MSU Weed Science

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Economics of Weed Control Programs for non-GMO Soybean, 2025

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A field trial sponsored by the Michigan Soybean Promotion Committee (MSPC) was conducted in 2025 at the MSU Plant Pathology Farm in 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 and were evaluated ~23 and 33 days after planting (DAP). At the 33 DAP evaluation, the PRE herbicide programs were scouted for weed escapes and POST herbicide treatments were selected based on weeds that escaped control. For example, if common ragweed was the escaped weed, herbicides like Flexstar or Cobra, were applied. Herbicide rates were adjusted to weed size. In some cases, some the PREs did not need a POST application at 33 DAP, therefore they were scouted again 45 DAP and POST herbicides were then applied and designated late POST (LPOS). Three additional POST only treatments were applied when weeds were 2-inches tall and were designated as an early POST (EPOS) application. All treatments were evaluated one week after the POST application for soybean injury. There was one PRE treatment where a POST herbicide was not applied to show the importance of a PRE followed by POST herbicide program. Site characteristics and herbicide application timings are described in Table 1. Table 2 describes the herbicide programs evaluated. The maximum soybean yield was 51.8 bu/A and yield loss due to weeds was high. The weedy (untreated) yield was 10.3 bu/A, resulting in a yield loss of 41.5 bu/A (80%). Tables 3 & 4 contain the data for soybean injury, weed control, herbicide program costs, soybean yield, and economic returns.

Table 1. Site description.

Crop	Soybean
Variety	ZFS 1326
Soil Texture	Loam
Soil pH	6.7
Soil Organic Matter	2.0
Dominant Weeds	ANGR, CHEAL, AMBEL[1]
Planting Date	May 14
Application Timings:	
PRE	May 15
EPOS	June 13
POST	June 18
LPOS	June 30
Evaluation Times	33 d after planting Prior to harvest

Abbreviations: ANGR = giant foxtail, CHEAL = c. lambsquarters, AMBEL[1] = c. ragweed.

[1]The c. ragweed population at this location is ALS-resistant (Group 2).

Table 2. non-GMO soybean herbicide programs evaluated in 2025.

PRE TREATMENT	POST/LPOS TREATMENT	ABBREVIATED FORM
Boundary (2.4 pt)	Flexstar (12 fl oz) + COC (1%) + AMS (2.5 lb)	Boundary fb. Flex (12)
BroadAxe XC (32 fl oz)	Flexstar (16 fl oz) + COC (1%) + AMS (2.5 lb)	Broadaxe fb. Flex (16)
Sonic (6 oz) + Boundary (1.5 pt)	Cobra (8 fl oz) + COC (1.5 pt) + AMS (2.5 lb)	Sonic + Boundary fb. Cobra (8)
Valor EZ (2 fl oz) + Metribuzin (6 oz)	Flexstar (1 pt) + SelectMax (12 fl oz) + COC (1%) + AMS (2.5 lb)	Valor EZ (2) + Metri (6) fb. Flex (16) + Select (12)
Valor EZ (2.5 fl oz) + Prowl H_2O (2 pt)	Cobra (10 fl oz) + SelectMax (12 fl oz) + COC (1.5 pt) + AMS (2.5 lb)	Valor EZ (2.5) + Prowl fb. Cobra (10) + Select (12)
Fierce EZ (7.5 fl oz)	Cobra (10 fl oz) + COC (1.5 pt) + AMS (2.5 lb)	Fierce EZ fb. Cobra (10)
Fierce MTZ (16 fl oz)	Cobra (10 fl oz) + COC (1 pt) + AMS (2.5 lb)	Fierce MTZ fb. Cobra (10)
Fierce XLT (4 oz)	Flexstar (1 pt) + COC (1%)	Fierce XLT fb. Flex (16)
Tendovo (2.1 qt)	Flexstar (16 fl oz) + COC (1%) + AMS (2.5 lb)	Tendovo fb. Flex (16)
Authority Edge (9 fl oz)	Cobra (12.5 fl oz) + COC (1.5 pt) + AMS (2.5 lb)	Auth Edge (9) fb. Cobra (12.5)
Authority Edge (7 fl oz) + Metribuzin (6 oz)	Cobra (12.5 fl oz) + COC (1 pt) + AMS (2.5 lb)	Auth Edge (7) + Metri (6) fb. Cobra (12.5)
Zidua PRO (6 fl oz)	Flexstar (1 pt) + COC (1%) + AMS (2.5 lb) (LPOS)	Zidua PRO fb. Flex (16) (LP)
Zidua PRO (6 fl oz) + Metribuzin (6 oz)	Cobra (10 fl oz) + COC (1.5 pt) + AMS (2.5 lb) (LPOS)	Zidua PRO fb. Cobra (10) (LP)
Valor XLT (2.5 oz) + Valor EZ (1.5 fl oz) + Metribuzin (8 oz)	**NO POST**	Valor XLT + Valor EZ + Metri (8)
Prefix (2 pt) + Metribuzin (6 oz)	Flexstar (1 pt) + COC (1%) + AMS (2.5 lb) (LPOS)	Prefix + Metri (6) fb. Flex (16) (LP)
Warrant Ultra (50 fl oz) + Metribuzin (6 oz)	Cobra (10 fl oz) + COC (1 pt) + AMS (2.5 lb) (LPOS)	Warr Ultra + Metri (6) fb. Cobra (10) (LP)
Matador-S (3 pt)	Ultra Blazer (1.5 pt) + NIS (0.25%)	Matador fb. UBlazer
NO PRE	Varisto (27 fl oz) + Flexstar (1 pt) + COC (1%) + AMS (2.5 lb) (EPOS) fb. SelectMax (9 fl oz) + NIS (0.25%) + AMS 2.5 lb) (LPOS)	Varisto + Flex (16) (EP) fb. Select (9) (LP)
NO PRE	Flexstar (1 pt) + Harmony SG (0.125 oz) + SelectMax (12 fl oz) + NIS (0.25%) + AMS (2.5 lb) (EPOS)	Flex (16) + Harm + Select (12) (EP)
NO PRE	Synchrony XP (0.375 oz) + Cobra (10 fl oz) + Assure II (9 fl oz) + NIS (0.25%) + AMS (2.5 lb) (EPOS)	Synchrony + Cobra (10) + Assure (EP)

Table 3. Weed control at the time of POST (33 DAP) herbicide application[1].

Herbicide Programs	INJURY[2]	Weed control (at POST – 33 DAP)[3,4]		
		ANGR	CHEAL	AMBEL[5]
	— % —	———— % control ————		
Boundary (2.4 pt)	4	**100**	**100**	87
BroadAxe XC (32 fl oz)	3	**100**	**100**	57
Sonic (6 oz) + Boundary (1.5 pt)	3	**100**	**100**	**90**
Valor EZ (2 fl oz) + Metribuzin (6 oz)	**6**	**95**	**100**	**92**
Valor EZ (2.5 fl oz) + Prowl H_2O (2 pt)	**5**	**90**	**96**	77
Fierce EZ (7.5 fl oz)	**7**	**99**	**100**	86
Fierce MTZ (16 fl oz)	4	**100**	**100**	**92**
Fierce XLT (4 oz)	**10**	**100**	**100**	**92**
Tendovo (2.1 qt)	**9**	**100**	**100**	**91**
Authority Edge (9 fl oz)	**7**	**100**	**100**	73
Authority Edge (7 fl oz) + Metribuzin (6 oz)	**10**	**100**	**100**	86
Zidua PRO (6 fl oz)	**7**	**100**	**100**	**94**
Zidua PRO (6 fl oz) + Metribuzin (6 oz)	**12**	**100**	**100**	**100**
Valor XLT (2.5 oz) + Valor EZ (1.5 fl oz) + Metribuzin (8 oz)	**8**	**100**	**100**	**95**
Prefix (2 pt) + Metribuzin (6 oz)	**6**	**100**	**100**	**98**
Warrant Ultra (50 fl oz) + Metribuzin (6 oz)	3	**100**	**100**	**97**
Matador-S (3 pt)	1	**100**	**100**	80
Varisto + Flex (16) (EP)	**35***	88	**100**	**98**
Flex (16) + Harm + Select (12) (EP)	**33***	**98**	**100**	**100**
Synchrony + Cobra (10) + Assure (EP)	**36***	**93**	**98**	**100**

Abbreviations: ANGR = giant foxtail, CHEAL = c. lambsquarters, AMBEL = c. ragweed, EP = Early POST, LP = Late POST.

[1]POST herbicide selection was based on weed control that was less than 90% for the different weed species.

[2]Soybean injury in bold is significant, the injury numbers with * are significantly greater than all other treatments.

[3]Control ratings in bold are not different from the highest value within that column.

[4]Control of EP treatments was 4 days after treatment.

[5]The common ragweed population at this location is resistant to Group 2 (ALS-inhibiting) herbicides.

Table 4. Soybean injury, weed control, program costs, soybean yield, and economic returns for non-GMO herbicide programs, 2025.

Herbicide Programs[1]	Soybean Injury		Prior to harvest			All Weeds	Costs[2]	Yield	Economic Returns[3]
	28 DAP	14 DA-POST	ANGR	CHEAL	AMBEL				
	(%)	(%)	% control			(>90%)	($/A)	(bu/A)	($/A)
Boundary fb. Flex (12)	8	**11**	**100**	**100**	**97**	**YES**	$60.75	**48.6***	**$574***
Broadaxe fb. Flex (16)	5	**14**	**100**	**100**	**100**	**YES**	$65.40	**45.8***	**$533***
Sonic + Boundary fb. Cobra (8)	2	**19**	**93**	**100**	**91**	**YES**	$76.52	**46.7***	**$533***
Valor EZ (2) + Metri (6) fb. Flex (16) + Select (12)	**9**	**14**	**99**	**100**	**100**	**YES**	$58.75	**49.5***	**$588***
Valor EZ (2.5) + Prowl fb. Cobra (10) + Select (12)	**9**	**19**	**93**	88	**90**	NO	$64.75	**51.8****	**$612***
Fierce EZ fb. Cobra (10)	8	**21**	**91**	**95**	**96**	**YES**	$53.19	**44.8***	**$532***
Fierce MTZ fb. Cobra (10)	**9**	**18**	**94**	**100**	**100**	**YES**	$66.49	**50.3***	**$590***
Fierce XLT fb. Flex (16)	8	**14**	**93**	**100**	**100**	**YES**	$69.38	**49.0***	**$571***
Tendovo fb. Flex (16)	**18**	**16**	**98**	**100**	**100**	**YES**	$76.69	**44.7***	**$507***
Auth Edge (9) fb. Cobra (12.5)	**9**	**23**	**97**	**100**	88	NO	$75.73	**43.7***	**$495***
Auth Edge (7) + Metri (6) fb. Cobra (12.5)	**12**	**20**	**100**	**100**	**92**	**YES**	$70.84	**45.8***	**$527***
Zidua PRO fb. Flex (16) (LP)	**10**	0	**99**	**100**	**99**	**YES**	$68.40	**45.9***	**$531***
Zidua PRO fb. Cobra (10) (LP)	**19**	4	**99**	**100**	**100**	**YES**	$66.46	**43.5***	**$502***
Valor XLT + Valor EZ + Metri (8)	**10**	4	**90**	100	68	NO	$28.63	37.2	**$457***
Prefix + Metri (6) fb. Flex (16) (LP)	**13**	0	**100**	**100**	**100**	**YES**	$59.07	**49.5***	**$587***
Warr Ultra + Metri (6) fb. Cobra (10) (LP)	5	0	**91**	**94**	**100**	**YES**	$63.22	**44.8***	**$522***
Matador fb. UBlazer	5	**14**	**100**	**100**	85	NO	$57.06	**47.4***	**$562***
Varisto + Flex (16) (EP) fb. Select (9) (LP)	0	**14**	**95**	**99**	**100**	**YES**	**$87.77****	**43.7***	**$483***
Flex (16) + Harm + Select (12) (EP)	0	**11**	83	82	**96**	NO	$38.43	**50.8***	**$625****
Synchrony + Cobra (10) + Assure (EP)	0	**15**	71	71	85	NO	$30.32	**47.9***	**$595***
Untreated	0	0	0	0	0	NO	---	10.3	$135

Abbreviations: ANGR = giant foxtail, CHEAL = c. lambsquarters, AMBEL = c. ragweed, fb. = followed by, EP = Early POST, LP = Late POST.

[1]Many herbicide programs have long rotation restrictions to sensitive crops. Consult the Table 12 in the MSU Weed Control Guide for Field Crops (E0434) or the herbicide label for crop rotation restrictions.

[2]Herbicide costs = avg. of price lists; App. cost = $12.00/A; seeding rate = 150,000 seeds/A. Weed control costs = Herbicide $ + Additive $ + Application $.

[3]Crop selling price = $11.06/bu + non-GMO premium $2.00/bu (December 2025). Economic return = (Yield x Price) – Weed Control Costs.

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

Injury ratings in bold are significant; control ratings in bold are not different from the highest value within that column.

General Observations and Interpretation:

Precipitation can influence the performance of herbicide programs in this non-GMO soybean study; however, overall treatment responses have remained fairly consistent across years. In 2025, soybeans were planted and PRE herbicides applied on May 15. Rainfall after planting was adequate for herbicide incorporation, with 1.55 inches of precipitation occurring within 10 days. Soybean injury from the PRE treatments ranged from 10–20% at 28 DAP, particularly with the more active products. Adequate precipitation contributed to very effective early-season control of annual grasses and common lambsquarters, as well as good control of common ragweed 33 DAP. Only 13 of the 17 PRE herbicide treatments required a POST application at this time. One PRE-only program was intentionally left without a POST application to serve as a comparison for early-season weed control benefits. POST herbicide treatments were applied at 45 DAP to the remaining four PRE herbicide treatments, referred to as LPOS applications. All POST applications caused soybean injury, although plants largely recovered as the season progressed. Across all herbicide programs evaluated, 14 of the 20 provided at least 90% control of the full weed spectrum. Of the remaining six programs, three were one-pass systems (PRE only or EPOS only), and the two-pass programs in this subset still achieved ≥85% weed control. Total cost for PRE followed by POST programs, including a $12/A application cost, ranged from $53.19 to $76.69 per acre. Yields from these two-pass systems ranged from 43.7 to 51.8 bu/A and ranked among the highest. The PRE-only treatment yielded 37.2 bu/A, 73% greater than the weedy control, demonstrating the critical role of PRE programs for early-season weed suppression. The highest yielding programs, including the highest-cost program and the EPOS-only programs, also ranked among the highest in economic return. However, the one-pass EPOS systems did not consistently deliver the best weed control. Overall, results reinforce the importance of planning a two-pass PRE followed by POST herbicide program for non-GMO soybean production. Across years, these two-pass programs consistently provide superior weed control, yield, and economic return, even with added herbicide and application costs.