AN EVALUATION OF SUGARBEET ROOT MAGGOT CONTROL AND PLANT HEALTH ASSOCIATED WITH INSECTICIDE, FUNGICIDE, AND STARTER FERTILIZER COMBINATIONS

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Introduction:

A common approach many sugarbeet producers use to save on input costs during the growing season is to combine pesticide and fertilizer applications into a single pass through the field, either during planting or after emergence of the crop. However, the impacts of such combinations on plant health or pest control efficacy are not always well understood, especially as new crop management materials enter the marketplace.

Several insect pests, including wireworms, springtails, white grubs, and the sugarbeet root maggot (SBRM), *Tetanops myopaeformis* (Röder) are annual threats to sugarbeet production in the Red River Valley (RRV) growing area. Sugarbeet producers typically manage these root-feeding pests by applying a prophylactic insecticide during sugarbeet planting. This at-plant protection usually involves a granular or sprayable liquid insecticide, insecticide-treated seed, or a combination thereof. In situations where there is moderate to high risk of damaging SBRM infestations, most producers also supplement the initial at-plant insecticide(s) with a postemergence granular or sprayable liquid insecticide application.

Fungicides are also frequently used in sugarbeet, but with the goal of managing soil-borne root diseases of sugarbeet such as Rhizoctonia damping off, as well as Rhizoctonia crown and root rot, which are all caused by the pathogen *Rhizoctonia solani* Kühn. Similar to the insecticides used to manage root-feeding insect pests, fungicides targeting Rhizoctonia management in sugarbeet also can be delivered as planting-time and/or early-season postemergence applications, and some are also formulated as fungicidal seed treatments.

Starter fertilizer is also used commonly at planting time by RRV sugarbeet producers. However, little is known about the crop safety of combining fertilizer and pesticide applications, or if they either complement or interfere with pesticide performance. If demonstrated as safe for the crop and at least neutral in impact on pest control performance, consolidating the delivery of these products into tank-mixed combinations or concurrent (i.e., single-pass) applications would provide major time savings and reduce application-associated input costs for sugarbeet growers.

The primary goal of this experiment was to evaluate the impact of multicomponent application systems on sugarbeet root maggot control. A secondary objective was to monitor for any potential symptoms of phytotoxic effects of the treatment combinations, including impacts on plant emergence and survival. Several treatment combinations, based on the following application groupings, were evaluated:

1) Counter 20G insecticide, banded at planting with a concurrently applied (i.e., at same time through a separate delivery system) dribble-in-furrow application of 10-34-0 starter fertilizer, with and without AZteroid (i.e., azoxystrobin) fungicide;

2) Mustang Maxx insecticide applied as a postemergence band in a tank mixture with Quadris (i.e., azoxystrobin) fungicide; and

3) Thimet 20G insecticide applied as a postemergence band with a concurrent, banded application of Quadris fungicide.

Materials and Methods:

This experiment was conducted in a commercial sugarbeet field site near St. Thomas in rural Pembina County, ND during the 2023 growing season. Plots were planted on May 31, 2023, and Betaseed 8018 CR+ glyphosate-and Cersospora leaf spot-resistant seed was used for all treatments. A 6-row Monosem NG Plus 4 7x7 planter, set to deliver seed at a depth of 1¼ inch and a rate of one seed every 4½ inches of row length, was used to plant the trial. Plots were six rows (22-inch spacing) wide by 35 ft long with the four centermost rows treated. The outer “guard” row on each side of the plot served as an untreated buffer. Thirty-five-foot tilled, plant-free alleys were maintained between replicates throughout the growing season. The experiment was arranged in a randomized complete block design with four replications. AZteroid fungicide was used for all treatments that included an at-plant fungicide, and Quadris was used in all treatments that included a postemergence fungicide. These two products were chosen for the experiment because they are commonly used azoxystrobin-based fungicides used by RRV producers for at-plant and postemergence root diseases, respectively, in the Red River Valley growing area.

Planting-time insecticide applications. Planting-time applications of Counter 20G were applied by using band (B) placement (Boetel et al. 2006), which consisted of 5-inch swaths of granules delivered through Gandy™ row banders. Granular application rates were regulated by using planter-mounted SmartBox™ electronic insecticide delivery system that had been calibrated on the planter before all applications.

Planting-time liquid spray applications were delivered by using dribble in-furrow (DIF) placement. Dribble in-furrow treatments were applied in a 3:2 gallon ratio of 10-34-0 starter fertilizer/water spray solution, and the applications were made by orienting microtubes (1/4" outside diam.) directly into the open seed furrows. An electric ball valve system, equipped with inline Teejet™ No. 24 orifice plates was used to propel spray output from the microtubes at a finished volume of five gallons per acre (GPA).

Postemergence insecticide applications. Additive postemergence insecticides applied in this trial included Mustang Maxx (active ingredient: zeta-cypermethrin) and Thimet 20G (active ingredient: phorate). Treatment combinations that included postemergence applications of Thimet and/or Quadris fungicide were applied on June 8, which was about two days after peak SBRM fly activity (i.e., "post-peak"). That timing is not recommended for applications of Thimet (recommended for 5-14 days pre-peak); however, the wet early-spring soil conditions that delayed planting operations in this experiment also led to unusually late plant emergence, thus delaying the postemergence fungicide/insecticide applications. Postemergence applications of Mustang Maxx insecticide and/or Quadris fungicide were also made on June 8 (i.e., 2d post-peak). Those applications were also carried out later than preferred, and for the same reasons. As such, and the timing of Mustang applications was also considered suboptimal for achieving good SBRM control.

Postemergence liquid treatments were delivered with a tractor-mounted CO_2-propelled spray system equipped with TeeJet™ XR 110015VS nozzles. The system was calibrated to deliver a finished output volume of 10 GPA. Postemergence granular insecticide output rates were regulated by using a SmartBox™ system mounted on a tractor-drawn four-row toolbar, and placement of insecticide in 4-inch bands was achieved by using Kinze™ row banders. Granules were incorporated into the soil by using two pairs of metal rotary tines that straddled each row. One pair of tines was positioned ahead of each bander, and a second pair was mounted behind it.

Plant stand counts: To determine treatment impacts on seedling emergence and survival throughout the growing season, surviving plant stands were counted on June 29 and July 5, 12, and 19, 2023 (i.e., 29, 35, 42, and 49 days after planting [DAP], respectively). Stand assessments involved counting all living plants within each 35-ft-long row. Raw stand counts were then converted to plants per 100 linear row feet for the analysis.

Root injury ratings: Sugarbeet root maggot feeding injury was assessed in this experiment on August 1, 2023. Sampling 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).

Harvest: Treatment performance was also compared on the basis of sugarbeet yield parameters. All plots were harvested on October 2, 2023. Foliage was removed from plots immediately before harvest by using a commercial-grade mechanical defoliator. All beets from the center two rows of each plot were extracted from soil 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 sucrose content and quality analysis.

Data analysis: All data from plant stand counts, root injury ratings, and harvest samples were subjected to analysis of variance (ANOVA) using the general linear models (GLM) procedure (SAS Institute, 2012), and treatment means were separated using Fisher's protected least significant difference (LSD) test at a 0.05 level of significance.

Results and Discussion:

The results from four counts of surviving plant stands are shown in Table 1. These data, as well as those involving SBRM larval feeding injury ratings and harvest results, should be interpreted with the aforementioned fact that unfavorable soil conditions prevented timely planting operations, which subsequently led to delayed applications of postemergence insecticides and fungicides. The most likely negative impact of those factors on these results was probably reduced efficacy of postemergence insecticides, because they could not be applied at an optimal interval ahead of peak SBRM fly activity to maximize control.

At the first stand count, which was carried out at 29 days after planting (29 DAP), the highest plant densities ranged between 120 and 146 plants per 100 linear row feet. Interestingly, the highest average stand count recorded during the first count was from the untreated check plots. Other treatments that resulted in comparable plant densities that were not significantly different from the check or each other included the following (listed in descending order of surviving stand):

1) Counter 20G (7.5 lb/ac, banded at planting);
2) Counter 20G (8.9 lb/ac, banded at planting);
3) Counter 20G (8.9 lb/ac, banded at planting) + Thimet 20G (7 lb product/ac, banded, 2d pre-peak) + Quadris (banded, 10 fl oz/ac, 2 d pre-peak)
4) Counter 20G (8.9 lb/ac, banded at planting) + Mustang Maxx (4 fl oz/ac, 2d post-peak); and
5) Counter 20G (8.9 lb/ac, banded at planting) + Thimet 20G (7 lb product/ac, banded, 2d pre-peak).

Table 1. ***Plant stand counts*** **from an evaluation of tank-mixed and concurrent applications of planting-time granular and liquid insecticides with starter fertilizer and azoxystrobin for sugarbeet root maggot control, St. Thomas, ND, 2023**

Treatment/form.[a]	Placement[b]	Rate (product/ ac)	Rate (lb a.i./ac)	Stand count[c] (plants / 100 ft)			
				29 DAP[c]	35 DAP[c]	42 DAP[c]	49 DAP[c]
Counter 20G	B	7.5 lb	1.5	141.3 ab	141.1 a	138.8 a	147.1 a
Counter 20G	B	8.9 lb	1.8	137.1 ab	137.5a	134.3 ab	139.8 ab
Check	-----	----	-----	145.9 a	137.9 a	133.4 abc	135.7 ab
Counter 20G + Thimet 20G + Quadris	B 4” Post B, 2 d Pre-peak 10” Post B	8.9 lb 7 lb 10 fl oz	1.8 1.4 0.17	126.3 abc	130.2 ab	133.2 abc	132.5 abc
Counter 20G + Mustang Maxx	B 10” Post B, 2 d Post-peak	8.9 lb 4 fl oz	1.8 0.025	129.3 abc	128.0 ab	123.0 a-d	127.3 a-d
Counter 20G + Thimet 20G	B 4” Post B, 2 d Pre-peak	8.9 lb 7 lb	1.8 1.4	121.4 a-d	121.8 abc	117.7 a-e	123.9 a-d
Counter 20G + 10-34-0	B DIF	8.9 lb 5 GPA	1.8	106.8 cde	105.2 bc	108.2 cde	117.5 bcd
Counter 20G + Mustang Maxx + Quadris	B 10” Post B, 2 d Post-peak	8.9 lb 4 fl oz 10 fl oz	1.8 0.025 0.17	115.9 b-e	114.5 abc	109.5 b-e	114.8 bcd
10-34-0 fertilizer check	DIF	5 GPA		104.8 cde	106.6 bc	106.6 de	114.5 bcd
Counter 20G + AZteroid FC+ 10-34-0	B DIF	7.5 lb 5.7 fl oz 5 GPA	1.5 0.0625	95.0 de	96.6 c	97.9 de	104.8 cd
Counter 20G + AZteroid FC+ 10-34-0	B DIF	8.9 lb 5.7 fl oz 5 GPA	1.8 0.0625	96.6 de	96.3 c	94.1 e	101.8 d
Counter 20G + 10-34-0	B DIF	7.5 lb 5 GPA	1.5	93.6 e	94.3 c	95.4 e	100.7 d
LSD (0.05)				27.3	27.9	26.0	27.8

Means within a column sharing a letter are not significantly (*P* = 0.05) different from each other (Fisher’s Protected LSD test).
[a]At-plant sprays were delivered in a 10-34-0 starter fertilizer/water carrier (3:2 gal. H_2O to fertilizer) at an output volume of 5 GPA.
[b]B = 5-inch at-plant band; Post B = postemergence band (i.e., 4-inch width for granular products; 10-inch width for sprayable liquid formulations); DIF = dribble in-furrow
[c]Surviving plant stands were counted on June 29, and July 5, 12, and 19, 2023 (i.e., 29, 35, 42, and 49 days after planting [DAP], respectively).

General patterns in the results from the first stand count indicated that treatment plots which contained significantly lower surviving plant stands than the untreated check at the first count were usually treated at planting time with either 10-34-0 starter fertilizer, Counter 20G at its high (8.9 lb product/ac) rate, and/or a planting-time combination of Counter 20G (either 7.5 or 8.9 lb product/ac) with a concurrently applied tank mixture of 10-34-0 and AZteroid fungicide.

The same patterns with regard to surviving plant stands continued through all four counts, although by 49 DAP, stand losses associated with SBRM feeding injury were slightly more apparent. As a result, there were fewer significant differences among treatments. However, the above-listed treatments, including the untreated check, continued to maintain the highest stand counts in the experiment.

At every stand count, plots that received a planting-time application of Counter 20G at its moderate rate (7.5 lb product/ac) and a concurrent application of 10-34-0 starter fertilizer had significantly lower plant stands than similar Counter-treated plots where the starter fertilizer was excluded.

Similarly, at all four stand counts conducted in this experiment, there was a significant stand reduction at in plots treated with concurrent applications of Counter 20G insecticide and the tank mixture of 10-34-0 starter fertilizer and AZteroid fungicide in comparison to similar plots that did not receive the fertilizer/fungicide combination. That was the case regardless of whether Counter was applied at 7.5 or 8.9 lb product per acre.

In the last series of stand counts, which were conducted on July 19 (49 DAP), the highest overall stand counts were recorded in plots that treated solely with a planting-time application of Counter 20G at its moderate (7.5 lb product/ac) rate. However, excellent stands were also maintained in several other treatments, including the following that had surviving plant stands that were not statistically different from the single, 7.5-lb rate of Counter 20G (listed in descending order of mean surviving plant stand):

1) Counter 20G (8.9 lb/ac, banded at planting);
2) Untreated check;
3) Counter 20G (8.9 lb/ac, banded at planting) + Thimet 20G (7 lb product/ac, banded, 2d post-peak) + Quadris (banded, 10 fl oz/ac, 2 d post-peak);
4) Counter 20G (8.9 lb/ac, banded at planting) + Mustang Maxx (4 fl oz/ac, 2d after peak fly); and
5) Counter 20G (8.9 lb/ac, banded at planting) + Thimet 20G (7 lb product/ac, banded, 2d post-peak);

The treatment combinations involving Counter 20G and a concurrent at-plant application of AZteroid, which was tank mixed with 10-34-0 starter fertilizer, were the only insecticide treatments in which stand counts at 49 DAP were significantly reduced when compared to that recorded in plots treated with the stand-alone planting-time application of Counter 20G (8.9 lb product/ac). This finding was consistent, regardless of whether the Counter 20G was applied at the 7.5- or 8.9-lb rate.

Sugarbeet root maggot feeding injury results from this trial appear in Table 2. The average SBRM feeding injury sustained in the true untreated check and the fertilizer-only check plots (5.45 and 5.90, respectively, on the 0 to 9 scale of Campbell et al. [2000]) indicated the presence of a moderate SBRM larval infestation for the experiment. All insecticide-treated entries in the trial provided significant reductions in SBRM feeding injury when compared to the untreated check and the fertilizer-only check. The lowest average SBRM feeding injury (i.e., the highest level of root protection) was observed in plots that received the combination of a planting-time application of Counter 20G at its high labeled rate (8.9 lb product/ac) plus a postemergence application of Thimet 20G.

However, because only a moderate SBRM infestation developed for this trial, there were very few significant differences among treatments that included an insecticide. One unusual and concerning result involved the treatment combination of Counter 20G at its high (8.9 lb product/ac) rate when it was accompanied by a concurrent application of AZteroid fungicide tank mixed with 10-34-0 starter fertilizer. Root maggot feeding injury sustained by plants in this treatment (mean rating = 3.98) was significantly greater than the injury in similar (i.e., Counter, AZteroid, and 10-34-0) plots when the Counter was applied at 7.5 lb/ac (mean rating = 3.18). Additionally, roots in the plots that received the treatment combination of Counter 20G (8.9 lb) plus a concurrent tank-mixed application of AZteroid and 10-34-0 incurred significantly greater SBRM feeding injury than those in similar plots when the AZteroid was excluded. This finding could suggest potential antagonistic impacts from the fungicide. As such, this phenomenon should be investigated further.

Root protection from SBRM feeding injury was not significantly impaired by including concurrent dribble-in-furrow applications of 10-34-0 starter fertilizer with banded applications of Counter 20G at planting time, irrespective of whether the insecticide was applied at 7.5 or 8.9 lb product per acre. There also were no significant reductions in SBRM control when Quadris was applied concurrently with Thimet 20G applications or when it was tank mixed with Mustang Maxx.

Table 2. *Larval feeding injury* from an evaluation of tank-mixed and concurrent applications of planting-time granular and liquid insecticides with starter fertilizer and azoxystrobin for sugarbeet root maggot control, St. Thomas, ND, 2023

Treatment/form.[a]	Placement[b]	Rate (product/ac)	Rate (lb a.i./ac)	Root injury (0-9)
Counter 20G + Thimet 20G	B 4” Post B, 2 d Pre-peak	8.9 lb 7 lb	1.8 1.4	2.65 d
Counter 20G + 10-34-0	B DIF	7.5 lb 5 GPA	1.5	2.95 cd
Counter 20G + Mustang Maxx + Quadris	B 10” Post B, 2 d Post-peak	8.9 lb 4 fl oz 10 fl oz	1.8 0.025 0.17	2.95 cd
Counter 20G + Thimet 20G + Quadris	B 4” Post B, 2 d Pre-peak 10” Post B	8.9 lb 7 lb 10 fl oz	1.8 1.4 0.17	2.95 cd
Counter 20G + Mustang Maxx	B 10” Post B, 2 d Post-peak	8.9 lb 4 fl oz	1.8 0.025	2.98 cd
Counter 20G + 10-34-0	B DIF	8.9 lb 5 GPA	1.8	2.98 cd
Counter 20G + AZteroid FC+ 10-34-0	B DIF	7.5 lb 5.7 fl oz 5 GPA	1.5 0.0625	3.18 cd
Counter 20G	B	8.9 lb	1.8	3.20 cd
Counter 20G	B	7.5 lb	1.5	3.48 bc
Counter 20G + AZteroid FC+ 10-34-0	B DIF	8.9 lb 5.7 fl oz 5 GPA	1.8 0.0625	3.98 b
Check	-----	----	-----	5.45 a
Fertilizer check	DIF	5 GPA		5.90 a
LSD (0.05)				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]At-plant sprays were delivered in a 10-34-0 starter fertilizer/water carrier (3:2 gal. H_2O to fertilizer) at an output volume of 5 GPA.
[b]B = 5-inch at-plant band; Post B = postemergence band (i.e., 4-inch width for granular products; 10-inch width for sprayable liquid formulations); DIF = dribble in-furrow

Yield data from this experiment are presented in Table 3. Overall performance patterns observed in relation to recoverable sucrose yield and root tonnage indicated that postemergence applications of either Thimet 20G or Mustang Maxx performed slightly better than those that lacked a post-applied insecticide. Another distinct pattern observed was that average recoverable sucrose yields and root yields from treatments that included either 10-34-0 starter fertilizer or a combination of the fertilizer and AZteroid fungicide were all numerically lower than that of the untreated check plots, although the differences were rarely significant. One notable and concerning exception was the treatment combination of Counter 20G at its high (8.9 lb product/ac) rate when it was accompanied by a concurrent application of AZteroid fungicide that was tank mixed with 10-34-0 starter fertilizer. Plots treated with that combination produced significantly lower sucrose and root yields than those treated solely with Counter 20G (i.e., at either 7.5 or 8.9 lb product/ac) and even the untreated check, which further suggests either phytotoxic impacts of the insecticide/fungicide/fertilizer combination on plant health or antagonistic impacts on the insecticidal activity of Counter 20G.

Other patterns in the yield results of this experiment could also provide cause for concern. For example, when Mustang Maxx was used for postemergence SBRM control, tank mixing the insecticide with Quadris fungicide resulted in numerical reductions in recoverable sucrose yield (938.6-lb loss) and root tonnage (2.3-ton loss) when compared to similar plots that lacked the fungicide, although the yield differences were not statistically significant. Similarly, applying Quadris fungicide concurrently to the application of Thimet 20G resulted in numerical reductions in recoverable sucrose yield and root tonnage, which translated to an $88/ac reduction in gross revenue when compared with a similar treatment combination that excluded the Quadris application, even though the yield differences were not significant.

Table 3. ***Sugarbeet yield parameters and gross economic return*** **from an evaluation of tank-mixed and concurrent applications of planting-time granular and liquid insecticides with starter fertilizer and azoxystrobin for sugarbeet root maggot control, St. Thomas, ND, 2023**

Treatment/form.[a]	Placement[b]	Rate (product/ac)	Rate (lb a.i./ac)	Sucrose yield (lb/ac)	Root yield (T/ac)	Sucrose (%)	Gross return ($/ac)
Counter 20G + Mustang Maxx	B 10” Post B, 2 d Post-peak	8.9 lb 4 fl oz	1.8 0.025	10,711.6 a	36.5 a	15.83 a	2,392
Counter 20G	B	7.5 lb	1.5	10,137.8 ab	34.1 ab	15.92 a	2,294
Counter 20G + Thimet 20G	B 4” Post B, 2 d Pre-peak	8.9 lb 7 lb	1.8 1.4	10,119.1 ab	33.9 abc	16.15 a	2,303
Counter 20G + Thimet 20G + Quadris	B 4” Post B, 2 d Pre-peak 10” Post B	8.9 lb 7 lb 10 fl oz	1.8 1.4 0.17	10,089.6 ab	34.9 ab	15.66 a	2,215
Counter 20G	B	8.9 lb	1.8	9,938.8 abc	34.8 ab	15.50 a	2,145
Counter 20G + Mustang Maxx + Quadris	B 10” Post B, 2 d Post-peak	8.9 lb 4 fl oz 10 fl oz	1.8 0.025 0.17	9,773.0 abc	34.2 ab	15.57 a	2,117
Check	-----	----	-----	9,466.6 abc	31.4 a-d	16.04 a	2,181
Counter 20G + AZteroid FC+ 10-34-0	B DIF	7.5 lb 5.7 fl oz 5 GPA	1.5 0.0625	8,870.5 bcd	30.0 bcd	15.67 a	1,996
Counter 20G + 10-34-0	B DIF	8.9 lb 5 GPA	1.8	8,866.5 bcd	29.9 bcd	15.92 a	2,005
Counter 20G + 10-34-0	B DIF	7.5 lb 5 GPA	1.5	8,631.2 bcd	29.3 bcd	15.67 a	1,935
Fertilizer check	DIF	5 GPA		8,343.2 cd	28.3 cd	15.83 a	1,870
Counter 20G + AZteroid FC+ 10-34-0	B DIF	8.9 lb 5.7 fl oz 5 GPA	1.8 0.0625	7,498.8 d	25.9 d	15.59 a	1,645
LSD (0.05)				1,667.0	5.7	NS	

Means within a column sharing a letter are not significantly (P = 0.05) different from each other (Fisher’s Protected LSD test).
[a]At-plant sprays were delivered in a 10-34-0 starter fertilizer/water carrier (3:2 gal. H_2O to fertilizer) at an output volume of 5 GPA.
[b]B = 5-inch at-plant band; Post B = postemergence band (i.e., 4-inch width for granular products; 10-inch width for sprayable liquid formulations); DIF = dribble in-furrow

The overall findings of this experiment suggest that combining a dribble-in-furrow application of 10-34-0 starter fertilizer with a concurrently applied planting-time banded application of Counter 20G will likely be safer if the insecticide is applied at a reduced rate of 7.5 lb/ac or lower. These findings further suggest that applying Counter at higher rates in such combinations could pose significant risk of reduced plant populations and corresponding yield and revenue losses. Additionally, the observations of numerical, and occasionally significant, root protection and yield impacts associated with applying azoxystrobin fungicide/10-34-0 starter fertilizer tank mixtures concurrently with planting-time tank applications of Counter 20G in sugarbeet are also concerning. Those trends also involved the maximum labeled rate (8.9 lb/ac) of Counter insecticide.

Similarly, these findings also suggested the possibility of deleterious impacts on yield and revenue occurring when applying azoxystrobin fungicide concurrently with postemergence banded applications of Thimet 20G or tank mixing the fungicide with Mustang Maxx. Therefore, research on concurrent and tank-mixed applications of these or similar treatment combinations should be further explored. Additional study should also include evaluating starter fertilizer products with alternative NPK concentrations.

Finally, it bears noting that this trial was conducted in an environment that involved a moderate SBRM infestation. The net impacts of the treatment combinations tested should also be evaluated under low SBRM pressure and probably in its absence to more fully understand the crop safety of these treatment combinations.

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