

Economics of Weed Control Programs for non-GMO Soybean, 2013

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A field trial sponsored by the Michigan Soybean Promotion Committee (MSPC) was conducted in 2013 at the MSU Research Farm in E. Lansing to compare weed control, soybean injury, soybean yield, and economic returns of potential programs in non-GMO (conventional) soybean. Soil-applied (PRE) herbicide programs were designed to provide control of dominant weed species found in Michigan soybean fields. Seventeen different soil-applied (PRE) herbicide programs were applied immediately after soybean planting. Throughout the growing season each treatment was evaluated for soybean injury and weed control. The soil-applied herbicide programs were scouted for weed escapes and postemergence (POST) herbicides were applied to control escaped weeds. POST herbicide programs were designed to demonstrate and answer grower questions on some of the different POST tank-mix options for control of the primary weed escapes. POST herbicides and rates were selected based on the weeds that needed to be controlled. For example, if common ragweed was the escaped weed a herbicide like Flexstar or Cobra was applied. Herbicide rates were adjusted to weed size. Site characteristics and herbicide application timings are described in Table 1. Table 2 describes the herbicide programs evaluated. The maximum soybean yield was 75.8 bu/A and yield loss due to weeds was extremely high. The weedy (untreated) yield was 28.6 bu/A, resulting in a yield loss of 47.2 bu/A (62%). Table 3 contains the data for soybean injury, weed control, herbicide program costs, soybean yield, and economic returns.

Table 1. Site description.

Crop	Soybean
Soil Texture	Loam
Soil pH	6.5
Soil Organic Matter	3.5
Dominant Weeds	ANGR, CHEAL, AMBEL, ABUTH
Planting Date	May 8
Application Timings:	
PRE	May 8
POST	June 19
Evaluation Times	Soybean injury – 30 d after planting & 7, 14, & 28 d after POST
	Weed control prior to harvest (28 d after POST)

Abbreviations: ANGR = giant & yellow foxtail, CHEAL = c. lambsquarters, AMAPO = Powell amaranth & redroot pigweed, AMBEL = c. ragweed, ABUTH = velvetleaf.

Table 2. non-GMO soybean herbicide programs evaluated in 2013.

PRE TREATMENT	POST TREATMENT	ABBREVIATED FORM
Valor (2.5 oz) + Prowl H ₂ O (2 pt)	Flexstar (1 pt) + SelectMax (12 fl oz) + COC (1%) + AMS (2.5 lb)	Valor + Prowl fb. Flex + Select
Valor (2.5 oz) + Zidua (2.5 oz)	Cobra (8 fl oz) + SelectMax (12 fl oz) + COC (0.5%) + AMS (2.5 lb)	Valor + Zidua fb. Cobra + Select
Valor XLT (4 oz) + Metribuzin (4 oz)	Flexstar (1 pt) + SelectMax (12 fl oz) + COC (1%) + AMS (2.5 lb)	Valor XLT + Metri fb. Flex + Select
Valor XLT (4 oz) + Zidua (2.5 oz)	Flexstar (1 pt) + COC (1%) + AMS (2.5 lb)	Valor XLT + Zidua fb. Flex
Envive (3.5 oz) + Prowl H ₂ O (2 pt)	Cobra (8 fl oz) + SelectMax (12 fl oz) + COC (0.5%) + AMS (2.5 lb)	Envive + Prowl fb. Cobra + Select
Canopy (2.25 oz) + Valor (2 oz) + Metribuzin (2 oz) + Prowl H ₂ O (2 pt)	Flexstar (1 pt) + Select Max (12 fl oz) + COC (1%) + AMS (2.5 lb)	Canopy + Valor + Metri + Prowl fb. Flex + Select
Classic (1.25 oz) + Metribuzin (4.75) + Valor (2 oz) + Zidua (2.5 oz)	Flexstar (12 fl oz) + COC (1%) + AMS (2.5 lb)	Classic + Metri + Valor + Zidua fb. Flex
Boundary (2.4 pt)	Flexstar (1 pt) + COC (1%) + AMS (2.5 lb)	Boundary fb. Flex
Python (0.8 oz) + Boundary (2 pt)	Cobra (8 fl oz) + COC (0.5%) + AMS (2.5 lb)	Python + Boundary fb. Cobra
Authority XL (3.2 oz) + Boundary (2 pt)	Cobra (8 fl oz) + COC (0.5%) + AMS (2.5 lb)	Auth XL + Boundary fb. Cobra
Metribuzin (5 oz) + Dual II Magnum (1.33 pt) + Linex (1 pt)	Flexstar (1 pt) + COC (1%) + AMS (2.5 lb)	Metri + Dual + Linex fb. Flex
Canopy (4 oz) + Prefix (2 pt)	Cobra (8 fl oz) + Resource (4 fl oz) + SelectMax (12 fl oz) + COC (0.5%) + AMS (2.5 lb)	Canopy + Prefix fb. Cobra + Res + Select
Optill PRO (2 oz + 10 fl oz) + Outlook (8 fl oz) + Sencor (5 oz)	Cobra (8 fl oz) + COC (0.5%) + AMS (2.5 lb)	Optill PRO + Outlook + Sencor fb. Cobra
Authority MTZ (13 oz) + Command (24 fl oz)	Flexstar (1 pt) + COC (1%) + AMS (2.5 lb)	Auth MTZ + Command fb. Flex
Authority MTZ (13 oz) + Dual II Magnum (1 pt)	Flexstar (1 pt) + SelectMax (9 fl oz) + COC (1%) + AMS (2.5 lb)	Auth MTZ + Dual fb. Flex + Select
Authority MTZ (16 oz)	Flexstar (1 pt) + SelectMax (9 fl oz) + COC (1%) + AMS (2.5 lb)	Auth MTZ fb. Flex + Select
Authority MTZ (16 oz)	Marvel (7.25 fl oz) + SelectMax (9 fl oz) + COC (1%) + AMS (2.5 lb)	Auth MTZ fb. Marvel + Select

^a 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.

Table 3. Soybean injury, weed control, program costs, soybean yield, and economic returns for non-GMO herbicide programs, 2013.

Herbicide Programs	Soybean injury						All Weeds (≥90%)	Costs ² (\$/A)	Yield (bu/A)	Economic Returns ³ (\$/A)	
	30 DAP	7 DAT	Prior to harvest (28 d after POST)								
	(%)	(%)	ANGR	CHEAL	AMAPO	AMBEL ¹					ABUTH
Valor + Prowl fb. Flex + Select	31	15	99	99	99	99	99	YES	\$63.20	70.0*	\$916.80*
Valor + Zidua fb. Cobra + Select	28	26	98	98	99	98	99	YES	\$69.10	64.2	\$829.70
Valor XLT + Metri fb. Flex + Select	19	20	97	99	99	99	99	YES	\$58.75	75.8**	\$1,002.45**
Valor XLT + Zidua fb. Flex	31	29	94	99	99	99	99	YES	\$63.15	61.4	\$796.45
Envive + Prowl fb. Cobra + Select	29	30	92	99	99	97	98	YES	\$64.90	73.4*	\$962.70*
Canopy + Valor + Metri + Prowl fb. Flex + Select	29	21	98	99	99	99	99	YES	\$67.60	68.2*	\$887.20*
Classic + Metri + Valor + Zidua fb. Flex	29	23	98	99	99	99	99	YES	\$79.00	73.0*	\$943.00*
Boundary fb. Flex	8	18	98	99	99	99	99	YES	\$51.35	62.5	\$823.65
Python + Boundary fb. Cobra	8	29	92	99	99	99	99	YES	\$57.30	64.2	\$841.50
Auth XL + Boundary fb. Cobra	9	28	93	99	99	98	98	YES	\$58.40	66.3	\$869.80
Metri + Dual + Linex fb. Flex	11	15	98	99	99	99	99	YES	\$62.40	70.4*	\$923.20*
Canopy + Prefix fb. Cobra + Res + Select	5	33	96	99	99	98	97	YES	\$61.80	71.2*	\$935.00*
Optill PRO + Outlook + Sencor fb. Cobra	5	28	97	99	99	99	99	YES	\$59.05	71.1*	\$936.35*
Auth MTZ + Command fb. Flex	0	17	99	99	99	99	99	YES	\$73.10	65.3	\$841.10
Auth MTZ + Dual fb. Flex + Select	5	21	99	99	99	96	96	YES	\$67.10	67.5*	\$877.90*
Auth MTZ fb. Flex + Select	1	21	99	99	99	99	99	YES	\$56.25	62.8	\$822.95
Auth MTZ fb. Marvel + Select	0	33	99	99	99	97	98	YES	\$56.65	68.6*	\$903.75*
<i>Weed-free</i>	0	-	-	-	-	-	-	YES	—	68.4*	\$957.60*
<i>Untreated</i>	0	0	0	0	0	0	0	NO	—	28.6	\$400.40

Abbreviations: ANGR = giant & yellow foxtail, CHEAL = c. lambsquarters, AMAPO = pigweed, AMBEL = c. ragweed, ABUTH = velvetleaf, fb. = followed by.

¹ A portion of the common ragweed population may have been resistant to ALS-herbicides.

² Herbicide costs = avg. of price lists; App. cost = \$7.50/A; seeding rate = 150,000 seeds/A. Weed control costs = Herbicide \$ + Additive \$ + Application \$.

³ Crop selling price = \$12.50/bu + non-GMO premium \$1.50/bu (December 2013). Economic return = (Yield x Price) – Weed Control Costs.

* Values are not significantly different from the highest value within that column. ** Highest yielding and highest economic returns.

General Observations and Interpretation:

Weather had a major impact on the overall outcome of the various herbicide programs. Early in the growing season there was ample rain (1.1-inches) within two weeks of the soil-applied (PRE) herbicide applications. This allowed for good incorporation of the herbicides for good weed control, but it also caused significant soybean injury. Soybean injury ranged from 0 to 30%, 30 DAP. Treatments that contained flumioxazin (Valor) tended to have the greatest amount of soybean injury. Even though there was significant soybean injury early in the season, only a few of these treatments resulted in lower yields than the highest yielding treatment. Reduced yields did not appear to be correlated to a specific PRE product. All PRE treatments resulted in excellent control of common lambsquarters and Powell amaranth, and good to excellent control of velvetleaf. None of the soil-applied programs provided excellent control of all weeds. High populations of giant foxtail and common ragweed contributed to the lack of excellent control of these two species with any of the soil-applied programs. POST herbicide programs were selected to help control common ragweed and/or giant foxtail. In two cases, additional control of velvetleaf was needed. To control velvetleaf, Resource was tank-mixed in one treatment and the new premixture Marvel was used in the other treatment. In both cases soybean injury was around 33%, 7 DAT. The POST herbicide programs provided good to excellent control of the remainder of the weeds and all PRE followed by POST programs provided excellent season-long weed control ($\geq 90\%$). The total cost of the programs ranged from \$51.35 to \$79.00 (herbicide + application costs). Soybean yield ranged from 61.4 to 75.8 bu/A for all herbicide treatments. There were 10 of the 17 herbicide programs that provided high yields (not different from the highest yielding program). All of these treatments were also amongst the programs with top economic returns. Yield was more of a factor for economic returns than herbicide program cost. Our recommendation when growing non-GMO soybean is to plan on a two-pass program (PRE fb. POST). These programs have consistently provided better weed control, yield, and economic returns, even with the added herbicide and application cost.