Corn response to soil residues of grass herbicides. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'DKC 35-51' corn was seeded at Prosper, North Dakota on June 5. Preplant dates and climate conditions were as follows:

Application timing	10 DBP	5 DBP	0 DBP
Date	May 27	Jun 2	Jun 5
Temperature, ° F	69	65	81
Relative humidity, %	45	35	24
Sky	Overcast	Overcast	15% cloudcover
Wind velocity	9 to 13	3	2
Soil temperature, ° F	-	59	56

Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. The study area was oversprayed with glyphosate twice to minimize weed competition effect on yield.

Rating Date			Jun 20	Jul 2	
Treatment	Rate	Application	Corn	Corn	Yield
	oz/A		%		bu/A
Quizalofop	0.54	10 DBP	0	0	126
Quizalofop	0.77	10 DBP	0	0	130
Quizalofop	1.54	10 DBP	0	0	121
Fluazifop-P	3	10 DBP	0	0	121
Sethoxydim	9	10 DBP	81	71	111
Clethodim	8	10 DBP	90	89	55
Quizalofop	0.54	5 DBP	0	0	111
Quizalofop	0.77	5 DBP	0	0	125
Quizalofop	1.54	5 DBP	0	0	140
Fluazifop-P	3	5 DBP	0	0	145
Sethoxydim	9	5 DBP	85	74	103
Clethodim	8	5 DBP	94	92	44
Quizalofop	0.54	0 DBP	0	0	137
Quizalofop	0.77	0 DBP	0	0	138
Quizalofop	1.54	0 DBP	0	0	127
Fluazifop-P	3	0 DBP	0	0	119
Sethoxydim	9	0 DBP	92	87	64
Clethodim	8	0 DBP	97	98	18
Untreated	0		0	0	128
LSD (P=0.05)			3	5	32
CV			8	12	21

Herbicide rates tested crop response to three to four times registered use rate for controlling a failed corn crop before reseeding to corn. A rain event occurred shortly after seeding that was sufficient to promote rapid germination and emergence, which also would have adequately incorporated all herbicides. Quizalofop and fluazifop-P did not cause noticeable crop response even when applied the day of seeding. These two herbicides would be the safest choices for killing grasses prior to seeding corn according to this research. Sethoxydim and clethodim caused significant injury even when applied 10 DBP. Injury increased when applications were made fewer days before planting, and clethodim caused more injury than sethoxydim for each application timing. Injury resulted in as much as 85% yield loss for corn seeded in plots treated with clethodim. Corn recovery from herbicide injury was surprising. Yield of corn that showed less than 80% injury on July 2 was not different from the untreated, although a strong trend towards lower yield was evident.

KIH-485 in corn. Zollinger, Richard K. and Jerry L. Ries. Experiments were conducted to evaluate corn response and weed control of an experimental soil applied herbicide and to compare activity with other soil-applied herbicides and herbicide combinations. At Valley City, Croplan '184 RR' corn was planted on May 20, 2003. PRE treatments were applied May 21 at 11:30 am with 57 F air, 54 F soil at a four inch depth, 45% relative humidity, 100% clouds, 10 to 15 mph S wind, dry soil surface, moist subsoil, and no dew present. POST treatments were applied on July 2 at 2:30 pm with 90 F air, 93 F soil surface, 48% relative humidity, 0% clouds, 8 to 13 mph SE wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to V6 to V7 corn. Weed species present were: 3 to 6 inch (1 to 15/ft^2) foxtail species (50% yellow and 50% green).

At Carrington, ND, Dekalb 'DKC32-59' corn was planted on May 13, 2003. PRE treatments were applied on May 15 at 11:30 am with 65 F air, 51 F subsoil at a four inch depth, 44% relative humidity, 0% clouds, 10 mph SW wind, damp soil surface, and moist subsoil. POST treatments were applied June 19 at 12:00 pm with 76 F air, 87 F soil surface, 25% relative humidity, 0% clouds, 7 to 12 mph S wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V4 to V5 corn. Weed species present were: 1 to 4 inch (50 to 80/ft^2) green and yellow foxtail; 6 to 12 inch (1 to 2/yd^2) wild mustard; 1 to 3 inch (10 to 20/ft^2) prostrate pigweed; 1 to 3 inch (1 to 5/ft^2) redroot pigweed; 1 to 3 inch (1 to 5/ft^2) common lambsquarters; 2 to 6 inch (5 to 10/ft^2) kochia; 2 to 4 inch (1 to2/ft^2) wild buckwheat.

At Casselton, Dekalb 'DKC32-59' corn was planted on June 2, 2003. PRE treatments were applied immediately after planting at 12:45 pm with 70 F air, 61 F subsoil at a four inch depth, 47% relative humidity, 100% clouds, 2 to 3 mph S wind, dry soil surface, moist subsoil, and no dew present. POST treatments were applied on July 2 at 11:30 a.m. with 85 F air, 93 F soil surface, 60% relative humidity, 10% clouds, 5 to 10 mph S wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V6 to V8 corn. Weed species present were: 2 to 8 inch (5 to 20/yd^2) common cocklebur.

PRE treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. POST treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot spryaer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

KIH-485 has been reported to have weed control properties similar to dinitroanilines and chloroacetamides. The objectives were to evaluate KIH-485 in course (Valley City), medium (Carrington), and fine textured (Casselton) soils and to compare weed control with Dual II Magnum at a respective rate range based on soil type. At Valley City, which had a course textured soil and minimal rainfall within the first 3 weeks after application, KIH-485 gave weed control similar to Dual II Magnum at respective rates except KIH-485 gave greater wild buckwheat control. Both herbicides gave greater than 91% foxtail control at the two highest rates. Corn injury was not visible with any treatment.

At Carrington, which had a medium textured soil and adequate rainfall after application, green and yellow foxtail were present in a 50:50 ratio and pigweed species were redroot pigweed and prostrate pigweed in a 50:50 ratio. On July 4 (30 DAT), KIH-485 and Dual II Magnum gave similar foxtail and pigweed control at all respective rates except KIH-485 at the lowest rate of 0.25 pt/A gave less weed control. KIH-485 gave greater control of common lambsquarters, kochia, and wild buckwheat than Dual II Magnum and control was 88% to 99% except at the lowest rate. Ample rainfall activated the herbicides after application. All PRE treatments containing atrazine and PRE/POST treatments gave 96% to 99% weed control. Corn injury was not visible with any treatment.

Casselton had a fine textured soil with organic matter greater than 7%, herbicides were activated by adequate rainfall after application. KIH-485 gave less foxtail control than Dual II Magnum at respective rates except control was similar at the highest rates. KIH-485 gave wild mustard, redroot pigweed, and common lambsquarters control similar to Dual II Magnum at respective rates. Neither herbicide controlled common cocklebur. All PRE treatments containing atrazine and PRE/POST treatments gave 99% weed control, except for common cocklebur. Corn injury was not visible with any treatment. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table 1. KIH-485 in corn, Valley City (Zollinger and Ries).

Treatment[1]	Rate	June 11			June 25				July 9			
		Fxtl	Prpw	Wibw	Fxtl	Prpw	Wibw	Ebns	Fxtl	Prpw	Wibw	Ebns
	(product/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
PRE												
KIH-485	0.25pt	82	95	0	72	95	0	93	75	95	50	99
KIH-485	0.33pt	88	99	30	85	95	60	95	91	96	60	99
KIH-485	0.5pt	88	99	20	85	96	60	97	92	96	67	99
KIH-485	0.6pt	95	99	35	93	96	70	95	94	99	75	99
Dual II Magnum	1pt	72	99	33	72	94	50	96	82	98	48	99
Dual II Magnum	1.33pt	82	99	20	83	85	50	87	83	95	48	94
Dual II Magnum	2pt	87	99	30	93	98	57	96	91	96	52	95
Dual II Magnum	4pt	95	99	20	96	99	50	99	96	96	57	99
KIH-485+atrazine	0.27pt+0.83lb	90	95	97	83	78	50	80	90	72	47	82
Bicep Lite II Magnum	1.1qt	87	96	95	83	70	53	87	78	70	68	80
Surpass	2pt	92	99	43	85	93	20	95	72	94	0	94
Outlook	17fl oz	85	95	10	88	95	23	95	92	96	23	94
Lumax	4pt	93	99	60	93	99	99	99	90	99	99	99
Lumax	5pt	96	99	99	93	99	99	99	89	99	99	99
PRE/POST												
Oulook/Distinct+Basic Blend	17fl oz/4oz	88	99	0	88	99	50	95	91	95	45	96
Dual II Magnum/Callisto+PO+28-0-0	1.33pt/3fl oz	87	99	30	83	93	70	99	87	96	72	99
Untreated		0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		6	3	13	4	7	4	5	7	5	12	3

[1]KIH-485 = a proprietary herbicide from Kumiai America; Acetochlor = Surpass 6.4EC; Basic Blend = Quad 7 at 1% v/v; PO = petroleum oil = Herbimax at 1% v/v; 28-0-0 = urea ammonia nitrate at 2.5% v/v.

Table 2. KIH-485 in corn, Carrington (Zollinger and Ries).

Treatment[1]	Rate	June 20					July 4				
		Fxtl	Pigweed	Colq	Kochia	Wibw	Fxtl	Pigweed	Colq	Kochia	Wibw
	(product/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
PRE											
KIH-485	0.25pt	53	60	83	0	0	47	37	30	30	30
KIH-485	0.42pt	98	99	99	95	92	96	99	99	95	88
KIH-485	0.5pt	99	99	99	98	98	99	98	99	99	96
KIH-485	1pt	99	99	99	99	99	99	99	98	99	99
Dual II Magnum	1pt	80	86	63	7	7	78	73	40	20	0
Dual II Magnum	1.67pt	93	93	68	23	23	95	99	40	20	0
Dual II Magnum	2pt	95	99	95	43	53	95	98	83	40	30
Dual II Magnum	4pt	99	98	99	57	68	99	90	88	50	50
KIH-485+atrazine	0.33pt+1.13lb	99	99	99	99	99	97	99	99	99	99
Bicep Lite II Magnum	1.5qt	99	99	99	99	99	98	99	99	99	99
Surpass	2.5pt	98	99	99	47	47	95	99	99	17	10
Outlook	19fl oz	96	99	93	30	30	99	99	99	53	27
Lumax	5pt	99	99	99	99	99	99	99	99	99	99
Lumax	6pt	99	99	99	99	99	99	99	99	99	99
PRE/POST											
Oulook/Distinct+Basic Blend	19fl oz/4oz	96	99	99	30	30	99	99	99	99	99
Dual II Magnum/Callisto+PO+28-0-0	1.67pt/3fl oz	93	99	63	37	37	99	99	99	96	99
Untreated		0	0	0	0	0	0	0	0	0	0
LSD (0.05)		5	6	7	9	9	3	6	8	14	8

[1]KIH-485 = a proprietary herbicide from Kumiai America; Acetochlor = Surpass 6.4EC; Basic Blend = Quad 7 at 1% v/v; PO = petroleum oil = Herbimax at 1% v/v; 28-0-0 = urea ammonia nitrate at 2.5% v/v.

Table 3. KIH-485 in corn, Casselton (Zollinger and Ries).

Treatment[1]	Rate	June 23					July 7					July 21				
		Yeft	Wimu	Rrpw	Colq	Cocb	Yeft	Wimu	Rrpw	Colq	Cocb	Yeft	Wimu	Rrpw	Colq	Cocb
	(product/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
PRE																
KIH-485	0.25pt	27	0	88	67	0	40	30	73	63	0	40	30	73	63	0
KIH-485	0.42pt	40	0	98	93	0	53	40	90	83	0	53	40	90	83	0
KIH-485	0.5pt	50	0	98	68	0	63	53	99	82	0	63	53	99	82	0
KIH-485	0.6pt	80	87	99	93	30	92	99	99	99	13	92	99	99	99	13
Dual II Magnum	1pt	80	0	73	57	0	82	0	73	67	0	82	0	73	67	0
Dual II Magnum	1.67pt	90	50	80	70	0	93	40	90	82	0	93	40	90	82	0
Dual II Magnum	2pt	96	47	92	73	0	99	53	93	88	0	99	53	93	88	0
Dual II Magnum	4pt	95	72	99	85	0	96	60	96	93	0	96	60	96	93	0
KIH-485+atrazine	0.4pt+1.65lb	99	99	98	99	72	99	99	99	99	82	99	99	99	99	72
Bicep Lite II Magnum	2.2qt	99	99	99	99	47	99	99	99	99	72	99	99	99	99	72
Surpass	3pt	99	77	99	99	7	93	70	99	99	20	93	70	99	99	20
Outlook	21fl oz	98	47	99	99	0	99	53	99	99	0	99	53	99	99	0
Lumax	5pt	99	99	99	99	63	99	99	99	99	63	99	99	99	99	63
Lumax	6pt	99	99	99	99	63	99	99	99	99	88	99	99	99	99	88
PRE/POST																
Oulook/Distinct+Basic Blend	21fl oz/4oz	96	50	99	99	0	99	99	99	99	99	99	99	99	99	99
Dual II Magnum/Callisto+ PO+28-0-0	2pt/3fl oz	50	0	70	57	0	99	99	99	99	70	99	99	99	99	70
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		4	3	4	12	6	4	4	3	5	5	4	4	3	5	5

[1]KIH-485 = a proprietary herbicide from Kumiai America; Acetochlor = Surpass 6.4EC; Basic Blend = Quad 7 at 1% v/v; PO = petroleum oil = Herbimax at 1% v/v; 28-0-0 = urea ammonia nitrate at 2.5% v/v.

Option tank-mixes in corn. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate crop response and weed control from Option tank-mixes POST. Dekalb 'DKC35-50' corn was planted on June 2, 2003. EPOST (early postemergence) and POST treatments were applied at the same time because of rainy conditions at the EPOST application timing. All treatments were applied on July 2 at 11:45 am with 85 F air, 94 F soil surface, 60% relative humidity, 20% clouds, 5 to 10 mph S wind, moist soil surface, moist subsoil, good crop vigor, and no dew present to V6 to V8 corn. Weed species present were: 4 to 10 inch (5 to 20/yd^2) common cocklebur; and 3 to 5 inch (5 to 15/yd^2) yellow foxtail.

AT Chaffee, 6 rows each of Wensman '5088' and Mallard '386' were planted on May 4, 2003. EPOST treatments were applied on June 3 at 10:00 am with 58 F air, 65 F soil surface, 67% relative humidity, 80% clouds, 5 to 8 mph S wind, dry soil surface, moist subsoil, fair crop vigor, and no dew present to V3 to V4 corn. Weed species present were: 1 to 2 inch (10 to 30/ft^2) yellow foxtail; and 1 to 2 inch (5 to 20/yd^2) common lambsquarters. POST treatments were applied on June 17 at 2:15 pm with 75 F air, 76 F soil surface, 50% relative humidity, 40% clouds, 5 mph W wind, damp soil surface, moist subsoil, fair crop vigor, and no dew present to V4 to V5 corn. Weed species present were: 2 to 3 inch (10 to 30/ft^2) yellow foxtail; and 1 to 4 inch (5 to 20/yd^2) common lambsquarters.

Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 10 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Table 1. Option tank-mixes in corn, Casselton (Zollinger and Ries).

		July 16	July 30
Treatments[1]	Rate	Yeft	Yeft
	(product/A)	(%)	(%)
EPOST			
Option+Define+Distinct+ MSO+28-0-0	1.5oz+8oz+2oz	96	99
Option+Define+Distinct+ MSO+28-0-0	1.5oz+9.6oz+2oz	96	99
Option+Prowl+Distinct+ MSO+28-0-0	1.5oz+32oz+2oz	96	99
POST			
Option+Distinct+MSO+28-0-0	1.5oz+2oz	72	83
Equip+Distinct+MSO+28-0-0	1.5oz+2oz	72	83
Steadfast+Distinct+MSO+28-0-0	0.75oz+2oz	88	91
Option+Distinct+Renegade	1.5oz+2oz	68	77
Option+Callisto+Renegade	1.5oz+3fl oz	68	75
Option+Distinct+Renegade+28-0-0	1.5oz+2oz	85	91
Option+Callisto+Renegade+28-0-0	1.5oz+3fl oz	81	87
Option+Callisto+Renegade+28-0-0	1.5oz+2.5fl oz	67	73
Untreated		0	0
LSD (0.05)		5	5

[1]MSO = methylated seed oil = Scoil at 1.5 pt/A; 28-0-0 = urea ammonium nitrate at 2 qt/A; Renegade = MSO basic blend at 1% v/v.

Table 2. Option tank-mixes in corn, Chaffee (Zollinger and Ries).

Treatments[1]	Rate	June 17	July 1	July15
		Yeft	Yeft	Yeft
	(product/A)			
EPOST				
Option+Define+Distinct+ MSO+28-0-0	1.5oz+8oz+2oz	99	99	99
Option+Define+Distinct+ MSO+28-0-0	1.5oz+9.6oz+2oz	99	99	99
Option+Prowl+Distinct+ MSO+28-0-0	1.5oz+32oz+2oz	91	96	93
POST				
Option+Distinct+MSO+28-0-0	1.5oz+2oz		65	85
Equip+Distinct+MSO+28-0-0	1.5oz+2oz		65	85
Steadfast+Distinct+MSO+28-0-0	0.75oz+2oz		78	98
Option+Distinct+Renegade	1.5oz+2oz		68	72
Option+Callisto+Renegade	1.5oz+3fl oz		78	70
Option+Distinct+Renegade+28-0-0	1.5oz+2oz		80	83
Option+Callisto+Renegade+28-0-0	1.5oz+3fl oz		80	77
Option+Callisto+Renegade+28-0-0	1.5oz+2.5fl oz		75	70
Untreated			0	0
LSD (0.05)			5	6

[1]MSO = methylated seed oil = Scoil at 1.5 pt/A; 28-0-0 = urea ammonium nitrate at 2 qt/A; Renegade = MSO basic blend at 1% v/v.

Applications were made to 2 to 3 inch yellow foxtail at Chaffee and 3 to 5 inch yellow foxtail at Casselton because excessive rains delayed the July 2 (EPOST + POST) applications. No corn injury was observed with any treatments at either location. All treatments controlled common lambsquarters and wild buckwheat at Chaffee and all treatments controlled wild mustard, common lambsquarters, and common cocklebur at Casselton. All treatments containing Define gave complete or near complete season-long foxtail control and the treatments containing Prowl were similar. For POST applications, only the Steadfast treatment gave greater than 90% control at both locations. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Steadfast tank-mixes. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Chaffee, ND, to evaluate crop response and weed control from Steadfast tank-mixes applied POST. Six rows each of Wensman '5088' and Mallard '386' were planted on May 4, 2003. POST treatments were applied on June 12 at 1:00 pm with 73 F air, 73 F soil surface, 50% relative humidity, 40% clouds, 5 mph W wind, damp soil surface, moist subsoil, fair crop vigor, and no dew present to V4 to V5 corn. Weed species present were: 3 to 4 inch (10 to 30/ft^2) yellow foxtail. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Table. Steadfast tank-mixes (Zollinger and Ries).

Treatment[1]	Rate	June 26 Yeft	July 10 Yeft
	(product/A)	(%)	(%)
Steadfast+	0.75oz		
Activator 90+AMS	0.25% v/v+2lb	57	72
Atrazine+Activator 90+AMS	0.83lb+0.25% v/v+2lb	63	60
Callisto+Activator 90+AMS	1.5fl oz+0.25% v/v+2lb	63	72
Callisto+Atrazine+Activator 90+AMS	1.5fl oz+0.83lb+0.25% v/v+2lb	72	50
Distinct+Activator 90+AMS	2oz+0.25% v/v+2lb	53	68
Agridex+AMS	1% v/v+2lb	47	72
Atrazine+Agridex+AMS	0.83lb+1% v/v+2lb	72	70
Callisto+Agridex+AMS	1.5fl oz+1% v/v+2lb	77	75
Callisto+Atrazine+Agridex+AMS	1.5fl oz+0.83lb+1% v/v+2lb	85	72
Distinct+Agridex+AMS	2oz+1% v/v+2lb	53	93
Hi-Per-Oil+AMS	0.5% v/v+2lb	47	85
Atrazine+Hi-Per-Oil+AMS	0.83lb+0.5% v/v+2lb	70	57
Callisto+Hi-Per-Oil+AMS	1.5fl oz+0.5% v/v+2lb	50	53
Callisto+Atrazine+Hi-Per-Oil+AMS	1.5fl oz+0.83lb+0.5% v/v+2lb	65	40
Distinct+Hi-Per-Oil+AMS	2oz+0.5% v/v+2lb	67	93
Phase+AMS	0.5% v/v+2lb	72	96
Atrazine+Phase+AMS	0.83lb+0.5% v/v+2lb	77	87
Callisto+Phase+AMS	1.5fl oz+0.5% v/v+2lb	77	75
Callisto+Atrazine+Phase+AMS	1.5fl oz+0.83lb+0.5% v/v+2lb	96	95
Distinct+Phase+AMS	2oz+0.5% v/v+2lb	60	97
Option+Atrazine+MSO+AMS	1.5oz+0.83lb+1% v/v+2lb	53	50
Equip+Atrazine+MSO+AMS	1.5oz+0.83lb+1% v/v+2lb	58	53
Untreated		0	0
LSD (0.05)		7	8

[1]Activator 90 = nonionic surfactant; AMS = ammonium sulfate; Agidex and Hi-Per-Oil = petroleum oil concentrate; Phase = MSO (methylated seed oil) organosilicone surfactant; MSO = Scoil.

On June 19 (7 DAT), corn was yellow due to weed competition but not due to any herbicide effect and no injury was credited to the herbicide treatments on later evaluations. The study was conducted in a heavy infestation of yellow foxtail to evaluate adjuvant enhancement of Steadfast. Steadfast applied with Distinct and Phase (MSO + organosilicone) adjuvants gave the greatest foxtail control. Steadfast plus a half rate of Callisto (1.5 fl oz) plus atrazine + Phase + MSO was the only treatment that gave 95% control or greater at both the 14 and 28 DAT evaluations. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Corn micro-rates. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate crop response and weed control corn herbicides applied POST. Dekalb 'DKC32-59' corn was planted on June 2, 2003. POST treatments were applied on July 2 at 12:30 pm with 87 F air, 95 F soil surface, 55% relative humidity, 70% clouds, 5 to 10 mph S wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V6 to V8 corn. Weed species present were: 3 to 6 inch (1 to 5/yd^2) redroot pigweed; 4 to 10 inch (5 to 20/yd^2) common cocklebur; cotyledon to bloom (2 to 5/yd^2) wild mustard; and 3 to 5 inch (15 to 25/yd^2) yellow foxtail.

At Chaffee, 6 rows each of Wensman '5088' and Mallard '386' were planted on May 4, 2003. POST treatments were applied on June 12 at 1:45 pm with 74 F air, 74 F soil surface, 49% relative humidity, 40% clouds, 5 mph W wind, damp soil surface, moist subsoil, fair crop vigor, and no dew present to V4 to V5 corn. Weed species present were: 2 to 3 inch (10 to 30/ft^2) yellow foxtail; and 1 to 4 inch (10 to 25/yd^2) common lambsquarters.

Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

No corn injury was observed at either location or with any treatment and all treatments controlled broadleaf weeds present (wild mustard, redroot pigweed, common lambsquarters, and common cocklebur). Treatments at Chaffee were applied to 2 to 3 inch yellow foxtail and at Casselton to 3 to 5 inch yellow foxtail. Differences in grass height represent label recommendations and grass size growers may encounter. Most treatments applied at Chaffee to smaller size yellow foxtail gave grerater control those treatments applied at Casselton. However, MSO and Renegade used at highest herbicide rates enhanced control to greater than 93% control regardless of location. Addition of dicamba to Steadfast + atrazine antagonized foxtail control but addition of Callisto enhanced control. Reducing the rate of Callisto reduced foxtail control but MSO and Renegade enhanced control to some degree. Lumax at 3 pt/A contains the equivalent of 3 fl oz/A of Callisto, 0.42 lb/A of atrazine and 1 pt/A of Dual. Yellow foxtail control was similar or greater with Lumax compared or Callisto + Atrazine when applied with Steadfast. Callisto and Lumax label restricts use of MSO adjuvants. However, this data shows enhancement of weed control when used with Steadfast + Callisto or Lumax compared to PO + 28-0-0.
(Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Corn micro-rates, Casselton and Chaffee (Zollinger and Ries).

		Chaffee		Casselton	
		June 26	July 10	July 16	July 28
Treatment[1]	Rate	Yeft	Yeft	Yeft	Yeft
	(product/A)	(%)	(%)	(%)	(%)
Steadfast+Dicamba+Atrazine+ MSO	0.75oz+4fl oz+0.42lb	70	88	70	73
Steadfast+Dicamba+Atrazine+ Renegade	0.75oz+4fl oz+0.42lb	78	93	72	78
Steadfast+Callisto+Atrazine+ PO+28-0-0	0.75oz+3fl oz+0.42lb	86	92	88	88
Steadfast+Callisto+Atrazine MSO	0.75oz+3fl oz+0.42lb	96	97	93	95
Steadfast+Callisto+Atrazine+ Renegade	0.75oz+3fl oz+0.42lb	96	92	92	93
Steadfast+Dicamba+Atrazine+ Renegade	0.75oz+4fl oz+0.42lb	62	60	65	63
Steadfast+Callisto+Atrazine+ PO+28-0-0	0.75oz+2.5fl oz+0.42lb	92	73	82	70
Steadfast+Callisto+Atrazine+ MSO	0.75oz+2.5fl oz+0.42lb	97	92	82	79
Steadfast+Callisto+Atrazine+ Renegade	0.75oz+2.5fl oz+0.42lb	90	84	87	70
Steadfast+Lumax+ PO+28-0-0	0.75oz+3pt	89	81	80	77
Steadfast+Lumax+ MSO	0.75oz+3pt	94	93	85	86
Steadfast+Lumax+ Renegade	0.75oz+3pt	95	94	93	88
Steadfast+Lumax+ PO+28-0-0	0.5oz+2.5pt	85	86	84	72
Steadfast+Lumax+ MSO	0.5oz+2.5pt	91	90	86	83
Steadfast+Lumax+ Renegade	0.5oz+2.5pt	91	92	87	87
Steadfast+Lumax+ Renegade+28-0-0	0.5oz+2pt	78	90	79	90
LSD (0.05)		5	5	4	4

[1]MSO = methylated seed oil = Scoil at 1% v/v; Renegade = MSO basic blend at 1% v/v; PO = petroleum oil concentrate = Herbimax at 1% v/v, 28-0-0 = urea ammonium nitrate at 2.5% v/v.

Weed control in glyphosate-resistant corn. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate crop response and weed control from conventional corn herbicides and glyphosate applied POST. Dekalb 'DKC32-59' corn was planted on June 2, 2003. POST treatments were applied on July 2 at 1:15 pm with 94 F air, 100 F soil surface, 52% relative humidity, 100% clouds, 1 to 4 mph S wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V6 to V8 corn. Weed species present were: 2 to 6 inch (5 to 25/yd^2) common cocklebur; cotyledon to bloom (<1/yd^2) wild mustard; cotyledon to 2 inch (1 to 10/ft^2) common lambsquarters; 4 to 8 inch (5 to 25/yd^2) yellow foxtail; and 3 to 8 inch (1 to 10/yd^2) redroot pigweed. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Table. Weed control in glyphosate-resistant corn (Zollinger and Ries).

		July 16			July 30		
Treatment[1]	Rate	Yeft	Colq	Cocb	Yeft	Colq	Cocb
	(product/A)	(%)	(%)	(%)	(%)	(%)	(%)
Steadfast+	0.75oz						
MSO+AMS		76	60	20	77	57	27
Atrazine+MSO+AMS	0.42lb	82	92	40	88	99	52
Hornet WDG+Dicamba+Atrazine+ MSO+AMS	3oz+2fl oz+0.42lb	75	99	99	75	99	99
Distinct+Atrazine+MSO+AMS	2oz+0.42lb	75	99	99	73	99	99
Callisto+Atrazine+MSO+AMS	2fl oz+0.42lb	89	99	99	99	99	99
Dicamba+Atrazine+MSO+AMS	4fl oz+0.42lb	70	99	99	99	99	99
Starane+MSO+AMS	0.33pt	82	60	99	77	67	99
Starane+MSO+AMS	0.67pt	77	63	99	80	73	99
Starane+Atrazine+MSO+AMS	0.33pt+0.42lb	77	99	99	79	99	99
Starane+Atrazine+MSO+AMS	0.67pt+0.42lb	75	99	99	76	99	99
Roundup UltraMax+AMS	26fl oz	99	99	99	99	99	99
Roundup UltraMax+DPX-E9636+ AMS	26fl oz+0.75oz	99	99	99	99	99	99
Roundup UltraMax+Clarity+ Outlook+AMS	13fl oz+8fl oz+ 10fl oz	99	99	99	99	99	99
LSD (0.05)		5	1	0	3	3	2

[1]MSO = methylated seed oil = Scoil at 1% v/v; AMS = ammonium sulfate at 2lb/A.

No corn injury was observed at any evaluation or treatment. All treatments controlled wild mustard and redroot pigweed (data not shown). On August 14 (42 DAT), no new weed flushes had occurred and corn was 7 to 8 feet tall with good canopy. Scheduled applications at the V8 corn stage were not applied because no new weed flushes had emerged. All treatments containing glyphosate gave 99% weed control and treatments containing dicamba and Distinct controlled all broadleaf weeds. Treatments containing Starane controlled common cocklebur but not common lambsquarters. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Corn herbicides with adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate crop response and weed control of treatments applied POST. Dekalb 'DKC35-50' corn was planted on June 2, 2003. POST treatments were applied on July 2 at 12:30 pm with 83 F air, 94 F soil surface, 62% relative humidity, 40% clouds, 5 to 10 mph S wind, moist soil surface, moist subsoil, good crop vigor, and no dew present to V6 to V8 corn. Weed species present were: cotyledon to bloom (1 to 10/yd^2) wild mustard; 2 to 5 inch (5 to 10/yd^2) common cocklebur; 3 to 5 inch (5 to 15/yd^2) yellow foxtail; and 2 to 5 inch (1 to 5/yd^2) redroot pigweed. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Table. Corn herbicides with adjuvants (Zollinger and Ries).

		July 16		July 30	
Treatment[1]	Rate	Yeft	Colq	Yeft	Colq
	(product/A)	(%)	(%)	(%)	(%)
Accent+Priority+Premier 90+AMS	0.67oz+1oz	72	55	70	63
Accent+Priority+Premium COC+AMS	0.67oz+1oz	73	60	75	90
Option+Priority+Soy-Stik+AMS	1.5oz+1oz	77	70	86	99
Option+Priority+Base+AMS	1.5oz+1oz	83	70	82	99
Option+Priority+Base	1.5oz+1oz	75	60	79	99
Option+Distinct+Soy-Stik+AMS	1.5oz+2oz	69	99	79	99
Option+Distinct+Base	1.5oz+2oz	68	99	72	99
Steadfast+Priority+Soy-Stik+AMS	0.5oz+1oz	86	60	87	72
Steadfast+Priority+Base+AMS	0.5oz+1oz	88	60	86	74
Steadfast+Priority+Premium COC+AMS	0.5oz+1oz	75	60	72	65
Steadfast+Callisto+Atrazine+Premium COC	0.5oz+2fl oz+0.25lb	83	99	86	99
Steadfast+Clarity+Premium COC+AMS	0.5oz+4fl oz	69	99	68	99
LSD (0.05)		4	2	4	3

[1]Premier 90 = nonionic surfactant at 0.5% v/v; AMS = ammonium sulfate at 2 lb/A; Premium COC = petroleum oil concentrate at 1% v/v; Soy-Stik = methylated seed oil (MSO) at 1% v/v; Base = MSO basic blend at 1% v/v.

On July 16 (14 DAT) and July 30 (28 DAT), No corn injury was observed and all treatments controlled wild mustard, redroot pigweed, and common cocklebur. Priority is a premix of Aim (carfentrazone) + Permit (halosulfuron). Permit controls large-seeded broadleaf weeds but does not control small-seeded broadleaf weeds like redroot pigweed and common lambsquarters. Aim control small broadleaf weeds less than 2 inches tall. Petroleum oil adjuvant increased weed control from Accent + Priority. Option + Priority controlled common lambsquarters. Soy-Stik (MSO type) adjuvant enhanced weed control more than Base (MSO Basic pH Blend type) adjuvant with Option plus tank-mixes but was equal with Steadfast plus Priority. Petroleum oil enhanced Steadfast + Priority least. Dicamba antagonized yellow foxtail from Steadfast but atrazine and dicamba controlled common lambsquarters. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Weed control in corn. Jenks, Willoughby, and Markle. Corn was seeded May 12 at 18,000 seeds/A into 30-inch rows. Individual plots were 10 x 30 ft and replicated three times. Herbicide treatments were applied June 2 to V2 to V4 corn with 62 and 64 F air and soil temperatures, respectively; and 59% relative humidity. Treatments were applied with a bicycle sprayer delivering 10 gpa at 40 psi through XR 8001 nozzles. Plant sizes at treatment were green foxtail (Grft) at 2 to 3-leaf, kochia (Kocz) at 1 to 2-inch, redroot pigweed (Rrpw) at 1-inch, common lambsquarters (Colq) at 1-inch, wild buckwheat (Wibw) at 1-inch, and cutleaf nightshade (Clns) at 1-inch.

		Grft			Kocz			Rrpw			Colq			Wibw			Clns	
Treatment[a]	Rate	Jun 18	Jul 1	Jul 15	Jun 18	Jul 1	Jul 15	Jun 18	Jul 1	Jul 15	Jun 18	Jul 1	Jul 15	Jun 18	Jul 1	Jul 15	Jun 18	Jul 1
		% control																
Steadfast	0.75 oz	99	97	88	85	70	47	98	96	86	89	97	89	92	83	77	93	94
Steadfast + Atrazine	0.75 oz + 0.5 pt	99	92	78	100	100	98	98	93	84	99	100	99	99	97	91	100	100
Steadfast + Starane	0.75 oz + 0.33 pt	99	95	90	96	94	81	97	95	88	90	95	87	94	96	89	95	94
Steadfast + Starane	0.75 oz + 0.67 pt	99	95	90	95	96	87	98	94	88	92	98	95	95	94	87	93	94
Steadfast + Atrazine+ Starane	0.75 oz + 0.5 pt + 0.33 pt	99	96	90	98	98	92	99	97	90	99	98	95	100	99	97	100	99
Steadfast + Atrazine + Starane	0.75 oz + 0.5 pt + 0.67 pt	99	97	85	100	98	94	99	95	90	100	99	95	99	98	94	100	100
Option + Starane	1.5 oz + 0.67 pt	98	96	87	95	95	83	96	90	83	91	98	94	94	92	85	97	100
Option + Clarity	1.5 oz + 2 fl oz	97	95	85	95	93	83	99	95	84	91	99	98	80	73	60	96	98
Steadfast + Clarity	0.75 oz + 2 fl oz	99	97	89	94	88	68	98	95	88	91	100	95	94	88	83	90	92
Steadfast + Clarity + Atrazine	0.75 oz + 2 fl oz + 0.5 pt	99	95	88	100	99	96	99	95	87	100	99	100	99	97	92	98	99
Option + Clarity + Atrazine	1.5 oz + 2 fl oz + 0.5 pt	95	93	84	99	98	98	98	94	86	100	100	96	100	96	93	100	100
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		3	4	5	3	8	17	3	5	8	2	3	7	3	11	17	10	10
CV		2	3	4	2	6	13	2	4	6	1	2	5	2	8	13	7	7

[a] *Steadfast treatments were applied with MSO and 28% N at 1% v/v & 2 qt, respectively; Option treatments were applied with MSO and 28% N at 1.5 pt & 2 qt, respectively.*

None of the treatments caused visible corn injury. We applied the treatments early to control the heavy population of 2- to 3-leaf foxtail. In the June 18 evaluation (16 DAT), all treatments provided excellent control of all weeds, with the exception of Steadfast alone on kochia and lambsquarters, as well as Option + Clarity on wild buckwheat. Treatments containing atrazine had better season-long control of several weeds. Lack of soil residual activity in several treatments resulted in unacceptable weed control later in the season, particularly with kochia. Steadfast alone provided poor kochia control, likely due to the presence of ALS-resistant plants.

Biennial wormwood control in corn, Fargo, ND. Kegode and Ciernia. This experiment was conducted to evaluate PRE and POST herbicides for control of biennial wormwood in corn. Dekalb DKC35-51 RR corn was planted May 22 in 30 in. rows. PRE treatments were applied May 23 using a shielded 4-nozzle bicycle wheel sprayer equipped with XR8002 tips and delivering 17 gpa at 43 psi. At application, air temperature was 59 F, RH 55%, wind SE 12 mph, sky overcast and the soil surface dry. Using XR8001 tips delivering 8.5 gpa at 39 psi POST treatments were applied on June 18 to 5-leaf corn 8 in. tall, 3 to-5 leaf redroot pigweed 1-2 in. tall, 4-leaf common cocklebur 2-3 in. tall, and 2-leaf biennial wormwood 1 in. tall. At application, air temperature was 78 F, RH 55%, wind N 3 mph, sky clear and plant leaf surfaces dry. The entire trial was sprayed July 3 with Accent plus Quad 7 to control grasses. Weed control evaluations were made July 17 and 30 and 1treated row per plot was harvested Oct. 20. Plot size was 10 by 26 ft. and the experiment was a randomized complete block design with 4 reps.

			July 17		July 30			
Treatment	Timing	Rate	Injury	Cocb	Cocb	Rrpw	Biww	Yield
		oz ai/A	%	----------	% control	----------		bu/A
Atrazine	PRE	16	1	21	5	69	97	49
Basis	PRE	0.75	1	41	0	98	99	53
Balance Pro	PRE	1.5	0	82	65	97	99	68
Atrazine+COC	POST	16+0.25 G	0	89	78	99	95	73
Sencor+COC	POST	1.5+0.25 G	8	33	5	99	44	59
Distinct+COC+UAN	POST	4.2+ 0.25%+0.56 G	4	95	91	99	90	72
Hornet+COC	POST	3.4+1%	4	96	99	99	99	64
Aim	POST	0.128	5	14	4	89	0	58
Callisto+COC+UAN	POST	1.5+1%+2.5%	0	96	94	99	20	76
Basis Gold+COC+UAN	POST	12.54+0.25G+0.25 G	0	88	65	99	95	78
Option+ MSO+UAN	POST	1.226+0.25G+0.25 G	0	85	68	99	92	65
Untreated	POST	0	0	0	0	0	0	52
Weedfree	POST	0	0	99	99	99	99	64
C.V.%			112	11	13	11	17	16
LSD 5%			3	10	10	14	17	15
# of Reps			4	4	4	4	4	4

Biennial wormwood emergence was relatively late and seedling population was too low to rate on July 17. On July 30, PRE-applied Atrazine, Basis, and Balance Pro provided 97% or greater control of biennial wormwood. All POST treatments, except Sencor and Aim, provided 90% or greater control of biennial wormwood. Apart from PRE-applied Atrazine, all PRE and POST treatments provided 89% or greater control of redroot pigweed. Control of common cocklebur was generally best at the July 17 evaluation compared to the July 30 evaluation. The highest common cocklebur control was with PRE-applied Balance Pro which provided 65% control, whereas POST-applied Distinct, Callisto, and Hornet provided 91% or greater control of common cocklebur on July 30. POST-applied Aim, Distinct, Hornet, and Sencor caused between 4 and 8% injury to corn, however, yields were not reduced significantly when compared to the weedfree treatment.

Wild buckwheat control in glyphosate-resistant corn. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Jamestown, ND, to evaluate wild buckwheat control by glyphosate applied at three different timings. Wolf River Valley '2283' corn was planted on April 23, 2003. EPOST (early postemergence) treatments were applied on May 20 at 10:45 am with 52 F air, 53 F soil surface, 30% relative humidity, 0% clouds, 4 mph NE wind, damp soil surface, moist subsoil, good crop vigor, and no dew present to emerging to V1 corn. Wild buckwheat was 1 to 2 inch and 5 to 30/ft^2. POST treatments were applied on May 31 at 10:00 am with 60 F air, 69 F soil surface, 34% relative humidity, 50% clouds, 4 mph SE wind, damp soil surface, moist subsoil, fair crop vigor, and no dew present to V1 to V2 corn. Wild buckwheat was 1 to 4 inch 5 to 30/ft^2. LPOST (late postemergence) treatments were applied on June 9 at 11:30 am with 66 F air, 68 F soil surface, 63% relative humidity, 100% clouds, 7 to 12 mph S wind, damp soil surface, moist subsoil, fair crop vigor, and no dew present to V5 to V6 corn. Wild buckwheat was 4 to 6 inch (vining) and 5 to 30/ft^2. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Inadequate wild buckwheat control by glyphosate is a concern. The objective of this study was to determine control by glyphosate applied alone at different wild buckwheat stages or applied with adjuvants. Results on July 7 were very surprising. Glyphosate at 20 or 26 fl oz/A applied to wild buckwheat at 1 to 2 inches or 2 to 4 inches gave at least 94% control. Only glyphosate at 26 fl oz/A applied to 4 to 6 inch (vining) plants gave at least 91% control. All glyphosate treatments applied at the POST timing provided at least 91% wild buckwheat control. Glyphosate has no residual control and, though complete control from the EPOST application was observed through July 17, additional wild buckwheat flushes would have been expected. No rain occurred after application, which may help explain high levels of control 1.5 months after the earliest application. In summary, glyphosate at 26 fl oz/A provided adequate wild buckwheat control when applied to plants up to 6 inches long and vining. Reducing the rate of glyphosate to 20 fl oz/A controls wild buckwheat plants 4 inches tall or smaller. The micro-rate of Basagran + Poast (Rezult) + Raptor + Flexstar did not control wild buckwheat. Perhaps the micro-rate would have provided better control if applied at EPOST instead of POST. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Wild buckwheat control in glyphosate-resistant corn (Zollinger and Ries).

Treatment[1]	Rate	June 13 Wibw	June 27 Wibw	July 7 Wibw
	(product/A)	(%)	(%)	(%)
EPOST				
Glyt+AMS	20fl oz	99	99	94
Glyt+AMS	26fl oz	99	99	97
POST				
Glyt+AMS	20fl oz	95	98	96
Glyt+AMS	26fl oz	96	99	96
Glyt+Liberate	26fl oz+0.25% v/v	98	99	95
Glyt+Liberate	26fl oz+0.5% v/v	96	99	96
Glyt+Choice	26fl oz+0.5% v/v	96	98	93
A13998A+AMS	24fl oz	95	99	91
Basagran+Poast+Flexstar+ Raptor+Renegade	0.6pt+0.6pt+0.3pt+ 0.9fl oz+1% v/v	47	60	60
LPOST				
Glyt+AMS	20fl oz	30	67	73
Glyt+AMS	26fl oz	50	73	91
LSD (0.05)		16	12	6

[1]Glyphosate (glyt) = Roundup UltraMax; AMS = ammonium sulfate at 8.5 lb/100 gallons; Liberate = nonionic surfactant; Choice = water conditioning agent; A13998A = glyphosate-K at 5.0 lb ae/gallon; Renegade = MSO basic blend at 1% v/v; Basagran + Poast = Rezult.

Volunteer Roundup Ready Canola Control in Roundup Ready Soybeans. Jenks, Willoughby, and Markle. RR soybeans were seeded were seeded May 13. Canola was then seeded over the top of the soybeans to simulate a volunteer situation. Individual plots were 10 x 30 ft and replicated three times. Herbicide treatments were applied with a bicycle sprayer delivering 10 gpa at 40 psi through XR 8001 nozzles to 4-leaf canola on June 10 and to 6-leaf to bolting canola on June 16. Air and soil temperature were 61 and 65 F, respectively, and relative humidity was 71% during the June 10 application. Air and soil temperatures were 76 and 75 F, respectively, and relative humidity was 65% during the June 16 application. Soybean had 1 trifoliate leaf on June 10.

			Soybean		Volunteer canola	
Treatment[a]	Rate	Canola stage	Jun 14	Jun 19	Jul 2	Jul 14
			——% injury ——		—% control —	
Roundup / Roundup	26 fl oz / 26 fl oz	4-lf / 6-lf	1	0	0	0
Roundup + Harmony GT	26 fl oz + 0.083 oz	4-lf	5	0	53	27
Roundup + Harmony GT	26 fl oz + 0.083 oz	6-lf		1	48	55
Roundup + Harmony GT	26 fl oz + 0.0555 oz	4-lf	3	0	45	27
Roundup + Harmony GT	26 fl oz + 0.0555 oz	6-lf		1	47	45
Roundup + Cobra	26 fl oz + 6 fl oz	4-lf	24	8	92	94
Roundup + Cobra	26 fl oz + 6 fl oz	6-lf		25	12	12
Roundup + Cobra	26 fl oz + 4 fl oz	4-lf	19	5	87	82
Roundup + Cobra	26 fl oz + 4 fl oz	6-lf		21	10	12
Roundup + Amplify	26 fl oz + 0.3 oz	4-lf	16	0	92	97
Roundup + Amplify	26 fl oz + 0.3 oz	6-lf		11	57	89
Roundup + Amplify	26 fl oz + 0.2 oz	4-lf	14	0	87	95
Roundup + Amplify	26 fl oz + 0.2 oz	6-lf		11	50	83
Roundup + Raptor	26 fl oz + 2 fl oz	4-lf	11	0	88	98
Roundup + Raptor	26 fl oz + 2 fl oz	6-lf		3	48	65
Roundup + Raptor	26 fl oz + 1 fl oz	4-lf	7	0	81	86
Roundup + Raptor	26 fl oz + 1 fl oz	6-lf		2	40	53
LSD (0.05)			3	1	13	17
CV			15	14	14	17

[a]*Roundup treatments were Roundup UltraMax applied with AMS at 2.5gal/100 gal.*

Harmony GT, Cobra, Amplify, and Raptor were evaluated for volunteer RR canola control in RR soybeans. Each herbicide was applied at two low rates at two canola stages. The most important observation from the study was that canola is more easily controlled before the bolting stage. Cobra, Amplify, and Raptor applied at the 4-leaf canola stage provided good to excellent control. However, volunteer canola control decreased significantly when these same herbicides were applied beyond the 6-leaf stage.

Controlling volunteer glyphosate-resistant corn. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate control of volunteer glyphosate-resistant corn in glyphosate resistant-soybean applied POST. Glyphosate-resistant corn was spread and tilled into the soil followed by the seeding of Asgrow 'AG0801' soybean on May 29, 2003. POST treatments were applied on July 1 at 10:15 am with 78 F air, 75 F soil surface, 60% relative humidity, 5% clouds, 10 to 15 mph SE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V2 to V3 soybean. Weed species present were: 6 to 8 inch (50 to 75/ft^2) yellow foxtail; and 16 to 20 inch (5 to 40/yd^2) volunteer corn. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

The experiment was conducted to observe compatibility of clethodim formulations and Assure II with Roundup WeatherMax and potential antagonism in grass control of glyphosate-resistant corn. The large size of yellow foxtail at 6 to 8 inches tall and volunteer glyphosate-resistant corn at 16 to 20 inches was intentional to identify problems with herbicide interactions. No compatibility problems were observed during mixing and application, and no antagonism of grass control was observed during evaluation. Reducing the clethodim rate by 60% also resulted in complete corn death. Speed of symptom development and death of corn and yellow foxtail was greatest with the V-10137 formulation of clethodim (data not shown). Assure II applied without glyphosate was the only treatment that did not control yellow foxtail. In summary, clethodim can be used at low rates to kill volunteer glyphosate-resistant corn in glyphosate-resistant crops. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Controlling glyphosate-resistant corn (Zollinger and Ries).

Treatment[1]	Rate	July 15		July 29	
		Corn	Yeft	Corn	Yeft
	(product/A)	(%)	(%)	(%)	(%)
Clethodim+glyphosate	5fl oz+22fl oz	99	99	99	99
Clet+glyt+AMS	5fl oz+22fl oz	99	99	99	99
Clet+glyt+NIS+AMS	5fl oz+22fl oz	99	99	99	99
Clet+glyt+Preference+N-Pac AMS	2fl oz+5.5fl oz	99	99	99	99
Clet+glyt+AG 01023+N-Pac AMS	2fl oz+5.5fl oz	99	99	99	99
Clet+glyt+Prime Oil+N-Pac AMS	2fl oz+5.5fl oz	99	99	99	99
Clet+glyt+Destiny+N-Pac AMS	2fl oz+5.5fl oz	99	99	99	99
Clet(V-10137)+glyt	10fl oz+22fl oz	99	99	99	99
Clet(V-10137)+AMS	10fl oz	99	85	99	99
Clet(V-10137)+NIS+AMS	10fl oz	99	85	99	99
Clet(V-10137)+glyt+AMS	10fl oz+22fl oz	99	99	99	99
Clet(V-10137)+glyt+NIS+AMS	10fl oz+22fl oz	99	99	99	99
Clet(V-10139)+glyt	6fl oz+22fl oz	99	99	99	99
Clet(V-10139)+glyt+AMS	6fl oz+22fl oz	99	99	99	99
Clet(V-10139)+glyt+NIS+AMS	6fl oz+22fl oz	99	99	99	99
Clet(Arrow)+glyt	5fl oz+22fl oz	99	99	99	99
Clet(Arrow)+glyt+AMS	5fl oz+22fl oz	99	99	99	99
Clet(Arrow)+glyt+NIS+AMS	5fl oz+22fl oz	99	99	99	99
Assure II+Herbimax+AMS	5fl oz+22fl oz	99	70	99	75
Assure II+glyt+AMS	5fl oz+22fl oz	99	99	99	99
Assure II+glyt+NIS+AMS	5fl oz+22fl oz	99	99	99	99
Untreated		0	0	0	0
LSD (0.05)		0	0	0	0

[1]Clethodim = Select unless otherwise noted by trade or experimental number in parenthesis; Glyphosate (Glyt) = Roundup WeatherMax; Herbimax = petroleum oil at 1 qt/A; AMS = ammonium sulfate at 17lb/100 gallon; NIS = nonionic surfactant = Activator 90 at 0.125% v/v; Preference = nonionic surfactant at 0.25% v/v; N-Pac AMS = ammonium sulfate at 2.5% v/v; AG 01023 = a proprietary adjuvant from Agriliance; Prime Oil = petroleum oil at 1% v/v; Destiny = methylated seed oil at 1% v/v.

Eastern black nightshade control in glyphosate-resistant soybean. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Buffalo, ND, to evaluate Eastern black nightshade control applied at three different timings. EPOST (early postemergence) treatments were applied on June 19, 2003 at 11:45 am with 76 F air, 76 F soil surface, 34% relative humidity, 0% clouds, 10 to 15 mph SW wind, dry soil surface, moist subsoil, and no dew present to 1 to 3 inch (5 to 50/ft^2) Eastern black nightshade. POST treatments were applied July 1 at 12:30 pm with 84 F air, 80 F soil surface, 58% relative humidity, 0% clouds, 10 to 15 mph SE wind, dry soil surface, moist subsoil, and no dew present to 2 to 4 inch (5 to 50/ft^2) Eastern black nightshade. LPOST (late postemergence) treatments were applied July 18 at 10:30 am with 73 F air, 82 F soil surface, 53% relative humidity, 25% clouds, 1 to 3 mph SE wind, dry soil surface, moist subsoil, and no dew present to 6 to 12 inch (5 to 50/ft^2) Eastern black nightshade. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer with an attached wind screen delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Lack of nightshade control from glyphosate is a concern. The objective of this study was to determine control from glyphosate applied alone at different nightshade stages or applied with Raptor or Flexstar at a reduced glyphosate rate. Treatments were applied in a non-crop environment which nullified any control from crop competition. Results on August 8 were very surprising. Glyphosate applied at 20 or 26 fl oz/A to nightshade at 1 to 3 inches, 2 to 4 inches, or 6 to 12 inches gave at least 92% control. Glyphosate has no residual control and though complete control was observed at July 15 additional nightshade flushes would have been expected. No rain occurred after application which may help explain high level of nightshade control 1.5 months after the earliest application. Reducing the rate of glyphosate to 1 pt/A and adding Raptor or Flexstar did not extend nightshade control. Control was no greater than 60% when glyphosate used with reduced rates of Raptor or Flexstar. Adding MSO adjuvant to Extreme premix formulation increased nightshade control from 72 to 96%. The micro-rate of Rezult+Raptor+Flexstar did not control nightshade. Perhaps the micro-rate would have provided better control if applied at EPOST instead of POST. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Eastern black nightshade control in glyphosate-resistant soybean (Zollinger and Ries).

Treatment[1]	Rate	July 3 Ebns	July 15 Ebns	July 24 Ebns	August 8 Ebns
	(product/A)	(%)	(%)	(%)	(%)
EPOST					
Glyphosate[2]+AMS	20fl oz	99	99	99	99
Glyt[2]+AMS	26fl oz	99	99	99	99
POST					
Glyt[2]+AMS	20fl oz		99	97	92
Glyt[2]+AMS	26fl oz		99	97	90
Glyt[3]+Raptor+MSO	1pt+1.5fl oz		99	93	83
Glyt[3]+Raptor+MSO	1pt+0.9fl oz		99	91	57
Glyt[3]+Raptor+Renegade	1pt+0.9fl oz		99	87	53
Glyt[3]+Flexstar+MSO	1pt+0.75pt		99	85	57
Glyt[3]+Flexstar+MSO	1pt+0.5pt		99	83	50
Glyt[3]+Flexstar+MSO	1pt+0.3pt		99	87	53
Glyt[3]+Flexstar+Renegade	1pt+0.3pt		99	87	60
Extreme	1.5pt		99	84	72
Extreme+Renegade	1.5pt		99	96	96
Basagran+Poast+Flexstar+ Raptor+MSO	0.6pt+0.6pt+0.3pt+ 0.9fl oz		99	67	40
Basagran+Poast+Flexstar+ Raptor+Renegade	0.6pt+0.6pt+0.3pt+ 0.9fl oz		99	67	40
LPOST					
Glyt[2]+AMS	26fl oz			84	97
Glyt[2]+AMS	20fl oz			76	95
Extreme+glyt[2]+NIS	2.25pt+1pt			99	99
LSD (0.05)		0	0	5	7

[1]AMS = ammonium sulfate at 8.5 lb/100 gal; MSO = methylated seed oil = Scoil at1% v/v; Renegade = MSO basic blend at 1% v/v, NIS = nonionic surfactant = Activator 90 at 1 pt/100 gallon; Basagran + Poast = Rezult Copack.
[2]Glyphosate = Roundup UltraMax.
[3]Glyphosate = Roundup Original.

ClearOut 41 glyphosate in glyphosate-resistant soybean. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Buffalo, ND, to evaluate crop response and weed control from glyphosate treatments applied POST. NuTech '888' soybean was planted on June 5, 2003. POST treatments were applied on June 17 at 10:00 am with 64 F air, 73 F soil surface, 77% relative humidity, 100% clouds, 7 to 12 mph NE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V6 to R1 soybean. Weed species present were: 6 to 14 inch (50 to 100/yd^2) yellow foxtail; 6 to 12 inch diameter (1 to 15/yd^2) prostrate pigweed; 2 to 6 inch (<1/yd^2) biennial wormwood; 6 to 12 inch (<1/yd^2) kochia; and 6 to 8 inch (1 to 5/yd^2) redroot pigweed. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Table. ClearOut 41 glyphosate in glyphosate-resistant soybean (Zollinger and Ries).

		July 31					
Treatment[1]	Rate	Grass[2]	Pigweed[3]	Colq	Biww	Kochia	Mael
	(product/A)	(%)	(%)	(%)	(%)	(%)	(%)
ClearOut 41 Plus	1pt	81	84	82	86	82	72
ClearOut 41 Plus+AMS	1pt	89	94	91	96	91	94
ClearOut 41 Plus+N Tank	1pt	99	99	99	99	99	99
ClearOut 41 Plus	2pt	99	99	99	99	99	99
ClearOut 41 Plus+AMS	2pt	99	99	99	99	99	99
ClearOut 41 Plus+N Tank	2pt	99	99	99	99	99	99
ClearOut Technical	6.2oz	73	72	71	76	74	82
ClearOut Technical+AMS	6.2oz	81	86	81	87	82	87
ClearOut Technical+N Tank	6.2oz	96	97	97	97	97	98
ClearOut Technical	12.4oz	81	90	85	92	89	92
ClearOut Technical+AMS	12.4oz	96	96	89	97	92	93
ClearOut Technical+N Tank	12.4oz	99	99	99	99	99	99
Roundup WeatherMax	0.67pt	91	91	86	94	91	96
Roundup WeatherMax+AMS	0.67pt	98	99	97	98	97	98
Roundup WeatherMax+N Tank	0.67pt	99	99	99	99	99	99
Roundup WeatherMax	1.33pt	99	99	99	99	99	99
Roundup WeatherMax+AMS	1.33pt	99	99	99	99	99	99
Roundup WeatherMax+N Tank	1.33pt	99	99	99	99	99	99
N Tank	3% v/v	0	0	0	0	0	0
Untreated		0	0	0	0	0	0
LSD (0.05)		3	1	3	2	3	2

[1]ClearOut 41 Plus (ipa salt) and ClearOut Technical (acid) are proprietary glyphosate herbicides from Chemical Product Technologies; AMS = ammonium sulfate at 2% v/v; N Tank = water conditioner and buffer at 1% v/v from Adjuvants Plus Inc.
[2]Grass = yellow foxtail, barnyardgrass, stinkgrass, volunteer corn.
[3]Pigweed = redroot pigweed, prostate pigweed, tumble pigweed.

Most treatments containing both surfactant and AMS gave near 99% weed control. On July 24 (7 DAT) and July 31 (14 DAT), there was no soybean injury and all treatments gave 99% wild mustard control. Treatments containing N Tank adjuvant had visibly more desiccation than other treatments. On August 14 (28 DAT), there was no change in weed control and no new weed flushes due to excellent soybean growth and crop canopy. (Dept. of Plant Sciences, North Dakota State University, Fargo).

ClearOut 41 injury in glyphosate-resistant soybean. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Buffalo, ND, to evaluate crop response and weed control from glyphosate herbicides applied POST. NuTech '888' soybean was planted on June 5, 2003. POST treatments were applied on July 17 at 9:30 am with 63 F air, 72 F soil surface, 77% relative humidity, 100% clouds, 0 to 5 mph N wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V6 to R1 soybean. Weed species present were: 6 to 14 inch (1 to 10/yd^2) yellow foxtail; 6 to 12 inch diameter (1 to 3/yd^2) prostrate pigweed; 2 to 6 inch (<1/yd^2) biennial wormwood; 8 to 18 inch (<1/yd^2) kochia; flowering (<1/yd^2) wild mustard; and 12 to 24 inch (1 to 20/yd^2) marshelder. Treatments were applied twice at the half rate for each application to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Table. ClearOut 41 injury in glyphosate-resistant soybean (Zollinger and Ries).

		July 31			August 14		
Treatment[1]	Rate	Colq	Biww	Koch	Colq	Biww	Koch
	(product/A)	(%)	(%)	(%)	(%)	(%)	(%)
ClearOut 41 Plus	4pt	99	99	99	99	99	99
ClearOut 41 Plus+AMS	4pt+2% w/v	99	99	99	99	99	99
ClearOut 41 Plus+N tank	4pt+1% v/v	99	99	99	99	99	99
ClearOut Technical	24.8oz	86	88	81	86	88	81
ClearOut Technical+AMS	24.8oz+2% w/v	93	95	95	93	95	95
ClearOut Technical+N Tank	24.8oz+1% v/v	99	99	99	99	99	99
Roundup WeatherMax	2.67pt	92	99	96	92	99	96
Roundup WeatherMax+AMS	2.67pt+2% w/v	99	99	99	99	99	99
Roundup WeatherMax+N Tank	2.67pt+1% v/v	99	99	99	99	99	99
N Tank	3% v/v	0	0	0	0	0	0
Untreated		0	0	0	0	0	0
LSD (0.05)		1	1	1	1	1	1

[1]AMS = ammonium sulfate; N Tank = water conditioner and buffer.

The objectives of this study was to use glyphosate in different formulations and observe soybean injury with high rates. Each treatment was applied twice at the half the rate listed to simulate an overlap. No soybean injury was observed with any treatment. Grass species were yellow foxtail, barnyardgrass, stinkgrass, and volunteer corn. Pigweed species were redroot pigweed, tumble pigweed, and prostrate pigweed. All treatments controlled wild mustard. All treatments gave 99% weed control of yellow foxtail, barnyardgrass, stinkgrass, volunteer corn, redroot pigweed, tumble pigweed, prostrate pigweed, marshelder, and wild mustard, except ClearOut Technical (glyphosate acid) and Roundup WeatherMax without additional adjuvants. ClearOut Technical is a non-formulated glyphosate acid with no formulants which may help explain reduced weed control but Roundup WeatherMax is a full adjuvant load glyphosate which should contain the adjuvant load necessary for optimal weed control. Hard water was not used as a carrier. On August 14 (28 DAT), there was no change in weed control and no new weed flushes were observed primarily due to excellent soybean growth and canopy. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Prowl H_2O vs. Prowl. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Buffalo, ND, to evaluate soybean response and weed control to treatments applied PPI, PRE, and POST. On June 5, 2003, PPI treatments were applied and incorporated with a rototiller operating at a 2 inch depth at 9:30 am with 67 F air, 58 F subsoil at a four inch depth, 57% relative humidity, 10% clouds, 5 to 10 mph W wind, dry soil surface and a moist subsoil followed by the planting of NuTech '888' soybean. PRE treatments were applied June 5 at 10:00 am with 68 F air, 58 F subsoil at a depth of four inches, 56% relative humidity, 10% clouds, 5 to 10 mph W wind, dry soil surface and a moist subsoil. POST treatments were applied July 3 at 12:15 pm with 88 F air, 97 F soil surface, 33% relative humidity, 25% clouds, 5 to 8 mph NW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V2 to V3 soybean. Weed species present were: 2 to 6 inch (<1/yd^2) marshelder; 4 to 6 inch (5 to 10/yd^2) yellow foxtail; emerging to 2 inch (<1/yd^2) biennial wormwood; 2 to 3 inch (<1/yd^2) kochia; 1 to 3 inch (1 to 3/yd^2) redroot pigweed; and 1 to 2 inch (1to 3/yd^2) prostrate pigweed. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PPI and PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

Table. Prowl H_2O vs. Prowl (Zollinger and Ries).

		July 3			July 17			July 31		
Treatment[1]	Rate	Yeft	Rrpw	Kochia	Bygr	Prpw	Kochia	Bygr	Prpw	Kochia
	(product/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
PPI/POST										
Prowl/Basagran+Poast+ Raptor+PO+28-0-0	3pt/1.6pt+1.6pt+ 2fl oz	70	75	99	93	97	95	89	95	90
PRE/POST										
Prowl H_2O/Roundup WeatherMax+ AMS	2.63pt/22% v/v	75	95	99	93	97	95	89	95	90
Prowl/Roundup WeatherMax+ AMS	3pt/22% v/v	67	96	91	93	97	95	89	95	90
Prowl H_2O/Roundup WeatherMax+ AMS	5.26pt/22% v/v	86	95	99	93	97	95	89	95	90
Prowl/Roundup WeatherMax+ AMS	6pt/22% v/v	85	95	99	93	97	95	89	95	90
POST										
Basagran+Poast+Flexstar+ Raptor+Renegade	0.6pt+0.6pt+0.3pt+ 0.9fl oz				93	97	95	89	95	90
Untreated		0	0	0	0	0	0	0	0	0
LSD (0.05)		11	12	7	0	0	0	0	0	0

[1]Basagran+Poast = Rezult Copack; PO = petroleum oil concentrate = Herbimax at 1% v/v; 28-0-0 = urea ammonium nitrate at 1 qt/A; AMS = ammonium nitrate at 2.5 lb/A; Renegade = MSO (methylated seed soil) basic blend at 1% v/v.

All treatments controlled yellow foxtail and redroot pigweed (after July 3 rating), wild mustard, marshelder, and biennial wormwood. By July 17 all treatments gave 90% weed control or greater. No difference in weed control was observed between Prowl and Prowl H_2O. The Micro-rate treatment controlled grass and broadleaf weeds. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Glyphosate formulations with adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Mooreton, ND, to evaluate weed control from glyphosate with adjuvants applied POST. Asgrow 'AG0801' soybean was planted on April 25, 2003. POST treatments were applied on June 18 at 10:15 am with 73 F air, 86 F soil surface, 37% relative humidity, 0% clouds, 6 to 10 mph N wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V3 to V4 soybean. Weed species present were: 1 to 8 inch (5 to 25/yd^2) redroot pigweed; 2 to 5 inch (5 to 10/yd^2) common lambsquarters; 2 to 10 inch (5 to 15/yd^2) yellow foxtail; 1 to 6 inch (1 to 10/yd^2) barnyard grass and volunteer wheat; cotyledon to 8 inch (1 to 5/yd^2) common cocklebur; 2 to 6 inch (1 to 3/yd^2) common ragweed; 2 to 4 inch (5 to 10/yd^2) wild mustard; 1 to 5 inch (3 to 10/yd^2) annual smartweed; and 6 to 18 inch (<1/yd^2) marshelder. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

The objectives were to evaluate six glyphosate formulations applied with adjuvant systems allowed by label. Two full adjuvant load potassium salt formulations (Roundup WeatherMax and A13998A), one full adjuvant load isopropyl amine formulation (Glyphomax Plus), two partial load isopropyl amine formulations (Roundup Original and ClearOut 41 Plus), and one no load isopropyl amine formulation (Roundup Custom) was used with one adjuvant system from five major adjuvant companies selling products in the northern great plains: ClassAct Next Generation (Agriliance), N Tank (Adjuvants Plus), One-Ap XL (West Central), Bronc Plus (Wilbur-Ellis), and Blendmaster (UAP). A reduced rate of glyphosate (~0.192 lb ae/A) was used to measure adjuvant enhancement differences. The high degree of grass and broadleaf weed control was impressive considering the low rate of glyphosate used.

No soybean injury was observed with any treatment and all treatments gave 99% control of yellow foxtail, barnyardgrass, volunteer wheat, wild mustard, common cocklebur, and marshelder. No treatment provided adequate Pennsylvania smartweed control and little difference in adjuvant enhancement was observed. Roundup WeatherMax and A13998A applied at a low rate may not contain enough adjuvant load in the spray solution for optimum weed control. Nonionic surfactant (NIS) + ammonium sulfate (AMS) adjuvants, ClassAct Next Generation and N Tank, greatly increased weed control from Roundup WeatherMax and A13998A. Lack of common lambsquarters control from glyphosate at full rates has been reported by growers. It has been proposed that glyphosate-K formulations convert to glyphosate-NH3 when applied with adjuvant products containing AMS. However, isopropyl amine formulations with AMS adjuvants generally gave greater common lambsquarters control than glyphosate-K formulations with AMS. Data on common lambsquarters and common ragweed show that no- or partial-adjuvant isopropyl amine formulations plus NIS + AMS gave equal or greater weed control than glyphosate-K formulations plus AMS or NIS + AMS. Averaged across all adjuvants, Roundup Original and Roundup Custom gave the highest common lambsquarters control and averaged across all herbicides, N Tank and One-Ap XL enhanced common lambsquarters control the most. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Glyphosate formulations with adjuvants (Zollinger and Ries).

Treatment[1]	Rate	July 2					July 26				
		GRASS[8]	Rrpw	Colq	Corw	Pesw	GRASS[8]	Rrpw	Colq	Cocw	Pesw
	(product/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Glyphsate[2]+AMS	5.5fl oz	83	87	70	62	62	80	78	68	60	60
Glyt[2]+ClassAct NG	5.5fl oz	87	98	80	65	60	92	95	85	72	60
Glyt[2]+N Tank	5.5fl oz	85	92	78	63	60	92	94	80	72	62
A13998A[3]+AMS	5.5fl oz	75	78	70	60	57	82	82	70	70	60
A13998A[3]+ClassAct NG	5.5fl oz	90	98	68	73	68	96	99	80	75	67
A13998A[3]+N Tank	5.5fl oz	93	98	75	75	70	96	99	80	73	65
Glyt[4]+AMS	8.2fl oz	65	82	50	60	53	63	82	53	50	40
Glyt[4]+ClassAct NG	8.2fl oz	94	99	87	80	67	95	99	89	85	67
Glyt[4]+N Tank	8.2fl oz	93	99	86	85	73	95	99	91	86	67
Glyt[5]+ClassAct NG	8.2fl oz	73	99	70	60	50	89	99	82	70	60
Glyt[5]+N Tank	8.2fl oz	98	99	93	90	82	99	98	90	90	70
Glyt[5]+One-Ap XL	8.2fl oz	91	99	85	75	75	95	99	92	82	65
Glyt[5]+Bronc Plus	8.2fl oz	91	99	73	60	50	95	99	86	73	65
Glyt[5]+Blendmaster	8.2fl oz	80	94	78	60	53	86	99	75	67	57
Glyt[6]+ClassAct NG	6.2fl oz	94	99	88	80	70	95	99	86	79	65
Glyt[6]+N Tank	6.2fl oz	94	99	87	80	70	96	99	91	83	65
Glyt[6]+One-Ap XL	6.2fl oz	77	90	70	67	50	90	95	82	65	50
Glyt[6]+Bronc Plus	6.2fl oz	92	99	80	75	75	96	99	87	76	65
Glyt[6]+Blendmaster	6.2fl oz	90	96	72	68	62	94	99	79	73	63
Glyt[7]+ClassAct NG	8.2fl oz	94	99	92	83	77	95	99	85	78	68
Glyt[7]+N Tank	8.2fl oz	90	95	83	75	72	95	98	83	73	65
Glyt[7]+One-Ap XL	8.2fl oz	93	99	83	73	75	97	99	84	72	65
Glyt[7]+Bronc Plus	8.2fl oz	80	90	77	65	62	92	96	82	70	65
Glyt[7]+Blendmaster	8.2fl oz	93	99	78	73	72	96	99	82	72	65
LSD (0.05)		6	5	5	6	5	3	2	4	4	3

[1]AMS = ammonium sulfate at 8.5 lb/100 gallon; ClassAct NG (Next Generation) and Bronc Plus = surfactants + fertilizer at 2.5% v/v and 3% v/v respectively; N-Tank = water conditioner and buffer at 1% v/v; One-Ap XL = AMS fertilizer + surfactant + deposition + defoamer at 10 lb/100 gallon; BlendMaster = water conditioning agents + surfactants at 1% v/v.

[2]Glyphosate = Roundup WeatherMax.

[3]A13998A = glyphosate-K at a 5.0 lb ae/gal.

[4]Glyphosate = Glyphomax Plus.

[5]Glyphosate = Roundup Original.

[6]Glyphosate = Roundup Custom.

[7]Glyphosate = ClearOut 41 Plus.

[8]Grass = yellow foxtail, barnyardgrass, and volunteer wheat.

Glyphosate with water quality adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Wahpeton, ND, to evaluate weed control from glyphosate and various adjuvants applied POST. Pioneer '91B33' soybean was planted on May 30, 2003. POST treatments were applied on July 7 at 12:30 pm with 75 F air, 87 F soil surface, 43% relative humidity, 10% clouds, 5 to 10 mph NW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V3 to V4 soybean. Weed species present were: 2 to 5 inch (<1/yd^2) redroot pigweed; 2 to 5 inch (5 to 15/ft^2) common lambsquarters; 3 to 8 inch (10 to 30/yd^2) common ragweed; 4 to 10 inch (5 to 25/yd^2) common cocklebur; 8 to 12 inch (5 to 10/yd^2) grass (yellow foxtail, barnyardgrass, and wild proso-millet); and 3 to 6 inch (1 to 5/yd^2) smartweed. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Table. Glyphosate with water quality adjuvants (Zollinger and Ries).

		July 21 and August 4		
Treatment[1]	Rate	Colq	Corw	Smwe
	(product/A)	(%)	(%)	(%)
Roundup Original+	0.5pt	70	81	71
Bronc	2.5gal/100gal	81	82	76
Bronc Plus	3gal/100gal	99	95	95
Bronc Max	2qt/100gal	62	81	72
Bronc Max+R-11	2qt/100gal+1qt/100gal	99	99	99
Cayuse Plus	3qt/100gal	80	75	77
Bronc Max EDT	2qt/100gal	80	80	80
Bronc Max EDT+R-11	2qt/100gal+1qt/100gal	99	99	99
Bronc Plus Dry EDT	10lb/100gal	99	99	99
Bronc Max+R-11+In-Place	2qt/100gal+1qt/100gal+4oz	99	99	99
Glyphosate Original+	0.75pt	79	95	81
Bronc	2.5gal/100gal	85	86	86
Bronc Plus	3gal/100gal	99	99	99
Bronc Max	2qt/100gal	86	95	86
Bronc Max+R-11	2qt/100gal+1qt/100gal	99	99	99
Cayuse Plus	3qt/100gal	87	86	86
Bronc Max EDT	2qt/100gal	86	85	85
Bronc Max EDT+R-11	2qt/100gal+1qt/100gal	99	99	99
Bronc Plus Dry EDT	10lb/100gal	99	99	99
Bronc Max+R-11+In-Place	2qt/100gal+1qt/100gal+4oz	99	99	99
LSD (0.05)		1	2	2

[1]Bronc = ammonium sulfate; Bronc Plus = ammonium sulfate + nonionic surfactant; Bronc Max = ammonium sulfate + pH buffer; R-11 = nonionic surfactant; Cayuse Plus = ammonium nitrate + ammonium sulfate + nonionic surfactant; Bronc Max EDT = ammonium sulfate + pH buffer + drift retardant; Bronc Plus Dry EDT = ammonium sulfate + nonionic surfactant + drift retardant + defoamer; In-Place = drift retardant. All adjuvants are distributed under Wilbur-Ellis.

Glyphosate treatments applied at 0.75 pt/A gave greater weed control than glyphosate treatments applied at 0.5 pt/A. In summary, glyphosate applied with adjuvants containing NIS and AMS gave the greatest weed control. All treatments controlled (99%) Rrpw, Grass, and Cocb (data not shown). (Dept. of Plant Sciences, North Dakota State University, Fargo).

Glyphosate with water conditioners and hard water. Ramsdale, Brad K. and Calvin G. Messersmith. The experiment was conducted to examine the influence of water conditioners and mixing order on glyphosate efficacy when treatments were applied in high-calcium hard water. 'Jerry' oat, 'Sunrise' proso millet, 'Neche' flax, and oilseed sunflower were planted as 6-ft-wide strips side-by-side on May 25, 2003, near Fargo, ND. Plots 10 ft wide were laid out perpendicular to the strips so that each plot contained all four assay species. Treatments were applied on June 18 with a CO_2-pressurized bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Spray volume was 8.5 gpa and spray pressure was 35 psi. Conditions at application were 75 F, 32% RH, wind at 10 to 15 mph, and sky 10% clouds. Plant sizes when treated were oat at 5- to 7-inch and 3- to 4-leaf, proso millet at 2- to 5-inch and 2- to 4-leaf, flax 1- to 5-inch, and sunflower 2- to 6-inch. Experimental design was a randomized complete block with four replicates. Herbicide treatments were applied in hard water that contained 1550 mg/L $CaCO_3$. Glyphosate was applied at a reduced rate to better detect treatment effects on glyphosate efficacy. The spray water conditioners were added to the spray mixture either before or after the glyphosate to determine whether mixing sequence affected glyphosate efficacy. Weed control was evaluated visually where 0 equaled no visible injury and 100 equaled complete control of assay species.

Glyphosate control of grass species was generally best when glyphosate was applied with AMS, Bronc Max, Quest, or Transport. Glyphosate applied with Choice or Insure-GL water conditioners provided greater species control compared to glyphosate alone, but these water conditioners were generally less effective for enhancing glyphosate efficacy than the other conditioners with this very hard water source. Mixing order did not influence glyphosate as efficacy was similar whether glyphosate was added before or after the water conditioner.

Table. Glyphosate with water conditioners and hard water. (Ramsdale and Messersmith)

			June 30				July 8			
Treatment[a]	Rate	Herbicide added[b]	Oat	Proso millet	Flax	Sunflower	Oat	Proso millet	Flax	Sunflower
	(lb/A)		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Glyphosate	0.06	Before	42	31	26	41	34	29	12	35
Glyphosate + AMS	0.06 + 1%	Before	68	70	54	74	61	66	54	75
Glyphosate + Choice	0.06 + 0.75%	Before	64	54	45	55	60	46	45	50
Glyphosate + Quest	0.06 + 0.75%	Before	71	71	54	71	68	70	65	71
Glyphosate + Bronc Max	0.06 + 0.75%	Before	64	66	56	74	63	61	61	76
Glyphosate + Insure-GL	0.06 + 0.25%	Before	61	50	39	51	58	48	44	48
Glyphosate + Transport	0.06 + 0.75%	Before	75	74	61	71	73	70	60	65
Glyphosate + AMS	0.06 + 1%	After	75	78	60	76	68	75	66	75
Glyphosate + Choice	0.06 + 0.75%	After	63	53	46	58	58	41	38	53
Glyphosate + Quest	0.06 + 0.75%	After	80	85	63	75	78	79	66	70
Glyphosate + Bronc Max	0.06 + 0.75%	After	64	66	56	75	61	59	60	75
Glyphosate + Insure-GL	0.06 + 0.25%	After	66	66	54	61	68	63	53	56
Glyphosate + Transport	0.06 + 0.75%	After	68	75	59	73	64	73	60	68
LSD (5%)			7	11	12	11	9	14	12	12

[a] Glyphosate = Roundup UltraMax, isopropylamine salt.; AMS = ammonium sulfate; Choice = water conditioning agent by Loveland Industries Inc.; Quest = water conditioning agent and AMS replacement by Helena Chemical Company; Bronc Max = water conditioning agent containing AMS solution by Wilbur-Ellis; Insure-GL = water conditioning agent by Brandt Consolidated; Transport = sequestering system by Precision Laboratories Inc.
[b] Mixing sequence where glyphosate was added to the spray mixture either before or after the water conditioner.

Glyphosate: spray volume and nozzles. Ramsdale, Brad K. and Calvin G. Messersmith. The experiment was conducted to examine the influence of spray volume and nozzle type on glyphosate efficacy. The experiment was established on fallow ground with a heavy infestation of common lambsquarters and wild buckwheat. Plots were 12 ft wide by 25 ft long. Treatments were applied on June 3 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing). Conditions at application were 65 F, 42% RH, wind 10 to 15 mph, and 80% clouds, and wild buckwheat and common lambsquarters were 3 to 8 inches tall. Experimental design was a randomized complete block with four replicates. Weed control was evaluated visually where 0 equaled no visible injury and 100 equaled complete control.

Glyphosate applied at 0.19 lb/A with Turbo TeeJet nozzles in 20 gpa spray volume provided the lowest control of wild buckwheat and common lambsquarters. Similarly, glyphosate efficacy at 0.19 lb/A when applied with AirMix nozzles decreased as spray volume increased from 10 to 20 gpa. The lower rate of glyphosate was generally maximized by application in 5 gpa with the two drift-reducing nozzles. Glyphosate at 0.38 lb/A was more effective in 5 or 10 gpa than in 20 gpa spray volume when applied with XR or Turbo TeeJet nozzles. However, glyphosate at 0.38 lb/A applied with AirMix nozzles was equally effective at all three spray volumes. Overall, these data indicate that glyphosate efficacy increases as spray volume decreases, which is in agreement with many previous experiments. These data also suggest the new AirMix venturi nozzle was more effective than the XR or Turbo TeeJet nozzles in maintaining glyphosate efficacy over varying treatment conditions.

Table. Glyphosate: spray volume and nozzles. (Ramsdale and Messersmith)

				June 17		July 1	
Treatment[a]	Rate	Volume	Tip[b]	Wild buckwheat	Common lambsquarters	Wild buckwheat	Common lambsquarters
	(lb/A)	(gpa)		(%)	(%)	(%)	(%)
Glyphosate	0.19	5	XR 11001	25	58	36	59
Glyphosate	0.19	5	TT 11001	55	81	60	84
Glyphosate	0.19	5	AM 11001	48	77	59	81
Glyphosate	0.19	10	XR 11002	26	55	36	58
Glyphosate	0.19	10	TT 11002	33	59	39	61
Glyphosate	0.19	10	AM 11002	45	74	54	78
Glyphosate	0.19	20	XR 11004	29	60	33	53
Glyphosate	0.19	20	TT 11004	16	31	15	41
Glyphosate	0.19	20	AM 11004	28	54	29	48
Glyphosate	0.38	5	XR 11001	66	88	61	92
Glyphosate	0.38	5	TT 11001	70	91	66	93
Glyphosate	0.38	5	AM 11001	66	89	65	91
Glyphosate	0.38	10	XR 11002	60	86	70	94
Glyphosate	0.38	10	TT 11002	53	81	63	91
Glyphosate	0.38	10	AM 11002	71	92	79	97
Glyphosate	0.38	20	XR 11004	41	71	48	75
Glyphosate	0.38	20	TT 11004	39	70	48	76
Glyphosate	0.38	20	AM 11004	64	86	65	94
LSD (5%)				14	12	14	11

[a] Glyphosate = Roundup UltraMax®, isopropylamine salt.
[b] XR = Extended Range and TT = Turbo TeeJet nozzles by Spraying Systems Co.; AM = AirMix nozzles by Greenleaf Technologies. Treatments were applied at 28 psi and 5 mph.

Acifluorfen: spray volume and adjuvants. Ramsdale, Brad K. and Calvin G. Messersmith. The experiment was conducted to examine the influence of spray volume and adjuvants on acifluorfen efficacy. Oilseed sunflower, 'Neche' flax, and 'Mancan' tame buckwheat were planted as 6-ft-wide strips side-by-side on May 25, 2003, near Fargo, ND. Plots 12 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on July 2 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. All treatments were applied at 20 psi. Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles, and speed was adjusted to apply the correct volume with each nozzle. Conditions at application were 78 F, 70% RH, wind 8 to 10 mph, and sky 80% clouds. Sunflower was 8- to 12-inch, flax 8- to 12-inch, and buckwheat 8- to 15-inch. Experimental design was a randomized complete block with four replicates. Weed control was evaluated visually where 0 equaled no visible injury and 100 equaled complete control of assay species.

Acifluorfen efficacy was generally the highest when applied with Scoil at 1.5 pt/A in 5, 10, or 20 gpa spray volume, or when applied with Quad 7 at 1% v/v in 10 or 20 gpa spray volume. Broadleaf control by acifluorfen plus Herbimax at 1.5 pt/A or Activator 90 at 0.25% v/v was not influenced by spray volume, but control was less than by acifluorfen plus Scoil or Quad 7.

Table. Acifluorfen: spray volume and adjuvants. (Ramsdale and Messersmith)

			July 16			July 23		
Treatment[a]	Rate	Volume[b]	Sunflower	Tame buckwheat	Flax	Sunflower	Tame buckwheat	Flax
	(lb/A)	(gpa)	(%)	(%)	(%)	(%)	(%)	(%)
Acifluorfen + Scoil	0.13 + 1.5 pt	2.5	35	60	56	30	51	53
Acifluorfen + Quad 7	0.13 + 1%	2.5	25	53	45	21	46	44
Acifluorfen + Activator 90	0.13 + 0.25%	2.5	30	49	46	29	46	46
Acifluorfen + Herbimax	0.13 + 1.5 pt	2.5	34	55	39	36	55	45
Acifluorfen + Scoil	0.13 + 1.5 pt	5	45	75	64	46	76	65
Acifluorfen + Quad 7	0.13 + 1%	5	35	69	51	33	71	54
Acifluorfen + Activator 90	0.13 + 0.25%	5	30	46	50	26	41	48
Acifluorfen + Herbimax	0.13 + 1.5 pt	5	34	61	50	29	55	53
Acifluorfen + Scoil	0.13 + 1.5 pt	10	43	61	61	44	65	63
Acifluorfen + Quad 7	0.13 + 1%	10	41	76	64	41	80	64
Acifluorfen + Activator 90	0.13 + 0.25%	10	28	44	49	25	43	54
Acifluorfen + Herbimax	0.13 + 1.5 pt	10	34	53	54	29	49	50
Acifluorfen + Scoil	0.13 + 1.5 pt	20	46	70	64	44	70	61
Acifluorfen + Quad 7	0.13 + 1%	20	45	70	65	41	71	64
Acifluorfen + Activator 90	0.13 + 0.25%	20	36	50	56	30	41	55
Acifluorfen + Herbimax	0.13 + 1.5 pt	20	30	54	46	30	48	49
LSD (5%)			8	10	9	7	8	8

[a] Scoil = methylated seed oil; Quad 7 = basic pH blend adjuvant; Activator 90 = nonionic surfactant; Herbimax = petroleum oil concentrate.

[b] Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles.

Bentazon: spray volume and adjuvants. Ramsdale, Brad K. and Calvin G. Messersmith. The experiment was conducted to examine the influence of spray volume and adjuvants on bentazon efficacy. Oilseed sunflower and 'Mancan' tame buckwheat were planted as 6-ft-wide strips side-by-side on May 25, 2003, near Fargo, ND. Plots 12 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on June 19 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. All treatments were applied at 20 psi. Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles, and speed was adjusted to apply the correct volume with each nozzle. Conditions at application were 78 F, 30% RH, wind 10 to 15 mph, and sky clear. Sunflower was 2- to 5-inch, flax 1- to 5-inch, and buckwheat 2- to 5-inch. Experimental design was a randomized complete block with four replicates. Weed control was evaluated visually where 0 equaled no visible injury and 100 equaled complete control of assay species.

Bentazon efficacy increased as spray volume increased when applied with Quad 7 at 1% v/v. However, bentazon efficacy was similar for all spray volumes when applied with Scoil at 1.5 pt/A. Sunflower and buckwheat control by bentazon plus Scoil methylated seed oil or Quad 7 basic pH blend adjuvants were generally similar and greater than bentazon plus Herbimax petroleum oil. These data support previous experiments where efficacy with most herbicides increased as spray volume increased when adjuvants were applied as a percentage of spray volume, but efficacy was similar for all spray volumes when adjuvants were applied on a per acre basis.

Table. Bentazon: spray volume and adjuvants. (Ramsdale and Messersmith)

			June 30		July 8	
Treatment[a]	Rate	Volume[b]	Tame buckwheat	Sunflower	Tame buckwheat	Sunflower
	(lb/A)	(gpa)	(%)	(%)	(%)	(%)
Bentazon + Scoil	0.5 + 1.5 pt	2.5	41	92	40	68
Bentazon + Quad 7	0.5 + 1%	2.5	34	81	31	48
Bentazon + Herbimax	0.5 + 1.5 pt	2.5	24	70	20	41
Bentazon + Scoil	0.5 + 1.5 pt	5	40	89	38	64
Bentazon + Quad 7	0.5 + 1%	5	39	86	30	61
Bentazon + Herbimax	0.5 + 1.5 pt	5	33	81	26	58
Bentazon + Scoil	0.5 + 1.5 pt	10	46	92	39	70
Bentazon + Quad 7	0.5 + 1%	10	48	87	41	61
Bentazon + Herbimax	0.5 + 1.5 pt	10	36	81	33	54
Bentazon + Scoil	0.5 + 1.5 pt	20	41	88	36	59
Bentazon + Quad 7	0.5 + 1%	20	58	97	54	73
Bentazon + Herbimax	0.5 + 1.5 pt	20	30	83	30	56
LSD (5%)			18	9	NS	13

[a] Scoil = methylated seed oil; Quad 7 = basic pH blend adjuvant; Herbimax = petroleum oil concentrate.
[b] Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles.

Fomesafen (Flexstar®): spray volume and adjuvants, Fargo. Ramsdale, Brad K. and Calvin G. Messersmith. The experiment was conducted to examine the influence of spray volume and adjuvants on fomesafen efficacy. Oilseed sunflower, 'Neche' flax, and 'Mancan' tame buckwheat were planted as 6-ft-wide strips side-by-side on May 25, 2003, near Fargo, ND. Plots 12 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on July 2 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. All treatments were applied at 20 psi. Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles, and speed was adjusted to apply the correct volume with each nozzle. Conditions at application were 76 F, 75% RH, wind 8 to 10 mph, and sky 20% clouds. Sunflower was 8- to 12-inch, flax 8- to 12-inch, and buckwheat 8- to 15-inch. Experimental design was a randomized complete block with four replicates. Weed control was evaluated visually where 0 equaled no visible injury and 100 equaled complete control of assay species.

The Flexstar® formulation of fomesafen contains a partial adjuvant load but still requires additional nonionic surfactant or oil-based adjuvant. Fomesafen (Flexstar) efficacy was generally not influenced by changes in spray volume, regardless of spray adjuvant. Quad 7 and Scoil at 1.5 pt/A were generally the most effective adjuvants for flax control by fomesafen while Activator 90 was least effective. Flax control by fomesafen with Activator 90 at 0.25% v/v trended to decrease as volume increased, perhaps do to poor spray retention by flax as the total quantity of Activator 90 applied would increase with increasing spray volume. The adjuvant in the Flexstar® formulation was likely important for herbicide efficacy when applied at low spray volumes with Activator 90 at 0.25% v/v or Quad 7 at 1% v/v, where these supplemental adjuvants were applied on a percentage v/v basis

Table. Fomesafen (Flexstar®): spray volume and adjuvants. (Ramsdale and Messersmith)

			July 16			July 23		
Treatment[a]	Rate	Volume[b]	Sunflower	Flax	Tame buckwheat	Sunflower	Flax	Tame buckwheat
	(lb/A)	(gpa)	(%)	(%)	(%)	(%)	(%)	(%)
Fomesafen + Scoil	0.09 + 1.5 pt	2.5	35	68	51	30	59	36
Fomesafen + Quad 7	0.09 + 1%	2.5	36	79	51	29	69	34
Fomesafen + Activator 90	0.09 + 0.25%	2.5	33	66	45	29	53	33
Fomesafen + Herbimax	0.09 + 1.5 pt	2.5	33	68	51	23	55	33
Fomesafen + Scoil	0.09 + 1.5 pt	5	38	79	61	28	65	39
Fomesafen + Quad 7	0.09 + 1%	5	41	76	54	28	68	38
Fomesafen + Activator 90	0.09 + 0.25%	5	28	58	45	23	49	35
Fomesafen + Herbimax	0.09 + 1.5 pt	5	38	71	58	29	58	34
Fomesafen + Scoil	0.09 + 1.5 pt	10	36	76	50	33	60	33
Fomesafen + Quad 7	0.09 + 1%	10	39	79	50	33	64	33
Fomesafen + Activator 90	0.09 + 0.25%	10	30	50	46	24	36	35
Fomesafen + Herbimax	0.09 + 1.5 pt	10	36	63	48	30	51	35
Fomesafen + Scoil	0.09 + 1.5 pt	20	35	64	51	30	50	36
Fomesafen + Quad 7	0.09 + 1%	20	39	79	59	33	55	38
Fomesafen + Activator 90	0.09 + 0.25%	20	31	51	51	25	36	36
Fomesafen + Herbimax	0.09 + 1.5 pt	20	31	59	56	25	44	41
LSD (5%)			NS	10	NS	NS	15	NS

[a] Scoil = methylated seed oil; Quad 7 = basic pH blend adjuvant; Activator 90 = nonionic surfactant; Herbimax = petroleum oil concentrate.
[b] Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles.

Fomesafen (Reflex®): spray volume and adjuvants. Ramsdale, Brad K. and Calvin G. Messersmith. The experiment was conducted to examine the influence of spray volume and adjuvants on fomesafen (Reflex®) efficacy. Oilseed sunflower, 'Neche' flax, and 'Mancan' tame buckwheat were planted as 6-ft-wide strips side-by-side on May 25, 2003, near Fargo, ND. Plots 12 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on July 2 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. All treatments were applied at 20 psi. Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles, and speed was adjusted to apply the correct volume with each nozzle. Conditions at treatment were 78 F, 70% RH, wind 8-10 mph, and sky 80% clouds. Sunflower was 8- to 12-inch, flax 8- to 12-inch, and buckwheat 8- to 15-inch. Experimental design was a randomized complete block with four replicates. Weed control was evaluated visually where 0 equaled no visible injury and 100 equaled complete control of assay species.

The Reflex® formulation of fomesafen does not include an adjuvant. Overall, fomesafen (Reflex®) was most effective when applied with Scoil methylated seed oil adjuvant at 1.5 pt/A. Fomesafen plus Scoil provided similar broadleaf control whether applied in 2.5, 5, 10, or 20 gpa spray volume. Broadleaf control by fomesafen plus Herbimax crop oil concentrate at 1.5 pt/A also was generally not influenced by changes in spray volume. Fomesafen plus Activator 90 nonionic surfactant at 0.25% v/v was most effective when applied in 20 gpa spray volume. Likewise, fomesafen plus Quad 7 basic blend adjuvant at 1% v/v was generally most effective in 20 gpa spray volume, providing broadleaf control that was similar to fomesafen plus Scoil. These data support previous experiments where efficacy increase as spray volume increase when adjuvants were applied as a percentage of spray volume, but efficacy was similar for all spray volumes when adjuvants were applied on a per acre basis.

Table. Fomesafen: spray volume and adjuvants. (Ramsdale and Messersmith)

			July 16			July 23		
Treatment[a]	Rate	Volume[b]	Sunflower	Flax	Tame buckwheat	Sunflower	Flax	Tame buckwheat
	(lb/A)	(gpa)	(%)	(%)	(%)	(%)	(%)	(%)
Fomesafen + Scoil	0.09 + 1.5 pt	2.5	43	68	45	35	59	36
Fomesafen + Quad 7	0.09 + 1%	2.5	26	53	33	16	36	25
Fomesafen + Activator 90	0.09 + 0.25%	2.5	18	23	24	14	18	23
Fomesafen + Herbimax	0.09 + 1.5 pt	2.5	25	51	39	19	39	30
Fomesafen + Scoil	0.09 + 1.5 pt	5	39	74	61	33	68	51
Fomesafen + Quad 7	0.09 + 1%	5	35	65	39	29	59	33
Fomesafen + Activator 90	0.09 + 0.25%	5	25	34	29	21	26	25
Fomesafen + Herbimax	0.09 + 1.5 pt	5	35	68	55	29	61	45
Fomesafen + Scoil	0.09 + 1.5 pt	10	48	78	59	40	71	49
Fomesafen + Quad 7	0.09 + 1%	10	35	70	43	29	60	38
Fomesafen + Activator 90	0.09 + 0.25%	10	20	39	36	20	31	30
Fomesafen + Herbimax	0.09 + 1.5 pt	10	26	58	48	18	46	38
Fomesafen + Scoil	0.09 + 1.5 pt	20	36	71	60	31	64	51
Fomesafen + Quad 7	0.09 + 1%	20	46	85	64	41	83	56
Fomesafen + Activator 90	0.09 + 0.25%	20	29	49	46	20	34	39
Fomesafen + Herbimax	0.09 + 1.5 pt	20	26	58	49	15	45	38
LSD (5%)			10	9	10	10	10	10

[a] Fomesafen = Reflex® formulation; Scoil = methylated seed oil; Quad 7 = basic pH blend adjuvant; Activator 90 = nonionic surfactant; Herbimax = petroleum oil concentrate.
[b] Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles.

Lactofen: spray volume and adjuvants. Ramsdale, Brad K. and Calvin G. Messersmith. The experiment was conducted to examine the influence of spray volume and adjuvants on lactofen efficacy. Oilseed sunflower, 'Neche' flax, and 'Mancan' tame buckwheat were planted as 6-ft-wide strips side-by-side on May 25, 2003, near Fargo, ND. Plots 12 ft wide were laid out perpendicular to the strips so that each plot contained all three assay species. Treatments were applied on July 2 with an all-terrain vehicle equipped with a four-nozzle boom (20-inch spacing) offset to one side. All treatments were applied at 20 psi. Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles, and speed was adjusted to apply the correct volume with each nozzle. Conditions at application were 76 F, 75% RH, wind 8 to 10 mph, and sky 20% clouds. Sunflower was 8- to 12-inch, flax 8- to 12-inch, and buckwheat 8- to 15-inch. Experimental design was a randomized complete block with four replicates. Weed control was evaluated visually where 0 equaled no visible injury and 100 equaled complete control of assay species.

Overall, lactofen was most effective with Herbimax petroleum oil and when applied in 20 gpa spray volume. Broadleaf species control with lactofen increased as spray volume increased, regardless of the spray adjuvant. The rate of Herbimax was not critical in determining lactofen efficacy, as control was generally similar whether the rate of Herbimax was 1% v/v or 1.5 pt/A. The increased plant coverage by high spray volumes was important for maximizing the efficacy of lactofen.

Table. Lactofen: spray volume and adjuvants. (Ramsdale and Messersmith)

			July 16			July 23		
Treatment[a]	Rate	Volume[b]	Sunflower	Flax	Tame buckwheat	Sunflower	Flax	Tame buckwheat
	(lb/A)	(gpa)	(%)	(%)	(%)	(%)	(%)	(%)
Lactofen + Scoil	0.09 + 1.5 pt	2.5	31	61	29	25	43	21
Lactofen + Herbimax	0.09 + 1%	2.5	35	70	30	25	61	23
Lactofen + Herbimax	0.09 + 1.5 pt	2.5	31	69	35	19	60	29
Lactofen + Scoil	0.09 + 1.5 pt	5	36	73	38	23	66	30
Lactofen + Herbimax	0.09 + 1%	5	41	80	33	29	78	25
Lactofen + Herbimax	0.09 + 1.5 pt	5	41	79	36	31	71	30
Lactofen + Scoil	0.09 + 1.5 pt	10	39	76	34	31	66	30
Lactofen + Herbimax	0.09 + 1%	10	44	84	34	33	80	28
Lactofen + Herbimax	0.09 + 1.5 pt	10	49	85	40	40	84	36
Lactofen + Scoil	0.09 + 1.5 pt	20	44	84	36	34	79	34
Lactofen + Herbimax	0.09 + 1%	20	49	90	48	40	89	41
Lactofen + Herbimax	0.09 + 1.5 pt	20	50	89	50	38	86	38
LSD (5%)			9	9	11	11	13	10

[a] Scoil = methylated seed oil; Herbimax = petroleum oil concentrate.
[b] Spray volumes at 2.5 and 5 gpa were applied with Turbo TeeJet 11001 nozzles and at 10 and 20 gpa were applied with Turbo TeeJet 11004 nozzles.