ULTRA BLAZER SECTION 18 EMERGENCY EXEMPTION AND SUPPORTING EXPERIMENTS

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Summary

1. Ninety-three percent of respondents indicated the emergency exemption was beneficial for sugarbeet producers in Minnesota and North Dakota and contributed to overall weed management in 2022.
2. Eighty-nine percent of respondents indicated they would willingly support application for a 2023 emergency exemption in sugarbeet.
3. Roundup PowerMax3 mixed with Ultra Blazer reduced root yield as compared with repeat Roundup PowerMax3 applications or Ultra Blazer alone.
4. Apply Ultra Blazer at 20 gpa water carrier to optimize waterhemp control and/or use Turbo TeeJet Duo nozzles.

Introduction

The Environmental Protection Agency (EPA) approved our request for a Section 18 emergency exemption for Ultra Blazer (acifluorfen) which provided Minnesota and eastern North Dakota sugarbeet growers a postemergence herbicide to control glyphosate-resistant waterhemp in sugarbeet in 2022. The 2022 growing season was challenging for row crops producers, including sugarbeet producers, in Minnesota and North Dakota for several reasons. First, the calendar date for sugarbeet planting was delayed by cold and wet weather in April and early May. The average plant date was May 25, May 26, and May 19 for American Crystal Sugar Cooperative (ACS), Minn-Dak Farmers' Cooperative (MDFC), and Southern Minnesota Beet Sugar Cooperative (SMBSC) growers, respectively. Second, rainfall after planting to incorporate soil-residual herbicides commonly used for waterhemp control ranged from 1-inch to 5-inches below normal in June and July in the sugarbeet growing region south of Grand Forks, MN and into southwest and southcentral Minnesota. Lack of timely rainfall was widespread, especially in the SMBSC region. Finally, waterhemp emerging at or before sugarbeet emergence has historically caused the greatest loss of yield. Less than normal rainfall in April and May reduced the efficacy of preemergence (PRE), early postemergence (EPOST), and postemergence (POST) applied soil-residual herbicides. With the discontinuance of Betamix, there are currently no registered POST herbicides for effective waterhemp control that survives soil-residual herbicide treatments.

The exemption allowed a single Ultra Blazer application at 16 fluid ounces per acre per year. A Section 18 exemption under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) authorizes EPA to allow an unregistered use of a pesticide for a limited time if EPA determines that an emergency condition exists. This paper summarizes the Ultra Blazer Section 18 emergency exemption including application parameters and results of a survey of sugarbeet growers who applied Ultra Blazer. This report contains three 2022 program objectives: a) summarize results and user experiences from the 2022 Section 18 emergency exemption for use of Ultra Blazer in sugarbeet; b) summarize the crop tolerance experiment; and c) summarize the spray quality experiment.

Materials and Methods

Section 18 Emergency Exemption

Ultra Blazer was applied at 16 fl oz/A with non-ionic surfactant (NIS) or mixed with glyphosate and ammonium sulfate (AMS). One Ultra Blazer application was made per season using ground application equipment at 10 to 20 gpa water carrier targeting waterhemp less than 4-inches tall and sugarbeet greater than the 6-lf stage. Pre-harvest interval (PHI) was 45 days and Ultra Blazer was applied from April 28 through July 29, 2022.

Application of Ultra Blazer was targeted to air temperatures less than 85°F to reduce injury in sugarbeet. Likewise, producers were informed that sugarbeet injury may be greater following sudden changes from a cool, cloudy environment to a hot, sunny environment. On days when air temperature was greater than 85°F, we recommended delaying application until late afternoon or early evening or when air temperatures began to decrease.

Producers and agriculturalists at Southern Minnesota Beet Sugar Coop, Minn-Dak Farmers Coop, and American Crystal Sugar Coop were surveyed by electronic mail to learn about producer experiences with Ultra Blazer (Appendix).

Sugarbeet Tolerance

Experiments conducted near Crookston, Hendrum, Nashua, Lake Lillian, and Murdock, MN in 2022 evaluated sugarbeet tolerance from Ultra Blazer alone or mixed with glyphosate (Roundup PowerMax3). The experimental area was prepared for planting by applying the appropriate fertilizer and tillage. Sugarbeet was seeded in 22-inch rows at about 62,000 seeds per acre with 4.6 inch spacing between seeds. Treatments shown in Table 1 were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO_2 at 40 psi to the center four rows of six row plots 40 feet in length. Environmental conditions at application are in Table 2.

Table 1. Herbicide treatment, herbicide rate, and application timing across locations in 2022.

Herbicide Treatment	Rate (fl oz/A)	Application timing (SGBT leaf stage)
Ultra Blazer + Prefer 90 NIS	16 + 0.25%	6-8 lf
Ultra Blazer + Prefer 90 NIS / Ultra Blazer + Prefer 90 NIS	12 + 0.125% / 12 + 0.125 %	6-8 lf / A + 7-day
Ultra Blazer + Crop Oil Concentrate	16 + 0.25%	6-8 lf
Roundup PowerMax3 + Ultra Blazer + Amsol Liquid AMS	25 + 16 + 2.5% v/v	6-8 lf
Roundup PowerMax3 + Ultra Blazer + Prefer 90 NIS + Amsol Liquid AMS	25 + 16 + 0.25% + 2.5% v/v	6-8 lf
Roundup PowerMax3 + Prefer 90 NIS + Amsol Liquid AMS / Roundup PowerMax3 + Prefer 90 NIS + Amsol Liquid AMS	25 + 0.25% + 2.5% v/v / 25 + 0.25% + 2.5% v/v	2 lf / 6 lf

Table 2. Environmental application information.

	Crookston	Hendrum	Murdock	Lake Lillian
Date	June 24	July 5	June 22	June 22
Time of Day	10:00 AM	1:00 PM	6:00 AM	4:00 PM
Air Temperature (F)	80	73	-	84
Relative Humidity (%)	57	67	29	29
Wind Velocity (mph)	15	4	6	9
Wind Direction	NNW	NNE	NW	W
Soil Temp. (F at 6”)	70	-	74	-
Soil Moisture	Fair	Dry	Dry	Dry
Cloud Cover (%)	100	100	10	10

Visible sugarbeet necrosis, malformation, and growth reduction were evaluated approximately 7 and 14 days after treatment (DAT) as sugarbeet injury using a 0 to 100% injury scale with 0% denoting no sugarbeet injury and 100% denoting complete loss of sugarbeet stature. All evaluations were a visual estimate of injury in the four treated rows compared with the adjacent, two-row, untreated strip.

At harvest, sugarbeet was defoliated, harvested mechanically from the center two rows of each plot, and weighed. A root sample (about 20 lbs) was collected from each plot and analyzed for sucrose content and sugar loss to molasses by American Crystal Sugar Company (East Grand Forks, MN). Experimental design was a randomized complete block with six replications. Data were analyzed in this report as a RCBD with the ANOVA procedure of ARM, version 2022.5 software package.

Waterhemp Control as Influenced by Carrrier Volume and Nozzle Selection

Experiments conducted near Blomkest and Moorhead, MN and Hickson, ND in 2022 evaluated sugarbeet tolerance, waterhemp control, and spray coverage from Ultra Blazer mixed with crop oil concentrate. The experimental area was prepared for planting by applying the appropriate fertilizer and tillage. Sugarbeet was seeded in 22-inch rows at about 62,000 seeds per acre with 4.6 inch spacing between seeds. Treatments were applied with a bicycle sprayer in

15 or 20 gpa spray solution through various spray nozzles (Table 3) pressurized with CO_2 at 40 psi to the center four rows, of six row plots, 40 feet in length.

Table 3. Spray nozzles, nozzle size, spray pressure and resultant droplet size.

Nozzle	Size	Spray Pressure (psi)	Droplet Size
XR	XR 110002	40	F
AIXR	AIXR11002	40	C
Turbo TeeJet	TT11002	40	M
Turbo TeeJet Duo	2XTT11001	40	M

Water sensitive tape was attached to 12 tabs on a metal contraption and placed between rows three and four in rep 1 to simulate spray coverage to a 6-inch waterhemp plant. The contraption was removed from the plot after spraying and the water sensitive tape was transferred to a prepared template with coordinates matching the position on the contraption. The template was moved to a humidity-controlled environment for processing.

Figure 1. Water sensitive tape was attached to each tab on the contraption to simulate spray coverage on either sugarbeet or waterhemp.

Visible sugarbeet necrosis and growth reduction was evaluated approximately 7 and 14 DAT using a 0 to 100% injury scale with 0% denoting no sugarbeet injury and 100% denoting complete loss of sugarbeet stature. Visible waterhemp control using a 0 to 100 scale (0 is no injury and 100 is complete control) was evaluated approximately 7, 14, 28, and 42 days after application. All evaluations were a visual estimate of injury or control from the four treated rows compared with the adjacent, two-row, untreated strip. Data were analyzed in this report as a RCBD with the ANOVA procedure of ARM, version 2022.5 software package.

Results

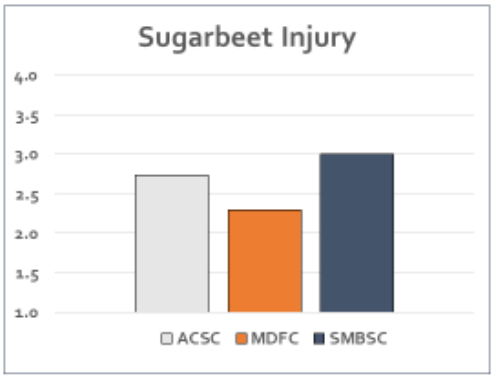
According to a survey of sugarbeet growers and agriculturalists, Ultra Blazer at 16 fl oz/A was applied to 43,397 sugarbeet acres in 2022 (totaling 5,425 gallons of Ultra Blazer). Eighty-nine percent or 38,484 acres were applied in Minnesota and 11% or 4,913 acres were applied in North Dakota.

Three observations standout from overseeing the emergency exemption and summarizing observations and agriculturist/producer critiques. First, waterhemp escapes rob yield in a low growing crop like sugarbeet and our producers understand this and are motivated to take action. Waterhemp interferes with sugarbeet yield, but even

worse, produces significant quantities of seed that must be managed for four to six years. Our producers understand Ultra Blazer is a tool we would prefer not to use. Second, Ultra Blazer consistently causes sugarbeet injury and waterhemp control is inconsistent (Figure 2). Waterhemp control is strongly influenced by environmental conditions at application and by spray quality or the selection of spray nozzles and carrier volume. Most growers are willing to accept the sugarbeet bronzing damage, provided waterhemp is controlled. It is becoming apparent that proper use of spray nozzles and selecting the appropriate carrier volume to ensure coverage improves the likelihood of success. Continued acifluorfen research must be focused on improving sugarbeet safety and waterhemp control. Finally, Roundup PowerMax3 mixed with Ultra Blazer caused more sugarbeet injury than was observed in the years Ms. Emma Burt conducted her research supporting her Masters of Science and in 2021, both in our producer fields and in our research. Our observations with Roundup PowerMax3 mixtures with Ultra Blazer will impact future recommendations.

Injury Scale:	
1	None (0-15%)
2	Slight (15-30%
3	Moderate (30-50%)
4	Severe (50-70%)

Control Scale:	
1	Excellent (90-99%)
2	Good (80-90%)
3	Fair (65-80%)
4	Poor (40-65%)



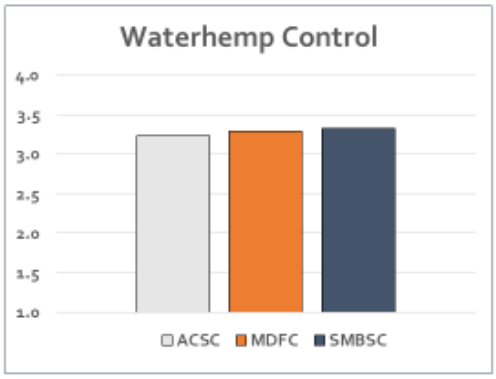


Figure 2. Results of producer and agriculturalist survey of sugarbeet injury and waterhemp control from Ultra Blazer Section 18 Emergency Exemption, Minnesota and North Dakota, 2022.

Sugarbeet Tolerance

Sugarbeet injury was evaluated multiple times throughout the growing season; however, only the evaluation of injury approximately 14 DAT is presented in Table 4. A very heavy rain event at Nashua, 6 days after planting, impacted sugarbeet stand and compromised the experimental area. We, therefore, elected to not present sugarbeet injury or yield data from Nashua, MN, due to variability.

Necrosis injury was evaluated as the percent of sugarbeet leaf area that was bronzed from Ultra Blazer application (Figure 3). Necrosis injury was greatest from repeat Ultra Blazer applications of 12 fl oz/A followed by (fb) 12 fl oz/A as compared with a single application of 16 fl oz/A and was consistent across locations (Table 4). Application of Roundup PowerMax3 mixed with Ultra Blazer increased necrosis injury as compared with Ultra Blazer alone. Roundup PowerMax3 alone did not cause necrosis injury to sugarbeet. Visual necrosis was most severe at Hendrum and Lake Lillian, MN.

Sugarbeet growth reduction from Ultra Blazer at 16 fl oz/A plus NIS ranged from 5% to 21% across locations (Table 4). Comparatively, sugarbeet growth reduction either increased, decreased, or remained the same, depending on location, from Ultra Blazer plus crop oil concentrate or from repeat applications of Ultra Blazer plus non-ionic surfactant, with no definitive pattern of growth reduction injury observed. However, sugarbeet growth was consistently reduced from Ultra Blazer plus Roundup PowerMax3 across all locations, regardless of adjuvant use.

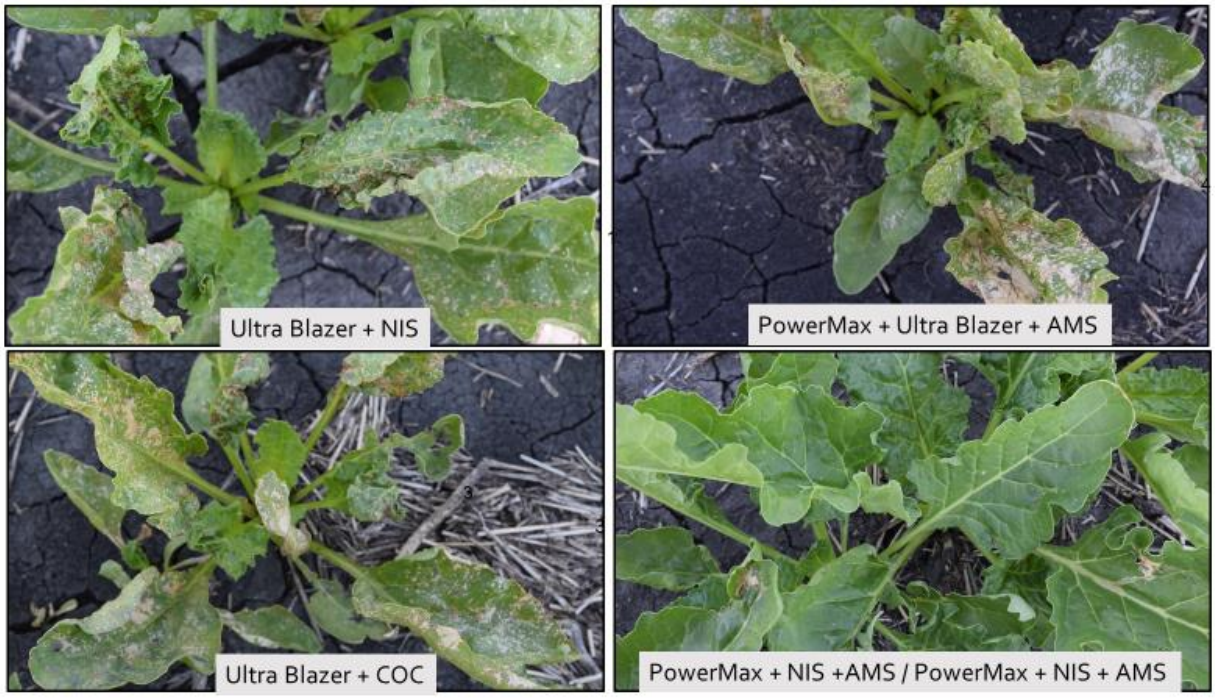


Figure 3. Sugarbeet necrosis injury symptoms in response to Ultra Blazer at 16 fl oz/A plus NIS or COC or mixed with Roundup PowerMax3 at 25 fl oz/A plus AMS as compared with repeat Roundup PowerMax3 at 25 fl oz/A plus NIS plus AMS, Hendrum, MN, 2022.

Table 4. Sugarbeet visible injury from herbicide treatments, across locations, 2022.[a]

		Sugarbeet Injury							
		Crookston		Hendrum		Murdock		Lake Lillian	
Herbicide Treatment	**Rate**	**Nec.[b]**	**GR**	**Nec.**	**GR**	**Nec.**	**GR**	**Nec.**	**GR**
	----fl oz/A----	----------%----------							
Ultra Blazer + Prefer 90 NIS	16 + 0.25%	2 a	21 b	33 b	19 b	0 a	5 a	8 b	12 ab
Ultra Blazer + Prefer 90 NIS / Ultra Blazer + Prefer 90 NIS	12 + 0.125% / 12 + 0.125 %	24 b	17 ab	90 e	26 c	37 b	14 b	38 d	16 bc
Ultra Blazer + Crop oil concentrate	16 + 0.25%	2 a	14 a	46 c	29 c	2 a	13 b	8 b	12 ab
Roundup PowerMax3 + Ultra Blazer + Amsol Liquid AMS	25 + 16 + 2.5% v/v	5 a	32 c	58 d	42 d	2 a	21 c	18 c	23 c
Roundup PowerMax3 + Ultra Blazer + Prefer 90 NIS + Amsol Liquid AMS	25 + 16 + 0.25% + 2.5% v/v	5 a	29 c	50 c	38 d	2 a	25 c	23 c	13 abc
Roundup PowerMax3 Prefer 90 NIS + Amsol Liquid AMS / Roundup PowerMax3 + Prefer 90 NIS + Amsol Liquid AMS	25 + 0.25% + 2.5% v/v / 25 + 0.25% + 2.5% v/v	0 a	12 a	0 a	5 a	0 a	0 a	0 a	4 a
LSD (0.10)		**5**	**6**	**8**	**7**	**3**	**6**	**6**	**10**

[a]Means within a rating timing that do not share any letter are significantly different by the LSD at the 10% level of significance.
[b] Nec. = Visual necrosis and GR = growth reduction collected approximately 14 days after treatment (±3 days).

Sugarbeet injury from Ultra Blazer reduced sugarbeet stature (Figure 4). Stature reduction is greatest when Ultra Blazer is mixed with either oil-based adjuvants or herbicides and the air temperature is 85°F at or later in the day of application. However, sugarbeet rapidly recover from Ultra Blazer injury by producing new leaves (Figure 5).

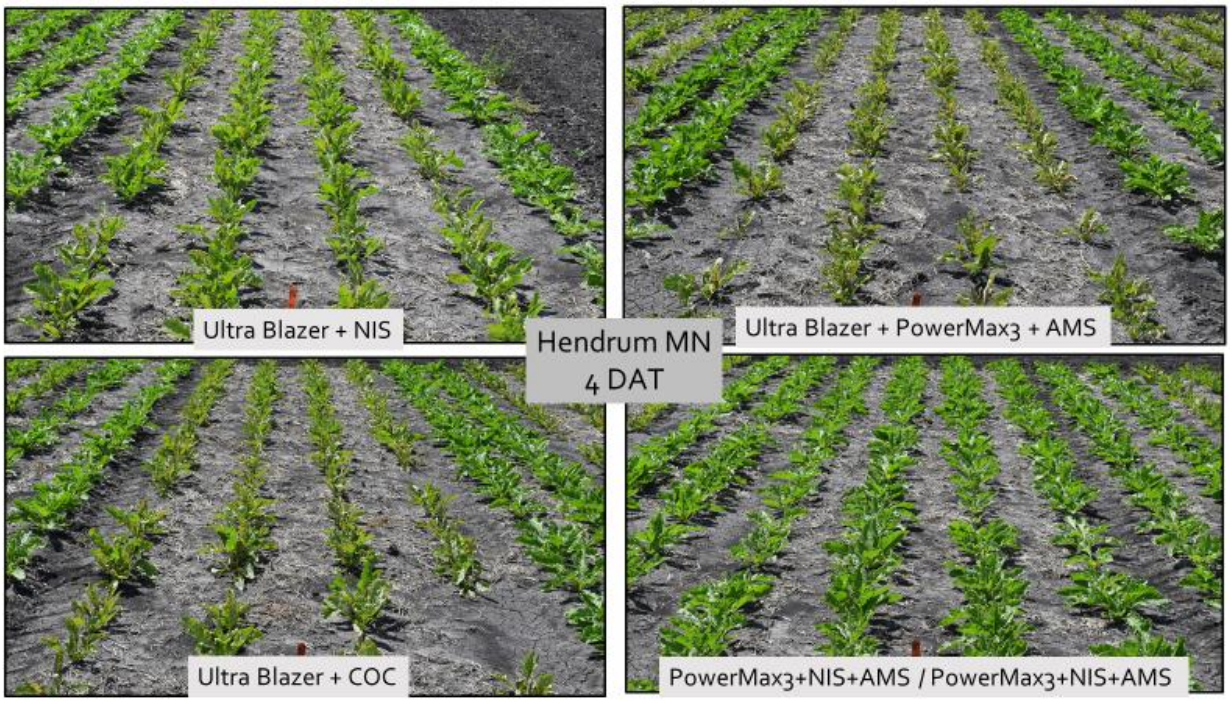


Figure 4. Sugarbeet injury in response to Ultra Blazer alone or mixed with Roundup PowerMax3 as compared with repeat Roundup PowerMax3 application, 4 DAT, Hendrum, MN, 2022.

Figure 5. Sugarbeet regrowth following Ultra Blazer or Ultra Blazer mixtures with Roundup PowerMax3, Murdock, MN, 2022.

Not all yield parameters were significantly different at each individual location; however, we have elected to combine yield data and present differences across all locations in Table 5. Root yield and recoverable sucrose from a single application of Ultra Blazer plus NIS, Ultra Blazer plus COC, or repeat applications of Ultra Blazer plus NIS,

generally were the same as the glyphosate control. Root yield and recoverable sucrose were less when Ultra Blazer was mixed with Roundup Powermax3 and Amsol or Amsol plus NIS. Ultra Blazer plus Roundup PowerMax3 consistently reduced root yield across locations compared with either product applied alone.

Table 5. Sugarbeet root yield, % sucrose, and recoverable sucrose in response to herbicide treatment across four locations, 2022.[a]

Herbicide Treatment	Rate	Root Yield	Sucrose	Recoverable Sucrose
	----------fl oz/A----------	-Ton/A-	--%--	---lb/A---
Ultra Blazer + Prefer 90 NIS	16 + 0.25%	31.0 b	16.0	8,504 abc
Ultra Blazer + Prefer 90 NIS / Ultra Blazer + Prefer 90 NIS	12 + 0.125% / 12 + 0.125 %	31.7 ab	16.1	8,770 a
Ultra Blazer + Crop oil concentrate	16 + 0.25%	31.4 ab	16.0	8,606 ab
Roundup PowerMax3 + Ultra Blazer + Amsol Liquid AMS	25 + 16 + 2.5% v/v	30.0 c	16.0	8,167 bc
Roundup PowerMax3 + Ultra Blazer + Prefer 90 NIS + Amsol Liquid AMS	25 + 16 + 0.25% + 2.5% v/v	29.4 c	16.0	7,974 c
Roundup PowerMax3 + Prefer 90 NIS + Amsol Liquid AMS / Roundup PowerMax3 + Prefer 90 NIS + Amsol Liquid AMS	25 + 0.25% + 2.5% v/v/ 25 + 0.25% + 2.5% v/v	32.8 a	16.1	8,963 a
P-Value (0.05)		**0.0040**	**NS**	**0.0123**

[a]Means within a rating timing that do not share any letter are significantly different by the LSD at the 5% level of significance.

Roundup PowerMax3 contains the active ingredient glyphosate in the form of potassium salt at 5.88 pound per gallon as compared with potassium salt at 4.5 pounds per gallon in Roundup PowerMax. An increase in sugarbeet injury from Ultra Blazer mixtures with Roundup PowerMax was previously observed. However, we did not observe the magnitude of injury, nor did we observe loss in root yield and recoverable sucrose, from Ultra Blazer mixtures with Roundup Powermax (PowerMax vs. PowerMax3). Observations of increased phytotoxicity from Roundup PowerMax3 as compared with Roundup PowerMax tank mixed with other actives has been observed by other researchers (personal communication with Brett Miller, Syngenta).

Waterhemp Control as Influenced by Carrrier Volume and Nozzle Selection

Waterhemp infestation was erratic at Hickson, making application and evaluation difficult. Application was delayed and waterhemp size was larger than desired at Blomkest, due to challenges with excessive winds. Thus, we elected to prioritize the Moorhead location. We observed necrosis/bronzing on sugarbeet from Ultra Blazer by day three and by day eight, necrosis ranged from 43% to 58% at 15 gpa and ranged from 50% to 66% at 20 gpa (Table 6). However, spray nozzle or spray volume did not influence necrosis or growth reduction from Ultra Blazer.

Table 6. Sugarbeet injury in response to Ultra Blazer + COC applied through various nozzles at 15 and 20 gpa water carrier, Moorhead, MN, 2022.[a]

	Necrosis				Growth Reduction			
	15 GPA		20 GPA		15 GPA		20 GPA	
Nozzle	8 DAT	12 DAT	8 DAT	12 DAT	8 DAT	12 DAT	8 DAT	12 DAT
	-------%-------		-------%-------		-------%-------		-------%-------	
XR	58	33	50	38	6	19	11	20
AIXR	43	23	55	23	5	8	10	8
Turbo TeeJet	58	28	59	30	15	15	10	13
Turbo TeeJet Duo	58	26	66	43	10	10	16	19
LSD (0.10)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

[a]Means within a rating timing that do not share any letter are significantly different by the LSD at the 5% level of significance.

Waterhemp control from Ultra Blazer was influenced by spray nozzle and spray volume. In general, we observed greater waterhemp control when Ultra Blazer was applied through nozzles at 20 gpa as compared with 15 gpa (data not shown). Ultra Blazer through the Turbo TeeJet Duo consistently gave the best waterhemp control, presumably because it gave the best spray coverage over waterhemp (Table 7). Likewise, Ultra Blazer through AIXR nozzles consistently gave less waterhemp control.

Table 7. Waterhemp control in response to Ultra Blazer + COC applied through various nozzles, averaged across spray volume, Moorhead, MN, 2022.[a]

	Waterhemp control			
Nozzle	**8 DAT**	**12 DAT**	**28 DAT**	**42 DAT**
	----------%----------			
XR	82	86 ab	70 b	60 b
AIXR	78	81 b	66 b	54 b
Turbo TeeJet	80	89 a	73 ab	59 b
Turbo TeeJet Duo	88	88 a	82 a	71 a
LSD (0.10)	**NS**	**6**	**9**	**11**

[a]Means within a rating timing that do not share any letter are significantly different by the LSD at the 5% level of significance.

Conclusion

Controlling weeds in sugarbeet with pesticides continues to be a compromise between sugarbeet injury and weed control. For many years, producers had the luxury of broad-spectrum and uniform weed control with glyphosate and no sugarbeet injury. Glyphosate applied over RR sugarbeet continues to be the safest active ingredient I have evaluated in sugarbeet in my 36-year career, both as a graduate student working with sugarbeet, a representative of industry, and an academic, developing weed control strategies in sugarbeet. Sugarbeet are not affected by glyphosate rate, adjuvant, growth stage, or environmental conditions.

Glyphosate resistant (GR) weeds forces producers to pursue products that cause greater sugarbeet injury in pursuit of control of escaped weeds. The Section 18 emergency exemption exemplifies the need for Ultra Blazer in sugarbeet but also reveals the crop injury potential and the possibilities for waterhemp regrowth. I support the use of Ultra Blazer for control of weed escapes in sugarbeet. However, it is clear that we need to find ways to improve sugarbeet safety and optimize waterhemp control. Finally, we need to continue to pursue other options for control of GR weeds.

Appendix. Survey

2022 Ultra Blazer Section 18 Emergency Exemption
Field Observations

Please answer the following questions.

1. What county was Ultra Blazer used for weed control in sugarbeet?_____

2. How many acres were sugarbeet treated with Ultra Blazer for weed control? _____

3. Record sugarbeet injury (necrosis or growth reduction) from Ultra Blazer?

   None (0-15%) Slight (15-30%) Moderate (30-50%) Severe (50-70%)

4. Record weed control from Ultra Blazer in sugarbeet?

   Excellent (90-99%) Good (80-90%) Fair (65-80%) Poor (40-65%)

5. Did you observe any unexpected / adverse effects from using Ultra Blazer in sugarbeet?

   YES NO

6. Did you find the Section 18 to be valuable/useful?

   YES NO

7. Would you like to use Ultra Blazer again in 2023?

   YES NO.

Write comments to provide additional details regarding your experiences.

_____

_____

_____