

## Economics of Weed Control Programs in Corn, 2018

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A field trial in corn was conducted in 2018 at the MSU Agronomy Research Farm in East Lansing, MI to compare weed control, corn injury, corn yield, and economic returns of weed control programs marketed to Michigan growers. Herbicide companies were 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 2018. 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 29. Precipitation at this location is presented in Table 4. Within 14 days after planting and application of the preemergence herbicides the site received 1.56 inches of rain. Twenty-three of the 24 herbicide programs tested resulted in greater than 90% control of all weeds prior to harvest. Twenty of the 24 herbicide programs resulted in statistically similar yield. The maximum yield in this trial was 245 bu/A, and yield was 210 bu/A in the untreated (weedy control) treatment. Weed competition in this trial resulted in a yield loss of 36 bu/A (14%). Thirteen out of 24 herbicide programs resulted in statistically similar gross margins. The maximum gross margin in this trial was \$784.72/A, and the gross margin in the untreated weedy treatment was \$704.42/A. Weed competition in this trial resulting in an economic loss of \$80.30/A (10%). Table 3 contains the data for corn injury, weed control, herbicide program costs, corn yield, and economic returns.

Table 1. Site description and application details

Crop	Corn
Variety	P9840 AM
Row Spacing	30 inches
Soil Texture	Loam
Soil pH	6.2
Soil Organic Matter	3.7%
Dominant Weeds	ANGR, CHEAL, AMAPO, AMBEL, ABUTH
Planting Date	May 29
Application Timing:	
PRE	May 29
EPOS	June 21
POST	June 25
Evaluation Times	Corn injury- 10 d after POST Weed control prior to harvest (46 d after POST)

Abbreviations: ANGR = annual grasses, mainly foxtail species, CHEAL = common lambsquarters, AMAPO = Powell amaranth, AMBEL = common ragweed, ABUTH = velvetleaf

Table 2. Commercial corn herbicide programs evaluated in 2018.

Conventional	Treatments (Rate/A)	Abbreviated Form
PRE	Corvus (3.3 oz) + Harness Xtra (1.8 qt) Acuron (3 qt) Acuron Flexi (2.25 qt)	Corvus + HarnXtra Acuron Acuron Flexi
Roundup Ready		
EPOS	Armezon PRO (16 oz) + Roundup PowerMax (16 oz) + Atrazine (1.1 lb) + NIS (0.25%) + AMS (8.5 lb) Degree Xtra (2 qt) + Roundup PowerMax (32 oz) + AMS (8.5 lb) Capreno (3 oz) + Roundup PowerMax (22 oz) + AMS (8.5 lb) Anthem MAXX (2 oz) + Callisto (2.5 oz) + Atrazine (1.1 lb) + Roundup PowerMax (22 oz) + COC (1%) + AMS (8.5 lb) Warrant (3 pt) + Atrazine (0.55 lb) + Roundup PowerMax (22 oz) + AMS (8.5 lb) Harness Max (64 oz) + Atrazine (1.1 lb) + Roundup PowerMax (22 oz) + AMS (8.5 lb)	Armezon PRO + RupPM + Atra DegXtra + RupPM Capreno + RupPM AnthM + Call + Atra + RupPM Warrant + Atra + RupPM HarnMax + Atra + RupPM
PRE/POST	Zidua SC (3.2 oz) + Sharpen (2 oz) + Atrazine (1.1 lb) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb) Zidua SC (3.2 oz) + Atrazine (1.1 lb) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb) Zidua SC (3.2 oz) + Callisto (3 oz) + Atrazine (1.1 lb) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb) Verdict (10 oz) + Atrazine (1.1 lb) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb) Balance Flexx (4 oz) fb. DiFlexx Duo (24 oz) + Roundup PowerMax (22 oz) + AMS (8.5 lb) SureStart II (1.25 qt) + Keystone NXT (1.25 qt) fb. Durango DMA (32 oz) + AMS (8.5 lb) Resicore (2.25 qt) + Atrazine (1.1 lb) fb. Durango DMA (32 oz) + AMS (8.5 lb) Keystone NXT (2 qt) + Instigate (5.2 oz) fb. Durango DMA (32 oz) + AMS (8.5 lb) Keystone NXT (2 qt) fb. Realm Q (4 oz) + Durango DMA (32 oz) + AMS (8.5 lb) Anthem MAXX (4 oz) + Atrazine (1.1 lb) fb. Callisto (2.5 oz) + Atrazine (0.55 lb) + Roundup PowerMax (22 oz) + COC (1 %) + AMS (2.5%) Degree Xtra (2 qt) fb. Status (2 oz) + Roundup PowerMax (22 oz) + AMS (8.5 lb) TripleFLEX II (1 qt) + Degree Xtra (1.5 qt) fb. Roundup PowerMax (22 oz) + AMS (8.5 lb) Acuron (1.5 qt) fb. Halex GT (3.6 pt) + NIS (0.25%) + AMS (8.5 lb) Acuron (1.5 qt) fb. Acuron (1.5 qt) + Roundup PowerMax (26 oz) + AMS (8.5 lb) Bicep II Magnum (2.1 qt) fb. Halex GT (3.6 pt) + NIS (0.25%) + AMS (8.5 lb)	Zidua SC + Sharp + Atra fb. RupPM Zidua SC + Atra fb. RupPM Zidua SC + Call + Atra fb. RupPM Verdict + Atra fb. RupPM Bal Flexx fb. DiFlexx Duo + RupPM SureStart + Keystone fb. Durango Resicore + Atra fb. Durango Keystone + Instigate fb. Durango Keystone fb. Realm Q + Durango AnthM + Atra fb. Call + Atra + RupPM DegXtra fb. Status + RupPM TripleFLEX II + DegXtra fb. RupPM Acuron fb. Halex GT Acuron fb. Acuron + RupPM Bicep fb. Halex GT

Table 3. Corn injury, weed control, program costs, corn yield, and economic returns of 24 herbicide programs in 2018.

Programs	Herbicide Treatments <sup>5</sup>	Injury 10 DAP	Prior to harvest (46 d after POST)					All Weeds (≥ 90%)	Cost <sup>1</sup> (\$/A)	Yield (bu/A)	Economic Return <sup>2</sup> (\$/A)
			ANGR	CHEAL	AMAPO	AMBEL	ABUTH				
Conventional		(%)	%								
PRE	Corvus + HarnXtra	0	100	100	100	100	100	YES	54.76	238* <sup>3</sup>	742.29** <sup>4</sup>
	Acuron	0	99	100	100	100	100	YES	59.36	240*	743.80**
	Acuron Flexi	0	97	100	100	100	100	YES	55.10	240*	750.24**
Roundup Ready											
EPOS	Armezon PRO + RupPM + Atra	0	96	100	100	100	100	YES	35.12	243*	778.76**
	DegXtra + RupPM	0	100	99	100	97	99	YES	37.11	243*	776.94**
	Capreno + RupPM	0	100	75	100	100	100	NO	32.61	236*	758.07**
	AnthM + Call + Atra + RupPM	0	96	100	100	100	100	YES	35.44	245*	784.72**
	Warrant + Atra + RupPM	0	100	98	100	92	100	YES	40.55	240*	762.11**
	HarnMax + Atra + RupPM	0	100	100	100	100	100	YES	50.94	239*	751.22**
PRE/POST	Zidua SC + Sharp + Atra fb. RupPM	0	99	100	100	100	100	YES	55.57	238*	740.06**
	Zidua SC + Atra fb. RupPM	0	100	100	100	100	100	YES	43.47	230	725.36
	Zidua SC + Call + Atra fb. RupPM	0	100	100	100	100	100	YES	50.38	239*	748.60**
	Verdict + Atra fb. RupPM	0	100	100	100	100	100	YES	43.64	233*	738.33
	Bal Flexx fb. DiFlexx Duo + RupPM	0	99	100	100	100	100	YES	55.52	240*	748.90**
	SureStart + Keystone fb. Durango	0	100	100	100	100	100	YES	66.24	239*	735.67
	Resicore + Atra fb. Durango	0	100	100	100	100	100	YES	64.12	237*	731.42
	Keystone + Instigate fb. Durango	0	100	100	100	100	100	YES	48.57	226	707.61
	Keystone fb. Realm Q + Durango	0	100	100	100	100	100	YES	48.69	234*	733.54
	AnthM + Atra fb. Call + Atra + RupPM	0	99	100	100	100	100	YES	56.86	232*	720.76
	DegXtra fb. Status + RupPM	0	100	100	100	100	100	YES	43.59	234*	740.73**
	TripleFLEX II + DegXtra fb. RupPM	0	100	100	100	100	100	YES	57.46	232*	719.07
	Acuron fb. Halex GT	0	100	100	100	100	100	YES	69.08	228	693.88
	Acuron fb. Acuron + RupPM	0	100	100	100	100	100	YES	72.99	230	695.75
	Bicep fb. Halex GT	0	100	100	100	100	100	YES	64.76	236*	725.76
	Untreated	0	0	0	0	0	0	NO	-	210	704.42

Abbreviations: ANGR = annual grasses, mainly foxtail species, CHEAL = common lambsquarters, AMAPO = Powell amaranth, AMBEL = common ragweed, ABUTH = velvetleaf, fb. = followed by

<sup>1</sup>Herbicide costs = avg. of price lists; App. cost = \$7.50/A; seeding rate = 34,600 seeds/A. Weed control costs = Herbicide \$ + Additive \$ + Application \$

<sup>2</sup>Crop selling price = \$3.35/bu (December 2018). Economic return = (Yield x Price) – Weed Control Costs

<sup>3</sup>\*Not statistically different from the highest yielding

<sup>4</sup>\*\*Not statistically different from the highest gross margins

<sup>5</sup>Many herbicide programs have long rotation restrictions to more sensitive crops, i.e., sugar beet, alfalfa, potatoes, etc. Consult Table 12 in the MSU Weed Control Guide for Field Crops (E-434) or the herbicide label for crop rotation restrictions

Table 4. 2018 Precipitation at the MSU Horticulture Teaching and Research Center, East Lansing, MI near study location.

Date	April	May	June	July	August	September
	Inches					
1			0.07		0.12	0.32
2		0.01				0.74
3	0.43	0.43	0.19		0.03	0.36
4	0.02	0.12				
5			0.15			0.37
6	0.03				0.41	0.02
7					0.06	
8					2.4	
9	0.01	0.16	0.32			0.1
10	0.06					0.01
11		0.82				
12	0.12	0.62				
13	0.01	0.52		0.34		
14	0.89	0.09		0.02		0.01
15	0.63	0.45		0.06		
16	0.12		0.07	0.01	0.11	
17					0.01	
18	0.02	0.02	0.05			
19		0.36				
20		0.02	0.23	0.16		1.44
21		0.48		0.26	0.16	0.05
22		0.04	0.09	0.01		
23			0.01	0.01		
24	0.02			0.01		0.04
25	0.02				0.56	0.05
26						
27			0.26			
28					0.71	0.05
29					0.02	0.04
30		0.74				0.47
31		0.09	0.07	0.19		0.32
<b>Total</b>	<b>2.38</b>	<b>4.97</b>	<b>1.44</b>	<b>1.07</b>	<b>4.59</b>	<b>4.07</b>