

Economics of Weed Control Programs in Corn, 2019

Erin E. Burns

A field trial in corn was conducted in 2019 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 2019. 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 15th. Precipitation at this location is presented in Table 4. Within 14 days after planting and application of the preemergence herbicides the site received 1.3 inches of rain. Twenty-three of the 24 herbicide programs tested resulted in greater than 90% control of all weeds prior to harvest. Twenty-three of the 24 herbicide programs resulted in statistically similar yield. The maximum yield in this trial was 233 bu/A, and yield was 83 bu/A in the untreated (weedy control) treatment. Weed competition in this trial resulted in a yield loss of 150 bu/A (64%). Twenty out of the 24 herbicide programs resulted in statistically similar gross margins. The maximum gross margin in this trial was \$838.25/A, and the gross margin in the untreated weedy treatment was \$311.91/A. Weed competition in this trial resulted in an economic loss of \$526.34/A (63%). 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	DKC 48-56-RIB
Row Spacing	30 inches
Soil Texture	Sandy Loam
Soil pH	5.9
Soil Organic Matter	2.9%
Dominant Weeds	ANGR, CHEAL, AMAPO, AMBEL, ABUTH
Planting Date	May 15
Application Timing:	
PRE	May 15
EPOS	June 12
POST	June 23
Evaluation Times	Corn injury- 10 d after POST Weed control prior to harvest (34 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 2019.

Conventional	Treatments (Rate/A)	Abbreviated Form
PRE	Corvus (3.3 oz) + Harness Xtra (1.8 qt)	Corvus + HarnXtra
	Acuron (3 qt)	Acuron
Roundup Ready		
EPOS	Armezon PRO (16 oz) + Roundup PowerMax (16 oz) + Atrazine (1.1 lb) + NIS (0.25%) + AMS (8.5 lb)	Armezon PRO + RupPM + Atra
	Degree Xtra (2 qt) + Laudis (3 oz) + Roundup PowerMax (32 oz) + AMS (8.5 lb)	DegXtra + Laud + RupPM
	Capreno (3 oz) + Roundup PowerMax (22 oz) + Atrazine (1.1 lb) + AMS (8.5 lb)	Capreno + RupPM + Atra
	Anthem MAXX (4 oz) + Balance Flexx (3 oz) + Atrazine (2.2 lb) + Roundup PowerMax (22 oz) + AMS (8.5 lb)	AnthM + Bal Flexx + Atra + RupPM
	Warrant (3 pt) + Atrazine (0.55 lb) + Roundup PowerMax (22 oz) + AMS (8.5 lb)	Warrant + Atra + RupPM
	Harness Max (64 oz) + Atrazine (1.1 lb) + Roundup PowerMax (22 oz) + AMS (8.5 lb)	HarnMax + Atra + RupPM
	Halex GT (4 pt) + Atrazine (0.55 lb) + NIS (0.25%) + AMS (8.5 lb)	HalGT + Atra
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 + Sharp + Atra fb. RupPM
	Zidua SC (3.2 oz) + Atrazine (1.1 lb) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb)	Zidua SC + Atra fb. RupPM
	Verdict (12 oz) + Atrazine (1.1 lb) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb)	Verdict + Atra fb. RupPM
	Balance Flexx (4 oz) fb. DiFlexx Duo (24 oz) + Roundup PowerMax (22 oz) + AMS (8.5 lb)	Bal Flexx fb. DiFlexx Duo + RupPM
	SureStart II (3 pt) + Atrazine (1.65 lb) fb. Durango DMA (32 oz) + AMS (8.5 lb)	SureStart + Atra fb. Durango
	Resicore (1.25 qt) + Atrazine (1.1 lb) fb. Resicore (1.25 qt) + Durango DMA (32 oz) + AMS (8.5 lb)	Resi + Atra fb. Resi + Durango
	Resicore (2.5 qt) + Atrazine (1.1 lb) fb. Durango DMA (32 oz) + AMS (8.5 lb)	Resi + Atra fb. Durango
	Cinch ATZ (2.1 qt) fb. Realm Q (4 oz) + Atrazine (0.55 lb) + Durango DMA (32 oz) + AMS (8.5 lb)	Cinch fb. Realm Q + Durango
	Anthem MAXX (4 oz) + Balance Flexx (3 oz) + Atrazine (1.65 lb) fb. Status (4 oz) + Roundup PowerMax (22 oz) + AMS (8.5 lb)	AnthM + Bal Flexx + Atra fb. Stat + RupPM
	Degree Xtra (2 qt) fb. DiFlexx (8 oz) + Roundup PowerMax (22 oz) + AMS (8.5 lb)	DegXtra fb. DiFlexx + RupPM
	TripleFLEX II (1 qt) + Degree Xtra (1.5 qt) fb. Roundup PowerMax (22 oz) + AMS (8.5 lb)	TripleFLEX II + DegXtra fb. RupPM
	Acuron (1.5 qt) fb. Halex GT (3.6 pt) + Atrazine (0.55 lb) + NIS (0.25%) + AMS (8.5 lb)	Acuron fb. Halex GT + Atra
	Armezon PRO (16 oz) + Callisto (3 oz) + Atrazine (1.1 lb) fb. Roundup PowerMax (32 oz) + AMS (8.5 lb)	Armezon + Call + Atra fb. RupPM
	Bicep II Magnum (1.3 qt) fb. Halex GT (3.6 pt) + Atrazine (0.55 lb) + NIS (0.25%) + AMS (8.5 lb)	Bicep fb. Halex GT + Atra

Table 3. Corn injury, weed control, program costs, corn yield, and economic returns of 24 herbicide programs in 2019.

Programs	Herbicide Treatments ⁵	Injury 10 DAP	ANGR	CHEAL	AMAPO	AMBEL	ABUTH	All Weeds (≥ 90%)	Cost ¹ (\$/A)	Yield (bu/A)	Economic Return ² (\$/A)	
			Prior to harvest (46 d after POST)									% Control
Conventional		(%)	%									
PRE	Corvus + HarnXtra	0	95.8	100	100	99.5	100	YES	54.89	222.8* ³	780.52** ⁴	
	Acuron	0	100	100	100	100	100	YES	61.25	210.5*	727.94	
Roundup Ready												
EPOS	Armezon PRO + RupPM + Atra	0	95.3	99.5	100	100	99.5	YES	35.88	233.1*	838.25**	
	DegXtra + Laud + RupPM	0	99	100	100	100	100	YES	48.19	228.4*	808.31**	
	Capreno + RupPM + Atra	0	95.3	100	100	99.5	100	YES	35.77	217.3*	779.2**	
	AnthM + Bal Flexx + Atra + RupPM	0	100	100	100	100	100	YES	56.30	223.4*	781.45**	
	Warrant + Atra + RupPM	0	90	100	100	92.5	97.5	YES	27.77	219.3*	794.51**	
	HarnMax + Atra + RupPM	0	90.8	98.8	92.5	98.8	98.8	YES	50.70	221.8*	780.86**	
	HalGT + Atra		92	100	100	99.5	100	YES	40.06	226.7*	810.16**	
PRE/POST	Zidua SC + Sharp + Atra fb. RupPM	0	99	99.5	100	100	100	YES	56.10	217.3*	758.68**	
	Zidua SC + Atra fb. RupPM	0	99	98.8	100	99	99.5	YES	43.47	210.9*	747.04	
	Verdict + Atra fb. RupPM	0	96	99	97	99.5	99.5	YES	47.81	222.5*	786.47**	
	Bal Flexx fb. DiFlexx Duo + RupPM	0	95.8	100	100	100	100	YES	55.54	224.6*	786.52**	
	SureStart + Atra fb. Durango	0	90	100	100	99	100	YES	60.35	218.9*	760.53**	
	Resi + Atra fb. Resi + Durango	0	100	100	100	100	100	YES	75.78	224.1*	770.94**	
	Resi + Atra fb. Durango	0	97.3	100	100	100	100	YES	69.44	221.6*	761.75**	
	Cinch fb. Realm Q + Durango	0	100	100	100	100	100	YES	64.66	223.6*	774.03**	
	AnthM + Bal Flexx + Atra fb. Stat + RupPM	0	100	100	100	100	100	YES	63.95	228*	790.96**	
	DegXtra fb. DiFlexx + RupPM	0	99.5	100	100	100	100	YES	54.30	218.3*	764.14**	
	TripleFLEX II + DegXtra fb. RupPM	0	99.5	100	100	99.5	100	YES	56.76	219.7*	767.12**	
	Acuron fb. Halex GT + Atra	0	100	100	100	100	100	YES	71.83	227.3*	780.55**	
	Armezon + Call + Atra fb. RupPM	0	93.3	100	98.8	98.3	98.8	YES	55.84	210.4*	733.07	
	Bicep fb. Halex GT + Atra	0	100	100	100	99.5	99.5	YES	58.36	230.5*	806.2**	
Untreated		0	0	0	0	0	0	NO	0	83.2	311.91	

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

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

²Crop selling price = \$3.75/bu (December 2019). Economic return = (Yield x Price) – Weed Control Costs

³*Not statistically different from the highest yielding ⁴**Not statistically different from the highest gross margins ⁵Many 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. 2019 Precipitation at the MSU Hancock Turfgrass Research Center, East Lansing, MI near study location.

Date	April	May	June	July	August	September
	Inches					
1		0.33	0.87			0.11
2		0.02	0.04	0.59		
3				0.01		0.02
4				0.86		
5	0.07		0.58	0.09		
6		0.03			0.1	0.03
7	0.03	0.63				
8					0.04	
9		0.53	0.39	0.02		0.02
10			1.93	0.06		0.29
11	0.07					0.52
12	0.23			0.01		0.04
13			0.34			0.04
14	0.42			0.02		
15	0.06	0.08	0.01	0.02	0.02	0.1
16	0.08		0.5	0.11		
17	0.02				0.04	
18	0.32	0.41		0.02		
19	0.12	0.19	0.47	0.34		
20	0.05		1.16	0.01	0.25	
21	0.01			0.29		0.11
22		0.31				0.16
23	0.01	0.07		0.19		0.05
24		0.05	0.2			
25		0.02	0.12			
26		0.03			0.15	
27	0.13	0.07	0.09		0.13	0.32
28	0.04	0.07	0.04			0.46
29	0.63	0.14	0.05	0.3	0.27	0.71
30	0.3	0.09				0.02
31						
Total	2.59	3.07	6.79	2.94	1.00	3.00