2024 Giant Ragweed Resistance Management Programs in Corn-Soybean Rotations

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Objectives were to achieve 95% control of giant ragweed in soybean and corn at crop canopy, showcase giant ragweed 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 program that provides the greatest control at an economical cost based on local supplier pricing and availability of products.

MATERIALS AND METHODS

Experiments were conducted on a severe infestation with various levels of ALS, HPPD, and glyphosate-resistant giant ragweed near Renville, Minnesota, in 2024. Soil was a fine-textured webster-clay loam soil with 4.4% organic matter and a 6.3 soil pH. Spring tillage was a field cultivator at 3" depth. Enestvedts 654 Enlist PWC corn was seeded 2.00 inches deep on 30-inch row spacings at 33,000 seeds per acre on May 6, emerging May 15. Preemergence herbicide treatments applied to corn on May 6, and early-postemergence treatments to V3 corn on May 23 (Table 1). Becks 1830E3 soybean was seeded 1.25 inches deep on 30-inch row spacings at 140,000 seeds per acre on May 13, emerging May 21. Preemergence herbicide treatments applied to soybean on May 13, and early-postemergence treatments to V1 soybean on May 29 (Table 1). All treatments applied with bicycle sprayer in 15 GPA spray solution through AIXR11002 air-induction flat fan nozzles pressurized with CO_2 at 26 psi to the center two rows of four row plots 40 feet in length.

Giant ragweed control in corn was evaluated May 20, June 3, June 18, and July 1 (Table 2). Giant ragweed control in soybean was evaluated May 27, June 10, June 24, and July 8 (Table 3). Giant ragweed evaluations were a visual estimate of percent fresh weight reduction between center two rows as compared to adjacent untreated strips. Experimental design was a randomized complete block with 4 replications. Data were analyzed with GLM procedure of SAS (Statistical Analysis Software, SAS Academic Studio October 30,2024, 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.

Table 1. Application information for Renville giant ragweed control trials in 2024.				
Crop	Corn		Soybean	
Application Code	A	B	A	B
Date	May 6	May 23	May 13	May 29
Time of Day	6:00 PM	8:00 AM	5:00 PM	9:00 AM
Air Temperature (F)	75	66	75	65
Relative Humidity (%)	58	67	29	59
Wind Velocity (mph)	19	5	2	2
Wind Direction	SE	S	N	E
Soil Temp. (F at 6")	58	56	61	59
Soil Moisture	Good	Good	Good	Good
Cloud Cover (%)	80	20	10	10
Crop Growth Stage (avg)	-	V3	-	V1
Giant Ragweed Height	-	4"	-	4"

RESULTS AND DISCUSSION

GIANT RAGWEED IN CORN

Giant ragweed pressure was uniform and significant across the study. Pre-emergence (PRE) product control at A+14, evaluation was taken 4-days prior to early post application, averaged 82.6% and ranged between 66.3 and 98.8%, with exception of one treatment that did not receive a PRE. The top 4 treatments were statistically similar. Products included in these treatments were Verdict and FortiTRI+Sinder 3L. Common actives within the premixes of FortiTRI and Verdict include saflufenacil (Sharpen) and dimethenamid-P (Outlook). FortiTRI included a third component, pyroxasulfone (Zidua), as compared to Verdict. The 2024 North Dakota Weed Control Guide (p.114-115; a digital version can be accessed online) summarizes pyroxasulfone alone provides poor-fair ragweed control and dimethenamid-P alone provides no control of ragweed. Saflufenacil in FortiTRI at 21 fl oz/A was applied at 0.084 lbs/ai/a while in Verdict at 15 fl oz/A was applied at 0.067 lbs/ai/a which are equivalent to 3.76 and 3.00 fl oz/a of Sharpen respectively, which are rates that provide good-excellent control of ragweed; thus, a conjecture can be drawn that saflufenacil appeared to be the most effective PRE active ingredient in corn in 2024. Saflufencil requires less water to activate which may have impacted the increased efficacy in this particular environment. Other PRE actives that performed in the second-tier ratings were dicamba (Status), a component of DiFlexx; clopyralid (Sinder 3L, Stinger), a component of Triple Flexx II and Trisidual; mesotrione (Callisto); and, atrazine (AAtrex). Overall, only 2 of the 16 treatments achieved the grant goal of 95% giant ragweed as PRE only applications.

Lay-by or early postemergence applications were made 4-days after the A+14 evaluation and 11-days prior to the A+28 evaluation to 4-6 inch tall giant ragweed. This evaluation emphasized the impact of the early post emergence foliar activity efficacy. Treatments averaged 98.3% and ranged between 88.8 and 100% giant ragweed control. The top 12 treatments were statistically similar. Common post emergence foliar actives included mesotrione (Callisto, Carabiner 4SC, Incinerate), a component of Resicore XL, Maverick, Acuron, and Acuron GT; clopyralid (Stinger), a component of Kyro, Maverick, and Resicore XL; dicamba (Status, Rifle), a component of DiFlexx; atrazine (AAtrex), a component of Acuron; topramezone, a component of Kyro; bicyclopyrone, a component of Acuron and Acuron GT; and, tembotrione (Laudis). Overall, 15 of 16 treatments achieved the grant goal of 95% giant ragweed control.

The A+42 evaluation occurred 26-days after the early post emergence application. This evaluation emphasized the impact of layered residual herbicides as PRE + EPOST treatment combinations began to separate. Treatments averaged 97.2% and ranged between 86.3 and 100% giant ragweed control. The top 11 treatments were all statistically similar. A common theme included a PRE residual followed by layering of one or more post emergence residuals in addition to a foliar activity active ingredient. Common post emergence residuals included dicamba, mesotrione, atrazine, tembotrione, topramezone, cloypyralid, and bicyclopyrone. Post activity products without significant residual impact included glyphosate, an active ingredient with little impact on the highly resistant population of giant ragweed. Overall, 14 of the 16 treatments achieved the grant goal of 95% giant ragweed control.

The A+56 evaluation occurred 39-days after early post emergence application. The A+56 rating emphasized the season-long durability of the residual products utilized in combination with crop canopy. The evaluation averaged 93.1% and ranged between 77.5 and 97.3% giant ragweed control. The top 12 treatments were statistically similar. The A+42 discussion above is relevant to this evaluation timing as well. We potentially observe a waiver in dicamba and mesotrione residuals wearing off late season with more reliance on post emergence applications inclusive of atrazine and clopyralid. Overall, only 5 of the 16 treatments achieve the grant goal of 95% giant ragweed control.

Table 2. Giant Ragweed control in corn in 2024.

Treatment[a]	Rate	App. Code[b]	Giant Ragweed Control			
			A+14[c]	A+28	A+42	A+56
	oz/A* or fl oz/A		----------------%----------------			
Surtain / Status+RU3+NIS+Dry AMS	14 / 5*+32+0.25%	A / B	75.0	96.3	99.5	93.3
Verdict / Status+Callisto+Atrazine+RU3+COC+AMS	15 / 3*+3+16+30	A / B	89.5	99.5	99.0	93.8
Harness Max+DiFlexx / Laudis+Atrazine+RU3+AMS[d]+MSO	55+10 / 3+16+30+0.5%	A / B	87.5	99.5	97.0	94.0
TripleFlex II+DiFlexx / Laudis+DiFlexx+RU3+MSO+Class Act Ridion	32+10 / 3+8+30+0.5%+1%	A / B	87.5	98.5	94.5	90.0
Surpass NXT / Kyro+AAtrex+RU3+COC+Amsol	32 / 45+16+30+2.5%	A / B	76.3	99.0	98.8	95.8
Surpass NXT / Resicore XL+AAtrex+RU3+COC+Amsol	32 / 45+16+30+2.5%	A / B	71.3	100	100	96.5
Anthem Maxx+Callisto+AAtrex / Status+RU3+AMS	4.5+5.5+32 / 5*+30	A / B	85.0	99.0	97.8	93.8
Anthem Maxx+Callisto+AAtrex+RU3+AMS+COC	4+3+32+30	B	-	96.5	94.5	91.3
FortiTRI+Sinder 3L / Rifle+Missile	21+2 / 8+0.25%	A / B	98.8	99.5	99.5	95.0
FortiTRI+Sinder 3L+Infuse / Rifle+Carabiner 4SC+Missile	21+2+24 / 8+3+0.25%	A / B	94.5	100	99.5	94.5
Calibra / AAtrex+Acuron GT+AMS	64 / 16+60	A / B	72.5	100	100	96.5
Acuron / Acuron+RU3+AMS	48 / 48+30	A / B	66.3	98.3	99.0	94.5
Harness / AAtrex+Maverick+RU3+AMS+HSMOC	44 / 16+14+30	A / B	73.8	97.8	93.3	92.5
DiFlexx / AAtrex+Maverick+RU3+AMS+HSMOC	8 / 16+24+30	A / B	76.3	99.5	97.5	93.3
Trisidual / Cornerstone 5 Plus+Incinerate	32 / 32+3	A / B	87.5	88.8	86.3	77.5
Verdict / Acuron+RU3+AMS	18 / 48+30	A / B	97.0	100	99.5	97.3
LSD (0.1)			10.4	2.0	2.7	4.6

[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]AMS=Class Act NG 2.5%v/v; RU2/3=Roundup 2/3; COC=Crop Oil Concentrate 1%v/v; HSMOC=Destiny HC 0.5%v/v.

GIANT RAGWEED IN SOYBEAN

Giant ragweed pressure was uniform and significant across the study. Pre-emergence (PRE) product control at A+14 was evaluated 2-days prior to early postemergence application and averaged 48.6% and ranged between 12.5 and 75.1%. The top 8 treatments were statistically similar. Products included in these treatments included Zidua Pro, Authority First, and Sonic. Common actives within these premixes include sulfentrazone (Spartan), a component of Authority First and Sonic; cloransulam (FirstRate), a component of Authority First, Tendovo, and Sonic; pyroxasulfone (Zidua), a component of Zidua Pro; saflufenacil (Sharpen), a component of Zidua Pro; and imazethapyr (Pursuit), a component of Zidua Pro. The 2024 North Dakota Weed Control Guide (p.114-115) summarizes pyroxasulfone alone provides poor-fair ragweed control while sulfentrazone and imazethapyr alone provide no control of ragweed. Saflufenacil at the Zidua Pro rate provides about 1 fl oz of Sharpen equivalent and provides fair control of ragweed. The FirstRate (cloransulam only product) label indicates giant ragweed is controlled at appropriate use rates. Thus, a majority of giant ragweed control PRE was likely a result of saflufenacil and cloransulam active ingredients. Overall, none of the pre-emergence alone treatments were able to provide the grant goal of 95% giant ragweed control.

Lay-by or early postemergence applications were made 2-days after the A+14 evaluation and 12-days prior to the A+28 evaluation to 4-6 inch tall giant ragweed. This evaluation emphasized the impact of the early post emergence foliar efficacy. Treatments averaged 91.4% and ranged between 80.0 - 98.0% giant ragweed control. The top 7 treatments were statistically similar. Foliar activity products included in were Liberty ULTRA (glufosinate) and Enlist One (2,4-D). Overall, only 2 of 15 treatments achieved the grant goal of 95% giant ragweed control.

The A+42 evaluation occurred 26-days after the early post emergence application. This evaluation emphasized the impact of layered residual herbicides as PRE + EPOST treatment combinations began to separate. Treatments averaged 81.7% and ranged between 68.8 and 97.0% giant ragweed control. The top 5 treatments were all statistically similar. A common theme included a strong PRE residual followed by layering of one or more post emergence residuals. All top treatments had a pre-emergence product statistically similar to the best performer at A+14 AND a

foliar product of glufosinate or 2,4-D at the early postemergence timing. Residual herbicides added to the treatments at early postemergence included dimethenamid-P (Outlook), acetachlor (Warrant), fluthiacet (AnthemMaxx), and s-metholachlor (EverPreX). Overall, only 1 of 15 treatments achieve the grant goal of 95% giant ragweed control.

The A+56 evaluation occurred 39-days after early post emergence application. The A+56 rating emphasized the season-long durability of the residual products utilized in combination with crop canopy. The evaluation averaged 72.1% and ranged between 55.0 and 91.8% giant ragweed control. The top 4 treatments were statistically similar. As evidence of a 9.6% drop in average giant ragweed control from the A+42 evaluation, one can conclude that residual herbicides continue to degrade over time, losing efficacy. There are not many residual active ingredients that control giant ragweed in soybean effectively, so options are limited. In a grower's field, the addition of a second post emergence application of glufosinate or 2,4-D based products would have been necessary. None of the treatments achieve the grant goal of 95% giant ragweed control.

Table 3. Giant ragweed control in soybean in 2024.						
		App.	Giant Ragweed Control			
Treatment[a]	Rate	Code[b]	A+14[c]	A+28	A+42	A+56
	oz/A* or fl oz/A		----------------%----------------			
Zidua Pro / Liberty ULTRA+RU3+Dry AMS	6 / 24+30+3lb/A	A / B	68.8	93.8	85.0	70.0
Zidua Pro / Liberty ULTRA+Outlook+RU3+Dry AMS	6 / 24+10+30+3lb/A	A / B	67.5	94.5	90.0	77.5
Auth. First / War+RU3+Liberty+AMS[d]	6.45* / 48+30+32	A / B	65.0	92.0	86.3	78.8
Auth. First / War.+RU3+Enlist One+AMS	6.45* / 48+30+32	A / B	65.0	98.0	97.0	91.8
Sonic / Enlist One+Liberty+AMS	5* / 32+32	A / B	67.5	93.3	88.3	82.5
Sonic / Enlist One+Liberty+EverpreX+AMS	5* / 32+32+16	A / B	65.0	94.5	91.3	86.3
Auth. First / Enlist One+RU3+Anthem Maxx+AMS	6.4* / 32+30+4	A / B	75.1	96.5	93.7	85.0
Tribal / Enlist One+Mad Dog+Missile	72 / 32+36+0.25%	A / B	22.5	80.0	70.0	57.5
Tribal+Infuse / Enlist One+Mad Dog+Missile	72+32 / 32+36+0.25%	A / B	42.5	87.5	71.3	62.5
Prefix / Enlist One+Sequence+AMS	32 / 32+48	A / B	42.5	88.8	77.5	70.0
Tendovo / Enlist One+Sequence+AMS	48 / 32+48	A / B	57.5	92.5	85.0	78.8
Fierce MTZ / Enlist One+Perpetuo+RU3+AMS	16 / 32+6+30	A / B	17.5	87.5	75.0	62.5
Fierce MTZ / Enlist One+Resource+RU3+AMS	16 / 32+4+30	A / B	17.5	86.3	68.8	55.0
Dimetric Charged+Interlock / Enlist One+Liberty+Cornerstone 5+StrikeLock+AMS	12+4 / 32+32+32+12	A / B	42.5	91.3	77.0	62.5
Presidual+Interlock / Enlist One+Liberty+Cornerstone 5 Plus+StrikeLock+AMS	24+4 / 32+32+32+12	A / B	12.5	88.8	70.0	61.3
LSD (0.1)			21.3	3.3	7.2	11.7

[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]AMS=Class Act NG 2.5%v/v; RU2/3=Roundup 2/3; War=Warrant; COC=Crop Oil Conc. 1%v/v; HSMOC=Destiny HC 0.5%v/v.

CONCLUSION

Giant ragweed population was excellent for evaluations. Rainfall was sufficient for activation of pre-emergence herbicides. Primarily there was consistency across crops in regards to evaluation timing meaning. The A+14 evaluations observed the PRE only performance; the A+28 evaluations observed the immediate early post application impact; the A+42 evaluations observed the layered residual impact; and, the A+56 evaluations observed the season-long performance of the programs demonstrated. Overall, a strong PRE with two or more active ingredients in addition to a post application of two or more active ingredients, with at least one of the actives having foliar activity, is critical for season long giant ragweed control. However, controlling giant ragweed in soybean is a much greater challenge and likely requires a 3rd later application timing of a foliar activity herbicide.

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