Liberty with adjuvants. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Fargo, ND, to evaluate weed efficacy from Liberty treatments applied POST. Treatments were applied August 31, 2005 at 10:30 am with 66 F air, 70 F soil surface, 77% relative humidity, 50% clouds, 7 to 11 mph W wind, dry soil surface, moist subsoil, and no dew present to non-cropland. Weed species present were: 12 to 16 inch (10 to 30/ft^2) yellow foxtail, 4 to 18 inch (10 to 25/ft^2) common lambsquarters, and 8 to 16 inch (1 to 2/yd^2) curly dock. 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 replicates per treatment.

Generally, adding AMS to Liberty enhanced weed control but adding Atrazine antagonized yellow foxtail and common lambsquarters control and increased curly dock control. Most adjuvant increased curly dock control. Most other adjuvants did not enhance control of yellow foxtail and common lambsquarters to the level as AMS. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Liberty with adjuvants (Zollinger and Ries).

		7 DAT			14 DAT			21 DAT
Treatment[1]	Rate	Yeft	Colq	Cudo	Yeft	Colq	Cudo	Cudo
	(product/A)	---------(%)---------			---------(%)---------			--(%)--
Liberty +	1 pt +	82	84	50	86	89	50	53
CB Premium AMS	3 lb	87	90	90	91	92	90	75
Atrazine+CB Premium AMS	0.56lb+3 lb	43	43	92	60	63	92	89
One-Ap XL	15lb/100gal	63	64	90	76	73	90	75
Atrazine+One-Ap XL	0.56lb+15lb/100gal	43	47	90	55	57	90	88
N-Tense	0.75% v/v	76	76	90	83	83	90	78
Atrazine+N-Tense	0.56lb+0.75% v/v	53	47	72	68	63	72	70
WC045	0.75% v/v	72	72	90	76	80	90	57
Atrazine+WC045	0.56lb+0.75% v/v	40	23	90	53	42	90	82
ClassAct NG	2.5% v/v	73	84	90	77	92	90	78
ClassAct NG + AG 05017	2.5% v/v+4fl oz	70	81	86	77	89	86	80
Liberty	26fl oz	82	88	92	89	95	92	87
CB Premium AMS	3 lb	84	90	92	93	97	92	88
N-Tense	0.75% v/v	70	73	90	79	81	90	79
One-Ap XL	15lb/100gal	82	74	92	86	82	92	79
ClassAct NG	2.5% v/v	70	78	92	80	83	92	90
ClassAct NG+AG 05017	2.5% v/v+4 fl oz	70	82	92	77	89	92	89
LSD (0.05)		8	10	5	11	16	5	14

[1]CB = Cornbelt Premium AMS = ammonium sulfate; One-Ap XL = AMS + surfactant + deposition + retention + defoamer; N-Tense = water conditioning agents + surfactants; WC045 = is a proprietary adjuvant from West Central Inc; ClassAct NG (Next Generation) = surfactants + fertilizer; AG 05017 = is a proprietary adjuvant from Agriliance.

Corn herbicides with adjuvants. Zollinger, Richard K. and Jerry Ries. An experiment was conducted near Valley City, ND, to evaluate weed control from corn herbicides applied at two timings. Pioneer '39D81' corn was planted May 27, 2005. EPOST treatments were applied June 17 at 9:30 am with 72 F air, 78 F soil surface, 56% relative humidity, 30% clouds, 5 to 8 mph SE wind, dry soil surface, moist subsoil, good crop vigor and no dew present to 2 collar corn. Weed species present were 1 to 3 inch (10 to 40/ft^2) yellow foxtail. POST treatments were applied June 24 at 12:00 pm with 71 F air, 83 F soil surface, 37% relative humidity, 85% clouds, 4 to 7 mph W wind, dry soil surface, moist subsoil, good crop vigor and no dew present to 3 collar corn. Weed species present 1 to 6 inch (15 to 40/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 randomized complete block design with three replicates per treatment.

On June 24, corn was V-4 stage and there was no corn injury from EPOST treatments. On July 1 (7 DAT), for POST treatments, corn injury could not be distinguished because of severe competition from yellow foxtail. EPOST treatments of Option + Define or Prowl gave 90% or greater yellow foxtail control. All Touchdown treatments controlled yellow foxtail. WC045 was antagonistic to Option + Distinct. Additional Accent was required with Steadfast to achieve greater than 82% foxtail control. (Dept. of Plant Sciences, North Dakota State University, Fargo),

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

Treatment[1]	Rate	14 DAT		28 DAT		42 DAT	Corn
		Yeft	Yeft	Yeft	Yeft	Yeft	yield
		- - - (%) - - -		- - - (%) - - -		- (%) -	(bu/A)
EPOST							
Option+Define+Distinct+ MSO+28% N	1.5oz+9.6floz+2oz+ 1.5pt+2qt	92		96		92	221
Option+Prowl H_2O+Distinct+ MSO+28% N	1.5oz+28floz+2oz+ 1.5pt+2qt	91		94		90	235
Option+Distinct+MSO+28%N	1.5oz+2oz+1.5pt+2qt	83		81		74	219
Option+Distinct+MSO+28%N	1.5oz+2oz+2pt+2qt	84		80		73	206
POST							
Option+Distinct+Soy-Stik+Prem AMS	1.5oz+2oz+1.5pt+2lb		83		83	87	-
Option+Distinct+WC045	1.5oz+2oz+0.5% v/v		63		63	67	-
Steadfast+Distinct+PO+28% N	0.75oz+2oz+1.5pt+1.5qt		83		83	78	236
Steadfast+Atrazine+ Premium COC+Premium AMS	0.75oz+0.56lb+ 1% v/v+2lb		23		23	32	-
Steadfast+Volley+WC045	0.75oz+2pt+0.5% v/v		37		37	28	-
Steadfast+Accent+Atrazine+ MSO+AMS	0.75oz+0.125oz+0.42lb+ 1.5pt+2lb		80		80	73	-
Steadfast+Accent+Dicamba+ Atrazine+MSO+AMS	0.75oz+0.125oz+4fl oz+ 0.42lb+1.5pt+2lb		87		87	77	-
Touchdown Total	24fl oz		99		99	99	-
Touchdown Total+Premium AMS	24fl oz+8.5lb/100gal		99		99	99	-
Touchdown Total+N-Tense	24fl oz+0.5% v/v		99		99	99	-
Touchdown Total+Volley+N-Tense	24fl oz+2pt+0.5% v/v		99		99	99	-
Touchdown Total+Callisto+Prem AMS	24fl oz+3fl oz+8.5lb/100gal		99		99	99	-
Touchdown Total+Callisto+N-Tense	24fl oz+3fl oz+0.5% v/v		99		99	99	-
Untreated		0	0	0	0	0	108
LSD (0.05)		4	13	8	13	11	37

[1]MSO = methylated seed oil = Scoil; 28% N = 28-0-0; PO = petroleum oil concentrate = Herbimax; Premium (Prem) AMS = ammonium sulfate; N-Tense = water conditioning agents + surfactants; Soy-Stik = methylated seed oil; WC045 = a proprietary adjuvant from West Central; Premium COC = petroleum oil concentrate.

Adjuvants with glyphosate. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Alice, ND, to evaluate adjuvant tank-mixes with Roundup Original Max and Extreme. POST treatments were applied June 9, 2005 at 10:45 am with 65 F air, 61 F soil surface, 55% relative humidity, 25% clouds, 3 to 5 mph NW wind, wet soil surface, wet subsoil and no dew present to non-cropland. Weed species present were: 4 to 18 inch (5 to 35/ft^2) common lambsquarters; 3 to 5 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 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replicates per treatment.

RU Original Max at 11 fl oz/A with most adjuvants except One-Ap XL gave greater than 90% control at 14 DAT. At 28 DAT, adding AMS or N-Tense at 0.75% v/v enhanced biennial wormwood control. Using N-Tense at rates below 0.75% v/v did not enhance control. Lower control of biennial wormwood at 28 DAT was from regrowth.

Extreme (glyphosate + Pursuit) plus NIS and AMS or N-Tense at 0.75% v/v gave excellent common lambsquarters control. In comparison, using One-Ap XL or N-Tense at the lower rate 0.5% v/v resulted in reduced control. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Adjuvants with glyphosate (Zollinger and Ries).

		14 DAT		28 DAT	
Treatment[1]	Rate	Colq	Biww	Colq	Biww
	(product/A)	----- (%) -----		----- (%) -----	
RU Original Max	11fl oz	96	96	95	75
RU Original Max+	11fl oz+				
Cornbelt Premium AMS	8.5lb/A	96	96	95	87
Cornbelt Premier 90+AMS	0.5% v.v+8.5lb/A	97	97	94	80
One-Ap XL	9lb/100gal	85	84	90	75
N-Tense	0.38% v/v	97	96	91	67
N-Tense+Cornbelt Gardian	0.25% v/v+0.25% v/v	96	96	88	77
N-Tense	0.75% v/v	95	95	93	85
Extreme+	1pt/a+				
Cornbelt Premier 90+ Cornbelt Premium AMS	0.25% v/v+ 8.5lb/100gal	93	91	92	68
N-Tense	0.75% v/v	94	87	96	47
One-Ap XL	9lb/100gal	86	85	80	50
N-Tense+Cornbelt Gardian	0.5% v/v+0.25% v/v	83	75	60	43
Untreated		0	0	0	0
LSD (0.05)		7	6	10	16

[1]RU Original Max = Roundup Original Max; Cornbelt Premium AMS and AMS = ammonium sulfate; Cornbelt Premier 90 = nonionic surfactants; One-Ap XL = AMS + surfactant + deposition + retention + defoamer; N-Tense = water conditioning agents + surfactants; Cornbelt Gardian = water conditioning agents + deposition + defoamer.

Glyphosate salt formulations. Zollinger, Richard K. and Jerry Ries. An experiment was conducted near Alice, ND to evaluate glyphosate salt formulations and adjuvants. POST treatments were applied May 16, 2005 at 12:00 pm with 78 F air, 73 soil surface, 56% relative humidity, 5% clouds, 3 to 7 mph SE wind, moist soil surface, wet subsoil and no dew present to non-cropland. Weed species present were 8 to 16 inch (15 to 30/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 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replicates per treatment.

Product rates listed equals the same acid equivalent rate (0.28 lb ae/A) of glyphosate. Some of the highest ratings (Rodeo) and the lowest rating (Touchdown HiTech) were from no-load glyphosate formulations. The highest ratings included partial-load, isopropylamine formulations of glyphosate (Buccaneer Plus, ClearOut 41 Plus, and Roundup Custom). (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Glyphosate sale formulations (Zollinger and Ries).

Treatment[1]	Rate	14 DAT	28 DAT
		Colq	Colq
	(product/A)	- - (%) - -	- - (%) - -
Cornerstone Plus+Preference	12fl oz+0.5% v/v	82	78
Buccaneer Plus+R-11	12fl oz+0.5% v/v	94	91
Glyphomax Plus+Activator 90	12fl oz+ 0.5% v/v	75	75
Durango+Activator 90	9fl oz+0.5% v/v	70	65
Rodeo+R-11	9fl oz+0.5% v/v	92	89
ClearOut 41 Plus+R-11	12fl oz+0.5% v/v	97	94
Mad Dog+Active It	12fl oz+0.5% v/v	77	74
Roundup Custom+R-11	9fl oz+0.5% v/v	95	91
Roundup UltraMax II+Activator 90	8fl oz+0.5% v/v	88	87
Roundup Original Max+Activator 90	8fl oz+0.5% v/v	84	73
Touchdown HiTech+Activator 90	7.2fl oz+0.5% v/v	43	43
Touchdown Total+Activator 90	8.6fl oz+0.5% v/v	79	70
LSD (0.05)		7	12

[1]Preference, R-11, Activator 90, and Active-It = nonionic surfactants.

Roundup Original Max with AMS replacement adjuvant. Zollinger, Richard K. and Jerry Ries. An experiment near Prosper, ND, to evaluate weed control from Roundup Original Max with AMS replacement adjuvant. POST treatments were applied June 22, 2005 at 12:30 pm with 87 F air, 94 F soil surface, 52% relative humidity, 10% clouds, 10 to 15 mph S wind, dry soil surface, moist subsoil and no dew present to non-cropland. Weeds species present were: 6 to 10 inch (30 to 40/ft^2) yellow foxtail; 12 to 30 inch (1 to 15/ft^2) wild mustard; 8 to 12 inch (10 to 20/ft^2) hairy nightshade; 1 to 12 inch (0 to 5/ft^2) common cocklebur; and 8 to 12 inch (1 to 10/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 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replications per treatment.

On July 20 (28 DAT), ratings were not taken due to tremendous overgrowth of plots. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. RU original Max with AMS replacement adjuvant (Zollinger and Ries).

		14 DAT				
Treatment[1]	Rate	Yeft	Wimu	Colq	Hans	Cocb
	(product/A)	---------- (%) ----------				
Roundup Original Max +	8fl oz +	75	58	61	63	90
N-Pac AMS	5% v/v	78	68	73	65	90
ClassAct Next Generation	2.5% v/v	93	87	85	85	90
Alliance	0.75% v/v	82	78	74	68	90
Alliance	1.5% v/v	83	78	77	79	90
AG 03019	0.5% v/v	88	84	83	81	90
Alliance+AG 05017	1.25% v/v+4fl oz	88	86	83	73	90
AG 05045	0.25% v/v	80	80	73	55	90
LI-166	0.5% v/v	90	85	83	70	90
LI-169	0.5% v/v	89	70	68	53	90
LI-170	0.75% v/v	85	72	72	64	90
AMS	8.5lb/100gal	92	88	87	83	90
N-Tense	0.5% v/v	82	81	83	73	90
Roundup Original Max +	11fl oz +					
AMS	8.5lb/100gal	92	88	87	83	90
LI-169	0.5% v/v	87	82	83	83	90
LI-170	0.75% v/v	77	72	80	72	90
LSD (0.05)		7	7	4	10	2

[1]N-Pac AMS = liquid ammonium sulfate; ClassAct Next Generation = surfactants + fertilizer; Alliance = water conditioning agents; N-Tense = water conditioning agents + surfactants; AMS = ammonium sulfate; AG compounds = proprietary adjuvants from Agriliance; LI compounds = proprietary adjuvants from Loveland Industries.

AMS replacement adjuvants with Roundup Original Max. Zollinger, Richard K. and Jerry Ries. An experiment was conducted near Alice and Prosper, ND, to evaluate Roundup Original Max tank-mixes with adjuvants. At Alice, POST treatments were applied May 16, 2005 at 12:45 pm with 77 F air, 74 F soil surface, 56% relative humidity, 5% clouds, 4 to 8 mph SE wind, moist soil surface, wet subsoil and no dew present to non-cropland. Weeds species present were 8 to 20 inch (15 to 30/ft^2) common lambsquarters.

At Prosper, POST treatments were applied June 20, 2005 at 3:00 pm with 83 F air, 74 F soil surface, 46% relative humidity, 25% clouds, 2 to 5 mph SW wind, moist soil surface, wet subsoil and no dew present to non-cropland. Weeds species present were: 10 to 14 inch (100-200/ft^2) yellow foxtail; 4 to 8 inch (1 to 5/yd^2) common lambsquarters; 10 to 14 inch (1 to 10/yd^2) kochia; blooming (1 to 10/ft^2) wild mustard; and 4 to 8 inch (1 to 5/yd^2) hairy nightshade.

Treatments at both locations 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 experiments had randomized complete block design with three replicates per treatment.

Treatments were applied with water containing 500 ppm hardness of Ca and Mg. Common lambsquarters greater than 12 inches tall at application. At 14 DAT, the study was relatively easy to rate because common lambsquarters was regrowing. Common lambsquarters in treatments with low ratings were starting to regrow but weeds in treatments with high ratings were still at the same size as when sprayed. Those adjuvants containing AMS were used at rates specified to provide approximately 8.5 lb/100 gal water. Other AMS replacements adjuvants were used at recommended rates. NIS was applied with some adjuvants because their formulation do not contain surfactant and the glyphosate rate was not high enough to provide the minimum amount of surfactant from the full-load surfactant formulation.

No 28 DAT evaluation was taken at Prosper because of tremendous weed re-regrowth which was a result of reduced rates used (4 fl oz instead of 8 fl oz used at Alice) and large weeds at application. We planned to spray smaller weeds at Prosper but rains relayed application. Those treatments containing NIS + AMS tended to have the highest weed control ratings. (Dept of Plant Sciences, North Dakota State University, Fargo).

Table 1. AMS replacement adjuvants with Roundup Original Max, Alice (Zollinger and Ries).

Treatment[1]	Rate	14 DAT Colq	28 DAT Colq
	(product/A)	---- (%) ----	---- (%) ----
Roundup Original Max+	8fl oz+	22	28
R-11	0.5% v/v	53	60
AMS	8.5lb/100gal	58	63
R-11+AMS	0.25% v/v+17lb/100gal	87	85
R-11+Citric Acid	0.25% v/v+1% v/v	72	75
R-11+Citric Acid	0.25% v/v+2% v/v	76	87
ClassAct Next Generation	2.5% v/v	58	67
Surfate	1% v/v	62	68
Alliance+Preference	1.25% v/v+0.5% v/v	69	80
Choice+Liberate	0.5% v/v+0.5% v/v	28	35
Quest+Preference	0.5% v/v+0.5% v/v	63	75
Bronc Max+R-11	0.5% v/v+0.5% v/v	73	81
Citron+Preference	2.2lb/100gal+0.5% v/v	76	79
Herbolyte	1% v/v	53	47
LoadOut	0.5% v/v	69	40
Full Load HWP	0.5% v/v	66	51
Arrow Four	0.5% v/v	43	43
Bronc Max EDT	0.5% v/v	72	62
N-Tense	0.5% v/v	53	59
N-Tank	0.5% v/v	75	57
LSD (0.05)		8	13

[1]R-11, Preference, and Liberate = nonionic surfactants; AMS = ammonium sulfate; ClassAct Next Generation and Surfate = surfactants + fertilizers; Alliance, Choice, Quest = water conditioning agents; Bronc Max and N-Tense = water conditioning agents + surfactants; Citron is a proprietary adjuvant from Farm Direct, LLC; Herbolyte is a proprietary adjuvant from ProfitPro, LLC; Full Load HWP = is a proprietary adjuvant from AgraSyst; Arrow Four = AMS + water conditioning + deposition + defoamer; Bronc Max EDT = AMS + deposition + retention + water conditioning; N-Tank = is a proprietary adjuvant from Adjuvants Plus.

Table 2. AMS replacement adjuvants with Roundup Original Max, Prosper (Zollinger and Ries).

Treatment[1]	Rate	14 DAT				
		Yeft	Wimu	Colq	Koch	Hans
	(product/A)	(%)				
Roundup Original Max+R-11	8fl oz+0.5% v/v	78	57	59	62	37
Roundup Original Max+	4fl oz+	37	20	20	20	20
AMS	8.5lb/100gal	73	47	59	74	45
R-11+AMS	0.25% v/v+17lb/100gal	79	73	59	70	47
R-11+Citric Acid	0.25% v/v+1% v/v	37	33	25	27	15
R-11+Citric Acid	0.25% v/v+2% v/v	68	45	48	48	27
ClassAct Next Generation	2.5% v/v	77	57	61	61	41
Surfate	1% v/v	69	50	55	56	38
Alliance+Preference	1.25% v/v+0.5% v/v	72	47	57	57	40
Choice+Liberate	0.5% v/v+0.5% v/v	55	52	45	45	25
Quest+Preference	0.5% v/v+0.5% v/v	66	42	48	48	32
Bronc Max+R-11	0.5% v/v+0.5% v/v	88	74	69	76	48
Citron+Preference	2.2lb/100gal+0.5% v/v	79	60	61	66	43
Herbolyte	1% v/v	58	33	47	47	28
LoadOut	0.5% v/v	71	50	56	57	39
Full Load HWP	0.5% v/v	79	55	59	60	39
Arrow Four	0.5% v/v	75	67	55	57	38
Bronc Max EDT	0.5% v/v	79	63	62	67	42
N-Tense	0.5% v/v	75	56	57	59	40
N-Tank	0.5% v/v	75	47	53	55	35
LSD (0.05)		7	7	7	8	6

[1]R-11, Preference, and Liberate = nonionic surfactants; AMS = ammonium sulfate; ClassAct Next Generation and Surfate = surfactants + fertilizers; Alliance, Choice, Quest = water conditioning agents; Bronc Max and N-Tense = water conditioning agents + surfactants; Citron is a proprietary adjuvant from Farm Direct, LLC; Herbolyte is a proprietary adjuvant from ProfitPro, LLC; Full Load HWP = is a proprietary adjuvant from AgraSyst; Arrow Four = AMS + water conditioning + deposition + defoamer; Bronc Max EDT = AMS + deposition + retention + water conditioning; N-Tank = is a proprietary adjuvant from Adjuvants Plus.

Glyphosate performance with adjuvants - Alice. Zollinger, Richard K. and Jerry Ries. An experiment was conducted near Alice, ND, to evaluate glphosate enhancement with adjuvant tank-mixes. POST treatments were applied June 9, 2005 at 11:00 am with 65 F air, 61 F soil surface, 55% relative humidity, 25% clouds, 3 to 5 mph NW wind, wet soil surface, wet subsoil and no dew present to non-cropland. Weed species present were 6 to 16 inch (10 to 35/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 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replications per treatment.

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

Treatment[1]	Rate	14 DAT Colq	28 DAT Colq
	(product/A)	- - (%) - -	- - (%) - -
Roundup Original Max+	8fl oz+		
AMS	8.5lb/100gal	88	88
R-11	0.5% v/v	98	96
Preference	0.5% v/v	98	97
Liberate	0.5% v/v	78	73
APSA-80	0.5% v/v	98	93
Purity 100	0.5% v/v	86	71
Cornbelt Premier 90	0.5% v/v	98	93
Wet-Sol 99	0.5% v/v	95	88
ClassAct Next Generation	2.5% v/v	98	93
Surfate	1% v/v	98	91
Alliance+Preference	1.25% v/v+0.5% v/v	98	86
Choice+Liberate	0.5% v/v+0.5% v/v	85	78
Bronc Max+R-11	0.5% v/v+0.5% v/v	96	95
Quest+Preference	0.5% v/v+0.5% v/v	92	88
Citron+Preference	2.2lb/100gal+0.5% v/v	92	87
N-Tense	0.5% v/v	82	78
Herbolyte	1% v/v	78	70
R-11+AMS	0.5% v/v+8.5lb/100gal	99	95
LSD (0.05)		4	8

[1]AMS = ammonium sulfate; R-11, Preference, Liberate, APSA-80, Purity 100, Cornbelt Premier 90, Wet-Sol 99 = nonionic surfactant; ClassAct Next Generation, Surfate = sufactants + fertilizer; Alliance, Choice, Quest = water conditioning agents; Bronc Max, N-Tense = water conditioning agents + surfactants; Citron = a proprietary adjuvant from Farm Direct, LLC; Herbolyte = a proprietary adjuvant from ProfitPro, LLC.

Low glyphosate rates were used to determine adjuvant enhancement of glyphosate. Common lambsquarters control at 14 DAT ranged from 78 to 99 and at 28 DAT from 70 to 97. Adjuvants containing NIS plus AMS tended to enhance glyphosate the greatest. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Glyphosate performance with adjuvants, Carrington. Zollinger, Richard K. and Gregory J. Endres. Weed control was investigated with glyphosate and selected adjuvants. The trial had a randomized complete block design with three replicates. Roundup Original Max was applied at 4 fl oz/A (2.26 oz ae/A) plus adjuvants with a CO_2 pressurized hand-held plot sprayer delivering 8.5 gal/A at 30 psi through 8001 flat fan nozzles on June 17 with 65 F, 76% RH, 50% clear sky, and 10 mph wind to 1- to 10-inch tall yellow foxtail, 1- to 15-inch tall common lambsquarters, 2- to 10-inch tall redroot and prostrate pigweed, 4- to 15-inch tall tame (volunteer) buckwheat, and rosette- to flowering-stage sheperdspurse.

Yellow foxtail, pigweed species, and sheperdspurse control were similar among treatments (Table). The highest common lambsquarters control (77 to 83%) with glyphosate when evaluated on July 5 was achieved with the adjuvants Class Act NG, Surfate, Bronc Max+R-11, N-Tense and R-11+AMS. Good to excellent tame buckwheat control (81 to 96%) with glyphosate when evaluated on July 19 was achieved with the adjuvants Purity 100, Premier 90, Class Act NG, Alliance+Preference, Bronc Max+R-11, Quest+Preference, Citron+Preference, N-Tense, Herbolyte and R-11+AMS.

Table. Glyphosate performance with adjuvants. (Zollinger and Endres).

		7/5					7/19		
Treatment[1]	Rate	Yeft	Colq	Pgwd spp.[2]	Tabw	Shpu	Colq	Pgwd spp.	Tabw
	% v/v	% control							
Roundup OriginalMax +	4 fl oz/A +								
AMS	8.5 lb/100 gal	92	69	76	69	94	72	50	78
R-11	0.5	87	72	83	69	98	65	38	50
Preference	0.5	93	68	70	70	91	68	53	70
Liberate	0.5	91	70	81	71	93	57	60	77
APSA-80	0.5	94	70	73	70	88	75	50	68
Purity 100	0.5	93	69	72	72	80	74	52	89
Wet-Sol	0.5	93	68	93	68	89	60	43	77
Premier 90	0.5	92	67	83	71	96	62	50	90
Class Act NG	2.5	93	79	78	74	99	71	40	91
Surfate	1	92	77	94	67	99	83	53	73
Alliance+Preference	1.25+0.5	93	74	90	70	95	77	63	81
Choice+Liberate	0.5+0.5	92	73	85	78	99	76	40	77
Bronc Max+R-11	0.5+0.5	92	79	92	71	98	70	53	90
Quest+Preference	0.5+0.5	90	71	88	72	99	68	47	93
Citron+Preference	2.2 lb/100 gal+0.5	91	73	78	73	95	69	55	96
N-Tense	0.5	91	77	91	74	96	73	48	82
Herbolyte	1	93	69	87	77	99	78	67	88
R-11+AMS	0.5+8.5 lb/100 gal	90	83	75	72	91	68	33	92
CV (%)		4	6	14	7	8	27	23	13
LSD (0.05)		NS	8	NS	NS	NS	NS	NS	17

[1]Roundup Original Max was used at 4 fl oz/A (2.26 oz ae/A).

[2]Pigweed spp.=Redroot and prostrate.

Glyphosate performance with adjuvants - Langdon. Zollinger, Richard K. and John Lukach. Treatments were applied to 4 to 5 leaf (12/ft^2) HRS wheat and wild oat, 6 inch tall common lambsquarters, 3 inch tall (1/ft^2) kochia, and 5 leaf, 4 inch tall (2/ft^2) wild buckwheat on June 16 with 70° F, 60% RH, clear skies, and 6 mph SE wind. Soil was saturated at and after application Treatments were applied to the center 6.7 feet of the 10 by 30 foot long plots with a tractor mounted CO^2 propelled plot sprayer delivering 8.5 gpa at 30 psi through 8001 flat fan nozzles. The experiment was a randomized complete block design with four replications.

Table. Glyphosate performance with adjuvants (Zollinger and Lukach)

		July 5				July 21		
Treatment	Rate	Grass	Colq	Koch	Wibw	Grass	Colq	Wibw
	(Product/A)	---------- % ----------				------- % -------		
Roundup OriginalMax +	2floz/A							
AMS	8.5lb/100gal	89	88	91	60	65	74	53
R-11	0.5% v/v	90	95	85	50	78	56	67
Preference	0.5% v/v	78	50	57	25	70	57	57
Liberate	0.5% v/v	68	37	43	33	62	35	60
APSA-80	0.5% v/v	83	72	67	48	72	63	67
Purity 100	0.5% v/v	85	73	67	38	73	53	65
Premier 90	0.5% v/v	68	37	40	20	67	50	54
Wet-Sol	0.5% v/v	81	37	37	28	72	63	50
Class Act NG	2.5% v/v	97	95	95	63	88	77	85
Surfate	1% v/v	83	92	88	55	72	73	81
Alliance + Preference	1.25% v/v+0.5%	85	68	60	45	74	60	65
Choice + Liberate	0.5% v/v+0.5% v/v	70	67	60	23	63	49	60
Bronc Max + R-11	0.5% v/v+0.5% v/v	92	90	90	50	83	73	72
Quest + Preference	0.5% v/v+0.5% v/v	78	53	53	18	81	62	76
Citron + Preference	2.2 lb/100+0.5%	90	82	90	63	73	74	75
N-Tense	0.5%v/v	83	83	90	25	68	54	53
Herbolyte	1% v/v	83	50	50	23	60	54	55
R-11 + AMS	0.5%v/v+8.5lb/100	92	95	92	60	78	73	73
LSD (0.05)		7	11	12	9	6	9	7

[1]AMS = ammonium sulfate; R-11, Preference, Liberate, APSA-80, Purity 100, Cornbelt Premier 90, Wet-Sol 99 = nonionic surfactant; ClassAct Next Generation, Surfate = sufactants + fertilizer; Alliance, Choice, Quest = water conditioning agents; Bronc Max, N-Tense = water conditioning agents + surfactants; Citron = a proprietary adjuvant from Farm Direct, LLC; Herbolyte = a proprietary adjuvant from ProfitPro, LLC.

Low glyphosate rates were used to determine adjuvant enhancement of glyphosate. At July 5, grass control ranged from 68 to 92, common lambsquarters and kochia from 37 to 95, and wild buckwheat from 23 to 63. At July 21, grass control ranged from 63 to 88, common lambsquarters from 35 to 77, and wild buckwheat from 50 to 85. Adjuvants containing NIS plus AMS tended to enhance glyphosate the greatest. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Glyphosate performance with adjuvants - Hettinger. Eriksmoen, Eric. Treatments were applied to 4 leaf wild oat (3/ft^2), heading downy brome (2/ft^2), 1.5 inch kochia (42/ft^2), 1 inch Russian thistle (2/ft^2), 3.5 inch wild buckwheat (4/ft^2), flowering dandelion (1/ft^2) and 3.5 inch field bindweed (2/ft^2) on June 3 with 72° F, 40% RH, clear sky and 4 mph W wind. Weed populations were not uniform throughout the trial. Treatments were applied with a tractor mounted CO^2 propelled plot sprayer delivering 10 gpa at 30 psi to 5 foot wide by 20 foot long plots. The experiment was a randomized complete block design with four replications. Plots were evaluated for percent control on June 17 and on July 1.

Table. Glyphosate performance with adjuvants (Ericksmoen)

		June 17						
Treatment	Rate	Wioa	Dobr	Koch	Ruth	Wibw	Dand	Fibw
	(Product/A)							
Roundup OriginalMax +	2floz/A							
AMS	8.5lb/100gal	50	50	35	22	20	15	2
R-11	0.5% v/v	81	77	60	23	58	18	10
Preference	0.5% v/v	50	22	42	11	32	27	12
Liberate	0.5% v/v	39	45	50	18	35	35	12
APSA-80	0.5% v/v	89	77	68	29	32	20	14
Purity 100	0.5% v/v	69	42	57	38	46	30	5
Premier 90	0.5% v/v	55	50	48	31	42	35	8
Wet-Sol	0.5% v/v	80	77	62	25	46	20	30
Class Act NG	2.5% v/v	92	92	81	58	55	30	25
Surfate	1% v/v	92	88	80	40	60	30	19
Alliance + Preference	1.25% v/v+0.5%	79	79	70	28	50	75	16
Choice + Liberate	0.5% v/v+0.5% v/v	61	50	69	28	45	20	16
Bronc Max + R-11	0.5% v/v+0.5% v/v	89	71	68	55	40	30	16
Quest + Preference	0.5% v/v+0.5% v/v	87	79	38	28	55	65	16
Citron + Preference	2.2 lb/100+0.5%	61	70	51	30	40	20	8
N-Tense	0.5%v/v	91	71	82	70	52	38	6
Herbolyte	1% v/v	64	59	35	26	32	40	12
R-11 + AMS	0.5%v/v+8.5lb/100	81	85	68	50	60	20	17
LSD (0.05)		24	37	24	35	20	36	18

[1]AMS = ammonium sulfate; R-11, Preference, Liberate, APSA-80, Purity 100, Cornbelt Premier 90, Wet-Sol 99 = nonionic surfactant; ClassAct Next Generation, Surfate = sufactants + fertilizer; Alliance, Choice, Quest = water conditioning agents; Bronc Max, N-Tense = water conditioning agents + surfactants; Citron = a proprietary adjuvant from Farm Direct, LLC; Herbolyte = a proprietary adjuvant from ProfitPro, LLC.

Treatment	Rate	July 1						
		Wioa	Dobr	Koch	Ruth	Wibw	Dand	Fibw
	(Product/A)							
Roundup OriginalMax +	2fl oz/A							
AMS	1	60	--	20	18	0	0	0
R-11	0.5	75	99	60	32	20	28	5
Preference	0.5	38	33	20	12	30	17	2
Liberate	0.5	71	40	40	40	42	30	5
APSA-80	0.5	64	72	58	42	21	20	0
Purity 100	0.5	36	57	35	18	1	15	1
Premier 90	0.5	38	65	28	25	15	2	0
Wet-Sol	0.5	58	80	52	40	40	35	1
Class Act NG	2.5	92	92	78	58	30	20	14
Surfate	1	91	91	79	80	18	30	6
Alliance + Preference	1.25 + 0.5	62	90	55	42	25	10	0
Choice + Liberate	0.5 + 0.5	50	65	42	38	12	5	2
Bronc Max + R-11	0.5 + 0.5	84	78	72	48	2	35	0
Quest + Preference	0.5 + 0.5	69	80	38	35	0	5	0
Citron + Preference	2.2 lb/100G + 0.5	49	12	30	28	12	15	2
N-Tense	0.5	69	67	70	52	8	40	4
Herbolyte	1%	55	85	18	9	2	0	0
R-11 + AMS	0.5 + 1	75	85	55	38	30	10	6
LSD (0.05)		25	38	26	37	24	24	7

[1]AMS = ammonium sulfate; R-11, Preference, Liberate, APSA-80, Purity 100, Cornbelt Premier 90, Wet-Sol 99 = nonionic surfactant; ClassAct Next Generation, Surfate = sufactants + fertilizer; Alliance, Choice, Quest = water conditioning agents; Bronc Max, N-Tense = water conditioning agents + surfactants; Citron = a proprietary adjuvant from Farm Direct, LLC; Herbolyte = a proprietary adjuvant from ProfitPro, LLC.

Low glyphosate rates were used to determine adjuvant enhancement of glyphosate. At June 17, significant differences between treatments were observed for control of wild oats, downy brome and kochia, and with the July 1 evaluation of kochia and Russian thistle. Specific adjuvants used with glyphosate appear to be more active on specific weeds such as N-Tense which tended to be more active than other adjuvants on broadleaf weeds, and Class Act NG which tended to have more activity on field bindweed.

Glyphosate performance with adjuvants - Minot. Jenks, Markle, and Willoughby. Herbicide treatments were applied July 11 with a bicycle sprayer delivering 10 gpa at 40 psi through XR 8001 nozzles. Air and soil temperatures were 80 and 75 F, respectively, and relative humidity was 63%. Weed sizes and densities at application were: common lambsquarters (COLQ) 18 to 24-in at 5 to 10 plants per ft^2, redroot pigweed (Rrpw) 6 to 10-in at 5 to 10 plants per ft^2, Pennsylvania smartweed (Pesm) 6 to 10-in at 5 to 15 plants per ft^2, yellow and green foxtail (Foxt) at 5 to 7-leaf at 10 to 20 plants per ft^2, and kochia (Kocz) was 12 to 18-inch at 2 to 20 plants per ft^2.

Grass control was excellent regardless of adjuvant applied with glyphosate. Although there were no significant differences in broadleaf weed control between the various adjuvants applied with glyphosate, water conditioner as well as fertilizer type adjuvants tended to provide slightly better broadleaf control than surfactant type adjuvants.

Table. Glyphosate adjuvant study.

		Colq		Rrpw		Pesm		Foxt		Wibw		Kocz	
Treatment[a]	Rate	Jul 18	Aug 3	Jul 18	Aug 3	Jul 18	Aug 3	Jul 18	Aug 3	Jul 18	Aug 3	Jul 18	Aug 3
		% control											
RU Original Max +	4 fl oz												
AMS	2.5 gal/100 gal	80	65	83	70	79	93	98	99	78	47	80	65
R-11	0.5% v/v	81	63	79	57	87	79	98	100	80	53	80	72
Preference	0.5% v/v	78	50	82	73	83	86	97	97	70	30	77	55
Liberate	0.5% v/v	85	60	86	68	82	87	98	98	82	45	77	72
APSA 80	0.5% v/v	89	80	89	71	80	92	98	98	80	43	79	78
Purity 100	0.5% v/v	82	55	83	57	77	73	97	98	73	20	81	55
Premier 90	0.5% v/v	88	65	91	68	88	92	98	97	80	35	88	68
Wet-Sol	0.5% v/v	88	83	88	73	82	75	98	95	85	50	88	83
ClassAct NG	2.5% v/v	96	90	93	83	83	90	99	99	92	70	94	88
Surfate	1% v/v	96	100	96	89	83	72	99	100	92	58	96	93
Alliance + Preference	1.25% v/v + 0.5% v/v	97	92	97	80	80	96	99	99	90	53	97	93
Choice + Liberate	0.5% v/v + 0.5% v/v	95	93	97	85	83	98	99	96	85	42	93	87
Bronc Max + R-11	0.5% v/v + 0.5% v/v	99	99	99	88	85	97	99	96	84	57	98	96
Quest + Preference	0.5% v/v + 0.5% v/v	83	70	94	71	87	93	98	100	80	43	94	87
Citron + Preference	2.2 lb/100 gal + 0.5% v/v	85	62	94	80	83	92	98	99	82	42	97	90
N-Tense	0.5% v/v	98	93	95	84	83	87	99	100	88	52	96	60
Herbolyte	1% v/v	89	76	97	90	88	97	98	99	90	47	97	85
R-11 + AMS	0.5% v/v + 2.5 gal/100 gal	94	87	93	77	75	88	99	96	83	38	93	83
LSD (0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV		13	28	10	22	7	16	1	3	11	50	15	29

[a]*Each treatment was applied with Roundup Original Max at 4 fl oz/A.*

Glyphosate performance with adjuvants - Williston. Zollinger, Richard K. and Neil Riveland. Treatments were applied to 5 leaf wild oat, and 6 to 8 leaf safflower on June 16 with 71° F, 55% RH, 50% clouds, and 2 to 5 mph SE wind. Treatments were applied to the center 6.7 feet of the 10 by 30 foot long plots with a tractor mounted CO^2 propelled plot sprayer delivering 6.6 gpa at 30 psi through 730077 flat fan nozzles. The experiment was a randomized complete block design with four replications. Plots were evaluated for percent control on July 14.

Table. Glyphosate performance with adjuvants (Zollinger and Riveland)

		July 14	
Treatment	Rate	Wioa	Saff
	(Product/A)	------- % -------	
Roundup OriginalMax +	2floz/A		
AMS	8.5lb/100gal	64	56
R-11	0.5% v/v	72	63
Preference	0.5% v/v	63	43
Liberate	0.5% v/v	52	43
APSA-80	0.5% v/v	61	58
Purity 100	0.5% v/v	61	53
Premier 90	0.5% v/v	74	38
Wet-Sol	0.5% v/v	74	54
Class Act NG	2.5% v/v	80	68
Surfate	1% v/v	87	51
Alliance + Preference	1.25% v/v+0.5%	84	49
Choice + Liberate	0.5% v/v+0.5% v/v	74	43
Bronc Max + R-11	0.5% v/v+0.5% v/v	84	65
Quest + Preference	0.5% v/v+0.5% v/v	79	50
Citron + Preference	2.2 lb/100+0.5%	76	59
N-Tense	0.5%v/v	73	48
Herbolyte	1% v/v	53	36
R-11 + AMS	0.5%v/v+8.5lb/100	89	65
LSD (0.05)		7	8

[1]AMS = ammonium sulfate; R-11, Preference, Liberate, APSA-80, Purity 100, Cornbelt Premier 90, Wet-Sol 99 = nonionic surfactant; ClassAct Next Generation, Surfate = sufactants + fertilizer; Alliance, Choice, Quest = water conditioning agents; Bronc Max, N-Tense = water conditioning agents + surfactants; Citron = a proprietary adjuvant from Farm Direct, LLC; Herbolyte = a proprietary adjuvant from ProfitPro, LLC.

Low glyphosate rates were used to determine adjuvant enhancement of glyphosate. Wild oat control at July 14 ranged from 52 to 89 and safflower from 36 to 68. Adjuvants containing NIS plus AMS tended to enhance glyphosate the greatest. (Dept. of Plant Sciences, North Dakota State University, Fargo).

AMS replacement adjuvants with Poast. Zollinger, Richard K. and Jerry Ries. An experiment was conducted near Leonard, ND, to evaluate grass control from Poast treatments with AMS replacement adjuvants. Wensman '6117' corn was planted on April 27, 2005. POST treatments were applied June 27 at 1:00 pm with 76 F air, 85 F soil surface, 49% relative humidity, 50% clouds, 1 to 3 mph N wind, moist soil surface, moist subsoil, poor to good crop vigor (water stress) and no dew present to 2 to 3 collar corn. Weed species present were: 2 to 11 inch (10 to 60/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 randomized complete block design with three replicates per treatment.

Treatments were applied with water containing 500 ppm hardness of Na. Those adjuvants containing AMS were used at rates specified to provide approximately 8.5 lb/100 gal water. Other AMS replacements adjuvants were used at recommended rates. NIS was applied with some adjuvants which normally would not require NIS because the formulation does not contain surfactant. Petroleum oil + AMS enhanced Poast and overcame Na antagonism more than each component alone and compared to 28%. In general, weed control was greatest with any treatment containing oil adjuvants (Herbimax, MSO, Z-64, and Renegade). Herbolyte many contain oil components but exact ingredients are proprietary and are not known as with most adjuvants used. The exception to high activity from oil adjuvants is Quad 7 which contains no oil but enhanced grass control. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. AMS replacement adjuvants with Poast (Zollinger and Ries).

		14 DAT		28 DAT	
Treatment[1]	Rate	Yeft	V corn	Yeft	V corn
	(product/A)	---- (%) ----		---- (%) ----	
Poast +	0.5pt +				
Herbimax	1qt	52	56	57	61
AMS	8.5lb/100gal	43	52	54	69
28% N	2.5% v/v	36	43	42	62
Herbimax+AMS	1qt+8.5lb/100gal	55	77	75	95
Herbimax+28% N	1qt+2.5% v/v	43	67	65	85
ClassAct Next Generation	2.5% v/v	40	61	43	62
Surfate	1% v/v	33	35	27	40
Alliance+Herbimax	1.25% v/v+1qt	46	60	62	73
Choice+Herbimax	0.5% v/v+1qt	34	52	43	59
Quest+Herbimax	0.5% v/v+1qt	43	67	62	90
Cayuse Plus	0.75% v/v	32	53	30	48
Citron+Herbimax	2.2lb/100gal+1qt	37	72	43	91
Herbolyte	1% v/v	22	15	12	13
N-Tense	0.75% v/v	53	40	53	55
Reddy IT	0.25% v/v	33	32	33	33
Quad 7	1% v/v	64	85	62	82
Scoil+AMS	1.5pt+8.5lb/100gal	73	91	73	93
Z-64	1.5pt	73	89	71	94
Renegade	1.5pt	87	92	89	94
LSD (0.05)		8	8	11	10

[1]Herbimax = petroleum oil concentrate; AMS = ammonium sulfate; 28% N = 28-0-0; ClassAct Next Generation, Surfate, and Cayuse Plus = surfactants + fertilizer; Alliance, Choice, Quest = water conditioning agents; Citron = a proprietary adjuvant from Farm Direct, LLC; Herbolyte = a proprietary adjuvant from ProfitPro, LLC; N-Tense = water conditioning agents + surfactants; Reddy IT = MSO complex surfactant blend; Quad 7 = basic pH blend; Scoil = methylated seed oil; Z-64 and Renegade = MSO basic pH blend.

AMS replacement adjuvants with Dicamba. Zollinger, Richard K. and Jerry Ries. An experiment was conducted near Alice, ND, to evaluate Dicamba tank-mixes with AMS replacement adjuvants. POST treatments were applied May 6, 2005 at 6:45 pm with 76 F air, 71 F soil surface, 59% relative humidity, 0% clouds, 8 to 11 mph E wind, moist soil surface, wet subsoil, and no dew present to non-cropland. Weed species present were: 1 to 8 inch (5 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 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replicates per treatment.

Treatments were applied with water containing 500 ppm hardness of Na. Common lambsquarters was 1 to 8 inches tall at application. On June 20 (14 DAT), the study was relatively easy to rate because common lambsquarters was regrowing. Common lambsquarters in treatments with low ratings were starting to regrow but weeds in treatments with high ratings were still at the same size as when sprayed. Those adjuvants containing AMS were used at rates specified to provide approximately 8.5 lb/100 gal water. Other AMS replacements adjuvants were used at recommended rates. NIS was applied with some adjuvants because the formulation does not contain surfactant and the glyphosate rate was not high enough to provide the minimum amount of surfactant from the full-load surfactant formulation. NIS + AMS enhanced dicamba more than other non-oil adjuvants. Basic pH blend (Quad 7) and oil adjuvants enhanced weed control from dicamba the greatest. No 28 DAT ratings were taken because of extreme regrowth. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. AMS replacement adjuvants with Dicamba (Zollinger and Ries).

Treatment[1]	Rate	14 DAT Colq
	(product/A)	- - - (%) - - -
Dicamba+	2fl oz +	5
R-11	0.25% v/v	42
AMS	8.5lb/100gal	25
28% N	2.5% v/v	7
R-11+AMS	0.25% v/v+8.5lb/100gal	53
R-11+28% N	0.25% v/v+2.5% v/v	35
ClassAct Next Generation	2.5% v/v	52
Surfate	1% v/v	43
Alliance+Preference	1.25% v/v+0.25% v/v	42
Choice+Liberate	0.5% v/v+0.25% v/v	3
Quest+Preference	0.5% v/v+0.25% v/v	42
Cayuse Plus	0.75% v/v	35
Citron+Preference	2.2lb/100gal+0.25% v/v	41
Herbolyte	1% v/v	10
N-Tense	0.75% v/v	48
Reddy IT	0.25% v/v	35
Quad 7	1% v/v	73
Scoil+AMS	1.5pt+8.5lb/100gal	73
Z-64	1.5pt	70
Renegade	1.5pt	74
LSD (0.05)		6

[1]R-11, Preference, and Liberate = nonionic surfactant; AMS = ammonium sulfate; 28% N = 28-0-0; ClassAct Next Generation, Surfate, and Cayuse Plus = surfactants + fertilizer; Alliance, Choice, and Quest = water conditioning agents; Citron = a proprietary adjuvant from Farm Direct, LLC; Herbolyte = a proprietary adjuvant from ProfitPro, LLC; N-Tense = water conditioning agents + surfactants; Reddy IT = MSO complex surfactant blend; Quad 7 = basic pH blend; Scoil = methylated seed oil; Z-64 and Renegade = MSO basic pH blend.

AMS replacement adjuvants with Raptor. Zollinger, Richard K. and Jerry Ries. An experiment was conducted near Prosper, ND, to evaluate weed control treatments of AMS replacement adjuvants with Raptor. POST treatments were applied June 17, 2005 at 9:00 am with 71 F air, 69 F soil surface, 62% relative humidity, 25% clouds, 3 to 6 mph S wind, moist soil surface, wet subsoil and no dew present to non-cropland. Weed species present were: 5 to 12 inch (10 to 30/ft^2) yellow foxtail, 4 to 10 inch (1 to 5/yd^2) common lambsquarters, and 4 to 8 inch (1 to 5/yd^2) hairy nightshade. 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 with water containing 500 ppm hardness of Na. Raptor was applied at a low rate and to large weeds to separate treatments. Those adjuvants containing AMS were used at rates specified to provide approximately 8.5 lb/100 gal water. Other AMS replacements adjuvants were used at recommended rates. NIS was applied with some adjuvants which normally would not require NIS because the formulation does not contain surfactant. In general, weed control was greatest with any treatment containing basic pH blend + MSO oil adjuvants (MSO, Z-64, and Renegade). Quad 7 does not contain oil adjuvants but enhanced weed control. This is a good example of specificity of a herbicide to a certain type of adjuvant. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. AMS replacement adjuvants with Raptor (Zollinger and Ries).

		14 DAT			28 DAT			
Treatment[1]	Rate	Yeft	Colq	Hans	Yeft	Colq	Hans	V. Snfl[2]
	(product/A)	-----(%)-----			--------(%)--------			
Raptor +	2fl oz +	20	0	10	20	0	10	20
R-11	0.25% v/v	27	8	22	27	8	22	42
AMS	8.5lb/100gal	10	0	17	10	0	17	25
28% N	2.5% v/v	15	10	17	15	10	17	40
R-11+AMS	0.25% v/v+8.5lb/100gal	34	27	37	34	27	37	43
R-11+28% N	0.25% v/v+2.5% v/v	30	23	32	30	23	32	32
ClassAct Next Generation	2.5% v/v	23	20	23	23	20	23	50
Surfate	1% v/v	35	28	40	35	28	40	73
Alliance+Preference	1.25% v/v+0.25% v/v	32	30	32	32	30	32	79
Choice+Liberate	0.5% v/v+0.25% v/v	15	10	20	15	10	20	58
Quest+Preference	0.5% v/v+0.25% v/v	27	25	27	27	25	27	74
Cayuse Plus	0.75% v/v	20	17	20	20	17	20	53
Citron+Preference	2.2lb/100gal+0.25% v/v	43	43	52	43	43	52	53
Herbolyte	1% v/v	22	12	20	22	12	20	31
N-Tense	0.75% v/v	63	60	76	63	60	76	80
Reddy IT	0.25% v/v	40	31	45	40	31	45	55
Quad 7	1% v/v	66	57	50	66	57	50	55
Scoil+AMS	1.5pt+8.5lb/100gal	75	65	77	75	65	77	57
Z-64	1.5pt	77	67	80	77	67	80	92
Renegade	1.5pt	75	63	75	75	63	75	92
LSD (0.05)		10	10	12	10	10	12	7

[1]R-11, Preference, and Liberate = nonionic surfactant; AMS = ammonium sulfate; 28% N = 28-0-0; ClassAct Next Generation, Surfate, and Cayuse Plus = surfactants + fertilizer; Alliance, Quest and Choice = water conditioning agents; Citron = a proprietary adjuvant from Farm Direct, LLC; Herbolyte = a proprietary adjuvant from ProfitPro LLC; N-Tense = water conditioning agents + surfactants; Reddy IT = MSO complex surfactant blend; Quad 7 = basic pH blend; Scoil = methylated seed oil; Z-64 and Renegade = MSO basic pH blend.

[2]V. snfl = volunteer sunflower.

AMS replacement adjuvants with Steadfast. Zollinger, Richard K. and Jerry Ries. An experiment was conducted near Leonard, ND to evaluate weed control from Steadfast treatments when using AMS replacement adjuvants. Wensman '6117' corn was planted on April 27, 2005. POST treatments were applied May 16 at 10:00 am with 71 F air, 70 F soil surface, 52% relative humidity, 0% clouds, 3 to 5 mph SE wind, wet soil surface, very wet subsoil, good crop vigor, and no dew present to 3 collar corn. Weed species present were: 2 to 5 inch (20 to 100/ft^2) yellow foxtail; 2 to 6 inch (5 to 20/yd^2) common lambsquarters. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replicates per treatment.

Treatments were applied with water containing 500 ppm hardness of Ca and Na. Those adjuvants containing AMS were used at rates specified to provide approximately 8.5 lb/100 gal water. Other AMS replacements adjuvants were used at recommended rates. NIS was applied with some adjuvants which normally would not require NIS because the formulation does not contain surfactant. In general, weed control was greatest with any treatment containing basic pH blend + MSO oil adjuvants (MSO, Z-64, and Renegade). Quad 7 does not contain oil adjuvants but enhanced weed control. Basic pH blend adjuvants increase spray solution making SU herbicides more soluble and MSO adjuvants increase absorption. This is a good example of specificity of a herbicide to certain type of adjuvants for optimum weed control. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. AMS replacement adjuvants with Steadfast (Zollinger and Ries).

		14 DAT		28 DAT	
Treatment[1]	Rate	Yeft	Colq	Yeft	Colq
	(product/A)	---- (%) ----		---- (%) ----	
Steadfast +	0.75 oz +	33	33	32	13
R-11	0.25% v/v	62	45	50	32
AMS	8.5lb/100gal	52	23	37	23
28% N	2.5% v/v	52	22	37	20
R-11+AMS	0.25% v/v+8.5lb/100gal	76	69	74	52
R-11+28% N	0.25% v/v+2.5% v/v	73	64	59	48
ClassAct Next Generation	2.5% v/v	63	55	53	30
Surfate	1% v/v	70	58	63	30
Alliance+Preference	1.25% v/v+0.25% v/v	72	60	72	60
Choice+Liberate	0.5% v/v+0.25% v/v	68	57	47	40
Quest+Preference	0.5% v/v+0.25% v/v	72	62	47	27
Cayuse Plus	0.75% v/v	70	61	58	30
Citron+Preference	2.2lb/100gal+0.25% v/v	63	53	67	28
Herbolyte	1% v/v	42	42	47	28
N-Tense	0.75% v/v	52	42	42	30
Reddy IT	0.25% v/v	62	48	48	42
Quad 7	1% v/v	72	60	70	60
Scoil+AMS	1.5pt+8.5lb/100gal	85	68	73	73
Z-64	1.5pt	87	74	90	77
Renegade	1.5pt	84	74	92	85
LSD (0.05)		6	7	20	45

[1]R-11, Liberate, and Preference = nonionic surfactant; AMS = ammonium sulfate; 28% N = 28-0-0; ClassAct Next Generation, Surfate, and Cayuse Plus = surfactants + fertilizer; Alliance, Choice, and Quest = water conditioning agents; Citron = a proprietary adjuvant from Farm Direct, LLC; Herbolyte = a proprietary adjuvant from ProfitPro, LLC; N-Tense = water conditioning agents + surfactants; Reddy IT = MSO complex surfactant blend; Quad 7 = basic pH blend; Scoil = methylated seed oil; Z-64 and Renegade = MSO basic pH blend.

Blue windshield wiper fluid as an adjuvant. Zollinger, Richard K. and Jerry Ries. An experiment was conducted near Prosper, ND, to evaluate blue windshield windshield wiper fluid as an adjuvant. POST treatments were applied June 17, 2005 at 8:30 am with 72 F air, 68 F soil surface, 62% relative humidity, 25% clouds, 3 to 6 mph S wind, moist soil surface, wet subsoil and no dew present to non-cropland. Weed species present were: 3 to 10 inch (10 to 40/ft^2) yellow foxtail; 8 to 10 inch (1 to 10/ft^2) redroot pigweed; 8 to 10 inch (1 to 15/ft^2) common lambsquarters; and 6 to 10 inch (1 to 15/ft^2) common ragweed. 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 replicates per treatment.

R-11 nonionic surfactant enhanced control of glyphosate and Raptor. Substituting dark blue windshield wiper fluid for NIS antagonized weed control. The higher the concentration of blue windshield wiper fluid added resulted in greater herbicide antagonism compared to NIS. However, in some cases 1% blue windshield wiper fluid gave greater weed control than adding no adjuvant at all. Bottom line - stick with proven adjuvants with herbicides. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Blue windshield wiper fluid as an adjuvant (Zollinger andRies).

		14 DAT			
Treatment[1]	Rate	Yeft	Rrpw	Colq	Corw
	(product/A)	----------(%)----------			
Buccaneer Plus	6fl oz	89	89	69	47
Buccaneer Plus+R-11	6fl oz+0.25% v/v	98	99	97	72
Buccaneer Plus+BWWF	6fl oz+1% v/v	87	90	87	65
Buccaneer Plus+BWWF	6fl oz+2% v/v	81	79	72	47
Buccaneer Plus+BWWF	6fl oz+3% v/v	69	68	67	27
Raptor	2fl oz	28	28	20	20
Raptor+R-11	2fl oz+0.25% v/v	62	72	52	38
Raptor+BWWF	2fl oz+1% v/v	37	30	25	23
Raptor+BWWF	2fl oz+2% v/v	27	20	15	8
Raptor+BWWF	2fl oz+3% v/v	22	22	11	
LSD (0.05)		4	3	5	6

[1]BWWF = blue windshield wiper fluid; R-11 = nonionic surfactant.

Improvement of Kochia Contol in Non-Crop Areas with Adjuvants. Kirk Howatt, Ronald Roach, Janet Harrington. An experiment was established in a fallow area infested with a high population of kochia, 200 plants/ft^2. Treatments were applied to 6- to 14-inch kochia on June 17 with air temperature of 79° F, 36% RH, 5% cloud cover, 12.5 mph wind at 135°, and dry soil with a temperature of 77° F. Treatments were applied with a backpack sprayer delivering 17 gpa at 35 psi through 11001 TT nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/22 KOCZ	7/8 KOCZ	7/22 KOCZ
	oz ae/A		%	
MCPA&triclopyr&diclorprop	31.5	52	78	67
MCPA&triclopyr&diclorprop+WE 5051	31.5+12	57	83	71
MCPA&triclopyr&diclorprop+WE 5035	31.5+0.125%	61	82	72
MCPA&triclopyr&diclorprop+WE 5050	31.5+12	64	86	75
MCPA&triclopyr&diclorprop+WE 5051	31.5+12	65	84	65
Fluroxypyr	1.5	51	75	72
Fluroxypyr	3	60	87	86
CV		5	3	7
LSD (P=0.05)		5	4	8

Adjuvants increased the control of kochia with MCPA&triclopyr&diclorprop by as much as 8 percentage points. WE 5050 gave the most enhancement of MCPA&triclopyr&diclorprop activity, resulting in 75% control of kochia on July 22. Fluroxypyr at 1.5 oz ae/A on the same date gave 72% control, but 3 oz/A fluroxypyr provided the best control at 86%.