

## Economics of glyphosate- and glufosinate-based weed control programs in soybean, 2019

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A field trial was conducted in 2019 at the MSU Agronomy Research Farm in E. Lansing to compare weed control, soybean injury, yield, and economic returns of commercial glyphosate- and glufosinate-based weed control programs in soybean. Each major herbicide company was asked to submit up to four weed control programs based on soil type and weed infestation history. Site characteristics and herbicide application timings are described in Table 1. Table 2 describes the herbicide programs selected by each company for 2019. Of the 23 treatments examined 21 were PRE followed by POST applications, two were applied POST only (weeds 4-6 inches tall), and one treatment was the untreated control. Yield loss due to weeds was extremely high. The maximum soybean yield was 47.3 bu/A and the weedy (untreated) yield was 16.6 bu/A, resulting in a yield loss of 30.7 bu/A (65%). Overall soybean yield was lower in this trial compared with some of the other trials planted on the same day, this was due to the early maturing variety used in this trial.

Within 14 days of planting and application of the preemergence herbicides the site received 1.5-inches of rain. This resulted in significant incorporation of the PRE herbicides and all but four of the PRE treatments exhibited signs of soybean injury 21 DAP (Table 3). Nine of these treatments exhibited injury >20%. All of these treatments contained the active ingredient flumioxazin (Valor) or sulfentrazone. Within the two weeks following this application soybean outgrew most of this injury. The POST treatments that contained the active ingredient fomesafen also caused some soybean injury. By the end of the season, all but seven treatments (including the untreated control) controlled all weeds >90%. Treatments that did not meet this level had some late-season grass escapes, and the one POST applications of Liberty or Roundup PowerMax did not effectively control common ragweed.

There was a wide range in herbicide program costs \$15.09 to \$90.34 and soybean yield for the different herbicide programs ranged from 47.4 to 58.9 bu/A (Table 3). Only three herbicide programs yielded less than highest yielding treatment. These three programs and the most expensive program were not amongst the highest economic returns. Overall several of the treatments that we examined were effective and resulted in high economic returns.

**Table 1.** Site description.

<b>Crop</b>	Soybean
<b>Variety</b>	Enlist E3 'P74312619'
<b>Soil Texture</b>	Clay Loam
<b>Soil pH</b>	7.2
<b>Soil Organic Matter</b>	3.3
<b>Dominant Weeds</b>	ANGR, CHEAL, AMBEL <sup>1</sup> , ABUTH
<b>Planting Date</b>	May 15
<b>Application Timings:</b>	
<b>PRE</b>	May 15
<b>POST</b>	July 1
<b>Evaluation Times</b>	Soybean injury –21 d after planting & 7, 14, & 28 d after POST Weed control prior to harvest (56 d after POST)

Abbreviations: ANGR = giant foxtail, CHEAL = c. lambsquarters, AMAPO = Powell amaranth, AMBEL = c. ragweed, ABUTH = velvetleaf. <sup>1</sup>ALS-resistant (Group 2).

**Table 2.** Commercial glyphosate- and glufosinate-based soybean herbicide programs selected by companies in 2019.

<i>Herbicide programs</i>	<i>Abbreviated Form</i>
<b>PRE/POST</b> Sonic (4.5 oz) fb. Durango DMA (32 fl oz) + AMS (17 lb/100 gal)	Sonic fb. Durango
Trivence (8 oz) fb. Durango DMA (32 fl oz) + AMS (17 lb/100 gal)	Trivence fb. Durango
Dimetric Charged (12 fl oz) fb. Roundup PowerMax (32 fl oz) + AMS (3 lb)	Dimetric Charged (12) fb. RupPM
Dimetric Charged (15 fl oz) fb. Roundup PowerMax (32 fl oz) + AMS (3 lb)	Dimetric Charged (15) fb. RupPM
Fierce (3 oz) fb. Roundup PowerMax (32 fl oz) + AMS (3 lb)	Fierce fb. RupPM
Fierce MTZ (1 pt) fb. Roundup PowerMax (32 fl oz) + AMS (3 lb)	Fierce MTZ fb. RupPM
Fierce XLT (4 oz) fb. Roundup PowerMax (32 fl oz) + AMS (3 lb)	Fierce XLT fb. RupPM
Tripzin ZC (2 pt) fb. Interline (32 fl oz) + AMS (17 lb/100 gal)	Tripzin fb. Interline
Moccasin MTZ (2.67 pt) fb. Interline (32 fl oz) + AMS (17 lb/100 gal)	Moccasin MTZ fb. Interline
Verdict (5 fl oz) + Metribuzin (5 oz) fb. Liberty (32 fl oz) + AMS (3 lb)	Verdict + Metribuzin fb. Liberty
Zidua PRO (4.5 fl oz) fb. Liberty (32 fl oz) + AMS (3 lb)	Zidua PRO fb. Liberty
Zidua PRO (4.5 fl oz) + Metribuzin (5 oz) fb. Liberty (32 fl oz) + AMS (3 lb)	Zidua PRO + Metribuzin fb. Liberty
Zidua PRO (4.5 fl oz) fb. Liberty (32 fl oz) + Roundup PowerMax (32 fl oz) + AMS (3 lb)	Zidua PRO fb. Liberty + RupPM
Valor (2 oz) fb. Warrant (3 pt) + Liberty (32 fl oz) + AMS (3 lb)	Valor fb. Warrant + Liberty
Authority MTZ (16 oz) fb. Anthem MAXX (3 fl oz) + Liberty (32 fl oz) + AMS (8.5 lb/100 gal)	Auth MTZ fb. Anthem MX + Lib
Authority Supreme (6.5 fl oz) + Metribuzin (6 oz) fb. Anthem MAXX (2.5 fl oz) + Liberty (32 fl oz) + AMS (8.5 lb/100 gal)	Auth Supr + Metri fb. Anth MX + Lib
Prefix (2 pt) + Metribuzin (6 oz) fb. Dual II Magnum (1.25 pt) + Liberty (32 fl oz) + AMS (8.5 lb/100 gal)	Prefix + Metri fb. Dual II + Liberty
Boundary (1.8 pt) fb. Prefix (32 fl oz) + Liberty (32 fl oz) + AMS (8.5 lb/100 gal)	Boundary fb. Prefix + Liberty
Boundary (1.8 pt) fb. Flexstar GT (3.5 pt) + Dual II Magnum (1.25 pt) + MSO (1%) + AMS (8.5 lb/100 gal)	Boundary fb. Flexstar GT + Dual
Sonic (4.5 oz) fb. EverpreX (1 pt) + Durango DMA (32 fl oz) + AMS (17 lb/100 gal)	Sonic fb. EverpreX + Durango DMA
<b>POST</b> Liberty (32 fl oz) + AMS (8.5 lb/100 gal)	Liberty
Roundup PowerMax (32 fl oz) + AMS (17 lb/100 gal)	Roundup PowerMax

**Table 3.** Soybean injury, weed control, program costs, soybean yield, and economic returns for glyphosate- and glufosinate-based programs, 2019.

Herbicide Programs	Soybean injury		Weed control (56 d after POST)					All Weeds (≥90%)	Costs <sup>1</sup> (\$/A)	Yield <sup>3</sup> (bu/A)	Economic Returns <sup>2,3</sup> (\$/A)
	21 DAP (%)	14 DAT (%)	ANGR	CHEAL	AMAPO	AMBEL	ABUTH				
Sonic fb. Durango	28	1	93	100	100	98	100	YES	\$45.51	44.9*	\$372.06*
Trivence fb. Durango	23	7	87	100	100	100	100	NO	\$43.23	43.5*	\$361.32*
Dimetric Charged (12) fb. RupPM	28	0	86	100	100	100	100	NO	\$37.86	45.5*	\$385.29*
Dimetric Charged (15) fb. RupPM	29	0	86	100	100	100	100	NO	\$41.55	43.4*	\$362.07*
Fierce fb. RupPM	30	1	93	100	100	100	100	YES	\$45.16	47.3**	\$394.73**
Fierce MTZ fb. RupPM	28	0	97	100	100	100	100	YES	\$49.45	40.1*	\$323.48*
Fierce XLT fb. RupPM	28	4	90	100	100	100	100	YES	\$47.18	40.4*	\$328.54*
Tripzin fb. Interline	12	0	94	100	100	100	100	YES	\$41.83	42.8*	\$356.21*
Moccasin MTZ fb. Interline	8	0	97	98	100	100	100	YES	\$48.06	43.9*	\$360.21*
Verdict + Metribuzin fb. Liberty	16	3	80	100	100	100	100	NO	\$50.30	40.9*	\$330.07*
Zidua PRO fb. Liberty	13	2	90	100	100	100	100	YES	\$51.99	36.1	\$283.74
Zidua PRO + Metribuzin fb. Liberty	6	4	96	100	100	100	100	YES	\$58.40	35.7	\$273.61
Zidua PRO fb. Liberty + RupPM	12	6	94	100	100	100	100	YES	\$57.76	33.6	\$254.72
Valor fb. Warrant + Liberty	19	0	99	100	100	100	100	YES	\$57.41	43.3*	\$345.28*
Auth MTZ fb. Anthem MX + Liberty	20	5	99	100	100	100	100	YES	\$90.34	41.6*	\$296.54
Auth Supr + Metri fb. Anth MX + Lib	11	6	100	100	100	100	100	YES	\$80.83	43.0*	\$319.07*
Prefix + Metri fb. Dual II + Liberty	6	2	100	100	100	100	100	YES	\$73.14	40.1*	\$299.79*
Boundary fb. Prefix + Liberty	4	11	100	100	100	100	100	YES	\$67.30	42.2*	\$325.16*
Boundary fb. Flexstar GT + Dual	2	14	100	100	100	100	100	YES	\$76.47	42.0*	\$314.13*
Sonic fb. EverpreX + Durango DMA	21	3	100	100	100	100	100	YES	\$54.98	38.6*	\$304.00*
Liberty ( <i>POST</i> )	0	0	78	94	100	78	100	NO	\$26.33	42.6*	\$369.85*
Roundup PowerMax ( <i>POST</i> )	0	0	88	90	100	85	100	NO	\$15.09	39.0*	\$347.61*
<i>Untreated</i>	0	0	0	0	0	0	0	NO	--	16.6	\$154.38

Abbreviations: ANGR = giant foxtail, CHEAL = c. lambsquarters, AMAPO = Powell amaranth, AMBEL = c. ragweed, ABUTH = velvetleaf, fb. = followed by

<sup>1</sup>Herbicide costs = avg. of price lists; App. cost = \$8.00/A; seeding rate = 157,000 seeds/A. Weed control costs = Herbicide \$ + Additive \$ + Application \$.

<sup>2</sup>Crop selling price = \$9.30/bu (January 2020). Economic return = (Yield x Price) – Weed Control Costs.

<sup>3</sup>\*\* = Highest yield and economic return; \* = yield and economic returns for these treatments were not significantly different from the treatment with highest yield or economic return. Consult the Table 12 in the MSU Weed Control Guide for Field Crops (E-434) or the herbicide label for crop rotation restrictions.