

WATERHEMP CONTROL FROM PRE VS. PRE FOLLOWED BY EPOST CONVENTIONAL HERBICIDE COMBINATIONS IN 2021

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Objective was to evaluate two different micro-rate residual combinations at two and three different incremental rates at all on label preemergence and early-postemergence combinations to determine the most effective micro-rate combination on glyphosate-resistant waterhemp populations.

MATERIALS AND METHODS

Experiments were conducted on natural glyphosate-resistant waterhemp populations near Renville, Minnesota, in 2021. Plot area was worked by Next Gen Ag with field cultivator at 3" depth. Golden Harvest 'GH1362E3' soybeans were seeded 1.25 inches deep in 30-inch rows at 150,000 seeds per acre on April 27. Preemergence (PRE) herbicide treatments were applied April 29 and early-postemergence (EPOST) treatments were applied at soybean second trifoliolate (V2) on May 26 (Table 1). Treatments were applied with bicycle sprayer in 15 GPA spray solution through AIXR11002 air-induction flat fan nozzles pressurized with CO₂ at 25 PSI to the center two rows of four row plots 35 feet in length. Field area had high levels of glyphosate-resistant waterhemp populations. No adjuvants used.

Waterhemp control was evaluated May 13, May 26, June 9, June 22, and July 7 at 14, 27, 40, 53, and 68 days after treatment "A" (DAA) (Table 1). 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 2021, version 10.0, SAS Institute, Inc.) at alpha=0.10 and differences are determined with 90% confidence in repeatability.

Location	Renville	
	A	B
Application Code	A	B
Date	April 29	May 26
Time of Day	11:00 AM	2:30 PM
Air Temperature (F)	66	64
Relative Humidity (%)	26	34
Wind Velocity (mph)	9	4.5
Wind Direction	NW	N
Soil Temp. (F at 6")	48	71
Soil Moisture	Good	Fair
Cloud Cover (%)	5	60
Soybean Growth Stage (avg)	-	V2
Lambsquarters Height	-	4"
Waterhemp Height	-	2"

RESULTS AND DISCUSSION

Rainfall between "A" (April 29) and "B" (May 26) applications was 0.40 inches, well below average, which resulted in abnormally dry conditions. As a result, soybean emergence was erratic, waterhemp emergence was delayed until 25 days after planting, and lambsquarters (a cool season, early emerging weed) became well established creating some difficulty in waterhemp control evaluations. One day after "B" application (May 26) a 0.90 inch rainfall occurred activating both PRE and EPOST residual herbicides. Accumulated rainfall from "B" application to trial conclusion (July 7) was 2.0 inches, also abnormally dry. Lack of rainfall, intense waterhemp pressure, and drought stress impact on waterhemp created a "worst case" scenario for evaluating residual herbicide treatments. Crop injury did not occur; thus, will not be discussed.

Table 2. Waterhemp control, Renville, MN.

Treatment ^a	Rate	Waterhemp Control					App. Code ^b	Cost
		A+14 ^c	A+27	A+40	A+53	A+68		
	oz/A* or fl oz/A	-----%-----						\$/A
Valor SX + Warrant + Zidua + Flex ^d	*1.5 + 30 + *2 + 7.5	100	62	83	89	75	A	30.35
Valor SX + Warrant + Zidua / Flex	*1.5 + 30 + *2 / 7.5	88	84	90	85	84	A / B	
Valor SX + Warrant / Zidua + Flex	*1.5 + 30 / *2 + 7.5	94	76	95	91	93	A / B	
Valor SX + Zidua / Warrant + Flex	*1.5 + *2 / 30 + 7.5	94	48	89	80	91	A / B	
Valor SX / Warrant + Zidua + Flex	*1.5 / 30 + *2 + 7.5	94	24	94	71	84	A / B	
Valor SX + Warrant + Zidua + Flex	*2 + 40 + *2.5 + 10	100	97	99	95	99	A	39.05
Valor SX + Warrant + Zidua / Flex	*2 + 40 + *2.5 / 10	100	62	100	98	99	A / B	
Valor SX + Warrant / Zidua + Flex	*2 + 40 / *2.5 + 10	100	56	95	94	95	A / B	
Valor SX + Zidua / Warrant + Flex	*2 + *2.5 / 40 + 10	94	54	98	95	98	A / B	
Valor SX / Warrant + Zidua + Flex	*2 / 40 + *2.5 + 10	100	36	88	89	87	A / B	
Blanket + Valor SX + Warrant + Flex	6 + *1.5 + 30 + 7.5	100	74	99	95	94	A	21.43
Blanket + Valor SX + Warrant / Flex	6 + *1.5 + 30 + 7.5	100	50	96	93	98	A / B	
Blanket + Valor SX / Warrant + Flex	6 + *1.5 + 30 + 7.5	88	31	87	86	88	A / B	
Blanket + Valor SX + Warrant + Flex	8 + *2 + 40 + 10	100	82	94	93	95	A	28.58
Blanket + Valor SX + Warrant / Flex	8 + *2 + 40 + 10	100	87	100	96	99	A / B	
Blanket + Valor SX / Warrant + Flex	8 + *2 + 40 + 10	100	72	96	93	94	A / B	
Blanket + Valor SX + Warrant + Flex	10 + *2 + 48 + 12	100	65	98	95	98	A	33.76
Blanket + Valor SX + Warrant / Flex	10 + *2 + 48 + 12	100	93	100	98	97	A / B	
Blanket + Valor SX / Warrant + Flex	10 + *2 + 48 + 12	100	79	96	91	94	A / B	
Blanket + Valor SX + War + Flex + Zidua	8 + *2 + 40 + 10 + 2*	100	74	99	94	99	A	45.58
LSD (0.1)		11	38	9	15	14		

^aPRE treatment applications contained no additional adjuvants.

^bApp. Code refer to data in table 1.

^cA+[number]=Days after “A” application.

^dFlex=Flexstar; War=Warrant.

Waterhemp control at A+14 (May 13) was evaluated as overall weed control due to delayed waterhemp emergence as a result of drought conditions. Overall weed control ranged from 88-100% and averaged 97.6% and can be attributed to drought conditions preventing weed, or crop, emergence rather than residual activity of treatments (Table 2). Rainfall of 0.20 inches occurred on May 14 and initiated a majority of weed emergence.

Waterhemp control at A+27 (May 26) was evaluated prior to application “B”. Waterhemp present were up to 2.0” in height. Waterhemp control ranged from 24-97% and averaged 65.3% which is an expected outcome considering the drought conditions (Table 2). Although three treatments achieved greater than 85% waterhemp control despite drought conditions, similar tank mixes were dramatically different; thus, differences in control at A+27 are attributed to variation within the trial area, specifically inconsistent weed pressure and emergence. First significant rainfall event occurred May 27 (0.90 inches) and activated the treatment residual herbicides for subsequent evaluations.

Waterhemp control at A+40 (June 9) ranged from 83-100% and averaged 94.8% and demonstrated the combination of effects resulting from the Flexstar EPOST activity and residual herbicide activity on 2” emerged, or emerging waterhemp after a 0.90 inch rainfall event (Table 2). As expected, treatment applications including Flexstar EPOST increased waterhemp control from 60.9% at A+27 to 94.6% at A+40, a differential of 33.7%. Unexpectedly, treatment applications excluding Flexstar EPOST increased waterhemp control from 75.7% at A+27 to 95.3% at A+40, a differential of 19.6%.

Waterhemp control at A+53 (June 22) ranged from 71-98% and averaged 91.1% and demonstrates an average 3.7% decrease in control compared to A+40 (Table 2). Decrease in control can be attributed to continued drought conditions (0.30 inches additional since A+40) and continued natural herbicide degradation. PRE followed by EPOST treatments averaged 90.0% waterhemp control compared to PRE only treatments that averaged 93.5%. Similar tank mixes and rates PRE + EPOST compared to PRE only averaged 81.8% vs. 89%, 94% vs. 95%, 89.5% vs. 95%, 94.5% vs. 93%, and 94.5% vs. 95% listed in respective order presented in table 2. EPOST tank mixes including Warrant + Zidua + Flexstar, regardless of rate, provided less control of waterhemp compared to other variations of equal products and rates and may suggest efficacy antagonism. Treatment tank mixes of Blanket + Valor SX +

Warrant + Flexstar, regardless of rate, provided similar control as PRE only or PRE followed by EPOST. However, EPOST tank mixes of Warrant + Flexstar, regardless of rate or other PRE residual products, provided less waterhemp control (-5.0%) than EPOST Flexstar only applications. In general, with one exception, PRE followed by EPOST treatments had greater waterhemp control when Flexstar was applied alone EPOST.

Waterhemp control at A+68 (July 7/canopy) ranged from 75-99% and averaged 93.1% and demonstrated an average 2.0% increase in control compared to A+53 (Table 2). Increase in control can be attributed to an additional 0.80 inches of rainfall that resulted in greater residual herbicide activation and increased competition from canopied soybeans since A+53 evaluation. PRE followed by EPOST treatments averaged 92.9% waterhemp control compared to PRE only treatments that averaged 93.3%. Compared to A+53 PRE followed by EPOST ratings, waterhemp control increased by 2.9% that is likely due to rain activation of the Warrant and/or Zidua products applied EPOST that remain more intact compared to the Warrant and/or Zidua applied PRE which has undergone 27 more days of biological degradation. Compared to A+53 PRE only ratings, waterhemp control decreased by 0.2% which can be attributed to continued biological degradation of products applied 68 days prior.

CONCLUSION

Rainfall of greater than 0.40 inches within 30 days of PRE application is required for effective (>85% waterhemp control) activation of most soil residual herbicides. A single rainfall event of 1.0 inches is likely to achieve that goal. A single, effective rainfall event increased residual herbicide activity on small emerged or emerging waterhemp by 19.6%. The addition of Flexstar EPOST provided a 14.1% increase in waterhemp control in addition to the 19.6% provided by residual herbicide activation following a single, effective rainfall event for a total increase of 33.7%.

PRE only treatments provided greater waterhemp control compared to PRE fb EPOST treatments at all evaluation timings. Waterhemp control averages, in order of evaluated tank mixes, PRE vs. PRE fb EPOST comparisons are 100% vs. 96.6%, 75.7% vs. 60.9%, 95.3% vs. 94.6%, 93.5% vs. 90.0%, and 93.3% vs. 92.9% at A+14, A+27, A+40, A+53, and A+68, respectfully (Table 2). Despite the “worst case” environment and waterhemp pressure for residual herbicide impact, all treatments averaged 93.1% waterhemp control at soybean canopy. A one-pass PRE only micro-rate application was just as effective as a two-pass PRE fb EPOST micro-rate application.

Crop safety of the most affordable micro-rate treatment has the products being applied at 50% (Blanket), 50% (Valor SX), 47% (Warrant), and 47% (Flexstar) of max single application rates for a fine textured soil with greater than 3% organic matter (Table 2). However, the grower should be aware that the micro-rates combination product rates may fall below the recommended label threshold in a similar environment. Valor SX can be applied with Warrant at 2 ounces per acre according to label, however be aware “splash up” rain events may result in some crop injury. Flexstar label only lists tank mix partners for POST applications, however, as PRE there is no risk of tissue injury or burn. Growers on more coarse soils with reduced organic matter, although rates of the four tank mix products are on label, should experiment on reduced acres in year one in the event of synergistic crop injury.

Growers should consider applying the residual micro-rates approach PRE as a potential cost and time saving one-time application in years with average early rainfall. A PRE only application of Blanket (6) + Valors SX (1.5) + Warrant (30) + Flexstar (7.5) provided 94% waterhemp control at soybean canopy for an estimated \$21.43 (Table 2). However, in years with below average early rainfall the grower must be prepared to utilize a glufosinate or 2, 4-D EPOST application as a rescue on glyphosate-resistant waterhemp populations. Volunteer corn control or fungicide applications may also require a second trip over the field, however, these applications, although optional, should be more affordable without the need to tank mix additional residual herbicides.

The PRE only residual micro-rates program allows the grower an opportunity to “wait-and-see” what other necessary inputs will be required rather than trying to predict the unknown. This program is also universal across all soybean genetics minimizing tank cleanout events for operations that grow multiple herbicide tolerant soybean genetics. The PRE only residual micro-rates program is affordable and may provide the necessary waterhemp control for \$21.43/A in ideal environmental conditions compared to the cost of a multiple post-emergent application, herbicides, and adjuvants. Crop safety of micro-rate PRE combinations will continue to be evaluated, however, at the reduced product rates the program should logically be considered safe in soybean. Next Gen Ag LLC is not liable for any decisions made on the basis of this study or publication.