

Economics of Weed Control Programs for non-GMO Soybean, 2011 Christy L. Sprague

A field trial sponsored by the Michigan Soybean Promotion Committee (MSPC) was conducted in 2011 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. Each soil-applied herbicide program was applied to two different sets of treatments. 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 one set of the treatments to control escaped weeds. 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 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 65.7 bu/A and yield loss due to weeds was extremely high. The weedy (untreated) yield was 10 bu/A, resulting in a yield loss of 55.7 bu/A (85%). Within 14 days after planting and application of the preemergence herbicides the site received 4.86-inches of rain, as a result the soil-applied herbicide programs caused significant soybean injury. Eventually soybean outgrew most of this injury. However, it did appear that early soybean injury from one of the treatments may have led to reduced soybean yield. Table 3 contains the data for soybean injury, weed control, herbicide program costs, soybean yield, and economic returns.

Table 1. Site description.

Crop	Soybean
Variety	Pioneer 92M61
Soil Texture	Silt loam
Soil pH	6.8
Soil Organic Matter	2.8
Dominant Weeds	SETFA, CHEAL, AMBEL, ABUTH
Planting Date	May 10
Application Timings:	
PRE	May 10
POST	June 27
Late-POST (LPOS)	July 7
Evaluation Times	Soybean injury – 30 & 50 d after planting Weed control prior to harvest (28 d after LPOS)

Abbreviations: SETFA = giant foxtail, CHEAL = c. lambsquarters, AMBEL = c. ragweed, ABUTH = velvetleaf.

Table 2. non-GMO soybean herbicide programs evaluated in 2011.

	Treatments (Rate/A) – Timing	Abbreviated Form
1	Valor (2.5 oz) + Prowl H ₂ O (2 pt) – PRE	Valor + Prowl
2	Valor (2.5 oz) + Prowl H ₂ O (2 pt) – PRE fb. Flexstar (12 fl oz) + SelectMax (9 fl oz) + COC (1% v/v) - POST	Valor + Prowl fb. Flexstar + Select (P)
3*	Boundary (2.4 pt) – PRE	Boundary
4*	Boundary (2.4 pt) – PRE fb. Flexstar (12 fl oz) + COC (1% v/v) - POST	Boundary fb. Flexstar (P)
5*	Canopy (4 oz) + Prefix (2 pt) – PRE	Canopy + Prefix
6*	Canopy (4 oz) + Prefix (2 pt) – PRE fb. Flexstar (1 pt) + SelectMax (9 fl oz) + COC (1% v/v) - LPOS	Canopy + Prefix fb. Flexstar + Select (P)
7*	Authority MTZ (10 oz) + Valor XLT (3 oz) - PRE	Auth. MTZ + Valor XLT
8*	Authority MTZ (10 oz) + Valor XLT (3 oz) – PRE fb. Flexstar (1 pt) + SelectMax (9 fl oz) + COC (1% v/v) - LPOS	Auth. MTZ + Valor XLT fb. Flexstar + Select (LP)
9*	Valor XLT (4 oz) + Metribuzin (4 oz) - PRE	Valor XLT + Metribuzin
10*	Valor XLT (4 oz) + Metribuzin (4 oz) – PRE fb. Flexstar (1 pt) + SelectMax (9 fl oz) + COC (1% v/v) - LPOS	Valor XLT + Metri fb. Fstar + Select (LP)
11*	Canopy (5.5 oz) + IntRRo (2 qt) - PRE	Canopy + IntRRo
12*	Canopy (5.5 oz) + IntRRo (2 qt) - PRE fb. Flexstar (1 pt) + SelectMax (9 fl oz) + COC (1% v/v) - LPOS	Canopy + IntRRo fb. Flexstar + Select (LP)
13	Python (0.8 oz) + Metribuzin (8 oz) + Outlook (18 fl oz) - PRE	Python + Metribuzin + Outlook
14	Python (0.8 oz) + Metribuzin (8 oz) + Outlook (18 fl oz) - PRE fb. Flexstar (1 pt) + SelectMax (9 fl oz) + COC (1% v/v) - LPOS	Python + Metr. + Outlook fb. Flexstar + Select (LP)
15*	Authority XL (3.8 oz) + Boundary (2 pt) – PRE	Auth. XL + Boundary
16*	Authority XL (3.8 oz) + Boundary (2 pt) – PRE fb. Flexstar (1 pt) + COC (1% v/v) - LPOS	Auth. XL + Boundary fb. Flexstar (LP)
17	Optill (2 oz) + Dual II Magnum (1.33 pt) – PRE	Optill + Dual
18	Optill (2 oz) + Dual II Magnum (1.33 pt) – PRE fb. Flexstar (1 pt) + COC (1% v/v) - POST	Optill + Dual fb. Flexstar (P)
19*	Envive (3.5 oz) + Prowl H ₂ O (2 pt) – PRE	Envive + Prowl
20*	Envive (3.5 oz) + Prowl H ₂ O (2 pt) – PRE fb. Flexstar (12 fl oz) + SelectMax (9 fl oz) + COC (1% v/v) - POST	Envive + Prowl fb. Flexstar + Select (P)
21	Dual II Magnum (1.33 pt) + Linex (1 pt) + Metribuzin (5 oz) – PRE	Dual + Linex + Metribuzin
22	Dual II Magnum (1.33 pt) + Linex (1 pt) + Metribuzin (5 oz) – PRE fb. Flexstar (1 pt) + COC (1% v/v) - POST	Dual + Linex + Metri fb. Flexstar (P)
23	Dual 8E (2 pt) + Metribuzin (6 oz) + Pursuit (4 fl oz) – PRE	Dual8 + Metribuzin + Pursuit
24	Dual 8E (2 pt) + Metribuzin (6 oz) + Pursuit (4 fl oz) – PRE fb. Flexstar (1 pt) + COC (1% v/v) - POST	Dual8 + Metri + Pursuit fb. Flexstar (P)

^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.

* Soil pH is important in the breakdown and availability of some of these herbicides. Rates evaluated above are too high for soils with pH's around 7.0. Consult the MSU Weed Control Guide for Field Crops (E-434) or the herbicide label for soil pH restrictions.

Table 3. Soybean injury, weed control, program costs, soybean yield, and economic returns for non-GMO herbicide programs, 2011.

Herbicide Programs	Soybean Injury						All Weeds (≥90%)	Costs ² (\$/A)	Yield (bu/A)	Economic Returns ³ (\$/A)
	(PRE)		SETFA CHEAL AMBEL ¹ ABUTH							
	30 DAP (%)	50 DAP (%)	Prior to harvest (28 d after LPOS) % control							
Valor + Prowl			73	99	54	85	NO	\$30.75	37.5	\$438.00
Valor + Prowl fb. Flexstar + Select (P)	32†	1	96	99	82	99	NO	\$58.60	63.0*	\$728.90*
Boundary			93	99	73	90	NO	\$29.55	58.3*	\$699.20*
Boundary fb. Flexstar (P)	30†	4	98	99	90	99	YES	\$50.75	65.7**	\$770.50**
Canopy + Prefix			98	99	94	99	YES	\$33.05	60.5*	\$723.20*
Canopy + Prefix fb. Flexstar + Select (P)	34†	25†	99	99	98	99	YES	\$64.75	65.3*	\$751.50*
Auth. MTZ + Valor XLT			84	99	74	99	NO	\$29.95	49.0	\$582.55
Auth. MTZ + Valor XLT fb. Flexstar + Select (LP)	43†	32†	99	99	99	99	YES	\$61.65	54.5	\$619.60
Valor XLT + Metribuzin			73	99	68	96	NO	\$26.35	45.8	\$546.15
Valor XLT + Metri fb. Flexstar + Select (LP)	36†	43†	96	99	99	99	YES	\$58.10	57.5*	\$660.65*
Canopy + IntRRo			88	99	71	99	NO	\$38.40	51.0	\$599.10
Canopy + IntRRo fb. Flexstar + Select (LP)	31†	23†	99	99	98	99	YES	\$70.10	59.3*	\$671.15*
Python + Metr. + Outlook			95	99	87	99	NO	\$50.10	57.5*	\$668.65*
Python + Metr. + Outlook fb. Flexstar + Select (LP)	43†	30†	99	99	99	99	YES	\$81.80	61.3*	\$684.45*
Auth. XL + Boundary			97	99	77	99	NO	\$37.10	59.5*	\$706.65*
Auth. XL + Boundary fb. Flexstar (LP)	32†	16†	99	99	99	99	YES	\$62.10	62.5*	\$719.15*
Optill + Dual			99	99	57	99	NO	\$38.25	43.8	\$509.25
Optill + Dual fb. Flexstar (P)	27†	9†	91	99	77	99	NO	\$63.25	59.7*	\$683.00*
Envive + Prowl			76	99	59	97	NO	\$35.50	39.0	\$452.00
Envive + Prowl fb. Flexstar + Select (P)	39†	17†	97	99	81	99	NO	\$63.40	56.5*	\$642.85
Dual + Linex + Metribuzin			93	99	70	87	NO	\$39.70	55.0	\$647.80
Dual + Linex + Metribuzin fb. Flexstar (P)	30†	4	96	99	90	99	YES	\$64.70	63.3*	\$726.55*
Dual8 + Metribuzin + Pursuit			96	99	67	99	NO	\$39.95	52.3	\$613.80
Dual8 + Metribuzin + Pursuit fb. Flexstar (P)	24†	5	97	99	94	99	YES	\$64.95	64.8*	\$745.05*
Untreated	0	0	0	0	0	0	NO	—	7.0	\$87.50

Abbreviations: SETFA = giant foxtail, CHEAL = c. lambsquarters, AMBEL = c. ragweed, ABUTH = velvetleaf, fb. = followed by, P = POST, LP = late POST.

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 = 155,000 seeds/A. Weed control costs = Herbicide \$ + Additive \$ + Application \$.

³ Crop selling price = \$11.50/bu (December 2011) and \$1.00 non-GMO premium. Economic return = (Yield x Price + Premium) – Weed Control Costs.

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

† Indicates significant soybean injury for the soil-applied herbicide.

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 (4.86-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 may also have been exacerbated by the higher rates of many of these products used for weed control in non-GMO soybean. Even though there was significant soybean injury early in the season, it appeared that injury from only one of the programs resulted in significant yield loss (Authority MTZ (10 oz) + Valor XLT (3 oz) fb. Flexstar (1 pt) + SelectMax (9 fl oz) + COC (1% v/v)). Other treatments with significant yield loss appeared to be due to poorer weed control, specifically common ragweed. All the total PRE herbicide programs provided excellent control of common lambsquarters and good to excellent control of velvetleaf. The cost of these programs ranged from \$26.35 to \$50.10 (herbicide + application costs). Due to the high populations of giant foxtail and common ragweed, only one of the PRE herbicide programs (Canopy (4 oz) + Prefix (2 pt)) provided excellent control of all weeds and POST herbicide programs were applied based on the weed escapes. The POST herbicide programs provided good to excellent control of the remainder of the weeds and all but three PRE followed by POST programs provided excellent season-long weed control ($\geq 90\%$). The extra application added to the cost of the treatment and this additional cost added anywhere from \$21 to \$32 per treatment (herbicide + application costs). Soybean yield ranged from 37.5 to 65.7 bu/A for all herbicide treatments. There were 15 of the 24 herbicide programs that provided high yields (not different from the highest yielding program). All of these treatments, except for one, also were amongst the programs with top economic returns. Four of these programs were PRE only programs and the ten remaining were PRE followed by POST programs. Overall, it may be possible with some of these soil-applied programs to provide season-long control under moderate or lower populations of giant foxtail and common ragweed. However, it is our recommendation when growing non-GMO soybean to plan on a two-pass program (PRE fb. POST). These programs provide more consistent weed control, yield, and economic returns, even though there is an added herbicide cost.