

## Economics of Commercial Weed Control Programs in Soybean, 2020 Christy L. Sprague

A field trial was conducted in 2020 at the MSU Research Farm in E. Lansing to compare weed control, soybean injury, yield, and economic returns of commercial weed control programs that can be used in Enlist E3 soybean. Some these programs can be used in glyphosate- and/or glufosinate-resistant 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 2020. Of the 20 treatments examined 18 were PRE followed by POST applications, one was a POST only treatment (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 55.9 bu/A and the weedy (untreated) yield was 20.6 bu/A, resulting in a yield loss of 35.3 bu/A (63%).

Within 14 days of planting and application of the preemergence herbicides the site received 0.48-inches of rain. Nine of the 18 treatments resulted in significant soybean injury 21 DAP (Table 3). Two of these treatments exhibited injury >20%. All of these treatments contained the active ingredient flumioxazin (Valor) + pyroxasulfone (Zidua). The POST treatments that contained the active ingredient fomesafen or flumiclorac also caused some soybean injury. By the end of the season, all but three treatments controlled all weeds >90%. Treatments that did not meet this level had some late-season grass escapes, and the one POST applications did not effectively control common ragweed.

There was a wide range in herbicide program costs \$15.04 to \$82.80 and soybean yield for the different herbicide programs ranged from 45.6 to 55.9 bu/A (Table 3). All herbicide programs were amongst the highest yielding and the highest economic returns.

**Table 1.** Site description.

<b>Crop</b>	Soybean
<b>Variety</b>	P25T09E (Enlist E3)
<b>Soil Texture</b>	Loam
<b>Soil pH</b>	7.5
<b>Soil Organic Matter</b>	2.6
<b>Dominant Weeds</b>	ANGR, CHEAL, AMAPO, AMBEL <sup>1</sup> , ABUTH
<b>Planting Date</b>	May 24
<b>Application Timings:</b>	
<b>PRE</b>	May 24
<b>EPOS</b>	June 22
<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>The c. ragweed population at this location is ALS-resistant (Group 2).

**Table 2.** Commercial soybean herbicide programs that can be used in Enlist E3 soybean selected by companies in 2020.

<b>Herbicide Programs*</b>	<b>Abbreviated Form</b>
<b>PRE/POST</b> Warrant (2 pt) fb. Roundup PowerMax (32 fl oz) + AMS (17 lb)	Warrant fb. RupPM
Sonic (4.5 oz) fb. Enlist One (32 fl oz) + Durango DMA (32 fl oz) + AMS (17 lb)*	Sonic fb. Enlist One + Durango*
Zidua PRO (4.5 fl oz) fb. Liberty (32 fl oz) + AMS (3 lb)	Zidua PRO fb. Liberty
Valor EZ (2 fl oz) fb. Perpetuo (6 fl oz) + Roundup PowerMax (32 fl oz) + AMS (17 lb)	Valor EZ fb. Perpetuo + RupPM
Boundary (2 pt) fb. Prefix (2 pt) + Liberty (32 fl oz) + AMS (8.5 lb)	Boundary fb. Prefix + Liberty
Authority XL (4 oz) fb. Enlist One (32 fl oz) + Roundup PowerMax (22 fl oz) + AMS (17 lb)*	Authority XL fb. Enlist One + RupPM*
Sonic (4.5 oz) fb. EverpreX (1 pt) + Enlist One (32 fl oz) + Durango DMA (32 fl oz) + AMS (17 lb)*	Sonic fb. EverpreX + EnlistO + Dura*
Zidua PRO (4.5 fl oz) fb. Liberty (32 fl oz) + Roundup PowerMax (32 fl oz) + AMS (3 lb)	Zidua PRO fb. Liberty + RupPM
Prefix (2 pt) + Metribuzin (6 oz) fb. Sequence (3.5 pt) + Liberty (32 fl oz) + AMS (8.5 lb)	Prefix + Metri fb. Sequence + Liberty
Fierce EZ (6 fl oz) fb. Perpetuo (6 fl oz) + Roundup PowerMax (32 fl oz) + AMS (17 lb)	Fierce EZ fb. Perpetuo + RupPM
Warrant (3 pt) + Metribuzin (6 oz) fb. Roundup PowerMax (32 fl oz) + AMS (17 lb)	Warrant + Metri fb. RupPM
Authority Edge (8 fl oz) fb. Enlist One (32 fl oz) + Roundup PowerMax (22 fl oz) + AMS (17 lb)*	Authority Edge fb. Enlist One + RupPM*
Verdict (5 fl oz) + Metribuzin (5 oz) fb. Liberty (32 fl oz) + Roundup PowerMax (32 fl oz) + AMS (3 lb)	Verdict + Metri fb. Liberty + RupPM
Trivence (6 oz) fb. Enlist One (32 fl oz) + Liberty (36 fl oz) + Durango DMA (32 fl oz) + AMS (8.5 lb)*	Trivence fb. Enlistne + Lib + Durango*
Prefix (2 pt) + FirstRate (0.5 oz) fb. Sequence (3.5 pt) + Liberty (32 fl oz) + AMS (8.5 lb)	Prefix + FirstRate fb. Sequence + Liberty
Fierce MTZ (1 pt) fb. Perpetuo (6 fl oz) + Roundup PowerMax (32 fl oz) + AMS (17 lb)	Fierce MTZ fb. Perpetuo + RupPM
Warrant Ultra (50 fl oz) fb. Roundup PowerMax (32 fl oz) + AMS (17 lb)	Warrant Ultra fb. RupPM
Authority Elite (26 fl oz) + Metribuzin (6 oz) fb. Enlist One (32 fl oz) + Roundup PowerMax (22 fl oz) + AMS (17 lb)*	Authority Elite + Metri fb. Enlist One + RupPM*
<b>POST</b> Roundup PowerMax (32 fl oz) + AMS (17 lb)	Roundup PowerMax (POST)

\*Treatment can only be applied in Enlist E3 soybean. Treatments that contain Liberty can only be applied to soybean varieties that are resistant to glufosinate (Liberty, etc.). All other treatments can be applied to soybean varieties that are glyphosate-resistant.

**Table 3.** Soybean injury, weed control, program costs, soybean yield, and economic returns for several herbicide programs, 2020.

Herbicide Programs <sup>3</sup>	Soybean Injury		Weed control (at harvest)					All Weeds (≥90%)	Costs <sup>1</sup> (\$/A)	Yield (bu/A)	Economic Returns <sup>2</sup> (\$/A)
	21 DAP	42 DAP	ANGR	CHEAL	AMAPO	AMBEL	ABUTH				
	(%)	(%)									
Warrant fb. RupPM	1	1	93	95	100	83	97	NO	\$32.31	50.0*	\$547.69*
Sonic fb. Enlist One + Durango*	1	1	100	100	100	100	100	YES	\$56.79	51.6*	\$541.77*
Zidua PRO fb. Liberty	1	0	98	99	100	90	100	YES	\$45.61	51.4*	\$550.63*
Valor EZ fb. Perpetuo + RupPM	18	9	100	100	100	91	100	YES	\$48.48	54.3*	\$581.40*
Boundary fb. Prefix + Liberty	9	12	98	97	100	99	100	YES	\$65.42	54.1*	\$562.14*
Authority XL fb. Enlist One + RupPM*	8	1	99	100	100	100	100	YES	\$48.93	47.5*	\$502.07*
Sonic fb. EverpreX + EnlistO + Dura*	13	9	100	100	100	100	100	YES	\$70.85	53.3*	\$547.43*
Zidua PRO fb. Liberty + RupPM	11	3	98	100	100	90	100	YES	\$52.22	50.0*	\$527.78*
Prefix + Metri fb. Sequence + Liberty	5	5	93	95	100	91	100	YES	\$70.06	45.6*	\$458.90*
Fierce EZ fb. Perpetuo + RupPM	28	10	100	100	100	98	100	YES	\$62.42	55.9**	\$586.02**
Warrant + Metri fb. RupPM	6	0	99	96	100	94	100	YES	\$43.45	52.6*	\$566.71*
AuthorEdge fb. Enlist One + RupPM*	8	1	100	100	100	100	100	YES	\$33.32	45.8*	\$497.96*
Verdict + Metri fb. Liberty + RupPM	11	4	88	96	100	94	100	NO	\$50.09	49.3*	\$521.79*
Trivence fb. Enlist One + Lib + Dura*	19	4	100	100	100	100	100	YES	\$47.94	52.1*	\$556.42*
Prefix + FirstR fb. Seq + Liberty	11	10	100	100	100	100	100	YES	\$82.80	52.1*	\$521.56*
Fierce MTZ fb. Perpetuo + RupPM	38	16	100	100	100	98	100	YES	\$66.11	47.3*	\$482.57*
Warrant Ultra fb. RupPM	5	0	98	100	100	100	100	YES	\$44.16	51.4*	\$552.08*
AuthElite + Metri fb. EnlistO + RupPM*	13	0	100	100	100	100	100	YES	\$65.99	48.9*	\$501.25*
Roundup PowerMax (POST)	0	0	85	93	100	85	100	NO	\$15.04	49.0*	\$553.36*
<b>Untreated</b>	0	0	0	0	0	0	0	NO	---	20.6	\$238.96

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 = 156,000 seeds/A. Weed control costs = Herbicide \$ + Additive \$ + Application \$.

<sup>2</sup>Crop selling price = \$11.60/bu (December 2020). Economic return = (Yield x Price) – Weed Control Costs.

<sup>3</sup>Many herbicide programs have long rotation restrictions to more sensitive crops, i.e., sugarbeet, alfalfa, potatoes, etc. Consult the Table 12 in the MSU Weed Control Guide for Field Crops (E-434) or the herbicide label for crop rotation restrictions.