Tan Section: Adjuvant and Application Technology Page

Weed control with paraquat and adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate broadleaf weed control. POST treatments were applied on July 11, 2014 at 11:30 am with 84 F air, 71 F soil at a four inch depth, 50% RH, 0% cloud cover, 8-10 mph NW wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 4-8" (10-18/ft2) flax, 2-4" (10-12/ft^2) redroot pigweed, 0-2" (10-12/ft^2) common purslane, and 8-10" (8-10/ft^2) tame buckwheat. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through TT11002 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. MSO adjuvants enhance most all herbicides except glyphosate and glufosinate. MSO adjuvants significantly enhance contact herbicides, including Groups 6 (bentazon) and 14 (Blazer, Cobra, Sharpen, Flexstar/Reflex, others). It was thought that MSO would enhance Group 22 herbicides (paraquat and diquat). This study was designed to observe the affect of NIS (R-11), PO (WCS Crop Oil), MSO (Upland MSO), and HSMOC (Destiny HC) adjuvants on paraquat applied at a labeled rate. NIS enhanced paraquat more than other adjuvants used which is contrary to the idea that MSO adjuvants would enhance paraquat activity the most. Increasing NIS from 0.25 to 1% v/v did not result in greater control (flax was slightly significant). Increasing PO, MSO, and HSMOC rates from 1 pt to 2 pt/A were neutral but mostly antagonistic.

NIS was positive to paraquat. PO generally has 17% surfactant/emulsifier, MSO generally has 10% surfactant/emulsifier, and HSMOC may contain 25 to 50% surfactant/emulsifier. It was thought that HSMOC adjuvants may overcome the antagonism from the oil by the greater concentration of surfactant (25 to 50%) but data from this study clear antagonism especially as HSMOC rate increated. Summary: Use NIS with paraquat.

Table. Weed control with paraquat and adjuvants. (Zollinger, Wirth, Adams).

		14 & 28 DAT			
Treatment[1]	Rate	Flax	Rrpw	Copu	Tabw
	(Product/A)	----------% Control----------			
POST					
Gramoxone+R-11	1.5pt+0.25%v/v	82	89	57	92
Gramoxone+R-11	1.5pt+0.5%v/v	96	99	50	94
Gramoxone+R-11	1.5pt+1%v/v	93	99	57	99
Gramoxone+PO	1.5pt+1pt	63	85	35	99
Gramoxone+PO	1.5pt+1.5pt	57	88	20	77
Gramoxone+PO	1.5pt+2pt	52	88	27	98
Gramoxone+MSO	1.5pt+1pt	72	88	30	93
Gramoxone+MSO	1.5pt+1.5pt	63	91	32	90
Gramoxone+MSO	1.5pt+2pt	73	95	43	83
Gramoxone+Destiny HC	1.5pt+1pt	83	73	43	96
Gramoxone+Destiny HC	1.5pt+1.5pt	60	62	40	83
Gramoxone+Destiny HC	1.5pt+2pt	67	50	42	88
LSD (0.05)		6	9	10	7

Adjuvants for paraquat. Howatt, Roach, and Harrington. 'Rahab 94' flax, buckwheat, amaranth, and quinoa was seeded near Fargo June 4. Treatments were applied to flowering buckwheat, 6 inch flax, pigweed and lambsquarters 4 to 6 true leaf, 2 to 4 inch Venice mallow, and 3 to 5 leaf yellow foxtail on July 7 with 80°F, 44% relative humidity, 100% cloud cover, 5 to 10 mph velocity wind at 330°, and dry soil at 76°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 feet. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Yeft 7/21	Flax 7/21	Tabw 7/21	Wimu 7/21	Rrpw 7/21	Wibw 7/21	Vema 7/21	Flax 8/4
	oz ai/A	%	%	%	%	%	%	%	%
Paraquat+NIS	6+0.25%	80	79	96	75	75	57	75	82
Paraquat+NIS	6+0.5%	80	89	97	82	90	61	79	95
Paraquat+NIS	6+1%	80	94	97	85	92	64	80	99
Paraquat+PO	6+16	80	74	95	85	85	70	74	69
Paraquat+PO	6+24	80	74	97	85	89	75	75	70
Paraquat+PO	6+32	80	75	97	87	87	76	79	72
Paraquat+MSO	6+16	80	82	96	85	85	71	84	77
Paraquat+MSO	6+24	80	84	96	87	86	75	84	76
Paraquat+MSO	6+32	80	86	97	84	84	76	84	77
Paraquat+HSMOC	6+16	80	93	97	85	89	80	84	96
Paraquat+HSMOC	6+24	80	93	97	86	88	81	87	98
Paraquat+HSMOC	6+32	80	95	97	87	90	86	90	98
CV		0	2	1	3	2	4	3	3
LSD (P=0.05)		0	3	1	3	3	4	3	3

Nonionic surfactant is a good adjuvant for paraquat. Nonionic surfactant or high surfactant methylated oil concentrate, which includes relatively high amount of NIS, provided the greatest control of several species. Control of yellow foxtail, tame buckwheat, and wild mustard were generally similar across adjuvant type. Adjuvants that included an oil component promoted improved control of wild buckwheat with paraquat, but best control was achieved with an adjuvant containing oil and NIS.

Adjuvants for Paraquat. Howatt, Roach, and Harrington. 'Rahab 94' flax, buckwheat, amaranth, and quinoa was seeded near Fargo June 4. Treatments were applied to 8 to 14 inch green foxtail, Venice mallow, wild mustard, and wild buckwheat on August 6 with 68°F, 79% relative humidity, 100% cloud cover and hazy, 1.5 mph wind at 90°, and damp soil at 68°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11002 TT nozzles to a 7 foot wide area the length of 10 by 30 feet. The experiment was a randomized complete block design with four replicates.

		All species	
Treatment	Rate	8/8	8/12
	oz ai/A	%	%
Paraquat+NIS	6+0.25%	60	75
Paraquat+NIS	6+0.5%	60	75
Paraquat+NIS	6+1%	60	75
Paraquat+PO	6+16	60	75
Paraquat+PO	6+24	60	75
Paraquat+PO	6+32	60	75
Paraquat+MSO	6+16	60	75
Paraquat+MSO	6+24	60	75
Paraquat+MSO	6+32	60	75
Paraquat+HSMOC	6+16	60	75
Paraquat+HSMOC	6+24	60	75
Paraquat+HSMOC	6+32	60	75
CV		0	0
LSD (P=0.05)		0	0

This study did not indicate adjuvant effect on paraquat efficacy.

Evaluate adjuvants for new herbicides. Howatt, Roach, and Harrington. 'Rahab 94' flax and buckwheat were seeded near Fargo on June 4. Treatments were applied to flowering mustard and 4 to 6 leaf Venice mallow on July 9 with 74°F, 39% relative humidity, 0% cloud-cover, 2 to 6 mph wind at 350°, and dry soil at 69°F. Treatments were applied with a sprayer mounted on a 4 wheel all-terrain vehicle delivering 17 gpa at 50 psi through various nozzles to a 7 ft wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Table 1

Treatment	Rate	Tip	Yeft 7/9	FLAX 7/9	TABW 7/9	Wimu 7/9	Vema 7/9	Rrpw 7/9	Yeft 7/23	FLAX 7/23	TABW 7/23
	fl oz/A		%	%	%	%	%	%	%	%	%
LPI6466	6.4	TTI	0	40	42	40	20	37	0	60	76
LPI6466+LPI6472	6.4+0.5%	TTI	0	40	50	40	20	42	0	74	84
LPI6466+LPI6494	6.4+0.5%	TTI	0	39	39	39	20	30	0	71	63
LPI6467	24	AIXR	60	60	57	50	25	55	99	92	94
LPI6467+LPI6472	24+0.5%	AIXR	60	55	57	50	30	62	99	89	95
LPI6467+LPI6494	24+0.5%	AIXR	60	57	50	50	27	65	99	89	94
LPI6468	15	TTI	60	57	55	47	20	60	99	87	87
LPI6468+LPI6472	15+0.5%	TTI	60	57	60	47	22	57	99	89	93
LPI6468+LPI6494	15+0.5%	TTI	60	45	55	45	20	52	99	79	89
LPI6468+HSMOC	15+16fl oz	TTI	60	55	57	47	20	60	99	86	90
LPI6468+Interlock+HSMOC	15+4fl oz+16fl oz	TTI	60	57	61	50	25	61	99	89	92
CV			0	7	8	6	14	8	0	4	4
LSD (P=0.05)			0	5	7	4	5	6	0	5	5

Table 2

Treatment	Rate	Tip	Wimu 7/23	Vema 7/23	Rrpw 7/23	Yeft 8/6	FLAX 8/6	TABW 8/6	Wimu 8/6	Vema 8/6	Rrpw 8/6
	fl oz/A		%	%	%	%	%	%	%	%	%
LPI6466	6.4	TTI	80	37	69	0	40	75	79	25	85
LPI6466+LPI6472	6.4+0.5%	TTI	80	35	76	0	66	88	80	42	93
LPI6466+LPI6494	6.4+0.5%	TTI	76	36	57	0	36	70	68	33	63
LPI6467	24	AIXR		86	86	99	94	96	98	89	95
LPI6467+LPI6472	24+0.5%	AIXR	95	92	95	99	94	97	98	87	95
LPI6467+LPI6494	24+0.5%	AIXR	95	90	95	99	87	94	96	72	87
LPI6468	15	TTI	89	76	91	99	88	90	95	66	94
LPI6468+LPI6472	15+0.5%	TTI	92	80	89	99	96	97	97	74	90
LPI6468+LPI6494	15+0.5%	TTI	87	80	84	99	91	97	93	74	90
LPI6468+HSMOC	15+16fl oz	TTI	92	80	90	99	91	97	95	82	90
LPI6468+Interlock+HSMOC	15+4fl oz+16fl oz	TTI	90	85	92	99	93	96	95	75	95
CV			3	7	5	0	4	3	2	7	4
LSD (P=0.05)			4	8	7	0	4	5	3	7	6

Control of broadleaf plants with LPI6466 was improved for several species with the addition of LPI6472. Tame buckwheat showed this on July 9, while other species took longer for the difference to develop. Wild mustard did not show this response. LPI6494 either had no effect or antagonized the activity of LPI6466.

Activity of LPI6467 was essentially similar whether LPI6472 was included or not. Again, LPI6494 tended to result in less control with LPI6467 than when applied alone on August 6.

LPI6468 control of flax, buckwheat, and Venice mallow was improved with the addition of LPI6472 late in the season. LPI6494 improved control of buckwheat and mallow as well, but control of pigweed and flax was less on earlier evaluation dates when LPI6494 was included with LPI6468.

Glyphosate plus dicamba with adjuvents. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to Clariant adjuvents with various herbicides. POST treatments were applied on July 16, 2014 at 3:30 pm with 87 F air, 76.7 F soil at a four inch depth, 32% RH, 80% cloud cover, 2-4 mph SW wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 10-12" (16-18/ft2) flax, 6-8" (8-10/ft^2) amaranth, 8-12" (4-6/ft^2) liberty link canola, and 8-10" (8-10/ft^2) roundup ready soybean. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. Flax is a key indicator species because Laudis has no activity and will only show glyphosate activity and adjuvant effects. LL Canola is a key indicator species because Clarity has no activity on it and will only show glyphosate and Laudis activity. RR soybean is a key indicator species because glyphosate has no activity and will only show Clarity and Laudis activity.

Table. Glyphosate plus dicamba plus tembotrione with adjuvants. (Zollinger, Wirth, Adams).

		14 DAT				28 DAT			
Treatment[1]	Rate	Flax	Amar	Cano	Soy	Flax	Amar	Cano	Soy
	(Product/A)	----------% Control----------				----------% Control----------			
POST									
TD HiTech+Clarity+R-11	7.2floz+4floz+1%v/v	58	77	62	75	78	87	92	85
TD HiTech+Clarity+MSO	7.2floz+4floz+0.5%v/v	38	70	43	60	38	77	43	70
TD HiTech+Clarity+MSO	7.2floz+4floz+1%v/v	32	77	53	88	32	77	67	95
TD HiTech+Clarity+SynOS30	7.2floz+4floz+0.25%v/v	43	70	42	53	43	80	52	87
TD HiTech+Clarity+SynOS30	7.2floz+4floz+0.5%v/v	40	75	45	62	40	75	55	90
TD HiTech+Clarity+Interlock	7.2floz+4floz+5floz	42	70	52	35	42	80	52	55
TD HiTech+Clarity+Masterlock	7.2floz+4floz+6.4floz	35	75	52	60	35	85	62	83
TD HiTech+Clarity+SynOS70	7.2floz+4floz+0.25%v/v	37	68	32	53	37	78	42	73
TD HiTech+Clarity+SynOS70	7.2floz+4floz+0.5%v/v	42	67	28	65	42	87	42	95
TD HiTech+Clarity+Laudis+MSO	7.2floz+4floz+3floz+0.5%v/v	43	60	43	95	43	67	49	96
TD HiTech+Clarity+Laudis+MSO	7.2floz+4floz+3floz+1%v/v	48	73	60	96	48	83	60	98
TD HiTech+Clarity+Laudis+SynOS30	7.2floz+4floz+3floz+0.25%v/v	45	62	68	93	45	72	70	95
TD HiTech+Clarity+Laudis+SynOS30	7.2floz+4floz+3floz+0.5%v/v	42	63	48	93	42	73	58	95
TD HiTech+Clarity+Laudis+Interlock	7.2floz+4floz+3floz+5floz	43	53	43	88	43	53	47	92
TD HiTech+Clarity+Laudis+Masterlock	7.2floz+4floz+3floz+6.4floz	47	65	32	98	53	82	35	98
TD HiTech+Clarity+Laudis+SynOS70	7.2floz+4floz+3floz+0.25%v/v	37	62	17	95	37	90	17	97
TD HiTech+Clarity+Laudis+SynOS70	7.2floz+4floz+3floz+0.5%v/v	40	62	45	96	40	67	48	96
LSD (0.05)		6	14	13	11	6	10	10	8

[1] TD HiTech= Touchdown HiTech (Glyphosate)

Glyphosate plus dicamba plus Corvus or Sharpen with adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to Clariant adjuvants with various herbicides. POST treatments were applied on July 17, 2014 at 9:00 am with 80 F air, 69 F soil at a four inch depth, 30% RH, 70% cloud cover, 2-4 mph SSW wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 8-14" (16-18/ft2) flax, 6-8" (6-8/ft^2) amaranth, 8-10" (5-7/ft^2) liberty link canola, and 8-10" (8-10/ft^2) roundup ready soybean. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. Flax is a key indicator species because Laudis in Corvus has no activity and will only show glyphosate activity and adjuvant effects. LL Canola is a key indicator species because Clarity has no activity on it and will only show glyphosate and Laudis activity. RR soybean is a key indicator species because glyphosate has no activity and will only show Clarity and Laudis activity.

Table. Glyphosate plus dicamba plus Corvus or Sharpen with adjuvants. (Zollinger, Wirth, Adams).

		14 DAT				28 DAT			
Treatment[1]	Rate	Flax	Amar	Cano	Soy	Flax	Amar	Cano	Soy
	(Product/A)	----------% Control----------				----------% Control----------			
POST									
TD HiTech+Clarity+R-11	7.2floz+4floz+1%v/v	32	70	58	70	42	70	47	67
TD HiTech+Clarity+Corvus+MSO	7.2floz+4floz+3.33floz+0.5%v/v	37	75	43	80	45	75	73	83
TD HiTech+Clarity+Corvus+MSO	7.2floz+4floz+3.33floz+1%v/v	38	72	40	85	38	82	50	96
TD HiTech+Clarity+Corvus+SynOS30	7.2floz+4floz+3.33floz+0.25%v/v	35	63	38	73	35	63	42	80
TD HiTech+Clarity+Corvus+SynOS30	7.2floz+4floz+3.33floz+0.5%v/v	32	63	50	88	32	63	50	93
TD HiTech+Clarity+Corvus+Interlock	7.2floz+4floz+3.33floz+5floz	30	62	45	73	30	62	45	83
TD HiTech+Clarity+Corvus+Masterlock	7.2floz+4floz+3.33floz+6.4floz	33	73	40	80	33	83	43	91
TD HiTech+Clarity+Corvus+FOP0059	7.2floz+4floz+3.33floz+0.5%v/v	33	62	33	81	33	72	33	88
TD HiTech+Clarity+Sharpen+MSO	7.2floz+4floz+1floz+0.5%v/v	58	82	72	93	52	92	77	95
TD HiTech+Clarity+Sharpen+MSO	7.2floz+4floz+1floz+1%v/v	65	73	68	92	67	87	85	95
TD HiTech+Clarity+Sharpen+SynOS30	7.2floz+4floz+1floz+0.25%v/v	42	80	68	90	48	94	78	95
TD HiTech+Clarity+Sharpen+SynOS30	7.2floz+4floz+1floz+0.5%v/v	57	82	67	93	67	92	77	95
TD HiTech+Clarity+Sharpen+Interlock	7.2floz+4floz+1floz+5floz	40	77	58	85	40	87	78	82
TD HiTech+Clarity+Sharpen+Masterlock	7.2floz+4floz+1floz+6.4floz	58	87	73	95	68	90	78	95
TD HiTech+Clarity+Sharpen+FOP0059	7.2floz+4floz+1floz+0.5%v/v	60	87	72	95	73	90	82	95
LSD (0.05)		6	8	7	9	5	7	6	5

[1] TD HiTech= Touchdown HiTech (Glyphosate)

Glyphosate plus dicamba with various adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to Clariant adjuvents with various herbicides. POST treatments were applied on July 17, 2014 at 9:00 am with 80 F air, 69 F soil at a four inch depth, 30% RH, 70% cloud cover, 2-4 mph SSW wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 8-14" (16-18/ft2) flax, 2-4" (6-8/ft^2) amaranth, 8-10" (3-5/ft^2) liberty link canola, and 4-6" (8-10/ft^2) roundup ready soybean. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. Flax is a key indicator species because Laudis has no activity and will only show glyphosate activity and adjuvant effects. LL Canola is a key indicator species because Clarity has no activity on it and will only show glyphosate and Laudis activity. RR soybean is a key indicator species because glyphosate has no activity and will only show Clarity and Laudis activity.

Table. Glyphosate plus dicamba with various adjuvants. (Zollinger, Wirth, Adams).

		14 DAT				28 DAT			
Treatment[1]	Rate	Flax	Amar	Cano	Soy	Flax	Amar	Cano	Soy
	(Product/A)	----------% Control----------				----------% Control----------			
POST									
TD HiTech+Clarity+R-11	7.2floz+4floz+1%v/v	50	70	77	93	57	73	77	93
TD HiTech+Clarity +R-11+AMS	7.2floz+4floz +1%v/v+8.5lb/100gal	79	78	80	96	81	92	95	96
TD HiTech+Clarity+DestinyHC	7.2floz+4floz+0.5%v/v	32	73	37	92	32	77	63	87
TD HiTech+Clarity+DensityHC	7.2floz+4floz+1%v/v	33	67	58	93	53	77	68	95
TD HiTech+Clarity+SynOS50	7.2floz+4floz+0.25%v/v	43	75	33	88	43	77	53	89
TD HiTech+Clarity+SynOS50	7.2floz+4floz+0.5%v/v	57	75	57	72	62	77	77	95
TD HiTech+Clarity+Interlock	7.2floz+4floz+5floz	33	77	50	93	43	80	60	93
TD HiTech+Clarity+Masterlock	7.2floz+4floz+6.4floz	40	80	45	93	45	83	48	93
TD HiTech+Clarity+Laudis+DestinyHC	7.2floz+4floz+3floz+0.5%v/v	42	70	45	98	52	77	65	98
TD HiTech+Clarity+Laudis+DestinyHC	7.2floz+4floz+3floz+1%v/v	38	70	57	98	52	80	67	98
TD HiTech+Clarity+Laudis+SynOS50	7.2floz+4floz+3floz+0.25%v/v	43	80	35	95	63	90	45	98
TD HiTech+Clarity+Laudis+SynOS50	7.2floz+4floz+3floz+0.5%v/v	33	83	30	99	53	85	40	99
TD HiTech+Clarity+Laudis+Interlock	7.2floz+4floz+3floz+5floz	38	68	32	98	42	78	42	98
TD HiTech+Clarity+Laudis+Masterlock	7.2floz+4floz+3floz+6.4floz	35	67	45	98	40	77	55	98
LSD (0.05)		8	11	9	5	6	8	8	4

[1] TD HiTech= Touchdown HiTech (Glyphosate)

Glyphosate plus dicamba with various adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate Clariant adjuvents with various herbicides. POST treatments were applied on July 17, 2014 at 9:00 am with 80 F air, 69 F soil at a four inch depth, 30% RH, 70% cloud cover, 2-4 mph SSW wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 12-14" (16-18/ft2) flax, 14-18" (4-6/ft^2) quinoa, 14-18" (4-6/ft^2) liberty link canola, and 10-12" (8-10/ft^2) roundup ready soybean. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. Flax is a key indicator species because Callisto has no activity and will only show glyphosate activity and adjuvant effects. LL Canola is a key indicator species because Clarity has no activity on it and will only show glyphosate and Callisto activity. RR soybean is a key indicator species because glyphosate has no activity and will only show Clarity and Callisto activity.

Table. Glyphosate plus dicamba with various adjuvants. (Zollinger, Wirth, Adams).

		14 DAT					28 DAT				
Treatment[1]	Rate	Flax	Cano	Amar	Quin	Soy	Flax	Cano	Amar	Quin	Soy
	(Product/A)	----------% Control----------					----------% Control----------				
POST											
TD HiTech+R-11	7.2floz+1%v/v	22	32	82	82	0	32	42	73	73	0
TD HiTech+R-11+AMS	7.2floz+1%v/v+8.5lb/100gal	42	63	90	90	0	52	73	90	90	0
TD HiTech+SynGA+AMS	7.2floz+0.15%v/v+8.5lb/100gal	23	42	87	87	0	33	52	87	87	0
TD HiTech+SynGA+AMS	7.2floz+0.3%v/v+8.5lb/100gal	37	40	87	87	0	57	70	87	87	0
TD HiTech+SynME	7.2floz+0.5%v/v	20	32	80	80	0	30	42	70	70	0
TD HiTech+SynMAX	7.2floz+0.5%v/v	27	40	87	87	0	37	53	82	82	0
TD HiTech+Clarity+R-11	7.2floz+4floz+1%v/v	32	55	92	92	83	42	85	93	93	90
TD HiTech+Clarity+R-11 +AMS +8.5lb/100gal	7.2floz+4floz+1%v/v	47	68	93	93	75	60	92	93	93	85
TD HiTech+Clarity+SynGA +AMS +8.5lb/100gal	7.2floz+4floz+0.15%v/v	50	60	85	85	72	60	88	88	88	92
TD HiTech+Clarity+SynGA +AMS +8.5lb/100gal	7.2floz+4floz+0.3%v/v	75	68	93	93	72	85	92	95	95	92
TD HiTech+Clarity+SynME	7.2floz+4floz+0.5%v/v	25	45	87	87	77	45	65	90	90	87
TD HiTech+Clarity+SynMAX	7.2floz+4floz+0.5%v/v	33	35	88	88	85	63	55	90	90	93
TD HiTech+Clarity+Callisto+R-11	7.2floz+4floz+1floz+1%v/v	25	37	85	85	75	45	57	95	95	85
TD HiTech+Clarity+Callisto+R-11 +AMS +8.5lb/100gal	7.2floz+4floz+1floz+1%v/v	67	50	95	95	80	77	80	95	95	82
TD HiTech+Clarity+Callisto+SynGA +AMS +8.5lb/100gal	7.2floz+4floz+1floz+0.15%v/v	43	57	88	88	55	53	80	95	95	75
TD HiTech+Clarity+Callisto+SynGA +AMS +8.5lb/100gal	7.2floz+4floz+1floz+0.3%v/v	43	40	90	90	70	52	60	92	92	80
TD HiTech+Clarity+Callisto+SynME	7.2floz+4floz+1floz+0.5%v/v	28	15	87	87	78	38	25	87	87	78
TD HiTech+Clarity+Callisto+SynMAX	7.2floz+4floz+1floz+0.5%v/v	35	17	82	82	68	45	36	83	83	73
LSD (0.05)		7	10	7	7	8	7	9	5	5	6

[1] TD HiTech= Touchdown HiTech (Glyphosate)

Clethodim formulations with different adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate corn and grass control. POST treatments were applied on July 15, 2014 at 9:30 am with 73 F air, 67 F soil at a four inch depth, 32% RH, 85% cloud cover, 6-8 mph N wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 14" (18-20/ft2) forage barley, and 18" (8-10/ft^2) roundup ready corn. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 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 at 40 psi through TT11001 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

RR corn was a key indicator species because glyphosate has no activity and would only show the clethodim activity and adjuvant effects.

Table. Clethodim formulations with different adjuvants. (Zollinger, Wirth, Adams).

		14 DAT		28 DAT	
Treatment[1]	Rate	Foba	Corn	Foba	Corn
	(Product/A)	--% Control--		--% Control--	
POST					
RUPM+AMS	22floz+0.75lb	80	0	85	0
RUPM+ARY-0411-024+PO+AMS	22floz+4floz+1%v/v+0.75lb	99	43	99	63
RUPM+ARY-0411-025+PO+AMS	22floz+4floz+1%v/v+0.75lb	99	43	99	73
RUPM+ARY-0411-024+SuperbHC+AMS	22floz+4floz+1.25%v/v+0.75lb	99	50	99	57
RUPM+ARY-0411-025+SuperbHC+AMS	22floz+4floz+1.25%v/v+0.75lb	99	63	99	73
RUPM+ARY-0411-024+MSO+AMS	22floz+4floz+1.25%v/v+0.75lb	99	70	99	80
RUPM+ARY-0411-024+DestinyHC+AMS	22floz+4floz+1.25%v/v+0.75lb	99	74	99	84
RUPM+ARY-0411-024+NIS+AMS	22floz+4floz+0.5%v/v+0.75lb	88	37	88	57
RUPM+SelectMax+NIS+AMS	22floz+12floz+0.25%v/v+0.75lb	91	58	91	68
RUPM+Select+PO+AMS	22floz+6floz+1%v/v+0.75lb	99	30	99	68
LSD (0.05)		6	7	6	8

[1] RUPM= Roundup PowerMax (Glyphosate); ARY-0411-024 & ARY-0411-025 = clethodim formulations; PO= WCS crop oil

Clethodim and dicamba with various adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate corn and grass control. POST treatments were applied on July 15, 2014 at 9:30 am with 73 F air, 67 F soil at a four inch depth, 32% RH, 85% cloud cover, 6-8 mph N wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 14-15" (18-20/ft2) forage barley, 6-8" (10-12/ft^2) amaranth, 12" (18-20/ft^2) foxtail millet, and 14-16" (8-10/ft^2) roundup ready corn. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. Amaranth is a key indicator species because SelectMax has no activity and will only show Clarity activity.

Table. Clethodim and dicamba with various adjuvants. (Zollinger, Wirth, Adams).

		14 DAT				28 DAT			
Treatment[1]	Rate	Amar	Fomi	Foba	Corn	Amar	Fomi	Foba	Corn
	(Product/A)	----------% Control----------				----------% Control----------			
POST									
SelectMax+R-11	8floz+0.25%v/v	0	25	25	42	0	55	72	83
SelectMax+PO	8floz+2pt	0	37	37	50	0	67	82	90
SelectMax+DestinyHC	8floz+1pt	0	57	57	62	0	90	87	96
SelectMax+Clarity+R-11	8floz+10.6floz+0.25%v/v	43	30	32	42	47	50	52	52
SelectMax+Clarity+PO	8floz+10.6floz+2pt	43	30	30	35	53	47	50	42
SelectMax+Clarity+DestinyHC	8floz+10.6floz+1pt	62	45	55	50	73	65	75	70
SelectMax+Clarity+R-11 +AMS	8floz+10.6floz+0.25%v/v +9lb/100gal	33	38	38	58	50	60	50	73
SelectMax+Clarity+PO+AMS	8floz+10.6floz+2pt+9lb/100gal	43	43	43	72	58	68	53	83
SelectMax+Clarity+DestinyHC+AMS	8floz+10.6floz+1pt+9lb/100gal	73	68	68	92	73	78	78	95
SelectMax+Clarity+R-11 +K_2PO_4	8floz+10.6floz+0.25%v/v +1.5%v/v	37	37	37	35	47	50	47	38
SelectMax+Clarity+PO+K_2PO_4	8floz+10.6floz+2pt+1.5%v/v	55	45	45	45	75	55	67	65
SelectMax+Clarity+DestinyHC+K_2PO_4	8floz+10.6floz+1pt+1.5%v/v	60	63	64	72	73	72	73	75
SelectMax+Clarity+R-11 +AMADS	8floz+10.6floz+0.25%v/v +0.5%v/v	33	38	38	50	53	75	58	67
SelectMax+Clarity+R-11+Brimstone	8floz+10.6floz+0.25%v/v+1%v/v	42	40	43	57	52	75	63	67
SelectMax+Clarity+R-11+ClassActNG	8floz+10.6floz+0.25%v/v2.5%v/v	55	55	58	92	62	70	68	95
SelectMax+Clarity+R-11 +Transport	8floz+10.6floz+0.25%v/v +0.75%v/v	58	60	58	87	67	78	68	89
SelectMax+Clarity+R-11 +Request	8floz+10.6floz+0.25%v/v +0.5%v/v	35	33	33	53	45	63	73	67
SelectMax+Clarity+R-11+BroncTotal	8floz+10.6floz+0.25%v/v+1%v/v	40	40	40	47	60	75	78	86
LSD (0.05)		7	6	6	6	6	5	5	4

[1] PO=WCS crop oil

Weed control with glyphosate. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate corn and grass control. POST treatments were applied on July 15, 2014 at 9:30 am with 73 F air, 67 F soil at a four inch depth, 32% RH, 85% cloud cover, 6-8 mph N wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 15-18" (18-20/ft2) flax, 4-6" (10-12/ft^2) amaranth, 8-10" (3-4/ft^2) quinoa, and 15-18" (18-20/ft^2) conventional corn. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. Glyphosate formulation had a significant effect on efficacy across all species.

Table. Weed control with glyphosate. (Zollinger, Wirth, Adams).

		14 DAT				28 DAT			
Treatment[1]	Rate	Flax	Amar	Quin	Corn	Flax	Amar	Quin	Corn
	(Product/A)	----------% Control----------				----------% Control----------			
POST									
GlyStar 5 Extra	12.2floz	37	62	28	60	47	72	48	70
Gly Star 5Extra+Activator 90	12.2floz+0.25%v/v	33	63	27	80	55	90	45	83
GlyStar 5 Extra+Activator 90+AMS	12.2floz+0.25%v/v+8.5lb/100gal	73	93	55	93	83	95	65	95
Buccaneer 5	13.1floz	85	85	43	80	93	88	63	90
Buccaneer 5+Activator 90	13.1floz+0.25%v/v	57	87	38	62	77	90	48	63
Buccaneer 5+Activator 90+AMS	13.1floz+0.25%v/v+8.5lb/100gal	62	95	53	95	72	95	73	95
Roundup PowerMax	10.8floz	70	63	38	83	68	73	68	82
Roundup PowerMax+Activator 90	10.8floz+0.25%v/v	60	62	32	65	60	72	42	75
Roundup PowerMax+Activator 90+AMS	10.8floz+0.25%v/v+8.5lb/100gal	75	95	65	95	75	95	75	95
Helosate 5	12.2floz	37	55	25	72	48	78	55	82
Helosate 5+Activator 90	12.2floz+0.25%v/v	27	40	13	60	43	58	23	70
Helosate 5+Activator 90+AMS	12.2floz+0.25%v/v+8.5lb/100gal	63	92	27	93	83	95	57	95
Helosate 5B	12.2floz	40	75	18	72	50	85	45	82
Helosate 5B+Activator 90	12.2floz+0.25%v/v	32	48	13	50	42	72	23	70
Helosate 5B+Activator 90+AMS	12.2floz+0.25%v/v+8.5lb/100gal	58	92	20	83	82	95	60	93
Helosate 5+Activator 90	16.2floz+0.25%v/v	37	58	23	62	47	78	27	72
Helosate Plus	16.2floz	43	65	32	62	53	75	50	77
Helosate Plus+Activator 90+AMS	16.2floz+0.25%v/v+8.5lb/100gal	68	95	65	95	78	95	75	95
LSD (0.05)		7	9	7	10	7	7	6	8

Weed control with glyphosate and adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate corn and grass control. POST treatments were applied on July 16, 2014 at 9:30 am with 79 F air, 70 F soil at a four inch depth, 26% RH, 80% cloud cover, 0-2 mph S wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 9-12" (18-20/ft2) flax, 6-8" (10-12/ft^2) amaranth, 10-13" (2-4/ft^2) quinoa, and 9-13" (8-10/ft^2) tame buckwheat. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane.

Table. Weed control with glyphosate and adjuvants. (Zollinger, Wirth, Adams).

		14 DAT				28 DAT			
Treatment[1]	Rate	Flax	Amar	Quin	Tabu	Flax	Amar	Quin	Tabu
	(Product/A)	----------% Control----------				----------% Control----------			
POST									
TD HiTech+WCS Crop Oil	9.7floz+1pt	23	50	45	52	23	60	45	55
TD HiTech+Upland MSO	9.7floz+1pt	22	47	33	40	45	73	55	70
TD HiTech+SuperbHC	9.7floz+1pt	32	74	56	55	32	75	48	58
TD HiTech+DestinyHC	9.7floz+1pt	35	73	55	43	45	73	58	43
TD HiTech+Huntsman1	9.7floz+1pt	57	61	64	45	73	82	88	45
TD HiTech+Huntsman2	9.7floz+1pt	65	66	60	35	80	72	73	57
Sharpen+WCS Crop Oil	1floz+1pt	42	86	86	86	32	72	75	78
Sharpen+Upland MSO	1floz+1pt	43	92	90	86	47	92	90	86
Sharpen+SuperbHC	1floz+1pt	48	86	86	87	35	75	75	70
Sharpen+DestinyHC	1floz+1pt	62	97	97	92	52	75	75	82
Sharpen+Hunstman1	1floz+1pt	63	85	85	91	43	65	65	62
Sharpen+Huntsman2	1floz+1pt	48	90	90	89	52	70	70	82
TD HiTech+Sharpen+WCS Crop Oil	9.7floz+1floz+1pt	45	85	85	78	62	75	75	72
TD HiTech+Sharpen+Upland MSO	9.7floz+1floz+1pt	82	95	95	95	82	95	95	95
TD HiTech+Sharpen+SuperbHC	9.7floz+1floz+1pt	57	83	83	87	62	80	80	85
TD HiTech+Sharpen+DestinyHC	9.7floz+1floz+1pt	57	83	83	87	62	80	80	85
TD HiTech+Sharpen+Huntsman1	9.7floz+1floz+1pt	95	95	95	93	95	95	95	93
TD HiTech+Sharpen+Huntsman2	9.7floz+1floz+1pt	93	94	94	88	94	96	96	93
LSD (0.05)		6	5	6	6	5	4	4	5

Weed control with glyphosate plus Laudis and adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate corn and grass control. POST treatments were applied on July 17, 2014 at 9:00 am with 80 F air, 69 F soil at a four inch depth, 30% RH, 70% cloud cover, 2-4 mph SSW wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 8-10" (16-18/ft2) flax, 2-4" (4-6/ft^2) amaranth, 8-12" (10-15/ft^2) foxtail millet, and 4-6" (8-10/ft^2) roundup ready soybean. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. Flax is a key indicator species because Laudis has no activity and will show only glyphosate activity. Amaranth and foxtail millett are controlled by Laudis and Glyphosate. RR soybean is a key indicator species because glyphosate has no activity and will only show Laudis activity and adjuvants effects.

Table. Weed control with glyphosate plus Laudis and adjuvants. (Zollinger, Wirth, Adams).

		14 DAT				28 DAT			
Treatment[1]	Rate	Flax	Amar	Fomi	Soy	Flax	Amar	Fomi	Soy
	(Product/A)	----------% Control----------				----------% Control----------			
POST									
Laudis+WCS Crop Oil	1.5floz+1pt	0	23	17	18	0	23	17	18
Laudis+Upland MSO	1.5floz+1pt	0	37	28	37	0	57	38	47
Laudis+SuperbHC	1.5floz+1pt	0	30	25	28	0	30	25	28
Laudis+DestinyHC	1.5floz+1pt	0	38	37	42	0	63	62	85
Laudis+Huntsman1	1.5floz+1pt	0	30	27	22	0	45	40	32
Laudis+Huntsman2	1.5floz+1pt	0	23	30	28	0	43	50	48
TD HiTech+Laudis+WCS Crop Oil	9.7floz+1.5floz+1pt	30	87	93	28	30	88	93	38
TD HiTech+Laudis+Upland MSO	9.7floz+1.5floz+1pt	30	90	92	48	40	95	95	58
TD HiTech+Laudis+SuperbHC	9.7floz+1.5floz+1pt	30	85	92	40	30	87	92	43
TD HiTech+Laudis+DestinyHC	9.7floz+1.5floz+1pt	40	88	96	50	52	93	97	70
TD HiTech+Laudis+Hunstman1	9.7floz+1.5floz+1pt	45	88	92	20	45	90	92	20
TD HiTech+Laudis+Huntsman2	9.7floz+1.5floz+1pt	40	93	98	27	50	88	98	63
LSD (0.05)		5	7	11	9	4	6	8	8

Weed control with glyphosate, dicamba, and adjuvants. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate corn and grass control. POST treatments were applied on July 15, 2014 at 11:30 am with 73 F air, 67 F soil at a four inch depth, 32% RH, 85% cloud cover, 6-8 mph NW wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 8-10" (10-18/ft^2) flax, 4-6" (12-16/ft^2) amaranth, 18-20" (10/ft^2) sunflower, and 15-18" (8-10/ft^2) conventional corn. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. Hard water was used with a concentration of Ca and Mg of 1000 ppm. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. Flax and conventional corn are key indicator species because Clarity has no activity and will only show glyphosate injury and adjuvant effects. Generally, potassium phosphate enhanced herbicide activity and reduced hard water antagonism but did not completely overcome antagonism at the same level as AMS.

Table. Weed control with glyphosate, dicamba, and adjuvants. (Zollinger, Wirth, Adams).

			14 DAT				28 DAT			
Treatment[1]	Rate	Hard Water	Flax	Amar	Snfl	Corn	Flax	Amar	Snfl	Corn
	(Product/A)	(ppm)	----------% Control----------				----------% Control----------			
POST										
RUPM+Clarity+NIS +AMS	11floz+6floz+0.25%v/v +8.5lb/100gal	0	74	75	81	95	76	79	92	95
RUPM+Clarity+NIS +AMS	11floz+6floz+0.25%v/v +17lb/100gal	0	88	91	94	96	90	96	95	97
RUPM+Clarity+NIS+Mon10	11floz+6floz+0.25%v/v+1%v/v	0	67	78	70	85	67	77	70	87
RUPM+Clarity+NIS+Mon10	11floz+6floz+0.25%v/v+2%v/v	0	62	85	83	94	62	83	85	93
RUPM+Clarity+NIS +AMS	11floz+6floz+0.25%v/v +8.5lb/100gal	1000	81	93	90	94	92	94	90	96
RUPM+Clarity+NIS +AMS	11floz+6floz+0.25%v/v +17lb/100gal	1000	93	93	90	94	95	93	95	95
RUPM+Clarity+NIS+Mon10	11floz+6floz+0.25%v/v+1%v/v	1000	53	63	70	68	63	73	70	78
RUPM+Clarity+NIS+Mon10	11floz+6floz+0.25%v/v+2%v/v	1000	48	77	72	85	58	77	82	87
LSD (0.05)			8	6	6	9	6	5	4	6

[1]RUPM= Roundup powerMax; NIS= R-11

AMS and K_2PO_4 comparisions. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Hillsboro, ND to evaluate corn and grass control. POST treatments were applied on July 16, 2014 at 9:30 am with 79 F air, 70 F soil at a four inch depth, 26% RH, 80% cloud cover, 0-2 mph S wind, and adequate soil moisture. Weeds species present at the time of the POST treatments were: 12-14" (16-18/ft2) flax, 6" (12-16/ft^2) amaranth, 18-20" (10/ft^2) sunflower, and 18-19" (8-10/ft^2) conventional corn. Soil characteristics were: 51% sand, 36% silt, 13% clay, loam, 4.1% OM, and 7.7 pH. Treatments were applied to the center 6.7 feet of the 9 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through TT11001 nozzles for the POST applications. Hard water was used with a Ca and Mg concentration of 1000 ppm. The experiment had a randomized complete block design with three replicates per treatment.

The site had a heavy infestation of red root pigweed and common purslane. Flax and conventional corn are key indicator species because Clarity has minimal activity and will only show glyphosate activity and adjuvant effects. Generally, potassium phosphate enhanced herbicide activity and reduced hard water antagonism but did not completely overcome antagonism at the same level as AMS.

Table. AMS and K_2PO_4 comparisons . (Zollinger, Wirth, Adams).

Treatment[1]	Rate	Hard Water	14 DAT				28 DAT			
			Flax	Amar	Snfl	Corn	Flax	Amar	Snfl	Corn
	(Product/A)	(ppm)	---------% Control---------				---------% Control---------			
POST										
RUPM+Clarity+R-11	10.8floz+6.1floz+0.25%v/v	0	63	65	75	63	65	73	79	62
RUPM+Clarity+R-11	10.8floz+6.1floz+0.25%v/v	1000	42	58	52	25	45	62	62	35
RUPM+Clarity+R-11+AMS	10.8floz+6.1floz+0.25%v/v+3lb/100gal	1000	62	45	63	42	63	45	63	43
RUPM+Clarity+R-11+K_2PO_4	10.8floz+6.1floz+0.25%v/v+0.5%v/v	1000	33	63	63	47	37	63	67	50
RUPM+Clarity+R-11+AMS	10.8floz+6.1floz+0.25%v/v+6lb/100gal	1000	57	62	76	62	72	82	87	80
RUPM+Clarity+R-11+K_2PO_4	10.8floz+6.1floz+0.25%v/v+1%v/v	1000	38	68	73	53	62	75	79	60
RUPM+Clarity+R-11+AMS	10.8floz+6.1floz+0.25%v/v+9lb/100gal	1000	58	57	69	65	63	73	85	77
RUPM+Clarity+R-11+K_2PO_4	10.8floz+6.1floz+0.25%v/v+1.5%v/v	1000	52	90	78	63	72	69	83	68
RUPM+Clarity+R-11+AMS	10.8floz+6.1floz+0.25%v/v+12lb/100gal	1000	65	63	85	82	88	88	93	93
RUPM+Clarity+R-11+K_2PO_4	10.8floz+6.1floz+0.25%v/v+2%v/v	1000	53	69	78	86	72	75	82	88
RUPM+Clarity+R-11+AMS	10.8floz+6.1floz+0.25%v/v+15lb/100gal	1000	78	76	83	76	88	95	95	92
RUPM+Clarity+R-11+K_2PO_4	10.8floz+6.1floz+0.25%v/v+2.5%v/v	1000	62	70	85	75	72	82	86	79
RUPM+Clarity+R-11+CANG	10.8floz+6.1floz+0.25%v/v+2.5%v/v	1000	82	83	86	76	92	95	95	93
RUPM+Clarity+R-11+AMADS	10.8floz+6.1floz+0.25%v/v+0.5%v/v	1000	86	75	88	70	91	87	93	84
RUPM+Clarity+R-11+Brimstone	10.8floz+6.1floz+0.25%v/v+1%v/v	1000	62	67	83	62	80	83	92	78
RUPM+Clarity+R-11+Transport	10.8floz+6.1floz+0.25%v/v+0.5%v/v	1000	70	71	83	55	87	92	93	67
RUPM+Clarity+R-11+Bronc Max	10.8floz+6.1floz+0.25%v/v+1%v/v	1000	78	84	88	62	88	92	95	83
RUPM+Clarity+R-11+Request	10.8floz+6.1floz+0.25%v/v+0.5%v/v	1000	60	48	65	40	63	57	67	43
LSD (0.05)			5	8	6	7	6	7	6	7

[1] RUPM= Roundup PowerMax (Glyphosate); CANG=Class Act NG

AMS replacements for Dicamba plus Glyphosate. Howatt, Roach, and Harrington. 'Rahab 94' flax, buckwheat, amaranth, and quinoa was seeded near Fargo on June 4. Hard water achieved by adding 13.5 g calcium chloride dihydrate and 4.5 g magnesium hexahydrate per 3 gallons was used for the carrier in treatments 2 through 18, distilled water was the carrier for treatment 1. Treatments were applied to flowering buckwheat, 8 to 10 inch flax, 4 to 6 leaf Venice mallow, 4 to 8 leaf pigweed, and flowering mustard on July 9 with 63°F 40% relative humidity, clear sky, 6 to 8 mph wind at 350°, and dry soil at 66°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 feet plots. The experiment was a randomized complete block design with four replicates.

Table 1

Treatment	Rate	Yeft 7/23	FLAX 7/23	TABW 7/23	Wimu 7/23	Vema 7/23	Yeft 8/6
	oz ae/A	%	%	%	%	%	%
Glyt-K salt+Dica+NIS+Distilled	6+3+0.25%	99	97	97	98	74	99
Glyt-K salt+Dica+NIS	6+3+0.25%	97	94	87	91	52	99
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+4	99	96	92	93	64	99
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+8	98	97	92	92	66	99
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+12	99	96	91	94	69	99
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+16	99	98	96	97	75	99
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+20	99	99	98	98	77	99
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+0.5%	92	92	90	88	55	99
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+1%	98	93	90	91	61	99
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+1.5%	95	91	87	88	60	99
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+2%	99	97	93	91	70	99
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+2.5	99	97	96	95	70	99
Glyt-K salt+Dica+NIS+ClassActNG	6+3+0.25%+2.5%	99	97	93	96	65	99
Glyt-K salt+Dica+NIS+AMADS	6+3+0.25%+0.5%	99	98	96	96	71	99
Glyt-K salt+Dica+NIS+Brimestone	6+3+0.25%+1%	95	95	91	94	66	99
Glyt-K salt+Dica+NIS+Transport	6+3+0.25%+0.5%	99	95	93	92	61	99
Glyt-K salt+Dica+NIS+BroncTotal	6+3+0.25%+1%	99	96	93	97	66	99
Glyt-K salt+Dica+NIS+Request	6+3+0.25%+0.5%	98	95	90	90	64	99
CV		3	1	4	2	6	0
LSD (P=0.05)		4	2	5	4	6	0

Table 2

Treatment	Rate	FLAX 8/6	TABW 8/6	Wimu 8/6	Vema 8/6	Wibw 8/6
	oz ae/A	%	%	%	%	%
Glyt-K salt+Dica+NIS+Distilled	6+3+0.25%	98	97	98	86	84
Glyt-K salt+Dica+NIS	6+3+0.25%	94	90	96	69	74
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+4	96	96	99	79	76
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+8	98	97	98	90	89
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+12	98	96	98	89	92
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+16	98	97	99	92	92
Glyt-K salt+Dica+NIS+AMS	6+3+0.25%+20	99	98	99	88	95
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+0.5%	95	91	94	75	67
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+1%	97	94	96	72	77
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+1.5%	95	89	93	80	79
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+2%	96	96	95	81	83
Glyt-K salt+Dica+NIS+K_2P	6+3+0.25%+2.5	97	96	97	87	85
Glyt-K salt+Dica+NIS+ClassActNG	6+3+0.25%+2.5%	97	92	96	74	74
Glyt-K salt+Dica+NIS+AMADS	6+3+0.25%+0.5%	98	97	99	88	86
Glyt-K salt+Dica+NIS+Brimestone	6+3+0.25%+1%	95	96	96	79	77
Glyt-K salt+Dica+NIS+Transport	6+3+0.25%+0.5%	96	96	96	85	85
Glyt-K salt+Dica+NIS+BroncTotal	6+3+0.25%+1%	95	95	93	74	62
Glyt-K salt+Dica+NIS+Request	6+3+0.25%+0.5%	95	91	95	79	79
CV		1	2	2	4	5
LSD (P=0.05)		18 2	2	3	4	6

Dipotassium phosphate (K_2P) equivalency to AMS for Glyphosate. Howatt, Roach, and Harrington. 'Rahab 94' flax, buckwheat, amaranth, and quinoa was seeded near Fargo on June 4. A hard water carrier was used in treatments 2 through 12, 13.5g CaCl2-2H20 and 4.6 g mg Cl2-6H2O per 3 gallons were added to the water, and treatment 1 distilled water only. Treatments were applied July 15 with 74°F, 58% relative humidity, 50% cloud-cover, 3 to 9 mph wind at 355°, and dry 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 feet. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Yeft 7/28	Flax 7/28	Tabw 7/28	Cudo 7/28	Rrpw 7/28	Vema 7/28	Yeft 8/12	Broadleaf 8/12
	oz ae/A	%	%	%	%	%	%	%	%
Glyt 4.5+NIS+Distilled	6+0.25%	99	97	98	94	95	85	99	99
Glyt 4.5+NIS	6+0.25%	92	90	87	84	85	76	96	99
Glyt 4.5+NIS+AMS	6+0.25%+4	96	94	91	89	91	80	99	99
Glyt 4.5+NIS+AMS	6+0.25%+8	96	96	93	95	95	85	99	99
Glyt 4.5+NIS+AMS	6+0.25%+12	96	99	94	95	95	85	99	99
Glyt 4.5+NIS+AMS	6+0.25%+16	98	98	95	96	97	88	99	99
Glyt 4.5+NIS+AMS	6+0.25%+20	98	99	97	97	96	93	99	99
Glyt 4.5+NIS+K_2P	6+0.25%+0.5%	91	93	89	87	92	79	99	99
Glyt 4.5+NIS+K_2P	6+0.25%+1%	95	96	95	94	94	84	99	99
Glyt 4.5+NIS+K_2P	6+0.25%+1.5%	98	98	94	93	94	87	99	99
Glyt 4.5+NIS+K_2P	6+0.25%+2%	99	97	95	94	95	85	99	99
Glyt 4.5+NIS+K_2P	6+0.25%+2.5%	99	98	95	95	96	87	99	99
CV		1	1	1	2	1	2	1	0
LSD (P=0.05)		2	2	2	2	2	2	1	0

Ammonium sulfate and dipotassium phosphate conditioned water to overcome hard water antagonism of glyphosate. Control of each species indicated roughly similar water conditioning capability. Control was exceptional for the rate of glyphosate used, especially with the hardness of water used. Control increased for most species as rate of ammonium sulfate or dipotassium phosphate increased July 28.

Tip and application volume effects on Glyphosate 4.5 efficacy. Howatt, Roach, and Harrington. 'Rahab 94' flax, buckwheat, amaranth, and quinoa was seeded near Fargo on June 4. Treatments were applied to flowering wild mustard on July 15 with 75°F, 33% relative humidity, 20% cloud cover, 3 to 7 mph wind velocity at 360°, and dry soil. Treatments were applied with a sprayer mounted on a four wheel all-terrain vehicle delivering 10 or 15 gpa with various nozzle tips to a 7 foot wide area the length of 10 by 30 feet. Water for treatment 1 was distilled and treatments 2 through 14 had 13.5 g CaCl2-2H2O and 4.6 g MgCl2-6H2O added per 3 gallons water to create a hard water carrier. The experiment was a randomized complete block design with four replicates.

Table 1

Treatment	Rate	Tip	Vol	Yeft 7/21	Flax 7/21	Tabw 7/21	Wimu 7/21	Rrpw 7/1	Colq 7/21	Vema 7/21	Yeft 7/28	Flax 7/28	Tabw 7/28	Wimu 7/28
	oz ae/A		gpa	%	%	%	%	%	%	%	%	%	%	%
Glyt4.5+Distilled H2O	18	TJ60	10	90	85	90	90	85	80	80	99	99	98	98
Glyt4.5	18	TJ60	10	90	85	90	90	85	80	80	99	99	99	99
Glyt4.5+AMS	18+2%	XR	10	90	85	90	90	85	80	80	99	99	99	99
Glyt4.5+K_2P	18+2%	XR	10	90	85	90	90	85	80	80	99	98	98	98
Glyt4.5+AMS	18+2%	XR	15	90	85	90	90	85	80	80	97	99	98	99
Glyt4.5+K_2P	18+2%	XR	15	90	85	90	90	85	80	80	98	99	99	99
Glyt4.5+AMS	18+2%	TJ60	10	90	85	90	90	85	80	80	98	99	97	99
Glyt4.5+K_2P	18+2%	TJ60	10	90	85	90	90	85	80	80	98	99	97	99
Glyt4.5+AMS	18+2%	TJ60	15	90	85	90	90	85	80	80	99	99	99	99
Glyt4.5+K_2P	18+2%	TJ60	15	90	85	90	90	85	80	80	99	99	99	99
Glyt4.5+AMS	18+2%	TTI	10	90	85	90	90	85	80	80	98	99	97	97
Glyt4.5+K_2P	18+2%	TTI	10	90	85	90	90	85	80	80	99	98	97	97
Glyt4.5+AMS	18+2%	TTI	15	90	85	90	90	85	80	80	98	98	97	97
Glyt4.5+K_2P	18+2%	TTI	15	90	85	90	90	85	80	80	98	98	98	98
CV				0	0	0	0	0	0	0	1	1	1	1
LSD (P=0.05)				0	0	0	0	0	0	0	1	1	1	1

Table 2

Treatment	Rate	Tip	Vol	Rrpw 7/28	Colq 7/28	Vema 7/28	Yeft 8/12	Flax 8/12	Tabw 8/12	Wimu 8/12	Rrpw 8/12	Colq 8/12	Vema 8/12
	oz ae/A		gpa	%	%	%	%	%	%	%	%	%	%
Glyt4.5+Distilled H2O	18	TJ60	10	98	97	97	99	99	99	99	99	99	99
Glyt4.5	18	TJ60	10	99	99	99	99	99	99	99	99	99	99
Glyt4.5+AMS	18+2%	XR	10	96	96	95	99	99	99	99	99	99	99
Glyt4.5+K_2P	18+2%	XR	10	97	95	93	99	99	99	99	99	99	99
Glyt4.5+AMS	18+2%	XR	15	98	95	96	99	99	99	99	99	99	99
Glyt4.5+K_2P	18+2%	XR	15	98	97	96	99	99	99	99	99	99	99
Glyt4.5+AMS	18+2%	TJ60	10	98	97	95	99	99	99	99	99	99	99
Glyt4.5+K_2P	18+2%	TJ60	10	97	96	96	99	99	99	99	99	99	99
Glyt4.5+AMS	18+2%	TJ60	15	99	99	98	99	99	99	99	99	99	99
Glyt4.5+K_2P	18+2%	TJ60	15	99	99	96	99	99	99	99	99	99	99
Glyt4.5+AMS	18+2%	TTI	10	97	96	92	99	99	99	99	99	99	99
Glyt4.5+K_2P	18+2%	TTI	10	96	93	91	99	99	99	99	99	99	99
Glyt4.5+AMS	18+2%	TTI	15	96	94	89	99	99	99	99	99	99	99
Glyt4.5+K_2P	18+2%	TTI	15	97	96	93	99	99	99	99	99	99	99
CV				2	2	2	0	0	0	0	0	0	0
LSD (P=0.05)				2	3	3	0	0	0	0	0	0	0

Glyphosate alone provided excellent weed control. Spray volume, tip selection, and water conditioner did not adversely affect end of season weed control.

Nozzle comparison for dicamba plus glyphosate-4.5. Howatt, Roach, and Harrington. 'Rahab 94' flax, buckwheat, amaranth, and quinoa was seeded June 4. Treatments were applied to flowering mustard on July 15 with 74°F, 58% relative humidity, 50% cloud cover, 3 to 9 mph wind at 355°, and dry soil at 70°F. Treatments were applied with a sprayer mounted on a 4-wheel all-terrain vehicle delivering 10 gpa through 8004 nozzles. The experiment was a randomized complete block design with four replicates.

Table 1

Treatment	Rate	Nozzle	Yeft 7/21	Flax 7/21	Tabw 7/21	Rrpw 7/21	Wimu 7/21	Vema 7/21	Colq 7/21	Yeft 7/28
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TT	75	80	85	70	80	70	75	96
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	AIXR	75	80	85	70	80	70	75	95
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	AITTJ60	75	80	85	70	80	70	75	95
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TADF04-D	75	80	85	70	80	70	75	95
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	AI	75	80	85	70	80	70	75	95
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TXDL	75	80	85	70	80	70	75	95
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	ULD	75	80	85	70	80	70	75	94
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TTI	75	80	85	70	80	70	75	94
Dica-E+Glyt-4.5+NIS+Interlock	8+16+0.25%+4	TT	75	80	85	70	80	70	75	99
Dica-E+Glyt-4.5+NIS+Interlock	8+16+0.25%+4	TTI	75	80	85	70	80	70	75	95
Untreated Check	0		0	0	0	0	0	0	0	0
CV			0	0	0	0	0	0	0	1
LSD (P=0.05)			0	0	0	0	0	0	0	2

Table 2

Treatment	Rate	Nozzle	Flax 7/28	Tabw 7/28	Rrpw 7/28	Wimu 7/28	Vema 7/28	Colq 7/28	Yeft 8/12	Flax 8/12
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TT	97	99	96	99	86	94	98	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	AIXR	97	99	95	98	86	93	99	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	AITTJ60	97	99	94	99	85	93	98	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TADF04-D	96	98	92	98	82	91	96	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	AI	97	99	95	99	85	93	96	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TXDL	97	99	95	98	85	93	97	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	ULD	96	99	94	98	85	93	99	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TTI	97	99	94	99	86	93	99	99
Dica-E+Glyt-4.5+NIS+Interlock	8+16+0.25%+4	TT	99	99	99	99	95	98	99	99
Dica-E+Glyt-4.5+NIS+Interlock	8+16+0.25%+4	TTI	98	99	97	99	88	94	99	99
Untreated Check	0		0	0	0	0	0	0	0	0
CV			1	0	2	1	2	1	2	0
LSD (P=0.05)			1	0	3	1	3	2	3	0

Table 3

Treatment	Rate	Nozzle	Tabw 8/12	Rrpw 8/12	Wimu 8/12	Vema 8/12	Colq 8/12	Rrpw 8/12	Vema 8/12
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TT	99	99	99	99	99	95	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	AIXR	99	99	99	99	99	95	98
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	AITTJ60	99	99	99	99	99	86	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TADF04-D	99	99	99	99	99	87	99
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	AI	99	99	99	99	99	91	96
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TXDL	99	99	99	99	99	93	97
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	ULD	99	99	99	99	99	92	97
Dica-E+Glyt-4.5+NIS+Interlock	4+8+0.25%+4	TTI	99	99	99	99	99	90	99
Dica-E+Glyt-4.5+NIS+Interlock	8+16+0.25%+4	TT	99	99	99	99	99	97	98
Dica-E+Glyt-4.5+NIS+Interlock	8+16+0.25%+4	TTI	99	99	99	99	99	95	99
Untreated Check	0		0	0	0	0	0	0	0
CV			0	0	0	0	0	6	2
LSD (P=0.05)			0	0	0	0	0	8	2

Nozzle selection did not appreciably affect weed control with dicamba plus glyphosate.

Nozzle tip effect on herbicide efficacy. Howatt, Roach, and Harrington. 'Rahab 94' flax, buckwheat, amaranth, and quinoa was seeded near Fargo on June 4. Treatments were applied to 3 leaf foxtail, 4 to 6 leaf broadleaf weeds (Venice mallow) and flowering mustard on July 15 with 76°F, 53% relative humidity, 30% cloud-cover, 2 mph wind at 360°, and 2 to 6 mph wind at 360° and dry soil at 71°F. Treatments were applied with a sprayer mounted on a 4 wheel all-terrain vehicle delivering 17 gpa at 40 psi through various nozzles to a seven foot wide area the length of 10 by 30 feet. The experiment was a randomized complete block design with four replicates.

Table 1

Treatment	Rate	Noz.	Yeft 7/21	Flax 7/21	Tabw 7/21	Wimu 7/21	Vema 7/21	Rrpw 7/21	Colq 7/21	Yeft 8/12	Flax 8/12
	oz ai/A		%	%	%	%	%	%	%	%	%
Gluf+AMS	8.5+24	TT	85	93	95	93	90	90	90	93	99
Gluf+AMS	8.5+24	TTI	85	93	95	93	90	90	90	90	99
Gluf	8.5	TT	85	93	95	93	90	90	90	92	99
Gluf	8.5	TTI	85	93	95	93	90	90	90	89	99
Gluf+2,4-DA4+AMS	8.5+7.6+24	TT	85	93	95	93	90	90	90	95	99
Gluf+2,4-DA4+AMS	8.5+7.6+24	TTI	85	93	95	93	90	90	90	89	99
Gluf+2,4-DA4	8.5+7.6	TT	85	93	95	93	90	90	90	93	99
Gluf+2,4-DA4	8.5+7.6	TTI	85	93	95	93	90	90	90	87	99
Gluf+Dica+AMS	8.5+4+24	TT	85	93	95	93	90	90	90	95	99
Gluf+Dica+AMS	8.5+4+24	TTI	85	93	95	93	90	90	90	90	99
Gluf+Dica	8.5+4	TT	85	93	95	93	90	90	90	92	99
Gluf+Dica	8.5+4	TTI	85	93	95	93	90	90	90	90	99
Gluf+ClethSM+AMS	8.5+0.75+24	TT	85	93	95	93	90	90	90	94	99
Gluf+ClethSM+AMS	8.5+0.75+24	TTI	85	93	95	93	90	90	90	88	99
Gluf+ClethSM	8.5+0.75	TT	85	93	95	93	90	90	90	94	99
Gluf+ClethSM	8.5+0.75	TTI	85	93	95	93	90	90	90	84	99
Gluf+ClethSM+2,4-DA4+AMS	8.5+0.75+7.6+24	TT	85	93	95	93	90	90	90	92	99
Gluf+ClethSM+2,4-DA4+AMS	8.5+0.75+7.6+24	TTI	85	93	95	93	90	90	90	90	99
Gluf+ClethSM+2,4-DA4	8.5+0.75+7.6	TT	85	93	95	93	90	90	90	92	99
Gluf+ClethSM+2,4-DA4	8.5+0.75+7.6	TTI	85	93	95	93	90	90	90	90	99
Gluf+ClethSM+Dica+AMS	8.5+0.75+4+24	TT	85	93	95	93	90	90	90	93	99
Gluf+ClethSM+Dica+AMS	8.5+0.75+4+24	TTI	85	93	95	93	90	90	90	90	99
Gluf+ClethSM+Dica	8.5+0.75+4	TT	85	93	95	93	90	90	90	93	99
Gluf+ClethSM+Dica	8.5+0.75+4	TTI	85	93	95	93	90	90	90	88	99
Untreated Check	0		0	0	0	0	0	0	0	0	0
CV			0	0	0	0	0	0	0	3	0
LSD (P=0.05)			0	0	0	0	0	0	0	4	0

Initial weed control was similar across all treatments. Control of broadleaf weeds present at application was 99% across treatments by August 12. Yellow foxtail control on this date varied slightly by treatment. Inclusion of clethodim did not improve foxtail control. Inclusion of AMS did not affect weed control, but larger droplets produced by the turbo teejet induction (TTI) nozzle provided slightly less control of foxtail than the turbo teejet (TT) nozzle across herbicide treatments.

A new cohort of pigweed, lambsquarters, and mallow were present on August 12. Treatments that included 2,4-D gave 65 to 95% control of these species. Dicamba provided better than

90% control of all three species. Both herbicides tended to provide better control of each species when applied with TT nozzle tips compared with TTI tips.

Table 2

Treatment	Rate	Noz.	Tabw 8/12	Wimu 8/12	Vema 8/12	Rrpw 8/12	Colq 8/12	Rrpw NEW 8/12	Colq NEW 8/12	Vema NEW 8/12
	oz ai/A		%	%	%	%	%	%	%	%
Gluf+AMS	8.5+24	TT	99	99	99	99	99	0	0	0
Gluf+AMS	8.5+24	TTI	99	99	99	99	99	0	0	0
Gluf	8.5	TT	99	99	99	99	99	0	0	0
Gluf	8.5	TTI	99	99	99	99	99	0	0	0
Gluf+2,4-DA4+AMS	8.5+7.6+24	TT	99	99	99	99	99	75	93	94
Gluf+2,4-DA4+AMS	8.5+7.6+24	TTI	99	99	99	99	99	75	85	80
Gluf+2,4-DA4	8.5+7.6	TT	99	99	99	99	99	74	87	85
Gluf+2,4-DA4	8.5+7.6	TTI	99	99	99	99	99	69	88	82
Gluf+Dica+AMS	8.5+4+24	TT	99	99	99	99	99	94	97	98
Gluf+Dica+AMS	8.5+4+24	TTI	99	99	99	99	99	89	96	95
Gluf+Dica	8.5+4	TT	99	99	99	99	99	94	97	95
Gluf+Dica	8.5+4	TTI	99	99	99	99	99	91	95	90
Gluf+ClethSM+AMS	8.5+0.75+24	TT	99	99	99	99	99	0	0	0
Gluf+ClethSM+AMS	8.5+0.75+24	TTI	99	99	99	99	99	0	0	0
Gluf+ClethSM	8.5+0.75	TT	99	99	99	99	99	0	0	0
Gluf+ClethSM	8.5+0.75	TTI	99	99	99	99	99	0	0	0
Gluf+ClethSM+2,4-DA4+AMS	8.5+0.75+7.6+24	TT	99	99	99	99	99	80	97	94
Gluf+ClethSM+2,4-DA4+AMS	8.5+0.75+7.6+24	TTI	99	99	99	99	99	65	74	69
Gluf+ClethSM+2,4-DA4	8.5+0.75+7.6	TT	99	99	99	99	99	81	95	94
Gluf+ClethSM+2,4-DA4	8.5+0.75+7.6	TTI	99	99	99	99	99	71	76	83
Gluf+ClethSM+Dica+AMS	8.5+0.75+4+24	TT	99	99	99	99	99	94	99	96
Gluf+ClethSM+Dica+AMS	8.5+0.75+4+24	TTI	99	99	99	99	99	91	96	98
Gluf+ClethSM+Dica	8.5+0.75+4	TT	99	99	99	99	99	95	98	97
Gluf+ClethSM+Dica	8.5+0.75+4	TTI	99	99	99	99	99	90	94	91
Untreated Check	0		0	0	0	0	0	0	0	0
CV			0	0	0	0	0	6	5	4
LSD (P=0.05)			0	0	0	0	0	5	4	4

Droplet size with paraquat, glufosinate and bromoxynil. Howatt, Roach, and Harrington. 'Rahab 94' flax, buckwheat, amaranth, and quinoa was seeded near Fargo on June 4. Treatments were applied to flowering mustard, 4 to 6 leaf pigweed and Venice mallow and foxtail on July 9 with 76°F, 33% relative humidity, clear sky, 5 to 10 mph wind velocity at 350°, and dry soil. Treatments were applied with a sprayer mounted on a four wheel all-terrain vehicle delivering 17 gpa with various size droplets to a 7 foot wide area the length of 10 by 30 feet. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Drop size	Yeft 7/23	Flax 7/23	Tabw 7/23	Wimu 7/23	Amar 7/23	Colq 7/23	Vema 7/23
	oz ai/A		%	%	%	%	%	%	%
Paraquat+NIS	6+0.25%	F	85	85	97	70	65	40	40
Paraquat+NIS	6+0.25%	M	85	85	97	70	65	40	40
Paraquat+NIS	6+0.25%	VC	85	85	97	70	65	40	40
Paraquat+NIS	6+0.25%	XC	85	85	97	70	65	40	40
Paraquat+NIS	6+0.25%	UC	85	85	97	70	65	40	40
Gluf+AMS	6.4+24	F	90	99	99	97	93	90	80
Gluf+AMS	6.4+24	M	90	99	99	97	93	90	80
Gluf+AMS	6.4+24	VC	90	99	99	97	93	90	80
Gluf+AMS	6.4+24	XC	90	99	99	97	93	90	80
Gluf+AMS	6.4+24	UC	90	99	99	97	93	90	80
Brox&Pyst&Thcz	2.9	F	50	30	85	97	85	85	80
Brox&Pyst&Thcz	2.9	M	50	30	85	97	85	85	80
Brox&Pyst&Thcz	2.9	VC	50	30	85	97	85	85	80
Brox&Pyst&Thcz	2.9	XC	50	30	85	97	85	85	80
Brox&Pyst&Thcz	2.9	UC	50	30	85	97	85	85	80
CV			0	0	0	0	0	0	0
LSD (P=0.05)			0	0	0	0	0	0	0

Control of each species was very consistent within herbicide. Herbicide efficacy was not affected by droplet size. An evaluation on August 6 indicated similar consistency among droplet size treatments within herbicide.

Droplet size with 2,4-D. Howatt, Roach, and Harrington. 'Rahab 94' flax, buckwheat, amaranth, and quinoa was seeded near Fargo on June 4. Treatments were applied July 15 with 82°F, 34% relative humidity, 20% cloud-cover, 3 to 7 mph wind at 350°, and dry soil. Treatments were applied with a sprayer mounted on a 4 wheel all-terrain vehicle delivering 17 gpa. The experiment was a randomized complete block design.

Treatment	Rate	Droplet size	Flax 7/28	Tabw 7/28	Rrpw 7/28	Vema 7/28
	oz ae/A		%	%	%	%
2,4-D amine 4	8	F	70	87	85	65
2,4-D amine 4	8	M	70	87	85	65
2,4-D amine 4	8	VC	70	87	85	65
2,4-D amine 4	8	XC	70	87	85	65
2,4-D amine 4	8	UC	70	87	85	65
2,4-D acid	8	F	70	87	85	65
2,4-D acid	8	M	70	87	85	65
2,4-D acid	8	VC	70	87	85	65
2,4-D acid	8	XC	70	87	85	65
2,4-D acid	8	UC	70	87	85	65
2,4-D E99	8	F	70	87	85	65
2,4-D E99	8	M	70	87	85	65
2,4-D E99	8	VC	70	87	85	65
2,4-D E99	8	XC	70	87	85	65
2,4-D E99	8	UC	70	87	85	65
CV			0	0	0	0
LSD (P=0.05)			0	0	0	0

Species control with 2,4-D was not affected by droplet size in this study. Control of species did not vary by formulation of 2,4-D either. Another evaluation on August 12 produced similar results.

Droplet size with fenoxaprop, pinoxaden, and pyroxsulam. Howatt, Roach, and Harrington. 'Asgrow AG0333' soybean was seeded near Fargo on June 6. Treatments were applied to 4 to 6 leaf pigweed and Venice mallow, 5 leaf foxtail, 2 to 4 inch tall smartweed, and flowering mustard on July 9 with 76°F, 30% relative humidity, clear sky, 3 to 7 mph wind at 360°, and dry soil. Treatments were applied with a sprayer mounted on a 4 wheel all-terrain vehicle delivering 17 gpa with various droplet sizes to a 7 foot wide area the length of 10 by 30 feet. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Droplet size	Yeft 7/23	VSoy 7/23	Vema 7/23	Wimu 7/23	Rrpw 7/23
	oz ai/A		%	%	%	%	%
Fenx+Brox&MCPA	0.8+8	F	60	40	60	90	65
Fenx+Brox&MCPA	0.8+8	M	60	40	60	90	65
Fenx+Brox&MCPA	0.8+8	VC	60	40	60	90	65
Fenx+Brox&MCPA	0.8+8	XC	60	40	60	90	65
Fenx+Brox&MCPA	0.8+8	UC	60	40	60	90	65
Pinoxaden+Brox&MCPA	0.86+8	F	87	30	60	90	60
Pinoxaden+Brox&MCPA	0.86+8	M	87	30	60	90	60
Pinoxaden+Brox&MCPA	0.86+8	VC	87	30	60	90	60
Pinoxaden+Brox&MCPA	0.86+8	XC	87	30	60	90	60
Pinoxaden+Brox&MCPA	0.86+8	UC	87	30	60	90	60
Pxlm&Flas&Flox+NIS	1.68+0.25%	F	60	90	80	87	85
Pxlm&Flas&Flox+NIS	1.68+0.25%	M	60	90	80	87	85
Pxlm&Flas&Flox+NIS	1.68+0.25%	VC	60	90	80	87	85
Pxlm&Flas&Flox+NIS	1.68+0.25%	XC	60	90	80	87	85
Pxlm&Flas&Flox+NIS	1.68+0.25%	UC	60	90	80	87	85
CV			0	0	0	0	0
LSD (P=.05)			0	0	0	0	0

Control of each species was very consistent within herbicide. Herbicide efficacy was not affected by droplet size. An evaluation on August 6 indicated similar consistency among droplet size treatments within herbicide.