

Quackgrass suppression with preharvest applications of glyphosate, with and without tillage of alfalfa sod at Rosemount, MN 1997. Becker, Roger and D.W. Miller. The objective of this study was to evaluate quackgrass control and alfalfa regrowth in field corn planted to conventional tilled or no-till alfalfa stubble following glyphosate applications at various rates and preharvest intervals. The experimental site was a two year old alfalfa stand with light to heavy infestations of quackgrass. The soil was a Waukegon silt loam. The trial was established with three replications in a split-split plot randomized complete block design. Two tillage treatments (conventional or no-till) comprised main plots. Preharvest spray intervals of 14, 6, 3, or 1 day comprised the sub plots. Sub-sub plots consisted of glyphosate rates of 0, 0.5, 0.75, 1.0, or 2.0 lbs ae/A. All treatments were applied to a 10' by 25' plot with a tractor mounted plot sprayer delivering 20 gpa at 35 psi using 8002 flat fan nozzles. On June 5 at 8:00 am, the entire experimental area was chopped and the forage removed, leaving a 4-8 inch stubble. One half of each rep was plowed to an eight inch depth and tandem-disked to a suitable planting bed. On June 6, 'Dekalb DK493' corn was planted at a rate of 27,500 seeds/acre in 30 inch rows to the entire area following the tillage treatment. (Note: Reps II and II, overseeded at 14,000 seeds per acre due to poor seeding conditions) Ammonium nitrate was surface applied at a rate of 150 lbs/A N. Acetochlor at 2.2 lbs ai/A was applied preemergence to reduce interference from small seeded annual grasses and broadleaves. In addition, bentazon at 1.0 lb ai/A was applied postemergence to control annual broadleaves (mainly velvetleaf). Silage and grain yields were determined by harvesting a 10 foot row from within the plot. Crop, weed, and spray data at application are listed below.

Application Data

Date	May 22	May 30	June 2	June 4
Treatment	14 days prior to harvest	6 days prior to harvest	3 days prior to harvest	1 days prior to harvest
Time	6:45-7:05 pm	10:45-11:00 am	1:45-2:00 pm	6:45-7:00 am
Temperature (°F)				
air	65	62	78	58
soil(2 inch)	53	55	58	55
Soil moisture	very dry	moist	dry	dry
Wind (mph)	5-10 S	calm	3-8 SE	calm
Cloud cover (%)	90	30	clear	clear
Relative Humidity (%)	26	53	34	78
Rainfall				
Before application				
Week 1 (inch)	0.31	0.85	--	--
After application				
Week 1	0.85	--	--	--
Week 2	--	--	--	--
Alfalfa				
stage	veg	veg	veg -E.Bud	veg -E.Bud
height (inch)	7-13	13-22	15-23	15-23
Quackgrass				
stage	veg	veg	Stem elongation	Stem elongation
height (inch)	8-15	15-27	16-28	16-24

Table 1. Effect of glyphosate rate, timing of application, and tillage on quackgrass control in an alfalfa stand at Rosemount MN - 1997 (Becker and Miller).

Application Timing	Glyphosate Rate (lb ae/A)	Quagr Control					
		Tillage			No Tillage		
		6/23	7/30	9/3	6/23	7/30	7/17
							(%)
14 Days Before Removal	No Glyphosate	100	48	38	0	0	0
	0.5	100	58	51	25	32	20
	0.75	100	72	66	33	30	33
	1.0	100	77	84	79	43	70
	2.0	100	87	91	99	91	92
6 Days Before Removal	No Glyphosate	100	65	55	0	0	0
	0.5	100	85	80	81	50	56
	0.75	100	85	79	94	93	70
	1.0	100	88	91	96	98	92
	2.0	100	92	96	99	99	94
3 Days Before Removal	No Glyphosate	100	72	68	0	0	0
	0.5	100	85	91	88	68	55
	0.75	100	93	96	96	92	72
	1.0	100	92	94	98	96	82
	2.0	100	92	93	99	98	92
1 Day Before Removal	No Glyphosate	100	43	40	0	0	0
	0.5	100	73	60	68	35	17
	0.75	100	77	75	65	33	39
	1.0	100	82	87	82	48	51
	2.0	100	92	92	90	78	81

Table 1a. Significance of factors and interactions from ANOVA analysis for quackgrass control.

Factor / Interaction	Prob (F)		
	6/23	7/30	9/3
Tillage	.001	.014	.007
Timing	.001	.001	.001
Tillage x Timing	.001	.047	ns
Rate	.001	.001	.001
Tillage x Rate	.001	.001	.001
Timing x Rate	.001	.004	.009
<u>Tillage x Timing x Rate</u>	.001	.001	ns

ns = Prob (F) > 0.05
.001 = Prob (F) = or < 0.001

Table 1b. LSD values for various mean comparisons (quackgrass control).

Comparison	LSD (0.05)		
	6/23	7/30	9/3
Tillage means	2.7	12.3	9.6
Timing	3.3	7.9	8.1
Timing for same Tillage	4.6	11.1	11.5
Timing for different Tillage	4.6	14.8	13.5
Rate	3.4	6.6	6.6
Rate for same Tillage	4.8	9.3	9.4
Rate for same Timing	6.8	13.1	13.2
Timing for same or different Rate	6.9	14.1	14.3
Tillage for same or different Rate	4.9	13.8	11.9
Rate for same Tillage and Timing	9.6	18.6	18.7
Timing for same Tillage and same or different Rate	9.7	20.0	20.3
<u>Tillage for same or different Timing and Rate</u>	9.7	21.9	21.1

Table 1c. Factorial means for quackgrass control.

			6/23	7/30	9/3		
Main plot	Tillage		100	78	76		
	No Tillage		65	54	51		
Sub plot	14 DBR		74	54	55		
	6 DBR		87	75	71		
	3 DBR		88	79	74		
	1 DBR		81	56	54		
Sub-sub plot	No glyphosate		50	28	25		
	0.5 lb ae/A		83	61	54		
	0.75 lb ae/A		86	72	66		
	1.0 lb ae/A		94	78	82		
	2.0 lb ae/A		98	91	91		
Main plot X	Tillage	14 DBR	100	68	66		
		6 DBR	100	83	80		
Sub plot	Tillage	3 DBR	100	87	88		
		1 DBR	100	73	71		
	No Tillage	14 DBR	47	39	43		
		6 DBR	74	68	62		
		3 DBR	76	71	60		
		1 DBR	61	39	38		
		Main plot X	Tillage	No glyphosate	100	57	50
				0.5 lb ae/A	100	75	71
Sub-sub plot	Tillage	0.75 lb ae/A	100	82	79		
		1.0 lb ae/A	100	85	89		
		2.0 lb ae/A	100	91	93		
		No Tillage	No glyphosate	0	0	0	
			0.5 lb ae/A	65	46	37	
	0.75 lb ae/A		72	62	54		
	1.0 lb ae/A		89	71	74		
	2.0 lb ae/A		97	92	90		
	Sub plot X	14 DBR	No glyphosate	50	24	19	
			0.5 lb ae/A	63	45	36	
0.75 lb ae/A			66	51	50		
1.0 lb ae/A			90	60	77		
2.0 lb ae/A			99	89	91		
6 DBR		No glyphosate	50	33	28		
		0.5 lb ae/A	90	68	68		
		0.75 lb ae/A	97	89	75		
		1.0 lb ae/A	98	93	92		
		2.0 lb ae/A	99	96	95		
3 DBR		No glyphosate	50	36	34		
		0.5 lb ae/A	94	77	73		
		0.75 lb ae/A	98	92	84		
		1.0 lb ae/A	99	94	88		
		2.0 lb ae/A	99	95	92		
1 DBR		No glyphosate	50	21	20		
		0.5 lb ae/A	84	54	38		
		0.75 lb ae/A	82	55	57		
		1.0 lb ae/A	91	65	69		
		2.0 lb ae/A	95	85	86		

Table 2. Effect of glyphosate rate, timing of application, and tillage on alfalfa control in an alfalfa stand at Rosemount MN - 1997 (Becker and Miller).

Application Timing	Glyphosate Rate (lb ae/A)	Alfalfa Control					
		Tillage			No Tillage		
		6/23	7/30	9/3	6/23	7/30	7/17
		----- (%) -----					
14 Days Before Removal	No Glyphosate	100	93	100	0	0	0
	0.5	100	97	100	27	42	27
	0.75	100	99	100	43	58	48
	1.0	100	100	100	75	53	73
	2.0	100	100	100	96	82	91
6 Days Before Removal	No Glyphosate	100	92	100	0	0	0
	0.5	100	98	100	78	45	55
	0.75	100	99	100	87	58	67
	1.0	100	100	100	90	75	83
	2.0	100	98	100	95	84	90
3 Days Before Removal	No Glyphosate	100	97	100	0	0	0
	0.5	100	95	100	83	56	46
	0.75	100	100	100	87	54	65
	1.0	100	98	100	87	73	70
	2.0	100	100	100	95	85	90
1 Day Before Removal	No Glyphosate	100	93	100	0	0	0
	0.5	100	98	100	68	36	30
	0.75	100	100	100	70	32	46
	1.0	100	100	100	86	48	50
	2.0	100	99	100	87	62	78

Table 2a. Significance of factors and interactions from ANOVA analysis for alfalfa control.

Factor / Interaction	Prob (F)		
	6/23	7/30	9/3
Tillage	.002	.004	.005
Timing	.001	.004	ns
Tillage x Timing	.001	.003	ns
Rate	.001	.001	.001
Tillage x Rate	.001	.001	.001
Timing x Rate	.001	ns	ns
<u>Tillage x Timing x Rate</u>	.001	ns	ns

ns = Prob (F) > 0.05
.001 = Prob (F) = or < 0.001

Table 2b. LSD values for various mean comparisons (alfalfa control).

Comparison	LSD (0.05)		
	6/23	7/30	9/3
Tillage means	7.6	14.7	15.5
Timing	3.4	4.5	6.5
Timing for same Tillage	4.8	6.3	9.2
Timing for different Tillage	8.2	15.1	16.5
Rate	3.4	6.5	4.2
Rate for same Tillage	4.8	9.2	5.9
Rate for same Timing	6.8	13	8.3
Timing for same or different Rate	7.0	12.4	9.9
Tillage for same or different Rate	8.2	15.7	15.6
Rate for same Tillage and Timing	9.6	18.4	11.8
Timing for same Tillage and same or different Rate	9.9	17.6	14.0
<u>Tillage for same or different Timing and Rate</u>	11.7	21.5	19.1

Table 2c. Factorial means for alfalfa control.

			6/23	7/30	9/3		
Main plot	Tillage		100	98	100		
	No Tillage		63	47	50		
Sub plot	14 DBR		74	72	74		
	6 DBR		85	75	79		
	3 DBR		85	76	77		
	1 DBR		81	67	70		
Sub-sub plot	No glyphosate		50	47	50		
	0.5 lb ae/A		82	71	70		
	0.75 lb ae/A		86	75	78		
	1.0 lb ae/A		92	81	85		
	2.0 lb ae/A		97	89	94		
Main plot X	Tillage	14 DBR	100	98	100		
		6 DBR	100	98	100		
Sub plot	Tillage	3 DBR	100	98	100		
		1 DBR	100	98	100		
		14 DBR	48	47	48		
		6 DBR	70	52	59		
	No Tillage	3 DBR	70	54	54		
		1 DBR	62	36	41		
		Main plot X	Tillage	No glyphosate	100	94	100
				0.5 lb ae/A	100	97	100
Sub-sub plot	Tillage	0.75 lb ae/A	100	99	100		
		1.0 lb ae/A	100	100	100		
		2.0 lb ae/A	100	99	100		
		No Tillage	No glyphosate	0	0	0	
			0.5 lb ae/A	64	45	39	
	0.75 lb ae/A		72	51	56		
	1.0 lb ae/A		84	62	69		
	2.0 lb ae/A	93	78	87			
Sub plot X	14 DBR	No glyphosate	50	47	50		
		0.5 lb ae/A	63	69	63		
Sub-sub plot	14 DBR	0.75 lb ae/A	72	79	74		
		1.0 lb ae/A	88	77	87		
		2.0 lb ae/A	98	91	96		
		6 DBR	No glyphosate	50	46	50	
			0.5 lb ae/A	89	72	78	
	0.75 lb ae/A		94	78	83		
	1.0 lb ae/A		95	88	91		
	2.0 lb ae/A		98	91	95		
	3 DBR	No glyphosate	50	48	50		
		0.5 lb ae/A	92	76	73		
		0.75 lb ae/A	94	77	83		
		1.0 lb ae/A	93	86	85		
		2.0 lb ae/A	97	92	95		
	1 DBR	No glyphosate	50	46	50		
		0.5 lb ae/A	84	67	65		
		0.75 lb ae/A	85	66	73		
		1.0 lb ae/A	93	74	75		
		2.0 lb ae/A	94	80	89		

Table 3. Effect of glyphosate rate, timing of application, and tillage on corn stand and grain yield in an alfalfa stand at Rosemount MN - 1997 (Becker and Miller).

Application Timing	Glyphosate Rate (lb ae/A)	Corn Stand		Grain Yield	
		Tillage --- (#/10 ft of row) ---	No Tillage	Tillage ----- (Bu/A) -----	No Tillage
14 Days Before Removal	No Glyphosate	15	14	143	96
	0.5	13	13	136	109
	0.75	16	12	158	131
	1.0	11	13	129	153
	2.0	14	14	134	157
6 Days Before Removal	No Glyphosate	15	11	147	81
	0.5	15	13	145	157
	0.75	15	16	151	165
	1.0	14	11	148	146
	2.0	16	15	150	166
3 Days Before Removal	No Glyphosate	14	9	144	53
	0.5	15	14	150	128
	0.75	16	14	154	141
	1.0	16	15	143	166
	2.0	15	15	156	137
1 Day Before Removal	No Glyphosate	13	14	129	100
	0.5	15	15	144	123
	0.75	14	13	130	131
	1.0	15	16	141	173
	2.0	16	14	134	139

Table 3a. Significance of factors and interactions from ANOVA analysis for stand and grain yield .

Factor / Interaction	Prob (F)	
	Stand	Grain Yield
Tillage	.036	ns
Timing	ns	ns
Tillage x Timing	ns	ns
Rate	ns	.001
Tillage x Rate	ns	.001
Timing x Rate	ns	ns
<u>Tillage x Timing x Rate</u>	<u>ns</u>	<u>ns</u>

ns = Prob (F) > 0.05
.001 = Prob (F) = or < 0.001

Table 3b. LSD values for various mean comparisons (stand and grain yield).

Comparison	LSD (0.05)	
	Stand	Grain Yield
Tillage means	.09	59.9
Timing	2.1	24.2
Timing for same Tillage	3.0	34.3
Timing for different Tillage	2.7	63.6
Rate	1.3	12.8
Rate for same Tillage	1.9	18.2
Rate for same Timing	2.6	25.7
Timing for same or different Rate	3.2	33.4
Tillage for same or different Rate	1.8	59.9
Rate for same Tillage and Timing	3.7	36.3
Timing for same Tillage and same or different Rate	4.5	47.2
<u>Tillage for same or different Timing and Rate</u>	<u>4.3</u>	<u>69.6</u>

Table 3c. Factorial means for corn stand and grain yield.

		Corn Stand		Grain Yield		
Main plot	Tillage		15	143		
	No Tillage		13	133		
Sub plot	14 DBR		13	135		
	6 DBR		14	146		
	3 DBR		14	137		
	1 DBR		14	134		
Sub-sub plot	No glyphosate		13	112		
	0.5 lb ae/A		14	137		
	0.75 lb ae/A		14	145		
	1.0 lb ae/A		14	150		
	2.0 lb ae/A		15	147		
Main plot X	Tillage	14 DBR	14	140		
		6 DBR	15	148		
Sub plot	Tillage	3 DBR	15	149		
		1 DBR	14	136		
		No Tillage	14 DBR	13	129	
		6 DBR	13	143		
	No Tillage	3 DBR	13	125		
		1 DBR	14	133		
		Main plot X	Tillage	No glyphosate	14	141
				0.5 lb ae/A	14	144
Sub-sub plot	Tillage	0.75 lb ae/A	15	148		
		1.0 lb ae/A	14	140		
		2.0 lb ae/A	15	144		
		No Tillage	No glyphosate	12	83	
			0.5 lb ae/A	13	129	
	0.75 lb ae/A		13	142		
	1.0 lb ae/A		14	159		
	2.0 lb ae/A		15	150		
	Sub plot X	14 DBR	No glyphosate	14	120	
			0.5 lb ae/A	13	123	
Sub-sub plot	14 DBR	0.75 lb ae/A	14	145		
		1.0 lb ae/A	12	141		
		2.0 lb ae/A	14	146		
		6 DBR	No glyphosate	13	114	
			0.5 lb ae/A	14	151	
	0.75 lb ae/A		15	158		
	1.0 lb ae/A		12	147		
	2.0 lb ae/A		15	158		
	3 DBR	No glyphosate	12	99		
		0.5 lb ae/A	14	139		
		0.75 lb ae/A	14	147		
		1.0 lb ae/A	15	154		
		2.0 lb ae/A	15	146		
	1 DBR	No glyphosate	14	115		
		0.5 lb ae/A	15	134		
		0.75 lb ae/A	13	131		
		1.0 lb ae/A	15	157		
		2.0 lb ae/A	15	137		

Table 4. Effect of glyphosate rate, timing of application, and tillage on silage moisture and yield in an alfalfa stand at Rosemount MN - 1997 (Becker and Miller).

Application Timing	Glyphosate Rate (lb ae/A)	Silage Moisture (10/28)		Silage Yield (10/28)	
		Tillage	No Tillage	Tillage	No Tillage
		----- (%) -----		----- (Ton/A) -----	
14 Days Before Removal	No Glyphosate	66	62	10.3	7.3
	0.5	59	61	9.8	7.5
	0.75	53	60	11.5	9.9
	1.0	59	56	9.5	10.7
	2.0	63	56	9.6	11.5
6 Days Before Removal	No Glyphosate	61	66	10.9	6.2
	0.5	58	57	11.0	12.7
	0.75	61	63	11.0	11.7
	1.0	63	61	10.6	10.6
	2.0	58	56	11.3	11.7
3 Days Before Removal	No Glyphosate	60	63	10.8	4.1
	0.5	59	60	10.2	9.8
	0.75	57	60	11.6	10.3
	1.0	60	62	10.1	12.0
	2.0	59	62	11.1	10.3
1 Day Before Removal	No Glyphosate	61	58	9.3	8.4
	0.5	58	63	10.6	9.1
	0.75	57	61	9.3	9.9
	1.0	57	59	9.8	12.7
	2.0	59	62	9.7	10.5

Table 4a. Significance of factors and interactions from ANOVA analysis for silage moisture and yield.

Factor / Interaction	Prob (F)	
	Moisture	Silage Yield
Tillage	ns	ns
Timing	ns	ns
Tillage x Timing	ns	ns
Rate	ns	.001
Tillage x Rate	ns	.001
Timing x Rate	ns	ns
Tillage x Timing x Rate	ns	ns

ns = Prob (F) > 0.05
.001 = Prob (F) = or < 0.001

Table 4b. LSD values for various mean comparisons (silage moisture and yield).

Comparison	LSD (0.05)	
	Moisture	Silage Yield
Tillage means	10.8	3.70
Timing	2.4	1.54
Timing for same Tillage	3.4	2.18
Timing for different Tillage	10.9	3.94
Rate	2.3	0.89
Rate for same Tillage	3.3	1.26
Rate for same Timing	4.7	1.78
Timing for same or different Rate	4.8	2.21
Tillage for same or different Rate	10.8	3.71
Rate for same Tillage and Timing	6.6	2.52
Timing for same Tillage and same or different Rate	6.8	3.13
Tillage for same or different Timing and Rate	11.8	4.42

Table 4c. Factorial means for silage moisture and silage yield.

		Silage Moisture		Silage Yield
Main plot	Tillage		59	10.4
	No Tillage		60	9.8
Sub plot	14 DBR		60	9.8
	6 DBR		60	10.8
	3 DBR		60	10.0
	1 DBR		59	9.9
Sub-sub plot	No glyphosate		62	8.4
	0.5 lb ae/A		59	10.1
	0.75 lb ae/A		59	10.6
	1.0 lb ae/A		60	10.7
	2.0 lb ae/A		59	10.7
Main plot X	Tillage	14 DBR	60	10.1
		6 DBR	60	11.0
Sub plot	Tillage	3 DBR	59	10.8
		1 DBR	58	9.7
		No Tillage		
		14 DBR	59	9.4
	No Tillage	6 DBR	60	10.6
		3 DBR	61	9.3
		1 DBR	61	10.1
Main plot X	Tillage	No glyphosate	62	10.3
		0.5 lb ae/A	59	10.4
Sub-sub plot	Tillage	0.75 lb ae/A	57	10.8
		1.0 lb ae/A	60	10.0
		2.0 lb ae/A	60	10.4
		No Tillage		
		No glyphosate	62	6.5
	No Tillage	0.5 lb ae/A	60	9.8
		0.75 lb ae/A	61	10.4
		1.0 lb ae/A	59	11.5
		2.0 lb ae/A	59	11.0
Sub plot X	14 DBR	No glyphosate	64	8.8
		0.5 lb ae/A	60	8.7
Sub-sub plot	14 DBR	0.75 lb ae/A	57	10.7
		1.0 lb ae/A	58	10.1
		2.0 lb ae/A	59	10.6
		No glyphosate	63	8.5
		0.5 lb ae/A	57	11.8
	6 DBR	0.75 lb ae/A	62	11.3
		1.0 lb ae/A	62	10.6
		2.0 lb ae/A	57	11.5
		No glyphosate	61	7.5
		0.5 lb ae/A	60	10.0
	3 DBR	0.75 lb ae/A	59	10.9
		1.0 lb ae/A	61	11.0
		2.0 lb ae/A	61	10.7
		No glyphosate	59	8.8
		0.5 lb ae/A	61	9.8
	1 DBR	0.75 lb ae/A	59	9.6
		1.0 lb ae/A	58	11.2
		2.0 lb ae/A	60	10.1
		No glyphosate		