Crop response to KIH-485 carryover. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate crop response in 2004 to KIH-485 applied PRE in 2003. KIH-485 was applied PRE on May 28, 2003 at 10:00 am with 71 F air, 57 F soil at a 4 inch depth, 50% relative humidity, 100% clouds, 8 to 12 mph SSW wind, dry soil surface, moist subsoil, and no dew present. Treatments were applied to the entire 10 by 40 foot plots with a bicycle-type plot sprayer with an attached 10 foot boom delivering 17 gpa at 40 psi through 8002 TeeJet flat fan nozzles. The study was maintained in 2003 by several mowings and tilled with a field cultivator parallel with the plot lengths to minimize soil contamination into adjacent plots in the fall. On May 19, 2004, a shallow cultivation with a field cultivator parallel with the plot lengths was performed followed by the planting of: Seeds 2000 'Charger' sunflower, 'Rider' canola, 'ND096' flax, and Betaseed '6610' sugarbeet in each plot. The experiment had a randomized complete block design with three replicates per treatment.

KIH-485 is an experimental herbicide from Kumiai America. The chemistry, fate and action, and biological information has not been released at this time. Weed control through soil activity, and similar application timing, weed spectrum, and rate comparison to metolachlor and other acetanilides would lead one to assume it is of similar chemistry. Acetanilides have a short soil residue and most all crops can be planted the year following application without any crop response. These data show that KIH-485 does have soil residue that extends to the following year and injures susceptible crops. Flax stunting was not visible at the final evaluation. Sugarbeet exhibited severe stunting and stand loss. Canola and sunflower was only affected terminally by the higher rate. Carryover studies should be conducted in other areas with different soil conditions and environmental patterns. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Crop response to KIH-485 carryover (Zollinger and Ries).

		21 DAP[2]				28 DAP				42 DAP			
Treatment[1]	Rate	Flax	Sgbt[3]	Canola	Snfl[4]	Flax	Sgbt	Canola	Snfl	Flax	Sgbt	Canola	Snfl
	(lb/A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
KIH-485	0.223	10	50	20	10	20	70	30	20	0	70	0	0
KIH-485	0.446	10	63	50	55	20	77	70	30	0	77	25	20
LSD (0.05)		0	57	0	7	0	29	0	0	0	29	0	0

[1]KIH-485 = a proprietary herbicide from Kumiai America.
[2]DAP = days after planting.
[3]Sgbt = sugarbeet.
[4]Snfl = sunflower.

Blue

Fall applied MANA-282. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate weed control the following spring from fall applied herbicides on non-cropland. The experiment was established on September 15, 2003, by preparing the study area with a field cultivator at a depth of 2 to 3 inches until all weeds were tilled under. Following cultivation, Early-PRE (E-PRE) treatments were applied at 10:45 am with 46 F air, 44 F soil at a 4 inch depth, 60% relative humidity, 50% clouds, 1 to 3 mph N wind, dry to moist soil surface, and moist subsoil. Late-PRE (L-PRE) treatments were applied on November 14 at 10:00 am with 36 F air, 30 F soil at a 4 inch depth, 78% relative humidity, 0% clouds, 3 to 5 mph N wind, dry to moist soil surface, and moist subsoil. 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 TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

No tillage was made in the spring following fall application. MANA-282 is 7.75 lb ai/gal of metolachlor + safener. The objective of this study was to determine the efficacy of MANA-282 vs. Dual II Magnum on important corn weeds when applied in the fall after harvest. Generally, MANA-282 gave similar weed control to Dual II Magnum at the same rate structure for each herbicide and generally, there were little differences in weed control with early preemergence (E-PRE) and late preemergence (L-PRE) applications. Good to excellent residual control resulted until June 11. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Fall applied MANA-282 (Zollinger and Ries).

		May 28, 2004			June 11, 2004			July 1, 2004			
Treatment[1]	Rate	Yeft	Rrpw	Colq	Yeft	Rrpw	Colq	Yeft	Rrpw	Colq	Kochia
	(product/A)	---- (%) ----			---- (%) ----			------ (%) ------			
E-PRE											
MANA-282	1.5pt	82	90	70	72	70	42	50	20	20	0
MANA-282	2pt	95	99	80	87	90	50	90	20	20	0
MANA-282	2.5pt	96	99	85	95	95	70	95	57	70	50
MANA-282	3pt	99	99	90	96	96	83	80	70	70	20
Dual II Magnum	1pt	80	90	70	70	80	50	50	20	20	0
Dual II Magnum	1.33pt	95	99	80	83	90	53	70	50	43	0
Dual II Magnum	1.67pt	99	99	85	90	95	70	83	80	70	50
Dual II Magnum	2pt	99	96	88	95	95	80	90	90	80	50
L-PRE											
MANA-282	1.5pt	80	88	70	70	72	50	50	20	20	0
MANA-282	2pt	90	99	80	90	90	70	83	60	60	33
MANA-282	2.5pt	95	99	85	92	95	70	85	70	70	50
MANA-282	3pt	99	99	85	92	95	70	90	83	70	53
Dual II Magnum	1pt	82	90	75	83	96	50	77	63	27	0
Dual II Magnum	1.33pt	93	99	75	92	93	53	82	70	40	20
Dual II Magnum	1.67pt	99	99	77	96	96	68	90	75	50	50
Dual II Magnum	2pt	99	99	82	96	97	73	90	82	70	50
Untreated		0	0	0	0	0	0	0	0	0	0
LSD (0.05)		2	4	5	4	2	4	6	8	8	3

[1]MANA-282 = proprietary herbicide from Mahkteshim-Agan.

KIH-485 applied PRE in corn. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted at three locations in North Dakota to evaluate weed control and crop injury to an experimental herbicide applied PRE to corn. At Carrington, DeKalb 'DKC35-51' corn was planted on May 7, 2004. PRE treatments were applied on May 18 at 2:00 pm with 72 F air, 61 F soil surface at a 4 inch depth, 22% relative humidity, 15% clouds, 3 to 7 mph S wind, dry soil surface, and moist subsoil.

At Casselton, DeKalb 'DKC35-50' corn was planted on April 28, 2004. PRE treatments were applied on May 4 at 9:30 am with 51 F air, 49 F soil surface at a 4 inch depth, 35% relative humidity, 0% clouds, 5 to10 mph NW wind, dry soil surface, and dry subsoil.

At Valley City, Kaystar 'KX-279' corn was planted on May 3, 2004. PRE treatments were applied on May 4, 2004 at 4:10 pm with 60 F air, 56 F soil at a 4 inch depth, 20% relative humidity, 0% clouds, 3 to 6 mph N wind, dry soil surface, and dry subsoil.

Treatments at all locations 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 TeeJet flat-fan nozzles. The experiments had randomized complete block design with three replications per treatment.

At Casselton, on May 18 (14 DAA), no weeds had emerged. Weather had been very dry and cold, soil temps not above 50 degrees. First rains came May 11, but weather had remained cold with soil temps below 50 degrees. Conditions were the same on May 25 (21 DAA), but corn was at spike stage. On June 1 (28 DAT), corn was 2 to 3 inches tall (1 to 2 collar). Yeft were just emerging and not uniform so ratings were not taken. Wild mustard was 1 to 3 inch rosettes. On June 15 (42 DAT), corn was 5 to 6 inches tall (3 to 4 collar). Yellow foxtail was 1 to 2 inches tall and redroot pigweed and common lambsquarters were just emerging. Wild mustard was 1 to 5 inch rosettes. No corn injury was observed.

At Valley City on May 18 (14 DAA), no weeds emerged. Weather has been very dry and cold, soil temps not above 50 degrees. First rains came May 11 but weather has remained cold with soil temps below 50 degrees. Conditions were the same on May 25 (21 DAA) but corn was at spike to V2. On June 1, corn was 2 inches tall (2 collar). Full weed spectrum emergence had not occurred. On June 8, corn was 3 to 4 inches tall (3 collar) and green foxtail was 3 leaves and less than 1 inch tall. Redroot pigweed, marshelder, nightshade, and common ragweed are germinating but was too early to rate. On June 15 (42 DAT), weeds were small only 1 to 1.5 inches. Corn was 4 to 5 inches tall and (3 to 4 collar). On June 29, (56 DAT), corn was still stunted from cold weather. Corn height was around 12 inches tall and there was no change in weed control from the last rating.

The purpose of these experiments were to evaluate weed control in corn from KIH-485 applied in a light soil (Valley City), in a medium textured soil (Carrington), and in a heavy textured soil (Casselton). Other soil-applied products that are commercially available were added as standard treatments. The mode of action and chemistry is not known, but is thought that it may be similar to the acetanilide chemistry. By these data it appears that KIH-485 is not an acetanilide herbicide because of significant broadleaf weed control. Foxtail control was excellent with all treatments except Dual. Of the acetanilide herbicides, acetachlor has given the greatest broadleaf weed control but does not control large-seeded broadleaf weeds like wild mustard and wild buckwheat. KIH-485 controls many weeds that acetanilde herbicide do not namely wild buckwheat, kochia, common ragweed, and marshelder. Good to excellent control of these broadleaf weeds occurred when reduced rates of KIH-485 were used. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table 1. KIH-485 applied PRE in corn, Carrington (Zollinger and Ries).

		28 DAT					42 DAT						52 DAT					
Treatment[1]	Rate	Fxtl[2]	V wht[3]	Rrpw	Colq	Wibw	Fxtl	V wht	Rrpw	Colq	Wibw	Koch[4]	Fxtl	V wht	Rrpw	Colq	Wibw	Koch
	(product/A)	(%)					(%)						(%)					
KIH-485	2 oz	99	0	99	95	87	99	20	99	95	87	80	99	20	99	95	87	80
KIH-485	4 oz	99	27	99	99	92	99	30	99	99	92	70	99	30	99	99	80	70
KIH-485	5 oz	99	30	99	99	99	99	50	99	99	99	99	99	50	99	99	99	99
KIH-485	6 oz	99	30	99	99	99	99	60	99	99	99	99	99	60	99	99	99	99
Dual II Magnum	0.65 pt	99	0	80	68	53	99	20	67	60	23	20	99	7	73	67	0	0
Dual II Magnum	1.33 pt	99	30	83	80	57	99	30	70	70	30	30	99	20	50	57	0	0
Harness	0.88 pt	99	30	99	98	80	99	30	83	78	30	40	99	30	70	60	0	0
Harness	1.25 pt	99	50	99	98	93	99	50	99	85	50	50	99	50	99	70	30	40
Harness	1.75 pt	99	85	99	99	99	99	85	99	91	96	68	99	70	99	80	50	50
Outlook	9 fl oz	99	0	90	73	67	99	0	90	65	20	30	99	0	70	65	3	0
Outlook	18 fl oz	99	20	99	83	77	99	20	99	83	47	37	99	20	99	70	66	20
Define	10 fl oz	93	0	57	73	40	88	7	37	37	0	0	88	7	23	30	0	0
Define	19 fl oz	99	0	85	92	50	99	40	70	80	30	30	99	40	50	80	30	30
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		5	3	5	6	5	4	5	4	7	5	3	4	11	6	6	4	3

[1]KIH-485 = a proprietary herbicide from Kumiai America.
[2]Fxtl = yellow and green foxtail.
[3]V wht = volunteer wheat.
[4]Koch = Kochia.

Table 2. KIH-485 applied PRE in corn, Casselton (Zollinger and Ries).

Treatment[1]	Rate	42 DAT		73 DAT				
		Yeft	Wimu	Yeft	Wimu	Rrpw	Colq	Wibw
	(product/A)	---- (%) ----		---------- (%) ----------				
KIH-485	2 oz	87	87	99	50	99	99	50
KIH-485	4 oz	99	78	99	83	99	99	88
KIH-485	5 oz	99	83	99	91	99	99	95
KIH-485	6 oz	99	95	99	99	99	99	99
Dual II Magnum	0.65 pt	70	20	82	0	73	73	0
Dual II Magnum	1.33 pt	83	40	87	0	78	75	0
Harness	0.88 pt	83	50	99	20	99	99	47
Harness	1.25 pt	99	63	99	72	99	99	62
Harness	1.75 pt	98	75	99	83	99	99	63
Outlook	9 fl oz	75	30	72	0	99	99	0
Outlook	18 fl oz	90	40	90	40	99	99	0
Define	10 fl oz	80	20	77	0	90	90	0
Define	19 fl oz	93	30	83	0	95	95	0
Untreated		0	0	0	0	0	0	0
LSD (0.05)		3	4	3	2	2	2	4

[1]KIH-485 = a proprietary herbicide from Kumiai America.

Table 3. KIH-485 applied PRE in corn, Valley City (Zollinger and Ries).

Treatment[1]	Rate	35 DAT	42 DAT					82 DAT				
		Grft	Grft	Rrpw	Corw	Mael	Wibw	Grft	Rrpw	Corw	Mael	Wibw
	(product/A)	- - (%) - -	- - - - - - - - - - - - - - - (%) - - - - - - - - - - - - - - -					- - - - - - - - - - - - - - - (%) - - - - - - - - - - - - - - -				
KIH-485	2 oz	80	80	70	40	40	80	80	89	79	79	83
KIH-485	4 oz	96	96	99	99	99	85	96	99	99	99	99
KIH-485	5 oz	98	98	99	99	99	99	97	99	99	99	99
KIH-485	6 oz	99	99	99	99	99	99	99	99	99	99	99
Dual II Magnum	0.65 pt	78	50	50	0	0	0	50	50	0	0	0
Dual II Magnum	1.33 pt	80	77	70	30	60	30	77	70	30	30	30
Harness	0.88 pt	96	95	95	70	70	40	85	99	99	70	40
Harness	1.25 pt	99	99	99	75	75	40	99	99	99	60	40
Harness	1.75 pt	99	99	99	83	83	50	99	99	99	90	90
Outlook	9 fl oz	99	97	99	70	70	20	85	99	99	70	20
Outlook	18 fl oz	97	87	98	80	80	40	90	99	99	80	50
Define	10 fl oz	68	60	90	57	57	30	60	90	90	57	30
Define	19 fl oz	88	87	92	70	70	30	90	92	90	70	30
Untreated		0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		3	4	2	3	3	5	3	8	15	15	13

[1]KIH-485 = a proprietary herbicide from Kumiai America.

Weed control with metolachlor formulations. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate weed control from treatments applied PRE 6 WBP (weeks before planting) and PRE 4 WBP. 6 WBP treatments were applied on May 7, 2004 at 8:00 am with 43 F air, 45 F subsoil at a 4 inch depth, 36% relative humidity, 20% clouds, 5 to 10 mph N wind, dry soil surface, and dry subsoil. 4 WBP treatments were applied on May 22 at 10:15 am with 60 F air, 53 F at a 4 inch depth, 43% relative humidity, 75% clouds, 4 to 6 mph N wind, dry soil surface, and moist subsoil. 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 TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

On May 21 no weeds had emerged. Weather had been very dry and cold soil temps not above 50 degrees. First rains came May 11 but weather remained cold with soil temps below 50 degrees. Conditions were the same on May 28. Ratings were not taken prior to June 4 because of delayed emergence from cold weather. At this time yellow foxtail was 1 inch tall and redroot pigweed was just emerging. On June 18, yellow foxtail was 1 to 2 inches tall and redroot pigweed was 1 inch tall.

Treatments were made at two application timings, 6 and 4 weeks before planting (WBP). Both products provided residual weed control well into 42 and 56 days after application. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Weed control with metolachlor formulations (Zollinger and Ries).

		6 WBP[2]							4 WBP										
		28 DAT		42 DAT		56 DAT			14 DAT		28 DAT		42 DAT			56 DAT			
Treatment[1]	Rate	Yeft	Rrpw	Yeft	Rrpw	Yeft	Rrpw	Kochia	Yeft	Rrpw	Yeft	Rrpw	Yeft	Rrpw	Kochia	Yeft	Rrpw	Kochia	Colq
	(product/A)	--(%)--		--(%)--		-----(%)-----			--(%)--		--(%)--		-----(%)-----			-------(%)-------			
RU Original	1 qt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MANA 282	1 pt	72	50	72	50	73	57	20	93	57	93	57	85	47	37	90	20	0	22
MANA 282	1.45 pt	98	96	98	96	93	73	27	70	50	70	50	67	50	23	90	20	0	20
MANA 282	2 pt	93	95	93	95	92	83	50	85	87	85	87	87	53	20	90	20	0	20
Dual II Magnum	0.67 pt	88	96	88	96	87	87	67	75	50	75	50	70	30	0	70	0	0	0
Dual II Magnum	1 pt	93	70	93	70	78	68	23	92	73	92	73	63	53	20	70	30	0	27
Dual II Magnum	2 pt	93	95	93	95	90	88	50	95	95	95	95	83	78	43	83	50	0	0
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		8	5	8	5	9	8	10	8	5	8	5	9	8	10	4	2	0	4

[1]MANA 282 = proprietary herbicide from Mahkteshim Agan.
[2]WBP = weeds before planting.

Application timing in glyphosate-resistant corn. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate weed control from treatments applied at different timings. DeKalb 'DKC35-50' glyphosate-resistant corn was planted on April 28, 2004. PRE treatments were applied on May 8 at 10:00 am with 66 F air, 52 F soil at 4 inch depth, 41% relative humidity, 0% clouds, 5 to 8 mph NW wind, dry soil surface, dry subsoil. POST treatments were applied on June 14 at 3:00 pm with 68 F air, 71 F soil surface, 33% relative humidity, 90% clouds, 0 to 5 mph N wind, good crop vigor, and no dew present to 5 to 7 inch (3 collar) corn. Weed species present were: 1 to 3 inch (15 to 20/yd^2) redroot pigweed; 1 to 3 inch (1 to 5/yd^2) common lambsquarters; 1 to 4 inch (1 to 5/yd^2) wild mustard; 1 to 3 inch (1 to 5/yd^2) wild buckwheat; 1 to 4 inch (10 to 20/yd^2) yellow foxtail; 1 to 3 inch (1 to 3/yd^2) common cocklebur. LPOST treatments were applied on June 18 at 8:00 am with 47 F air, 51 F soil surface, 76% relative humidity, 80% clouds, 5 to 8 mph NW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 8 to 12 inch (4 to 6 collar) corn. Weed species present were: 1 to 4 inch (15 to 20/yd^2) redroot pigweed; 1 to 5 inch (1 to 5/yd^2) common lambsquarters; 2 to 6 inch (1 to 5/yd^2) wild mustard; 1 to 3 inch (1 to 5/yd^2) wild buckwheat; 1 to 5 inch (10 to 20/yd^2) yellow foxtail; 1 to 5 inch (1 to 3/yd^2) common cocklebur. 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 TeeJet flat-fan nozzles for PRE treatments and 8.5 gpa at 40 psi with 8001 TeeJet flat-fan nozzles for POST and LPOST treatments. The experiment had randomized complete block design with three replications per treatment.

All treatments gave 99% yellow foxtail control and most treatments gave complete control of broadleaf weeds. There was no differences in glyphosate formulations or treatments as rates were high and residual products were used. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Application timing in glyphosate-resistant corn (Zollinger and Ries).

Treatment[1]	Rate	July 16					August 13					Corn
		Wimu	Rrpw	Colq	Wibw	Cocb	Wimu	Rrpw	Colq	Wibw	Cocb	Yield
	(product/A)	---------- (%) ----------					---------- (%) ----------					(bu/A)
PRE/POST												
Outlook/RU WeatherMax+AMS	12fl oz/22fl oz+3 lb	99	99	99	99	99	99	99	99	99	99	113.6
Outlook/RU Custom+Clarity+ NIS+AMS	12fl oz/24fl oz+8fl oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	98.4
Outlook/RU Custom+Distinct+ NIS+AMS	12fl oz/24fl oz+3oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	106.6
G-Max Lite/RU Custom+Distinct+ NIS+AMS	1.6pt/24fl oz+3oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	101.4
Outlook/RU Custom+ NIS+AMS	12fl oz/24fl oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	112.8
Outlook/RU Custom+Distinct+ NIS+AMS	12fl oz/24fl oz+3oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	105.2
POST												
RU WeatherMax+AMS	22fl oz+3 lb	90	90	90	70	90	90	90	90	70	90	109.4
RU Custom+Clarity+ NIS+AMS	24fl oz+8 fl oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	95.8
RU Custom+Distinct+ NIS+AMS	24fl oz+3oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	104.4
RU Custom+Prowl H_2O+ NIS+AMS	24fl oz+2.5pt+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	111.1
RU Custom+Prowl H_2O+Distinct+ NIS+AMS	24fl oz+2.5pt+3oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	116.5
RU Custom+G-Max Lite+Distinct+ NIS+AMS	24fl oz+1.6pt+3oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	119.0
LPOST												
RU WeatherMax+AMS	22fl oz+3 lb	99	99	99	99	99	99	99	99	99	99	114.0
RU Custom+Distinct+ NIS+AMS	24fl oz+3oz+ 0.25% v/v+3 lb	99	99	99	99	99	99	99	99	99	99	114.3
Untreated		0	0	0	0	0	0	0	0	0	0	91.5
LSD (0.05)		4	4	4	6	4	4	4	4	4	6	19.4

[1]RU = Roundup; NIS = nonionic surfactant = R-11; AMS = ammonium sulfate.

POST corn applications at two weed stages. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate weed control and crop injury from treatments applied at two weed stages. DeKalb 'DKC35-50' glyphosate-resistant corn was planted on April 28, 2004. EPOST treatments were applied on June 14 at 2:45 pm with 68 F air, 72 F soil surface, 33% relative humidity, 90% clouds, 0 to 5 mph N wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 5 to 6 inch (3 to 4 collar) corn. Weed species present: 1 to 3inch (30 to 75/yd^2) redroot pigweed; 1 to 3 inch (15 to 30/yd^2) common lambsquarters; 1 to 4 inch (1 to 5/yd^2) wild mustard; 0.5 to 3 inch (15 to 75/yd^2) yellow foxtail; 1 to 3 inch (1 to 3/yd^2) common cocklebur, 1 to 2 inch (2 to 5/yd^2) wild buckwheat. POST treatments were applied on June 17 at 11:05 am with 74 F air, 77 F soil surface, 32% relative humidity, 0% clouds, 5 to 8 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 8 to 10 inch (4 to 5 collar) corn. Weed species present were: 1 to 5 inch (30 to 75/yd^2) redroot pigweed; 1 to 4 inch (15 to 30/yd^2) common lambsquarters; 2 to 6 inch (1 to 5/yd^2) wild mustard; 0.5 to 4 inch (15 to 75/yd^2) yellow foxtail; 1 to 4 inch (1 to 3/yd^2) common cocklebur; 1 to 3 inch (2 to 5/yd^2) wild buckwheat. 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 TeeJet flat-fan nozzles to both EPOST and POST treatments. The experiment had randomized complete block design with three replications per treatment.

Option may give less than adequate yellow foxtail control under stressed conditions or if the foxtail is large. Define enhances yellow foxtail control from Option. Increasing MSO rate from 1.5 to 2 pt/A improved yellow foxtail control. Distinct controls most broadleaf weeds. No corn injury was observed at June 21 and June 28 and all treatments controlled wild mustard. There is no explanation of the yield data showing POST applications yielding more than EPOST treatments since no injury was observed. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. POST corn applications at two weed stages (Zollinger and Ries).

Treatment[1]	Rate	June 28				July1					July 15					Corn
		Yeft	Rrpw	Colq	Cocb	Yeft	Rrpw	Colq	Cocb	Wibw	Yeft	Rrpw	Colq	Cocb	Wibw	Yield
	(product/A)	------- (%) -------				---------- (%) ----------					---------- (%) ----------					(bu/A)
EPOST																
Option+Define+Distinct MSO+28% N	1.5oz+9.6fl oz+2oz+ 1.5pt+2qt	91	97	97	91	99	99	99	99	99	99	99	99	99	99	75.9
Option+Prowl H_2O+ Distinct+ MSO+28% N	1.5oz+28fl oz+ 2oz+1.5pt+2qt	75	77	70	75	95	97	96	96	99	95	99	99	99	99	89.7
POST																
Option+Distinct+ MSO+28% N	1.5oz+2oz+ 1.5pt+2qt	68	68	68	68	75	75	75	75	70	82	87	95	95	90	95.4
Option+Distinct+ MSO+28% N	1.5oz+2oz+ 2pt+2qt	70	70	68	70	85	87	87	88	83	85	95	99	99	99	105.1
Steadfast+Distinct+ PO+28% N	0.75oz+2oz+ 1.5pt+1.5qt	75	75	75	75	80	92	90	90	90	80	99	99	99	99	107.6
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	73.8
LSD (0.05)		7	8	7	7	5	3	4	5	4	4	2	2	2	3	19.2

[1]MSO = methylated seed oil = Scoil; 28% N = 28% nitrogen.

Two-pass weed control in corn. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate a two-pass weed control system in corn. DeKalb 'DKC35-50' corn was planted on April 28, 2004. PRE treatments were applied on May 4 at 9:15 am with 47 F air, 49 F soil at a 4 inch depth, 34% relative humidity, 0% clouds, 5 to 10 mph NW wind, dry soil surface, and dry subsoil. POST treatments were applied on June 16 at 2:45 pm with 69 F air, 88 F soil surface, 39% relative humidity, 75% clouds, 4 to 7 mph N wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 6 to 10 inch (4 to 5 collar) corn. Weed species present were: 1 to 4 inch (2 to 10/yd^2) wild mustard; 1 to 3 inch (1 to 3/yd^2) wild buckwheat; 0.5 to 3 inch (15 to 20/yd^2) yellow foxtail; 0.5 to 3 inch (1 to 3/yd^2) common lambsquarters; 0.5 to 3 inch (1 to 3/yd^2) redroot pigweed. LPOST treatments were applied on June 30, 2004 at 9:00 am with 70 F air, 76 F soil surface, 30% relative humidity, 50% clouds, 3 to 5 mph NW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 18 to 24 inch (5 to 7 collar) corn. No weeds present at the LPOST application. 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 TeeJet flat-fan nozzles for PRE treatments, and 8.5 gpa at 40 psi through 8001 TeeJet flat-fan nozzles for POST and LPOST treatments. The experiment had randomized complete block design with three replications per treatment.

No precipitation occurred to activate PRE treatments. Spring conditions were very dry and corn and weeds were delayed in emergence. Corn was at spiking stage at 1 month after planting and no weeds present. On June 16, evaluations were made immediately before POST applications. Evaluations were made twice before this evaluation but corn was at spike stage and weeds were emergence to 2 inches and wild mustard was emergence to bolting. On June 21 DAT (5 DAT POST application), there was no corn injury. All POST and LPOST applications gave 99% control of yellow foxtail, green foxtail, wild mustard, redroot pigweed, common lambsquarters, and wild buckwheat. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Two-pass weed control in corn (Zollinger and Ries).

		June 16 (PRE applications)					Corn
Treatment[1]	Rate	Yeft	Wimu	Rrpw	Colq	Wibw	Yield
	(product/A)	---------- (%) ----------					(bu/A)
PRE							
Lumax	3qt	99	99	99	99	96	117.1
PRE/POST							
Dual II Magnum/Callisto+Atrazine+ PO+28% N	1qt/3fl oz+0.556 lb+ 1% v/v+2.5% v/v	99	20	85	83	0	100.9
Outlook/Distinct+ NIS+28% N	0.65pt/4oz+ 0.25% v/v+2.5% v/v	99	40	95	90	20	95.2
Keystone LA/Hornet WDG+ NIS+28% N	2.25qt/3oz+ 0.25% v/v+2.5% v/v	99	96	99	99	95	99.2
Cinch/Steadfast+Callisto+ Atrazine+PO+28% N	0.66pt/0.76oz+3fl oz+ 0.556 lb+1% v/v+2.5% v/v	99	20	85	70	0	107.6
Define/Option+Distinct+ MSO+28% N	15fl oz/1.5oz+2oz+ 1% v/v+2.5% v/v	99	37	70	50	20	96.6
Harness Xtra/RUWM[2]+AMS	1qt/0.67pt+17 lb/100gal	99	83	99	99	95	105.6
POST/LPOST							
RUWM+AMS/ RUWM+AMS	0.67pt+17 lb/100gal/ 0.67pt+17 lb/100gal	-	-	-	-	-	114.4
Untreated		0	0	0	0	0	93.1
LSD (0.05)		0	5	4	2	3	14.8

[1]PO = petroleum oil concentrate = Herbimax; 28% N = 28% nitrogen; NIS = nonionic surfactant = R-11; MSO = methylated seed oil = Scoil; AMS = ammonium sulfate.

Corn herbicide tank-mixes. Zollinger, Richard K. And Jerry L. Ries. An experiment was conducted near Casselton and Chaffee, ND, to evaluate crop injury and weed control in POST applications of herbicides in corn. DeKalb 'DKC35-50' corn was planted on April, 28, 2004. POST treatments were applied on June 21 at 11:00 am with 61 F air, 46 F soil surface, 62% relative humidity, 100% clouds, 5 to 11 mph N wind, dry soil surface, moist subsoil, poor to good crop vigor, and no dew present to 6 to 12 inch (4 to 5 collar) corn. Weed species present were: 1 to 6 inch (5 to 20/ft^2) yellow foxtail; 3 to 5 inch (1 to 5/yd^2) common lambsquarters; 2 to 6 inch (5 to 10/yd^2) redroot pigweed; and 1 to 4 inch (1 to 2/yd^2) wild buckwheat.

At Chaffee, Pioneer '39D81' was planted on May 1, 2004. POST treatments were applied on June 16 at 12:15 pm with 67 F air, 75 F soil surface, 54% relative humidity, 75% clouds, 4 to 8 mph N wind, damp soil surface, moist subsoil, good crop vigor, and no dew present to 6 to 8 inch (3 to 4 collar) corn. Weed species present were: 2 to 4 inch (10 to 50/ft^2) yellow foxtail; 2 to 8 inch (5 to 10/yd^2) common lambsquarters; 1 to 6 inch (2 to 3/yd^2) redroot pigweed; and 2 to 6 inch (1 to 2/yd^2) wild buckwheat.

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 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replications per treatment.

At Casselton, June 28 (7 DAT) ratings, there was no stunting or crop injury except in some treatments containing Surpass, which showed slight leaf tip burn on the leaves that intercepted the spray. About 5 to 10% of the leaf area was affected. Treatments containing Lumax also showed burned leaf tips but not to the extent of the Surpass treatments. Only a very small amount of the leaf was affected, just leaf tips. On July 5 (14 DAT), all treatments controlled redroot pigweed and on July 19 (28 DAT), all treatments controlled wild buckwheat, redroot pigweed, and common lambsquarters.

At Chaffee, Callisto stuck to the bottle when mixed with Surpass and Define (Treatments 13 and 14). Callisto stuck more when mixed with Surpass than Define. On June 23 (7 DAT), no stunting or crop injury except treatments containing Surpass. Symptoms were leaf tip burn on the leaves that intercepted the spray. About 20 to 30% of the leaf area was affected. Treatments containing Lumax (16 to 20) also had burned leaf tips but not to the extent of the Surpass treatments. Only 10 to 20% of the leaf was affected, just leaf tips.

Yellow foxtail control was similar when adding Prowl H_2O, Define, Surpass, or Outlook to Option or Steadfast plus Distinct. Differences was more erratic at Chaffee. However, at Casselton and Chaffee, substituting MSO for PO resulted in reduced foxtail control. MSO with Steadfast and Lumax also enhanced control over PO. Applying Renegade on an area basis (pt/A) provided equal or greater control than applying it on a % v/v basis (1% v/v).

Table 1. Corn herbicide tank-mixes, Casselton (Zollinger and Ries).

Treatment[1]	Rate	14 DAT			28 DAT
		Yeft	Colq	Wibw	Yeft
	(product/A)	----- (%) -----			(%)
Option+Distinct+ MSO+28% N	1.5oz+2oz+ 1.5pt+2qt	70	70	30	99
Option+Prowl H_2O+Distinct+ MSO+28% N	1.5oz+28fl oz+2oz+ 1.5pt+2qt	60	60	30	82
Option+Define+Distinct+ MSO+28% N	1.5oz+9.6fl oz+2oz+ 1.5pt+2qt	60	60	30	83
Option+Surpass+Distinct+ MSO+28% N	1.5oz+1.25pt+2oz+ 2pt+2qt	60	60	30	83
Option+Outlook+Distinct+ MSO+28% N	1.5oz+10fl oz+2oz+ 2pt+2qt	60	60	30	80
Steadfast+Distinct+ MSO+28% N	0.5oz+2oz+ 1.5pt+1.5qt	75	60	30	85
Steadfast+Prowl H_2O+Distinct+ MSO+28% N	0.5oz+28fl oz+2oz+ 1.5pt+2qt	50	60	30	83
Steadfast+Define+Distinct+ MSO+28% N	0.5oz+9.6fl oz+2oz+ 1.5pt+2qt	50	60	30	80
Steadfast+Surpass+Distinct+ MSO+28% N	0.5oz+1.25pt+2oz+ 2pt+2qt	50	60	30	80
Steadfast+Outlook+Distinct+ MSO+28% N	0.5oz+10fl oz+2oz+ 2pt+2qt	50	60	30	82
Steadfast+Callisto+Atrazine+ PO	0.5oz+2fl oz+0.42 lb+ 1qt	50	99	99	78
Steadfast+Prowl H_2O+Callisto+ Atrazine+PO	0.5oz+28fl oz+2fl oz+ 0.42lb+1qt	50	99	99	67
Steadfast+Define+Callisto+ Atrazine+PO	0.5oz+9.6fl oz+2fl oz+ 0.42 lb+1qt	50	99	99	57
Steadfast+Surpass+Callisto+ Atrazine+PO	0.5oz+1.25pt+2fl oz+ 0.42 lb+1qt	50	99	99	60
Steadfast+Outlook+Callisto+ Atrazine+PO	0.5oz+10fl oz+2fl oz+ 0.42 lb+1qt	50	99	99	50
Steadfast+Lumax+PO	0.5oz+4pt+1qt	65	99	99	60
Steadfast+Lumax+MSO	0.5oz+3pt+1.5pt	75	99	99	70
Steadfast+Lumax+Quad 7	0.5oz+3pt+1% v/v	70	99	99	70
Steadfast+Lumax+Renegade	0.5oz+3pt+1% v/v	75	99	99	85
Steadfast+Lumax+Renegade	0.5oz+3pt+1.5pt	75	99	99	82
LSD (0.05)		5	4	3	7

[1]MSO = methylated seed oil = Scoil; 28% N = 28% nitrogen; PO = petroleum oil concentrate = Herbimax; Quad 7 = basic pH blend; Renegade = MSO basic pH blend.

Table 2. Corn herbicide tank-mixes, Chaffee (Zollinger and Ries).

Treatment[1]	Rate	14 DAT Yeft	28 DAT Yeft
	(product/A)	- - (%) - -	- - (%) - -
Option+Distinct+ MSO+28% N	1.5oz+2oz+ 1.5pt+2qt	70	73
Option+Prowl H_2O+Distinct+ MSO+28% N	1.5oz+28fl oz+2oz+ 1.5pt+2qt	68	80
Option+Define+Distinct+ MSO+28% N	1.5oz+9.6fl oz+2oz+ 1.5pt+2qt	73	86
Option+Surpass+Distinct+ MSO+28% N	1.5oz+1.25pt+2oz+ 2pt+2qt	73	73
Option+Outlook+Distinct+ MSO+28% N	1.5oz+10fl oz+2oz+ 2pt+2qt	73	86
Steadfast+Distinct+ MSO+28% N	0.5oz+2oz+ 1.5pt+1.5qt	82	78
Steadfast+Prowl H_2O+Distinct+ MSO+28% N	0.5oz+28fl oz+2oz+ 1.5pt+2qt	78	93
Steadfast+Define+Distinct+ MSO+28% N	0.5oz+9.6fl oz+2oz+ 1.5pt+2qt	85	96
Steadfast+Surpass+Distinct+ MSO+28% N	0.5oz+1.25pt+2oz+ 2pt+2qt	30	50
Steadfast+Outlook+Distinct+ MSO+28% N	0.5oz+10fl oz+2oz+ 2pt+2qt	63	75
Steadfast+Callisto+Atrazine+ PO	0.5oz+2fl oz+0.42 lb+ 1qt	77	57
Steadfast+Prowl H_2O+Callisto+ Atrazine+PO	0.5oz+28fl oz+2fl oz+ 0.42lb+1qt	70	53
Steadfast+Define+Callisto+ Atrazine+PO	0.5oz+9.6fl oz+2fl oz+ 0.42 lb+1qt	70	50
Steadfast+Surpass+Callisto+ Atrazine+PO	0.5oz+1.25pt+2fl oz+ 0.42 lb+1qt	67	53
Steadfast+Outlook+Callisto+ Atrazine+PO	0.5oz+10fl oz+2fl oz+ 0.42 lb+1qt	70	57
Steadfast+Lumax+PO	0.5oz+4pt+1qt	83	75
Steadfast+Lumax+MSO	0.5oz+3pt+1.5pt	67	63
Steadfast+Lumax+Quad 7	0.5oz+3pt+1% v/v	57	57
Steadfast+Lumax+Renegade	0.5oz+3pt+1% v/v	77	73
Steadfast+Lumax+Renegade	0.5oz+3pt+1.5pt	87	88
LSD (0.05)		7	8

[1]MSO = methylated seed oil = Scoil; 28% N = 28% nitrogen; PO = petroleum oil concentrate = Herbimax; Quad 7 = basic pH blend; Renegade = MSO basic pH blend.

Starane in corn. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Chaffee, ND, to evaluate crop response and weed control from POST applications of Starane in corn. Pioneer '39D81' corn was planted on May 1, 2004. POST treatments were applied on June 21 at 12:40 pm with 64 F air, 76 F soil surface, 34% relative humidity, 90% clouds, 8 to 13 mph N wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 10 to 13 inch (4 to 5 collar) corn. Weed species present were: 2 to 10 inch (3 to 10/ft^2) common lambsquarters; and 2 to 6 inch (10 to 20/yd^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 11001 Turbo TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

The purpose of the study was to observe any affects from Starane added to POST grass herbicides in corn. No corn injury was observed with any treatment. Starane did not reduce grass control and in some treatments increased broadleaf weed control. (Dept. of Plant Sciences, North Dakota State University. Fargo).

Table. Starane in corn (Zollinger and Ries).

		14 DAT	28 DAT	
Treatment[1]	Rate	Yeft	Yeft	Colq
	(product/A)	(%)	(%)	(%)
Starane	0.67pt	0	0	30
Starane+Stinger	0.5pt+4fl oz	0	0	30
Steadfast+PO+28% N	0.75oz+1% v/v+2.5% v/v	60	78	40
Steadfast+Starane+PO+28% N	0.75oz+0.37pt+1% v/v+2.5% v/v	60	75	62
Option+MSO+28% N	1.5oz+1% v/v+2.5% v/v	50	58	63
Option+Starane+MSO+28% N	1.5oz+0.67pt+1% v/v+2.5% v/v	50	63	80
Accent+PO+28% N	0.67oz+1% v/v+2.5% v/v	50	60	40
Accent+Starane+PO+28% N	0.67oz+0.67pt+1% v/v+2.5% v/v	50	60	40
Starane+Atrazine+PO	0.67pt+0.83 lb+1% v/v	0	0	99
Starane+Distinct	0.67pt+4oz	0	50	99
Starane+Clarity	0.67pt+8fl oz	0	0	99
Untreated		0	0	0
LSD (0.05)		5	5	3

[1]PO = petroleum oil concentrate = Herbimax; 28% N = 28% nitrogen; MSO = methylated seed oil = Scoil.

Steadfast combinations in corn. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate weed control from Steadfast tank-mixes in corn. DeKalb 'DKC35-50' corn was planted on April 28, 2004. POST treatments were applied on June 21 at 11:35 am with 65 F air, 79 F soil surface, 27% relative humidity, 80% clouds, 10 to 15 mph NE wind, dry soil surface, moist subsoil, poor to good crop vigor, and no dew present to 6 to 12 inch (4 to 5 collar) corn. Weed species present were: 3 to 4 inch (1 to 5/yd^2) common lambsquarters; 1 to 5 inch (10 to 25/yd^2) yellow foxtail; and 2 to 3 inch (1 to 3/yd^2) wild buckwheat. 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 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replications per treatment.

Priority and atrazine had little affect on yellow foxtail control from Steadfast. Only treatments containing atrazine or dicamba controlled broadleaf weeds present in the study. Priority added to Steadfast slightly increased common lambsquarters and wild buckwheat control. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Steadfast combinations in corn (Zollinger and Ries).

		14 DAT			28 DAT		
Treatment	Rate	Yeft	Colq	Wibw	Yeft	Colq	Wibw
	(product/A)	----- (%) -----			----- (%) -----		
Steadfast+Priority+ NIS+AMS	0.75oz+1oz+ 0.25% v/v+2 lb	50	50	30	70	73	65
Steadfast+Priority+ PO+AMS	0.75oz+1oz+ 1% v/v+2 lb	60	60	30	77	82	70
Steadfast+Priority+Atrazine+ NIS+AMS	0.75oz+1oz+0.556lb+ 0.25% v/v+2 lb	40	70	30	70	99	99
Steadfast+Priority+Atrazine+ PO+AMS	0.75oz+1oz+0.556lb+ 1% v/v+2 lb	50	70	30	75	99	99
Steadfast+Dicamba+ NIS+AMS	0.75oz+4fl oz+ 0.25% v/v+2 lb	50	70	30	75	99	99
Steadfast+Dicamba+ PO+AMS	0.75oz+4fl oz+ 1% v/v+2 lb	50	70	30	82	99	99
LSD (0.05)		4	3	0	3	3	4

[1]NIS = nonionic surfactant = R-11; AMS = ammonium sulfate; PO = petroleum oil concentrate = Herbimax.

Liberty with adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate weed control with Liberty applied POST to non-cropland. POST treatments were applied on June 29, 2004 at 8:30 am with 71 F air, 74 F soil surface, 59% relative humidity, 0% clouds, 1 to 3 mph N wind, dry soil surface, moist subsoil, and dew present. Weed species present were: 1 to 8 inch (1 to 20/ft^2) redroot pigweed; 2 to 10 inch (1 to 5/yd^2) common lambsquarters; 3 to 12 inch (1 to 2/yd^2) kochia; 3 to 8 inch (10 to 100/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 11001 Turbo TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

InterLock and Placement enhanced yellow foxtail control from Liberty. However Class Act NG enhanced redroot pigweed, common lambsquarters, and kochia more than other treatments. Greater weed control from Class Act NG may be due to NIS and AMS in the formulation. This shows that herbicides are adjuvant and weed specific. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Liberty with adjuvants (Zollinger and Ries).

		14 DAT				28 DAT			
Treatment[1]	Rate	Yeft	Rrpw	Colq	Kochia	Yeft	Rrpw	Colq	Kochia
	(product/A)								
Liberty+Select	22fl oz+4fl oz	70	72	67	70	63	67	60	63
Liberty+Select+AMS	22fl oz+4fl oz+3 lb	70	70	70	90	63	62	63	78
Liberty+Select+ Class Act NG	22fl oz+4fl oz+ 2.5% v/v	70	75	90	95	65	72	83	93
Liberty+Select+ Class Act NG+InterLock	22fl oz+4fl oz+ 2.5% v/v+4oz	92	65	72	78	90	62	70	75
Liberty+Select+ Class Act NG+Placement	22fl oz+4fl oz+ 2.5% v/v+5fl oz	95	60	75	75	90	57	72	72
LSD (0.05)		4	4	6	4	8	8	8	6

[1]AMS = ammonium sulfate; Class Act NG (Next Generation) = surfactants + fertilizer; InterLock and Placement = deposition + drift retardants.

Glyphosate-resistant volunteer corn control. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate control of glyphosate-resistant volunteer corn with POST applied grass herbicides. DeKalb 'DKC35-50' glyphosate-resistant corn was planted on April 28, 2004. POST treatments were applied on July 1 at 10:10 am with 75 F air, 91 F soil surface, 35% relative humidity, 10% clouds, 4 to 7 mph NE wind, dry soil surface, moist subsoil, and no dew present. Weed species present were: 18 to 24 inch (V6 to V7) corn; and 2 to 7 inch (10 to 50/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 TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replications per treatment.

All treatments contained Roundup UltraMax II at 22 fl oz/A plus AMS at 8.5lb/100gal. All treatments were applied to 18 to 24 inch tall volunteer Roundup Ready Corn. Select is a 2 lb ai/gal formulation and V-10137 is a 1 lb ai/gal formulation so equivalent amounts of active ingredient were compared. All treatments controlled yellow foxtail which is surprising since Assure II is weak on yellow foxtail and the foxtail was large (2 to 7 inches) at application. Assure II killed corn at all rates used. V-10137 gave better corn control than Select at equivalent ai rates. Adding NIS to Select almost doubled corn control. The highest rate of Select did not control volunteer corn where V-10137 at 6 fl oz/A (ai equal to Select at 3 fl oz/A) gave greater than 90% corn control. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Glyphosate-resistant volunteer corn control (Zollinger and Ries).

		14 DAT		28 DAT	
Treatment[1]	Rate	Yeft	Corn	Yeft	Corn
	(product/A)	(%)	(%)	(%)	(%)
Select	2 fl oz	99	33	99	37
Select+NIS	2 fl oz+0.25% v/v	99	57	99	60
Select	3 fl oz	99	43	99	57
Select	4 fl oz	99	60	99	72
V-10137	4 fl oz	99	70	99	77
V-10137	6 fl oz	99	78	99	93
V-10137	8 fl oz	99	93	99	96
Assure II	4 fl oz	99	90	99	95
Assure II+NIS	4 fl oz+0.25% v/v	99	95	99	98
Assure II	6 fl oz	99	99	99	99
Assure II	8 fl oz	99	99	99	99
LSD (0.05)		0	9	0	10

[1]NIS = nonionic surfactant = R-11; V-10137 = a 1 EC clethodim herbicide from Valent.

Glyphosate-resistant volunteer corn control from grass herbicides and adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate control of glyphosate-resistant volunteer corn with POST applied grass herbicides and adjuvants. DeKalb 'DKC35-50' glyphosate-resistant corn was planted on April 28, 2004. POST treatments were applied on July 1 at 10:40 am with 80 F air, 93 F soil surface, 30% relative humidity, 10% clouds, 3 to 6 mph NE wind, dry soil surface, moist subsoil, and no dew present. Weed species present were: 20 to 24 inch (V6 to V7) corn; and 3 to 8 inch (25 to 100/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 TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replications per treatment.

All treatments contained ClearOut 41 Plus at 1 qt/A plus AMS at 8.5lb/100gal. Treatments were applied to volunteer corn 20 to 24 inches tall. The focus of this study was to compare Assure II and Select at similar use rates within their rate structure. All treatments killed yellow foxtail which is surprising since Assure II is weak on yellow foxtail and the foxtail was large (3 to 8 inches) at application. Assure II killed corn at all rates used. V-10137 gave better corn control than Select at equivalent ai rates. The highest rate of Select did not control volunteer corn where V-10137 at 6.6 fl oz/A (ai equal to Select at 3.3 fl oz/A) gave greater than 90% corn control. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Glyphosate-resistant volunteer corn control from grass herbicides and adjuvants (Zollinger and Ries).

		14 DAT		28 DAT	
Treatment[1]	Rate	Yeft	Corn	Yeft	Corn
	(product/A)	(%)	(%)	(%)	(%)
Select+NIS	2fl oz+0.25% v/v	99	50	99	63
Select+NIS	3.3fl oz+0.25% v/v	99	70	99	70
Select+NIS	4fl oz+0.25% v/v	99	70	99	73
Select+NIS	5fl oz+0.25% v/v	99	70	99	72
Select+NIS	5.33fl oz+0.25% v/v	99	70	99	72
Select+NIS	6fl oz+0.25% v/v	99	70	99	80
V-10137	4fl oz	99	70	99	70
V-10137	6.6fl oz	99	83	99	93
V-10137	8fl oz	99	90	99	99
V-10137	10fl oz	99	99	99	99
V-10137	10.7fl oz	99	99	99	99
V-10137	12fl oz	99	99	99	99
Assure II+NIS	4fl oz+0.25% v/v	99	99	99	99
Assure II+NIS	5fl oz+0.25% v/v	99	99	99	99
Assure II+NIS	6fl oz+0.25% v/v	99	99	99	99
Assure II+NIS	8fl oz+0.25% v/v	99	99	99	99
Assure II+NIS	9fl oz+0.25% v/v	99	99	99	99
LSD (0.05)		0	5	0	6

[1]NIS = nonionic surfactant = R-11; V-10137 = 1 EC clethodim from Valent.

Glyphosate-resistant volunteer corn control with adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate control of glyphosate-resistant volunteer corn from grass herbicides applied POST with adjuvants. DeKalb 'DKC35-50' glyphosate-resistant corn was planted on April 28, 2004. POST treatments were applied on July 13 at 9:30 am with 72 F air, 80 F soil surface, 53% relative humidity, 0% clouds, 4 to 8 mph N wind, moist soil surface, moist subsoil, and no dew present to 30 to 40 inch (V5 to V7) 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 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replications per treatment.

Treatments were applied to large corn (30 to 40 inch). Glyphosate formulation and adjuvants influenced activity of V-10137 and Select. Half use rates of glyphosate and clethodim at application to tall corn was used to evaluate formulation and adjuvant enhancement of clethodim. The K salt of glyphosate was antagonistic to both formulations of clethodim but the V-10137 formulation of clethodim overcame part of the antagonism. K is antagonist to weak acid herbicides, such as clethodim and glyphosate, and could contribute to reduced weed control. However, reduced control may be from the type and concentration of formulants in the glyphosate formulation in addition to the K salt. Clethodim is oil soluble and is enhanced when applied with oil based adjuvants. Data below support current use recommendations of adding oil adjuvants to clethodim. Other weeds were not present to evaluate weed control from glyphosate. Of the commercial and experimental adjuvants tested with Select at 3 fl oz/A, MSO (Destiny) and Superb HC were the only adjuvants that enhanced corn control greater than 80%. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Glyphosate-resistant volunteer corn control with adjuvants (Zollinger and Ries).

Treatment[1]	Rate	Corn	
		14 DAT	28 DAT
	(product/A)	(%)	(%)
Roundup UltraMax II+AMS+	11 fl oz+1 lb+		
V-10137	6 fl oz	50	73
Select	3 fl oz	40	37
ClearOut 41 Plus+AMS	1 pt/A+1 lb+		
V-10137	6fl oz	70	88
Select	3fl oz	53	52
Select+Activator 90	3fl oz+0.25% v/v	60	48
Select+One-Ap XL	3fl oz+9 lb/100gal	50	60
Select+Bronc Max+R-11	3fl oz+2qt+0.25% v/v	50	57
Select+L-283	3fl oz+1% v/v	50	57
Select+ N Tank	3fl oz+1% v/v	50	69
Select+Herbimax	3fl oz+1% v/v	60	73
Select+Syl-Tac	3fl oz+4 fl oz	60	76
Select+AMS	3fl oz+1 lb	50	50
Select+Alliance	3fl oz+1.25% v/v	50	53
Select+Destiny+AMS	3fl oz+1% v/v+1 lb	70	86
Select+Preference+AMS	3fl oz+0.25% v/v+1 lb	60	57
Select+Superb HC+AMS	3fl oz+0.5% v/v+1 lb	57	87
Select+Superb HC+Alliance	3fl oz+0.5% v/v+1.25% v/v	71	75
Select+AG 03002	3fl oz+1% v/v	53	68
Select+AG 03002	3fl oz+1.5% v/v	50	68
Select+AG 03002	3fl oz+2% v/v	53	70
Select+AG 04029+AMS	3fl oz+0.5% v/v+1 lb	50	68
LSD (0.05)		6	6

[1]V-10137 = 1 EC clethodim from Valent; Activator 90, R-11, and Preference = nonionic surfactant; One-Ap XL = AMS + surfactant + deposition + retention + defoamer; Bronc Max and Alliance = water conditioning agents + surfactants; L-283 = proprietary adjuvant from NDSU; N Tank = water conditioning agents; Herbimax and Superb HC = petroleum oil concentrates; Syl-Tac = methylated seed oil (MSO) + organosilicone surfactants; AMS = ammonium sulfate; Destiny = methylated seed oil; AG 03002 and AG 04029 = proprietary adjuvants from Agriliance.

Overcoming grass antagonism from Express with Clethodim. Zollinger, Richard K. And Jerry L. Ries. An experiment was conducted near Chaffee, ND, to evaluate grass control from Express with Clethodim and adjuvants. Pioneer '39D81' corn was planted on May 1, 2004. POST treatments were applied on June 6 at 10:30 am with 57 F air, 72 F soil surface, 33% relative humidity, 80% clouds, 5 to 10 mph NW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present 14 to 20 inch (4 to 5 collar) corn. Weed species present were: 3 to 8 inch (20 to 40/yd^2) yellow foxtail; 18 to 30 inch (1 to 3/yd^2) wild oat; and 5 to 8 inch (5 to 15/yd^2) volunteer wheat. 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 TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replications per treatment.

Due to formulation difference between Express XP (75DF) and Express SG (50DF), Express was applied at the same amount of active ingredient. Grass = yellow foxtail, wild oat, and volunteer wheat. All Express treatments controlled common lambsquarters.

Evaluation at 7 DAT (data not shown) was taken to observe speed of grass kill. No differences in control was seen with any treatment. However, the corn in treatments containing V-10137 applied alone showed purpling and all the other treatments did not.

At 14 DAT, activity was very slow probably based on cool weather after application.

Grass herbicides, with the exception of the reduced rate of Select at 6 fl oz/A, applied without Express gave 90% corn control or greater. Prism and V-10137, which are 1 lb ai/gal formulations gave the greatest grass control. Express antagonized all grass herbicides. V-10137 formulation of clethodim was able to overcome some but not all antagonism. NIS or PO improved grass and corn control when V-10137 was applied at reduced rates. Express SG antagonized Select and V-10137 more than Express XP. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Overcoming grass antagonism from Express with Clethodim (Zollinger and Ries).

Treatment[1]	Rate	14 DAT		28 DAT	
		Grass[2]	Corn	Grass	Corn
	(product/A)	(%)	(%)	(%)	(%)
Assure II+PO	8fl oz+1% v/v	50	50	89	99
Arrow+PO	6fl oz+1% v/v	50	50	75	90
Prism+PO	12.75fl oz+1% v/v	50	50	90	90
Select+PO	6fl oz+1% v/v	50	50	70	80
V-10137+NIS	12fl oz+0.25% v/v	60	70	96	99
V-10137+NIS	9fl oz+0.25% v/v	50	50	90	99
Express XP[3]+	0.25oz+				
Assure II+PO	8fl oz+1% v/v	50	50	40	99
Arrow+PO	6fl oz+1% v/v	50	50	30	70
Prism+PO	12.75fl oz+1% v/v	50	50	40	60
Select+PO	6fl oz+1% v/v	50	50	60	80
V-10137+NIS	12fl oz+0.25% v/v	57	60	82	90
V-10137+NIS	9fl oz+0.25% v/v	50	50	50	80
V-10137+PO	12fl oz+1% v/v	60	60	72	95
V-10137+PO	9fl oz+1% v/v	50	50	85	90
V-10137	12fl oz	60	60	72	95
V-10137	9fl oz	50	50	65	85
Express SG[4]+	0.375oz+				
Select+PO	6fl oz+1% v/v	50	50	50	70
V-10137+PO	9fl oz+1% v/v	60	50	62	65
V-10137+NIS	9fl oz+0.25% v/v	60	50	70	85
V-10137	12fl oz	60	60	60	70
V-10137	9fl oz	60	50	50	60
Untreated		0	0	0	0
LSD (0.05)		2	2	8	6

[1]PO = petroleum oil concentrate = Herbimax; NIS = nonionic surfactant = R-11; V-10137 = a proprietary adjuvant from Valent.
[2]Grass = yellow foxtail, wild oat, and volunteer wheat.
[3]Express XP = 75 DF.
[4]Express SG = 50 SG.

Corn response to soil residues of grass herbicides. (Kirk Howatt, Ronald Roach, and Janet Harrington). A study was conducted to determine the necessary seeding interval when ACCase-inhibiting herbicides are used preplant to kill grasses. Treatments 14 days before seeding (DBS) were applied on May 21 with 61 F air temperature, 37% RH, 50% cloud cover, 11 to 13 mph east wind, and 52 F soil temperature. Treatments 7 DBS were applied May 27 with 56 F air temperature, 46% RH, 25% cloud cover, 12 mph north wind, and 54 F soil temperature. Treatments 0 DBS were applied June 4 with 64 F air temperature, 68% RH, 50% cloud cover, 6 to 8 mph east wind, and 57 F soil temperature. 'DKC 32-59' corn was seeded June 4. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 to 40 psi through TT 11001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment had a randomized complete-block design with four replicates. Corn could not be harvested.

Table. Corn response to soil residues of grass herbicides.

Treatment	Rate	Application	June 18 corn	July 01 corn
	oz ai/A	Days before seeding	%	%
Quizalofop	0.54	14	0	0
Quizalofop	0.77	14	0	0
Quizalofop	1.54	14	0	0
Fluazifop-P	3	14	0	0
Sethoxydim	9	14	0	0
Clethodim	8	14	4	3
Quizalofop	0.54	7	0	0
Quizalofop	0.77	7	0	0
Quizalofop	1.54	7	0	0
Fluazifop-P	3	7	0	0
Sethoxydim	9	7	3	0
Clethodim	8	7	5	1
Quizalofop	0.54	0	0	0
Quizalofop	0.77	0	0	0
Quizalofop	1.54	0	3	2
Fluazifop-P	3	0	9	1
Sethoxydim	9	0	53	63
Clethodim	8	0	90	95
Untreated	0		0	0
CV			21	30
LSD (P=0.05)			3	4

Herbicide rates were three times the typical application rates to encourage plant response and identify the herbicides that cause less injury in adverse conditions. Clethodim caused injury with all three application timings on June 18, but injury was 5% or less when clethodim was applied 7 or 14 DBS compared with 90% injury when applied 0 DBS. Sethoxydim caused 53% injury when applied 0 DBS. In 2003, injury from clethodim and sethoxydim was greater than 70% during both evaluations for all application timings. In 2003, precipitation did not fall until all treatments had been applied. In 2004, rain fell between 7 and 0 DBS. The difference in moisture for the two seasons is likely the reason for differences in corn injury between the two years and will be studied further. In 2004, most injury diminished before July 1 except for clethodim and sethoxydim applied 0 DBS, which resulted in substantial plant injury and stand reduction with clethodim. Fluazifop caused 9% injury and quizalofop caused 3% injury on June 18 when applied 0 DBS, but injury was not expected to affect yields of these treatments.

Volunteer canola control in corn. Jenks, Markle, and Willoughby. Corn was seeded May 18 into 30-inch rows. Canola was seeded over the top to simulate a volunteer canola (VC) situation. Individual plots were 10 x 30 ft and replicated 3 times. Herbicide treatments were applied preemergence (PRE) on May 18 with a bicycle sprayer delivering 20 gpa at 30 psi with XR 80015 nozzles. Air and soil temperatures were 80 and 61 F, respectively, relative humidity was 18%. Postemergence treatments were applied to 3-leaf canola on June 18 with a bicycle sprayer delivering 10 gpa at 40 psi through XR 8001 nozzles. Air and soil temperatures were 66 and 63 F, respectively, relative humidity was 25%. Treatments to 6-leaf canola were applied in the same fashion on June 28. Air and soil temperatures were 82 and 81 F, respectively, relative humidity was 30%.

In corn, soil-applied Balance Pro provided excellent VC control. Postemergence herbicides Steadfast, Accent, and Option provided excellent VC control at both application timings. VC control with Callisto and and Distinct dropped 12-13% with the 6-leaf application, while control with 2,4-D amine dropped 43%. Atrazine and Starane provided very little control at either application stage. We conducted a follow-up study in the fall and found that Starane caused 20-50% injury applied at 0.33-0.67 pt. We are not sure why Starane caused little injury in the first study.

Table. Volunteer canola control in corn (2004).

			Volunteer canola	
Treatment	Rate	Timing	Jul 8	Jul 28
			—— % control ——	
Untreated			0	0
Balance Pro	3 fl oz	PRE	99	98
Steadfast + MSO + 28% N	0.75 oz + 1% v/v + 2 qt	3-leaf	99	100
Steadfast + MSO + 28% N	0.75 oz + 1% v/v + 2 qt	6-leaf	76	99
Accent + MSO + 28% N	0.5 oz + 1% v/v + 1 qt	3-leaf	98	99
Accent + MSO + 28% N	0.5 oz + 1% v/v + 1 qt	6-leaf	81	98
Option + MSO + 28% N	1.5 oz + 1.5 pt + 1.5 qt	3-leaf	99	100
Option + MSO + 28% N	1.5 oz + 1.5 pt + 1.5 qt	6-leaf	71	98
Atrazine + COC	0.25 lb ai + 1 qt	3-leaf	31	10
Atrazine + COC	0.25 lb ai + 1 qt	6-leaf	24	12
2,4-D amine	0.5 pt	3-leaf	88	87
2,4-D amine	0.5 pt	6-leaf	20	34
Callisto + COC + 28% N	3 fl oz + 1% v/v + 2.5% v/v	3-leaf	99	99
Callisto + COC + 28% N	3 fl oz + 1% v/v + 2.5% v/v	6-leaf	62	86
Starane	0.5 pt	3-leaf	0	0
Starane	0.5 pt	6-leaf	20	0
Distinct + NIS + 28%	4 oz + 0.25% v/v + 1.25% v/v	3-leaf	83	88
Distinct + NIS + 28%	4 oz + 0.25% v/v + 1.25% v/v	6-leaf	58	70
LSD (0.05)			11	13
CV			11	12

Roundup application timing for weed control in corn, Kegode and Ciernia. This study was conducted at Fargo and used Roundup applications to control weeds in plots at the V2, V4, and V6 stages of corn. DeKalb DKC 35-50 RR corn was seeded in 30 in. rows on May 6 at a population density of 26,200 plants/A. Treatments consisted of 2 pt/A Roundup UltraMax II plus 32 oz/A AMS applied June 4 (V2), June 10 (V4), and June 24 (V6) with a 4-nozzle bike sprayer equipped with XR8001 tips which delivered 8.5 gpa at 40 psi. Subsequent to each application weed escapes were monitored weekly in four 1 ft^2 quadrats per plot. Weed biomass was harvested from these quadrats on Sept. 19, dried, and biomass production per acre determined. The center 2 rows of each plot were harvested on Nov. 15. The experiment was a randomized complete block design with 4 replicates.

Roundup application timing	Weed Biomass	Corn Yield
	lb/A	*Bu/A*
Corn V2 stage	32	96
Corn V4 stage	19	101
Corn V6 stage	14	103
Weed free control	0	104
Untreated control	224	36
Reps	4	4
C.V. %	73	14
LSD 5%	65	19

There was no significant difference in amount of biomass produced by weeds or in corn yield when Roundup was applied at corn V2, V4, or V6 stages. Corn yield and weed biomass production for the Roundup treatments was similar to the weed free control. However, the production of 14 to 32 lb of biomass/A indicates that there was the potential for seed production by weed escapes despite the application of Roundup at the specific corn growth stages. In addition, the unusually cool periods in June and July probably delayed weed emergence, consequently weeds that escaped Roundup treatment did not influence weed biomass production or crop yield significantly.

HARES Field Validation for Weed Control in Corn, Zhou, Kegode, and Ciernia. The experiment was conducted near Fargo, Casselton, and Prosper, ND to validate weed control recommendations by the computer program HARES (Herbicide Application Rule-based Expert System) which was developed at NDSU. Glyphosate-resistant corn was seeded in 30-inch rows on May 3, 2004. The target weed species were foxtail and redroot pigweed. HARES recommended PRE treatments according to site-specific soil properties, soil condition, and temperature. PRE treatments were applied at May 4. The soil properties and conditions at application are shown in Table 1. HARES recommended POST treatments according to soil and weather conditions, and weed size and density. POST treatments were applied July 1 and conditions at each location are shown in Table 2. Treatments were applied to the center 6.7 ft of the 10 by 30 ft plots with a bicycle-wheel-type plot sprayer, which delivered 17 gpa at 40 psi through 8002 flat fan nozzles for the PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for the POST treatments. Experimental design was a randomized complete block with four replicates. Weed control was evaluated visually two times where 0 equaled no visible injury and 100 equaled complete control.

Table 1. Soil properties and environmental conditions at Fargo, Casselton and Prosper at PRE application.

	Soil property			Conditions			
Location	PH	OM	Type	Temperature (F)	Soil moisture	Sky	Wind
Fargo	7.5	5%	Silty clay	56	Dry	Sunny	8 mph N
Prosper	7.0	4%	Loam	64	Moist	Sunny	5 mph NW
Casselton	7.8	4.4%	Silty clay	62	Wet	25% cloudy	9 mph NW

Table 2. Environmental conditions and major weeds and height at Fargo, Casselton and Prosper at POST application.

Location	Temperature	RH	Sky	Wind	Major weed (inch)
Fargo	74 F	49%	40% cloudy	8 mph S	Fxtl (4), Wimu (5), Wibu (3)
Prosper	69 F	50%	30% cloudy	7 mph SW	Fxtl (5), Hans (3), Sufl (6)
Casselton	72 F	52%	15% cloudy	5 mph SW	Fxtl (4), Rrpw (4), Colq (5), Wimu (4)

Weed control threshold refers to the lowest required control, which was set at 80% for HARES. Two PRE and three POST treatments were selected from a list of recommendations provided by HARES for comparison at each location. The predominant weed species at each location were: foxtail (Fxtl), wild mustard (Wimu), and wild buckwheat (Wibu) at Fargo; foxtail, hairy nightshade (Hans), and common Sunflower (Sufl) at Prosper; and foxtail, redroot pigweed (Rrpw), wild mustard and common lambsquarter (Colq) at Casselton.

Table 3. Treatments recommended by HARES and weed control at Fargo

			June 21			July 15		
Treatment	Timing	Rate	Fxtl	Wimu	Wibu	Fxtl	Wimu	Wibu
		lb ai/A	*% Control*					
Surpass	PRE	2.4	95	78	56	97	80	45
Dual II Magnum	PRE	1.9	94	40	58	98	34	42
Steadfast	POST	0.047	94	97	67	90	98	56
NorthStar	POST	0.3125	80	96	72	83	95	54
Glyphosate	POST	0.57	99	98	99	90	97	94
Untreated		0	0	0	0	0	0	0
LSD (0.05)			5	9	7	2	6	11

Table 4. Treatments recommended by HARES and weed control at Prosper

Treatment	Timing	Rate	June 21			July 15		
			Fxtl	Hans	Sufl	Fxtl	Hans	Sufl
		lb ai/A	*% Control*					
Surpass	PRE	1.6	94	95	25	90	86	5
Dual II Magnum	PRE	1.7	78	60	30	98	34	10
Steadfast	POST	0.047	86	85	95	92	90	92
NorthStar	POST	0.3125	80	88	88	79	95	90
Glyphosate	POST	0.57	99	98	99	97	92	98
Untreated		0	0	0	0	0	0	0
LSD (0.05)			4	7	4	4	9	5

Table 5. Treatments recommended by HARES, weed control, and corn yield at Casselton

Treatment	Timing	Rate	June 21				July 15				Corn yield
			Fxtl	Rrpw	Wimu	Colq	Fxtl	Rrpw	Wimu	Colq	
		lb ai /A	% control								*Bu/A*
Surpass	PRE	1.6	95	98	86	90	93	96	78	90	115
Dual II Magnum	PRE	1.7	90	86	65	73	89	79	54	62	98
Steadfast	POST	0.047	86	81	97	78	92	94	98	85	110
NorthStar	POST	0.3125	85	84	97	76	90	89	98	88	106
Glyphosate	POST	0.57	98	98	98	98	98	98	98	98	109
Untreated		0	0	0	0	0	0	0	0	0	79
LSD (0.05)			3	7	6	5	9	4	12	7	NS

Redroot pigweed density at Fargo and Prosper was low and therefore not evaluated. All PRE and POST treatments provided better than the expected 80% control of foxtails at Fargo and Proper (Table 3 and 4). Control of redroot pigweed and foxtail at Casselton was equal to or better than the projected control of 80% with HARES recommendations. At all locations, Dual II Magnum provided poor control of other weeds, whereas Surpass provided poor control of common sunflower at Prosper and wild buckwheat at Fargo. The POST treatments generally provided poor control of wild buckwheat at Fargo whereas they provided good to excellent control of hairy nightshade and common sunflower at Prosper and of wild mustard and common lambsquarers at Casselton. In the first year of field validation, HARES provided good to excellent recommendation for weed control as well as information for improving the program.

2 - pass weed control in soybean. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Alice, ND, to evaluate crop response and weed efficacy to treatments applied PRE/POST and MPOST/LPOST. Asgrow 'AG0801' glyphosate-resistant soybean was planted on May 19, 2004. PRE treatments were applied on May 26 at 9:30 am with 60 F air, 48 F subsoil at a 4 inch depth, 57% relative humidity, 30% clouds, 13 to 18 mph S wind, moist soil surface and subsoil. POST applications were applied on June 29 at 10:30 am with 76 F air, 84 F soil surface, 38% relative humidity, 0% clouds, 5 to 11 mph W wind, dry soil surface, moist subsoil, good crop vigor and no dew present to V1 to V3 soybean. Weeds species present were: 0.5 to 3 inch (0 to 4/yd^2) redroot pigweed, 1 to 3 inch (0 to 2/yd^2) common lambsquarters, 1 to 3 inch (0 to 2/yd^2) biennial wormwood, and 1 to 3 inch (0 to 1/yd^2) kochia. MPOST treatments were applied on July 13 at 9:00 am with 75 F air, 80 F soil surface, 52% relative humidity, 10% clouds, 10 to 12 mph NW wind, moist soil surface and subsoil, good crop vigor, and no new present to V4 to V5 soybean. Weeds species present were: 5 to 7 inch (0 to 4/yd^2) redroot pigweed, 5 to 7 inch (0 to 2/yd^2) common lambsquarters, 4 to 8 inch (0 to 2/yd^2) biennial wormwood, and 5 to 7 inch (0 to 1/yd^2) kochia. LPOST treatments were applied on July 20 at 8:30 am with 63 F air, 77 F soil surface, 90% relative humidity, 25% clouds, 5 to 7 mph E wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V4 to V6 soybean. Weeds species present were: 4 to 12 inch (2 to 5/yd^2) redroot pigweed, 4 to 8 inch (1 to 4/yd^2) common lambsquarters, 4 to 6 inch (0 to 2/yd^2) biennial wormwood. PRE treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a bicycle-type plot sprayer with attached windscreen delivering 17 gpa at 40 psi through 8002 TeeJet flat-fan nozzles. All POST 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 11001 Turbo TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

The objective of this study was to evaluate soybean yield from a soil-applied followed by a postemergence application treatments compared to total POST applications applied to large weeds (See methods paragraph). Soybean stand was poor due to cold and dry conditions which extended through June resulting in very poor yields. On July 12 (14 DAT POST), soybean plants in all Python plots were chlorotic with 20 to 30% stunting and 50% of the soybean plants in the FirstRate plots were chlorotic with 10 to 20% stunting. All POST, MPOST, LPOST plots had 100% redroot pigweed, common lambsquarters, kochia, and biennial wormwood control. On July 27, Aug 10, and Aug 24, soybean plants were the same as on July 12, except FirstRate showed more chlorosis and burning than Valor at 2 oz plus Python. On Sept 7, injured soybean had recovered and all plots had 100% weed control. Soybean chlorosis from Python was due to miscalculation error where Python was applied at higher rate of a factor of 10X (5 oz/A instead of 0.5 oz/A). (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. 2 - pass weed control in soybean (Zollinger and Ries).

		PRE Application			
		34 DAT			Soybean
Treatment[1]	Rate	Rrpw	Colq	Biww	Yield
	(product/A)	(%)	(%)	(%)	(bu/A)
PRE/POST					
Valor/RUWM+AMS	1.5oz/22fl oz+2 lb	84	84	99	18.6
Valor/RUWM+AMS	2oz/22fl oz+2 lb	90	88	98	18.9
Valor+Python/RUWM+AMS	1.5oz+5oz/22fl oz+2 lb	92	87	96	16.5
Valor+Python/RUWM+AMS	2oz+5oz/22fl oz+2 lb	90	87	96	20.2
Valor+FirstRate/RUWM+AMS	1.5oz+0.3oz/22fl oz+2 lb	85	82	96	16.0
MPOST/LPOST					
RUWM+AMS/RUWM+AMS	22fl oz+2 lb/22fl oz+2 lb	-	-	-	22.8
Untreated		0	0	0	0
LSD (0.05)		10	13	6	7.1

[1]RUWM = Roundup WeatherMax; AMS = ammonium sulfate.

Nutrient additives in glyphosate-resistant soybean. Zollinger, Richard K. and Jerry L.Ries. An experiment was conducted near Alice, ND, to evaluate crop response to glyphosate and nutrient additives applied POST/LPOST. Asgrow 'AG0801' soybean was planted on May 19, 2004. POST treatments were applied on July 2 at 8:40 am with 73 F air, 72 F soil surface, 86% relative humidity,100% clouds, 6 to 10 mph SSW wind, dry soil surface and subsoil, good crop vigor, and no dew present to V3 to V4 soybean. Weed species present were: 2 to 6 inch (5 to 15/yd^2) redroot pigweed; 1 to 6 inch (5 to 15/yd^2) common lambsquarters, and 1 to 5 inch (5 to 15/yd^2) biennial wormwood. LPOST treatments were applied on July 29 at 12:40 pm with 69 F air, 83 F soil surface, 54% relative humidity, 10% clouds, 3 to 7 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to R1 soybean. Weeds species present were: 4 to 14 inch (5 to 15/yd^2) common lambsquarters; and 5 to 16 inch (5 to 15/yd^2) biennial wormwood. 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 TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

The objective of this study was evaluate affect of micronutrients applied with the 2nd glyphosate application in Roundup Ready Soybean. All treatments controlled weeds but there were no differences in yield due to environment not treatment differences. Cold and dry conditions prevailed well into the growing season which delayed germination and reduced soybean growth. The affects of these abnormal growing conditions lasted throughout the rest of the growing season and resulted in low yields. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Nutrient additives in glyphosate-resistant soybean (Zollinger and Ries).

		August 12			August 26			Soybean
Treatment[1]	Rate	Rrpw	Colq	Biww	Rrpw	Colq	Biww	Yield
	(product/A)	----- (%) -----			----- (%) -----			(bu/A)
TD HiTech+Liberate+Choice/ TD HiTech+Liberate+Choice	15fl oz+0.25% v/v+0.5% v/v / 15fl oz+0.25% v/v+0.5% v/v	99	99	99	99	99	99	24
TD HiTech+Liberate+Choice/ TD HiTech+Liberate+Choice+Citraplex MN 20%	15fl oz+0.25% v/v+0.5% v/v / 15fl oz+0.25% v/v+0.5% v/v+1lb	99	99	99	99	99	99	25
TD HiTech+Liberate+Choice/ TD HiTech+Liberate+Choice+Awaken 16-0-2	15fl oz+0.25% v/v+0.5% v/v / 15fl oz+0.25% v/v+0.5% v/v+2qt	99	99	99	99	99	99	24
TD HiTech+ClassAct NG/ TD HiTech+ClassAct NG	15fl oz+2.5% v/v / 15fl oz+2.5% v/v	99	99	99	99	99	99	24
TD HiTech+ClassAct NG/ TD HiTech+ClassAct NG+Maxin for Beans	15fl oz+2.5% v/v / 15fl oz+2.5% v/v+1qt	99	99	99	99	99	99	25
TD HiTech+ClassAct NG/ TD HiTech+ClassAct NG+Maxin MN	15fl oz+2.5% v/v / 15fl oz+2.5% v/v+1qt	99	99	99	99	99	99	22
Untreated		0	0	0	0	0	0	0
LSD (0.05)		0	0	0	0	0	0	8

[1]Liberate = nonionic surfactant; Choice = water conditioning agents; Class Act NG (Next Generation) = surfactants + fertilizer; Citraplex MN 20% and Awaken 16-0-2 = micronutrient fertilizers from UAP; Maxin for Beans and Maxin MN = micronutrient fertilizers from Agriliance.

Glyphosate-resistant volunteer soybean control. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate volunteer glyphosate-resistant soybean control at two soybean stages with no corn present. NDSU 'RG200RR' soybean was planted on May 28, 2004. POST treatments were applied on June 28 at 12:05 pm with 77 F air, 91 F soil surface, 22% relative humidity, 0% clouds, 7 to 12 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V2 to V3 soybean. Late postemergence (LPOST) treatments were applied July 13 at 11:00 am with 75 F air, 84 F soil surface, 56% relative humidity, 0% clouds, 7 to 10 mph NW wind, moist soil surface, wet subsoil, good crop vigor, and no dew present to V4 to V6 soybean. Treatments were applied to the center 6.7 feet of the 10 by 40 plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 11001 Turbo TeeJet flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Herbicides rates used were significantly reduced from labeled crop use. Soybean size at application determined degree of control with reduced herbicide rates. Data shows herbicide application early is key for soybean control. Most herbicides applied to V2 to V3 soybean gave near complete control. The rate of 2,4-D, clopyralid&2,4-D, or the lowest rate of clopyralid&fluroxypyr gave less than 80% soybean control. Herbicides applied to V4 to V6 soybean slowly elicited phytotoxicity and did not give greater than 53% control at 14 DAT. However, by 28 DAT only treatments containing dicamba gave greater than 93% control. Soybean control from treatments containing clopyralid seems inconsistent in that the greatest control observed was from flumetsulam&clopyralid. Flumetsulam is labeled preemergence on soybean but apparently causes greater injury when applied POST because flumetsulam&clopyralid resulted in greater injury than other cloypyralid pre-mixes when applied at V2 to V3 soybean. 2,4-D or fluroxypyr when pre-mixed with clopyralid did not increase soybean control to the same level as flumetsulam&clopyralid in the earlier application. However, the high rates of 2,4-D or fluroxypyr with cloypyralid were similar to flumetsulam&clopyralid in the later application. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Glyphosate-resistant volunteer soybean control (Zollinger and Ries).

		Soybean control			
		V2 to V3		V4 to V6	
Treatment[1]	Rate	14 DAT	28 DAT	14 DAT	28 DAT
	(product/A)	(%)	(%)	(%)	(%)
Dicamba+Herbimax	4fl oz+1qt	99	99	40	96
Dicamba+Herbimax	5fl oz+1qt	99	99	40	93
Distinct (Dicamba&diflufenzopyr)+Herbimax	1oz+1qt	70	95	40	83
Distinct (Dicamba&diflufenzopyr)+Herbimax	2oz+1qt	94	98	40	94
Atrazine+Herbimax	0.42 lb+1qt	92	92	50	53
Atrazine+Herbimax	0.56 lb+1qt	94	95	53	70
2,4-D Amine	0.25pt	20	20	33	43
2,4-D Amine	0.5pt	30	30	40	60
Curtail (Clopyralid&2,4-D)	0.25pt	35	67	33	53
Curtail (Clopyralid&2,4-D)	0.5pt	72	77	40	83
Hornet WDG (Flumetsulam&clopyralid)+Herbimax	1oz+1qt	80	95	37	75
Hornet WDG (Flumetsulam&clopyralid)+Herbimax	2oz+1qt	97	97	40	80
WideMatch (Clopyralid&fluroxypyr)	0.125pt	33	60	-	-
WideMatch (Clopyralid&fluroxypyr)	0.25pt	63	92	40	83
LSD (0.05)		5	3	5	8

[1]Herbimax = petroleum oil concentrate.

Volunteer canola control in soybean. Jenks, Markle, and Willoughby. Roundup Ready soybeans were seeded May 18 at 80 lb/A into 7.5-inch rows. Canola was seeded over the top to simulate a volunteer canola (VC) situation. Individual plots were 10 x 30 ft and replicated 3 times. Herbicide treatments were applied preemergence (PRE) on May 18 with a bicycle sprayer delivering 20 gpa at 30 psi with XR 80015 nozzles. Air and soil temperatures were 80 and 61 F, respectively, relative humidity was 18%. Postemergence treatments were applied to 3-leaf canola on June 18 with a bicycle sprayer delivering 10 gpa at 40 psi through XR 8001 nozzles. Air and soil temperatures were 66 and 63 F, respectively, relative humidity was 25%. Treatments to 6-leaf canola were applied in the same fashion on June 28. Air and soil temperatures were 82 and 83 F, respectively, relative humidity was 30%.

In soybeans, soil-applied Valor and Extreme provided excellent VC control, while Sencor and Python provided fair to good control. Raptor and Flexstar , applied postemergence, provided excellent VC control at both timings. Harmony GT, Basagran, and Cobra provided much less control when applied at the 6-leaf stage. Ultra Blazer at 0.5 pt provided poor VC control at either timing. In 2003, both 0.33 and 0.75 pt provided excellent VC control. Cool and cloudy conditions during the 2004 growing season may have reduced Ultra Blazer activity.

Table. Volunteer canola control in soybean (2004).

			Volunteer Canola	
Treatment	Rate	Timing	Jul 8	Jul 28
			% control	
Sencor	0.25 lb	PRE	79	83
Valor	2.5 oz	PRE	99	98
Python	1 oz	PRE	73	79
Extreme	1.5 pt	PRE	98	96
Harmony GT + NIS	0.083 oz + 0.125% v/v	3-leaf	88	77
Harmony GT + NIS	0.083 oz + 0.125% v/v	6-leaf	35	60
Basagran + COC	0.5 pt + 1 qt	3-leaf	76	90
Basagran + COC	0.5 pt + 1 qt	6-leaf	53	71
Raptor + NIS + 28% N	4 fl oz + 0.25% v/v + 2.5% v/v	3-leaf	98	98
Raptor + NIS + 28% N	4 fl oz + 0.25% v/v + 2.5% v/v	6-leaf	77	98
Cobra + COC	6 fl oz + 1 qt	3-leaf	73	85
Cobra + COC	6 fl oz + 1 qt	6-leaf	40	35
Ultra Blazer + NIS	0.5 pt + 0.125% v/v	3-leaf	22	45
Ultra Blazer + NIS	0.5 pt + 0.125% v/v	6-leaf	32	28
Flexstar + MSO + AMS	0.75 pt + 1% v/v + 2.94 gal/100 gal	3-leaf	99	99
Flexstar + MSO + AMS	0.75 pt + 1% v/v + 2.94 gal/100 gal	6-leaf	95	97
Untreated			0	0
LSD (0.05)			16	22
CV			14	18

Roundup application timing for weed control in soybean. Kegode and Ciernia. This study was conducted at Fargo and used Roundup applications to control weeds in plots at the VC, V1, and V3 growth stages of soybean. Asgrow AG 0801 RR soybean was seeded in 7 in. rows on May 20. Treatments consisted of 2 pt/A Roundup UltraMax II plus 32 oz/A AMS and were applied June 4 (VC), June 24 (V1), and July 9 (V3) with a 4-nozzle bike sprayer equipped with XR8001 tips which delivered 8.5 gpa at 40 psi. . Subsequent to each application weed escapes were monitored weekly in four 1 ft^2 quadrats per plot. Weed biomass was harvested from these quadrats on Oct. 12 dried, and biomass production per acre determined. The center 2 rows of each plot were harvested on Oct. 12. The experiment was a randomized complete block design with 4 replicates.

Roundup application timing	Soybean Yield
	Bu/A
Soybean VC stage	21
Soybean V1 stage	21
Soybean V3 stage	22
Weed free	22
Untreated	21
Number of reps	4
C.V. %	11
LSD 5%	NS

This study was designed to determine how weed escapes following Roundup applications in RR soybean would influence crop yield. However, because soybean was seeded late weeds that emerged either did not compete effectively with soybean or were controlled by the Roundup treatments. In addition, because of the relatively cool months of June and July, very few weeds emerged following soybean emergence which perhaps explains in part why soybean yields did not differ among treatments.

HARES Field Validation for Weed Control in Soybeans, Zhou, Kegode, and Ciernia. The experiment was conducted near Fargo, Casselton, and Prosper, ND to validate weed control recommendations by the computer program HARES (Herbicide Application Rule-based Expert System) that was developed at NDSU. Glyphosate-resistant soybean was seeded in 7-inch rows. The target weeds were foxtail and redroot pigweed. HARES recommended PRE treatments according to soil properties, soil condition, and temperature for each site. PRE treatments were applied at May 28. The soil properties and conditions at application are shown in Table 1. HARES recommended POST treatments according to soil and weather conditions and weed situations, which included density, and size. POST treatments were applied July 1. Conditions at application are shown in Table 2. Treatments were applied to the center 6.7 ft of the 10 by 30 ft plots with a bicycle-wheel-type plot sprayer, which delivered 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatment. Experimental design was a randomized complete block with four replicates. Weed control was evaluated visually two times where 0 equaled no visible injury and 100 equaled complete control.

Table 1. Soil properties and environmental conditions at Fargo, Casselton, and Prosper at PRE application.

	Soil property			Conditions			
Location	PH	OM	Type	Temperature (F)	Soil moisture	Sky	Wind
Fargo	7.5	5%	Silty clay	68	dry	Sunny	2 mph N
Prosper	7.0	4%	Loam	67	Moist	Cloudy	5 mph NW
Casselton	7.8	4.4%	Silty clay	70	Wet	25% cloudy	9 mph NW

Table 2. Environmental conditions and major weeds and height at Fargo, Casselton, and Prosper at POST application

Location	Temperature	RH	Sky	Wind	Major weed (inch)
Fargo	72 F	49%	40% cloudy	8 mph S	Fxtl (4), Wimu (5), Vema (3)
Prosper	71 F	50%	30% cloudy	7 mph SW	Fxtl (5), Hans (3), Rrpw (3), Colq (6)
Casselton	75 F	52%	15% cloudy	5 mph SW	Fxtl (4), Rrpw (4), Cocb (5)

Weed control threshold refers to the lowest required control, which was set at 80% for HARES. Two PRE and three POST treatments were selected from a list of recommendation provided by HARES for comparison at each location. The predominant weed species at each location were: foxtail (Fxtl), wild mustard (Wimu), and Venice mellow (Vema) at Fargo; foxtail, redroot pigweed (Rrpw), hairy nightshade (Hans), and common lambsquarters (Colq) at Prosper; and foxtail, redroot pigweed, and common cocklebur (Cocb) at Casselton.

Table 3. Treatments recommended by HARES and weed control at Fargo

			July 15			July 29		
Treatment	Timing	Rate	Fxtl	Wimu	Vema	Fxtl	Wimu	Vema
		lb ai/A	*% Control*					
Outlook	PRE	1	95	78	89	90	71	85
Dual II Magnum	PRE	1.9	92	50	84	90	34	90
Raptor	POST	0.039	92	98	90	93	98	89
Rezult	POST	1 + 0.2	89	90	92	92	95	90
Glyphosate	POST	0.57	98	98	96	98	97	97
Untreated		0	0	0	0	0	0	0
LSD (0.05)			3	5	9	3	7	4

Table 4. Treatments recommended by HARES, weed control, and soybean yield at Prosper

Treatment	Timing	Rate	July 15				July 29				Soybean yield
			Fxtl	Rrpw	Hans	Colq	Fxtl	Rrpw	Hans	Colq	
		lb ai /A	*% Control*								*Bu/A*
Outlook	PRE	0.86	93	87	65	86	94	79	40	80	15
Dual II Magnum	PRE	1.57	96	90	40	90	96	90	40	95	17
Raptor	POST	0.039	98	95	90	--	98	94	95	--	16
Rezult	POST	1+0.2	93	76	27	94	90	69	15	90	20
Glyphosate	POST	0.57	98	98	98	96	98	98	95	95	20
Untreated		0	0	0	0	0	0	0	0	0	12
LSD (0.05)			7	6	6	8	5	5	9	11	NS

Table 5. Treatments recommended by HARES, weed control, and soybean yield at Casselton

Treatment	Timing	Rate	July 15			July 29			Soybean yield
			Fxtl	Rrpw	Cocb	Fxtl	Rrpw	Cocb	
		lb ai /A	*% Control*						*Bu/A*
Outlook	PRE	0.86	95	98	89	90	80	85	41
Dual II Magnum	PRE	1.57	92	60	84	90	34	90	39
Raptor + Ultra Blazer	POST	0.039+0.25	88	89	93	90	80	95	39
Rezult	POST	1+0.2	93	65	91	95	45	95	37
Glyphosate	POST	0.57	98	98	98	98	98	98	42
Untreated		0	0	0	0	0	0	0	17
LSD (0.05)			3	6	4	2	7	5	7

The density of redroot pigweed, one of the predefined target weeds for PRE, was very low and inconsistent at Fargo. Foxtail density at Fargo was relatively high and all treatments provided better than the predefined control level of 80% (Table 3). Outlook and Duall II Magnum provided foxtail control of 90% or greater at all three sites. Control of redroot pigweed with Duall II Magnum was 90% at Prosper and only 34% at Casselton, whereas it was about 80% with Outlook (Table 4 and 5). At Prosper, control of redroot pigweed was lowest at 45% (Casselton) and 69% (Prosper) with Rezult (Table 4 and 5), whereas all other POST-applied treatments were equal to or were better than the predefined control level of 80%. Foxtail control was 90% or better. There was a relatively high density of hairy nightshade at Prosper that was poorly controlled by a majority of treatments and which flourished late in the season and may have impacted soybean yield. In the first year field validation, HARES has provided good to excellent recommendations for weed control as well as information on improving the program.

POST weed control in corn. Zollinger, Richard K. And Jerry L. Ries. An experiment was conducted near Casselton, ND, to evaluate crop injury and weed control from POST applications. DeKalb 'DKC35-50' glyphosate-resistant corn was planted on April 28, 2004. POST treatments were applied on June 25 at 10:45 am with 68 F air, 71 F soil surface, 31% relative humidity, 76% clouds, 3 to 5 mph NW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 12 to 20 inch (4 to 6 collar) corn. Weed species present were: 2 to 8 inch (5 to 15/yd^2) common lambsquarters; 2 to 6 inch (5 to 15/yd^2) redroot pigweed; 3 inch to bloom (5 to 15/yd^2) wild mustard; 2 to 8 inch (1 to 15/ft^2) yellow foxtail; and 2 inch to vining (1 to 2/yd^2) wild buckwheat. 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 11001 Turbo TeeJet nozzles. The experiment had randomized complete block design with three replications per treatment.

All glyphosate treatments controlled grass and broadleaf weeds. Option and Steadfast treatments controlled wild mustard, redroot pigweed, and common lambsquarters at 30 DAT. Atrazine added to Steadfast with Priority and adjuvant controlled wild buckwheat in non-glyphosate treatments. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. POST weed control in corn (Zollinger and Ries).

		7 DAT					30 DAT				
Treatment[1]	Rate	Yeft	Wimu	Rrpw	Colq	Wibw	Yeft	Wimu	Rrpw	Colq	Wibw
	(product/A)	---------- (%) ----------					---------- (%) ----------				
Buccaneer	1qt	99	99	99	99	99	99	99	99	99	99
Buccaneer+CB Premier 90+AMS	1qt+0.5% v/v+8.5 lb/100 gal	99	99	99	99	99	99	99	99	99	99
Buccaneer+One-Ap XL	1qt+9 lb/100 gal	99	99	99	99	99	99	99	99	99	99
Buccaneer Plus+Volley+ CB Gardian Plus	1qt+2pt+ 2.5% v/v	99	99	99	99	99	99	99	99	99	99
Buccaneer Plus+Atrazine+ CB Gardian Plus	1qt+0.83 lb+ 2.5% v/v	99	99	99	99	99	99	99	99	99	99
Buccaneer Plus+Volley+ Atrazine+CB Gardian Plus	1qt+1.5pt+ 0.556 lb+2.5% v/v	70	70	99	99	99	95	82	99	99	99
Option+Priority+Soy-Stik+AMS	1.5oz+1oz+1.5pt+2 lb	60	70	70	70	70	73	99	99	93	70
Steadfast+Priority+ Premium COC+AMS	0.75oz+1oz+ 1% v/v+2 lb	60	60	70	70	70	78	99	99	90	70
Steadfast+Priority+Atrazine+ Premium COC+AMS	0.75oz+1oz+0.556 lb+ 1% v/v+2 lb	65	50	70	70	70	75	98	99	99	99
Steadfast+Priority+Volley+ Premium COC+AMS	0.75oz+0.5oz+1.5pt+ 1% v/v+2 lb	60	50	70	70	70	73	99	99	92	70
LSD (0.05)		5	6	4	4	4	3	2	0	2	0

[1]CB (Cornbelt) Premier 90 = nonionic surfactant; AMS = ammonium sulfate; One-Ap XL = AMS + surfactant + deposition + retention + defoamer; CB Gardian Plus = AMS + deposition + defoamer; Soy-Stik = methylated seed oil; Premium COC = petroleum oil concentrate.

Buccaneer formulations and adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Alice, ND, to evaluate common lambsquarters control of treatments applied POST on non-cropland. On June 18, 2004, POST treatments were applied at 9:30 am with 52 F air, 68 F soil surface, 44% relative humidity, 25% clouds, 5 to 9 mph N wind, dry soil surface, moist subsoil, and no dew present. Weed species present were: 8 to 14 inch (20 to 40/ft^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 TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

A reduce rate of glyphosate and large common lambsquarters were used to evaluate adjuvant enhancement. Proprietary adjuvants were used but increase in common lambsquarters control were due to surfactant and AMS in the adjuvant formulations. Buccaneer Plus has a higher surfactant load in the formulation than Buccaneer which probably contribute to increased weed control. Some adjuvants (WC037 and WC036) appear to enhance and optimize both formulations of glyphosate. Experimental adjuvant WC038 ratings were similar to Buccaneer when applied alone. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Buccaneer formulations and adjuvants (Zollinger and Ries).

		14 DAT	28 DAT
Treatment[1]	Rate	Colq	Colq
	(product/A)	(%)	(%)
Buccaneer	0.75pt	50	50
Buccaneer+CB Premier 90+AMS	0.75pt+0.5% v/v+8.5lb/100gal	63	77
Buccaneer Plus+CB Gardian	0.75pt+0.5% v/v	57	67
Buccaneer+One-Ap XL	0.75pt+9 lb/100gal	70	83
Buccaneer+WC038	0.75pt+0.5% v/v	43	57
Buccaneer Plus+CB Dri-Gard	0.75pt+9 lb/100gal	63	75
Buccaneer Plus+CB Gardian Plus	0.75pt+2.5% v/v	60	70
Buccaneer+WC037	0.75pt+0.5% v/v	70	83
Buccaneer Plus+WC037	0.75pt+0.5% v/v	80	88
Buccaneer+WC037	0.75pt+1% v/v	93	92
Buccaneer Plus+WC037	0.75pt+1% v/v	93	93
Buccaneer+WC036	0.75pt+0.5% v/v	82	88
LSD (0.05)		5	6

[1]CB (Cornbelt) Premier 90 = nonionic surfactant; AMS = ammonium sulfate; CB Gardian = AMS + drift + deposition + water conditioner; One-Ap XL = AMS + surfactant + deposition + retention + defoamer; WC038, WC037, and WC036 are proprietary adjuvants from West Central Inc.; CB Dri-Gard and CB Gardian Plus = AMS + deposition + water conditioner.

Buccaneer and Roundup UltraMax II with adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Alice, ND, to evaluate common lambsquarters control from Buccaneer and Roundup (RU) UltraMax II treatments applied POST to non-cropland. On June 18, 2004, POST Buccaneer treatments were applied at 9:40 am with 51 F air, 68 F soil surface, 43% relative humidity, 30% clouds, 5 to 8 mph N wind, dry soil surface, moist subsoil, and no dew present. RU UltraMax II treatments were applied at 10:00 am with 53 F air, 68 F soil surface, 45% relative humidity, 25% clouds, 6 to 10 mph N wind, dry soil surface, moist subsoil, and no dew present. Weed species present were: 8 to 14 inch (20 to 40/ft^2) common lambsquarters. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replications per treatment.

Low glyphosate rates and large common lambsquarters were use to determine adjuvant enhancement of glyphosate. Data again shows that glyphosate is optimized by AMS (Bronc) + NIS (R-11) and other adjuvants and adjuvant combination may not be equal. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table 1. Buccaneer with adjuvants (Zollinger and Ries).

Treatment[1]	Rate	14 DAT Colq	28 DAT Colq
	(product/A)	(%)	(%)
Buccaneer	0.75pt	40	47
Buccaneer+Bronc Max+R-11	0.75pt+0.5% v/v+0.25% v/v	73	73
Buccaneer+Bronc Max EDT+R-11	0.75pt+0.5% v/v+0.25% v/v	80	87
Buccaneer+Bronc Max+WECO 11-1	0.75pt+0.5% v/v+0.25% v/v	47	53
Buccaneer+WECO-CPAK	0.75pt+0.75% v/v	47	60
Buccaneer+Bronc Plus Dry EDT	0.75pt+10lb/100gal	73	83
Buccaneer+WECO 11-2A	0.75pt+0.75% v/v	60	70
Buccaneer+Bronc+R-11	0.75pt+2.5% v/v+0.25% v/v	85	92
LSD (0.05)		8	6

[1]Bronc Max = watering conditioning agents + surfactants; R-11 = nonionic surrfactant; Bronc Max EDT = AMS + deposition + water conditioning; WECO products are proprietary adjuvants from Wilbur-Ellis; Bronc = ammonium sulfate solution.

Table 2. RU UltraMax II with adjuvants (Zollinger and Ries).

Treatment[1]	Rate	14 DAT Colq	28 DAT Colq
	(product/A)	(%)	(%)
RU UltraMax II	0.75pt	62	60
RU UltraMax II+Bronc Max+R-11	0.75pt+0.5% v/v+0.25% v/v	87	92
RU UltraMax II+Bronc Max EDT+R-11	0.75pt+0.5% v/v+0.25% v/v	82	92
RU UltraMax II+Bronc Max+WECO 11-1	0.75pt+0.5% v/v+0.25% v/v	70	80
RU UltraMax II+WECO-CPAK	0.75pt+0.75% v/v	63	75
RU UltraMax II+Bronc Plus Dry EDT	0.75pt+10lb/100gal	77	88
RU UltraMax II+WECO 11-2A	0.75pt+0.75% v/v	53	67
RU UltraMax II+Bronc+R-11	0.75pt+2.5% v/v+0.25% v/v	87	92
LSD (0.05)		5	3

[1]Bronc Max = watering conditioning agents + surfactants; R-11 = nonionic surrfactant; Bronc Max EDT = AMS + deposition + water conditioning; WECO products are proprietary adjuvants from Wilbur-Ellis; Bronc = ammonium sulfate solution.

Glyphosate with buffered NIS adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Alice, ND, to evaluate common lambsquarters control from treatments applied POST on non-cropland. POST treatments were applied on June 18, 2004 at 9:15 am with 52 F air, 67 F soil surface, 44% relative humidity, 30% clouds, 6 to 9 mph N wind, dry soil surface, moist subsoil, and no dew present. Weed species present were: 8 to 14 inch (20 to 40/ft^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 TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

Touchdown HiTech was used because it has no NIS in the formulation and common lambsquarters was large at application to get treatment separation and detect adjuvant enhancement differences. Touchdown at 7.2 fl oz/A equals 3/4 pt of a 3 lb ae/gal glyphosate. All adjuvants increase common lambquarters control over Touchdown HiTech applied alone. R-11, AG 03030, and Wet-Sol provided the greatest adjuvant enhancement of Touchdown HiTech. Previous research has shown R-11 to enhance glyphosate. See ND Weed Control Guide). Data on Wet-Sol from Schaeffers was interesting. Schaeffers makes high quality oils for engine lubrication and other types. More research will be conducted with this adjuvant. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Glyphosate with buffered NIS adjuvants (Zollinger and Ries).

		14 DAT	28 DAT
Treatment[1]	Rate	Colq	Colq
	(product/A)	- - (%) - -	- - (%) - -
Touchdown HiTech +	7.2fl oz +	20	7
Preference	0.5% v/v	65	57
AG 03019	0.5fl oz	37	30
AG 03037	0.5% v/v	37	30
TopSurf	0.5% v/v	37	30
AG 03030	0.5% v/v	70	73
AG 04021	0.5% v/v	40	37
R-11	0.5% v/v	72	75
L-283	0.5% v/v	50	57
Wet-Sol	0.5% v/v	72	78
Liberate	0.5% v/v	43	53
APSA-80	0.5% v/v	50	60
LSD (0.05)		7	9

[1]Preference, TopSurf, R-11, Wet-Sol, Liberate, and APSA-80 = nonionic surfactants; AG - 03019, 03037, 03030, and 04021 are proprietary adjuvants from Agriliance; L-283 is a proprietary adjuvant from NDSU.

Spray retention and drift control. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Alice, ND, to evaluate common lambsquarters control. POST treatments were applied June 18, 2004 at 9:10 am with 51 F air, 60 F soil surface, 43% relative humidity, 35% clouds, 6 to 9 mph NNE wind, dry soil surface, moist subsoil and no dew present to non-cropland. Weed species present were: 8 to 16 inch (5 to 20/ft^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 TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

RU Original formulation of glyphosate was applied with various drift reducing agents. All drift agents improved weed control probably because of the affect of surfactants, AMS, and adjuvants in the formulations. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Spray retention and drift control (Zollinger and Ries).

Treatments[1]	Rate	July 2 Colq	July 16 Colq
	(product/A)	(%)	(%)
POST			
RU Original	12fl oz	50	50
RU Original+Alliance	12fl oz+5qt/100gal	67	70
RU Original+Alliance+InterLock	12fl oz+5qt/100gal+2fl oz	60	68
RU Original+Alliance+InterLock	12fl oz+5qt/100gal+4fl oz	63	63
RU Original+Corral Dry	12fl oz+10lb/100gal	62	63
RU Original+Arrow Four	12fl oz+3qt/100gal	67	67
RU Original+Alliance+AG 04020	12fl oz+5qt/100gal+4fl oz	73	78
RU Original+N-Pac AMS+AG 04021	12fl oz+2.5% v/v+0.5% v/v	70	73
RU Original+Array	12fl oz+9lb/100gal	60	70
Untreated		0	0
LSD (0.05)		5	5

[1]Alliance = water conditioning agent; InterLock = drift control agent; Corral Dry = AMS + drift retardant; Arrow Four = AMS + water conditioning + deposition + defoamer; AG 04020, AG 04021, and AG 04028 are proprietary adjuvants from Agriliance; Array = AMS + deposition + retention + defoamer.

Roundup UltraMax II + AMS replacement adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Alice, ND, to evaluate weed efficacy to Roundup UltraMax II (RUM II) when applied with AMS replacement type adjuvants. POST treatments were applied on June 14, 2004 at 9:30 am with 54 F air, 65 F soil surface, 64% relative humidity, 100% clouds, 0 to 2 NW wind, dry soil surface, moist subsoil, and no dew present to non-cropland. Weeds species present: 4 to 16 inch (20 to 40/ft^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 water with 500 ppm hardness at 8.5 gpa at 40 psi through 8001 TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

500 ppm hard water was prepared by adding:

95.6 g $CaCl_2 : 2H_20$ to enough Fargo municipal water to make 1.3 L of stock solution and
63.0 g $MgCl_2 : 6H_2O$ to enough Fargo municipal water to make 0.4 L of stock solution.

Then 6.58 ml of the 1.3 L CaCl stock solution and 1.63 ml of the 0.4 L MgCl stock solution was added and thoroughly mixed in each treatment bottle containing Fargo municipal water before herbicides and adjuvants were added.

Hard water was used for all treatments except the first two. Applying glyphosate with 500 ppm hard water completely inactivated glyphosate at 8 and 12 fl oz (equivalent to 3/4 and 1 pt/A of a 3lb ae/gal concentration). 500 ppm hardness is not uncommon and is normally higher in North Dakota. Water in north-central and western ND and many other places in the state, water can exceed 2,600 ppm hardness.

A formula for amount of AMS to overcome water hardness was developed by Dr. John Nalewaja and is published in the ND Weed Control Guide in the Spray Carrier Water Quality section. Magnesium and calcium are two of the strongest antagonists to glyphosate. According to the formula, less than 6 lbs of AMS/100 gallon of water is needed to prevent hard water antagonism.

Adjuvant companies claim AMS replacements "condition" the spray solution, thereby preventing glyphosate antagonism. They claim these adjuvants can function in the place of AMS or allow reduced AMS rates to be used. Many adjuvants in this study are categorized as AMS replacements: Alliance, Choice, N Tank, and Quest. However, none of these performed better than AMS. Only five commercial adjuvants gave statistically greater lambsquarters control than AMS at 8.5 lb/100 gallons of water: R-11 + AMS, Class Act NG, N-Tank, Full Load HWP, and Reddy-It. R-11 has historically enhanced glyphosate activity (see ND Weed Control Guide, Spray Adjuvants section) and combined with AMS gave 93% control. A reduced rate of Roundup UltraMax II also resulted in a reduced surfactant load originating from the formulation. So adding more surfactant to a reduced glyphosate rate would enhance control. The same is true with Surfate (NIS + AMS) and this product has enhanced weed control from glyphosate and other weak acid herbicides. Interesting that Activator 90 alone and with AMS did not provide the same weed control as R-11 alone and with AMS, respectively, showing that all surfactants are not created equal.

N-Tank acidifies the pH of the spray solution to the pKa of the glyphosate molecule (pH ~2) and by doing so prevents binding with cations. Very acidic spray water may damage application equipment and may pose a risk to applicators. N-Tank also contains a nitrogen source which is important because nitrogen is needed to make glyphosate-N in the spray solution which enhances absorption and translocation.

The author does not know the components in Full Load HWP but HWP is an acronym for Hard Water Protection so it must work in this case. Reddy-It is from Adjuvants Plus and contains some MSO. The company claim the adjuvant works with many other herbicides types also (SUs, IMIs, 2,4-D, dicamba, others). MSO or oil with little or no surfactant has been shown to antagonize glyphosate. However, with a sufficient concentration of surfactant glyphosate activity was high.

Summary, the user should have his water source analyzed for hard water, calculate the amount of AMS needed to inactivate hard water cations, always use AMS with glyphosate, have the patience to wait for the AMS to dissolve before spraying, and use adjuvants that optimize glyphosate activity. If time is critical, liquid AMS is available from most chemical distributors. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Roundup UltraMax II + AMS replacement adjuvants (Zollinger and Ries).

Treatment[1]	Rate	14 DAT Colq	28 DAT Colq
	(product/A)	(%)	(%)
Fargo municipal water			
Roundup UltraMax II	12fl oz	60	90
Roundup UltraMax II	8fl oz	40	60
Hard water - 500 ppm hardness			
Roundup UltraMax II	12fl oz	0	0
Roundup UltraMax II+	8fl oz+	0	0
AMS	8.5lb/100gal	50	82
Surfate	1% v/v	50	80
Activator 90	0.25% v/v	40	70
R-11	0.25% v/v	60	80
Activator 90+AMS	0.25% v/v+AMS	50	82
R-11+AMS	0.25% v/v+8.5lb/100gal	63	93
N-Pac AMS	5% v/v	47	78
ClassAct NG	2.5% v/v	60	88
Alliance	1.25% v/v	60	80
Alliance	0.75% v/v	40	83
AG 03018	0.5% v/v	57	70
AG 03030	0.5% v/v	57	80
AG 04027	3lb/100gal	47	70
AG 04031	0.25% v/v	63	75
Arrow Four	0.75% v/v	53	73
Choice	0.5% v/v	37	65
Quest	0.5% v/v	33	70
N Tank	1% v/v	72	96
Spray Savy	0.5% v/v	40	70
Full Load HWP	0.5% v/v	50	90
L-283	1% v/v	40	75
Reddy It	0.3% v/v	62	93
Citron	2.2lb/100gal	23	65
ATR-0407	0.5% v/v	40	73
ATR-0409	0.5% v/v	50	87
Herbolyte	1% v/v	38	70
GlyGran[2]+AQ114	5.6oz+0.5% v/v	40	70
GlyGran+AQ114	5.6oz+1% v/v	40	70
LSD (0.05)		5	4

[1]AMS = ammonium sulfate; Surfate, ClassAct NG (Next Generation) = surfactants + fertilizers; Activator 90 and R-11 = nonionic surfactants; N-PAC AMS = ammonium sulfate solution; Alliance, Choice, Quest, and N tank= water conditioning agents; AG 03018, AG 03030, AG 04027, and AG 04031 = proprietary adjuvants from Agriliance; Arrow Four = AMS + water conditioners + deposition + defoamer; Spray Savy and Full Load HWP = proprietary adjuvant from AgraSyst; L-283 = proprietary adjuvant from NDSU; Reddy It = methylated seed oil complex surfactant blend; Citron = AMS replacement; ATR-0407 and ATR-0409 = proprietary coded adjuvants; Herbolyte = nonionic surfactant + AMS replacement; AQ114 = proprietary coded adjuvants.

[2]GlyGran = 80 WDG glyphosate.

Glyphosate salt formulations with adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Alice, ND, to evaluate common lambsquarters control from glyphosate salt formulations with adjuvant types. POST treatments were applied on June 14, 2004 at 10:15 am, with 59 F air, 56 F soil surface, 64% relative humidity, 100% clouds, 0 to 2 mph NW wind, dry soil surface, moist subsoil, and no dew present to non-cropland. Weeds species present were: 10 to 18 inch (20 to 40/ft^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 water with 500 ppm hardness at 8.5 gpa at 40 psi through 8001 TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

500 ppm hard water was prepared by adding:
95.6 g $CaCl_2 : 2H_20$ to enough Fargo municipal water to make 1.3 L of stock solution and
63.0 g $MgCl_2 : 6H_2O$ to enough Fargo municipal water to make 0.4 L of stock solution.
Then 6.58 ml of the 1.3 L CaCl stock solution and 1.63 ml of the 0.4 L MgCl stock solution was added and thoroughly mixed in each treatment bottle containing Fargo municipal water before herbicides and adjuvants were added.

The objective of this study was to compare no surfactant formulations of glyphosate-ipa (Roundup Custom) and glyphosate-K (Touchdown Hi-Tech) and full surfactant load formulations of glyphosate-ipa (Roundup UltraMax) and glyphosate-K (Roundup UltraMax II). All four glyphosate formulations were applied at the same acid equivalent rate (0.28 lb ae/A or 3/4 pt/A of a 3 lb ae gal glyphosate formulation and were applied alone and with various adjuvants. (Dept. of Plant Sciences, North Dakota State University, Fargo).

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

		14 DAT	28 DAT
Treatment[1]	Rate	Colq	Colq
	(product/A)	- - (%) - -	- - (%) - -
Roundup UltraMax II +	8fl oz +	23	50
R-11	0.25% v/v	50	70
R-11+AMS	0.5% v/v+1 lb	62	80
Class Act Next Generation	2.5% v/v	53	80
Full Load HWP	0.5% v/v	58	60
Spray Savy	0.35% v/v	40	50
Roundup UltraMax +	9.7fl oz +	58	57
R-11	0.5% v/v	72	75
R-11+AMS	0.5% v/v+1 lb	82	88
Class Act Next Generation	2.5% v/v	73	70
Full Load HWP	0.5% v/v	60	60
Roundup Custom +	9fl oz +	0	0
R-11	0.25% v/v	57	62
R-11+AMS	0.5% v/v+1 lb	75	85
Class Act Next Generation	2.5% v/v	70	70
Touchdown HiTech +	7.2fl oz +	8	0
R-11	0.25% v/v	40	47
R-11+AMS	0.5% v/v+1 lb	52	57
Class Act Next Generation	2.5% v/v	47	50
Spray Savy	0.35% v/v	33	47
LSD (0.05)		10	6

[1]R-11 = nonionic surfactant; AMS = ammonium sulfate; Class Act Next Generation = surfactants + fertilizers; Full Load HWP = ammonium replacement; Spray Savy = water conditioner.

Glyphosate salt formulations. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted neat Alice, ND, to evaluate common lambsquaters control from glyphosate salt formulations with adjuvants on non-cropland. POST applications were made on June 14, 2004 at 9:30 am with 55 F air, 56 F soil surface, 64% relative humidity, 100% clouds, 0 to 2 mph NW wind, dry soil surface, moist subsoil, and no dew present. Weed species present were: 10 to 18 inch (20 to 40/ft^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 water with 500 ppm hardness at 8.5 gpa at 40 psi through 8001 TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replications per treatment.

500 ppm hard water was prepared by adding:

95.6 g $CaCl_2 : 2H_20$ to enough Fargo municipal water to make 1.3 L of stock solution and

63.0 g $MgCl_2 : 6H_2O$ to enough Fargo municipal water to make 0.4 L of stock solution.

Then 6.58 ml of the 1.3 L CaCl stock solution and 1.63 ml of the 0.4 L MgCl stock solution was added and thoroughly mixed in each treatment bottle containing Fargo municipal water before herbicides and adjuvants were added.

The objective of this study was to compare different glyphosate-ipa and K formulations with commercial adjuvants recommended by distributors. Cornerstone (Agriliance), Buccaneer (Tenkoz/West Central), Glyphomax Plus and Durango/Glyphomax XRT (Dow), ClearOut 41 (Adjuvants Plus), Mad Dog (AGSCO), and Roundup UltraMax II (Monsanto). R-11 was used because it historically has performed well with glyphosate. All glyphosate formulations were applied at the same acid equivalent rate (0.28 lb ae/A or 3/4 pt/A of a 3 lb ae gal) and were applied alone and with various adjuvants. Data is suspect as indicated by the large LSD. Common lambsquarters growing in the study was not uniform in height or vigor because the study location varied from a low area up a slope on a hill. Common lambsquarters growing in low areas was tall and growing vigorously, while common lambsquarters on the hill side was stunted due to growing in a dry, rocky, and poor fertility soil. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Glyphosate salt formulations (Zollinger and Ries).

Treatment[1]	Rate	14 DAT Colq	28 DAT Colq
	(product/A)	- - (%) - -	- - (%) - -
Cornerstone +	12fl oz +		
Preference	0.5% v/v	37	63
Preference+AMS	0.5% v/v+1 lb	65	80
Class Act Next Generation	2.5% v/v	45	65
Buccaneer +	12fl oz +		
Cornbelt Premier 90	0.5% v/v	30	60
Cornbelt Premier 90+AMS	0.5% v/v+1 lb	40	67
One-Ap XL	9 lb/100gal	40	60
Glyphomax Plus +	12fl oz +		
R-11	0.5% v/v	35	60
R-11+AMS	0.5% v/v+1 lb	60	78
Bronc Max	0.5% v/v	30	63
Durango/Glyphomax XRT +	9fl oz +		
R-11	0.5% v/v	45	67
R-11+AMS	0.5% v/v+1 lb	57	82
Class Act Next Generation	1% v/v	55	72
ClearOut 41 +	12fl oz +		
R-11	0.5% v/v	43	60
R-11+AMS	0.5% v/v+1 lb	73	92
Class Act Next Generation	1% v/v	50	67
Mad Dog +	12fl oz +		
Active-It	0.5% v/v	50	63
Active-It+AMS	0.5% v/v+1 lb	47	65
Surfate	1% v/v	37	73
Roundup UltraMax II +	8fl oz +		
R-11	0.5% v/v	48	62
R-11+AMS	0.5% v/v+1 lb	48	72
Class Act Next Generation	1% v/v	48	70
LSD (0.05)		24	28

[1]Preference, R-11, Cornbelt Premier 90, and Active-It = nonionic surfactants; AMS = ammonium sulfate; Class Act Next Generation and Surfate = surfactants + fertilizers; One-Ap XL = AMS + surfactant + deposition + retention + defoamer; Bronc Max = water conditioning agents + surfactants.

Volunteer Roundup Ready Canola Control in Roundup Ready Soybean, Langdon 2004 (Lukach)
Roundup ready Hyola 357magnum canola at 1 lb/a and Dekalb 5001 roundup ready soybeans were seeded at 64 lb/a on May 29. Soybean stands were thin due to soil crusting. The experiment received 5 oz/a Roundup Ultramax II on June 16 as a broadcast over all plots. Treatments on June 28 were finished at 9am and applied to predominantly 3 leaf canola and one trifoliate leaf soybeans. The treatments July 6 were finished at 3pm and were applied to big 5 leaf to bud stage canola and 2nd trifoliate soybeans. Conditions on June 28 were 72F, 46RH, 10mph wind from the west with a clear sky. Conditions on July 6 were 65F, 54RH, 6mph wind from the north and a clear sky. A drift shield was used. Applications were made using a CO2 pressurized sprayer, mounted on tractor 3-point. Five nozzles in 20 inch spacing were used with DG8001.5 tips at 35psi and 4.2mph applying 10 gal/a solution. The trial had a RCBD design with four replications.

Volunteer RR Canola Control in RR Soybean, Langdon 2004

		Canola	Control						Canola	Canola	Height Aug 19	
Treatment	Rate	Stage	cano	wibu	rrpw	kocz	colq	Soybean	regrowth	escape	canola	Soy
	oz/a product	leaf	---------- % ----------					Plants / yd2 Aug 19			----- cm -----	
Roundup Ultramax II	21.3	2-4	0	84	100	100	98	13	0	15	102	51
Glyp + Raptor	21.3 + 2.0	2-4	96	95	100	90	96	16	2	0	89	47
Glyp + Raptor	21.3 + 1.5	2-4	93	98	100	91	96	15	2	0	84	54
Glyp + Raptor	21.3 + 1.0	2-4	93	96	98	99	98	16	2	0	82	43
Glyp + 1st Rate	21.3 + 0.3	2-4	91	95	100	99	98	16	1	4	85	51
Glyp + 1st Rate	21.3 + 0.2	2-4	88	86	100	100	98	15	1	2	86	46
Glyp + 1st Rate	21.3 + 0.1	2-4	80	87	99	100	100	16	1	2	90	51
Glyp + Harmony GT	21.3 + 0.083	2-4	93	98	100	100	100	19	3	0	92	51
Glyp + Basagran	21.3 + 16.0	2-4	97	96	100	100	94	14	0	0	88	56
Glyp + Basagran	21.3 + 8.0	2-4	93	89	96	100	97	15	2	2	90	55
Roundup Ultramax II	21.3	5-6	0	98	98	100	99	14	0	14	93	47
Glyp + Raptor	21.3 + 2.0	5-6	83	100	100	100	100	14	6	0	77	54
Glyp + Raptor	21.3 + 1.5	5-6	80	95	100	93	98	15	5	0	85	47
Glyp + Raptor	21.3 + 1.0	5-6	88	99	100	99	96	15	5	0	89	52
Glyp + 1st Rate	21.3 + 0.3	5-6	68	99	100	100	99	15	0	12	99	56
Glyp + 1st Rate	21.3 + 0.2	5-6	43	95	100	99	100	13	0	12	91	60
Glyp + 1st Rate	21.3 + 0.1	5-6	23	97	100	100	100	14	0	11	104	57
Glyp + Harmony GT	21.3 + 0.083	5-6	68	96	100	100	98	15	10	0	100	55
Glyp + Basagran	21.3 + 16.0	5-6	86	96	97	100	96	17	1	7	91	54
Glyp + Basagran	21.3 + 8.0	5-6	83	94	96	97	96	15	1	4	95	48
C.V. %			14	11	2	6	3	22	47	68	10	22
LSD 5%			14	NS	3	NS	NS	NS	2	6	13	NS

AMS included in all treatments, 17 lb/100gal

Regrowth canola plants were in early bloom on Aug19 when canola escape plants were done blooming and had full seed set. Most weeds except canola emerged after herbicide application and set seed. This was allowed by the thin stand and frequent rains.

Blue