

Minnesota Wheat Research and Promotion Council

Annual Research Progress Report

Due November 15th

Audience: This information will be utilized to create a research reporting booklet that will be distributed to growers and crop consultants. This is a great opportunity to communicate your research directly to growers. Please keep your producer audience in mind when submitting your report. Reports will be printed in **COLOR** – please include color figures and photos to help explain your results to growers!

Project Title: 2024 Waterhemp Resistance Management Programs in Corn-Soybean Rotations

Principal Investigator(s): Next Gen Ag LLC - Andrew Lueck, Research Lead & Jenna Whitmore, Research Manager

Project Period: April 2024 – March 2025

Research Question/Objectives:

1. Collaborate with industry partners (8 participants) (Done).
2. Successfully apply chemistry (Done).
3. Successfully record data and images (Done).
4. Summarize and publish data (Done & continuing).
 - a. Publications; published to Next Gen Ag LLC website (Done).
 - b. Speak at SMSU Plot tour (Done).
 - c. Present at summer conference (Done).
 - d. Present at Prairie Grains conference (December).
 - e. Present at Ag Expo conference (January).

Results:

WATERHEMP IN CORN

Waterhemp pressure across the study area was uniformly distributed. Waterhemp germination was later than expected due to lower soil temperature and cooler weather conditions until the first week of June. Pre-emergence (PRE) product control at A+14 was 99.97% across all treatments as a result of late-emerging waterhemp. PRE product treatments had consistent rain activation all spring and through July, which allowed the products to consistently prevent new waterhemp germination well into crop canopy. There were no statistically significant differences, meaning all treatments performed equally to each other with 90% repeatability. All treatments met the grant goal of 95% waterhemp control at A+14, A+28, and A+42. At the last evaluation of A+56 on July 8, one of the 16 treatments fell below 95% however, no statistically significant differences.

Table 2. Waterhemp control in corn in 2024.							
Treatment ^a	Rate	App. Code ^b	Waterhemp Control				
			A+14 ^c	A+28	A+42	A+56	
	oz/A* or fl oz/A		-----%-----				
Surtain / Status+RU3+NIS+Dry AMS ^d	14 / 5*+30+1.5lb/A	A / B	100	98.5	98.8	98.8	
Verdict / Status+Callisto+Atrazine+RU3+COC+Dry AMS	15 / 3*+3+16+30+1.5lb/A	A / B	100	100	100	98.8	
Trivolt / Laudis+DiFlexx+RU3+MSO+Class Act Ridion	12 / 3+8+30+0.5%+1%	A / B	100	98.3	97.0	92.5	
Harness Max / Capreno+Atrazine+RU3+MSO+AMS	40 / 3+16+30+0.5%	A / B	100	99.5	100	97.5	
Surpass NXT / Kyro+AAtrex+RU3+COC+Amsol	32 / 45+16+30+2.5%	A / B	100	100	100	96.3	
Surpass NXT / Resicore XL+AAtrex+RU3+COC+Amsol	32 / 45+16+30+2.5%	A / B	100	100	100	98.8	
Anthem Maxx / AAtrex+RU3+Callisto+AMS+COC	4.5 / 32+30+3	A / B	100	100	100	99.5	
Anthem Maxx+Callisto+AAtrex / AAtrex+Anthem Maxx+RU3+DiFlexx+AMS	4.5+5.5+16 / 16+2.5+30+8	A / B	100	100	100	100	
FortiTRI+Sinder 3L / Rifle+Missile	21+2 / 8+0.25%	A / B	100	100	98.8	97.0	
FortiTRI+Sinder 3L+Infuse / Rifle+Carabiner 4SC+Missile	21+2+24 / 8+3+0.25%	A / B	100	99.5	100	98.8	
Calibra / AAtrex+Acuron GT+AMS	64 / 16+60	A / B	100	100	100	99.0	
Acuron / Acuron+RU3+AMS	48 / 48+30	A / B	100	100	99.5	100	
Harness / AAtrex+Maverick+RU3+AMS+HSMOC	44 / 16+14+30	A / B	100	100	100	98.8	
TriVolt / AAtrex+Maverick+RU3+AMS+HSMOC	10 / 16+14+30	A / B	99.5	100	100	100	
Trisidual / Cornerstone 5 Plus+Insinerate	32 / 32+3	A / B	100	98.8	98.8	96.3	
Verdict / Acuron+RU3+AMS	18 / 48+30	A / B	100	100	99.5	96.3	
LSD (0.1)			NS	NS	NS	NS	

^aPRE treatment applications contained no additional adjuvants.

^bApplication codes refer to the information in Table 1.

^cA+[#] or B+[#]=Days after "A" or "B" application.

^dAMS=Class Act NG 2.5%v/v; RU3=Roundup 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 uniformly distributed. Waterhemp germination was later than expected due to lower soil temperature and cooler weather conditions until the first week of June. Pre-emergence (PRE) product control at A+14 averaged 99.7% and ranged between 98.3 and 100%. The top 14 treatments were statistically similar; however, all treatments exceed 98% waterhemp control which would be considered "excellent" and all 16 treatments achieved the goal of 95% waterhemp control.

Lay-by or early postemergence applications were made 10-days after the A+14 evaluation and 4-days prior to the A+28 evaluation to 4-6 inch tall waterhemp. This evaluation emphasized the impact of the early post emergence foliar efficacy. PRE product treatments had consistent rain activation all season through July, which allowed the products to prevent new waterhemp germination well into the growing season. Treatments averaged 99.2% and ranged between 95.3 and 100%. The top 14 treatments were statistically similar; however, all treatments exceed 95% waterhemp control which would be considered "excellent" and all 16 treatments achieved the goal of 95% waterhemp control.

The A+42 evaluation occurred 18-days after the early post emergence application. This evaluation emphasized the impact of layered residual herbicides. Treatments averaged 98.6% and ranged from 95 to 100%. The top 14 treatments were statistically similar; however, all treatments exceed 95% waterhemp control which would be considered "excellent" and all 16 treatments achieved the goal of 95% waterhemp control.

The A+56 evaluation occurred 32-days after the early post emergence application. This evaluation emphasized the season-long durability of the residual products utilized, without a lot of help from crop canopy, as the soybeans did not canopy until early-mid August as a result of excessive early rainfall and subsequent stunting. Treatments averaged 95.5% and ranged between 87.5 and 100. The top 7 treatments were statistically similar. One take away at this evaluation is the importance of applying two or more active ingredients PRE and to follow with an early post application that includes at least one residual active ingredient in addition to an active ingredient with foliar activity. The lower performing treatments at A+56 did not contain any residual active ingredients as part of the early post emergence tank mix. Overall, 8 of the 16 treatments achieved the goal of 95% waterhemp control.

Table 3. Waterhemp control in soybean in 2024.						
Treatment ^a	Rate oz/A* or fl oz/A	App. Code ^b	Waterhemp Control			
			A+14 ^c	A+28	A+42	A+56
			-----%-----			
Zidua Pro / Liberty ULTRA+Outlook+RU3+Dry AMS ^d	6 / 24+10+30+3lb/A	A / B	100	99.5	97.8	93.8
Zidua Pro / Liberty ULTRA+RU3+Dry AMS	6 / 24+30+3lb/A	A / B	99.5	99.0	95.3	94.5
War.+Mauler / War.+RU3+Liberty+AMS	48+8 / 64+30+32	A / B	100	99.5	97.8	93.8
War. Ultra / War.+RU3+Liberty+AMS	48 / 48+30+32	A / B	100	99.5	99.5	95.8
Sonic / Enlist One+Liberty+AMS	5* / 32+32	A / B	98.3	98.3	95.0	93.8
Sonic / Enlist One+Liberty+EverpreX+AMS	5* / 32+32+16	A / B	99.5	99.5	98.3	95.0
Auth. Edge / Anthem Maxx+RU3+Enlist One+AMS	10 / 2.5+30+32	A / B	100	100	100	100
Auth. Edge / Anthem Maxx+RU3+Enlist One+AMS	8 / 3+30+32	A / B	100	98.3	99.0	97.0
Tribal / Enlist One+Mad Dog+Missile	72 / 32+36+0.25%	A / B	100	95.3	98.8	98.3
Tribal+Infuse / Enlist One+Mad Dog+Missile	72+32 / 32+36+0.25%	A / B	100	99.5	98.5	96.3
Boundary+Blanket / Enlist One+Sequence+AMS	32+5 / 32+48	A / B	100	99.5	99.5	95.0
BroadAxe XC / Enlist One+Prefix+RU3+AMS	28 / 32+32+30	A / B	100	100	100	98.8
Fierce MTZ / Liberty+Perpetuo+RU3+AMS	16 / 36+6+30	A / B	100	100	100	100
Fierce MTZ / Liberty+Resource+RU3+AMS	16 / 36+4+30	A / B	100	99	100	96.3
Dimetric Charged+Interlock / Enlist One+Liberty+Cornerstone 5+StrikeLock+AMS	12+4 / 32+32+32+12	A / B	98.3	100	98.8	92.5
Presidual+Interlock / Enlist One+Liberty+Cornerstone 5+StrikeLock+AMS	24+4 / 32+32+32+12	A / B	100	100	99.0	87.5
LSD (0.1)			1.0	1.6	2.3	3.9

^aPRE treatment applications contained no additional adjuvants.

^bApplication codes refer to the information in Table 1.

^cA+[#] or B+[#]=Days after "A" or "B" application.

^dAMS=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.

Application/Use:

Resistant Waterhemp Control; Industry Comparison; Return on Investment.

Materials and Methods:

Experiments were conducted on a low to moderate infestation of waterhemp near Renville, Minnesota, in 2024. Soil was a fine-textured webster-clay loam soil with 4.7% organic matter and a 6.4 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 13 and emerging May 21. Preemergence herbicide treatments were applied to corn on May 14 and early-postemergence treatments to V4 corn on June 7 (Table 1). Becks 1830E soybean was seeded 1.25 inches deep on 30-inch row spacings at 140,000 seeds per acre on May 13 and emerging May 22. Preemergence herbicide treatments were applied to soybean on May 14 and early-postemergence treatments to V2 soybean on June 7 (Table 1). All treatments applied with bicycle sprayer in 15 GPA spray solution through AIXR11002 air-induction flat fan nozzles pressurized with CO₂ at 26 psi to the center two rows of four row plots 40 feet in length. Field area had moderate levels of ALS and glyphosate-resistant waterhemp.

Waterhemp control in corn was evaluated May 28, June 11, June 25, and July 8 (Table 2). Waterhemp control in soybean was evaluated May 28, June 11, June 25, and July 8 (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 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 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.

Crop	Corn		Soybean	
Application Code	A	B	A	B
Date	May 14	June 7	May 14	June 7
Time of Day	8:00 AM	9:00 AM	11:00 AM	9:00 AM
Air Temperature (F)	60	61	68	61
Relative Humidity (%)	38	64	38	64
Wind Velocity (mph)	4	5	4	5
Wind Direction	NE	W	NE	W
Soil Temp. (F at 6")	58	59	58	59
Soil Moisture	Good	Good	Good	Good
Cloud Cover (%)	10	5	10	5
Crop Growth Stage (avg)	-	V4	-	V2
Waterhemp Height	-	3"	-	3"

Economic Benefit to a Typical 500 Acre Soybean/Corn Enterprise:

In general, waterhemp pressure was late-germinating due to cooler soil temperatures and cooler weather conditions through the first week of June. Both studies had regular rainfall from planting through July providing great activation for residual products. Inclusion of residual herbicides applied at the "A" applications, along with rain activation, was important to maintain weed-free environments. The "B" applications were vital in controlling weeds that may have germinated through the first application, along with layered residuals to continue to prevent new germination. In both corn and soybean crops, there is a plethora of programs demonstrated, across various companies. 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.

Related Research:

2024 Giant Ragweed Resistance Management Programs in Corn-Soybean Rotations; All articles available at www.nxtgenag.com under the "Latest News" tab.

Recommended Future Research:

Next Gen Ag LLC, and our industry collaborators, are very appreciative for the funding of our competitive industry trials. Next Gen Ag LLC collaborates with 25+ national and international agriculture crop protection companies annually. Collaborators of Next Gen Ag LLC provide all the treatment and products required at no cost for the work to be conducted. MSRPC dollars fund all the operating and labor costs associated with the project to provide Minnesota Soybean Growers a non-biased data set to compare products on the market in weed control, aphid control, white mold control, and value-added inputs. Next Gen Ag LLC and our industry collaborators are already hard at work developing grant proposals for 2025. We intend to repeat our 2024 competitive industry studies and plan to have new proposals looking at adjuvant impact on postemergence foliar herbicides on giant ragweed and waterhemp in addition to a grant looking at broadcasted/inter-seeded rye impact on soybean yield and SCN. Each year the latest products entering the market have an opportunity to be showcased to Minnesota Soybean Growers. ***Non-biased, collaborative, and ROI focused research.***

Publications:

2024 Waterhemp Resistance Management Programs in Corn-Soybean Rotations; All articles available at www.nxtgenag.com under the "Latest News" tab.

Next Gen Ag: Conducting Research with the Next Generation [of soybean growers] in Mind!

This publication and more MSRPC funded research conducted by Next Gen Ag, LLC can be found online at www.nxtgenag.com under the "Latest News" tab and "Public Grant Research Studies" page.