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Equipment BMPs for Glufosinate. Howatt, Ciernia, Roach, Harrington. Asgrow AG0634 soybean (non-glufosinate) was planted on June 10 near Fargo. Treatments were applied 2nd trifoliolate soybean, 3 to 8 inch redroot pigweed, 4 to 6 inch common lambsquarters, and 2 to 4 leaf yellow foxtail on July 16 with 75°F, 74% relative humidity, 95% cloud-cover, 3 to 6 mph wind at 180°, dry top- and moist sub-soil at 71°F. Treatments were applied with a four wheel ATV with a mounted sprayer delivering 5 and 17 gpa (as indicated in table) at 40 psi through 8002 AI nozzles (12 mph speed for 5 gpa to obtain 500+ micron droplets) and 11003 TT nozzles (5.2 mph speed for 17 gpa to obtain 300 micron droplets) to an area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

		Spray	July 23				July 27		
Treatment[a]	Rate	volume	soy	rrpw	colq	yeft	soy	rrpw	colq
	oz ai/A	gpa	%	%	%	%	%	%	%
Gluf+AMS	8.5+48	17	91	91	71	80	91	88	69
Gluf+AMS	8.5+24	17	90	91	74	75	94	92	68
Gluf	8.5	17	86	84	73	76	89	81	63
Gluf+AMS	8.5+48	5	73	63	43	40	71	69	25
Gluf+AMS	8.5+24	5	71	69	40	50	79	70	28
Gluf	8.5	5	75	59	33	30	75	66	23
Gluf+Dica-DF+AMS	8.5+4+24	17	93	87	84	73	95	89	84
Gluf+Dica-DF	8.5+4	17	94	88	83	74	94	86	80
Gluf+Dica-DF+AMS	8.5+4+24	5	92	84	74	63	92	79	75
Gluf+Dica-DF	8.5+4	5	89	84	71	60	86	73	65
Gluf+Dica+AMS	8.5+4+24	17	95	90	86	75	97	93	88
Gluf+Dica	8.5+4	17	91	84	81	71	95	89	84
Gluf+Dica+AMS	8.5+4+24	5	89	83	70	53	90	84	68
Gluf+Dica	8.5+4	5	88	78	68	50	89	80	71
Untreated Check	0		0	0	0	0	0	0	0
C.V.			5	6	9	10	4	7	8
LSD 5%			6	6	8	9	5	7	7

[a]Abbreviations: Dica-DF was DiFlexx from Bayer CropSciences, Dica was Clarity from BASF Corp.

Weed control with glufosinate was better with smaller droplets and greater application volume than the other equipment settings. Control difference was accentuated by treatment of larger weeds that recommended. The overall result demonstrates that the glufosinate system requires more attention to weed management than the glyphosate system has needed. Addition of AMS improved control of volunteer soybean, redroot pigweed, and common lambsquarters (colq only at the second evaluation), but difference between AMS rates was not confirmed.

Dicamba formulations appeared to be similar when averaged across all weed control. Differences occasionally were present between formulation but not of consistent rank across the experiment. Addition of dicamba compensated for loss of control with large droplets and low spray volume. Greatest control of common lambsquarters occured when dicamba was included with glufosinate at equipment settings to provide the smaller spray droplets and higher spray volume.

Roundup Weathermax with water conditioners in hard water. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate the quality of water conditioners with glyphosate. Flax, amaranth, sunflower, and conventional corn was planted on June 10, 2015. POST treatments were applied on July 9, 2015 at 9:00 AM with 70 F air, 64 F soil at a four inch depth, 77% RH, 75% cloud cover, 1-2 mph W wind, and moist soil moisture. Weeds present at the time of POST application were flax 8-10" at 30/ft2, amaranth 12-14" at 30/ft2, sunflower 17-19" at 5-10/ft2, and conventional corn 20-22" at 5-10/ft2. Soil characteristics were: 31.9% sand, 36.4% silt, 31.7% clay, Clay Loam, 4.6% OM, and 7.5 pH. 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 through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

A reduced rated of glyphosate was used to show the effects that each water conditioner has on each indicator species used. Conventional corn is a key indicator species used to compare all treatments back to the standard treatment (glyphosate plus AMS) because corn is sensitive to AMS.

Table. Roundup Weathermax with water conditioners in hard water (Zollinger, Wirth, Adams).

		14 DAA				28 DAA			
Treatment	Rate	Flax	Amar	Snfl	Corn	Flax	Amar	Snfl	Corn
	(Product/A)	------------% control------------				------------% control------------			
Distilled Water									
RUWM	10.7floz	69	90	88	90	68	87	88	90
RUWM+MON 0818	10.7floz+0.25%v/v	83	93	86	97	81	91	86	99
1,000 ppm Hard Water									
RUWM[1]	10.7floz	58	73	74	71	60	70	73	77
RUWM+MON 0818	10.7floz+0.25%v/v	61	81	73	84	67	81	75	93
RUWM+AMS	10.7floz+8.5lb/100gal	73	89	89	97	73	88	89	97
RUWM+CANG	10.7floz+2.5%v/v	68	86	86	88	70	82	86	92
RUWM+LoadUp	10.7floz+0.25%v/v	69	79	78	83	68	75	78	93
RUWM+LoadUp	10.7floz+0.5%v/v	71	77	72	78	72	72	72	88
RUWM+Full Load	10.7floz+0.5%v/v	68	72	72	78	69	73	72	85
RUWM+Full Load Complete	10.7floz+0.5%v/v	72	75	75	76	78	72	75	90
LSD (0.05)		8	7	5	7	8	6	5	4

[1]RUWM=Roundup Weathermax; AMS=Ammonium Sufate; CANG=Class Act NG

Glyphosate with surfactants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate the quality of surfactants with unloaded glyphosate. Flax, amaranth, quinoa, and LL soybean was planted on June 10, 2015. POST treatments were applied on July 7, 2015 at 11:50 AM with 77 F air, 69 F soil at a four inch depth, 30% RH, 0% cloud cover, 4-6 mph E wind, and adequate soil moisture. Weeds present at the time of POST application were flax 4-6" at 25-30/ft2, amaranth 11-13" at 20-25/ft2, quinoa 12-14" at 15-20/ft2, and LL soybean 3-trifoliate at 10-15/ft2. Soil characteristics were: 31.9% sand, 36.4% silt, 31.7% clay, Clay Loam, 4.6% OM, and 7.5 pH. 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 through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Touchdown HiTech is glyphosate without an adjuvant package (unloaded) while Buccaneer Plus is glyphosate with an adjuvant package (loaded). Adjuvant rates used depended on whether the glyphosate product used was loaded or unloaded.

Table. Glyphosate with surfactants (Zollinger, Wirth, Adams).

Treatment	Rate	14 DAA				28 DAA			
		Flax	Amar	Quin	Soyb	Flax	Amar	Quin	Soyb
	(Product/A)	------------% control------------				------------% control------------			
TDHT[1]	9.6floz	20	22	7	20	20	22	7	20
TDHT+R-11	9.6floz+0.5%v/v	63	53	58	75	63	50	58	75
TDHT+Activator 90	9.6floz+0.5%v/v	35	32	27	55	35	32	22	53
TDHT+LI-700	9.6floz+0.5%v/v	37	38	38	33	35	38	37	32
TDHT+APSA-80	9.6floz+0.5%v/v	65	62	65	74	62	62	65	76
TDHT+Amway Exp	9.6floz+0.5%v/v	35	43	23	62	30	42	22	58
TDHT+APSA-80	9.6floz+0.4%v/v	63	55	60	72	63	57	63	73
TDHT+Amway Exp	9.6floz+0.4%v/v	40	40	25	58	40	40	22	55
TDHT+APSA-80	9.6floz+0.2%v/v	47	36	42	55	43	33	40	53
TDHT+Amway Exp	9.6floz+0.2%v/v	47	48	28	47	43	42	27	45
TDHT+R-11+AMS	9.6floz+0.5%v/v+8.5lb/100gal	74	66	58	79	76	66	58	79
TDHT+APSA-80+AMS	9.6floz+0.4%v/v+8.5lb/100gal	73	80	62	83	76	79	62	84
TDHT+Amway Exp+AMS	9.6floz+0.4%v/v+8.5lb/100gal	52	60	25	73	53	62	25	73
Buc Plus	16floz	47	37	38	30	45	38	37	28
Buc Plus+APSA-80	16floz+0.2%v/v	45	60	61	70	47	62	63	73
Buc Plus+Amway Exp	16floz+0.2%v/v	38	48	32	33	35	48	27	33
Buc Plus+AMS	16floz+8.5lb/100gal	65	75	67	82	67	77	65	82
TDHT+Hook	9.6floz+0.25%v/v	35	40	25	30	32	42	20	30
TDHT+Hook	9.6floz+0.5%v/v	42	37	25	25	40	35	20	25
TDHT+AJHSS106215	9.6floz+0.25%v/v	38	50	27	32	36	53	25	30
LSD (0.05)		7	8	5	7	4	6	4	5

[1]TDHT=Touchdown HiTech; Buc Plus=Buccaneer Plus

Effectiveness of nano technology on glyphosate resistant waterhemp. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate the efficacy of glyphosate resistant waterhemp using nano technology mixed with glyphosate. POST treatments were applied on July 14, 2015 at 11:00 PM with 86 F air, 73 F soil at a four inch depth, 48% RH, 0% cloud cover, 0-2 mph NW wind, and adequate soil moisture. Weeds present at the time of POST application were wahe 8-16" at 10-15/ft2. Soil characteristics were: 4.7% sand, 56.3% silt, 39% clay, Silty Clay Loam, 4.9% OM, and 8.1 pH. 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 through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Nano treatments gave a small increase in weed efficacy. Glyphosate was not able to effectively overcome glyphosate resistance with the addition of a nano-technology based adjuvant.

Table. Effectiveness of nano technology on glyphosate resistant waterhemp (Zollinger, Wirth, Adams).

Treatment	Rate	14 DAA Wahe	28 DAA Wahe
	(Product/A)	-----------% control-----------	
RUPM[1]	22floz	48	43
RUPM+AMS	22floz+8.5lb/100gal	62	48
Nano-Revolution 2.0	2floz	10	0
Nano-Revolution 2.0	4floz	5	0
Nano Xcel	2floz	7	0
Nano Xcel	4floz	5	0
RUPM+Nano-Revolution 2.0	22floz+2floz	60	42
RUPM+Nano-Revolution 2.0	22floz+4floz	65	42
RUPM+Nano Xcel	22floz+2floz	63	48
RUPM+Nano Xcel	22floz+4floz	75	50
LSD (0.05)		7	5

[1]RUPM=Roundup Powermax

<u>Effectiveness of nano technology on glyphosate resistant common ragweed.</u> Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate the efficacy of glyphosate resistant common ragweed using nano technology mixed with glyphosate. POST treatments were applied on June 30, 2015 at 2:00 PM with 85 F air, 71 F soil at a four inch depth, 43% RH, 100% cloud cover, 2-4 mph SE wind, and adequate soil moisture. Weeds present at the time of POST application were corw 4-6" at 6-8/ft2. Soil characteristics were: 76.6% sand, 14% silt, 9.4% clay, Sandy Loam, 2.5% OM, and 6.7 pH. 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 through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Nano treatments gave a small increase in weed efficacy. Glyphosate was not able to effectively overcome glyphosate resistance with the addition of a nano-technology based adjuvant.

Table. Effectiveness of nano technology on glyphosate resistant common ragweed (Zollinger, Wirth, Adams).

		28 DAA	14 DAA 2x
Treatment	Rate	Corw	Corw
	(Product/A)	------------% control------------	
RUPM[1]	22floz	33	22
RUPM+AMS	22floz+8.5lb/100gal	33	22
Nano-Revolution 2.0	2floz	0	0
Nano-Revolution 2.0	4floz	0	0
Nano Xcel	2floz	0	0
Nano Xcel	4floz	0	0
RUPM+Nano-Revolution 2.0	22floz+2floz	30	30
RUPM+Nano-Revolution 2.0	22floz+4floz	30	35
RUPM+Nano Xcel	22floz+2floz	32	30
RUPM+Nano Xcel	22floz+4floz	30	38
LSD (0.05)		7	4

[1]RUPM=Roundup Powermax

Nano tech activity on glyt-res kochia. 'Faller' hard red spring wheat was seeded April 10 near Rogers, North Dakota. Treatments were applied to 5 leaf tillering wheat, 1 to 4 inch kochia and 1 to 3 inch common lambsquarters on June 8 with 70°F, 64% relative humidity, 75% cloud-cover, 1 to 5 mph wind at 315°, and dry to damp soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/16 wht	6/16 koch	6/16 colq	6/22 wht	6/22 koch	6/22 colq	7/6 koch
	oz ae/A	%	%	%	%	%	%	%
Glyt4.5	12	84	80	75	99	77	83	60
Glyt4.5+AMS	12+11	83	91	90	99	88	93	83
Glyt4.5+Rev 2.0	12+4	84	88	81	99	79	84	65
Glyt4.5	24	85	94	94	99	93	98	97
Rev 2.0	4	16	0	0	0	0	0	0
CV		5	5	5	0	5	4	5
LSD 0.05		5	6	5	.	6	5	4

Revolution 2.0 caused minor wheat injury of 16% on June 16. Injury manifested as slight chlorosis and growth inhibition. This injury was not apparent by June 22.

Revolution 2.0 provided adjuvant benefit for glyphosate control of kochia and common lambsquarters. Greater adjuvant benefit was obtained with AMS for glyphosate activity. Better control was obtained by doubling the rate of glyphosate than by including AMS or Revolution 2.0 with a standard glyphosate rate.

Evaluation of nano-tech for Foxtail control. Howatt, Roach, and Harrington. Soybean were planted near Fargo. Treatments were applied to 1st trifoliolate soybean and 2 to 4 leaf foxtail on July 9 with 62°, 100% humidity, 1 to 2.5 mph wind at 225°, and dry soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	7/23 yellow foxtail	7/23 soybean
	oz ai/A	%	%
Fenx+Brox&MCPA5	1+8	65	79
Fenx+Brox&MCPA5+Rev	1+8+2	59	80
Pxdn+Carf+Flox+NIS	0.86+0.128+1.5+0.25%	88	86
Pxdn+Carf+Flox+NIS+Rev	0.86+0.128+1.5+0.25%+2	89	86
Flcz2.0+Trib-sg+2,4-D+BB	0.32+0.3+6+1%	85	90
Flcz2.0+Trib-sg+2,4-D+BB+Rev	0.32+0.3+6+1%+2	86	89
Pxlm&Flas&Flox+BB	1.67+1%	80	90
Pxlm&Flas&Flox+BB+Rev	1.67+1%+2	85	90
Brox&Pyst&Thcz+BB	4+1%	86	94
Brox&Pyst&Thcz+BB+Rev	4+1%+2	88	95
Revolution 2.0	2	0	0
Untreated Check	0	0	0
CV		6	2
LSD 0.05		6	3

Each herbicide treatment already had adjuvant components. Addition of Revolution 2.0 did not increase control compared with similar herbicide and adjuvant treatment. In other studies, Revolution has worked as an adjuvant in place of other adjuvant systems.

Evaluation of nano-tech for Wild Oat control. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded April 27 near Fargo. Treatments were applied to 5 leaf wheat and 3 leaf wild oat on June 9 with 78°F, 44% relative humidity, clear sky, 5 to 8 mph wind at 180°, and wet soil at 68°F. Treatments were with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/23 wild oat	7/7 wild oat
	oz ai/A	%	%
Fenx+Brox&MCPA5	1+8	71	66
Fenx+Brox&MCPA5+Rev	1+8+2	70	60
Pxdn+Carf+Flox+NIS	0.86+0.128+1.5+0.25%	84	96
Pxdn+Carf+Flox+NIS+Rev	0.86+0.128+1.5+0.25%+2	84	96
Flcz2.0+Trib-sg+2,4-D+BB	0.32+0.3+6+1%	75	79
Flcz2.0+Trib-sg+2,4-D+BB+Rev	0.32+0.3+6+1%+2	73	80
Pxlm&Flas&Flox+BB	1.67+1%	74	84
Pxlm&Flas&Flox+BB+Rev	1.67+1%+2	80	81
Brox&Pyst&Thcz+BB	4+1%	74	78
Brox&Pyst&Thcz+BB+Rev	4+1%+2	74	78
Revolution 2.0	2	0	0
Untreated Check	0	0	0
CV		4	7
LSD 0.05		3	7

Each herbicide treatment already had adjuvant components. Addition of Revolution 2.0 did not increase control compared with similar herbicide and adjuvant treatment on July 7. Wild oat control on June 23 was slightly better with pyroxsulam (plus florasulam and fluroxypyr) when Revolution was included than without it. All other herbicides with existing adjuvant packages gave similar control of wild oat with or without Revolution 2.0. In other studies, Revolution has worked as an adjuvant in place of other adjuvant systems.

Adjuvant for kochia control with Rimsulfuron&Mesotrione-I. Howatt, Roach, and Harrington. 'Faller' hard red spring wheat was seeded April 10 near Rogers, North Dakota. Treatments were applied to 5 leaf tillering wheat, 2 to 5 inch Kochia, and 1 to 6 inch common lambsquarters on June 8 with 70°F, 74% relative humidity, 75% cloud-cover, 1 to 5 mph wind at 315°, and dry to damp soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/16 wht	6/16 koch	6/16 colq	6/22 wht	6/22 koch	6/22 colq	7/6 koch
	oz ai/A	%	%	%	%	%	%	%
Rims+Mest-I	0.3+3	13	28	20	60	45	70	63
Rims+Mest-I+UAD1501	0.3+3+16	18	48	45	60	83	92	88
Rims+Mest-I+UAD1502	0.3+3+16	16	43	28	60	83	90	83
Rims+Mest-I+UAD1503	0.3+3+16	18	45	33	60	87	93	89
Rims+Mest-I+UAD1504	0.3+3+16	18	45	33	60	80	90	80
Rims+Mest-I+UAD1505	0.3+3+16	10	28	23	60	83	88	84
Rims+Mest-I+UAD1407	0.3+3+16	13	38	33	60	80	88	79
Rims+Mest-I+UAD1331	0.3+3+8	18	33	23	60	85	91	86
Rims+Mest-I+UAD1387	0.3+3+16	15	35	25	60	83	93	79
Rims+Mest-I+UAD1353	0.3+3+12	13	38	28	60	84	91	84
Rims+Mest-I+MSO	0.3+3+20	26	50	43	60	93	96	93
CV		31	20	31	0	5	4	4
LSD 0.05		7	11	13	.	6	5	5

Rimsulfuron and mesotrione is sold as Instigate. MSO gave excellent enhancement of herbicide efficacy, often resulting in the highest control rating. MSO was the only adjuvant to improve herbicide control of wheat on June 16, but the rating was minimal at 26%. All treatments gave similar control of wheat by June 22 of 60%, and wheat was not present on July 6.

All adjuvants tended to improve herbicide control of kochia on June 16. UAD 1501, 1502, 1503, and 1504 resulted in greater control, 43 to 48%, than when herbicides were applied alone. All adjuvants greatly enhanced herbicide efficacy June 22 with at least 80% control of kochia. UAD 1503 enhanced herbicide activity to 87% control while MSO was slightly better at 93%.

UAD 1501 enhanced herbicide control of lambsquarters to 45% on June 16. Other numbered adjuvants gave higher numerical values than the herbicides alone but were not statistically better than herbicide alone. By June 22, all adjuvants aided herbicide efficacy with MSO and UAD1501, 1503, and 1387 providing the greatest benefit.

Adjuvant for kochia control with Saflufenacil. Howatt, Roach, and Harrington. 'Faller' hard red spring wheat was seeded April 10 near Rogers, North Dakota. Treatments were applied to 5 leaf tillering wheat, 1 to 6 inch common lambsquarters, and 1 to 4 inch kochia on June 8 with 70°F, 74% humidity, 75% cloud-cover, 1 to 5 mph wind at 315°, and dry to damp soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/16 wht	6/16 koch	6/16 colq	6/22 koch	6/22 colq	7/6 koch
	oz ai/A	%	%	%	%	%	%
Saflufenacil+Glyt4.5	0.36+6	84	70	88	70	99	58
Saff+UAD1501+Glyt4.5	0.36+16+6	78	76	93	83	99	70
Saff+UAD1502+Glyt4.5	0.36+16+6	79	80	92	85	99	86
Saff+UAD1503+Glyt4.5	0.36+16+6	81	85	91	88	99	80
Saff+UAD1504+Glyt4.5	0.36+16+6	81	88	92	94	99	90
Saff+UAD1505+Glyt4.5	0.36+16+6	78	71	93	83	99	79
Saff+UAD1407+Glyt4.5	0.36+16+6	80	90	92	96	99	90
Saff+UAD1331+Glyt4.5	0.36+8+6	80	79	84	84	99	78
Saff+UAD1387+Glyt4.5	0.36+16+6	85	83	90	93	99	91
Saff+UAD1353+Glyt4.5	0.36+12+6	83	75	85	85	99	69
Saff+MSO+Glyt4.5	0.36+20+6	70	96	94	98	99	97
CV		7	6	6	3	0	5
LSD (0.05)		8	7	8	4	.	6

The experiment was located in a field with glyt-resistant kochia. Control of kochia with glyphosate alone at 12 oz ae/A in other studies was about 45%. MSO increased kochia control with herbicides to 96% June 16. This was similar to adjuvant benefit from UAD 1407, 90%, and better than all other treatments. None of the adjuvants resulted in less herbicidal activity, but UAD 1501, 1505, and 1353 did not improve control with herbicides at this first evaluation.

By July 6 all adjuvants improved herbicidal activity and MSO improved herbicide efficacy the most to 97%. Of the numbered adjuvants, UAD 1504, 1406, and 1387 brought control with saflufenacil and glyphosate to 90% or better.

The highest numerical lambsquarters control value was 94% on June 16 with addition of MSO to the herbicides. Adjuvants did not improve lambsquarters control but tended to increase control rating at this early evaluation. UAD 1331 and 1353 only gave 84 to 85% control. However, all treatments provided 99% control of lambsquarters by June 22.

Control of wheat was not aided by additional adjuvant. The base treatment gave 84% control June 16, but MSO resulted in antagonism of herbicide activity at 70% control. By June 22 all wheat was completely controlled.

Adjuvants for Kochia control with Paraquat. Howatt, Roach, and Harrington. 'Faller' hard red spring wheat was seeded April 10 near Rogers, North Dakota. Treatments were applied to 5 leaf tillering wheat, 2 to 5 inch kochia and 1 to 6 inch common lambsquarters on June 8 with 70°F, 74% relative humidity, 1 to 5 mph wind at 315°, and dry to damp soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/16 wht	6/16 koch	6/16 colq	6/22 wht	6/22 koch	6/22 colq
	oz ai/A	%	%	%	%	%	%
Paraquat	4	81	95	68	78	99	30
Paraquat+UAD1501	4+16	86	95	74	86	99	30
Paraquat+UAD1502	4+16	85	95	78	89	99	30
Paraquat+UAD1503	4+16	84	95	75	85	99	30
Paraquat+UAD1504	4+16	88	95	88	88	99	30
Paraquat+UAD1505	4+16	86	95	73	88	99	30
Paraquat+UAD1407	4+16	86	95	87	88	99	30
Paraquat+UAD1331	4+8	85	95	75	88	99	30
Paraquat+UAD1387	4+16	88	95	91	88	99	30
Paraquat+UAD1353	4+12	86	95	80	90	99	30
Paraquat+NIS	4+0.5%	76	95	74	81	99	30
CV		4	0	7	3	0	0
LSD 0.05		5	.	8	4	.	.

Paraquat gave consistent control of kochia regardless of adjuvant included. Control was rapid with evaluation of 95% control 8 days after treatment on June 16. Complete control was observed by June 22.

Wheat control with paraquat was slightly antagonized by MSO on June 16. This effect was not detected on June 22. Several UAD adjuvants increased wheat control with paraquat on June 16. All UAD adjuvants enhanced control of wheat June 22 with UAD 1353 resulting in the highest value of 90%.

Many adjuvants initially increased activity of herbicides on lambsquarters. Control was as high as 91% with UAD 1387. However, surviving plants recovered quickly and took advantage of open canopy left from wheat and kochia control. This resulted in a general 30% control of lambsquarters in late June.

Gramoxone applied with fertilizers. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate the effect that fertilizers have on paraquat efficacy. Flax, amaranth, quinoa, and tame buckwheat was planted on June 10, 2015. POST treatments were applied on July 7, 2015 at 11:50 AM with 77 F air, 69 F soil at a four inch depth, 30% RH, 0% cloud cover, 4-6 mph E wind, and adequate soil moisture. Weeds present at the time of POST application were flax 6-8" at 30/ft2, amaranth 10-12" at 30/ft2, quinoa 12-14" at 10-15/ft2, and tame buckwheat 12-15" at 10/ft2. Soil characteristics were: 31.9% sand, 36.4% silt, 31.7% clay, Clay Loam, 4.6% OM, and 7.5 pH. 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 through 11002 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

The addition of fertilizers were compatible and even enhanced the weed efficacy of gramoxone.

Table. Gramoxone applied with fertilizers (Zollinger, Wirth, Adams).

		14 DAA				28 DAA			
Treatment	Rate	Flax	Amar	Quin	Tabw	Flax	Amar	Quin	Tabw
	(Product/A)	------------% control------------				------------% control------------			
Gramoxone	2pt	20	62	20	67	20	62	20	67
Gramoxone+R-11	2pt+0.25%v/v	62	65	68	70	86	82	93	96
Gramoxone+MON 0818	2pt+0.25%v/v	76	75	82	75	74	80	99	99
Gramoxone+R-11 +AIS-4000	2pt+0.25%v/v +2%v/v	81	73	80	75	95	86	98	98
Gramoxone+R-11 +N Pak AMS	2pt+0.25%v/v +2.5%v/v	55	53	52	58	68	71	78	85
Gramoxone+R-11 +Ammonium Chloride	2pt+0.25%v/v 10.3oz	53	55	60	60	62	60	83	90
Gramoxone+R-11 +ATS (12-0-0-26S)	2pt+0.25%v/v 0.75%v/v	72	72	82	73	87	81	91	96
Gramoxone+R-11 +MTS (0-0-0-10S-4Mg)	2pt+0.25%v/v 2%v/v	72	72	78	70	75	72	91	94
Gramoxone+R-11 +KTS (0-0-25-17S)	2pt+0.25%v/v 1.2%v/v	63	57	52	62	68	63	72	82
LSD (0.05)		4	6	4	5	5	7	4	3

Fertilizer effect on Paraquat Efficacy. Howatt, Roach, and Harrington. 'York' flax, 'Mancun' buckwheat, 'Blanca14' quinoa, and 'Plainsman' amaranth were planted in bioassay strips on June 12 near Fargo. Treatments were applied to 4 to 5 inch flax, 10 to 12 inch tame buckwheat, 5 to 6 inch amaranth, 1 to 4 inch wild buckwheat, and 1 to 3 inch Venice mallow, on July 7, with 64°F, 75% relative humidity, clear sky, calm wind at 180°, and dry soil at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	7/13 Flax	7/13 Tabw	7/13 Vema	7/13 Quinoa	7/13 Wibw	7/13 Rrpw	7/13 Wimu	7/23 Flax	7/23 Tamw	7/23 Vema	7/23 Quinoa	7/23 Wibw
	oz ai/A	%	%	%	%	%	%	%	%	%	%	%	%
Paraquat	8	73	81	86	78	76	99	99	86	96	91	68	65
Paraquat+NIS	8+0.25%	98	93	95	98	81	99	99	98	99	95	98	70
Paraquat+MON0818	8+0.25%	99	89	93	98	88	99	99	98	97	95	96	73
Paraquat+NIS+AIS4000	8+0.25%+2%	98	93	94	93	85	99	99	98	98	92	96	76
Paraquat+NIS+AMS-L	8+0.25%+2.5%	97	91	91	97	75	99	99	99	99	95	88	66
Paraquat+NIS+AmChl	8+0.25%+10.3	97	94	88	97	83	99	99	98	98	96	96	75
Paraquat+NIS+ATS	8+0.25%+0.75%	98	89	93	93	75	99	99	98	98	95	90	70
Paraquat+NIS+MTS	8+0.25%+2%	94	86	86	94	66	99	99	94	95	90	90	60
Paraquat+NIS+KTS	8+0.25%+1.2%	91	85	84	90	66	99	99	97	96	88	81	65
CV		2	3	4	4	5	0.0	0.0	1	1	2	6	8
LSD 0.05		2	3	5	5	6	.	.	2	2	2	7	8

Control of redroot pigweed and wild mustard was 99% with paraquat alone. Control of other species was improved with addition of NIS. Control of weed species was not improved with the addition of fertilizer above what was achieved with paraquat plus NIS.

Laudis and Diflexx with adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate adjuvants with laudis and diflexx. Flax, amaranth, canola, and LL soybean was planted on June 10, 2015. POST treatments were applied on July 9, 2015 at 9:00 AM with 70 F air, 64 F soil at a four inch depth, 77% RH, 75% cloud cover, 1-2 mph W wind, and moist soil moisture. Weeds present at the time of POST application were flax 6-8" at 30/ft2, amaranth 8-10" at 30/ft2, canola 11-13" at 10-15/ft2, and LL soybean 7-9" at 5-10/ft2. Soil characteristics were: 31.9% sand, 36.4% silt, 31.7% clay, Clay Loam, 4.6% OM, and 7.5 pH. 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 through 11001 TT nozzles at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Flax is a key indicator species because Laudis has no activity and will show minimal diflexx activity and adjuvant effects. Canola is a key indicator species because diflexx has no activity on it and will only show laudis activity. Both laudis and diflexx have activity on amaranth and soybean.

Table. Laudis and Diflexx with adjuvants (Zollinger, Wirth, Adams).

		14 DAA				28 DAA			
Treatment	Rate	Flax	Amar	Cano	Soyb	Flax	Amar	Cano	Soyb
	(Product/A)	-----------% control-----------				-----------% control-----------			
Laudis+Diflexx	1.5floz+4floz	50	37	33	72	50	37	27	72
Laudis+Diflexx+MSO	1.5floz+4floz+1pt	68	72	65	95	67	75	75	95
Laudis+Diflexx+Destiny HC	1.5floz+4floz+1pt	43	68	68	96	43	62	58	93
Laudis+Diflexx+Hybrid	1.5floz+4floz+12floz	63	63	63	95	68	73	67	95
Laudis+Diflexx+HSOC 4	1.5floz+4floz+12floz	63	68	62	91	60	65	52	89
Laudis+Diflexx+HSOC 5	1.5floz+4floz+12floz	62	60	48	93	52	75	50	95
Laudis+Diflexx+Hybrid	1.5floz+4floz+1pt	53	63	43	92	52	62	43	90
Laudis+Diflexx+HSOC 4	1.5floz+4floz+1pt	67	75	66	96	68	83	66	97
Laudis+Diflexx+HSOC 5	1.5floz+4floz+1pt	66	71	55	96	66	73	53	96
LSD (0.05)		6	7	10	2	5	6	6	3

Drift and volatility of dicamba formulation. Howatt, Ciernia, and Harrington. Dekalb DKC 38-04RIB corn and Asgrow AG0634 soybean were planted June 9 near Casselton North Dakota. Treatments were applied to 2 to 4 leaf corn surrounded by 2nd to 3rd trifoliolate soybean on July 9 with 81°F, 34% relative humidity, sky with 15% smoke haze, 2 to 2.5 mph wind at 250°, and dry soil at 71°F. Treatments were applied with a four wheel ATV with a mounted sprayer delivering 8.5 gpa at 30 psi through 11002 TT nozzles to an area the length of 10 by 50 foot plots. Soybean in an area adjacent to and downwind from the treated plants at the midpoint of the plot was covered during application with a tarp measuring 16 by 20 ft. The general observation area would include particle and vapor drift exposure, but response of protected soybean should only be due to volatilization from the treated area. Plots were 75 ft apart north to south. The experiment was a randomized complete block design with two replicates. Soybean was evaluated for visible injury from 0 (not injured by treatment) to 9 (dead). Plants were evaluated at 10-ft intervals on the upwind and downwind side of each plot. For the downwind distance, injury estimate was recorded for open and tarped plants separately.

a.

Distance west (ft)								Distance east (ft)						
70	60	50	40	30	20	10	Treatment	10	20	30	40	50	60	70
0	0	0	0	0	0.3	0.6	1	1.3 / 0	0.3	0	0	0	0	0
0	0	0	0	0	0.3	0.3	2	1 / 0	0.3	0	0	0	0	0
0	0	0	0	0	0	1	3	1.3 / 0	0.6	0	0	0	0	0
0	0	0	0	0	0	1	4	1.3 / 0.3	0.6	0	0	0	0	0

b.

Distance west (ft)								Distance east (ft)						
70	60	50	40	30	20	10	Treatment	10	20	30	40	50	60	70
0	0	0	0	0	0.3	1.6	1	3 / 0.3	0.6	0.3	0	0	0	0
0	0	0	0	0	0.3	2	2	2.6 / 0.3	0.6	0	0	0	0	0
0	0	0	0	0	0.3	2	3	2.3 / 0.3	1.3	0.6	0.3	0	0	0
0	0	0	0	0	0.3	2	4	3.3 / 0.6	2	0.3	0	0	0	0

c.

Distance west (ft)								Distance east (ft)						
70	60	50	40	30	20	10	Treatment	10	20	30	40	50	60	70
0	0	0	0	1	2.3	4	1	3.6 / 3, 1	3.3	2.3	1.3	1	0.6	0
0	0	0	0	0.6	1.6	4	2	4 / 2, 1	2.6	1.3	1	0	0	0
0	0	0	0	0.6	2	4	3	3.3 / 3, 1	2.3	1.6	0.6	0.6	0.3	0
0	0	0	0.3	1	2.3	4	4	5 / 3, 1	3.6	2.3	1.3	1.3	0.6	0

d.

Distance west (ft)								Distance east (ft)						
	60	50	40	30	20	10	Treatment	10	20	30	40	50	60	
	0	0	0.3	0.6	2	4	1	4 / 1, 1	3.3	2.6	2	0.6	0.3	
	0	0	0	0.6	2	3.6	2	3.6 / 2, 1	3	2.3	1.6	1	0.6	
	0	0	0	1	2.6	4.6	3	4.6 / 1, 1	3.3	1.6	1.3	1	0.3	
	0	0	0.3	1	2.3	4.3	4	4.3 / 3, 2	4	3.6	2.3	1.6	1	

Figure 1. Visible injury of dicamba to soybean 8 (a), 19 (b), 26 (c), and 40 (d) d after treatment with evaluation scale 0 (not injured) to 9 (dead). For 10 ft east of treated area, value in top portion of cell corresponds to exposed soybean and the lower value for soybean under tarp during application. At 26 and 40 d, values were recorded for soybean under tarp in the first two rows next to the treated area and the remainder of the tarped area. Treatment order same as in tables with all rates equivalent to 8 oz ae/A dicamba: 1, experimental dicamba formulation; 2, Status; 3, Clarity; and 4, Banvel.

Evidence of dicamba movement upwind was present from the first evaluation (Figure 1a) and was observed farther from the treated area with each evaluation (Figure 1c-d). Some upwind movement could be possible in low wind environment. The intensity was greater than injury on soybean under the tarp, which would have been exclusively caused by volatility. Volatility with Banvel was similar to other formulations until 40 d after treatment. Differences in volatility injury among the other formulations were only numerical.

Distance of observed injury and intensity of injury caused by dicamba increased for all formulations throughout the study duration. By 40 d after treatment (DAT), dicamba injury was evident the entire downwind extent of the study area, 70 ft, and was overlapping with upwind movement in the next replicate. This work demonstrated substantial particle movement even under preferred application environment and indicated the need for drift mitigation in the dicamba-resistant soybean technology.

Injury to soybean protected by the tarp likely resulted from volatility. Volatility was evident only for Banvel at 8 DAT (Figure 1a). This treatment presented the greatest numerical injury throughout all evaluations. Dicamba injury was noted on covered soybean in all plots at the latter two evaluations (Figure 1c-d). Injury to soybean in the two rows closest to the treated corn was more severe as the season progressed than soybean in the third row or farther away, which indicated substantial volatility in the microenvironment (Figure 1c-d). Soil about 12 inches from the first soybean row would have been exposed to the spray pattern in addition to plant material in the treatment area.

Particle movement of the spray volume likely accounted for the majority of soybean injury downwind, and even upwind from the application site. Injury upwind numerically was 1 to 3 rating units greater than the similar distance downwind and under the tarp (only 10 ft distance available for comparison). Therefore volatility cannot account for all the injury upwind. Injury downwind extended at least 70 ft by the end of the experiment. This resulted from a single 10-ft wide application strip. Wind was believed optimal for limiting particle spray drift according to available best management practices, but movement to great distance compared with treatment area was recorded.

		7/17	7/17	7/17	7/17	7/17	7/17	7/17	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28	7/28
Treatment	Rate	T	1e	1w	2e	2w	3e	3w	T	1e	1w	2e	2w	3e	3w	4e	4w
	oz ae/A																
Dicamba	8	0	1.3	0.6	0.3	0.3	0	0	0.3	3	1.6	0.6	0.3	0.3	0	0	0
Dicamba-S	8	0	1	0.3	0.3	0.3	0	0	0.3	2.6	2	0.6	0.3	0	0	0	0
Dicamba-C	8	0	1.3	1	0.6	0	0	0	0.3	2.3	2	1.3	0.3	0.6	0	0.3	0
Dicamba-B	8	0.3	1.3	1	0.6	0	0	0	0.6	3.3	2	2	0.3	0.3	0	0	0
CV		346	23	49	88	200	0	0	138	16	39	84	150	206	0	346	0
LSD 0.05		0.6	0.6	0.7	0.9	0.7	.	.	1.2	0.9	1.5	2.0	1.0	1.4	.	0.6	.

		7/28	7/28	8/4	8/4	8/4	8/4	8/4	8/4	8/4	8/4	8/4	8/4	8/4	8/4	8/4
Treatment	Rate	5e	5w	T	T2	1e	1w	2e	2w	3e	3w	4e	4w	5e	5w	6e
	oz ae/A															
Dicamba	8	0	0	2.6	1.3	3.6	4	3.3	2.3	2.3	1	1.3	0	1	0	0.6
Dicamba-S	8	0	0	2.3	1	4	4	2.6	1.6	1.3	0.6	1	0	0	0	0
Dicamba-C	8	0	0	2.6	1.3	3.3	4	2.3	2	1.6	0.6	0.6	0	0.6	0	0.3
Dicamba-B	8	0	0	3.3	1.3	5	4	3.6	2.3	2.3	1	1.3	0.3	1.3	0	0.6
CV		0	0	33	40	11	12	30	17	33	40	43	346	49	0	132
LSD 0.05		.	.	1.9	1.0	0.9	1.0	1.9	0.7	1.3	0.7	0.9	0.6	0.7	.	1.1

		8/4	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18	8/18
Treatment	Rate	6w	T	T2	1e	1w	2e	2w	3e	3w	4e	4w	5e	5w	6e	6w
	oz ae/A															
Dicamba	8	0	1.3	1	4	4	3.3	2	2.6	0.6	2	0.3	0.6	0	0.3	0
Dicamba-S	8	0	1.6	1.3	3.6	3.6	3	2	2.3	0.6	1.6	0	1	0	0.6	0
Dicamba-C	8	0	1	1	4.6	4.6	3.3	2.6	1.6	1	1.3	0	1	0	0.3	0
Dicamba-B	8	0	2.6	1.6	4.6	4.3	4	2.3	3.6	1	2.3	0.3	1.6	0	1	0
CV		0	33	37	11	17	30	20	49	52	37	200	40	0	63	0
LSD 0.05		.	1.1	0.9	1.0	1.5	2.1	0.9	2.6	0.9	1.4	0.7	0.9	.	0.7	.

Adjuvants to minimize off target movement. Howatt, Ciernia, and Harrington. Dekalb DKC38-04 RIB corn and Asgrow AG0634 Soybean were planted June 9 near Casselton, North Dakota. Treatments (Table 1) were applied to 2 to 4 leaf corn surrounded by 2nd to 3rd trifoliolate soybean on July 9 with 81°F, 34% relative humidity, sky with 15% smoke haze, 2 to 2.5 mph wind at 250°, and dry soil at 71°F. Treatments were applied with a four wheel ATV with a mounted sprayer delivering 8.5 gpa at 30 psi through 11002 TT nozzles to an area the length of 10 by 50 foot plots. Soybean in an area adjacent to and downwind from the treated plants at the midpoint of the plot was covered during application with a tarp measuring 16 by 20 ft. The general observation area would include particle and vapor drift exposure, but response of protected soybean should only be due to volatilization from the treated area. Plots were 75 ft apart north to south. The experiment was a randomized complete block design with two replicates. Soybean was evaluated for visible injury from 0 (not injured by treatment) to 9 (dead). Plants were evaluated at 10-ft intervals on the upwind and downwind side of each plot. For the downwind distance, injury estimate was recorded for open and tarped plants separately.

Table 1. Treatment list.

	Treatment	Rate
		oz ae/A
1	Glyt4.5 (PowerMax) + DicaC (Clarity) + NIS + AMS	8+8+0.5%+23
2	Glyt4.5 + DicaC + AQ889 + Full Load	8+8+0.25%+0.5%
3	Glyt4.5 + DicaB (Banvel) + AQ889 + Full Load	8+8+0.25%+0.5%
4	Glyt4.5 + DicaC + Drift-Fiant + Full Load	8+8+0.25%+0.5%
5	Glyt4.5 + DicaC + Full Load Complete	8+8+0.5%

Evidence of dicamba movement upwind was present at the first evaluation (Figure 1a). This injury was recorded at the greatest intensity and the farthest distance with Drift-Fiant plus Full Load as the adjuvant system. Injury was rated as 4 on plants upwind from this treatment by the end of the experiment (Figure 1c-d).

Dicamba movement downwind from the application site was most severe with NIS plus AMS (Figure 1b-d). By 40 d after treatment (DAT), dicamba injury was evident the entire downwind extent of the study area, 70 ft, for dicamba with NIS plus AMS or with Full Load Complete. The adjuvant AQ889 tended to limit the severity and distance of dicamba injury from the treated area. Dicamba formulated as Banvel generally resulted in injury farther from the treated area than the Clarity formulation.

Injury to soybean protected by the tarp likely resulted from volatility. Volatility was evident only for dicamba mixed with NIS and AMS at 8 DAT (Figure 1a). This combination presented the greatest injury throughout all evaluations. Dicamba injury was noted on covered soybean in all treatments at the latter two evaluations (Figure 1c-d), but injury was less with AQ889 or Full Load Complete than other treatments. Injury to soybean in the two rows closest to the treated corn was very severe as the season progressed, regardless of adjuvant load, which indicated substantial volatility in the microenvironment (Figure 1c-d). Soil about 12 inches from the first soybean row would have been exposed to the spray pattern in addition to plant material in the treatment area.

Particle movement of the spray volume likely accounted for the majority of soybean injury downwind, and even upwind from the application site. Injury upwind numerically was 1 to 2 rating units greater than the similar distance downwind and under the tarp (only 10 ft distance available for comparison). Wind was believed optimal for limiting particle spray drift according to available best management practices, but movement to great distance compared with treatment area was recorded.

a.

Distance west (ft) 70	60	50	40	30	20	10	Treatment	Distance east (ft) 10	20	30	40	50	60	70
0	0	0	0	0	1	1	1	2 / 1	1	1	1	0	0	0
0	0	0	0	0	0	1	2	2 / 0	1	0	0	0	0	0
0	0	0	0	0	1	1	3	2 / 0	1	0	0	0	0	0
0	0	0	0	1	1	2	4	2 / 0	2	1	0	0	0	0
0	0	0	0	0	0	1	5	3 / 0	2	1	1	1	0	0

b.

Distance west (ft) 70	60	50	40	30	20	10	Treatment	Distance east (ft) 10	20	30	40	50	60	70
0	0	0	0	0	1	2	1	4 / 2	4	3	1	1	0	0
0	0	0	0	0	0	1	2	3 / 1	1	0	0	0	0	0
0	0	0	0	0	1	2	3	3 / 1	2	1	0	0	0	0
0	0	0	0	0	1	2	4	3 / 0	3	1	0	0	0	0
0	0	0	0	0	1	2	5	4 / 1	3	2	1	1	0	0

c.

Distance west (ft) 70	60	50	40	30	20	10	Treatment	Distance east (ft) 10	20	30	40	50	60	70
0	0	0	0	0	1	3	1	5 / 4, 3	4	4	3	2	2	1
0	0	0	0	0	1	3	2	3 / 3, 1	1	1	0	0	0	0
0	0	0	0	1	2	3	3	4 / 4, 1	3	1	1	0	0	0
0	0	0	0	0	2	4	4	4 / 4, 2	3	2	0	0	0	0
0	0	0	0	0	0	1	5	2 / 2, 1	1	1	0	0	0	0

d.

Distance west (ft) 70	60	50	40	30	20	10	Treatment	Distance east (ft) 10	20	30	40	50	60	70
0	0	0	1	1	2	3	1	4 / 4, 3	4	3	3	3	2	2
0	0	0	0	0	1	3	2	4 / 3, 1	2	1	0	0	0	0
0	0	0	0	1	2	3	3	3 / 4, 1	3	1	1	0	0	0
0	0	0	0	1	3	4	4	4 / 4, 2	3	3	3	1	0	0
0	0	0	0	1	1	2	5	2 / 2, 1	2	3	3	2	2	1

Figure 1. Visible injury of dicamba to soybean 8 (a), 19 (b), 26 (c), and 40 (d) d after treatment with evaluation scale 0 (not injured) to 9 (dead). For 10 ft east of treated area, value in top portion of cell corresponds to exposed soybean and the lower value for soybean under tarp during application. At 26 and 40 d, values were recorded for soybean under tarp in the first two rows next to the treated area and the remainder of the tarped area.

Table 2. Data used in figures.

Treatment	Rate	7/17 T	7/17 1e	7/17 1w	7/17 2e	7/17 2w	7/17 3e	7/17 3w	7/17 4e	7/17 4w	7/17 5e	7/17 5w
Glyt4.5+DicaC+NIS+AMS	8+8+0.5%+23	1	2	1	1	1	1	0	1	0	0	0
Glyt4.5+DicaC+AQ889+Full Load	8+8+0.25%+0.5%	0	2	1	1	0	0	0	0	0	0	0
Glyt4.5+DicaB+AQ889+Full Load	8+8+0.25%+0.5%	0	2	1	1	1	0	0	0	0	0	0
Glyt4.5+DicaC+Drift-Fiant+Full Load	8+8+0.25%+0.5%	0	2	2	2	1	1	1	0	0	0	0
Glyt4.5+DicaC+Full Load Complete	8+8+0.5%	0	3	1	2	0	1	0	1	0	1	0
CV		316	48	79	71	197	155	316	194	0	316	0
LSD 0.05		0.9	2.6	1.8	2.0	1.6	2.2	0.9	1.1	-	0.9	-

Treatment	Rate	7/28 T	7/28 1e	7/28 1w	7/28 2e	7/28 2w	7/28 3e	7/28 3w	7/28 4e	7/28 4w	7/28 5e	7/28 5w
Glyt4.5+DicaC+NIS+AMS	8+8+0.5%+23	2	4	2	4	1	3	0	1	0	1	0
Glyt4.5+DicaC+AQ889+Full Load	8+8+0.25%+0.5%	1	3	1	1	0	0	0	0	0	0	0
Glyt4.5+DicaB+AQ889+Full Load	8+8+0.25%+0.5%	1	3	2	2	1	1	0	0	0	0	0
Glyt4.5+DicaC+Drift-Fiant+Full Load	8+8+0.25%+0.5%	0	3	2	3	1	1	0	0	0	0	0
Glyt4.5+DicaC+Full Load Complete	8+8+0.5%	1	4	2	3	1	2	0	1	0	1	0
CV		86	47	31	54	83	84	0	158	0	250	0
LSD 0.05		2.2	3.9	1.4	3.3	1.4	2.6	.	1.8	.	1.4	.

Treatment	Rate	8/4 T	8/4 T2	8/4 1e	8/4 1w	8/4 2e	8/4 2w	8/4 3e	8/4 3w	8/4 4e	8/4 4w	8/4 5e
Glyt4.5+DicaC+NIS+AMS	8+8+0.5%+23	4	3	5	3	4	1	4	0	3	0	2
Glyt4.5+DicaC+AQ889+Full Load	8+8+0.25%+0.5%	3	1	3	3	1	1	1	0	0	0	0
Glyt4.5+DicaB+AQ889+Full Load	8+8+0.25%+0.5%	4	1	4	3	3	2	1	1	1	0	0
Glyt4.5+DicaC+Drift-Fiant+Full Load	8+8+0.25%+0.5%	4	2	4	4	3	2	2	0	0	0	0
Glyt4.5+DicaC+Full Load Complete	8+8+0.5%	2	1	2	1	1	0	1	0	0	0	0
CV		36	62	39	31	41	0	51	316	65	0	105
LSD 0.05		3.2	2.2	3.6	2.2	2.6	.	2.0	0.9	1.1	.	0.9

Treatment	Rate	8/4 5w	8/4 6e	8/4 6w	8/4 7e	8/4 7w	8/18 T	8/18 T2	8/18 1e	8/18 1w	8/18 2e	8/18 2w
Glyt4.5+DicaC+NIS+AMS	8+8+0.5%+23	0	2	0	1	0	4	3	4	3	4	2
Glyt4.5+DicaC+AQ889+Full Load	8+8+0.25%+0.5%	0	0	0	0	0	3	1	4	3	2	1
Glyt4.5+DicaB+AQ889+Full Load	8+8+0.25%+0.5%	0	0	0	0	0	4	1	3	3	3	2
Glyt4.5+DicaC+Drift-Fiant+Full Load	8+8+0.25%+0.5%	0	0	0	0	0	4	2	4	4	3	3
Glyt4.5+DicaC+Full Load Complete	8+8+0.5%	0	0	0	0	0	2	1	2	2	2	1
CV		0	0	0	0	0	35	45	37	40	45	50
LSD 0.05		.	.	.	.	.	3.0	1.6	3.4	3.0	3.1	2.2

Treatment	Rate	8/18 3e	8/18 3w	8/18 4e	8/18 4w	8/18 5e	8/18 5w	8/18 6e	8/18 6w	8/18 7e	8/18 7w
Glyt4.5+DicaC+NIS+AMS	8+8+0.5%+23	3	1	3	1	3	0	2	0	2	0
Glyt4.5+DicaC+AQ889+Full Load	8+8+0.25%+0.5%	1	0	0	0	0	0	0	0	0	0
Glyt4.5+DicaB+AQ889+Full Load	8+8+0.25%+0.5%	1	1	1	0	0	0	0	0	0	0
Glyt4.5+DicaC+Drift-Fiant+Full Load	8+8+0.25%+0.5%	3	1	3	0	1	0	0	0	0	0
Glyt4.5+DicaC+Full Load Complete	8+8+0.5%	3	1	3	0	2	0	2	0	1	0
CV		31	111	28	316	66	0	45	0	97	0
LSD 0.5		1.6	2.2	1.4	0.9	1.6	.	0.9	.	1.1	.