SUMMARY OF ULTRA BLAZER APPLIED IN SUGARBEET

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Summary

1. Environmental conditions at application and adjuvants influence sugarbeet tolerance and waterhemp control from Ultra Blazer.
2. Glyphosate (Roundup PowerMax/Roundup PowerMax3) mixed with Ultra Blazer consistently has improved waterhemp control from Ultra Blazer.
3. Roundup PowerMax3 mixed with Ultra Blazer increased necrosis and sugarbeet growth reduction injury and reduced root yield and recoverable sucrose as compared with Ultra Blazer alone.
4. Nozzle selection and 20 gpa spray volume improved waterhemp control, theoretically, by improving coverage.
5. Control escape waterhemp less than 4-inches tall with Ultra Blazer at 16 fl oz/A with NIS; control 'train-wreck' situations with Roundup PowerMax3 mixed with Ultra Blazer and AMS.

Introduction

I remember asking Dr. Dexter, Professor Emeritus and retired Extension Sugarbeet and Weed Control Specialist from 1969 to 2007, if he had any regrets; ideas he never got around to pursuing. Alan immediately replied that he wished he would have spent more time investigating Ultra Blazer in sugarbeet. I took that hint and invested seven years pursuing use of Ultra Blazer in sugarbeet. This will be our final report.

The first experiments were proof of concept; exploring sugarbeet injury from Ultra Blazer. We found that environment was important. Ultra Blazer was more active during hot and humid environments as compared with cooler or drier air. However, we learned that we could avoid the effects of environment by applying Ultra Blazer to sugarbeet greater than the 6-lf stage. Ms. Emma Burt's Master of Science thesis work focused on Ultra Blazer alone and with adjuvants and Ultra Blazer mixed with Roundup PowerMax and/or Stinger. We found that petroleum or vegetable oil-based adjuvants increased sugarbeet injury and waterhemp control. Sugarbeet injury was greater when Ultra Blazer was mixed with HSMOC (high surfactant methylated seed oil), MSO (methylated oil concentrate), or COC (crop oil concentrate) than with NIS (non-ionic surfactant). We also found sugarbeet injury from Ultra Blazer mixed with Roundup PowerMax was greater than from either Ultra Blazer or Roundup PowerMax alone. Sugarbeet injury was attributed to the formulated surfactant with glyphosate, not the salt of glyphosate. Further, adding Ultra Blazer with glyphosate and either *S*-metolachlor or Outlook, applied at the 6- to 8-lf sugarbeet stage in the layby program application, caused unacceptable injury. Finally, our original experiments were Ultra Blazer tank mixed with Roundup PowerMax. We believe Roundup PowerMax3 mixed with Ultra Blazer causes more sugarbeet injury than the Roundup PowerMax formulation mixed with Ultra Blazer.

Ultra Blazer was applied to approximately 80,000 acres in 2021 and 2022 to control escape waterhemp. The primary concern from producers was regrowth to waterhemp, especially when sugarbeet leaves partially covered waterhemp. Experiments in 2022 and 2023 were designed to improve waterhemp control by increasing either carrier volume or through nozzle selection to improve spray coverage. Second, in an effort to find the appropriate balance between efficacy and tolerance, we evaluated applying Ultra Blazer at 12 fl oz/A in a split application, Ultra Blazer at 16 fl oz/A with COC, or mixing Ultra Blazer plus Roundup PowerMax3 with Warrant as a safener. This report summarizes sugarbeet tolerance and waterhemp control experiments conducted in 2022 and 2023.

Materials and Methods

Sugarbeet tolerance experiments were conducted near Crookston, Hendrum, Kent, Lake Lillian, and Murdock, MN in 2023. Waterhemp efficacy experiments were conducted near Moorhead and Blomkest, MN. 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. We had started the Moorhead experiment in a sugarbeet area; however, due to challenges with waterhemp emergence and sugarbeet size, we moved the Moorhead experiment into a bulk fill soybean area to be consistent with waterhemp size at application.

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 35 psi to the center four rows of six row plots 40 feet in length. Environmental conditions at application are in Table 2 and 3.

Table 1. Herbicide treatment, herbicide rate, and application timing across locations in 2023.

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 + 3-days
Ultra Blazer + Crop Oil Concentrate	16 + 1.25%	6-8 lf
Roundup PowerMax3 + Ultra Blazer + Amsol Liquid AMS	25 + 16 + 2.5% v/v	6-8 lf
Roundup PowerMax3 + Ultra Blazer + Warrant + Amsol Liquid AMS	25 + 16 + 40 + 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. Application information for tolerance experiments.

	Crookston	Hendrum	Kent	Murdock	Lake Lillian
Plant Date	May 5	May 16	May 17	May 9	May 4
Application Date	June 8	June 15	June 21	June 9	June 6
Time of Day	10:30 AM	10:00 AM	6:00 PM	12:30 PM	8:00 AM
Air Temperature (F)	72	73	86	73	61
Relative Humidity (%)	56	62	43	57	83
Wind Velocity (mph)	8	3	8	7	6
Wind Direction	SSE	NE	NW	SW	E
Soil Temp. (F at 6”)	70	66	-	-	-
Soil Moisture	Good	Fair	-	-	-
Cloud Cover (%)	50	100	-	-	-

Table 3. Application information for efficacy experiments.

	Moorhead	Blomkest
Plant Date	May 24	May 22
Application Date	July 5	June 23
Time of Day	7:00 AM	7:00 AM
Air Temperature (F)	67	66
Relative Humidity (%)	43	94
Wind Velocity (mph)	2	2
Wind Direction	-	-
Soil Temp. (F at 6”)	70	70
Soil Moisture	Good	-
Cloud Cover (%)	90	20

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. Visible weed control was evaluated 7, 14, and 21 days after the 2-lf stage application using a 0 to 100 scale (0 is no control and 100 is complete control). All evaluations were a visual estimate of percent fresh weight reduction in the four treated rows compared with the adjacent untreated strip.

At harvest for tolerance experiments, 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 2023.3 software package.

Results

Tolerance and Yield Components. Sugarbeet necrosis injury was evaluated as the percent of sugarbeet leaf area that was bronzed from Ultra Blazer application. All Ultra Blazer treatments caused necrosis injury; however, necrosis injury was greatest from Ultra Blazer at 16 fl oz/A plus crop oil concentrate (COC) at 1.25% v/v and was consistent across locations (Table 4). Similarly, an application of Roundup PowerMax3 mixed with Ultra Blazer plus AMS increased necrosis injury as compared with Ultra Blazer alone. Repeat Ultra Blazer applications of 12 fl oz/A followed by (fb) 12 fl oz/A gave slightly less necrosis injury than Ultra Blazer at 16 fl oz/A; however, the repeat Ultra Blazer application extended the duration of necrosis injury as compared with a single application.

Table 4. Sugarbeet visible injury from herbicide treatments, across locations, 2023.[a]

		Necrosis[b]	**Sugarbeet Growth Reduction**		
Herbicide Treatment	**Rate**	**3 DAAC[c]**	**3 DAAC**	**10 DAAC**	**20 DAAC**
	-----fl oz/A-----	----------%----------			
Ultra Blazer + Prefer 90 NIS	16 + 0.25%	26 bc	25 b	22 b	13 ab
Ultra Blazer + Prefer 90 NIS / Ultra Blazer + Prefer 90 NIS	12 + 0.125% / 12 + 0.125 %	21 b	22 b	33 bc	23 bc
Ultra Blazer + Crop Oil Concentrate	16 + 1.25%	49 d	43 c	46 d	34 c
Roundup PowerMax3 + Ultra Blazer + Amsol Liquid AMS	25 + 16 + 2.5% v/v	48 d	44 c	43 cd	32 c
Roundup PowerMax3 + Ultra Blazer + Warrant + Amsol Liquid AMS	25 + 16 + 40 + 2.5% v/v	35 c	29 b	28 b	18 b
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	1 a	4 a	2 a	3 a
P-Value (0.05)		**<0.0001**	**<0.0001**	**<0.0001**	**<0.0001**

[a]Means within a rating timing that do not share any letter are significantly different by the LSD at the 5% level of significance.
[b] Nec. = Visual necrosis.
[c]DAAC = Days after application C.

Necrosis injury from Warrant mixed with Ultra Blazer, Roundup PowerMax3, and liquid AMS was less than injury from Ultra Blazer plus Roundup PowerMax3 and liquid AMS (Table 4). Sugarbeet necrosis and growth reduction injury from adding Warrant to Ultra Blazer and Roundup PowerMax3 was similar to the Ultra Blazer at 16 fl oz/A plus NIS standard treatment, across locations.

Sugarbeet growth reduction injury across treatments averaged 28%, 29%, and 21%, 3, 10, and 20 DAAC, respectively (Table 4). As with necrosis, growth reduction injury was greatest when COC or Roundup PowerMax3 with liquid AMS was mixed with Ultra Blazer. Sugarbeet growth reduction injury from Ultra Blazer at 16 fl oz/A with NIS was similar to sugarbeet injury from 2-times Roundup PowerMax3 applications with NIS and liquid AMS. Two-times Ultra Blazer application at 12 fl oz/A with NIS gave growth reduction injury similar to Ultra Blazer at 16 fl oz/A with NIS; however, injury was greater than injury from the Roundup PowerMax3 control.

Root yield, % sucrose, and recoverable sucrose from Ultra Blazer at 16 fl oz/A plus NIS were the same as two applications of glyphosate alone (Table 5). Root yield and % sucrose from two applications of Ultra Blazer at 12 fl oz/A with NIS were the same as Ultra Blazer at 16 fl oz/A. However, recoverable sucrose from two applications of Ultra Blazer applications at 12 fl oz/A was less than a single application of Ultra Blazer at 16 fl oz/A.

Warrant mixed with Ultra Blazer, Roundup PowerMax3, and liquid AMS appeared to reduce sugarbeet vegetative injury and yield components as compared with Ultra Blazer mixed with Roundup PowerMax3 and liquid AMS. This is consistent from results in Michigan (personal communication with Dr. Christy Sprague).

Table 5. Sugarbeet root yield, % sucrose, and recoverable sucrose in response to herbicide treatment across locations, 2023.[a]

Herbicide Treatment	Rate	Root Yield	Sucrose	Recoverable Sucrose
	-----fl oz/A-----	-Ton/A-	--%--	---lb/A---
Ultra Blazer + Prefer 90 NIS	16 + 0.25%	35.5 ab	17.7	11,180 ab
Ultra Blazer + Prefer 90 NIS / Ultra Blazer + Prefer 90 NIS	12 + 0.125% / 12 + 0.125 %	34.2 bc	17.7	10,611 c
Ultra Blazer + Crop Oil Concentrate	16 + 1.25%	33.3 c	17.7	10,417 c
Roundup PowerMax3 + Ultra Blazer + Amsol Liquid AMS	25 + 16 + 2.5% v/v	33.3 c	17.8	10,430 c
Roundup PowerMax3 + Ultra Blazer + Warrant + Amsol Liquid AMS	25 + 16 + 40 + 2.5% v/v	34.9 bc	17.5	10,737 bc
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	37 a	17.8	11,639 a
P-Value (0.05)		**0.001**	**NS**	**0.001**

[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. The waterhemp control experiment at Moorhead was terminated and reestablished in soybean. The efficacy experiment was in sugarbeet at Blomkest. Thus, we elected to consider each experiment singly due to the difference in crop species between the two experiments.

Waterhemp control ranged from 40 to 88% at Moorhead, MN and 68 to 93% at Blomkest, MN, 14 DAAC (Table 6). Waterhemp control was or tended to be best when Ultra Blazer was tank mixed with Roundup PowerMax3 plus AMS across locations and evaluations. These results are consistent with results from Ms. Emma Burt's Master of Science research and other results previously communicated. Ultra Blazer plus COC provided or tended to provide waterhemp control similar to Ultra Blazer mixed with Roundup PowerMax3 across locations and evaluations. Two applications of Ultra Blazer at 12 fl oz/A gave better waterhemp control at Blomkest than Moorhead. Conversely, Ultra Blazer plus Roundup PowerMax3 and Warrant plus AMS gave better control at Moorhead than Blomkest.

Table 6. Waterhemp control 7 and 14 days after herbicide treatments, two locations, 2023.[a]

		Waterhemp Control			
		Moorhead		Blomkest	
Herbicide Treatment	Rate	7 DAAC[b]	14 DAAC	7 DAAC	14 DAAC
	-----fl oz/A-----	----------%----------			
Ultra Blazer + Prefer 90 NIS	16 + 0.25%	71 b	61 c	79 abc	81 abc
Ultra Blazer + Prefer 90 NIS / Ultra Blazer + Prefer 90 NIS	12 + 0.125% / 12 + 0.125 %	74 b	71 c	84 ab	89 ab
Ultra Blazer + Crop Oil Concentrate	16 + 1.25%	83 ab	73 bc	88 ab	81 abc
Roundup PowerMax3 + Ultra Blazer + Amsol Liquid AMS	25 + 16 + 2.5% v/v	91 a	85 ab	93 a	93 a
Roundup PowerMax3 + Ultra Blazer + Warrant + Amsol Liquid AMS	25 + 16 + 40 + 2.5% v/v	89 a	88 a	75 bc	73 bc
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	43 c	40 d	69 c	68 c
P-Value (0.05)		**<0.0001**	**<0.0001**	**0.0383**	**0.0472**

[a]Means within a rating timing that do not share any letter are significantly different by the LSD at the 5% level of significance.
[b]DAAC = Days after application C.

A repeat application of Ultra Blazer at 12 fl oz/A plus NIS gave waterhemp control similar to a single Ultra Blazer application at 16 fl oz/A plus NIS.

Roundup PowerMax3 provided excellent common lambsquarters control whereas Ultra Blazer provided little or no common lambsquarters control (Table 7). We did not observe any antagonism with common lambsquarters when Ultra Blazer and Warrant were tank mixed with glyphosate.

Table 7. Common lambsquarters control 7 and 14 days after herbicide treatments, Moorhead, MN, 2023.[a]

		Common Lambsquarters Control	
Herbicide Treatment	**Rate**	**7 DAAC[b]**	**14 DAAC**
	-----fl oz/A-----	----------%----------	
Ultra Blazer + Prefer 90 NIS	16 + 0.25%	3 d	0 e
Ultra Blazer + Prefer 90 NIS / Ultra Blazer + Prefer 90 NIS	12 + 0.125% / 12 + 0.125 %	35 b	10 d
Ultra Blazer + Crop Oil Concentrate	16 + 1.25%	23 c	23 c
Roundup PowerMax3 + Ultra Blazer + Amsol Liquid AMS	25 + 16 + 2.5% v/v	99 a	94 b
Roundup PowerMax3 + Ultra Blazer + Warrant + Amsol Liquid AMS	25 + 16 + 40 + 2.5% v/v	99 a	97 ab
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	98 a	98 a
P-Value (0.05)		**<0.0001**	**<0.0001**

[a]Means within a rating timing that do not share any letter are significantly different by the LSD at the 5% level of significance.
[b]DAAC = Days after application C.

Conclusion

The 2023 (and 2022) Ultra Blazer experiments were designed to determine if sugarbeet injury in response to Ultra Blazer could be reduced, while maintaining or improving waterhemp control through improved water volume, spray nozzle selection, adjuvants or herbicide mixtures. Unfortunately, there is no 'silver bullet' with Ultra Blazer. COC mixed with Ultra Blazer increased vegetative sugarbeet injury and reduced root yield while providing only a modest improvement in waterehemp control. Repeat Ultra Blazer applications extended the length of time with visual necrosis with only a modest improvement in waterhemp control. Mixing Warrant with Ultra Blazer, Roundup PowerMax3, and AMS reduced sugarbeet injury but waterhemp control was inconsistent across locations. We have not investigated glyphosate formulations with adjuvants different from Roundup PowerMax3. Once again, improving sugarbeet safety likely results in less waterhemp control. At this time, I am hesitant to recommend Warrant mixtures with Ultra Blazer and Roundup PowerMax3. Warrant, a chloroacetamide herbicide, is a very important component to our waterhemp control strategy. Suggesting Warrant can be used to safen sugarbeet injury from Ultra Blazer and Roundup PowerMax3 seems to send a confusing message. Likewise, the weed control results from Warrant mixtures with Ultra Blazer and Roundup PowerMax3 were inconsistent.

We recommend applying single Ultra Blazer applications at 16 fl oz/A plus NIS for waterhemp control with XR TeeJet, Turbo TeeJet, or Turbo TwinJet nozzles in 20 gpa water carrier (Table 8). Waterhemp should be less than 4-inches tall to optimize control. Ultra Blazer mixtures with Roundup PowerMax3 may be used in situations with significant waterhemp control challenges. We recommend ammonium sulfate with Roundup PowerMax3 and Ultra Blazer but no additional surfactant. As with Ultra Blazer alone, optimize spray quality to deliver good spray coverage.

Table 8. Sugarbeet necrosis, growth reduction, and waterhemp control in response to spray nozzle and water carrier volume, Moorhead, MN, 2022.

Spray Nozzle[a]	Necrosis[b]		Growth Reduction[b]		Waterhemp Control[c]	
	15 GPA	20 GPA	15 GPA	20 GPA	15 GPA	20 GPA
XR TeeJet	33 abc	38 ab	19 a	20 a	60 c	80 a
AIXR	23 c	23 c	8 c	8 c	64 c	68 c
Turbo TeeJet	28 bc	30 bc	15 ab	13 bc	69 bc	78 ab
Turbo TwinJet	26 c	43 a	10 bc	19 a	83 a	81 a
P-Value (0.20)	0.1781		0.0324		0.0357	

[a]TeeJet.
[b]Necrosis and growth reduction, 13 DAT.
[c]Waterhemp control, 41 DAT.