TANK MIXING ROUNDUP POWERMAX AND QUADRIS WITH FOLIAR LIQUID INSECTICIDES: IMPACTS ON SUGARBEET YIELD

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Introduction:

The recent development of Roundup Ready (i.e., glyphosate-resistant) sugarbeet, coupled with increasing fuel costs for making pesticide applications, have prompted producer interest in combining more than one pesticide application into single tank mixtures. This project involved two experiments to achieve the following objectives: 1) to assess the impacts of combining either Lorsban Advanced or Vydate C-LV liquid insecticide with Roundup herbicide on plant health and associated yield and revenue; and 2) to determine if three-product tank mixtures, comprised of Roundup PowerMax herbicide, Lorsban Advanced insecticide, and Quadris fungicide can be applied to sugarbeet without causing deleterious effects on yield parameters and associated economic return.

Materials and Methods:

Methods common to both studies: 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. Betaseed 87RR38 (glyphosate-resistant) seed was used for all plots in both experiments. Treatments were arranged in a randomized complete block design with four replications. Yield data were collected by harvesting both rows of each plot with a 2-row mechanical harvester. Subsamples of 12-18 harvested beets were sent to the American Crystal Sugarbeet Tare Laboratory (East Grand Forks, MN) for quality analyses. All data was subjected to analysis of variance (ANOVA) using the general linear models (GLM) procedure (SAS Institute, 2008), and treatment means were compared using Fisher's protected least significant difference (LSD) test at a 0.05 level of significance.

Study I methods: This experiment was planted on 27 May at the NDSU Prosper Research Farm near Prosper, ND. Each plot was established with one pass of the 6-row planter, but treatment applications and evaluations were conducted on the four inner rows of each plot. The outer rows of each plot served as a buffer between adjacent plots. All plots, including the check, received a planting-time application of Counter 15G at a low (5.9 lb product /ac) rate in 5-inch bands to prevent unwanted impacts from secondary pests such as springtails, wireworms, or white grubs. In addition to the untreated check, which was hand-weeded and did not receive Roundup, the study also included a Roundup-only control. This preventative application was made because the focus of the experiment was on impacts of the tank-mixed postemergence combinations.

Insecticides in Study I included Lorsban Advanced (either 1 or 2 pts product/ac) and the ***experimental*** (i.e., unregistered in sugarbeet) insecticide Vydate C-VL (17 or 34 fl oz product/ac), and each was applied either alone or as a tankmixed combination with Roundup PowerMax at 1 qt/ac. All entries treated with Roundup also included dry ammonium sulfate (AMS) at a rate of 4 lb product/100 gal of spray solution, and an AMS control was included for comparative purposes to monitor for yield impacts from the adjuvant. All postemergence treatments were broadcast-applied on 24 June by using a tractor-mounted CO_2 spray system that delivered a finished spray volume of 10 GPA using TeeJet 11002VS nozzles. This study was harvested on 22 September, 2010.

Study II methods: This experiment was planted on 2 June at a field site near Moorhead, MN. Each plot was established with one pass of the planter, but treatment applications and evaluations were conducted on the four inner rows of each plot. The outer rows of each plot served as a buffer between adjacent plots. All plots, including the untreated check, received a planting-time application of Counter 20G at its low (5.9 lb product /ac) rate in 5-inch bands to prevent unwanted impacts from soil-dwelling pests such as springtails, wireworms, or white grubs. In addition to the untreated check, which was hand-weeded and did not receive Roundup, the study also included a Roundup PowerMax-only control. This preventative application was made because the focus of the experiment was on impacts of the tank-mixed postemergence combinations.

Insecticides in Study II included Lorsban Advanced (either 1 or 2 pts product/ac) and Mustang Max at its highest labeled rate (4 oz/ac). The fungicide used in this study was Quadris, and all entries assigned to receive this material were treated at its recommended rate of 9 fl oz/ac. All spray treatments were broadcast-applied on 9 July by using a tractor-mounted CO_2 spray system that delivered a finished spray volume of 10 GPA using TeeJet 11002VS nozzles. This study was harvested on 5 October, 2010.

Results and Discussion:

One concern from this trial was that some sprayer screens collected a whitish precipitate during mixing and application of tank-mixed combinations that included Lorsban Advanced. That phenomenon was not observed when the 4E formulation of Lorsban was used in previous testing. This will be examined further in future research.

The results of yield and economic return comparisons for Study I are presented in Table 1. There were no significant differences between treatments with regard to any of the yield parameters measured; however, slight numerical increases in recoverable sucrose yield and root tonnage were observed with all chemically treated plots, irrespective of whether they were single-material applications or tank mixtures. There were no consistent trends toward yield or revenue loss associated with application rates or tank-mixed combinations of Roundup herbicide with either of the insecticides. In fact, slight numerical increases in recoverable sucrose yield and root yield were most evident with Roundup/Vydate and Roundup/Lorsban Advanced combinations.

Overall the results of Study I indicate that there appear to be no negative impacts on recoverable sucrose yield, sugarbeet root yield, or gross economic return from tank-mixed foliar sprays comprised of Roundup PowerMax and either Lorsban Advanced or Vydate C-LV insecticides. This supports our previous findings of no significant impacts (i.e., positive or negative) on sugarbeet yield parameters or economic return values from similar tank mixtures that involved Lorsban 4E and Vydate C-LV (Boetel et al. 2010).

Table 1. Sugarbeet yield and quality impacts from tankmixed spray combinations containing Roundup PowerMax herbicide and postemergence liquid insecticides in the absence of insect pest pressure (Study I), Prosper, ND, 2010

Treatment/form.	Rate (product/ac)	Rate (lb a.i. or a.e./ac)	Sucrose yield (lb/ac)	Root yield (T/ac)	Sucrose (%)	Gross return ($/ac)
Vydate C-LV + Roundup PowerMax	34 fl oz 32 fl oz	1.0 a.i. 1.13 a.e.	6793 a	25.4 a	14.95 a	863
Vydate C-LV + Roundup PowerMax	17 fl oz 32 fl oz	0.5 a.i. 1.13 a.e.	6724 a	25.1 a	14.98 a	858
Lorsban Advanced + Roundup PowerMax	2 pts 32 fl oz	1.0 a.i. 1.13 a.e.	6690 a	25.2 a	14.85 a	840
Vydate C-LV	17 fl oz	0.5	6609 a	24.5 a	15.03 a	849
Lorsban Advanced	2 pts	1.0 a.i.	6595 a	24.8 a	14.75 a	831
Lorsban Advanced	1 pt	0.5 a.i.	6585 a	24.3 a	15.08 a	856
Vydate C-LV	34 fl oz	1.0 a.i.	6584 a	24.6 a	14.98 a	838
Roundup PowerMax	32 fl oz	1.13 a.e.	6535 a	24.7 a	14.80 a	816
Lorsban Advanced + Roundup PowerMax	1 pt 32 fl oz	0.5 a.i. 1.13 a.e.	6349 a	24.8 a	14.40 a	756
Check	----	-----	6325 a	24.1 a	14.73 a	780
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).

Results from the analyses of harvest parameters for Study II are listed in Table 2. Overall, there were no significant impacts, either negative or positive, on recoverable sucrose yield, sugarbeet root tonnage, or percent sucrose from the treatments in this experiment. No consistently strong trends were evident in relation to specific types of tank mixtures of the materials used in this trial, but the combination treatments tended to produce slightly higher recoverable sucrose and root tonnage than single-material applications. For example, some of the lowest yields in the experiment occurred in plots treated with single treatments of Lorsban Advanced insecticide (1 pt/ac), Roundup PowerMax herbicide (16 and 32 fl oz/ac), and Quadris fungicide, whereas some of the highest yields were from two- and three-product tank mixtures.

One encouraging trend was that, although not statistically significant, all of the three-product tank mixture treatments in this study produced numerically greater recoverable sucrose yields than the untreated check plots. Similarly, single-product sprays of Roundup PowerMax (16 fl oz/ac), Lorsban Advanced (1 pt/ac), and Quadris tended to result in slightly less recoverable sucrose yield than either higher rates of single-product entries or 2- and 3-product tank mixtures.

Table 2. Sugarbeet yield and quality impacts from tankmixed spray combinations containing Quadris fungicide, Roundup PowerMax herbicide, and postemergence liquid insecticides in the absence of insect pest pressure (Study II), Moorhead MN, 2010

Treatment/form.[a]	Rate (product/ac)	Rate (lb a.i. or a.e./ac)	Sucrose yield (lb/ac)	Root yield (T/ac)	Sucrose (%)	Gross return ($/ac)
Lorsban Advanced + Roundup PowerMax	1 pt 16 fl oz	0.5 a.i. 0.56 a.e.	6675 a	21.1 a	17.13 a	1042
AMS Check	4 lb/100 gal	-----	6645 a	21.7 a	16.78 a	1002
MustangMax 0.8EC + Roundup PowerMax + Quadris	4 fl oz 32 fl oz 15.4 fl oz	0.025 a.i. 1.13 a.e. 0.25 a.i.	6630 a	21.0 a	17.13 a	1035
Lorsban Advanced + Quadris	2 pts 15.4 fl oz	1.0 a.i. 0.25	6627 a	21.6 a	16.83 a	1001
Roundup PowerMax + Quadris	32 fl oz 15.4 fl oz	1.13 a.e. 0.25 a.i.	6572 a	21.1 a	16.95 a	1012
Lorsban Advanced + Quadris	1 pt 15.4 fl oz	0.5 a.i. 0.25 a.i.	6427 a	21.4 a	16.65 a	948
Lorsban Advanced + Roundup PowerMax + Quadris	2 pts 32 fl oz 15.4 fl oz	1.0 a.i. 1.13 a.e. 0.25 a.i.	6424 a	20.5 a	17.10 a	994
Lorsban Advanced	2 pts	1.0 a.i.	6414 a	20.2 a	17.20 a	1007
Lorsban Advanced + Roundup PowerMax + Quadris	1 pt 16 fl oz 15.4 fl oz	0.5 a.i. 0.56 a.e. 0.25 a.i.	6399 a	21.5 a	16.53 a	936
Check	----	-----	6313 a	20.2 a	17.05 a	974
Roundup PowerMax	32 fl oz	1.13 a.e.	6217 a	20.3 a	16.75 a	941
Lorsban Advanced + Roundup PowerMax	2 pts 32 fl oz	1.0 a.i. 1.13 a.e.	6204 a	20.6 a	16.68 a	922
Roundup PowerMax + Quadris	16 fl oz 15.4 fl oz	0.56 a.e. 0.25 a.i.	6192 a	20.9 a	16.58 a	901
MustangMax 0.8EC + Roundup PowerMax	4 fl oz 32 fl oz	0.025 a.i. 1.13 a.e.	6152 a	19.6 a	17.08 a	952
Roundup PowerMax	16 fl oz	0.56 a.e.	6078 a	19.6 a	16.93 a	928
Lorsban Advanced	1 pt	0.5 a.i.	6074 a	20.3 a	16.55 a	896
Quadris	15.4 fl oz	0.25 a.i.	6034 a	19.3 a	17.10 a	933
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] Dry ammonium sulfate was added at a rate of 4 lb/100 gallons of spray solution to all treatments that contained Roundup PowerMax herbicide.

Another positive finding was that, although not statistically significant, adding Quadris fungicide resulted in numerically higher recoverable sucrose yields than when it was omitted from the following combinations: 1) Mustang Max + Roundup PowerMax (32 fl oz/ac); and 2) Lorsban Advanced (2 pt/ac) + Roundup PowerMax (32 fl oz/ac). Similarly, adding Quadris to either 1- or 2-pt applications of Lorsban Advanced provided numerically more recoverable sucrose yield than that recorded for the Lorsban-only treatments.

Although no significant differences were detected between any pair of treatments in this experiment, one comparison raises some concern. The two-product tank mixture comprised of Lorsban Advanced and Roundup PowerMax appeared to be safer when these materials were used at their respective lower labeled rates of 1 pt and 16 fl oz product/ac. Plots treated with the combination of these products at these lower rates averaged 471 lb/ac more recoverable sucrose yield and generated $120/ac more gross revenue than when the materials were applied in a tank mixture comprised of 2 pts and 32 fl oz/ac, respectively. We must stress that these differences cannot be declared statistically significant; however, a revenue disparity of $120/ac would obviously be considered a major loss from a

grower's perspective. It should be pointed out that this nonsignificant difference could be an anomaly, because the three-product tank mixture that included high rates of both Lorsban Advanced and Roundup PowerMax, combined with Quadris fungicide actually produced slight increases in recoverable sucrose yield and an average of $58/ac more revenue than when these same three materials were mixed using the lower rates of Lorsban and Roundup.

Until more research can be carried out to more fully characterize and quantify the impacts of these combinations on sugarbeet plant health and yield parameters, growers desiring to apply tank mixtures containing both Lorsban Advanced and Roundup PowerMax to Roundup Ready sugarbeet are advised to use the lower rate of at least one of the materials in the mixture. Reducing the rate of just one of the products may be sufficient to prevent yield loss, but more research is needed to confirm that contention. One way to decide which material to apply at a reduced rate would be to prioritize which pest (i.e., weed[s] or insect) requires the most product strength at the time of the application, and the decision should probably be based biological factors such as pest developmental stage or severity and performance in previous testing.

The overriding theme of the findings from both Study I and Study II is that there were no statistically significant impacts, either negative or positive, from any of the insecticide/herbicide or insecticide/herbicide/ fungicide tank mixtures evaluated. Although a general lack of statistical differences is rarely preferred in research on crop protection chemicals, our findings of no differences between single and tank-mixed combinations in this experiment are very encouraging, and suggest that growers can save time and application costs by combining up to three of the crop protection chemicals we tested into a single pass across their fields.

Although applying these materials in the absence of pest pressure resulted in slight numerical increases in yields when compared with untreated controls, we do not endorse applying pesticides without pest infestations to justify their use. Such practices contradict one of the long-standing fundamental tenets of pest management, which states that a pesticide (e.g., fungicide, insecticide, or herbicide) should only be used when pest populations are expected to otherwise reach economically significant levels. This research should be continued on similar tank-mixed combinations to determine the repeatability of these very encouraging results.

References Cited:

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