2023 Waterhemp Resistance Management Programs in Corn-Soybean Rotations

Andrew Lueck[1] and Jenna Whitmore[2]

Next Gen Ag LLC, Renville, MN; [1]Research Lead and [2]Research Manager

Objectives were to achieve 95% control of waterhemp in soybean and corn at crop canopy, showcase 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 waterhemp 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 low to moderate natural population of ALS and glyphosate-resistant waterhemp near Renville, Minnesota, in 2023. Soil was a fine-textured webster-clay loam soil with 5.0% organic matter and a 6.6 soil pH. Spring tillage was a field cultivator at 3" depth. Becks 4844V2P corn was seeded 2.00 inches deep on 30-inch row spacings at 32,000 seeds per acre on May 24 and emerging May 30. Preemergence herbicide treatments were applied to corn on May 24 and early-postemergence treatments to V4 corn on June 12 (Table 1). Becks 1630E soybean was seeded 1.25 inches deep on 30-inch row spacings at 130,000 seeds per acre on May 16 and emerging May 25. Preemergence herbicide treatments were applied to soybean on May 26 and early-postemergence treatments to V1 soybean on June 21 (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 25 psi to the center two rows of four row plots 40 feet in length. Field area had moderate levels of glyphosate-resistant waterhemp.

Waterhemp control in corn was evaluated June 8, June 19, June 27, and July 24 (Table 2). Waterhemp control in soybean was evaluated June 9, June 20, June 28, July 4, and July 20 (Table 3). Waterhemp evaluations were a visual estimate of percent fresh weight reduction in center two treated rows compared to adjacent untreated strips. Experimental design was randomized complete block with 4 replications. Data were analyzed with GLM procedure of SAS (Statistical Analysis Software 2023, version 9.4M8, SAS Institute, Inc.) at alpha=0.10 and differences are determined with 90% confidence; meaning, if the study were repeated 100 times that 90 times out of 100, we would expect treatments that are statistically similar (within one LSD value of each other in data tables 2 and 3) to continue to be similar.

Table 1. Application information for Renville giant ragweed control trials in 2023.				
Crop	Corn		Soybean	
Application Code	A	B	A	B
Date	May 24	June 12	May 26	June 21
Time of Day	3:00 PM	2:00 PM	7:00 PM	8:00 AM
Air Temperature (F)	89	80	83	74
Relative Humidity (%)	44	31	20	62
Wind Velocity (mph)	9	10	6	3
Wind Direction	SE	NW	SE	SW
Soil Temp. (F at 6")	68	75	68	72
Soil Moisture	Good	Good	Fair	Dry
Cloud Cover (%)	40	30	10	5
Crop Growth Stage (avg)	-	V4	-	V3
Waterhemp Height	-	3"	-	6"

RESULTS AND DISCUSSION

WATERHEMP IN CORN

Waterhemp pressure across the study area was lower than expected due to lack of rainfall for waterhemp germination; although, species were present, this study was not conducted in a significant infestation. Preemergence product control at A+14 exceeded 90% across all treatments as a result of low weed pressure (Table 2). Of the 16 programs evaluated, 16, 12, and 16, achieved the 95% waterhemp control objective at B+7, B+14, and B+42, respectively.

Table 2. Waterhemp control in corn in 2023.						
		App.	**Waterhemp Control**			
Treatment[a]	**Rate**	**Code[b]**	**A+14[c]**	**B+7**	**B+14**	**B+42**
	oz/A* or fl oz/A		---------------%---------------			
Verdict / Status+RUII+AMS[d]	15 / 5*+32	A / B	95	96	88	99
Verdict / Status+RUII+AAtrex+Callisto+COC+AMS	15 / 5*+32+16+3	A / B	93	100	100	100
Trivolt / Laudis+DiFlexx+RU3+AMS+HSMOC	12 / 3+8+30	A / B	95	100	99	100
Harness Max / Capreno+AAtrex+RU3+AMS+HSMOC	40 / 3+16+30	A / B	91	100	99	100
Surpass NXT / Kyro+AAtrex+RU3+COC+Amsol	32 / 45+16+30+2.5%	A / B	91	100	98	99
Surpass NXT / Resicore XL+AAtrex+RU3+COC+Amsol	32 / 45+16+30+2.5%	A / B	93	99	99	100
Anthem Maxx / AAtrex+RUII+Callisto+AMS+COC	4.5 / 32+32+3	A / B	91	100	99	100
Anthem Maxx+Callisto+AAtrex / AAtrex+Anthem Maxx+RUII+DiFlexx+AMS	4.5+5.5+16 / 16+2.5+32+8	A / B	92	99	98	100
Fortitri+Sinder 3L / Rifle+Missile	21+2 / 8+0.25%	A / B	94	99	90	100
Fortitri+Sinder 3L+Infuse / Rifle+Carabiner 4SC+Missile	21+2+24 / 8+3+0.25%	A / B	93	96	89	98
Calibra / AAtrex+Acuron GT+AMS	64 / 16+60	A / B	93	99	95	100
Acuron / Acuron+RUII+AMS	48 / 48+32	A / B	93	99	99	100
Harness / AAtrex+Maverick+RU3+AMS+HSMOC	44 / 16+14+30	A / B	95	100	100	100
Trivolt / AAtrex+Maverick+RU3+AMS+HSMOC	10 / 16+14+30	A / B	94	100	99	99
Trisidual+Interlock / Charger Max+Sterling Blue+Cornerstone 5 Plus+AMS+StrikeLock	32+4 / 16+6+32+8	A / B	95	96	94	100
Verdict / Acuron+RU3+AMS	18 / 48+30	A / B	93	98	98	100
LSD (0.1)			**3**	**3**	**5**	**2**

[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.

WATERHEMP IN SOYBEAN

Waterhemp pressure across the study area was lower than expected due to lack of rainfall for germination; although, species were present, this study was not conducted in a significant infestation. Waterhemp were late to emerge likely due to low soil temperatures and lack of early rainfall at the A+14 evaluation (Table 3). At the A+28 evaluation waterhemp control ranged from 68 to 99% and averaged 88.3%. This evaluation had the lowest ratings likely due to the waterhemp population emerging in now warmer soils, but not being impacted by the preemergence soil residual herbicides which had lack of rainfall for activation. Of the 20 programs evaluated, 19, 20, and 20, achieved the 95% waterhemp control objective at B+7, B+14, and B+28, respectively.

Table 3. Waterhemp control in soybean in 2023.							
		App.		Waterhemp Control			
Treatment[a]	Rate	Code[b]	A+14[c]	A+28	B+7	B+14	B+28
	oz/A* or fl oz/A		-----------------------%---------------------				
Zidua Pro / Liberty+Dry AMS	6 / 32+3lb/A	A / B	99	86	99	98	97
Zidua Pro / Liberty+Outlook+Dry AMS	6 / 32+10+3lb/A	A / B	100	90	100	100	99
War.+Mauler / War. Ultra+RU3+AMS[d]	48+8 / 48+30	A / B	100	90	97	98	98
War. Ultra / War.+RU3+Liberty+Amsol	48 / 48+30+32+2.5%	A / B	100	94	100	100	100
Kyber / Enlist One+Liberty+Amsol	16 / 32+32+2.5%	A / B	100	83	95	95	98
Kyber / Enlist One+Liberty+EverpreX+Amsol	16 / 32+32+16+2.5%	A / B	100	91	100	99	100
Auth. Edge / Anthem Maxx+RUII+Enlist One+AMS	10 / 2.5+32+32	A / B	100	92	100	99	100
Auth. Edge+Metribuzin 75 DF / Anthem Maxx+RUII+Enlist One+AMS	8+6* / 3+32+32	A / B	99	79	98	95	98
Tribal / Enlist One+Mad Dog+Missile	72 / 32+36+0.25%	A / B	100	98	100	100	100
Tribal+Infuse / Enlist One+Mad Dog+Missile	72+32 / 32+36+0.25%	A / B	98	93	100	99	100
Boundary+Blanket / Enlist One+Sequence+AMS	32+5 / 32+48	A / B	100	81	100	96	99
BroadAxe XC / Enlist One+Prefix+RUII+AMS	28 / 32+32+32	A / B	98	75	98	96	100
Fierce MTZ / Liberty+Perpetuo+RU3+AMS	16 / 36+6+30	A / B	100	99	100	100	100
Fierce MTZ / Liberty+Resource+RU3+AMS	16 / 36+4+30	A / B	100	85	100	98	96
Dimetric Charged+Interlock / Enlist One+ Liberty+Cornerstone 5+StrikeLock+AMS	12+4 / 32+ 32+32+12	A / B	100	93	100	100	100
Presidual+Interlock / Enlist One+ Liberty+Cornerstone 5+StrikeLock+AMS	24+4 / 32+ 32+32+12	A / B	100	68	100	100	100
Blanket+Valor SX+War. / Flexstar+HSMOC	6+1.5*+30 / 7.5	A / B	100	95	95	99	96
Blanket+Valor SX+War. / Flexstar+HSMOC	8+2*+40 / 10	A / B	100	90	85	98	98
Blanket+Valor SX+War. / Enlist One+Liberty+AMS	6+1.5*+30 / 32+32	A / B	100	84	100	99	99
Blanket+Valor SX+War. / Enlist One+Liberty+AMS	8+2*+40 / 32+32	A / B	100	99	100	100	100
LSD (0.1)			1	20	7	3	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]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

In general, waterhemp pressure was low and inconsistent making the data sets difficult to interpret in both corn and soybean, in both studies all treatments were similar to 100% control at crop canopy. Only 2 inches of rain occurred from preemergence application to last evaluation in both crops. Inclusion of residual herbicides with post-emergence activity applied at the "B" applications were important, as the activity from contact and systemic products was critical for eliminating the emerged waterhemp that came through non-activated preemergence residuals. In both crops there is a plethora of programs demonstrated to assist growers that choose to use the data set as a guide to visit with their crop consultants or local suppliers and determine a waterhemp program that provides the greatest control at an economical cost based on local supplier pricing and availability of products.

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