SUGARBEET TOLERANCE FROM ULTRA BLAZER

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Summary

1. Environmental conditions at application and adjuvants influence sugarbeet tolerance and waterhemp control.
2. Yield parameters support either repeat Ultra Blazer applications at 12 fl oz/A followed by (fb) 12 fl oz/A with non-ionic surfactant or Ultra Blazer at 16 fl oz/A with Crop Oil Concentrate (COC).
3. Greater sugarbeet injury was observed from Ultra Blazer mixtures with Roundup PowerMax3 in 2022 than with Roundup PowerMax in previous years.
4. Acifluorfen use in sugarbeet requires a compromise between sugarbeet injury and waterhemp control.

Introduction

Ultra Blazer (acifluorfen) was repurposed into sugarbeet in 2019 and 2020 to replace Betamix (desmedipham & phenmedipham) and provide control of glyphosate-resistant (GR) waterhemp in sugarbeet. The Environmental Protection Agency (EPA) approved a request for a Section 18 emergency exemption for Ultra Blazer for control of escaped waterhemp in sugarbeet in Minnesota and eastern North Dakota in 2021 and 2022. The exemption allowed a single Ultra Blazer application at 16 fluid ounces per acre per year, either alone or mixed with Roundup PowerMax(3). 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.

Our 2022 Ultra Blazer Section 18 emergency exemption label provided flexibility and recommended Ultra Blazer at 16 fl oz/A either alone, with non-ionic surfactant at 0.125% v/v, or mixed with Roundup PowerMax3 and ammonium sulfate at 2.5% v/v, but without NIS, depending on situation (Table 1). However, our challenge has been to optimize waterhemp control without increasing sugarbeet injury. Sugarbeet must be greater than the 6-lf stage and waterhemp less than 4-inches (preferred) for selective control while reducing injury potential.

Table 1. Herbicide treatment, rate, and application timing, Ultra Blazer Section 18 emergency exemption, 2022.

Treatment	Rate (fl oz/A)	Sugarbeet Stage (lvs)
Ultra Blazer	16	>6
Ultra Blazer + Prefer 90 NIS	16 + 0.125% v/v	>6
Ultra Blazer + Roundup PowerMax + Amsol Liquid AMS	16 + 28 + 2.5 % v/v	>6

We have learned that sugarbeet injury increases when oil-based adjuvants or herbicides are mixed with Ultra Blazer. We have also learned that Ultra Blazer is more active on sugarbeet and waterhemp when the maximum day-time temperature is 85°F as compared with 75°F. The objective of this experiment was to determine sugarbeet visible injury, root yield, % sucrose, and recoverable sucrose from Ultra Blazer with adjuvants or mixtures with glyphosate.

Materials and Methods

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 2 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 3.

Table 2. 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 3. 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 to 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 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.

Results

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 1). Necrosis injury was greatest from repeat Ultra Blazer applications of 12 fl oz/A 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.

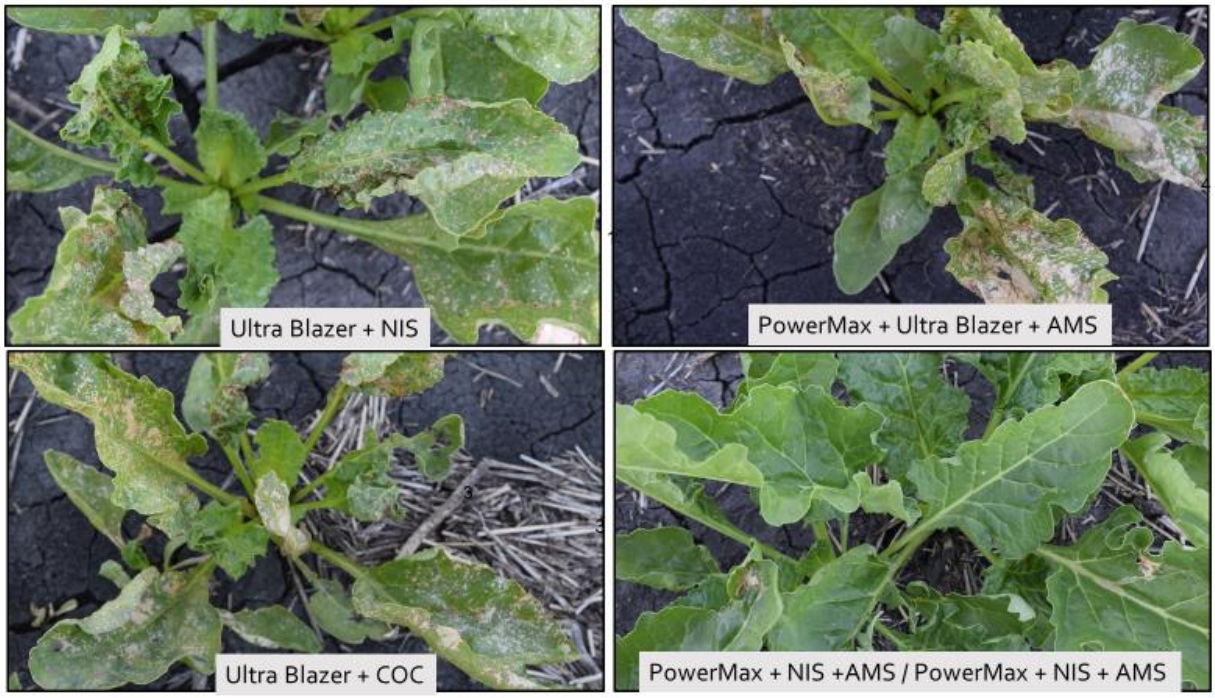

Figure 1. Sugarbeet necrosis injury symptoms in response to Ultra Blazer at 16 fl oz/A plus NIS or COC or mixed with Roundup PowerMax3 at 25 fl oz/A plus AMS as compared with repeat Roundup PowerMax3 at 25 fl oz/A plus NIS plus AMS, Hendrum, MN, 2022.

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 2). 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 3).

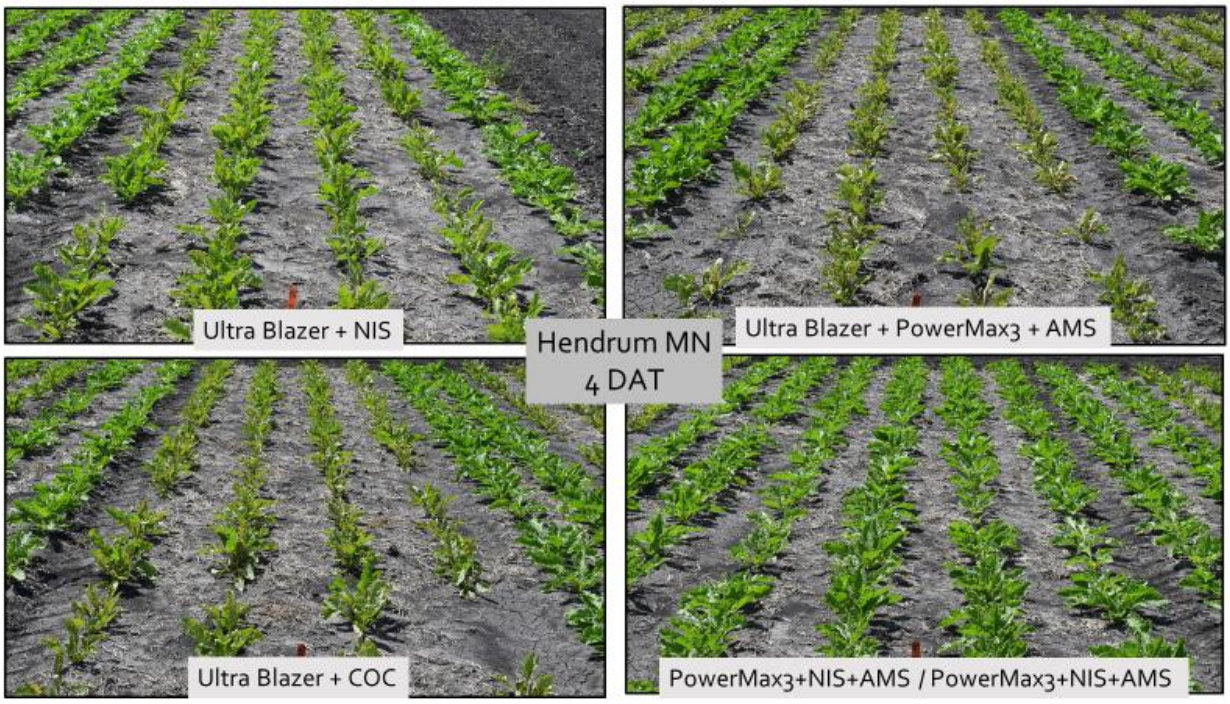

Figure 2. Sugarbeet injury in response to Ultra Blazer alone or mixed with Roundup PowerMax3 as compared with repeat Roundup PowerMax3 application, 4 DAT, Hendrum MN, 2022.

Figure 3. 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).

Conclusion

The 2022 Ultra Blazer experiment was designed to determine if sugarbeet injury in response to Ultra Blazer could be reduced. Sugarbeet rapidly recovers from necrosis and growth reduction injury from Ultra Blazer plus NIS. The addition of COC with Ultra Blazer increases sugarbeet injury as compared with Ultra Blazer plus NIS; however, injury was less than Ultra Blazer mixtures with Roundup PowerMax3. A remedy to sugarbeet injury that may increase waterhemp control is applying split applications of Ultra Blazer at 12 fl oz/A plus NIS; however, we cannot avoid growth reduction or necrosis injury with split applications. Matter of fact, necrosis injury persists longer from repeat Ultra Blazer applications as compared with single applications; however, reduction in yield parameters did not occur. Ultra Blazer tank-mixtures with Roundup PowerMax3 and AMS or with AMS plus NIS caused significant sugarbeet injury that persisted and negatively impacted yield. We suggest utilizing single Ultra Blazer applications at 16 fl oz/A plus adjuvants or repeat applications of Ultra Blazer at 12 fl oz/A with NIS instead of Ultra Blazer mixtures with Roundup PowerMax3, unless there are significant waterhemp control challenges. Further research is needed to improve the tolerance of sugarbeet to these treatments in order to maintain yield parameters while optimizing waterhemp control.