

Economics of Commercial Weed Control Programs in No-Till Soybean 2-Year Summary (2005 & 2006) Christy L. Sprague

Field trials in no-till soybean were conducted at the MSU Research Farm in E. Lansing to compare weed control, soybean injury, soybean yield, and economic returns of dominant weed control programs being marketed to Michigan growers. Each major herbicide company was asked to submit up to four weed control programs for the study based on soil type and weed infestation history. Site characteristics and herbicide application timings are described in Table 1. Tables 2 and 3 describe the herbicide programs selected by each company for the 2005 and 2006 season. Herbicide programs are sorted by application timing and the need for Roundup Ready seed. Yield loss due to weeds was extremely high both years. In 2005, the maximum soybean yield was 61.7 bu/A and the weedy (untreated) yield was 28.6 bu/A, resulting in a yield loss of 33.1 bu/A (54%). In 2006, the maximum soybean yield was 77.3 bu/A and the weedy (untreated) yield was 45.0 bu/A, resulting in a yield loss of 32.3 bu/A (42%).

Table 1. Site description.

	2005	2006
Crop	Soybean	Soybean
Variety	Asgrow 2107	Asgrow 2107
Soil Texture	Clay Loam	Clay Loam
Soil pH	7.3 ^a	6.8
Soil Organic Matter (OM)	2.5%	2.8%
Dominant Weeds	TAROF, ERIST, ERICA, DAUCA, SETFA/DIGSA, CHEAL, AMBEL	TAROF, ERIST, LACSE, SETFA/PANDI, CHEAL
Planting Date	May 5	May 8
Application Timings:		
14 EPP	April 19	April 24
7 EPP	April 28	May 1
PRE	May 5	May 8
MPOS	—	June 14
POST	June 13	June 20
LPOS	—	June 23
Replications (#)	4	5
Evaluation Time	54 d (injury) & 67 d (control)	51 d (injury) & 72 d (control)

Abbreviations: TAROF = dandelion, ERIST = rough fleabane, ERICA = horseweed (marestail), DAUCA = wild carrot, LACSE = prickly lettuce, SETFA = giant foxtail, DIGSA = large crabgrass, PANDI = fall panicum, CHEAL = c. lambsquarters, AMBEL = c. ragweed.

^a Due to the high soil pH at this site some of the programs listed in this trial would be restrictive to rotational crops the following season (i.e., programs containing chlorimuron).

Table 2. Commercial no-till soybean herbicide programs selected by companies in 2005.

<i>Conventional</i>	<i>Treatments (Rate/A)</i>	<i>Abbreviated Form</i>
7 EPP	Extreme (3 pt) + 2,4-D ester (1 pt) + Prowl H ₂ O (2 pt) + NIS (0.25%) + AMS (2.5 lb)	Extreme + 2,4-D + Prowl
PRE	Define (14.4 fl oz) + Extreme (3 pt) + Sencor (6.4 oz) + NIS (0.25%) + AMS (17 lb/100 gal) Gangster (3.6 oz) + Pendimax (2 pt) + Roundup OriginalMax (1.5 pt) + AMS (17 lb/100 gal)	Define + Extreme + Sencor Gangster + Pend + RupOM
7EPP/POST	Boundary (1.75 pt) + 2,4-D ester (1 pt) + COC (1%) fb. Flexstar (16 fl oz) + COC (1%) Glyphosate (32 fl oz) + 2,4-D ester (1 pt) + AMS (17 lb/100 gal) fb. Classic (0.25 oz) + Harmony GT (0.08 oz) + Assure II (8 fl oz) + NIS (0.2 pt) + 28% N (2 qt) - WeedSOFT	Boundary + 2,4-D fb. Flexstar Glypho + 2,4-D fb. Class + Harm + Assure
PRE/POST	Sequence (2.5 pt) + AMS (17 lb/100 gal) fb. Flexstar (16 fl oz) + COC (1%)	Sequence fb. Flexstar
Roundup Ready		
14EPP/POST	Extreme (3 pt) + 2,4-D ester (1 pt) + NIS (0.25%) + AMS (2.5 lb) fb. Roundup OriginalMax (22 fl oz) + AMS (2.5 lb) Linex (1 pt) + 2,4-D ester (1 pt) + COC (1%) fb. Roundup WeatherMax (22 fl oz) + AMS (17 lb/100 gal) Synchrony XP (1 oz) + Roundup WeatherMax (16 fl oz) + AMS (17 lb/100 gal) fb. Roundup WeatherMax (22 fl oz) + AMS (17 lb/100 gal) Roundup WeatherMax (16 fl oz) + 2,4-D Ester (1 pt) + AMS (17 lb/100 gal) fb. Roundup WeatherMax (22 fl oz) + AMS (17 lb/100 gal)	Extreme + 2,4-D fb. RupOM Linex + 2,4-D fb. RupWM Synch + RupWM fb. RupWM RupWM + 2,4-D fb. RupWM
7EPP/POST	Python (0.8 oz) + Durango (1.5 pt) + 2,4-D ester (1 pt) + AMS (1.5%) fb. Durango (1.5 pt) + AMS (1.5%) FirstRate (0.3 oz) + Durango (1.5 pt) + 2,4-D ester (1 pt) + AMS (1.5%) fb. Durango (1.5 pt) + AMS (1.5%) Boundary (1.75 pt) + 2,4-D ester (1 pt) + COC (1%) fb. Touchdown Total (24 fl oz) + AMS (17 lb/100 gal) Glyphosate (32 fl oz) + 2,4-D ester (1 pt) + AMS (17 lb/100 gal) fb. Glyphosate (32 fl oz) + AMS (17 lb/100 gal) – WeedSOFT	Python + Dura + 2,4-D fb. Dura FRate + Dura + 2,4-D fb. Dura Boundary + 2,4-D fb. Touchdown Glypho + 2,4-D fb. Glypho
PRE/POST	Sencor (6.4 oz) + COC (1%) fb. Roundup WeatherMax (22 fl oz) + AMS (17 lb/100 gal) Roundup OriginalMax (16 fl oz) + AMS (17 lb/100 gal) fb. Roundup OriginalMax (16 fl oz) + AMS (17 lb/100 gal) Sequence (2.5 pt) + AMS (17 lb/100 gal) fb. Touchdown Total (24 fl oz) + AMS (17 lb/100 gal)	Sencor fb. RoundupWM RoundupOM fb. RoundupOM Sequence fb. Touchdown

Table 3. Commercial no-till soybean herbicide programs selected by companies in 2006.

Conventional	Treatments (Rate/A)	Abbreviated Form
14 EPP	Sencor (5.3 oz) + Linex (1.25 pt) + Define (16 fl oz) + 2,4-D ester (1 pt) + COC (1 qt)	Sencor + Linex + Define + 2,4-D
7 EPP	Extreme (3 pt) + 2,4-D ester (1 pt) + Prowl H ₂ O (2 pt) + NIS (0.25%) + AMS (2.5 lb)	Extreme + 2,4-D + Prowl
PRE	Define (15 fl oz) + Extreme (3 pt) + Sencor (6.4 oz) + NIS (0.25%) + AMS (17 lb/100 gal) Gangster (3.6 oz) + Pendimax (2 pt) + Roundup OriginalMax (22 fl oz) + AMS (17 lb/100 gal)	Define + Extreme + Sencor Gangster + Pend + RupOM
7EPP/MPOST	Glyphosate (32 fl oz) + 2,4-D ester (1 pt) + AMS (17 lb/100 gal) fb. Basagran (1 qt) + Cobra (8 fl oz) + Assure II (10 fl oz) + COC (1 pt)	Glypho + 2,4-D fb. Bas + Cobra + Assure
Roundup Ready		
14EPP/MPOS	Sencor (8 oz) + 2,4-D ester (1 pt) + COC (1 qt) fb. Roundup WeatherMax (22 fl oz) + AMS (17 lb/100 gal) Linex (1 pt) + 2,4-D ester (1 pt) + COC (1%) fb. Roundup OriginalMax (22 fl oz) + AMS (17 lb/100 gal) Roundup WeatherMax (22 fl oz) + 2,4-D ester (1 pt) + AMS (17 lb/100 gal) fb. Roundup WeatherMax (22 fl oz) + AMS (17 lb/100 gal) Roundup OriginalMax (22 fl oz) + 2,4-D ester (1 pt) + AMS (17 lb/100 gal) fb. Roundup OriginalMax (22 fl oz) + AMS (17 lb/100 gal)	Sencor + 2,4-D fb. RupWM Linex + 2,4-D fb. RupOM RupWM + 2,4-D fb. RupWM RupOM + 2,4-D fb. RupOM
14EPP/POST	Extreme (3 pt) + 2,4-D ester (1 pt) + NIS (0.25%) + AMS (2.5 lb) fb. Roundup OriginalMax (22 fl oz) + NIS (0.25%) + AMS (2.5 lb) Canopy (2.25 oz) + 2,4-D ester (1 pt) + COC (1%) fb. Roundup OriginalMax (22 fl oz) + AMS (17 lb/100 gal) Roundup WeatherMax (22 fl oz) + 2,4-D ester (1 pt) + AMS (17 lb/100 gal) fb. Roundup WeatherMax (22 fl oz) + AMS (17 lb/100 gal)	Extreme + 2,4-D fb. RupOM Canopy + 2,4-D fb. RupOM RupWM + 2,4-D fb. RupWM
14EPP/LPOS	Boundary (3pt) + Gramoxone Inteon (2.5 pt) + COC (1%) fb. Touchdown Total (24 fl oz) + AMS (8.5 lb/100 gal)	Boundary + Gramx fb. Touchdown
7EPP/MPOS	Sencor (8 oz) + Extreme (3 pt) + NIS (0.25%) + AMS (17 lb/100 gal) fb. Roundup WeatherMax (22 fl oz) + AMS (17 lb/100gal) Glyphosate (32 fl oz) + 2,4-D ester (1 pt) + AMS (17 lb/100 gal) fb. Glyphosate (32 fl oz) + AMS (17 lb/100 gal)	Sencor + Extreme fb. RupWM Glypho + 2,4-D fb. Glypho
PRE/POST	IntRRo (2 qt) + Roundup WeatherMax (22 fl oz) + AMS (17 lb/100 gal) fb. Roundup WeatherMax (22 fl oz) + AMS (17 lb/100 gal)	IntRRo + RupWM fb. RupWM
PRE/LPOS	Python (0.8 oz) + Durango (1.5 pt) + AMS (1.5%) fb. Durango (1.5 pt) + AMS (1.5%) Sequence (3.5 pt) + AMS (8.5 lb/100 gal) fb. Touchdown Total (24 fl oz) + AMS (8.5 lb/100 gal)	Python + Dura fb. Dura Sequence fb. Touchdown

Table 3. Soybean injury, weed control, weed control costs, soybean yield, and economic returns for no-till herbicide programs in 2005.

	<i>Soybean Injury (%)</i>	<i>TAROF (%)</i>	<i>ERIST (%)</i>	<i>ERICA (%)</i>	<i>DAUCA (%)</i>	<i>SETFA (%)</i>	<i>CHEAL (%)</i>	<i>AMBEL (%)</i>	<i>All Weeds (>90%)</i>	<i>Costs¹ (\$/A)</i>	<i>Yield (bu/A)</i>	<i>Economic Returns² (\$/A)</i>
7 EPP (Conventional)												
Extreme + 2,4-D + Prowl	0	97	99	92	99	80	97	58	NO	\$27.06	52.2	\$233.94*
PRE (Conventional)												
Define + Extreme + Sencor	0	76	66	91	55	94	93	91	NO	\$40.61	54.0	\$229.64*
Gangster + Pend + RupOM	5†	83	98	99	50	89	88	90	NO	\$36.44	55.6*	\$241.44*
7 EPP fb. POST (Conventional)												
Boundary + 2,4-D fb. Flexstar	11†	38	9	55	25	91	81	98	NO	\$40.67	43.1	\$174.83
Glypho + 2,4-D fb. Class + Harm + Assure	10†	96	99	99	99	91	70	59	NO	\$31.90	51.7	\$226.48*
PRE fb. POST (Conventional)												
Sequence fb. Flexstar	10†	74	68	89	64	81	48	99	NO	\$40.21	49.6	\$207.79
14 EPP fb. POST (Roundup Ready)												
Extreme + 2,4-D fb. RupOM	0	98	99	99	99	93	99	99	YES	\$51.38	61.7*	\$256.88*
Linex + 2,4-D fb. RupWM	0	89	99	99	96	89	99	98	NO	\$51.11	56.4*	\$230.77*
Synch + RupWM fb. RupWM	1	98	99	99	99	91	99	99	YES	\$55.06	56.9*	\$229.32*
RupWM + 2,4-D fb. RupWM	1	98	99	99	99	86	98	99	NO	\$51.03	57.5*	\$236.47*
7 EPP fb. POST (Roundup Ready)												
Python + Dura + 2,4-D fb. Dura	0	96	99	99	99	91	99	99	YES	\$51.41	61.5*	\$255.97*
FRate + Dura + 2,4-D fb. Dura	4†	99	99	99	99	89	99	99	NO	\$51.73	53.6	\$216.02
Boundary + 2,4-D fb. Touchdown	0	87	93	99	91	90	99	99	NO	\$54.05	56.3*	\$227.20*
Glypho + 2,4-D fb. Glypho	1	99	99	99	99	88	99	99	NO	\$44.02	57.7*	\$244.36*
PRE fb. POST (Roundup Ready)												
Sencor fb. RoundupWM	1	79	93	99	86	86	99	99	NO	\$51.16	52.2	\$209.72
RoundupOM fb. RoundupOM	0	84	99	99	99	90	98	98	NO	\$41.72	56.7*	\$241.91*
Sequence fb. Touchdown	0	93	99	99	99	90	99	98	YES	\$53.59	57.2*	\$232.41*
Untreated	0	0	0	0	0	0	0	0	NO	0	28.6	\$142.75

¹Herbicide and additive costs = avg. of price lists (April 2005); Application cost = \$6.00/A; Roundup Ready seed premium = \$14.00/50 lb bag; seeding rate = 200,000 seeds/A. Weed control costs = Herbicide \$ + Additive \$ + Application \$ + seed premium \$ (where applicable).

²Crop selling price = \$5.00/bu (December 2005). Economic return = (Yield x Price) – Weed Control Costs.

* Values are not significantly different from the highest value within that column; † Indicates significant soybean injury 54 days after soybean planting.

Table 4. Soybean injury, weed control, weed control costs, soybean yield, and economic returns for no-till herbicide programs in 2006.

	<i>Soybean Injury (%)</i>	<i>TAROF (%)</i>	<i>ERIST (%)</i>	<i>LACSE (%)</i>	<i>SETFA (%)</i>	<i>CHEAL (%)</i>	<i>All Weeds (≥90%)</i>	<i>Costs¹ (\$/A)</i>	<i>Yield (bu/A)</i>	<i>Economic Returns² (\$/A)</i>
Conventional										
Sencor + Linex + Define + 2,4-D (<i>14 EPP</i>)	0	76	95	99	99	99	NO	\$38.79	72.8	\$398.01*
Extreme + 2,4-D + Prowl (<i>7 EPP</i>)	0	99	99	99	96	98	YES	\$27.39	71.6	\$402.21*
Define + Extreme + Sencor (<i>PRE</i>)	0	86	99	99	99	99	NO	\$39.15	74.7*	\$409.05*
Gangster + Pend + RupOM (<i>PRE</i>)	0	96	98	95	97	99	YES	\$36.50	68.8	\$376.30
Glypho+2,4-D/ Bas+Cobra+Assure (<i>7EPP/MP</i>)	15†	99	99	99	86	96	NO	\$57.56	70.0	\$362.44
14 EPP fb. MPOS (Roundup Ready)										
Sencor + 2,4-D fb. RupWM	0	83	95	97	95	99	NO	\$50.46	75.6*	\$403.14*
Linex + 2,4-D fb. RupOM	0	74	77	95	99	98	NO	\$48.02	73.7*	\$394.18*
RupWM + 2,4-D fb. RupWM	0	99	99	99	98	99	YES	\$48.56	76.2*	\$408.64*
RupOM + 2,4-D fb. RupOM	0	99	99	99	97	99	YES	\$45.29	73.5*	\$395.71*
14 EPP fb. POST (Roundup Ready)										
Extreme + 2,4-D fb. RupOM	0	98	99	99	99	99	YES	\$52.99	77.3*	\$410.81*
Canopy + 2,4-D fb. RupOM	0	99	93	99	99	99	YES	\$47.07	72.4	\$387.33*
RupWM + 2,4-D fb. RupWM	0	99	99	99	99	99	YES	\$48.56	72.0	\$383.44*
14 EPP fb. LPOS (Roundup Ready)										
Boundary + Gramx fb. Touchdown	0	99	99	99	99	99	YES	\$70.20	74.1*	\$374.40
7 EPP fb. MPOS (Roundup Ready)										
Sencor + Extreme fb. RupWM	0	99	99	99	99	99	YES	\$59.43	73.8*	\$383.37*
Glypho + 2,4-D fb. Glypho	0	98	99	99	99	99	YES	\$41.78	73.3*	\$398.02*
PRE fb. POST (Roundup Ready)										
IntRRo + RupWM fb. RupWM	0	83	93	96	98	99	NO	\$56.38	69.7	\$361.82
PRE fb. LPOS (Roundup Ready)										
Python + Dura fb. Dura	0	94	98	91	99	99	YES	\$50.45	74.2*	\$394.75*
Sequence fb. Touchdown	0	74	87	99	99	99	NO	\$59.38	72.1	\$373.22
Untreated	0	0	0	0	0	0	NO	--	45.0	\$270.00

¹ Herbicide and additive costs = avg. of price lists (April 2006); Application cost = \$6.00/A; Roundup Ready seed premium = \$14.00/50 lb bag; seeding rate = 205,000 seeds/A.

Weed control costs = Herbicide \$ + Additive \$ + Application \$ + seed premium \$ (where applicable).

² Crop selling price = \$6.00/bu (December 2006). Economic return = (Yield x Price) – Weed Control Costs.

* Values are not significantly different from the highest value within that column; † Indicates significant soybean injury 51 days after soybean planting.

Table 5. Summary of instances of soybean injury, weed control, herbicide program costs, highest yielding, and highest economic returns for the 7 no-till weed control systems in 2005.

	Soybean Injury	All Weeds Controlled ($\geq 90\%$)	5 Most Expensive	5 Least Expensive	Highest Yielding	Highest Economic Returns
Conventional						
7 EPP	0/1	0/1	0/1	1/1	0/1	1/1
PRE	1/2	0/2	0/2	2/2	1/2	2/2
7 EPP/POST	2/2	0/2	0/2	1/2	0/2	1/2
PRE/POST	1/1	0/1	0/1	1/1	0/1	0/1
Roundup Ready						
14 EPP/POST	0/4	2/4	1/4	0/4	4/4	4/4
7 EPP/POST	1/4	1/4	3/4	0/4	3/4	3/4
PRE/POST	0/3	1/3	1/3	0/3	2/3	2/3

Information in Table 5 is based on results presented in Table 3.

Table 6. Summary of instances of soybean injury, weed control, herbicide program costs, highest yielding, and highest gross margins for the 10 no-till weed control systems in 2006.

	Soybean Injury	All Weeds Controlled ($\geq 90\%$)	5 Most Expensive	5 Least Expensive	Highest Yielding	Highest Economic Returns
Conventional						
14 EPP	0/1	0/1	0/1	1/1	0/1	1/1
7 EPP	0/1	1/1	0/1	1/1	0/1	1/1
PRE	0/2	1/2	0/2	2/2	1/2	1/2
7 EPP/MPOS	1/1	0/1	1/1	0/1	0/1	0/1
Roundup Ready						
14 EPP/MPOS	0/4	2/4	0/4	0/4	4/4	4/4
14 EPP/POST	0/3	3/3	0/3	0/3	1/3	3/3
14 EPP/LPOS	0/1	1/1	1/1	0/1	1/1	0/1
7 EPP/MPOS	0/2	2/2	1/2	1/2	2/2	2/2
PRE/POST	0/1	0/1	1/1	0/1	0/1	0/1
PRE/LPOS	0/2	1/2	1/2	0/2	1/2	1/2

Information in Table 6 is based on results presented in Table 4.

Table 7. A 2-year summary of all no-till weed control programs for soybean yield (% of maximum yield) and economic return (% of maximum economic return).

	2004	2005	2004	2005
	— % of max. yield ^a —		— % of max. economic return —	
14 EPP (Conventional)				
Sencor + Linex + Define + 2,4-D	—	94	—	97*
7 EPP (Conventional)				
Extreme + 2,4-D + Prowl	85	93	91*	98*
PRE (Conventional)				
Define + Extreme + Sencor	88	97*	89*	100*
Gangster + Pend + RupOM	90*	89	94*	92
7 EPP fb. POST (Conventional)				
Boundary + 2,4-D fb. Flexstar	70	—	68	—
Glypho + 2,4-D fb. Class + Harm + Assure	84	—	88*	—
Glypho + 2,4-D fb. Bas + Cobra + Assure	—	91	—	88
PRE fb. POST (Conventional)				
Sequence fb. Flexstar	80	—	81	—
14 EPP fb. MPOS (Roundup Ready)				
Sencor + 2,4-D fb. RupWM	—	98*	—	98*
Linex + 2,4-D fb. RupOM	—	95*	—	96*
RupWM + 2,4-D fb. RupWM	—	99*	—	99*
RupOM + 2,4-D fb. RupOM	—	95*	—	96*
14 EPP fb. POST (Roundup Ready)				
Extreme + 2,4-D fb. RupOM	100*	100*	100*	100*
Linex + 2,4-D fb. RupWM	91*	—	90*	—
Synch + RupWM fb. RupWM	92*	—	89*	—
RupWM + 2,4-D fb. RupWM	93*	93	92*	93*
Canopy + 2,4-D fb. RupOM	—	94	—	94*
14 EPP fb. LPOS (Roundup Ready)				
Boundary + Gramx fb. Touchdown	—	96*	—	91
7 EPP fb. MPOS (Roundup Ready)				
Sencor + Extreme fb. RupWM	—	95*	—	93*
Glypho + 2,4-D fb. Glypho	—	95*	—	97*
7 EPP fb. POST (Roundup Ready)				
Python + Dura + 2,4-D fb. Dura	100*	—	100*	—
FRate + Dura + 2,4-D fb. Dura	87	—	84	—
Boundary + 2,4-D fb. Touchdown	91*	—	88*	—
Glypho + 2,4-D fb. Glypho	94*	—	95*	—
PRE fb. POST (Roundup Ready)				
Sencor fb. RoundupWM	85	—	81	—
RoundupOM fb. RoundupOM	92*	—	94*	—
Sequence fb. Touchdown	93*	—	90*	—
IntRRO + RupWM fb. RupWM	—	90	—	88
PRE fb. LPOS (Roundup Ready)				
Python + Dura fb. Dura	—	96*	—	96*
Sequence fb. Touchdown	—	93	—	91

* Values are not significantly different from the highest value within that column.