2026 Resistance Management of Giant Ragweed and Waterhemp Programs in Soybean

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Objectives were to achieve 95% control of giant ragweed and waterhemp in soybean at crop canopy, showcase giant ragweed and waterhemp control programs from eight industry partners, and provide an unbiased evaluation of entries to allow growers to benchmark competitive performance. Growers should use the data set as a guide to visit with their crop consultants or local suppliers to determine a giant ragweed and waterhemp program that provides the greatest control at an economical cost based on local supplier pricing and availability of products.

MATERIALS AND METHODS

Giant ragweed experiment was conducted on a severe infestation of giant ragweed near Renville, Minnesota, in 2026. Waterhemp experiments were conducted on moderate infestations of waterhemp at two locations in 2026, the first location was near Renville, Minnesota, and the second location was near Gary, Minnesota (Northern Location). At the Renville location, soil was a fine-textured webster-clay loam soil with 4.9% organic matter and a 6.8 soil pH. Spring tillage was field cultivation at 3" depth. Becks 1860E3 soybean was seeded at 1.25 inches deep on 30-inch row spacing at 130,000 seeds per acre. At the Northern location, soil was a medium-coarse textured, sandy loam soil with 2.9% organic matter and an 8.3 soil pH. Spring tillage was field cultivation at 3" depth. Xitavo 0554E3 soybean was seeded at 1 inch deep on 22-inch row spacing at 130,000 seeds per acre.

Giant ragweed study preemergence herbicide application occurred May 5, and the early post-emergence treatments were applied to V2 soybean on June 1 (Table 1). Treatments were applied with a bicycle sprayer in a 20 GPA spray solution through AIXR11002 air-induction flat fan nozzles pressurized with CO_2 at 42 psi to the center two rows of four row plots 30 feet in length. Experimental design was a randomized complete block with 3 replications. Giant ragweed control was evaluated May 19, June 1, June 15, and June 29 (Table 2). Soybean injury was evaluated June 4 and June 8 (Table 2).

The Renville location waterhemp study preemergence herbicide application occurred May 8, and the early post-emergence treatments were applied to V4 soybean on June 15 (Table 1). Treatments were applied with a bicycle sprayer in a 20 GPA spray solution through AIXR11002 air-induction flat fan nozzles pressurized with CO_2 at 42 psi to the center two rows of four row plots 30 feet in length. Experimental design was a randomized complete block with 3 replications. Waterhemp control was evaluated May 21, June 4, June 18, and July 1. Soybean injury was evaluated June 18 (Table 3).

The Northern location waterhemp study preemergence application occurred on June 3, and the early post-emergence application was applied to V2 soybean on July 2 (Table 1). Treatments were applied with a bicycle sprayer in a 20 GPA spray solution through AIXR11002 air-induction flat fan nozzles pressurized with CO_2 at 42 psi to the center four rows of six row plots 40 feet in length. Experimental design was a randomized complete block with 4 replications. Waterhemp control was evaluated June 18, July 2, July 14, and July 24. Soybean injury was evaluated June 18, July 2, July 14, and July 24 (Table 4).

All evaluations were a visual estimate of percent fresh weight reduction between center treated rows as compared to adjacent untreated strips. Soybean injury was a visual estimate of percent growth reduction or necrosis.

Data were analyzed with GLM procedure of SAS (Statistical Analysis Software, SAS Academic Studio July 8,2026, SAS Institute, Inc.) at alpha=0.10 and differences are determined with 90% confidence; meaning, if the study was repeated 100 times that 90 times out of 100, we would expect statistically similar treatments (within one LSD value of each other) to remain similar in performance groupings. Data sets were analyzed at greater levels of confidence if statistical power allowed for meaningful separation at alpha=0.05 (95%) or alpha=0.01 (99%).

Table 1. Application information for Renville giant ragweed and waterhemp control trials in 2026.						
Weed	Giant Ragweed		Waterhemp – Renville		Waterhemp – North	
Application Code	A	B	A	B	A	B
Date	May 5	June 1	May 8	June 15	June 3	July 2
Time of Day	5:00 PM	12:00 PM	11:00 AM	10:30 AM	2:30 PM	9:15 AM
Air Temperature (F)	51	84	63	71	73	72
Relative Humidity (%)	34	58	27	49	71	74.5
Wind Velocity (mph)	8	4	8	5	13	1
Wind Direction	NW	SE	NW	SW	SSE	N
Soil Temp. (F at 6”)	48	68	45	62	69	71
Soil Moisture	Good	Good	Good	Good	Good	Good
Cloud Cover (%)	100	20	20	70	40	10
Crop Growth Stage (avg)	-	V2	-	V4	-	V2
Weed Height	-	6”	-	4”	-	4”

RESULTS AND DISCUSSION

GIANT RAGWEED IN SOYBEAN

Giant ragweed pressure was significant across the study, with replications 1 and 2 having moderate pressure and replication 3 having severe pressure. There were no significant differences for the PRE application at either A+14 or A+27. Treatments averaged 31.5% control at the A+14 evaluation and 12.8% control at the A+27 evaluation (Table 2). The poor giant ragweed control from the PRE is likely related to herbicide activation. While the residuals waited nine days for an activating rainfall the severe infestation of giant ragweed did not and continued to vigorously grow.

Lay-by or early postemergence applications were made immediately following the A+27 evaluation to 6” tall giant ragweed. This evaluation emphasized the impact of the early post emergence foliar activity efficacy. Two weeks later, at the A+42 evaluation timing, treatments averaged 93.1% control and ranged between 78 and 99% control. The top nine treatments were statistically similar at the 90% confidence level. Treatments that had Enlist One (Site of action 4, Auxin Mimics/Plant Growth Regulator) were statistically better than the treatments that did not include 2,4-D. Treatments 1 and 7 which included Liberty Ultra and Flexstar as a component of Prefix, respectively, were also statistically similar to the Enlist One treatments. At the 42DAA evaluation, 8 of the 12 treatments met the grant goal of 95% giant ragweed control.

The A+56 evaluation occurred 28 days after the early post emergence application. At this evaluation, treatments averaged 86.2% control and ranged between 67 and 97% control. At 90% confidence level, the top seven treatments were statistically similar. Treatments 3, 4, 5, 6, 7, 8, 11, and 12, were statistically better than treatments 2, 9, and 10. Common post emergence foliar actives included glufosinate (Liberty ULTRA, Liberty 280 SL, and Interline Mega), 2,4-D (Enlist One), glyphosate (Round Up PowerMax 3, Mad Dog, and a component of Sequence), encapsulated acetochlor (Warrant and a component of Enclosa) and s-metolachlor (Moccasin II Plus and a component of Prefix). Overall, only treatments 4 and 12 achieved the grant goal of 95% giant ragweed control at the 56 DAA evaluation. Multiple residual active ingredients combined with a group 4 herbicide, like Enlist One, post emergence is ideal for heavy infestations and the addition of a second post application pass closer to R1 may be required. For mild infestations where weed density did not impact herbicide contact, glufosinate also provided acceptable post control. Unlike in waterhemp, our strongest tools for giant ragweed control still lay in our post emergence actives. Tank mixes with oil-based herbicides can enhance chances of crop injury, however, by 14 days after post application injury was no longer present and unlikely to impact yield.

Table 2. Giant Ragweed control in soybean in 2026.										
#	Treatment[a]	Rate	App. Code[b]	Giant Ragweed Control				Injury	
				A+14[c]	A+27	A+42	A+56	B+3	B+7
		oz/A* or fl oz/A		----------%----------				----%----	
1	Zidua Pro / Liberty ULTRA+RU3[d]+AMS	6 / 29+30+3lbs	A / B	33	17	92	85	0	0
2	Authority First / Warrant+RU3+ Liberty 280 SL+AMS	6.4 / 48+30+32+3lbs	A / B	13	13	78	67	0	0
3	Sonic / Enlist One+Liberty ULTRA+ Enclosa+MSO with Leci-Tech+AMS	5* / 32+24+48+1%+2.5%	A / B	23	13	98	93	9	5
4	Sonic Boom / Enlist One+Liberty ULTRA+ Enclosa+MSO with Leci-Tech+AMS	21 / 32+24+48+1%+2.5%	A / B	13	0	98	97	7	5
5	Tribal+Infuse / Missile+Enlist One+ Mad Dog	64+32 / 0.25%+32+36	A / B	27	13	98	90	4	3
6	Arterio Prime+Infuse / Missile+ Enlist One+Mad Dog	10+24 / 0.25%+32+36	A / B	43	20	97	91	4	1
7	Tendovo / Liberty 280 SL+Prefix+AMS	56 / 40+32+2.6lbs	A / B	43	7	97	92	22	13
8	Boundary+Spartan / Enlist One+ Sequence+Agri-dex	56+4 / 32+32+1%	A / B	30	7	95	85	0	2
9	Moccasin II Plus / Interline Mega+ Moccasin II Plus+AMS	21.28 / 17.6+21.28+2lbs	A / B	43	20	85	74	1	2
10	Satellite Hydro Cap / Interline Mega+ Moccasin II Plus+AMS	37.28 / 17.6+21.28+2lbs	A / B	30	17	85	73	0	1
11	Fierce MTZ / Enlist One+ Perpetuo+RU3+AMS+AMS	16 / 32+6+30+ 1.3lbs+0.25%	A / B	37	13	95	90	12	10
12	Fierce EZ+FirstRate / Enlist One+ Perpetuo+RU3+AMS+NIS	6+0.6* / 32+6+30+ 1.3lbs+0.25%	A / B	43	13	99	97	15	10
	LSD (0.1)			**NS**	**NS**	**8.4**	**10.8**	**3.1**	**1.5**
	LSD (0.05)					**10.1**	**13.1**	**3.8**	**1.8**
	LSD (0.01)					**13.8**	**17.8**	**5.1**	**2.4**

[a]PRE treatment applications contained no additional adjuvants.
[b]Application codes refer to the information in Table 1.
[c]A+[#] or B+[#]=Days after "A" or "B" application.
[d]RU2/3=Roundup PowerMax 2/3

WATERHEMP CONTROL IN SOYBEAN – RENVILLE LOCATION

Waterhemp pressure was uniform and moderate across the study (Table 3). Waterhemp was not emerged at the A+14 evaluation timing, therefore, not included in the table. The A+28 evaluation was taken 10 days prior to the early post-emergence application. Waterhemp control averaged 98% control and ranged from 95 to 100% control. At this evaluation, the top 13 treatments were statistically similar. The top 4 treatments, treatments 1, 2, 4, and 6, were statistically better than treatment 11. Residual herbicides in this study had multiple activating rainfalls (1" within 14 days of application) and were the best tool in controlling early flushes of emerging waterhemp. All preemergence treatments met the goal of 95% control of waterhemp at A+28.

Injury did occur at B+3 from PPO containing post applications (Prefix, Perpetuo, and Anthem Maxx) (Table 3).

There were no statistical differences at the A+42 or A+56 evaluation timings. Treatments averaged 98.2% waterhemp control and ranged from 94 to 100% control at the A+42 evaluation. At this timing, 13 of the 14 treatments achieved the grant goal of 95% waterhemp control. Treatments averaged 97.6% waterhemp control and ranged from 95 to 99% control at the A+56 evaluation timing. All treatments achieved the grant goal of 95% waterhemp control at the A+56 evaluation.

In a year when strong residual programs combine with activating rainfalls, waterhemp control can be easily achieved in a two-spray program. A weaker residual program than those demonstrated below, or less timely activating rainfalls, can increase the burden on post emergence activity programs and result in less-than-ideal waterhemp control. A minimum of 2 different residual actives were used in each program and as many as 4 actives were used in some programs.

Table 3. Waterhemp control in soybean at Renville location in 2026.							
#	Treatment[a]	Rate	App. Code[b]	Waterhemp Control			Injury
				A+28	A+42	A+56	B+3
		oz/A* or fl oz/A		---------%---------			--%--
1	Zidua Pro / Liberty ULTRA+Outlook+RU3[d]+AMS	4.5 / 29+12+30+3lbs	A / B	99	98	99	0
2	Zidua Pro / Liberty ULTRA+RU3+AMS	6 / 29+30+3lbs	A / B	99	95	95	0
3	Warrant+Mauler / Warrant+RU3+ Liberty 280 SL+AMS	48+8 / 64+30+36+3lbs	A / B	98	94	95	0
4	Warrant+Mauler / Warrant+RU3+ Liberty 280 SL+AMS	64+8 / 48+30+36+3lbs	A / B	100	99	99	0
5	Sonic Boom / Enlist One+Liberty ULTRA+ Enversa+MSO with Leci-Tech+AMS	21 / 32+24+48+1%+2.5%	A / B	98	97	99	3
6	Kyber Pro / Enlist One+Liberty ULTRA+ Enversa+MSO with Leci-Tech+AMS	16 / 32+24+48+1%+2.5%	A / B	100	100	98	3
7	Authority Edge / Anthem Maxx+Enlist One+ Liberty 280 SL+AMS	8 / 2.75+32+40+3%	A / B	97	99	99	43
8	Authority Supreme / Enlist One+ Liberty 280 SL+AMS	9.5 / 32+40+3%	A / B	97	97	95	0
9	Tribal+Infuse / Missile+Enlist One+Mad Dog	64+32 / 0.25%+32+36	A / B	98	100	99	0
10	Aertios Prime+Infuse / Missile+ Enlist One+Mad Dog	10+24 / 0.25%+32+36	A / B	98	100	99	0
11	Tendovo / Liberty 280+Prefix+AMS	56 / 40+32+2.6lbs	A / B	95	99	95	12
12	Boundary+Spartan / Enlist One+ Sequence+ Agri-dex+AMS	56+4 / 32+56+1%+2.6lbs	A / B	98	98	98	3
13	Fierce MTZ / Enlist One+ Perpetuo+RU3+AMS+NIS	16 / 32+6+30+1.3lbs+0.25%	A / B	97	99	98	12
14	Fierce EZ / Enlist One+Perpetuo+RU3+AMS+NIS	6 / 32+6+30+1.3lbs+0.25%	A / B	98	100	99	10
	LSD (0.1)			**3.7**	**NS**	**NS**	**3.1**

[a]PRE treatment applications contained no additional adjuvants.
[b]Application codes refer to the information in Table 1.
[c]A+[#] or B+[#]=Days after "A" or "B" application.
[d]NIS=Preference; RU3=Roundup PowerMax 3; COC=Crop Oil Concentrate, Superb HC; NIS=Preference; HSMOC=Destiny HC.

WATERHEMP CONTROL IN SOYBEAN – NORTHERN LOCATION

Waterhemp pressure was uniform and significant across the study (Table 4). At the A+14 evaluation, all treatments were statistically similar, except treatment 13. Treatments 4, 14, and 15, which included the active flumioxazin, caused injury, however, this was not unexpected and will not impact yield. Treatments averaged 96.3% waterhemp control and ranged from 62.5-99%. With the exception of treatment 13, all other treatments met the grant goal of 95% waterhemp control at the A+14 evaluation timing.

At the A+28 evaluation, treatments averaged 94.9% and ranged from 74.3-98.8% waterhemp control. The top 12 treatments were statistically similar and met the grant goal of 95% waterhemp control. At this timing, all treatments were statistically similar for soybean crop injury deeming all pre-emergence programs safe (Table 5).

The A+42 evaluation timing, nearly two weeks after the POST application, showcased the efficacy of the POST treatments. The treatments ranged from 94.3-100% with an average of 99% waterhemp control. The top 11 treatments were statistically similar. Treatments with lower waterhemp control before the POST application timing, had lower control after the POST application as well, reiterating the importance of having a good preemergence program for the best season long waterhemp control. Some crop injury occurred with Group 14 "PPO inhibitor" herbicides as expected. Only one treatment did not meet the grant goal of 95% waterhemp control.

At the final evaluation, A+52, treatments averaged 98.6% waterhemp control and ranged from 92-100% control. The top 13 treatments were statistically similar and better than treatments 12 and 13. Treatment 12 was statistically better

than treatment 13. The injury recorded at this evaluation was consistent with recovering PPO injury or what would be expected with the POST herbicides included in treatments and unlikely to impact yield. At this evaluation, 14 of 15 treatments achieved the 95% waterhemp control goal.

Table 4. Waterhemp control in soybean at Northern location in 2026.

#	Treatment[a]	Rate	App. Code[b]	Waterhemp Control			
				A+14[c]	A+28	A+42	A+52
		oz/A* or fl oz/A		----------%----------			
1	Zidua PLUS / Liberty ULTRA+ Outlook+RU3+AMS	6 / 29+12+30+3lbs	A / B	99	96.8	99.5	99
2	Zidua PLUS / Liberty ULTRA+RU3+ Zidua SC+AMS	6 / 29+30+2+3lbs	A / B	98.5	97	100	99.8
3	Warrant / Warrant+RU3+Liberty 280 SL+AMS	54 / 48+30+36+3lbs	A / B	98.8	95.3	100	99.8
4	Fierce EZ / Warrant+RU3+ Liberty 280 SL+AMS	6 / 48+30+36+3lbs	A / B	98.8	97.8	99.8	99.5
5	Sonic+Zidua SC / Enlist One+Liberty ULTRA +Enversa+MSO with Leci-Tech+AMS	4*+3.5 / 32+24+48+1%v/v+2.5%v/v	A / B	98	96	100	99.5
6	Authority Edge / Anthem Maxx+Enlist One+ Liberty 280 SL+AMS	8 / 2.75+32+40+3%v/v	A / B	99	97.8	100	99.8
7	Authority Supreme / Enlist One+ Liberty 280 SL+AMS	7 / 32+40+3%v/v	A / B	99	97.5	100	100
8	FortiTRI+Infuse / Choice Trio+Missile+ Enlist One+Mad Dog	5+24 / 0.25%v/v+0.25%v/v+32+36	A / B	98.5	92.5	97.8	98
9	Aertios Prime+Infuse / Missile+ Enlist One+Mad Dog	8.8+24 / 0.25%v/v+32+36	A / B	99	98.3	98.3	98.3
10	Tendovo / Liberty 280 SL+Prefix+AMS	56 / 40+32+2.6lbs	A / B	99	98.8	100	99.8
11	Bounday+Spartan / Enlist One+Sequence+ Agri-dex+AMS	24+4 / 32+56+1%v/v+2.6lbs	A / B	99	99	100	99.8
12	Moccasin II Plus / Interline Mega+ Moccasin II Plus+AMS	21.3 / 17.6+21.3+3lbs	A / B	97.5	85	96.5	95.3
13	Satellite Hydro Cap / Interline Mega+ Moccasin II plus+AMS	37.3 / 17.6+21.3+3lbs	A / B	62.5	74.3	94.3	92
14	Fierce MTZ / Enlist One+Perpetuo+ RU3+AMS+NIS	16 / 32+6+30+1.3lbs+0.25%v/v	A / B	99	98.8	100	99.8
15	Fierce EZ / Enlist One+Perpetuo+ RU3+AMS+NIS	6 / 32+6+30+1.3lbs+0.25%v/v	A / B	99	98.8	99.5	99
	LSD (0.01)			**2.6**	**5.3**	**1.7**	**2.1**

[a]PRE treatment applications contained no additional adjuvants.
[b]Application codes refer to the information in Table 1.
[c]A+[#] or B+[#]=Days after "A" or "B" application.
[d]NIS=Preference; RU3=Roundup PowerMax 3; COC=Crop Oil Concentrate, Superb HC; NIS=Preference; HSMOC=Destiny HC.

Table 5. Injury in soybean at Northern location in 2026.							
#	Treatment[a]	Rate	App. Code[b]	Injury			
				A+14[c]	A+28	A+42	A+52
		oz/A* or fl oz/A		----------%----------			
1	Zidua PLUS / Liberty ULTRA+ Outlook+RU3+AMS	6 / 29+12+30+3lbs	A / B	0	0.75	7.5	2
2	Zidua PLUS / Liberty ULTRA+RU3+ Zidua SC+AMS	6 / 29+30+2+3lbs	A / B	0	0	2.5	2.75
3	Warrant / Warrant+RU3+Liberty 280+AMS	54 / 48+30+36+3lbs	A / B	1.5	1.25	6.25	4.25
4	Fierce EZ / Warrant+RU3+ Liberty 280+AMS	6 / 48+30+36+3lbs	A / B	15	0	7.5	6.75
5	Sonic+Zidua SC / Enlist One+Liberty ULTRA +Enversa+MSO with Leci-Tech+AMS	4*+3.5 / 32+24+48+1%v/v+2.5%v/v	A / B	0	0	2.5	3.5
6	Authority Edge / Anthem Maxx+Enlist One+ Liberty 280 SL+AMS	8 / 2.75+32+40+3%v/v	A / B	0	0	22.5	18.75
7	Authority Supreme / Enlist One+ Liberty 280 SL+AMS	7 / 32+40+3%v/v	A / B	0	0	7.5	1.75
8	FortiTRI+Infuse / Choice Trio+Missile+ Enlist One+Mad Dog	5+24 / 0.25%v/v+0.25%v/v+32+36	A / B	0	0	0	0.75
9	Aertios Prime+Infuse / Missile+ Enlist One+Mad Dog	8.8+24 / 0.25%v/v+32+36	A / B	0	0	3.75	3
10	Tendovo / Liberty 280 SL+Prefix+AMS	56 / 40+32+2.6lbs	A / B	0.75	0	12.5	4
11	Bounday+Spartan / Enlist One+Sequence+ Agri-dex+AMS	24+4 / 32+56+1%v/v+2.6lbs	A / B	0	0	8.25	3
12	Moccasin II Plus / Interline Mega+ Moccasin II Plus+AMS	21.3 / 17.6+21.3+3lbs	A / B	0	0	2.5	0
13	Satellite Hydro Cap / Interline Mega+ Moccasin II Plus+AMS	37.3 / 17.6+21.3+3lbs	A / B	0	2	8.75	0
14	Fierce MTZ / Enlist One+Perpetuo+ RU3+AMS+NIS	16 / 32+6+30+1.3lbs+0.25%v/v	A / B	15.75	1.25	10.75	6.5
15	Fierce EZ / Enlist One+Perpetuo+ RU3+AMS+NIS	6 / 32+6+30+1.3lbs+0.25%v/v	A / B	11.75	2.25	13.75	4.75
	LSD (0.01)			**1.7**	**NS**	**8.7**	**5.9**

[a]PRE treatment applications contained no additional adjuvants.
[b]Application codes refer to the information in Table 1.
[c]A+[#] or B+[#]=Days after "A" or "B" application.
[d]NIS=Preference; RU3=Roundup PowerMax 3; COC=Crop Oil Concentrate, Superb HC; NIS=Preference; HSMOC=Destiny HC.

CONCLUSION

Giant ragweed population was excellent for evaluations. Rainfall did not occur for nine days after the preemergence application, leading to poor giant ragweed control as treatments were not activated while giant ragweed continued to grow. Pre-emergence actives for giant ragweed control remain limited and dependent and quick rainfall after application. Post emergent actives in addition to strong residual programs continue to be the strongest tool.

Both waterhemp studies had significant waterhemp populations and received adequate rainfall to activate preemergent treatments. Treatments that did not have great PRE control, tended to continue the trend later in the season, showing the importance of having strong preemergent programs with multiple residual actives to achieve the greatest season-long waterhemp control. Multiple activated soil residual herbicides are still our best chance against waterhemp.

Although not all suppliers may provide all products listed above, growers can reference product labels for active ingredient names and ratios of pre-packaged, pre-mixed products to find equivalent products. Using the application rate listed in the table above and the "lb ai/gallon" on the product label, total "ai/acre" can be determined using [(product A rate/a in fl oz or dry oz) / (128 fl oz or 16 dry oz) * (labeled product ratio in "lb ai/gal (for fl oz)" or "% by weight (for dry oz)" = lbs of active ingredient applied per acre to be compared with product B label and rate].

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