MSU Weed Science

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Economics of Commercial Weed Control Programs in Corn, 2016

Christy L. Sprague

A field trial in corn was conducted in 2016 at the MSU Agronomy Research Farm in East Lansing, MI to compare weed control, corn injury, corn yield, and economic returns of dominant weed control programs 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. Table 2 describes the herbicide programs selected by each company for 2016. Herbicide programs are sorted by application timing and the need for glufosinate- (LibertyLink) or glyphosate- (Roundup Ready) resistant corn seed. Corn was planted and PRE herbicide applications were made on May 18. Precipitation at this location was less than 0.2 inch within two weeks of planting and was well below average throughout June. Weather affected weed emergence and control in this trial. Dry conditions resulted in low early season weed emergence. However, by late-July and August precipitation was greater than the 30-year average resulting in late-season giant foxtail, common lambsquarters and common ragweed emergence. Twenty of the 30 herbicide programs examined resulted in greater than 90% control of all weeds prior to harvest. Many of these programs were two pass programs (PRE fb. POST or EPOS fb. POST) with residual herbicide components. The maximum yield in this trial was 252 bu/A, and yield was 162 bu/A in the weedy (non-treated) control. Weed competition in this trial resulted in a yield loss of 90 bu/A (36%). Table 3 contains the data for corn injury, weed control, herbicide program costs, corn yield and economic returns.

Table 1. Site description.

Crop	Corn
Variety	P9807 AM
Soil Texture	Loam
Soil pH	6.2
Soil Organic Matter	3.3
Dominant Weeds	ANGR, CHEAL, AMAPO, AMBEL, ABUTH
Planting Date	May 18
Application Timings:	
PRE	May 18
EPOS	Jun 6
POST	Jun 13
LPOS	Jun 21
Evaluation Times	Corn injury – 28 d after planting Weed control prior to harvest (28 d after POST)

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

Table 2. Commercial corn herbicide programs evaluated in 2016.

Conventional	*Treatments (Rate/A)*	*Abbreviated Form*
PRE	Balance Flexx (4 oz) + Harness Xtra (3.6 pt)	Bal Flexx + HarnXtra
	Corvus (3.3 oz) + Harness Xtra (3 pt)	Corvus + HarnXtra
	Keystone NXT (2.4 qt) + Hornet (3 oz)	Keystone NXT + Hornet
	Resicore (2.75 qt)	Resicore
	Resicore (2 qt) + Keystone NXT (1 qt)	Resicore + Keystone NXT
EPOS	Harness Xtra (3.6 pt) + Impact (1 oz) + MSO (0.25%) + AMS (8.5 lb)	HarnXtra + Impact
PRE/EPOS	Cinch ATZ (1 qt) fb. Revulin Q (3.4 qt) + NIS (0.25%) + AMS (2 lb/A)	Cinch ATZ fb. Revulin Q
	Cinch ATZ (1 qt) fb. Resolve Q (1.25 oz) + Status (5 oz) + NIS (0.25%) + AMS (2 lb/A)	Cinch ATZ fb. Resolve Q
PRE/POST	Harness Xtra (3.6 pt) fb. Impact (0.75 oz) + Atrazine (0.56 lb) + MSO (1%) + AMS (8.5 lb)	HarnXtra fb. Impact + Atra
LibertyLink		
PRE/POST	Harness Xtra (3.6 pt) fb. Impact (0.75 oz) + Liberty (29 oz) + Atrazine (0.56 lb) + MSO (1%) + AMS (8.5 lb)	HarnXtra fb. Impact + Liberty + Atra
Roundup Ready		
EPOS	Capreno (3 oz) + Roundup PowerMax (22 oz) + AMS (8.5 lb)	Capreno + RupPM
	Armezon PRO (16 oz) + Roundup PowerMax (16 oz) + Atrazine (1.1 lb) + NIS (0.25%) + AMS (8.5 lb)	Armezon PRO + RupPM + Atra
	Resicore (1.25 qt) + Durango DMA (32 oz) + AMS (8.5 lb)	Resicore + Durango DMA
	Degree Xtra (1 qt) + Impact (0.5 oz) + Roundup PowerMax (22 oz) + AMS (17 lb)	DegXtra + Impact + RupPM
EPOS / LPOS	Warrant (3 pt) + Atrazine (0.56 lb) +Roundup (22 oz) + AMS (17 lb) fb. Roundup (22 oz) + AMS (17 lb)	Warnt + Atra + RupPM fb. RupPM
PRE / POST	Acuron Flexi (1.25 qt) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb)	Acuron Flexi fb. RupPM
	Acuron (1.5 qt) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb)	Acuron fb. RupPM
	Verdict (16 oz) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb)	Verdict fb. RupPM
	Verdict (16 oz) + Atrazine (1.1 lb) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb)	Verdict + Atra fb. Rup PM
	Zidua (3.3 oz) + Sharpen (2 oz) + Atrazine (1.1 lb) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb)	Zidua + Sharp + Atra fb. RupPM
	TripleFLEX II (2 pt) + Degree Xtra (1.5 qt) fb. Roundup PowerMax (22 oz) + AMS (17 lb)	TripleFLEX II + DegXtra fb. RupPM
	Cinch ATZ (2 qt) + Instigate (5.25 oz) fb. Abundit Extra (1 qt) + AMS (2 lb/A)	CinchATZ + Instig fb. AbunditX
	Instigate (5.25 oz) fb. Atrazine (1.1 lb) + Abundit Extra (1 qt) + AMS (2 lb/A)	Instigate fb. Atra + AbunditX
	Harness Xtra(3.6 pt) fb. Impact (0.75 oz)+Roundup (32 oz) + Atrazine (0.56 lb) + MSO (0.5%) + AMS (8.5 lb)	HarnXtra fb. Impact + RupPM + Atra
	Balance Flexx (4 oz) fb. Roundup PowerMax (22 oz) + DiFlexx Duo (24 oz) + AMS (8.5 lb)	Bal Flexx fb. RupPM + DiFlexx Duo
	Degree Xtra (2 qt) fb. Status (2 oz) + Roundup PowerMax (22 oz) + AMS (17 lb)	DegXtra fb. Status + RupPM
	Acuron Flexi (1.25 qt) fb. Halex GT (3.6 pt) + NIS (0.5%) + AMS (8.5 lb)	Acuron Flexi fb. Halex GT
	Acuron (1.5 qt) fb. Halex GT (3.6 pt) + NIS (0.5%) + AMS (8.5 lb)	Acuron fb. Halex GT
	Anthem MAXX (3.5 oz) + Simazine (1.1 lb) fb. Atrazine (1.5 lb) + Roundup (32 oz) + AMS (2.5 lb/A)	AnthM + Sima fb. Atra + RupPM
	Anthem MAXX (3.5 oz) + Atrazine (1.1 lb) fb. Solstice (2.5 oz) + Atrazine (0.56 lb) + Roundup (32 oz) + AMS (2.5 lb/A)	AnthM + Atra fb. Sols + Atra + RPM

Table 3. Corn injury, weed control, program costs, corn yield, and economic returns for 30 herbicide programs in 2016.

Programs	Herbicide Treatments[4]	Injury 28 DAP	ANGR Prior to harvest (28 d after POST)	CHEAL Prior to harvest (28 d after POST)	AMAPO Prior to harvest (28 d after POST)	AMBEL Prior to harvest (28 d after POST)	ABUTH Prior to harvest (28 d after POST)	All Weeds	Costs[1]	Yield	Economic Returns[2]
Conventional		(%)	% control					(≥90%)	($/A)	(bu/A)	($/A)
PRE	Balance Flexx + Harness Xtra	0	89	**94**	**100**	84	80	NO	$51.66	**246***	**$747.84***
	Corvus + Harness Xtra	0	80	83	**98**	78	**91**	NO	$52.92	**244***	**$740.08***
	Keystone NXT + Hornet	0	**95**	**98**	**100**	85	86	NO	$54.83	**243***	$734.92
	Resicore	0	88	55	78	50	77	NO	$49.53	**247***	**$753.22***
	Resicore + Keystone NXT	0	**98**	**93**	**96**	69	85	NO	$52.10	236	$714.90
EPOS	Harness Xtra + Impact	**8**	**100**	**93**	**96**	**100**	**97**	**YES**	$59.65	**241***	$723.60
PRE/EPOS	Cinch ATZ fb. Revulin Q	0	88	75	**100**	**96**	**95**	NO	$46.54	**246***	**$752.96***
	Cinch ATZ fb. Resolve Q	0	88	79	**98**	**100**	**90**	NO	$57.69	**245***	**$738.56***
PRE/POST	Harness Xtra fb. Impact + Atra	0	**94**	**100**	**100**	**100**	**100**	**YES**	$65.76	**243***	$658.53
LibertyLink											
PRE/POST	HarnXtra fb. Impact + Liberty + Atra	0	**99**	**96**	**100**	**100**	**100**	**YES**	$82.25	**245***	$714.00
Roundup Ready											
EPOS	Capreno + RupPM	**5**	**94**	66	85	**100**	**95**	NO	$31.54	234	$728.96
	Armezon PRO + RupPM + Atra	1	**96**	**96**	**100**	**100**	**95**	**YES**	$33.66	**250***	**$778.84****
	Resicore + Durango DMA	0	**95**	78	**100**	**100**	**90**	NO	$36.46	**245***	**$759.79***
	DegXtra + Impact + RupPM	0	**95**	80	**100**	**99**	**96**	NO	$34.97	**241***	**$748.28***
EPOS/LPOS	Warnt + Atra + RupPM fb. RupPM	0	**100**	**100**	**100**	**100**	**100**	**YES**	$39.76	**250***	**$772.74***
PRE/POST	Acuron Flexi fb. RupPM	0	**100**	**97**	**100**	**100**	**100**	**YES**	$46.33	**248***	**$759.67***
	Acuron fb. RupPM	0	**99**	**100**	**100**	**100**	**100**	**YES**	$45.37	**252****	**$773.63***
	Verdict fb. RupPM	0	**100**	**100**	**100**	**100**	**100**	**YES**	$47.96	**244***	**$745.04***
	Verdict + Atra fb. Rup PM	0	**98**	**95**	**99**	**100**	**100**	**YES**	$51.48	**247***	**$751.27***
	Zidua + Sharp + Atra fb. RupPM	0	**100**	**100**	**100**	**100**	**100**	**YES**	$53.50	**247***	**$749.25***
	TripleFLEX II + DegXtra fb. RupPM	0	**100**	**100**	**100**	**100**	**100**	**YES**	$57.77	**245***	**$738.48***
	CinchATZ + Instig fb. AbunditX	0	**100**	**99**	**100**	**100**	**100**	**YES**	$58.49	**246***	**$741.01***
	Instigate fb. Atra + AbunditX	0	**100**	**98**	**100**	**100**	**100**	**YES**	$39.82	**238***	$733.68
	HarnXtra fb. Impact + RupPM + Atra	0	**100**	**100**	**100**	**100**	**98**	**YES**	$69.53	**240***	$710.47
	Bal Flexx fb. RupPM + DiFlexx Duo	0	**100**	**100**	**100**	**100**	**100**	**YES**	$58.90	**241***	$724.35
	DegXtra fb. Status + RupPM	0	**100**	**100**	**100**	**100**	**100**	**YES**	$49.78	**240***	$730.22
	Acuron Flexi fb. Halex GT	0	**100**	**100**	**100**	**99**	**100**	**YES**	$69.86	**241***	$713.39
	Acuron fb. Halex GT	0	**100**	**100**	**100**	**100**	**99**	**YES**	$68.90	**241***	$714.35
	AnthM + Sima fb. Atra + RupPM	0	**100**	**100**	**100**	**100**	**100**	**YES**	$50.47	**241***	$732.78
	AnthM + Atra fb. Sols + Atra +RPM	2	**100**	**100**	**100**	**100**	**100**	**YES**	$59.27	**246***	**$740.23***

Abbreviations: ANGR = giant foxtail, CHEAL = c. lambsquarters, AMAPO = Powell amaranth, AMBEL = c. ragweed, ABUTH = velvetleaf, fb. = followed by.
[1] Herbicide costs = avg. of price lists; App. cost = $7.50/A; seeding rate = 32,000 seeds/A. Weed control costs = Herbicide $ + Additive $ + Application $.
[2] Crop selling price = $3.25/bu (December 2016). 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.
[4] 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.