

Long-term tillage by herbicide study in a transgenic corn and soybean rotation. Krausz, Ronald F. and Bryan G. Young. This study was designed to evaluate weed control and weed population shifts over a long period of time in transgenic crops. The study was conducted on an Ebbert silt loam with 1.5% organic matter and pH 6.7 at the Belleville Research Center beginning in 1998. The study has been in a corn/soybean rotation beginning with corn in 1998. Fertilizer applied in 2002 was 150, 50 and 150 lb/A N, P₂O₅ and K₂O, respectively, to an area that had been cropped to soybean in 2001. Pioneer brand '33P69LL' glufosinate-resistant field corn was planted 1.5 inch deep at 28 000 seed/A on June 2. Plots consisted of four rows with 30 inch row spacing, 27 ft long arranged in a split-plot design with 4 replications. Main plots were either no-till or tilled and sub-plots were herbicide treatment. The herbicides were broadcast applied with a CO₂ pressurized sprayer using 8003 flat fan tips at 40 PSI in 20 GPA water. Application timings were preemergence (PRE), 2 to 4 inch weeds POST only or following a PRE that did not include atrazine (2-4"W-1), 2 to 4 inch weeds following a PRE application that included atrazine (2-4"W-2) and 10 days after a 2-4"W-1 application (10DA2-4"). Monthly rainfall in inches in 2002 was 4.9, 6.6, 1.7, 3.7 and 3.6 in April, May, June, July and August, respectively. Weed population per 0.25 m² in the nontreated plots, at no-till burndown in 2002, was 11 little barley, 6 common ragweed, 1 giant foxtail, 1 yellow nutsedge, and 1 common cocklebur. Weed population per 0.25 m² in the nontreated plots, mid-season in 2002, was 8 common ragweed, 45 giant foxtail, 1 yellow nutsedge, and <1 common cocklebur, ivyleaf morningglory, velvetleaf and common waterhemp.

Application information is listed below.

Date	Jun-1-02	Jun-18-02	Jun-28-02	Jun-24-02
Treatment	PRE	2-4"W-1	10DA2-4"	2-4"W-2
Air temperature (F)	88	84	86	88
Relative humidity (%)	48	40	50	50
Soil moisture	normal	normal	normal	dry
field corn				
leaf no.		V3-V4	V6	V5-V6
height (inch)		6-8	18	12-16
barley, little				
leaf no.	1-3			
height (inch)	10-15			
common ragweed				
leaf no.	4-8			
height (inch)	2-6			
giant foxtail				
leaf no.	2-4	3-5	3-4	3-7
height (inch)	2-6	2-6	3-4	3-7
yellow nutsedge				
leaf no.		5-7		5-8
height (inch)		4-7		4-7
common cocklebur				
leaf no.	2-4	0-4		0-4
height (inch)	3-6	1-4		1-4
ivyleaf morningglory				
leaf no.		0-4	4-5	0-2
height (inch)		1-3	6-8	0-2

(continued)

(continued)

velvetleaf			
leaf no.	0-3	3-9	0-4
height (inch)	0-2	3-4	0-3
common waterhemp			
leaf no.	0-4	6-8	
height (inch)	0-2	6-8	

There was no difference in the control of weeds among the glyphosate formulations applied at planting. Tillage had an effect on weed control and weed species establishment. Common ragweed population was greatest in no-till. In the no-till nontreated plots, yellow nutsedge, common cocklebur, ivyleaf morningglory, velvetleaf, and common waterhemp control ranged from 94 to 100%. In the tilled nontreated plots, common ragweed control was 100% and yellow nutsedge, common cocklebur, ivyleaf morningglory, velvetleaf, and common waterhemp control was zero. In no-till, herbicide treatments controlled all weeds 85 to 100% regardless of application timing. In tilled plots, sequential applications of a broadleaf herbicide provided 94% or greater control of common cocklebur, ivyleaf morningglory, velvetleaf, and common waterhemp. Grain yield tended to be greater in no-till compared to tilled. The greater grain yields were related to moisture conservation in the no-till compared to tilled because of the abnormally hot, dry growing season. (Dept. of Plant, Soil and General Agriculture, Southern Illinois University, Carbondale).

Table 1. Long-term tillage by herbicide study in a transgenic corn and soybean rotation. (Krausz and Young)

Treatment ^a	Application		Corn yield bu/A	Corn injury days after treatment ^b			Corn height Sep 26 inch	Control					
								HORPU 10 da PRE	AMBEL				
	10 da PRE	Days after treatment											
		14 %		28 %	56 %	14 %			28 %	56 %			
	Rate (lb/A)	Time		14 %	28 %	56 %		PRE	PRE	14 %	28 %	56 %	
No-till													
Nontreated			10	0	50	50	71	100		0	0	0	0
Glyphosate(UM)+handweed	0.75	PRE	156	0	0	0	99	100		100	100	100	100
Glyphosate(UM)+s-metolachlor &atra&CGA-154281+atra	0.75+1.26 &1.62+0.4	PRE	180	0	0	0	106	100		100	100	100	100
Glyphosate(UM)+s-metolachlor &atra&CGA-154281+atra /glufosinate+AMS	0.75+1.26 &1.62+0.4 /0.27	PRE /2-4"W-2	186	0	0	0		100		100	100	100	100
Glyphosate(UM)+s-metolachlor &atra&CGA-154281+atra /nicosulfuron+COC	0.75+1.26 &1.62+0.4 /0.031	PRE /2-4"W-2	179	0	0	0	108	100		100	100	100	100
Glyphosate(UM)+s-metolachlor &CGA-154281 /glufosinate+AMS	0.75+1.27 /0.27	PRE /2-4"W-1	185	0	0	0	106	100		100	100	100	100
Glyphosate(UM) /glufosinate+AMS /glufosinate+AMS	0.75 /0.27 /0.27	PRE /2-4"W-1 /10DA2-4"	182	0	0	0	106	100		100	100	100	100
Glyphosate(TD) /glufosinate+AMS	0.75 /0.27	PRE /2-4"W-1	180	0	0	0	105	100		100	100	100	100
Glyphosate(UM) /glufosinate+atra+AMS	0.75 /0.27+0.75	PRE /2-4"W-1	186	0	0	0	105	100		100	100	100	100
Glyphosate(UM) /rimsulfuron&nicosulfuron &atra+COC	0.75 /0.012&0.012 &0.77	PRE /2-4"W-1	189	0	0	0	107	100		100	100	100	100
							108						
Tillage													
Nontreated			9	0	50	50	72			100	100	100	
Cultivation+handweed			169	0	0	0	94			100	100	100	
S-metolachlor&atra &CGA-154281+atra	1.26&1.62 +0.4	PRE	144	0	0	0	93			100	100	100	
S-metolachlor&atra &CGA-154281+atra /glufosinate+AMS	1.26&1.62 +0.4 /0.27	PRE /2-4"W-2	169	0	0	0	92			100	100	100	
S-metolachlor&atra &CGA-154281+atra /nicosulfuron+COC	1.26&1.62 +0.4 /0.031	PRE /2-4"W-2	177	0	0	0	92			100	100	100	
S-metolachlor&CGA-154281 /glufosinate+AMS	1.27 /0.27	PRE /2-4"W-1	158	0	0	0	97			100	100	100	
Glufosinate+AMS /glufosinate+AMS	0.27 /0.27	2-4"W-1 /10DA2-4"	180	0	0	0	93			100	100	100	
Glufosinate+AMS	0.27	2-4"W-1	181	0	0	0	92			100	100	100	
Glufosinate+atra+AMS	0.27+0.75	2-4"W-1	164	0	0	0	90			100	100	100	
Rimsulfuron&nicosulfuron &atra+COC	0.012&0.012 &0.77	2-4"W-1	162	0	0	0	92			100	100	100	
LSD			19	0	0	0	5	0		0	0	0	0
P			0.01	1.0	1.0	1.0	0.01	1.0		1.0	1.0	1.0	1.0

^aGlyphosate(UM) was Roundup UltraMax from Monsanto.

All AMS at 3.0 lb/A. AMS = spray grade ammonium sulfate.

All COC at 1.0% v/v. COC = Prime Oil crop oil concentrate, a petroleum based additive with 17% emulsifier from Agrilience.

Glyphosate(TD) was Touchdown from Syngenta.

Study conducted since 1998 on same area.

^bDays after treatment was after PRE for PRE only, after POST for PRE/POST, and after first POST for PRE/POST/POST or POST/POST.

Ratings at 14 days after PRE, 2-4"W-1 and 2-4"W-2 applications were on 6-15-02, 7-2-02, and 7-8-02, respectively.

Ratings at 28 days after PRE, 2-4"W-1 and 2-4"W-2 applications were on 6-29-02, 7-16-02, and 7-22-02, respectively.

Ratings at 56 days after PRE, 2-4"W-1 and 2-4"W-2 applications were on 7-27-02, 8-13-02, and 8-19-02, respectively.

Non-zero crop injury and weed control ratings in the nontreated plots reflect the effects of: competition among weeds, tillage, and/or dense matting of burned-down weeds.

Table 2. Long-term tillage by herbicide study in a transgenic corn and soybean rotation. (Krausz and Young)

Treatment ^a	Application		SETFA control				Control, days after treatment								
			Days after treatment ^b				CYPES			XANST			IPOHE		
	Rate	Time	10 da	14	28	56	14	28	56	14	28	56	14	28	56
	(lb/A)		%	%	%	%	%	%	%	%	%	%	%	%	%
No-till															
Nontreated			0	0	0	0	94	94	94	98	98	98	100	100	100
Glyphosate(UM)+handweed	0.75	PRE	100	100	100	100	100	100	100	100	100	100	100	100	100
Glyphosate(UM)+s-metolachlor & atrazine+CGA-154281+atrazine	0.75+1.26 & 1.62+0.4	PRE	100	100	93	93	97	97	97	100	99	99	100	100	100
Glyphosate(UM)+s-metolachlor & atrazine+CGA-154281+atrazine / glufosinate+AMS	0.75+1.26 & 1.62+0.4 / 0.27	PRE / 2-4"W-2	100	99	99	99	100	100	100	100	100	100	100	100	100
Glyphosate(UM)+s-metolachlor & atrazine+CGA-154281+atrazine / nicosulfuron+COC	0.75+1.26 & 1.62+0.4 / 0.031	PRE / 2-4"W-2	100	100	100	100	100	100	100	100	100	100	100	100	100
Glyphosate(UM)+s-metolachlor & CGA-154281 / glufosinate+AMS	0.75+1.27 / 0.27	PRE / 2-4"W-1	100	99	99	99	99	99	99	98	98	98	100	100	100
Glyphosate(UM) / glufosinate+AMS	0.75 / 0.27	PRE / 2-4"W-1	100	100	100	100	96	96	96	100	100	100	100	100	100
Glyphosate(UM) / glufosinate+AMS	0.75 / 0.27	PRE / 10DA2-4"	100	100	100	100	96	96	96	100	100	100	100	100	100
Glyphosate(TD) / glufosinate+AMS	0.75 / 0.27	PRE / 2-4"W-1	100	90	85	85	91	91	91	100	100	100	100	100	100
Glyphosate(UM) / glufosinate+atrazine+AMS	0.75 / 0.27+0.75	PRE / 2-4"W-1	100	94	93	93	95	95	95	100	100	100	100	100	100
Glyphosate(UM) / rimsulfuron & nicosulfuron & atrazine+COC	0.75 / 0.012 & 0.012 & 0.77	PRE / 2-4"W-1	100	98	96	96	99	99	99	100	100	100	100	100	100
Tillage															
Nontreated			0	0	0	0	0	0	0	0	0	0	0	0	0
Cultivation+handweed			100	100	100	100	100	100	100	100	100	100	100	100	100
S-metolachlor & atrazine+CGA-154281+atrazine	1.26 & 1.62 +0.4	PRE	96	91	91	91	93	91	91	84	64	64	98	98	98
S-metolachlor & atrazine+CGA-154281+atrazine / glufosinate+AMS	1.26 & 1.62 +0.4 / 0.27	PRE / 2-4"W-2	100	100	100	100	97	97	97	100	100	100	100	94	94
S-metolachlor & atrazine+CGA-154281+atrazine / nicosulfuron+COC	1.26 & 1.62 +0.4 / 0.031	PRE / 2-4"W-2	100	100	100	100	96	96	96	81	79	79	100	90	90
S-metolachlor & CGA-154281 / glufosinate+AMS	1.27 / 0.27	PRE / 2-4"W-1	100	99	99	99	100	100	100	83	80	80	100	100	100
Glufosinate+AMS	0.27 / 0.27	2-4"W-1 / 10DA2-4"	100	100	100	100	93	93	93	100	100	100	100	100	100
Glufosinate+AMS	0.27	2-4"W-1	90	88	88	88	88	85	85	86	84	84	100	100	100
Glufosinate+atrazine+AMS	0.27+0.75	2-4"W-1	97	94	94	94	88	86	86	96	96	96	100	100	100
Rimsulfuron & nicosulfuron & atrazine+COC	0.012 & 0.012 & 0.77	2-4"W-1	90	81	81	81	88	84	84	99	99	99	100	100	100
LSD			0	5	6	6	5	5	5	4	6	6	2	2	2
P			1.0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

^aGlyphosate(UM) was Roundup UltraMax from Monsanto.

All AMS at 3.0 lb/A. AMS = spray grade ammonium sulfate.

All COC at 1.0% v/v. COC = Prime Oil crop oil concentrate, a petroleum based additive with 17% emulsifier from Agrilience.

Glyphosate(TD) was Touchdown from Syngenta.

Study conducted since 1998 on same area.

^bDays after treatment was after PRE for PRE only, after POST for PRE/POST, and after first POST for PRE/POST/POST or POST/POST.

Ratings at 14 days after PRE, 2-4"W-1 and 2-4"W-2 applications were on 6-15-02, 7-2-02, and 7-8-02, respectively.

Ratings at 28 days after PRE, 2-4"W-1 and 2-4"W-2 applications were on 6-29-02, 7-16-02, and 7-22-02, respectively.

Ratings at 56 days after PRE, 2-4"W-1 and 2-4"W-2 applications were on 7-27-02, 8-13-02, and 8-19-02, respectively.

Non-zero crop injury and weed control ratings in the nontreated plots reflect the effects of: competition among weeds, tillage, and/or dense matting of burned-down weeds.

Table 3. Long-term tillage by herbicide study in a transgenic corn and soybean rotation. (Krausz and Young)

Treatment ^a	Application		Control, days after treatment ^b					
			ABUTH			AMATA		
	Rate (lb/A)	Time	14 %	28 %	56 %	14 %	28 %	56 %
No-till								
Nontreated			100	100	100	100	100	100
Glyphosate(UM)+handweed	0.75	PRE	100	100	100	100	100	100
Glyphosate(UM)+s-metolachlor &atra&CGA-154281+atra	0.75+1.26 &1.62+0.4	PRE	100	100	100	100	100	100
Glyphosate(UM)+s-metolachlor &atra&CGA-154281+atra /glufosinate+AMS	0.75+1.26 &1.62+0.4 /0.27	PRE /2-4"W-2	100	100	100	100	100	100
Glyphosate(UM)+s-metolachlor &atra&CGA-154281+atra /nicosulfuron+COC	0.75+1.26 &1.62+0.4 /0.031	PRE /2-4"W-2	100	100	100	100	100	100
Glyphosate(UM)+s-metolachlor &CGA-154281 /glufosinate+AMS	0.75+1.27 /0.27	PRE /2-4"W-1	100	100	100	100	100	100
Glyphosate(UM) /glufosinate+AMS	0.75 /0.27	PRE /2-4"W-1	100	100	100	100	100	100
Glyphosate(UM) /glufosinate+AMS	0.75 /0.27	PRE /10DA2-4"	100	100	100	95	95	95
Glyphosate(TD) /glufosinate+AMS	0.75 /0.27	PRE /2-4"W-1	100	100	100	100	100	100
Glyphosate(UM) /glufosinate+atra+AMS	0.75 /0.27+0.75	PRE /2-4"W-1	100	100	100	100	100	100
Glyphosate(UM) /rimsulfuron&nicosulfuron &atra+COC	0.75 /0.012&0.012 &0.77	PRE /2-4"W-1	100	100	100	100	100	100
Tillage								
Nontreated			0	0	0	0	0	0
Cultivation+handweed			100	100	100	100	100	100
S-metolachlor&atra &CGA-154281+atra	1.26&1.62 +0.4	PRE	98	98	98	100	100	100
S-metolachlor&atra &CGA-154281+atra /glufosinate+AMS	1.26&1.62 +0.4 /0.27	PRE /2-4"W-2	100	100	100	100	100	100
S-metolachlor&atra &CGA-154281+atra /nicosulfuron+COC	1.26&1.62 +0.4 /0.031	PRE /2-4"W-2	100	100	100	100	100	100
S-metolachlor&CGA-154281 /glufosinate+AMS	1.27 /0.27	PRE /2-4"W-1	97	97	97	100	100	100
Glufosinate+AMS	0.27	2-4"W-1	100	100	100	100	100	100
Glufosinate+AMS	0.27	/10DA2-4"	100	100	100	100	100	100
Glufosinate+AMS	0.27	2-4"W-1	98	98	98	100	100	100
Glufosinate+atra+AMS	0.27+0.75	2-4"W-1	100	100	100	100	100	100
Rimsulfuron&nicosulfuron &atra+COC	0.012&0.012 &0.77	2-4"W-1	98	98	98	90	89	89
LSD			3	3	3	3	4	4
P			0.01	0.01	0.01	0.01	0.01	0.01

^aGlyphosate(UM) was Roundup UltraMax from Monsanto.

All AMS at 3.0 lb/A. AMS = spray grade ammonium sulfate.

All COC at 1.0% v/v. COC = Prime Oil crop oil concentrate, a petroleum based additive with 17% emulsifier from Agrilience.

Glyphosate(TD) was Touchdown from Syngenta.

Study conducted since 1998 on same area.

^bDays after treatment was after PRE for PRE only, after POST for PRE/POST, and after first POST for PRE/POST/POST or POST/POST.

Ratings at 14 days after PRE, 2-4"W-1 and 2-4"W-2 applications were on 6-15-02, 7-2-02, and 7-8-02, respectively.

Ratings at 28 days after PRE, 2-4"W-1 and 2-4"W-2 applications were on 6-29-02, 7-16-02, and 7-22-02, respectively.

Ratings at 56 days after PRE, 2-4"W-1 and 2-4"W-2 applications were on 7-27-02, 8-13-02, and 8-19-02, respectively.

Non-zero crop injury and weed control ratings in the nontreated plots reflect the effects of: competition among weeds, tillage, and/or dense matting of burned-down weeds.