost-competitiveness in comparison to many of the conventional products in the sugarbeet market. Although slightly greater root maggot control activity from Mustang has been observed with T-banded applications in some NDSU trials, the overall performance of the insecticide has variable. Additionally, the activity of soil-applied Mustang treatments has not been sufficient under heavy root maggot infestation levels. The purpose of this experiment was to use large-scale study sites to compare the performance of Mustang Max 0.8EC as a postemergence treatment with commonly used conventional materials for protection of sugarbeet fields from root maggot feeding injury and resultant yield losses.

Materials and Methods:

Three sugarbeet growers in the northern end of the Red River Valley (all in Pembina County) were identified for participation in the study. One field was selected from each grower and all three fields were within about five miles of each other. Two of the fields were 80 ac in size and the other was a 160-ac field. Beets were planted in early to mid-May. All planting and insecticide applications were done with conventional equipment, and growers maintained their fields with normal crop production practices. Fly counts were monitored at each location using Blickenstaff sticky-stakes. Numbers of flies captured on sticky stakes at the study sites ranged from 1,568 to 2,012 total flies for the season. Thus, relatively high populations were present in these fields during the study. Each site was established with strips of the following base treatments:

1. Conventional planting-time insecticide only
2. Conventional planting-time + 1 conventional postemergence insecticide
3. Conventional planting-time + Mustang Max
4. Untreated check

Each grower applied their preferred conventional planting-time insecticide in a strip for base treatment 1 and their choice of conventional + postemergence materials for base treatment 2 in a second strip. The remaining treatments (Mustang Max and the untreated check) were established as strips in all fields. Applications of Mustang Max were made on the same day in all fields. Treatment performance in providing root protection was measured (21 to 22 August, 2003) by rating ten roots in five zones within each field strip according to the criteria of the 0 to 9 rating scale of Campbell et al. (2000). Data were subjected to the general linear models (GLM) procedure in SAS. Treatment separations for root damage ratings were carried out using Fisher's protected Least Significant Difference (LSD) test. Duncan's multiple range test was used for analysis of yield data because the data was unbalanced due to the loss of one treatment at Field 3. In addition to within-field comparisons of individual treatments, data was also analyzed using each field site as a replicate to look for overall patterns in performance between the aforementioned base treatments.

Field 1 was planted on 2 May 2003. Counter 15G, applied at 11.5 lb product/ac was the planting-time insecticide treatment. The untreated strip was 24 rows wide. Postemergence applications of Mustang Max (4.0 oz product/ac) and Lorsban 4E (at 2 pt/A) were broadcast-applied by airplane in a spray volume of 5 GPA on 16 June, and the size of each strip was about 24 ac. This field was harvested on 10 October 2003, and three harvest samples were collected from each treatment.

Field 1 Results: Fly counts on the border of this field totaled 2,012 flies for the season. The conventional dual treatment (Counter 15G at planting + Lorsban 4E postemergence) had significantly lower root damage when compared to the check or other insecticides used at this site (Table 1). Counter alone and the dual treatment of Counter + Mustang Max did not provide a significant reduction in root injury when damage was compared to that of the untreated check plots.

Table 1. *Root feeding injury* in comparison of Mustang Max and Lorsban 4E as postemergence

rescue treatments to control sugarbeet root maggot larvae, St. Thomas, ND, 2003.

Treatment/form.	Placement	Rate (lb product/ac)	Rate (lb ai/ac)	Root injury (0-9)
Counter 15G + Lorsban 4E	B Broadcast	11.5 2 pt	1.7 1.0	4.88 b
Counter 15G + Mustang 0.8 EC	B Broadcast	11.5 4 oz	1.7	5.98 a
Counter 15G		11.5	1.7	5.98 a
Check	---	---	---	6.20 a
LSD (0.05)				0.58

Differences among treatments with regard to yield corresponded well with root injury data. The dual conventional treatment of Counter 15G + Lorsban 4E was superior to all other treatments in recoverable sucrose yield at this site (Table 2). Also, the conventional dual treatment using Lorsban 4E was statistically better than the treatment with Mustang Max as the postemergence treatment. in regards to root yield and percent sucrose.

Table 2. *Yield parameters* from comparison of Mustang Max and Lorsban 4E as postemergence rescue treatments to control sugarbeet root maggot larvae, St. Thomas, ND, 2003.

Treatment/form.	Placement	Rate (lb product/ac)	Rate (lb ai/ac)	Recoverable sucrose (lb/ac)	Root yield (T/ac)	Sucrose (%)
Counter 15G + Lorsban 4E	B Broadcast	11.5 2 pt	1.7 1.0	10656 a	28.8 a	18.55 ab
Counter 15G		11.5	1.7	9848 b	28.1 a	17.56 b
Counter 15G + Mustang 0.8 EC	B Broadcast	11.5 4 oz	1.7	9620 b	25.8 b	18.71 a
Check	---	---	---	8652 c	26.4 b	16.49 c
LSD (0.05)						

Field 2:

Counter 20CR was selected as the planting-time insecticide and it was applied at 8 lb product/ac. The untreated check plot was twenty-four rows wide. Thimet 20G was applied as the conventional postemergence treatment at a rate of 7 lb product/ac to 48 ac. The postemergence application of Mustang Max (4 oz/ac) was applied to a 50-ac strip using a band sprayer on 16 June. This field was harvested on 19 September 2003, harvesting four samples from each treatment and one sample from the untreated check.

Field 2 Results:

A total of 1,724 root maggot flies were captured on sticky-stakes throughout the season at this site. Results of root injury assessments (Table 3) indicate that comparable levels of root protection were achieved with Thimet 20G and Mustang Max, and that both treatments provided significant improvements in control when compared to the Counter 20CR (planting-time only) application as well as the Counter 20CR planting-time only treatment and the untreated check. Also, root injury in the planting-time only strip of Counter 20CR was significantly lower than the untreated check.

Table 3. *Root feeding injury* in comparison of Mustang Max and Thimet 20G as postemergence rescue treatments to control sugarbeet root maggot larvae, St. Thomas, ND, 2003.

Treatment/form.	Placement	Rate (lb product/ac)	Rate (lb ai/ac)	Root injury (0-9)
Counter 20CR + Thimet 20G	B B	8.0 7.0	1.6 1.4	3.98 c
Counter 20CR + Mustang 0.8 EC	B B	8.0 4.0 oz	1.6	4.06 c
Counter 20CR	B	8.0	1.6	4.74 b
Check				6.50 a
LSD (0.05)				0.52

Sugarbeet root yield was highest in plots that received either the conventional postemergence treatment of Thimet or Mustang, although those treatments were not significantly different from each other (Table 4). All insecticide-treated plots yielded significantly more recoverable sucrose and root yield than the untreated controls. Differences in percent sucrose, although typically difficult to detect in these types of experiments, were observed. For example, the conventional treatment of planting-time Counter 20CR + postemergence Thimet 20G produced beets with statistically higher percent sugar than the check. No further differences were detected at this field site.

Table 4. *Yield parameters* from comparison of Mustang Max and Thimet 20G as postemergence rescue treatments to control sugarbeet root maggot larvae, St. Thomas, ND, 2003.

Treatment/form.	Placement	Rate (lb product/ac)	Rate (lb ai/ac)	Recoverable sucrose (lb/ac)	Root yield (T/ac)	Sucrose (%)
Counter 20CR + Thimet 20G	B B	8.0 7.0	1.6 1.4	5273 a	15.9 a	16.60 a
Counter 20CR + Mustang 0.8 EC	B B	8.0 4.0 oz	1.6	4877 a	15.7 a	15.53 ab
Counter 20CR	B	8.0	1.6	4840 a	15.1 b	16.03 a
Check				4176 b	14.4 c	14.50 b
LSD (0.05)						

Field 3:

This field was planted on 16 May 2003, although the conventional planting-time treatment was Lorsban 15G at a rate of 13 lb product/ac. As with the other field sites, a 24-row untreated strip was established in Field 3. Mustang Max was applied at 4 oz/ac to a 25.3-ac strip and Lorsban 4E was applied at 2 pt/ac to the rest of the field on 16 June. The untreated strip was reduced to just 12 rows with this application. A ground-based band sprayer was used to apply all postemergence treatments at this site. This field was harvested on 15 October 2003, and three truckload samples were collected from treatment strips.

Field 3 Results:

A total of 1,568 flies were trapped on sticky-stakes along the border of this field during the season. In looking at the damage rating data, both chemical regimes resulted in significant reductions in root injury from the untreated check; however, the conventional program of planting-time Lorsban 15G + a postemergence application of Lorsban 4E was statistically better in providing root protection from maggot feeding injury than the Lorsban 15G + Mustang scheme (Table 5). This finding is especially surprising given the low root maggot pressure (4.78 in the check) that developed at this site.

Table 5. *Root feeding injury* in comparison of Mustang Max and Lorsban 4E as postemergence rescue treatments to control sugarbeet root maggot larvae, St. Thomas, ND, 2003.

Treatment/form.	Placement	Rate (lb product/ac)	Rate (lb ai/ac)	Root injury (0-9)
Lorsban 15G + Lorsban 4E	B B	13 2 pt	1.95 1.0	2.80 c
Lorsban 15G + Mustang 0.8EC	B B	13 4 oz	1.95	3.34 b
Check				4.78 a
LSD (0.05)				0.52

Despite major differences among treatments with regard to root injury, no statistically significant yield responses were observed among treatments at this site (Table 6). This is probably due to the relatively low root maggot feeding pressure that developed at this site in 2003.

Table 6. *Yield parameters* from comparison of Mustang Max and Lorsban 4E as postemergence rescue treatments to control sugarbeet root maggot larvae, St. Thomas, ND, 2003.

Treatment/form.	Placement	Rate (lb product/ac)	Rate (lb ai/ac)	Recoverable sucrose (lb/ac)	Root yield (T/ac)	Sucrose (%)
Lorsban 15G + Mustang 0.8EC	B B	13 4 oz	1.95	6720 a	18.5 a	19.33 a
Lorsban 15G + Lorsban 4E	B B	13 2 pt	1.95 1.0	6560 a	18.9 a	18.57 a
Check				5760 a	17.0 a	18.20 a
LSD (0.05)						

Combined Results:

Averaging the three fields together produced very interesting results (Table 7). All insecticide regimes, including the planting-time only treatment, resulted in significant reductions in root feeding injury as compared to that incurred by beets in the untreated check plots. Also, the Mustang-based plots had less root damage than the planting-time only plots; however, Mustang Max was again statistically outperformed by the conventional chemical regime.

Table 7. Overall r*oot feeding injury* in comparison of Mustang Max and conventional postemergence insecticides to control sugarbeet root maggot larvae, St. Thomas, ND, 2003.

Treatment/form.	Root injury (0-9)
Conventional planting-time + post	3.89 d
Conventional planting-time + Mustang 0.8EC	4.46 c
Conventional planting-time	5.36 b
Check	5.83 a

Yield data were just as striking as the root injury ratings; however, the separations did not follow the same pattern (Table 8). Interestingly, these overall data show that a conventional chemical regime is likely to produce statistically higher recoverable sucrose and tonnage yields than the Mustang-based program. Also, no statistically significant increase in total recoverable sucrose was achieved by applying postemergence Mustang Max when the treatment was compared with the planting-time only program.

These data suggest that postemergence applications of Mustang Max may not produce the desired results under high root maggot infestation levels. However, suppression of moderate to low populations appears to be achievable with this product.

Table 8. Overall *yield parameters* from comparison of Mustang Max and conventional postemergence insecticides for controlling sugarbeet root maggot larvae, St. Thomas, ND, 2003.

Treatment/form.	Recoverable sucrose (lb/ac)	Root yield (T/ac)	Sucrose (%)
Conventional planting-time + post	7274 a	20.7 a	17.78 a
Conventional planting-time	6986 ab	20.7 a	16.68 b
Conventional planting-time + Mustang Max 0.8EC	6853 b	19.6 b	17.62 a
Check	5994 c	18.8 b	16.21 b

Reference Cited:

Campbell, L. G., J. D. Eide, L. J. Smith, and G. A. Smith. 2000. Control of the sugarbeet root maggot with the fungus *Metarhizium anisopliae*. J. Sugarbeet Res. 37: 57–69.

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