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Wheat response to glyphosate drift during two-leaf growth stage. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16. Treatments were applied to 3 leaf wheat on June 12 with 65°F, 68% relative humidity, 100% cloud-cover, 2 to 3 mph at 22°, and moist soil at 64°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa a 35 psi through TT11001 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	6/28 Wht	7/10 Wht	8/20 Yield
	oz/A	%	%	bu/A
Glyt4.5+NIS+AMS	1+0.25%+12	95	98	0
Glyt4.5+NIS+AMS	0.75+0.25%+12	91	95	0
Glyt4.5+NIS+AMS	0.5+0.25%+12	88	89	1
Glyt4.5+NIS+AMS	0.35+0.25%+12	84	88	2
Glyt4.5+NIS+AMS	0.25+0.25%+12	73	73	10
Glyt4.5+NIS+AMS	0.1+0.25%+12	5	2	48
Glyt4.5+NIS+AMS	0.05+0.25%+12	2	0	44
Glyt4.5+NIS+AMS	0.01+0.25%+12	0	0	52
Untreated Check	0	0	0	52
CV		5	5	27
LSD 5%		3	4	9

Glyphosate at 0.75 oz/A, 4 to 6% of a field rate, killed nearly all wheat vegetation. Even one-third that much provided 73% injury to wheat and resulted in nearly 80% yield loss. Visible injury was barely perceivable with glyphosate at 0.05 to 0.1 oz/A, 2 to 5% injury. Injury manifested as slight stunting but chlorosis was not apparent. Glyphosate at these rates, less than 1% of a field use rate, still caused about 15% yield loss. Although this was not statistically significant, the numerical difference and strength of the trend in yield loss with such low glyphosate rates warrants concern and refined investigation to the non-identified loss potential at field margins bordering glyphosate-resistant crops.

Wheat response to glyphosate drift during four-leaf growth stage. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16. Treatments were applied to 4 leaf wheat on June 17 with 70°F, 64% relative humidity, 20% cloud-cover, 6 to 8 mph wind at 315°, and dry soil at 65°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/2 Wht	7/15 Wht	8/20 Yield
	oz/A	%	%	bu/A
Glyt4.5+NIS+AMS	1+0.25%+12	98	99	0
Glyt4.5+NIS+AMS	0.75+0.25%+12	93	99	0
Glyt4.5+NIS+AMS	0.5+0.25%+12	88	95	0
Glyt4.5+NIS+AMS	0.35+0.25%+12	80	86	4
Glyt4.5+NIS+AMS	0.25+0.25%+12	68	71	10
Glyt4.5+NIS+AMS	0.1+0.25%+12	14	10	33
Glyt4.5+NIS+AMS	0.05+0.25%+12	2	1	46
Glyt4.5+NIS+AMS	0.01+0.25%+12	0	0	46
Untreated Check	0	0	0	51
CV		8	3	33
LSD 5%		6	3	10

Glyphosate at 0.5 oz/A, 2 to 4% of a field rate, killed nearly all wheat vegetation. Even one-half that much provided 71% injury to wheat and resulted in nearly 80% yield loss. Glyphosate at 0.1 oz/A produced about 10% wheat injury but resulted in 35% yield loss. Visible response of wheat to glyphosate at 0.05 oz/A was barely perceivable, 2% injury. Injury manifested as slight stunting but chlorosis was not apparent. Glyphosate at this rate or 0.01 oz/A, which did not elicit noticeable wheat response, resulted in 46 bu/A compared with 51 bu/A in the untreated. Although this was not statistically significant, the numerical difference and strength of the trend in yield loss with such low glyphosate rates warrants concern and refined investigation to the non-identified loss potential at field margins bordering glyphosate-resistant crops.

Wheat response to glyphosate drift during flag/boot stage. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16. Treatments were applied to flag to boot stage wheat on July 1 with 67°F, 76% relative humidity, clear sky, 1 o 4 mph wind at 45°, and moist soil at 69°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/15 Wht	7/29 WHT	8/21 Yield
	oz/A	%	%	bu/A
Glyt4.5+NIS+AMS	1+0.25%+12	98	99	0
Glyt4.5+NIS+AMS	0.75+0.25%+12	97	99	1
Glyt4.5+NIS+AMS	0.5+0.25%+12	92	99	3
Glyt4.5+NIS+AMS	0.35+0.25%+12	83	96	3
Glyt4.5+NIS+AMS	0.25+0.25%+12	60	74	14
Glyt4.5+NIS+AMS	0.1+0.25%+12	55	59	30
Glyt4.5+NIS+AMS	0.05+0.25%+12	0	0	48
Glyt4.5+NIS+AMS	0.01+0.25%+12	0	0	49
Untreated Check	0	0	0	51
CV		22	21	25
LSD 5%		17	17	8

Glyphosate at 0.35 oz/A, 2 to 3% of a field rate, killed nearly all wheat vegetation. Even 0.25 oz/A provided 74% injury to wheat and resulted in more than 70% yield loss. Glyphosate at 0.1 oz/A produced nearly 60% wheat injury and resulted in almost 40% yield loss. Visible response of wheat to glyphosate at 0.05 oz/A or less was not observed. Glyphosate at this rate or less resulted in wheat yield that was similar although numerically less than the untreated wheat. The effect of glyphosate at very low rate seemed to have less effect on wheat nearing anthesis than when exposure was earlier in plant development as was demonstrated in other studies. Even so glyphosate at less than 1% of field use rate substantially reduced wheat yield in this study by nearly 40%.

Fungicide interaction with pyroxsulam to injure wheat. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 at Fargo. Treatments were applied to 4 leaf wheat on June 17 with 70°F, 64% relative humidity, 60% cloud-cover, 6 to 10 mph wind at 315°, and dry soil at 65°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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.

Table 1. Response of wheat vegetation to mixtures of pyroxsulam and fungicides.

Treatment	Rate	6/19 Chlor	6/28 Chlor	6/28 Stunt	7/2 Stunt	7/15 Stunt	7/29 Stunt
	oz/A	%	%	%	%	%	%
Pxlm&Flas&Flox+NIS+AMS	1.67+0.5%+48	4	2	5	3	3	4
Pxlm&Flas&Flox+2,4-DeLV+AMS	1.67+6+48	5	5	10	6	3	4
2,4-DeLV	6	4	2	5	0	0	1
GF 242	1.82	1	0	0	0	1	0
Pxlm&Flas&Flox+GF 242+AMS	1.67+1.82+48	4	1	6	2	3	3
Pxlm&Flas&Flox+2,4-DeLV+GF 242+AMS	1.67+6+1.82+48	5	3	8	5	3	5
2,4-DeLV+GF 242+AMS	6+1.82+48	2	2	3	1	0	0
Pyraclostrobin	2.37	1	0	2	0	0	2
Pxlm&Flas&Flox+Pyrac+AMS	1.67+2.37+48	4	2	5	3	2	4
Pxlm&Flas&Flox+2,4-DeLV+Pyrac+AMS	1.67+6+2.37+48	5	2	7	3	2	2
2,4-DeLV+Pyraclostrobin+AMS	6+2.37+48	2	1	3	2	0	1
Propicon&Trifloxy	2.61	1	2	4	0	0	1
Pxlm&Flas&Flox+Propicon&Trifloxy+AMS	1.67+2.61+48	4	4	8	6	5	7
Pxlm&Flas&Flox+2,4-DeLV+Propico&Trifloxy+AMS	1.67+6+2.61+48	4	4	8	5	3	5
2,4-DeLV+Propicon&Trifloxy+AMS	6+2.61+48	2	2	5	1	2	2
Pxlm&Flas&Flox+2,4-eLV+Pyrac+NIS+AMS	1.67+6+2.37+0.5%+48	6	2	5	4	1	2
Untreated Check	0	0	0	0	0	0	1
CV		44	106	43	88	131	68
LSD 5%		2	3	3	3	3	2

Nearly all treatments resulted in minor injury of 5% or less chlorosis shortly after application (Table 1). Chlorosis was temporary and not observed after 10 days but stunting became evident and could be observed on wheat in several treatments throughout the season. The most severe stunting late in the season was estimated at 7% with pyroxsulam and florasulam and fluroxypyr plus propiconazole and trifloxystrobin plus AMS. Development of the head including emergence of awns and beginning of anthesis was not delayed by any of the treatments (Table 2). Treatment differences were present for grain moisture, test weight, and adjusted yield, but treatments did not often cause deficiency in more than one of these categories. The treatment that caused the most stunting late into the season resulted in wheat with higher grain moisture and lower adjusted yield than other treatments, but test weight was high at 61 lb/bu. The treatment with the worst grain measurements did not include a fungicide. Pyroxsulam and florasulam and fluroxypyr plus 2,4-D plus GF 242 plus AMS resulted in wheat grain that was higher moisture, lower test weight and lower adjusted yield than other treatments.

Table 2. Response of wheat grain development to mixtures of pyroxsulam and fungicides.

Treatment	Rate	7/9 Heading delay	8/19 Grain moisture	8/19 Test weight	8/19 Yield
	oz/A	days	%	lb/bu	bu/A
Pxlm&Flas&Flox+NIS+AMS	1.67+0.5%+48	4	15	60	62
Pxlm&Flas&Flox+2,4-DeLV+AMS	1.67+6+48	4	14	60	66
2,4-DeLV	6	1	13	61	61
GF 242	1.82	0	14	60	65
Pxlm&Flas&Flox+GF 242+AMS	1.67+1.82+48	3	14	61	61
Pxlm&Flas&Flox+2,4-DeLV+GF 242+AMS	1.67+6+1.82+48	5	15	59	58
2,4-DeLV+GF 242+AMS	6+1.82+48	0	13	61	66
Pyraclostrobin	2.37	2	14	59	64
Pxlm&Flas&Flox+Pyrac+AMS	1.67+2.37+48	4	14	59	60
Pxlm&Flas&Flox+2,4-DeLV+Pyrac+AMS	1.67+6+2.37+48	2	14	61	66
2,4-DeLV+Pyraclostrobin+AMS	6+2.37+48	1	14	61	62
Propicon&Trifloxy	2.61	1	14	60	62
Pxlm&Flas&Flox+Propicon&Trifloxy+AMS	1.67+2.61+48	7	15	61	57
Pxlm&Flas&Flox+2,4-DeLV+Propico&Trifloxy+AMS	1.67+6+2.61+48	5	15	61	67
2,4-DeLV+Propicon&Trifloxy+AMS	6+2.61+48	2	14	61	60
Pxlm&Flas&Flox+2,4-eLV+Pyrac+NIS+AMS	1.67+6+2.37+0.5%+48	2	14	61	63
Untreated Check	0	1	14	60	56
CV		68	8	2	8
LSD 5%		2	1	2	7

Fungicide interaction with herbicides. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 near Fargo. Treatments were applied to 5 leaf wheat on June 18 with 64°F, 66% relative humidity, clear sky, 5 mph at 135°, and dry soil at 64°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/19 Chlor	7/2 Stunt	7/15 Head del	7/15 Stunt	7/29 Stunt	8/19 Yield
	oz/A	%	%	days	%	%	bu/A
Pxlm&Flas&Flox+NIS+AMS	1.68+0.25%+48	2	0	0	1	1	54
Pxlm&Flas&Flox+Propiconazole+NIS+AMS	1.68+1.8+0.25%+48	2	2	0	1	1	56
Pxlm&Flas&Flox+Pyraclostrobin+NIS+AMS	1.68+2.34+0.25%+48	4	1	0	1	1	59
Pxlm&Flas&Flox+Pyrac&Metcon+NIS+AMS	1.68+1.97+0.25%+48	3	0	0	1	1	66
Brox&Pyst&Thcz	3	2	2	0	1	2	65
Brox&Pyst&Thcz+Propiconazole	3+1.8	4	1	0	0	2	63
Brox&Pyst&Thcz+Pyraclostrobin	3+2.34	2	2	0	2	2	63
Brox&Pyst&Thcz+Pyrac&Metcon	3+1.97	4	1	0	1	2	67
Fenx&Brox&Pyst	3.9	2	0	0	0	1	61
Fenx&Brox&Pyst+Propiconazole	3.9+1.8	2	1	0	2	2	61
Fenx&Brox&Pyst+Pyraclostrobin	3.9+2.34	4	1	0	0	1	59
Fenx&Brox&Pyst+Pyrac&Metcon	3.9+1.97	4	1	0	0	1	57
Pxdn+Brox&MCPA5	0.86+8	1	0	0	1	2	58
Pxdn+Brox&MCPA5+Propiconazole	0.86+8+1.8	2	1	0	1	1	52
Pxdn+Brox&MCPA5+Pyraclostrobin	0.86+8+2.34	2	1	0	1	2	52
Pxdn+Brox&MCPA5+Pyrac&Metcon	0.86+8+1.97	3	1	0	0	1	63
Propiconazole	1.8	0	0	0	0	0	59
Pyraclostrobin	2.34	1	1	0	0	0	62
Pyraclostrobin&Metconazole	1.97	1	0	0	0	1	49
CV		66	192	0	29	159	11
LSD 5%		3	2	0	2	2	9

Initial wheat response was observed as chlorosis on several treatments, but the response was not consistent enough across the four replicates for most treatments to be different from untreated areas along the plot borders. Chlorosis was not noticed after the first evaluation, but slight stunting was noticed occasionally. The stunting was not consistent across reps or from one evaluation to the next. Wheat response to treatments was very mild. The only treatment that had consistent stunting response across evaluations was bromoxynil and pyrasulfotole and thiencarbazone plus pyraclostrobin, but stunting was only 2% and yield was not affected compared with the thiencarbazone premix.

Evaluation of Panoflex tank mixes for burndown prior to spring wheat. (Jenks, Walter, and Willoughby). The objective of this study was to evaluate Panoflex for weed control prior to planting spring wheat. Panoflex is a new premix containing a 4:1 ratio of tribenuron:thifensulfuron. This ratio is opposite that of Affinity TankMix. All treatments were applied June 6 when most weeds were 1-4 inches tall and less than 2 per sq ft. All treatments provided good to excellent control of lambsquarters and horseweed; however, Glyphosate and Metribuzin (85-86%) provided slightly less lambsquarters control compared to the other treatments (88-99%). As expected, Panoflex did not control Group 2-resistant kochia, while treatments containing glyphosate did control kochia. All treatments provided excellent flixweed control except for Metribuzin, which provided poor flixweed control.

Table. Evaluation of Panoflex tank mixes for burndown prior to spring wheat. (1313)

		Weed Control							
		Lambsquarters		Horseweed		Kochia		Flixweed	
Treatments[abc]	Rate	Jun-27	Aug-3	Jun-27	Aug-3	Jun-27	Aug-3	Jun-27	Aug-3
		%							
Tri + Thi + NIS	0.12 oz + 0.03 oz + 0.25%	100	99	96	87	30	23	100	100
Tri + Thi + Gly	0.12 oz + 0.03 oz + 22 oz	100	94	100	95	100	95	100	100
Tri + Thi + NIS	0.24 oz + 0.06 oz + 0.25%	100	98	100	97	40	35	100	100
Tri + Thi + Metri + NIS	0.24 oz + 0.06 oz + 4 oz + 0.25%	100	94	100	98	50	50	100	100
Tri + Thi + Gly	0.24 oz + 0.06 oz + 22 oz	100	88	100	97	100	94	100	100
Tri + NIS	0.15 oz + 0.25%	100	96	100	90	33	33	100	100
Tri + Met + NIS	0.15 oz + 0.02 oz + 0.25%	100	98	100	100	45	43	100	100
Tri + Met + Gly	0.15 oz + 0.02 oz + 22 oz	100	97	100	100	100	94	100	100
Tri + Met + Metri	0.15 oz + 0.02 oz + 4 oz	94	95	100	100	65	55	100	100
Gly	22 oz	98	86	100	97	100	99	100	100
Metri + NIS	4 oz + 0.25%	93	85	100	100	35	35	10	10
Sharpen + Gly + MSO	1 oz + 22 oz + 1%	100	92	100	100	100	99	100	100
Untreated		0	0	0	0	0	0	0	0
LSD (0.05)		4.5	10.3	3.3	12.3	13.8	16.4	4.9	4.9
CV		2.7	6.1	2.1	8.1	12.9	16.2	3.4	3.4

[a] *All treatments applied with AMS (5.88%)*

[b] *Tri=Tribenuron; Thi=Thifensulfuron; Gly=Roundup PowerMax; Met=Metsulfuron; Metri=Metribuzin*

[c] *All treatments applied June 6 (no crop - prevent plant)*

Burndown with residual for control of volunteer canola. Howatt, Roach, and Harrington. The trial was established in Casselton on May 16. Treatments were applied to cotyledon canola on May 16 with 76°F, 40% relative humidity, 90% cloud-cover, 7 mph wind at 45°, and dry soil at 58°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/1 Yeft	7/1 Rrpw	7/1 Wibw	7/1 Wimu	7/1 Vema
	oz/A	%	%	%	%	%
Trib-sg+Thif-sg+NIS+AMS	0.12+0.03+0.25%+32	10	28	0	23	38
Trib-sg+Thif-sg+Glyt-4.5+AMS	0.12+0.03+12+32	0	20	0	35	38
Trib-sg+Thif-sg+NIS+AMS	0.24+0.06+0.25%+32	30	59	33	83	76
Trib-sg+Thif-sg+Metr+NIS+AMS	0.24+0.06+4+0.25%+32	68	92	83	91	91
Trib-sg+Thif-sg+Glyt-4.5+AMS	0.24+0.06+12+32	5	38	70	91	76
Trib-sg+NIS+AMS	0.15+0.25%+32	0	38	35	88	43
Trib-sg+Mets+NIS+AMS	0.15+0.02+0.25%+32	60	95	94	94	92
Trib-sg+Mets+Glyt-4.5+AMS	0.15+0.02+12+32	66	91	90	96	90
Trib-sg+Mets+Metr+AMS	0.15+0.02+4+32	83	97	97	97	95
Glyt-4.5+AMS	12+32	0	13	0	10	13
Metr+NIS+AMS	4+0.25%+32	86	93	60	95	91
Saff+Glyt-4.5+MSO+AMS	0.36+12+1%+32	8	0	0	10	40
Saff+Glyt-4.5+MSO+AMS	1.08+12+1%+32	0	30	5	43	30
Flcz+Glyt-4.5+NIS+AMS	0.21+12+0.25%+32	43	63	8	33	28
Untreated Check	0	0	0	0	0	0
CV		36	25	23	18	15
LSD 5%		15	18	13	16	12

Table continued.

Treatment	Rate	7/11 Rrpw	7/11 Wibw	7/11 Wimu	7/11 Vema
	oz/A	%	%	%	%
Trib-sg+Thif-sg+NIS+AMS	0.12+0.03+0.25%+32	20	0	28	23
Trib-sg+Thif-sg+Glyt-4.5+AMS	0.12+0.03+12+32	5	5	43	35
Trib-sg+Thif-sg+NIS+AMS	0.24+0.06+0.25%+32	18	10	79	65
Trib-sg+Thif-sg+Metr+NIS+AMS	0.24+0.06+4+0.25%+32	71	58	91	83
Trib-sg+Thif-sg+Glyt-4.5+AMS	0.24+0.06+12+32	0	50	91	49
Trib-sg+NIS+AMS	0.15+0.25%+32	10	5	85	48
Trib-sg+Mets+NIS+AMS	0.15+0.02+0.25%+32	88	88	96	88
Trib-sg+Mets+Glyt-4.5+AMS	0.15+0.02+12+32	90	90	96	86
Trib-sg+Mets+Metr+AMS	0.15+0.02+4+32	97	97	98	93
Glyt-4.5+AMS	12+32	0	0	0	0
Metr+NIS+AMS	4+0.25%+32	79	76	95	84
Saff+Glyt-4.5+MSO+AMS	0.36+12+1%+32	0	0	0	0
Saff+Glyt-4.5+MSO+AMS	1.08+12+1%+32	0	5	50	38
Flcz+Glyt-4.5+NIS+AMS	0.21+12+0.25%+32	50	5	33	18
Untreated Check	0	0	0	0	0
CV		18	22	9	15
LSD 5%		9	10	8	10

There were not any weeds emerged in the study on June 17. Inclusion of metribuzin or metsulfuron in the treatment improved and stabilized control across species for both evaluations. Residual benefit of saflufenacil or flucarbazone generally was similar to thifensulfuron and tribenuron in this study.

Recrop interval after metsulfuron application near Fargo. Howatt, Roach, and Harrington. The trial was established June 7 near Fargo. Treatments were applied to cotyledon redroot pigweed and common lambsquarters and 2 leaf common ragweed on June 7 with 70°F, 52% relative humidity, 6 mph wind at 180°, and dry soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. Seeding dates in 2014 will be early April (Trt 1 through 3) and June (Trt 4 through 6) to achieve 10 and 12 month interval before seeding. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Corw 6/25	Rrpw 6/25	Colq 6/25	Corw 7/3	Rrpw 7/3	Colq 7/3
	oz/A	%	%	%	%	%	%
Mets+Trib-sg+NIS	0.02+0.15+0.25%	60	99	99	48	99	99
Mets+Trib-sg+NIS	0.04+0.30+0.25%	63	99	99	58	99	99
Mets+Trib-sg+NIS	0.06+0.45+0.25%	58	99	98	50	99	98
Mets+Trib-sg+NIS	0.02+0.15+0.25%	60	99	99	60	99	99
Mets+Trib-sg+NIS	0.04+0.30+0.25%	55	99	99	48	99	99
Mets+Trib-sg+NIS	0.06+0.45+0.25%	63	99	98	65	99	99
Untreated Check	0	0	0	0	0	0	0
CV		17	0	1	24	0	1
LSD 5%		13	0	1	17	0	1

All herbicide treatments provided complete control of redroot pigweed and common lambsquarters without new establishment. Common ragweed expressed chlorosis and stunting but plants did not become necrotic. Evidence of ALS-resistant common ragweed has been observed in the region. This biotype may have moved into the research location. Growing points of ragweed plants remained chlorotic with very little height change from June 25 to July 3, but plants were not expressing necrosis. No other weeds were emerging in the study area. The study area was oversprayed with glyphosate and mowed to reduce ragweed seed production.

Recrop interval after metsulfuron application near Valley City. Howatt, Roach, and Harrington. The trial was established at Valley City, North Dakota on June 7. Treatments were applied to 2 leaf volunteer soybean and wild buckwheat, 1 to 2 inch erect knotweed, and 3 to 4 inch diameter common dandelion on June 7 with 60°F, 58% relative humidity, 20% cloud-cover, 6 mph wind at 225°, and dry soil at 58°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. Seeding dates in 2014 will be early April (Trt 1 through 3) and June (Trt 4 through 6) to achieve 10 and 12 month interval before seeding. The experiment was a randomized complete block design with three replicates.

Treatment	Rate	6/20 Vsoy	6/20 Wibw	6/20 Knotweed	6/20 Dali	7/9 Vsoy	7/9 Wibw	7/9 Knotweed	7/9 Dali
	oz/A	%	%	%	%	%	%	%	%
Mets+Trib-sg+NIS	0.02+0.15+0.25%	10	58	73	70	27	50	73	88
Mets+Trib-sg+NIS	0.04+0.30+0.25%	28	63	78	70	78	87	91	94
Mets+Trib-sg+NIS	0.06+0.45+0.25%	37	72	83	70	85	95	93	97
Mets+Trib-sg+NIS	0.02+0.15+0.25%	17	50	75	70	33	43	67	90
Mets+Trib-sg+NIS	0.04+0.30+0.25%	27	62	82	70	62	72	78	88
Mets+Trib-sg+NIS	0.06+0.45+0.25%	33	67	87	70	92	94	96	97
Untreated Check	0	0	0	0	0	0	0	0	0
Reps		3	3	3	3	3	3	3	3
CV		22	14	9	0	17	18	12	4
LSD 5%		9	13	11	0	16	16	10	3

Increased herbicide rate resulted in better weed control, although dandelion was slow to produced separated symptom evaluations. In general, herbicides did not provide the level of control expected and the study area was oversprayed twice with glyphosate after July 9 to remove plant biomass in preparation for seeding in 2014.

Foxtail control in spring wheat with Zidua. (Jenks, Walter, and Willoughby). The objective of the study was to evaluate wheat tolerance and foxtail control with Zidua applied preemergence (PRE) vs. postemergence (POST) compared to other herbicides applied POST. PRE treatments were applied May 16 after spring wheat had been seeded earlier in the day. It should be noted that the study was conducted with no tillage and the ground had about 85-90% residue cover from a previous wheat crop. Zidua and Prowl H2O were applied at the 1-1.5 leaf stage on May 29. Axial XL was applied on June 18 at the 4-leaf stage. None of the treatments caused more than 10% crop injury. Zidua applied PRE provided only poor to fair foxtail control with all rates tested. Zidua and Prowl applied POST provided as much foxtail control (71-73%) as the highest PRE rate (69%). However, the standard POST treatment of Axial XL provided significantly better foxtail control (93%). None of the treatments provided acceptable wild buckwheat control.

Table. Foxtail control in spring wheat with Zidua. (1310)

			Injury			Weed Control			
			HRSW			Yellow foxtail			Wibw[a]
Treatment	Rate	Timing	Jun-22	Jul-3	Jul-18	Jun-22	Jul-3	Jul-18	Jun-22
			----------%----------			----------%----------			-----%-----
Untreated			0	0	0	0	0	0	0
Zidua	1 oz	PRE	2	0	0	38	40	43	13
Zidua	1.34 oz	PRE	5	0	0	47	50	48	23
Zidua	1.68 oz	PRE	5	1	1	52	52	48	42
Zidua	2.01 oz	PRE	8	6	3	64	65	61	45
Zidua	3 oz	PRE	10	8	3	78	76	69	58
BAS 820AAH	2.5 oz	PRE	0	2	0	50	53	51	10
Zidua[b]	1.34 oz	1-leaf	1	1	0	82	77	71	43
Prowl H20	2.25 pt	1-leaf	4	4	0	82	78	73	57
Axial XL	16.3 oz	4-leaf	3	2	0	63	93	93	0
LSD (0.05)			NS	3.5	2.0	16.5	13.9	15.0	11.8
CV			100.0	87.3	156.6	17.3	13.9	15.7	23.5

[a] *Wibw=Wild buckwheat*

[b] *Applied with NIS (0.25%) and 28% N (2%)*

Foxtail barley control with Pre-Pare and Everest 2.0. (Jenks, Walter, and Willoughby). The objective of the study was to evaluate preplant and postemergence herbicides for foxtail barley control. Preplant treatments were applied May 17 to 3- to 5-inch foxtail barley (3 per ft^2). Spring wheat was seeded May 29. Postemergence treatments were applied June 18 to 4-leaf wheat. All preplant treatments (except one) were applied with glyphosate at 11 fl oz. Preplant treatments provided only suppression of foxtail barley. We received over 4 inches of rain within three days after the preplant application, which may have affected residual control. Only two postemergence treatments provided at least fair foxtail barley control. Everest applied POST at 1 oz either alone or tank mixed with tribenuron+thifensulfuron (1:1) provided 67 to 73% control of foxtail barley.

Table. Foxtail barley control with Pre-Pare and Everest 2.0. (1301)

			Injury		Weed Control				
			HRSW		Foxtail barley				
Treatment[ab]	Rate	Timing[c]	Jun-19	Jul-3	Jun-7	Jun-19	Jul-3	Jul-18	Aug-1
			------%------		----------%----------				
Untreated			0	0	0	0	0	0	0
Pre-Pare + NIS	0.3 oz + 0.25%	PP	4	0	27	10	10	3	3
Gly	11 oz	PP	0	0	85	71	45	42	35
Gly + Pre-Pare	11 oz + 0.3 oz	PP	6	0	83	71	45	42	37
Gly + Olympus	11 oz + 0.2 oz	PP	11	0	89	85	62	55	45
Gly + Pre-Pare/ Everest 2.0 + BB	11 oz + 0.3 oz / 0.5 oz + 1%	PP/POST	8	0	85	70	68	60	57
Gly / Everest 2.0 + BB	11 oz / 1 oz + 1%	PP/POST	0	0	84	71	69	66	67
Gly / Everest 2.0 + ARY547 + BB	11 oz / 1 oz+ 0.4 oz + 1%	PP/POST	0	0	85	70	74	69	73
Gly / GoldSky + BB	11 oz / 1 pt + 1%	PP/POST	0	0	84	71	65	52	52
Gly / Huskie Complete	11 oz / 13.7 oz	PP/POST	0	0	85	69	72	62	63
LSD (0.05)			0.1	NS	2.2	5.2	4.8	11.0	10.0
CV			23.2	0.0	1.8	5.2	5.5	14.2	13.5

[a] *Gly=Glyphosate; BB=Basic Blend (Quad 7); ARY547=Triben:Thifen 1:1; PP=Preplant*

[b] *All treatments applied with AMS (2.94%)*

[c] *POST applied at 4-leaf wheat*

Pre-emergence propoxycarbazone for brome grass control in winter wheat. Howatt, Roach, and Harrington. Jerry winter wheat was seeded September 13, 2012 near Valley City. Preemergence treatments were applied to emerging to 2 leaf wheat, but downy brome was not present, on September 28, 2012 with 59° F, 29% relative humidity, 5% cloud cover, 3 mph wind at 250°, and dry soil at 54° F. Spring treatments were applied to 3 to 4 leaf downy brome on June 1 with 68°F, 58% relative humidity, 6 mph wind at 180°, and moist soil at 58°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Grow Stg	6/20 dobr	7/9 dobr
	oz/A		%	%
Glyphosate+AMS	9+23	Pre	0	0
Glyphosate+ AMS/Prcz+NIS	9+23/0.63+0.25%	Pre/Spring	75	68
Glyphosate+Prcz+AMS	9+0.42+23	Pre	93	93
Glyt+Prcz+AMS/Mess+NIS	9+0.42+23/0.144+0.25%	Pre/Spring	92	92
Glyt+Prcz+AMS/Mess+MSO	9+0.42+23/0.21+0.16G	Pre/Spring	92	92
Glyt+ AMS/Prcz&Mess+MSO	9+23/0.2+0.16G	Pre/Spring	58	63
Glyt+Prcz+AMS/Prcz&Mess+MSO	9+0.42+23/0.2+0.16G	Pre/Spring	96	95
Glyt+Flcz 2.0+AMS/Flcz 2.0+NIS	9+0.21+23/0.21+0.5%	Pre/Spring	65	73
CV			5	5
LSD 5%			7	6

Treatments that included Propoxycarbazone PRE to downy brome emergence provided at least 92% control of downy brome. When propoxycarbazone was included POST, even at greater rate, control was less than 70% at the end of the season. Propoxycarbazone was more effective than flucarbazone as a PRE herbicide. Propoxycarbazone PRE followed by mesosulfuron in the spring gave 92% control of downy brome even though mesosulfuron as a POST only treatment has given less control than flucarbazone in previous study.

Downy brome control with Pre-emergent treatments in winter wheat. Howatt, Roach, and Harrington. Jerry Winter wheat was seeded in Valley City, North Dakota on September 13, 2012. Treatments were applied to 1 to 2 inch wheat, but downy brome was not present, on September 28, 2012 with 59° F, 29% relative humidity, 10% cloud-cover, 4 mph wind at 240°, and dry soil at 54°F. Pyroxsulam at 0.25 oz/A plus MSO at 20 oz/A was over-sprayed on the study in spring. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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.

		6/20
Treatment	Rate	Dobr
	oz/A	%
Saflufenacil	0.72	52
Saflufenacil	1.44	82
Pyroxasulfone	1.6	96
Pyroxasulfone	2.5	96
Sulfentrazone	2	33
Flumioxazin	1	13
Flucarbazone	0.21	33
Propoxycarbazone	0.42	92
Untreated Check	0	0
CV		18
LSD 5%		16

Pyroxasulfone PRE followed by pyroxsulam provided 96% control of downy brome. Propoxycarbazone as the PRE herbicide also was effective resulting in 92% control of brome. Observations at many locations indicate that winter and/or spring emergence of winter annual brome species precludes a single application in the fall when these bromes are young and susceptible to ALS-inhibiting herbicides. Therefore, fall followed by spring treatments may be necessary, and this work demonstrates that products with pyroxasulfone or propoxycarbazone are effective as PRE herbicides for control of downy brome.

Preemergence treatments for weed control in wheat. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 15 near Fargo. Treatments were applied May 16 with 77°F, 30% relative humidity, clear sky, 7 mph wind at 90°, and dry soil at 50°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block with four replicates, of which two reps were not greatly affected by flooding.

Treatment	Rate	6/19 Wht	6/19 Vema	6/19 Rrpw	6/19 Yeft
	oz/A	%			
Saflufenacil	0.72	5	40	55	45
Saflufenacil	1.08	8	80	68	60
Pyroxasulfone	1.4	23	85	99	95
Pyroxasulfone	2.1	68	93	99	95
Pyroxasulfone	2.8	60	97	99	97
Sulfentrazone	2	23	75	93	50
Sulfentrazone	3	33	80	93	55
Flumioxazin	1	28	88	85	80
Flumioxazin	1.5	40	96	99	93
Flumioxazin&Pyroxasulfone	2.3	58	96	99	96
Flucarbazone	0.21	8	38	99	83
Untreated Check	0	0	0	0	0
CV		36	21	5	10
LSD 5%		23	33	9	15

Saturated soil enhanced herbicide availability and injury to wheat. Saflufenacil or flucarbazone were substantially safer to wheat than other herbicides with injury of 8% or less. Pyroxasulfone caused as much as 68% wheat injury but provided 93% control of Venice mallow. Flumioxazin also provided about 90% control of Venice mallow with other herbicides giving 80% or less control. Pyroxasulfone or flucarbazone provided 99% control of redroot pigweed, and pyroxasulfone also gave 95% or better control of yellow foxtail.

Preemergence treatments for weed control in wheat. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 24 near Prosper, North Dakota. Treatments were applied on May 24 with 66°F, 40% relative humidity, 90% cloud-cover, 18 mph wind at 135°, and moist soil at 52°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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.

Table 1. Early season wheat injury and weed control.

Treatment	Rate	6/13 Wht	6/18 Wht	6/18 Yeft	6/18 Rrpw	6/18 Colq
	oz/A	%	%	%	%	%
Saflufenacil	0.72	0	0	71	90	85
Saflufenacil	1.08	0	0	80	92	90
Pyroxasulfone	1.4	0	0	89	96	90
Pyroxasulfone	2.1	0	0	89	96	91
Pyroxasulfone	2.8	0	0	94	93	92
Sulfentrazone	2	0	0	74	96	98
Sulfentrazone	3	0	0	80	99	99
Flumioxazin	1	0	0	86	99	98
Flumioxazin	1.5	0	0	91	99	99
Flum&Pyroxasulfone	2.3	0	0	94	99	99
Flucarbazone	0.21	0	0	70	97	60
Untreated Check	0	0	0	0	0	0
Reps		4	4	4	3	3
CV		0	0	6	2	6
LSD		0	0	7	4	4

Wheat injury was not observed (Yable 1). Treatments with pyroxasulfone or flumioxazin provided the best yellow foxtail control with maximum values of 94% on June 18. Pyroxasulfone tended to maintain this control through July 8 better than flumioxazin (Table 2). Many treatments gave excellent control of redroot pigweed, but saflufenacil gave less control than other herbicides (Tables 1 and 2). Sulfentrazone or flumioxazin provided the best control of common lambsquarters, at least 97%. Flucarbazone only gave 60% control of labsquarters on June 18 (Table 1), but activity could not be discerned from the untreated on July 8 (Table 2). Sulfentrazone and flumioxazin provided the best broadleaf weed control, allowing only 2 plants or fewer per square m at the end of the season, but pyroxasulfone was more effective against yellow foxtail.

Table 2. Late season weed control and wheat yield.

Treatment	Rate	7/8 Yeft	7/8 Rrpw	7/8 Colq	Broadleaf plants	Broadleaf dry wt	Yield 8/27
	oz/A	%	%	%	no./m^2	g	bu/A
Saflufenacil	0.72	45	74	64	26	2.3	34
Saflufenacil	1.08	64	91	80	42	2.6	36
Pyroxasulfone	1.4	82	92	72	21	4.2	42
Pyroxasulfone	2.1	86	94	81	19	3.1	37
Pyroxasulfone	2.8	87	97	85	5	2.6	38
Sulfentrazone	2	35	99	98	1	1.4	36
Sulfentrazone	3	60	99	98	2	1.3	35
Flumioxazin	1	65	97	97	2	2.6	34
Flumioxazin	1.5	76	99	99	1	1.9	38
Flum&Pyroxasulfone	2.3	89	99	99	0	0.0	34
Flucarbazone	0.21	25	93	0	35	3.3	41
Untreated Check	0	0	0	0	40	3.9	38
Reps		4	3	3	3	3	4
CV		11	6	8	114	60	16
LSD		13	5	7	27	2.4	8

PRE treatments for kochia in wheat at Barney. Howatt, Roach, Harrington. Prosper hard red spring wheat was seeded May 10 in Barney, North Dakota. Treatments were applied pre-emergence on May 15 with 72°F, 39% relative humidity, 30% cloud-cover, 10 mph wind at 270°, and dry soil at 52°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/5 Wht	6/5 Koch	6/26 Wht	6/26 Koch	8/12 Koch	8/12 Rrpw	8/12 Colq	Koch pop.	Koch dry wt.	8/12 Wht
	oz/A	%	%	%	%	%	%	%	no./m^2	g	bu/A
Saflufenacil	0.72	3	9	1	5	56	40	45	122.8	3.2	52
Saflufenacil	1.08	3	50	0	59	83	88	81	66.8	1.5	59
Pyroxasulfone	1.4	3	74	2	90	83	96	86	40.5	1.2	56
Pyroxasulfone	2.1	1	59	0	88	85	97	91	51.5	1.7	60
Pyroxasulfone	2.8	1	74	1	92	90	98	86	56.8	1.5	57
Sulfentrazone	2	36	95	12	99	99	99	99	10.8	0.1	59
Sulfentrazone	3	50	95	15	99	99	99	99	2.3	0.1	51
Flumioxazin	1	4	88	0	96	93	98	96	13.0	0.4	63
Flumioxazin	1.5	4	93	0	98	97	99	99	8.0	0.2	61
Flum&Pyroxasulfone	2.3	5	94	5	98	99	99	98	5.5	0.2	61
Flucarbazone	0.21	3	25	2	64	53	98	48	70.5	2.4	60
Untreated Check	0	0	0	0	0	0	0	0	48.0	1.1	54
CV		36	12	74	15	8	12	17	80	96	9
LSD 5%		4	11	3	16	9	15	19	48	1.5	7

Sulfentrazone caused substantial injury that persisted through the end of June to a lesser extent. The injury manifested as chlorosis and necrosis mainly on the first two leaves. Necrotic leaf tissue shattered from the plant but new tissue starting with the third leaf was relatively unaffected. Visible wheat injury was not observed in August and wheat grain yield with 2 oz/A sulfentrazone (1x rate for this soil type) was similar to other treatments.

Sulfentrazone or flumioxazin provided exceptional control of kochia, 93 to 99%. These herbicides allowed fewer plants to establish through the season than saflufenacil, pyroxasulfone, or flucarbazone and plants were smaller. The midseason flush of kochia was accompanied by redroot pigweed and common lambsquarters. All herbicides except saflufenacil provided at least 96% control of pigweed. Sulfentrazone or flumioxazin provided better than 95% control of lambsquarters.

Broadleaf herbicide comparison in wheat for kochia control. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 10 at Barney, North Dakota. Treatments were applied to 3 leaf wheat and 1 inch Kochia on May 29 with 65°F, 78% relative humidity, 95% cloud-cover, and 9 mph wind at 135°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/26 Kocz	7/12 Kocz
	oz/A	%	%
Pxdn+Flox+MCPA	0.86+2+6	99	99
Pxdn+Flox&Dicamba	0.86+1.75	99	99
Pxdn+Flox&Dicamba	0.86+2.6	99	99
Pxdn+Clopyralid&Flox+Thif	0.86+3+0.15	99	99
Pxdn+Carfentrazone+Flox	0.86+0.128+1	98	99
Pxdn+Carf+Flox	0.86+0.128+2	99	99
Pxdn+Carf&2,4-D+NIS	0.86+4.1+0.25%	96	99
Pxdn+Brox&MCPA5	0.86+8	98	99
Pxdn+Brox&Flox	0.86+5	99	99
Pxdn+Brox&Flox	0.86+7.5	99	99
Pxdn+Brox&2,4-D	0.86+10	97	98
Pxdn+Brox&Pyrasulfotole	0.86+3	96	99
Pxdn+Brox&Pyrasulfotole	0.86+3.78	99	99
Pxdn (as untreated)	0.86	0	0
CV		2	1
LSD 5%		2	1

Pinoxaden caused slight chlorosis that was observed a couple days after application. But wheat injury was not observed at the first evaluation. All treatments provided more than 95% control of kochia. Carfentrazone and 2,4-D or the low field rate of bromoxynil and pyrasulfotole took longer to reach maximum efficacy than other treatments, but all treatments provided quick and complete control of small kochia.

Control of kochia suspected of glyphosate and fluroxypyr resistance in wheat. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 28 near Montpeliar, North Dakota. Treatments were applied to 4 to 5 leaf wheat and 2 to 5 inch kochia on June 28 with 72°F, 57% relative humidity, 10 mph wind at 315°, and dry soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/9 Wht	7/9 Kocz	7/16 Kocz	7/30 Kocz
	oz/A	%	%	%	%
Pxdn+Flox+MCPA	0.86+2+6	0	78	80	93
Pxdn+Flox&Dicamba	0.86+1.75	0	76	92	97
Pxdn+Flox&Dicamba	0.86+2.6	0	83	95	99
Pxdn+Clopyralid&Flox+Thif	0.86+3+0.15	0	75	83	91
Pxdn+Carfentrazone+Flox	0.86+0.128+1	0	91	94	96
Pxdn+Carf+Flox	0.86+0.128+2	0	92	96	98
Pxdn+Carf&2,4-D+NIS	0.86+4.1+0.25%	0	90	85	89
Pxdn+Brox&MCPA5	0.86+8	0	63	74	86
Pxdn+Brox&Flox	0.86+5	0	86	81	90
Pxdn+Brox&Flox	0.86+7.5	0	96	98	96
Pxdn+Brox&2,4-D	0.86+10	0	74	79	86
Pxdn+Brox&Pyrasulfotole	0.86+3	0	96	97	98
Pxdn+Brox&Pyrasulfotole	0.86+3.78	0	94	99	99
Pxdn (as untreated)	0.86	0	0	0	0
CV		0	5	4	3
LSD 5%		0	5	5	4

Herbicides did not cause visible wheat injury. Treatments gave better control in the field than in previous greenhouse experiments. Although as in the greenhouse, fluroxypyr and dicamba gave better control of kochia than a higher rate of fluroxypyr with MCPA. Treatments that included carfentrazone or pyrasulfotole provided more rapid control, 90 to 96% on July 9, than other treatments. Eventually, kochia control reached a minimum of 86% on July 30, and even fluroxypyr and MCPA, which was not expected to work well on a location with previous kochia survival after fluroxypyr, provided 93% control. Fluroxypyr and dicamba, carfentrazone and fluroxypyr, bromoxynil and fluroxypyr, or bromoxynil and pyrasulfotole provided near complete control of kochia, especially at the higher of use rates.

Broadleaf herbicide comparison in wheat. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 13 at Fargo. Treatments were applied to 4 leaf wheat; 2 to 4 leaf wild mustard, common ragweed, and wild buckwheat; and 1 leaf Venice mallow on June 11 with 75°F, 58% relative humidity, 60% cloud-cover, 2 mph wind at 0°, and moist soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa a 35 psi through TT11001 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 with the exception of common ragweed that had 3 replicates evaluated.

Treatment	Rate	6/25 Wht	6/25 Wimu	6/25 Wibw	6/25 Vema	6/25 Corw
	oz/A	%	%	%	%	%
Pxdn+Flox+MCPA	0.86+2+6	0	97	88	90	92
Pxdn+Flox&Dicamba	0.86+1.75	0	95	85	85	88
Pxdn+Flox&Dicamba	0.86+2.6	0	95	90	89	93
Pxdn+Clopyralid&Flox+Thif	0.86+3+0.15	0	97	92	92	94
Pxdn+Carfentrazone+Flox	0.86+0.128+1	0	98	96	93	95
Pxdn+Carf+Flox	0.86+0.128+2	0	97	94	91	93
Pxdn+Carf&2,4-D+NIS	0.86+4.1+0.25%	0	98	88	91	92
Pxdn+Brox&MCPA5	0.86+8	0	97	89	84	88
Pxdn+Brox&Flox	0.86+5	0	96	92	91	89
Pxdn+Brox&Flox	0.86+7.5	0	99	92	94	93
Pxdn+Brox&2,4-D	0.86+10	0	99	93	94	97
Pxdn+Brox&Pyrasulfotole	0.86+3	0	99	99	97	95
Pxdn+Brox&Pyrasulfotole	0.86+3.78	0	99	99	96	98
Pxdn (as untreated)	0.86	0	0	0	0	0
Reps		4	4	4	4	3
CV		0	2	6	4	4
LSD 5%		0	3	7	5	6

Table continued.

Treatment	Rate	7/10 Wimu	7/10 Wibw	7/10 Vema	7/10 Corw
Pxdn+Flox+MCPA	0.86+2+6	99	90	91	93
Pxdn+Flox&Dicamba	0.86+1.75	99	92	89	98
Pxdn+Flox&Dicamba	0.86+2.6	99	96	93	99
Pxdn+Clopyralid&Flox+Thif	0.86+3+0.15	99	98	97	99
Pxdn+Carfentrazone+Flox	0.86+0.128+1	99	97	91	94
Pxdn+Carf+Flox	0.86+0.128+2	99	89	91	96
Pxdn+Carf&2,4-D+NIS	0.86+4.1+0.25%	99	90	91	96
Pxdn+Brox&MCPA5	0.86+8	99	89	86	91
Pxdn+Brox&Flox	0.86+5	99	86	86	90
Pxdn+Brox&Flox	0.86+7.5	99	94	93	96
Pxdn+Brox&2,4-D	0.86+10	99	95	90	99
Pxdn+Brox&Pyrasulfotole	0.86+3	96	79	88	77
Pxdn+Brox&Pyrasulfotole	0.86+3.78	99	99	95	99
Pxdn (as untreated)	0.86	0	0	0	0
Reps		4	4	4	3
CV		1	4	4	4
LSD 5%		1	5	5	7

Wild buckwheat and common ragweed recovered from the low rate of bromoxynil and pyrasulfotole.

Broadleaf herbicide comparison in wheat at Langdon. Lubenow, Howatt, and Harrington. 'Faller' hard red spring wheat was seeded as drill strips at the LREC on May 29th. Treatments were applied to 5-7 leaf wheat on June 26th with 76°F, 74% relative humidity, mostly cloudy skies with a few sprinkles, 14 mph wind at 280°, and moist soil at 72°F. Broad leaf weeds were approximately 2 to 3 inches tall. Grass weeds were 1 to 3 leaf in size. Treatments were applied with a tractor sprayer with a 9 foot boom at 3 mph with Teejets 8001.5 DG, 40 lbs psi and 15 gallons of water/acre. Plots were 10 ft by 20 ft. The experiment was a randomized complete block design with four replicates. Wheat was harvested for grain yield on September 5th.

		7/18	7/18	7/18	7/18	7/18	Wheat	
Treatment	Rate	Wht	Wimu	Wibw	Colq	Rrpw	TW	Yield
	oz/A	%	%	%	%	%	lb/bu	bu/A
Pxdn+Flox+MCPA	0.86+2+6	0	97	87	92	88	59.7	63
Pxdn+Flox&Dica	0.86+1.75	0	95	84	98	97	60.0	62
Pxdn+Flox&Dica	0.86+2.6	0	96	94	96	99	60.6	64
Pxdn+Clpy&Flox+Thif-sg	0.86+3+0.15	0	97	98	99	99	60.3	70
Pxdn+Carf+Flox	0.86+0.128+1	0	60	66	69	48	60.0	63
Pxdn+Carf+Flox	0.86+0.128+2	0	55	51	48	49	60.2	68
Pxdn+Carf&2,4-D+NIS	0.86+4.1+0.25%	0	82	64	80	97	59.9	64
Pxdn+Brox&MCPA5	0.86+8	0	49	48	45	94	59.5	71
Pxdn+Brox&Flox	0.86+5	0	79	79	82	89	59.8	56
Pxdn+Brox&Flox	0.86+7.5	0	44	42	33	48	59.9	60
Pxdn+Brox&2,4-D	0.86+10	0	98	97	97	94	59.4	68
Pxdn+Brox&Pyst	0.86+3	0	0	0	0	0	59.8	48
Pxdn+Brox&Pyst	0.86+3.78	0	33	25	20	35	59.8	60
Pxdn (as untreated)	0.86	0	0	0	0	0	60.3	50
CV		0	46	48	47	48	0.8	14.
LSD 5%		0	41	41	42	69	0.7	13

Weed control values were widely variable across replicates within a treatment. The reason for this could not be determined, but it resulted in very large LSD values. Treatments that provided above 85% had consistent values across all four reps. Even though broadleaf weeds were relatively small at application, size range outliers may have contributed to variability. Treatments with wide variability tended to have a contact herbicide which would have more difficulty controlling larger weeds than PGR or ALS herbicides because of coverage and translocation.

Treatments did not cause injury that was observed on July 18. Clopyralid and fluroxypyr plus thifensulfuron provided 97 to 99% control of each weed species present and resulted in 70 bu/A wheat yield. Wheat canopy was very competitive and enabled substantial yield benefit compared to untreated wheat even when the herbicide treatment gave low weed control.

Improving kochia control with additives. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 28 near Montpeliar, North Dakota. Treatments were applied to 4 leaf wheat and 1 to 6 inch kochia on July 2 with 85°F, 20% cloud-cover, 1 to 2 mph wind at 315°, and dry soil. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/9 Wht	7/9 Kocz	7/16 Kocz	7/30 Kocz
	oz/A	%	%	%	%
AGH09035	8.7	0	70	76	83
AGH09035+Interlock	8.7+4	0	70	76	83
AGH09035+AG8050	8.7+6.4	0	70	74	84
AGH09035+MSO	8.7+24	0	70	79	86
AGH08032	12	0	86	86	89
AGH08032+Interlock	12+4	0	88	88	96
AGH08032+AG8050	12+6.4	0	85	88	93
AGH08032+MSO	12+24	0	86	89	96
Fluroxypyr	2	0	66	78	86
Fluroxypyr+MSO	2+24	0	71	75	89
CV		0	4	4	3
LSD 5%		0	4	5	4

Treatments did not cause visible wheat injury. Evaluation on July 9, identified that AGH08032 produced more damage on kochia, average control of 86%, than AGH09035, 70%, or fluroxypyr, average 68%. Additives did not enhance herbicidal activity except for slight imcrease in contro with fluroxypyr when MSO was added. This benefit was not present at other evaluations, but control with fluroxypyr eventually reached 87% average on July 30. At this date, all three additives enhanced the control with AGH08032 for an average of 95% control compared with 89% with AGH08032 alone. Additives still did not benefit AGH09035 efficacy to kochia.

Broadleaf weed control with Pyraflufen. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 at Fargo. Treatments were applied to 4 leaf wheat, 2 to 4 leaf wild buckwheat, 2 to 6 leaf wild mustard, and 4 to 6 leaf common ragweed on June 11 with 75°F, 58% relative humidity, 60% cloud cover, 2 mph wind at 0°, and moist soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/13 Wht	6/25 Wht	6/25 Wimu	6/25 Wibw	6/25 Vema	6/25 Corw
	oz/A	%	%	%	%	%	%
Pxdn+Pyff&2,4-D	0.86+12	10	0	97	81	92	94
Pxdn+Pyff&2,4-D	0.86+24	14	0	98	92	93	96
Pxdn+Carf&2,4-D+NIS	0.86+4.1+0.25%	11	0	97	94	89	91
Pxdn+Carf&2,4-D+MSO	0.86+4.1+20	7	0	96	91	85	88
Pxdn+Pyff&2,4-D+NIS	0.86+12+0.25%	10	0	98	91	89	95
Pxdn+Pyff&2,4-D+MSO	0.86+12+20	7	0	98	86	90	94
Pxdn+2,4-D LV4	0.86+12	2	0	98	81	85	90
Pxdn+Clpy&Flox	0.86+3	0	0	95	92	89	91
Pxdn+Thifsg+Tribsg+MCPA	0.86+0.24+0.06+6	0	0	98	93	91	91
Pxdn+Brox&Pyst	0.86+2.9	1	0	99	96	96	97
Pxdn+Brox&MCPA5	0.86+8	1	0	99	94	84	87
Pxdn+Brox&Flox	0.86+5	2	0	98	96	92	93
Untreated Check	0	0	0	0	0	0	0
Reps		4	4	4	4	4	3
CV		31	0	2	6	5	5
LSD 5%		2	0	2	7	5	7

Table continued.

Treatment	Rate	7/10 Wimu	7/10 Wibw	7/10 Vema	7/10 Corw	8/16 Yield
	oz/A	%	%	%	%	bu/A
Pxdn+Pyff&2,4-D	0.86+12	99	76	90	98	58
Pxdn+Pyff&2,4-D	0.86+24	99	85	90	98	56
Pxdn+Carf&2,4-D+NIS	0.86+4.1+0.25%	97	76	83	95	58
Pxdn+Carf&2,4-D+MSO	0.86+4.1+20	99	86	80	95	56
Pxdn+Pyff&2,4-D+NIS	0.86+12+0.25%	99	93	89	98	57
Pxdn+Pyff&2,4-D+MSO	0.86+12+20	99	79	86	92	61
Pxdn+2,4-D LV4	0.86+12	99	76	85	96	62
Pxdn+Clpy&Flox	0.86+3	93	93	92	98	61
Pxdn+Thifsg+Tribsg+MCPA	0.86+0.24+0.06+6	99	94	91	96	53
Pxdn+Brox&Pyst	0.86+2.9	99	97	95	99	53
Pxdn+Brox&MCPA5	0.86+8	99	84	84	94	56
Pxdn+Brox&Flox	0.86+5	98	91	91	87	56
Untreated Check	0	0	0	0	0	55
Reps		4	4	4	3	3
CV		2	5	4	4	8
LSD 5%		2	5	4	5	8

Treatments with pyraflufen or carfentrazone caused 7 to 14% wheat injury 2 DAT. NIS did not alter injury response, but MSO tended to reduce injury with the herbicides. Wheat injury was not apparent 14 DAT. Herbicides gave exceptional control of wild mustard and common ragweed. bromoxynil and pyrasulfotole provided 97% control of wild buckwheat, but pyraflufen and 2,4-D with NIS, clopyralid and fluroxypyr, or thifensulfuron and tribenuron plus MCPA gave similar control at 93 to 94%. Bromoxunil and pyrasulfotole also gave the greatest Venice mallow control at 95%.

Fluthiacet in wheat. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 13 at Fargo. Treatments were applied to 4 leaf wheat and 2 to 4 leaf wild mustard, common ragweed, Venice mallow, and wild buckwheat on June 11 with 75°F, 58% relative humidity, 60% cloud cover, 2 mph wind at 300°, and moist soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/13 Wht	6/18 Wht	6/18 Wimu	6/18 Corw	6/18 Vema	6/18 Wibw	6/25 Wht	6/25 Wimu
	oz/A	%	%	%	%	%	%	%	%
Pxdn+Fluthiacet+MCPA+NIS	0.86+0.085+10+0.25%	10	6	90	83	89	84	0	98
Pxdn+Fluthiacet+2,4-D+NIS	0.86+0.085+8+0.25%	13	6	90	81	89	84	0	99
Pxdn+Fluthiacet+Thif-sg+Trib-sg+NIS	0.86+0.085+0.2+0.2+0.25%	3	34	86	83	86	86	0	99
Pxdn+Clpy&Flox+Pxsf&Fluthiacet	0.86+3+1.34	5	5	80	73	84	85	0	97
Pyroxasulfone&Fluthiacet	1.34	2	1	78	65	75	40	0	86
Pxsf&Fluthiacet	2.1	2	0	80	70	76	43	0	86
Pxsf&Fluthiacet	2.7	2	0	88	76	78	43	0	91
Flcz+Pxsf&Fluthiacet	0.21+1.34	0	0	78	65	76	73	0	94
Untreated Check	0	0	0	0	0	0	0	0	0
CV		4	1	3	7	6	3	0	11
LSD 5%		2	1	6	6	5	7	0	4

Treatment	Rate	6/25 Corw	6/25 Vema	6/25 Wibw	7/3 Wimu	7/3 Corw	7/3 Vema	7/3 Wibw
	oz/A	%	%	%	%	%	%	%
Pxdn+Fluthiacet+MCPA+NIS	0.86+0.085+10+0.25%	92	94	89	99	94	85	81
Pxdn+Fluthiacet+2,4-D+NIS	0.86+0.085+8+0.25%	98	97	95	99	94	92	90
Pxdn+Fluthiacet+Thif-sg+Trib-sg+NIS	0.86+0.085+0.2+0.2+0.25%	95	96	98	99	95	94	97
Pxdn+Clpy&Flox+Pxsf&Fluthiacet	0.86+3+1.34	98	97	98	99	99	97	98
Pyroxasulfone&Fluthiacet	1.34	75	69	48	85	76	71	30
Pxsf&Fluthiacet	2.1	71	78	40	88	73	84	40
Pxsf&Fluthiacet	2.7	78	85	48	89	84	83	30
Flcz+Pxsf&Fluthiacet	0.21+1.34	76	70	85	99	75	79	80
Untreated Check	0	0	0	0	0	0	0	0
CV		19	25	20	4	12	13	23
LSD 5%		14	9	8	3	7	5	9

Pyroxasulfone is included with fluthiacet for residual weed control. Since an additional flush of weeds did not occur after application, the benefit of this combination was not demonstrated. Fluthiacet was not provide complete control of the broadleaf spectrum as demonstrated by increased weed control with inclusion of other broadleaf herbicides. Flucarbazone only increased the control of wild mustard and wild buckwheat. Thifensulfuron and tribenuron was a cost-effective tankmix partner for the species present.

Tankmix partners accentuated typical speckling injury associated with fluthiacet. Injury from fluthiacet alone was nearly imperceptible and injury with combination treatments was not detected by June 25.

Weed control with F9312-3. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 at Fargo. Preemergence treatments were applied May 16 with 77° F, 30% relative humidity, clear sky, 7 mph wind at 90°m dry soil at 50°F. Post treatments were applied to 4 leaf wheat and 2 leaf yellow foxtail on June 17 with 70°F, 64% relative humidity, 6 to 7 mph wind at 330°, and dry soil at 61°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with three replicates.

Treatment	Rate	Timing	6/24 Wht	6/24 Yeft	7/3 Wht	7/3 Yeft	7/19 Yeft	7/19 Cudo	Wht
	oz/A		%	%	%	%	%	%	no./m row
F9312-3	1.15	Pre	4	90	8	92	85	25	17
F9312-3	1.53	Pre	8	96	8	97	97	73	12
F9310-7	1.58	Pre	7	95	8	95	88	50	17
F9312-3	1.9	Pre	5	95	7	96	96	80	18
F9312-3	2.3	Pre	30	95	30	96	96	85	8
F9312-3	1.9	PPI	5	96	7	97	96	80	17
F9314-3	2.85	Pre	3	95	12	95	95	88	19
F9314-3	3.55	Pre	10	95	37	96	96	91	18
F9312-3/Brox&Pyst+NIS+AMS	1.15/1.5+0.25%+24	Pre/1-2lf	3	97	5	98	91	98	12
F9312-3/Brox&Pyst+NIS+AMS	1.15/2.9+0.25%+8	Pre/1-2lf	5	95	12	96	88	96	13
F9312-3/Brox&Pyst+NIS+AMS	1.53/1.5+0.25%+24	Pre/1-2lf	5	95	10	96	95	97	18
F9312-3/MCPA+NIS+AMS	1.53/8+0.25%+24	Pre/1-2lf	13	95	12	96	94	90	17
Brox&Pyst+NIS+AMS	2.9+0.25%+24	1-2lf	3	78	18	80	63	75	19
Flum&Pxsf	2.3	Pre	10	94	8	95	92	88	12
Pxsf	1.42	Pre	8	90	8	93	92	80	14
Flcz	0.21	Pre	0	0	0	0	0	0	20
Flcz-2.0+Clpy&Flox+MCPA	0.42+3+8	1-2lf	10	85	7	83	84	95	21
Pinoxaden+Clpy&Flox+MCPA	0.86+3+8	1-2lf	0	93	2	95	96	97	20
Untreated Check	0		0	0	0	0	0	0	19
No of Reps			2	2	3	3	3	2	3
CV			110	6	129	6	8	7	37
LSD 5%			15	11	22	8	11	11	10

Excessive precipitation after study establishment caused severe plant stress resulting in loss of replicate for some evaluations and early termination of the study. The high rates of 9312 and 9314 caused substantial wheat injury, but the response likely was accentuated by the excessive moisture condition. Preemergence activity of numbered treatments gave excellent control of yellow foxtail throughout the season. Midseason establishment of curly dock also was inhibited by several of the treatments. Several of the postemergence herbicides also demonstrated residual activity towards curly dock. Flucarbazone gave much better control of yellow foxtail PRE than POST, but the rate difference in what was allowed PRE and POST confounds definitive comment on reason.

Weed control with F9312-3. Howatt, Roach, and Harrington. Preplant incorporated treatment was applied, Prosper hard red spring wheat was seeded, and pre-emergence treatments were applied on May 24 at Prosper, North Dakota with 66°F, 40% relative humidity, 90% cloud-cover, 18 mph wind at 135°, and moist soil at 52° F. Post treatments were applied to 2 leaf wheat, 2 to 3 leaf yellow foxtail, cotyledon redroot pigweed and common lambsquarters, emerging wild oat, and 2 leaf common cocklebur on June 11 with 84°F, 30% relative humidity, clear sky, 5 mph wind at 90°, moist soil at 70°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. Hairy nightshade emerged after herbicide application. The experiment was a randomized complete block design with four replicates except where indicated.

Treatment	Rate	Timing	6/13 Emerge	6/18 Wht	6/18 Yeft	6/18 Rrpw	6/18 Colq	7/1 Yeft	7/1 Hans
	oz/A		%	%	%	%	%	%	%
F9312-3	1.15	Pre	0	0	80	95	79	78	60
F9312-3	1.53	Pre	0	0	84	95	88	91	88
F9310-7	1.58	Pre	0	0	86	95	88	90	92
F9312-3	1.9	Pre	0	0	87	95	81	90	78
F9312-3	2.3	Pre	0	0	93	99	91	93	93
F9312-3	1.9	PPI	0	0	85	95	86	90	90
F9314-3	2.85	Pre	0	0	90	99	97	90	93
F9314-3	3.55	Pre	0	0	92	99	97	92	96
F9312-3/Brox&Pyst+NIS+AMS	1.15/1.5+0.25%+24	Pre/1-2lf	0	0	87	99	96	94	96
F9312-3/Brox&Pyst+NIS+AMS	1.15/2.9+0.25%+8	Pre/1-2lf	0	0	86	99	97	90	96
F9312-3/Brox&Pyst+NIS+AMS	1.53/1.5+0.25%+24	Pre/1-2lf	0	0	88	95	95	91	96
F9312-3/MCPA+NIS+AMS	1.53/8+0.25%+24	Pre/1-2lf	0	0	92	95	93	93	96
Brox&Pyst+NIS+AMS	2.9+0.25%+24	1-2lf	0	0	0	0	0	88	98
Flum&Pxsf	2.3	Pre	0	0	86	95	95	90	97
Pxsf	1.42	Pre	0	0	81	95	91	78	88
Flcz	0.21	Pre	0	0	15	95	85	33	62
Flcz-2.0+Clpy&Flox+MCPA	0.42+3+8	1-2lf	0	0	0	0	0	86	96
Pinoxaden+Clpy&Flox+MCPA	0.86+3+8	1-2lf	0	0	0	0	0	85	96
Untreated Check	0		0	0	0	0	0	0	0
Reps			4	4	4	1	4	3	3
CV			0	0	6	.	6	6	5
LSD 5%			0	0	6	.	6	8	7

Pre-emergence treatments did not cause delay of wheat emergence or wheat stand reduction early in the season. Similarly none of the treatments caused visible injury to wheat through the season or difference in wheat population at the end of the season. Although only one rep had redroot pigweed present, all pre-emergence treatments provided at least 95% control of pigweed. Pigweed was not found in treated plots on July 1. Numbered PRE herbicides gave good to excellent control of yellow foxtail, 80 to 93%, and most numbered product treatments maintained about 90% foxtail control through the season. Hairy nightshade was very effectively controlled by postemergence herbicides, 96 to 98%, but PRE application of flumioxazin and pyroxasulfone or F9314 gave similar control. F9314 also maintained at least 93% control of common labsquarters while control with F9312 or 9310 diminished through the season. F9310 and 9314 maintained 70 to 88% control of wild mustard while control with F9312 was 30% or less by July 1. The numbered herbicides gave slight to moderate suppression of wild oat, less than 70% control, but flucarbazone PRE gave 83% control and flucarbazone or pinoxaden POST provided 99% control. F9314 provided more effective control of weeds than F9310 or 9312, but none of the three affected common cocklebur and wild oat was only suppressed.

Table continued

Treatment	Rate	Timing	7/1 Colq	7/1 Cocb	7/1 Wimu	7/11 Wioa	7/24 Wioa	7/24 Yeft	7/24 Wht	8/27 Yield
	oz/A		%	%	%	%	%	%	no./m	bu/A
F9312-3	1.15	Pre	27	0	27	0	10	76	40	35
F9312-3	1.53	Pre	72	0	0	10	33	86	44	35
F9310-7	1.58	Pre	67	0	83	45	58	91	40	40
F9312-3	1.9	Pre	43	0	30	13	50	90	41	35
F9312-3	2.3	Pre	75	0	0	30	68	94	45	40
F9312-3	1.9	PPI	62	0	0	43	49	88	40	37
F9314-3	2.85	Pre	93	0	88	5	43	90	43	37
F9314-3	3.55	Pre	96	10	70	5	48	91	42	35
F9312-3/Brox&Pyst+NIS+AMS	1.15/1.5+0.25%+24	Pre/1-2lf	97	92	97	5	33	90	38	36
F9312-3/Brox&Pyst+NIS+AMS	1.15/2.9+0.25%+8	Pre/1-2lf	96	90	96	8	53	91	40	32
F9312-3/Brox&Pyst+NIS+AMS	1.53/1.5+0.25%+24	Pre/1-2lf	96	90	96	40	48	90	38	32
F9312-3/MCPA+NIS+AMS	1.53/8+0.25%+24	Pre/1-2lf	96	82	93	38	58	92	37	35
Brox&Pyst+NIS+AMS	2.9+0.25%+24	1-2lf	98	96	98	0	13	71	42	38
Flum&Pxsf	2.3	Pre	96	0	92	35	51	79	39	37
Pxsf	1.42	Pre	85	0	33	5	55	85	39	34
Flcz	0.21	Pre	52	53	93	90	83	30	39	28
Flcz-2.0+Clpy&Flox+MCPA	0.42+3+8	1-2lf	96	93	96	99	99	80	38	42
Pinoxaden+Clpy&Flox+MCPA	0.86+3+8	1-2lf	96	89	96	98	99	88	39	33
Untreated Check	0		0	0	0	0	0	0	39	31
Reps			3	3	3	4	4	4	4	4
CV			11	14	9	33	18	6	12	19
LSD 5%			13	8	9	14	13	6	7	10

Broadleaf weed control in spring wheat, Carrington, 2013. Greg Endres and Mike Ostlie. The experiment was conducted at the NDSU Carrington Research Extension Center in cooperation with Bayer CropScience. Experimental design was a randomized complete block with three replicates. 'Glenn' HRS wheat was seeded on May 15 at 1.8 million seeds/A in conventionally tilled soil. Herbicide treatments were applied with a CO_2-hand-boom plot sprayer delivering 10 gal/A at 35 psi through 8001 flat fan nozzles to the center 6.7 ft of 10- by 25-ft plots. Treatments were applied on June 21 with 72 F, 74% RH and 5 mph wind to 4- to 5-leaf wheat, 0.5- to 3-inch tall common lambsquarters and 0.5- to 3-inch redroot and prostrate pigweed. Axial XL at 16.4 fl oz/A was sequentially applied on June 21 to plots previously not receiving a grass herbicide except the untreated check. The trial was harvested for seed yield on August 28.

Control of common lambsquarters generally was excellent among herbicide treatments (Table). Pigweed control generally was good to excellent (78-95%) 4 wk after treatment (WAT) and excellent 8 WAT. Wheat injury was not observed 11 days after treatment (July 2). Wheat seed yield did not improve with herbicide treatments compared with the untreated check, likely due to low weed density. Also, yield with several treatments was less than the untreated check.

Table.

Herbicide		Weed control[1]						Wheat
		2-Jul		19-Jul		16-Aug		Seed
Treatment[2]	Rate	colq	pigw	colq	pigw	colq	pigw	yield
	fl oz product/A	%						bu/A
Untreated check	x	0	0	0	0	0	0	55.2
Huskie + AMS	11 + 18.8	97	80	99	87	99	94	56.1
Huskie + AMS	13.5 + 18.8	98	83	99	91	99	98	51.1
Huskie Complete + AMS	13.7 +18.8	99	82	99	95	99	99	55.3
Varro + Bison	6.9 + 15.4	98	75	99	87	99	98	53.7
Varro + Affinity TankMix + Starane Ultra	6.9 + 0.6 (oz wt) + 4.3	85	81	95	85	99	98	42.9
WideMatch + MCPA	12 + 8	92	82	99	78	99	96	49.8
Affinity TankMix + Starane Ultra + NIS	0.6 (oz wt) + 4.3 + 0.25%	90	84	94	93	99	99	50.4
C.V. (%)		5.1	5.8	3.6	9.6	0.2	3.1	3.6
LSD (0.05)		7	7	5	13	1	5	3

[1]Colq=common lambsquarters; pigw=redroot and prostrate pigweed.

[2]AMS=Npak AMS liq; NIS=Preference (Winfield).

Tankmixes for thiencarbazone. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 near Fargo. Treatments were applied to 4 leaf wheat, 2 to 3 leaf green and yellow foxtail and redroot pigweed, 2 to 4 leaf common cocklebur and wild buckwheat, and 1 leaf Venice mallow on June 17 with 68°F, 63% relative humidity, 10% cloud-cover, 6 to 9 mph wind at 315°, and dry soil at 65°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/2 Wht	7/2 Fxtl	7/2 Rrpw	7/2 Cocb	7/2 Wibw	7/2 Vema	7/10 Fxtl	7/10 Rrpw
	oz/A	%	%	%	%	%	%	%	%
Fenx+Brox&Pyrst+AMS	1.32+2.9+8	0	91	95	98	97	95	91	99
Fenx+Brox&Pyst+AMS	1.32+3.6+8	0	92	97	99	98	94	94	99
Brox&Pyst&Thcz+AMS	3+8	0	86	94	96	95	91	85	99
Thcz+Brox&MCPA5	0.072+8	0	90	95	99	98	86	84	97
Thcz+Thif-sg+Trib-sg+Flox	0.072+0.24+0.06+1	0	87	95	97	98	85	87	97
Fenx+Clopyralid&Flox+MCPA	1.32+3+4	0	92	94	98	97	86	91	99
Fenx+Thif-sg+Trib-sg+Flox+NIS	1.32+0.24+0.06+1+0.25%	0	85	88	92	93	85	84	94
Fenx+Brox&Flox	1.32+7.5	0	91	91	96	97	85	92	98
Untreated Check	0	0	0	0	0	0	0	0	0
CV		0	4	4	3	3	4	4	2
LSD 5%		0	5	5	3	4	5	4	3

Table continued.

Treatment	Rate	7/10 Cocb	7/10 Wibw	7/10 Vema	7/29 Fxtl	7/29 Cocb	7/29 Wibw	7/29 Vema	Yield
	oz/A	%	%	%	%	%	%	%	bu/A
Fenx+Brox&Pyst+AMS	1.32+2.9+8	99	99	97	96	99	99	97	53
Fenx+Brox&Pyst+AMS	1.32+3.6+8	99	99	93	94	99	99	98	60
Brox&Pyst&Thcz+AMS	3+8	99	99	93	92	99	98	97	56
Thcz+Brox&MCPA5	0.072+8	98	93	80	93	99	99	89	58
Thcz+Thif-sg+Trib-sg+Flox	0.072+0.24+0.06+1	97	95	85	91	99	99	87	48
Fenx+Clopyralid&Flox+MCPA	1.32+3+4	99	97	90	96	99	99	93	46
Fenx+Thif-sg+Trib-sg+Flox+NIS	1.32+0.24+0.06+1+0.25%	97	91	85	86	99	99	83	48
Fenx+Brox&Flox	1.32+7.5	99	96	85	96	99	99	92	50
Untreated Check	0	0	0	0	0	0	0	0	44
CV		2	3	4	3	1	1	4	15
LSD 5%		3	4	4	4	1	1	3	11

Fenoxaprop, 91 to 94%, provided slightly better control of foxtail species than thiencarbazone, 85 to 86%, when the treatment included bromoxynil and pyrasulfotole. But late season foxtail control was slightly better with thiencarbazone than fenoxaprop, 91 and 86%, respectively, when thifensulfuron and tribenuron were included. All treatments provided excellent control, above 90%, of broadleaf weeds except Venice mallow, although thifensulfuron and tribenuron plus fluroxypyr gave less control of redroot pigweed and wild buckwheat. The best control of Venice mallow, 97 to 98% control on July 29, was provided by bromoxynil and pyrasulfotole, regardless of whether thiencarbazone was included.

Comparison of 2,4-D formulations. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 14 near Fargo. Treatments were applied to 4 leaf wheat, 6 to 15 inch Canada thistle, 3 to 5 leaf wild mustard, and 2 to 5 leaf wild buckwheat on June 18 with 63°F, 68% relative humidity, clear sky, 3 to 5 mph wind at 135°, and dry surface soil at 65°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/2 Wimu	7/2 Wibw	7/2 Cath	7/22 Wibw	7/22 Cath
	oz ae/A	%	%	%	%	%
E-99	8	99	89	86	85	73
2,4-DeLV	7.4	98	83	74	80	76
2,4-DeLV	8	99	90	84	81	81
2,4-D amine	7.6	99	86	78	86	79
2,4-D amine	8	99	80	83	74	83
AGH9008	7	99	83	81	78	88
AGH9008	8	98	86	83	76	81
AGH9008+Preference+Interlock	7+0.25%+4	99	89	88	85	92
AGH9008+AG8050	7+6.4	98	85	85	73	85
Salvo	8	99	89	84	85	86
Saber	8	99	86	83	83	78
Dicamba	1.5	92	79	71	74	58
AGH11021	6	99	89	84	88	91
Brash	5.8	99	88	79	90	91
Untreated Check	0	0	0	0	0	0
CV		1	4	5	5	6
LSD 5%		2	4	6	6	7

Brash gave 90% control of wild buckwheat on July 22. This was similar to E-99, Salvo, or AGH11021. The average buckwheat control with AGH9008 was 78% but with the addition of Preference and Interlock it also gave similar control, 88%, to Brash. AGH9008 gave about 85% control of Canada thistle, but control again was improved with Preference and Interlock to achieve 92% control. Brash or AGH11021 gave 91% control of Canada thistle. AGH11021, AGH9008 plus Preference and Interlock, or Brash provided the best combined control of tough broadleaf weeds in this study.

Grass herbicides compared in wheat. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 14 near Fargo. Treatments were applied to 4 leaf wheat and wild oat on June 12 with 74°F, 56% relative humidity, 80% cloud-cover, 11 mph wind at 360°, and moist soil at 61°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/28 Wioa	7/10 Wioa	8/19 Yield
	oz/A	%	%	bu/A
Flucarbazone+Broxl&MCPA5+BB	0.32+8+1%	75	87	24
Prcz+Brox&MCPA5+BB	0.42+8+1%	75	73	22
Prcz&Mess+Broxl&MCPA5+BB	0.2+8+1%	76	80	30
Pxlm+Brox&MCPA5+BB	0.26+8+1%	75	76	35
Pxlm&Flas&Fluroxypyr+BB	1.68+1%	81	92	29
Brox&Pyst&Thcz+UAN	3.0+16	75	79	23
Fenx+Brox&MCPA5	1.32+8	83	64	22
Clodinfop NG+Brox&MCPA5	0.8+8	85	89	19
Pinoxaden+Brox&MCPA5	0.86+8	91	96	36
Fenx&Pinoxaden+Brox&MCPA5	0.86+8	90	95	38
Untreated Check	0	0	0	16
CV		3	5	24
LSD 5%		4	6	9

Excessively and persistently saturated soil caused stress to wheat and reduced yield potential. Herbicides did not appear to cause wheat injury. Pinoxaden or pyroxsulam premix as Goldsky provided greater than 90% control. The activity from pyroxsulam was interesting because ALS-herbicides struggle to control grasses under cool and wet conditions and because pyroxsulam formulated as PowerFlex only gave 76% control of wild oat. Flucarbazone provided 87% control and clodinafop gave 89% control, but control with other herbicides was 80% or less.

Grass herbicides compared in wheat at Langdon. Lubenow, Howatt, and Harrington. 'Faller' hard red spring wheat was seeded as drill strips at the LREC on May 29th. Treatments were applied to 5-7 leaf wheat on June 25th with 86°F, 48% relative humidity, partly cloudy skies, 10 mph wind at 149°, and dry soil at 84°F. Broad leaf weeds were approximately 2 to 3 inches tall. Grass weeds were 1 to 3 leaf in size. Treatments were applied with a tractor sprayer with a 9 foot boom at 3 mph with Teejets XR8001, 40 lbs psi and 10 gallons of water/acre. Plots were 10 ft by 20 ft. The experiment was a randomized complete block design with four replicates. Wheat was harvested for grain yield on September 5th.

Treatment	Rate	7/18 Wht	7/18 Wioa	Wheat TW	Wheat Yield
	oz/A	%	%	lb/bu	bu/A
Flcz+Brox&MCPA5+BB	0.32+8+1%	0	97	58.8	44
Prcz+Brox&MCPA5+BB	0.42+8+1%	0	80	59.3	48
Prcz&Mess+Brox&MCPA5+BB	0.2+8+1%	0	78	59.1	50
Pxlm+Brox&MCPA5+BB	0.26+8+1%	0	79	58.9	53
Pxlm&Flas&Flox+BB	1.68+1%	0	85	58.8	56
Brox&Pyst&Thcz+UAN	3.0+16	0	85	59.0	46
Fenx+Brox&MCPA5	1.32+8	0	65	59.0	47
ClfpNG+Brox&MCPA5	0.8+8	0	55	59.0	46
Pxdn+Brox&MCPA5	0.86+8	0	86	59.7	48
Fenx&Pxdn+Brox&MCPA5	0.86+8	0	82	59.2	39
Untreated Check	0	0	0	59.1	36
CV		0	9	0.9	19
LSD 5%		0	10	0.7	13

Treatments did not cause visible injury to wheat July 18. Resistance to ACCase-inhibiting herbicides has developed in this site. Flucarbazone provided the best control of wild oats, 97%. Thiencarbazone, a new grass herbicide in the United States, gave 85% control of this biotype. Resistance was most evident with clodinafop, which only gave 55% control. Pinoxaden killed more of the plants but control, 86%, was not as high as expected from a susceptible biotype.

Wild oat control with ALS graminicides plus SU. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 14 near Fargo. Treatments were applied to 5 leaf wheat and 4 leaf wild oat on June 12 with 66°F, 68% relative humidity,100% cloud-cover, 5 to 6 mph wind at 10°, and moist soil at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/18 Wht	6/25 Wioa	7/10 Wioa
	oz/A	%	%	%
Pinoxaden	0.86	0	95	97
Flcz2.0+NIS+AMS	0.43+0.25%+32	0	76	85
Prcz+NIS+AMS	0.63+0.25%+32	0	84	90
Pxlm-13+NIS+AMS	0.26+0.25%+32	0	80	83
Pxlm-L+NIS+AMS	0.26+0.25%+32	0	83	86
Prcz&Mess+NIS+AMS	0.2+0.25%+32	0	81	86
Pxdn+Thif-sg+Trib-sg+AMS	0.86+0.06+0.24+32	0	91	97
Flcz2.0+Thif-sg+Trib-sg+NIS+AMS	0.43+0.06+0.24+0.25%+32	0	79	86
Prcz+Thif-sg+Trib-sg+NIS+AMS	0.63+0.06+0.24+0.25%+32	0	83	86
Pxlm-13+Thif-sg+Trib-sg+NIS+AMS	0.26+0.06+0.24+0.25%+32	0	84	85
Pxlm-L+Thif-sg+Trib-sg+NIS+AMS	0.26+0.06+0.24+0.25%+32	0	83	87
Prcz&Mess+Thif-sg+Trib-sg+NIS+AMS	0.2+0.06+0.24+0.25%+32	0	84	87
Untreated Check	0	0	0	0
CV		0	3	4
LSD 5%		0	3	4

Herbicides did not cause visible injury to wheat. Pinoxaden, an ACCase-inhibiting herbicide, provided 97% wild oat control. While the July rating was unaffected by thifensulfuron and tribenuron, earlier evaluation indicated antagonism of pinoxaden. Propoxycarbazone gave less control of wild oat, 90%, than pinoxaden but better control than other graminicides, 83 to 86%. Addition of thifensulfuron and tribenuron did not improve wild oat control with ALS graminicides in this study.

ACCase-resistant wild oat control with Rimfire Max, Huskie Complete, and Varro. (Jenks, Walter, and Willoughby). The objective of this study was to evaluate Group 1-resistant wild oat control with Group 2 herbicides (Rimfire Max, Huskie Complete, and Varro). All treatments were applied postemergence on June 11 to 3- to 4-leaf wheat, 3-leaf wild oat, and 1- to 2-inch green foxtail. All three Group 2 herbicides provided good to excellent wild oat control. Wild oat control was slightly less Varro was tank mixed with Bison Advanced compared to Huskie. Wolverine provided very poor wild oat control because this wild oat population is resistant to some Group 1 herbicides such as Puma and Wolverine. Rimfire Max provided poor green foxtail control while Varro and Huskie Complete provided fair control.

Table. ACCase-resistant wild oat control with Rimfire Max, Huskie Complete, and Varro (1333)

		Injury			Weed Control[c]			
		HRSW			Wild oat			Grft
Treatment[ab]	Rate	Jun-21	Jul-05	Jul-31	Jun-21	Jul-05	Jul-31	Jul-31
		----------%----------			----------%----------			---%---
Untreated		0	0	0	0	0	0	0
RM + Huskie + BB	3 oz + 11 oz + 1%	0	0	0	86	96	99	35
RM + Huskie + HSOC	3 oz + 11 oz + 0.75 pt	0	0	0	82	94	93	38
RM + Affinity TM + SU + BB	3 oz + 0.60 oz + 0.27 pt + 1%	0	0	0	84	95	98	37
Varro + Bison Advanced	6.85 oz + 0.8 pt	0	0	0	81	89	88	65
Varro + Huskie	6.85 oz + 11 oz	0	0	0	81	90	93	63
Huskie Complete + AMS	13.7 oz + 1.47%	0	0	0	87	93	97	65
Wolverine	27.4 oz	0	0	0	23	20	18	--
LSD (0.05)		NS	NS	NS	16.3	11.8	11.9	9.0
CV		0	0	0	14.2	9.3	9.2	13.4

[a] *All treatments applied 3-4 leaf wheat*

[b] *RM=Rimfire Max; SU=Starane Ultra; BB=Basic Blend (Quad 7)*

[c] *Grft=Green foxtail*

Wild oat control with thiencarbazone. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 near Fargo. Treatments were applied to 4 leaf wheat and wild oat on June 12 with 74°F, 56% relative humidity, 80% cloud-cover, 7 mph wind at 360°, moist soil at 61°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/18 Wht	6/18 Wioa	6/28 Wioa	7/3 Wioa	7/10 Wioa	7/24 Wioa
	oz/A	%	%	%	%	%	%
Prcz&Mess+Broxl&Pyst+BB	0.2+2.9+1%	0	58	78	85	83	85
Prcz&Mess+Broxl&Pyst+ HSOC	0.2+2.9+12	0	58	75	85	81	88
Prcz&Mess+Thif-sg+Trib-sg+Flox+BB	0.2+0.24+0.06+1+1%	0	58	84	86	90	88
Thcz+Broxl&MCPA5	0.072+8	0	58	80	76	85	79
Thcz+Brox&Pyst	0.072+2.9	0	58	76	76	85	80
Brox&Pyst&Thcz+AMS	3+8	0	58	81	76	84	79
Fenx&Brox&Pyrst	3.9	0	45	86	81	73	79
Flcz+Thif-sg+Trib-sg+Flox+BB	0.23+0.24+0.06+1+1%	0	58	79	79	85	79
Untreated Check	0	0	0	0	0	0	0
CV		0	4	3	4	5	6
LSD 5%		0	3	4	4	6	6

The study area had saturated soil through much of the season. Grain was not harvested because of adverse effect of soil saturation on yield potential and variability from one end of the study to the other. Wild oat control with all herbicides was less than 60% 6 DAT. Herbicide control of wild oat generally was 75 to 85% on other evaluation dates. Best control at the end of July was provided by propoxycarbazone and mesosulfuron, 85 to 88%, when thiencarbazone, fenoxaprop, or flucarbazone gave 79% control.

Weed and crop response to tankmixes with thiencarbazone premix. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded on May 14 near Fargo. Treatments were applied to 4 leaf wheat and wild oat on June 12 with 74°F, 56% relative humidity, 80% cloud-cover, 9 mph wind at 360°, and moist soil at 61°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/28 Wioa	7/10 Wioa	7/24 Wioa
	oz/A	%	%	%
Brox&Pyst&Thcz	3	79	70	79
Brox&Pyst&Thcz+Thif sg+Trib sg	3+0.25+0.25	75	78	78
Brox&Pyst&Thcz+Thif sg+Trib sg	3+0.53+0.14	78	81	79
Brox&Pyst&Thcz+Thif sg+Trib sg	3+0.1+0.4	75	75	82
Brox&Pyst&Thcz+Trib sg	3+0.5	76	80	81
Brox&Pyst&Thcz+Pyraclostrobin	3+2.4	75	65	69
Brox&Pyst&Thcz+Thif sg+Trib sg+Pyrac	3+0.25+0.25+2.4	78	79	76
Brox&Pyst&Thcz+MCPA	3+6	78	79	82
Brox&Pyst&Thcz+MCPA+Pyrac	3+6+2.4	75	75	71
Brox&Pyst&Thcz+MCPA+Thif sg+Trib sg	3+6+0.25+0.25	79	80	85
Brox&Pyst&Thcz+MCPA+Thif sg+Trib sg+Pyrac	3+6+0.25+0.25+2.4	76	79	71
Untreated Check	0	0	0	0
CV		4	7	5
LSD 5%		4	8	6

Weed control within a treatment was fairly consistent across evaluation dates. The thiencarbazone premix alone gave 79% control of wild oat on July 24. Only the tankmix with MCPA plus thifensulfuron and tribenuron provided better control, 85%. Several treatments were similar to the premix alone, but the tankmixes of the thiencarbazone premix with the fungicide pyraclostrobin, MCPA plus pyraclostrobin, or MCPA plus thifensulfuron and tribenuron plus pyraclostrobin resulted in less control, 70%, than the premix alone. The other treatment that included pyraclostrobin gave 76% control.

Wild oat control with AGH120020 and adjuvants. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 14 near Fargo. Treatments were applied to 4 leaf wheat and wild oat on June 12 with 74°F, 56% relative humidity, 100% cloud-cover, 10 mph wind at 360°, and moist soil at 61°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/28 Wioa	7/10 Wioa
	oz/A	%	%
AGH120020+Class Act	1.8+2.5%	80	80
AGH120020+Class Act+Interlock	1.8+2.5%+4	80	81
AGH120020+Thifsg+Tribsg+Class Act	1.8+0.24+0.06+2.5%	80	80
AGH120020+AG08034	1.8+1%	80	81
AGH120020+AG08034+Interlock	1.8+1%+4	80	80
AGH120020+AG08034+AG8050	1.8+1%+6.4	80	80
AGH120020+AG7043	1.8+1%	80	84
AGH120020+AG11011	1.8+1%	80	80
AGH120020+AG13061	1.8+1%	80	81
AGH120020+AG13063	1.8+1%	80	80
CV		0	2
LSD 5%		0	2

AGH120020 plus Class Act was identified as the standard. This treatment gave 80% control. Wild oat control was very consistent across treatments. Only AG7043 resulted in better control of wild oat with AGH120020, but the improvement was only to 84% control.

Wild Oat control with propoxycarbazone and mesosulfuron and adjuvants. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 14 near Fargo. Treatments were applied to 5 leaf wheat and 4 leaf wild oat on June 12 with 69°F, 59% relative humidity, 100% cloud-cover, 8 to 11 mph Northeast wind, and moist soil at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/28 Wioa	7/10 Wioa
	oz/A	%	%
Prcz&Mess+Brox&Flox	0.2+5	70	58
Prcz&Mess+Brox&Flox+Class Act+Interlock	0.2+5+2.5%+4	80	79
Prcz&Mess+Brox&Flox+AG08034+Interlock	0.2+5+1%+4	75	70
Prcz&Mess+Brox&Flox+AG08034+AG8050	0.2+5+1%+6.4	76	76
Prcz&Mess+Brox&Flox+AG7043	0.2+5+1%	76	76
Prcz&Mess+Brox&Flox+AG11011	0.2+5+1%	78	78
Prcz&Mess+Brox&Flox+AG13061	0.2+5+1%	76	73
Prcz&Mess+Brox&Flox+AG13063	0.2+5+1%	74	63
Prcz&Mess+Brox&Flox+MSO	0.2+5+24	78	84
Prcz&Mess+Brox&Flox+NIS+UAN	0.2+5+0.25%+32	75	63
CV		4	6
LSD 5%		4	6

All adjuvants enhanced control of the herbicide by 4 to 10 percentage points on June 28. By July 10, herbicide alone gave only 58% wild oat control. Herbicide was enhanced most by the addition of MSO resulting in 84% control. Treatments with Class Act plus Interlock or AG11011 gave similar control to the treatment with MSO, but wild oat control was less than 80%. Several other adjuvants enhanced the activity of herbicides. While treatments with AG13063 or NIS plus UAN were numerically larger than herbicides alone, values were not different.

Wild oat control with pyroxsulam and adjuvants. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 14 near Fargo. Treatments were applied to 4 leaf wheat and wild oat on June 12 with 67°F, 66% relative humidity, 100% cloud-cover, 1 mph wind at 360°, and moist soil at 61°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/28 Wioa	7/10 Wioa
	oz/A	%	%
PxIm&Flas&Flox	1.67	80	73
PxIm&Flas&Flox+Class Act+Interlock	1.67+2.5%+4	80	78
PxIm&Flas&Flox+AG08034+Interlock	1.67+1%+4	80	74
PxIm&Flas&Flox+AG08034+AG8050	1.67+1%+6.4	80	79
PxIm&Flas&Flox+AG7043	1.67+1%	80	74
PxIm&Flas&Flox+AG11011	1.67+1%	80	81
PxIm&Flas&Flox+AG13061	1.67+1%	80	73
PxIm&Flas&Flox+AG13063	1.67+1%	80	71
PxIm&Flas&Flox+MSO	1.67+24	80	80
PxIm&Flas&Flox+NIS+AMS	1.67+0.25%+24	80	78
CV		0	4
LSD 5%		0	4

Pyroxsulam premix alone gave 73% control of wild oat. Addition of AG11011 improved control of wild oat with pyroxsulam to 81%. Treatments that included Class Act plus Interlock, AG08034 plus AG8050, MSO, or NIS plus AMS gave similar control to the treatment with AG11011 and also had greater control than the premix alone. All other treatments were similar to the premix alone.

Wild Oat control with thiencarbazone and adjuvants. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 14 near Fargo. Treatments were applied to 5 leaf wheat and 4 leaf wild oat on June 12 with 70°F, 55% relative humidity, 100% cloud-cover, 6 to 7 mph wind at 10°, and moist soil at 64°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	6/28 Wioa	7/10 Wioa
	oz/A	%	%
Brox&Pyst&Thcz	3	76	74
Brox&Pyst&Thcz+Class Act+Interlock	3+2.5%+4	80	74
Brox&Pyst&Thcz+AG08034+Interlock	3+1%+4	78	80
Brox&Pyst&Thcz+AG08034+AG8050	3+1%+6.4	81	85
Brox&Pyst&Thcz+AG7043	3+1%	79	78
Brox&Pyst&Thcz+AG11011	3+1%	83	66
Brox&Pyst&Thcz+AG13061	3+1%	80	75
Brox&Pyst&Thcz+AG13063	3+1%	79	74
Brox&Pyst&Thcz+MSO	3+24	78	78
CV		5	6
LSD 5%		6	7

Wild oat control with the thiencarbazone premix alone was 74% on July 10. Only AG08034 plus Interlock enhanced the activity of thiencarbazone, 85%. Ag11011 reduced wild oat control with thiencarbazone to 66% even though this treatment provided the greatest control value earlier in the season.

Herbicide timing for yellow foxtail control with ALS-inhibiting herbicides. Howatt, Roach, and Harrington. Proper hard red spring wheat was seeded May 16 near Fargo. Spike treatments were applied to 1 leaf wheat, cotyledon redroot pigweed and Venice mallow, and 2 leaf common cocklebur and yellow foxtail on June 7 with 70°F, 50% relative humidity, 30% cloud-cover. 6 mph wind at 225°, and moist soil at 60°F. 1 to 2 leaf treatments were applied to 3 leaf wheat, 1 to 3 leaf yellow foxtail and Venice mallow, 1 inch redroot pigweed, and 4 leaf common cocklebur on June 14 with 66°F, 65% relative humidity, 60% cloud-cover, 6 to 13 mph at 160°, and damp soil at 67°F. 1T treatments were applied to tillered wheat, 6 leaf redroot pigweed and common cocklebur, and 3 to 4 leaf yellow foxtail and Venice mallow on July 1 with 67°F, 76% relative humidity, clear sky, 1 to 4 mph wind at 45°, moist soil at 69°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wild area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Timing	7/2 Yeft	7/11 Yeft	7/11 Rrpw	7/11 Cocb	7/11 Vema	7/19 Yeft	7/29 Yeft
	oz/A		%	%	%	%	%	%	%
Flcz2.0+BB	0.33+1%	Spike	83	85	98	45	93	88	84
Flcz2.0+BB	0.42+1%	Spike	89	91	99	49	96	92	93
Flcz2.0+ARY547+BB	0.33+0.2+1%	Spike	89	90	98	48	97	91	93
Pxlm&Flas&Flox+BB	1.67+1%	Spike	90	91	94	80	95	89	90
Brox&Pyst&Thcz	3	Spike	88	88	99	89	97	89	91
Flcz2.0+BB	0.33+1%	1-2lf	84	83	95	77	85	84	88
Flcz2.0+BB	0.42+1%	1-2lf	85	85	98	80	88	85	87
Flcz2.0+ARY547+BB	0.33+0.2+1%	1-2lf	88	87	97	80	94	89	90
Pxlm&Flas&Flox+BB	1.67+1%	1-2lf	87	88	97	91	95	88	91
Brox&Pyst&Thcz	3	1-2lf	87	89	98	94	95	88	93
Flcz2.0+BB	0.33+1%	1T	0	48	50	40	45	70	73
Flcz2.0+BB	0.42+1%	1T	0	48	45	43	45	74	80
Flcz2.0+ARY547+BB	0.33+0.2+1%	1T	0	45	48	53	45	83	84
Pxlm&Flas&Flox+BB	1.67+1%	1T	0	58	48	52	55	81	82
Brox&Pyst&Thcz	3	1T	0	58	53	64	55	81	90
Untreated Check	0		0	0	0	0	0	0	0
CV			7	7	7	21	7	10	5
LSD 5%			5	7	7	18	8	11	5

Treatments provided 94 to 99% control of redroot pigweed when applied at the spike or 2 leaf timings. All treatments provided greater than 90% control of Venice mallow only when applied at the spike timing. Flucarbazone control of Venice mallow dropped to an average of 86% when applied at the 2 leaf stage. Control of common cocklebur generally was better and more consistent across treatments when applied at the 2 leaf stage rather than the spike stage. Control of broadleaf weeds generally was only 50% when timing was delayed until tillering.

Thiencarbazone provided consistent control of yellow foxtail, 91%, across all three timings on July 29. Pyroxsulamprovided 90% control at spike or 2 leaf application but only 82% control after tillering. Flucarbazone activity was enhanced with the higher use rate or with the inclusion of ARY547 (contains tribenuron). But flucarbazone control of yellow foxtail was most subject to growth stage. Control with flucarbazone at 0.42 oz/A changed from 93% at spike to 87% at 2 leaf to 80% at tillering. Early application is important for maximum efficacy.

Effect of application timing on grass control in HRSW with Everest 2.0, GoldSky, and Huskie Complete. (Jenks, Walter, and Willoughby). The objective of this study was to determine the effect of application timing on foxtail control with Group 2 herbicides (Everest 2.0, GoldSky, and Huskie Complete). The same 5 treatments were applied at three different timings (2-leaf on June 13 and 68° F; 3-leaf on June 19 and 74° F; and 4-leaf on June 24 and 84° F). Yellow foxtail was 1-2, 3-4, and 3-7 inches on these days, respectively. All treatments tended to provide better foxtail control with the later timings. Crop yield also tended to increase with the later timings. Early-season cool temperatures and frequent rainfall events may have delayed and prolonged weed germination.

Table. Effect of application timing on grass control in HRSW with Everest 2.0, GoldSky, and Huskie Complete. (1304)

			Weed Control			HRSW	
			Yellow foxtail			Yield	Test wt.
Treatment[a]	Rate	Timing	Jul-2	Jul-16	Aug-3	Sep-12	Sep-12
			----------%----------			bu/A	lb/bu
Untreated			0	0	0	49.8	61.0
Everest 2.0[a]	0.75 fl oz	2-leaf	87	71	68	56.3	61.3
Everest 2.0[a]	1 fl oz	2-leaf	89	80	75	55.0	61.8
Everest 2.0 + ARY-0547-102[a]	0.75 fl oz + 0.4 oz	2-leaf	90	84	81	57.5	61.9
GoldSky[a]	1 pt	2-leaf	95	84	80	60.4	62.0
Huskie Complete	13.7 fl oz	2-leaf	94	93	87	56.8	61.9
Everest 2.0[a]	0.75 fl oz	3-leaf	89	80	79	56.1	61.5
Everest 2.0[a]	1 fl oz	3-leaf	91	85	80	58.5	61.0
Everest 2.0 + ARY-0547-102[a]	0.75 fl oz + 0.4 oz	3-leaf	91	85	78	58.2	60.6
GoldSky[a]	1 pt	3-leaf	96	96	94	62.1	61.7
Huskie Complete	13.7 fl oz	3-leaf	93	90	84	56.4	61.5
Everest 2.0[a]	0.75 fl oz	4-leaf	72	79	87	60.0	62.3
Everest 2.0[a]	1 fl oz	4-leaf	75	87	89	63.0	62.9
Everest 2.0 + ARY-0547-102[a]	0.75 fl oz + 0.4 oz	4-leaf	81	87	89	55.2	62.0
GoldSky[a]	1 pt	4-leaf	84	95	93	62.1	61.7
Huskie Complete	13.7 fl oz	4-leaf	81	90	89	57.8	62.2
LSD (0.05)			6.5	12.3	15.1	NS	NS
CV			4.8	9.2	11.5	13.3	1.3

[a] *Everest and GoldSky applied with Quad 7 (1%)*

Yellow foxtail control with Rimfire Max, Huskie Complete, and Varro. (Jenks, Walter, and Willoughby). The objective of the study was to evaluate foxtail control with three grass herbicides (Rimfire Max, Huskie Complete, and Varro). Huskie Complete is a combination of Huskie (broadleaf herbicide) and Varro (grass herbicide). All treatments were applied June 24 to 4-leaf wheat and 1-4 leaf foxtail. None of the treatments caused crop injury. Rimfire Max tank mixed with Huskie provided poor yellow foxtail control, while Rimfire tank mixed with Affinity provided good yellow foxtail control (89%). Historically, we haven't seen this level of enhanced foxtail control with Rimfire + Affinity. Normally, we have seen only 5-15% higher control with this tank mix over Rimfire alone. Varro, Huskie Complete, and Wolverine provided excellent yellow foxtail control.

Table. Yellow foxtail control with Rimfire Max, Huskie Complete, and Varro. (1326)

		Injury		Weed Control	
		Wheat		Yellow foxtail	
Treatment[ab]	Rate	Jul-3	Jul-18	Jul-18	Aug-8
		-----%-------		-------%------	
Untreated		0	0	0	0
RM + Huskie + BB	3 oz + 11 fl oz + 1%	1	0	50	42
RM + Huskie + HSOC	3 oz + 11 fl oz + 0.75 pt	0	0	33	47
RM + Affinity + Starane Ultra + BB	3 oz + 0.6 oz + 0.27 pt + 1%	0	0	65	89
Varro + Bison Advanced	6.85 fl oz + 0.8 pt	0	0	83	93
Varro + Huskie	6.85 fl oz + 11 fl oz	0	0	87	97
Huskie Complete + AMS	13.7 fl oz + 1.47%	0	0	82	97
Wolverine	27.4 fl oz	0	0	69	93
LSD (0.05)		0.7	NS	23.3	10.6
CV		132.3	0.0	22.6	8.6

[a] *All treatments applied at 4-leaf wheat*

[b] *RM=Rimfire Max; Affinity=Affinity Tank Mix; BB=Basic Blend (Quad 7)*

Weed and crop response to Huskie Complete tank-mixes. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 near Fargo. Treatments were applied to 4 leaf wheat, 2 to 3 leaf yellow foxtail, 2 to 4 leaf common cocklebur, and 1 leaf redroot pigweed on June 17 with 72°F, 62% relative humidity, 10% cloud-cover, 7 mph wind at 360°, and dry soil at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/2 Wht	7/2 Yeft	7/2 Rrpw	7/2 Cocb	7/15 Wht	7/15 Yeft
	oz/A	%	%	%	%	%	%
Brox&Pyst&Thcz	3	2	85	96	95	0	83
Brox&Pyst&Thcz+Thif sg+Trib sg	3+0.25+0.25	5	89	94	94	0	88
Brox&Pyst&Thcz+Thif sg+Trib sg	3+0.53+0.14	2	91	99	97	0	92
Brox&Pyst&Thcz+Thif sg+Trib sg	3+0.1+0.4	4	92	99	98	0	85
Brox&Pyst&Thcz+Trib sg	3+0.5	2	88	95	95	0	91
Brox&Pyst&Thcz+Pyraclostrobin	3+2.4	2	85	98	97	0	83
Brox&Pyst&Thcz+Thif sg+Trib sg+Pyrac	3+0.25+0.25+2.4	1	85	94	94	0	85
Brox&Pyst&Thcz+MCPA	3+6	3	86	98	98	0	81
Brox&Pyst&Thcz+MCPA+Pyrac	3+6+2.4	2	88	96	94	0	90
Brox&Pyst&Thcz+MCPA+Thif sg+Trib sg	3+6+0.25+0.25	2	94	99	99	0	90
Brox&Pyst&Thcz+MCPA+Thif sg+Trib sg+Pyrac	3+6+0.25+0.25+2.4	2	87	97	97	0	91
Untreated Check	0	0	0	0	0	0	0
CV		108	4	3	3	0	4
LSD 5%		3	5	4	3	0	4

Wheat injury was expressed as stunting. Minor injury of 5% or less was not present at the July 15 evaluation. The premix alone (bromoxynil and pyrasulfotole and thiencarbazone) gave 95% control of broadleaf weeds present. Tankmixes were not necessary to control broadleaf weeds but the combinations, even with the fungicide pyraclostrobin, did not cause concern for injury. Thiencarbazone gave 83% control of yellow foxtail on June 15. Many of the treatments with tribenuron, which has been shown to increase yellow foxtail control with ALS grass herbicides, provided better control, 88 to 92%, than thiencarbazone premix alone.

Foxtail control with AGH120020 and Adjuvants. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 near Fargo. Treatments were applied to 4 leaf wheat and 3 to 4 leaf yellow foxtail on June 18 with 61°F, clear sky, 5 to 8 mph wind at 135° and dry surface soil at 65°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/2 Yeft	7/15 Yeft
	oz/A	%	%
AGH120020+Class Act	1.8+2.5%	53	58
AGH120020+Class Act+Interlock	1.8+2.5%+4	69	60
AGH120020+Thifsg+Tribsg+Class Act	1.8+0.24+0.06+2.5%	71	66
AGH120020+AG08034	1.8+1%	65	55
AGH120020+AG08034+Interlock	1.8+1%+4	69	66
AGH120020+AG08034+AG8050	1.8+1%+6.4	75	69
AGH120020+AG7043	1.8+1%	73	76
AGH120020+AG11011	1.8+1%	76	70
AGH120020+AG13061	1.8+1%	65	60
AGH120020+AG13063	1.8+1%	68	66
CV		6	11
LSD 5%		6	10

All adjuvants enhabced early response of yellow foxtail to AGH120020 compared to the standard of Class Act. But final control rating on July 15 was more discriminating. The standard gave 58% control. AG7043 was the best adjuvant for AGH120020 resulting in 76% control. This was not an exceptional value but the size of yellow foxtail was allowed to get larger than recommended to accentuate differences in the adjuvant systems. AG11011 or AG08034 plus AG8050 gave similar enhancement of herbicide activity with slightly lower numerical values for control, 70 and 69%, respectively. All other adjuvants were not different than Class Act, although control with AGH120020 tended to be greater than with the standard.

Foxtail control with Propoxycarbazone&Mesosulfuron and adjuvants. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 near Fargo. Treatments were applied to 4 leaf wheat and 2 to 3 leaf yellow foxtail on June 17 with 67°F, 66% relative humidity, 30% cloud-cover, 6 mph wind at 315°, and dry soil at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/2 Wht	7/2 Yeft	7/15 Wht	7/15 Yeft
	oz/A	%	%	%	%
Prcz&Mess+Brox&Flox	0.2+5	7	49	5	28
Prcz&Mess+Brox&Flox+Class Act+Interlock	0.2+5+2.5%+4	11	61	5	50
Prcz&Mess+Brox&Flox+AG08034+Interlock	0.2+5+1%+4	8	65	5	50
Prcz&Mess+Brox&Flox+AG08034+AG8050	0.2+5+1%+6.4	7	68	7	45
Prcz&Mess+Brox&Flox+AG7043	0.2+5+1%	12	68	6	55
Prcz&Mess+Brox&Flox+AG11011	0.2+5+1%	16	81	8	75
Prcz&Mess+Brox&Flox+AG13061	0.2+5+1%	15	75	5	55
Prcz&Mess+Brox&Flox+AG13063	0.2+5+1%	7	59	6	45
Prcz&Mess+Brox&Flox+MSO	0.2+5+24	8	73	7	63
Prcz&Mess+Brox&Flox+NIS+UAN	0.2+5+0.25%+32	9	73	8	70
CV		35	13	33	21
LSD 5%		5	12	3	16

Yellow foxtail was allowed to get larger than recommended to accentuate differences in the herbicide-enhancing properties of the adjuvants. All treatments produced stunting injury that persisted. Wheat injury was greater on July 2 with the inclusion of AG7043, AG11011, or AG13061 than when herbicide alone was applied. Injury was essentially similar across all treatments on July 15, 5 to 8% stunting. Herbicide alone gave 28% control of yellow foxtail on July 15. All adjuvant treatments improved control with herbicide. AG11011 enhanced herbicide control to 75%. The treatment with NIS and UAN, 70% control, or MSO, 63% control, provided similar control to AH11011.

Foxtail control with Pyroxsulam and adjuvants. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 near Fargo. Treatments were applied to 5 leaf wheat and 3 leaf yellow foxtail on June 18 with 71°F, 60% relative humidity, clear sky, 3 mph wind at 135°, and dry soil at 64°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/2 Yeft	7/15 Yeft
	oz/A	%	%
Pxlm&Flas&Flox	1.67	73	79
Pxlm&Flas&Flox+Class Act+Interlock	1.67+2.5%+4	85	89
Pxlm&Flas&Flox+AG08034+Interlock	1.67+1%+4	83	86
Pxlm&Flas&Flox+AG08034+AG8050	1.67+1%+6.4	80	84
Pxlm&Flas&Flox+AG7043	1.67+1%	84	85
Pxlm&Flas&Flox+AG11011	1.67+1%	85	88
Pxlm&Flas&Flox+AG13061	1.67+1%	76	80
Pxlm&Flas&Flox+AG13063	1.67+1%	85	84
Pxlm&Flas&Flox+MSO	1.67+24	89	90
Pxlm&Flas&Flox+NIS+AMS	1.67+0.25%+24	86	93
CV		5	5
LSD 5%		6	6

Yellow foxtail was allowed to get larger than recommended to accentuate differences in the herbicide-enhancing properties of the adjuvants. Control ratings were slightly more on July15 than July 2 although rank of treatments was essentially the same. Pyroxsulam without additional adjuvant gave 79% control July 15. The herbicide plus NIS and AMS provided 93% control of yellow foxtail. AMS has provided benefit to other ALS-herbicides for yellow foxtail control. MSO, AG1101, and Class Act plus Interlock had similar adjuvant benefit to NIS plus AMS for pyroxsulam activity. AG08034 plus interlock and AG7043 enhanced pyroxsulam activity but gave less control than NIS plus AMS. Other treatments were similar to pyroxsulam alone.

Foxtail control with thiencarbazone and adjuvants. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 16 near Fargo. Treatments were applied to 4 leaf wheat and 2 to 4 leaf yellow foxtail on June 18 with 61°F, 75% relative humidity, clear sky, 5 to 8 mph wind at 135°, and dry surface soil at 65°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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	7/2 Yeft	7/15 Yeft
	oz/A	%	%
Brox&Pyst&Thcz	3	76	79
Brox&Pyst&Thcz+Class Act+Interlock	3+2.5%+4	81	88
Brox&Pyst&Thcz+AG08034+Interlock	3+1%+4	83	84
Brox&Pyst&Thcz+AG08034+AG8050	3+1%+6.4	83	80
Brox&Pyst&Thcz+AG7043	3+1%	85	86
Brox&Pyst&Thcz+AG11011	3+1%	79	84
Brox&Pyst&Thcz+AG13061	3+1%	81	84
Brox&Pyst&Thcz+AG13063	3+1%	73	58
Brox&Pyst&Thcz+MSO	3+24	84	84
CV		4	8
LSD 5%		4	9

Yellow foxtail was allowed to get larger than recommended to accentuate differences in the herbicide-enhancing properties of the adjuvants. Thiencarbazone gave 79% control of yellow foxtail on July 15. Addition of Class Act plus Interlock to thiencarbazone provided enhancement of herbicide activity to 88%. Other treatments were similar to thiencarbazone alone except thiencarbazone plus AG13063 which reduced control of yellow foxtail to 58%.

Green Foxtail control with thiencarbazone. Howatt, Roach, and Harrington. Prosper hard red spring wheat was seeded May 13 at Fargo. Treatments were applied to 4 leaf wheat, 4 to 6 leaf wild buckwheat and wild mustard, 1 to 2 leaf green foxtail, and 2 leaf common ragweed on June 11 with 75°F, 58% relative humidity, 60% cloud-cover, 2 mph wind at 360°, moist soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 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.

Table 1. Early season wheat response and weed control.

Treatment	Rate	6/13 Wht	6/18 Wht	6/18 Wimu	6/18 Corw	6/18 Vema	6/18 Wibw	6/18 Grft
	oz/A	%	%	%	%	%	%	%
Prcz&Mess+Brox&Pyst+BB	0.2+2.9+1%	6	13	98	98	88	95	74
Prcz&Mess+Brox&Pyst+ HSOC	0.2+2.9+12	5	11	99	96	89	95	69
Prcz&Mess+Thif-sg+Trib-sg+Flox+BB	0.2+0.24+0.06+1+1%	5	26	76	68	74	74	63
Thcz+Brox&MCPA5	0.072+8	3	0	98	88	84	93	90
Thcz+Brox&Pyst	0.072+2.9	3	0	99	93	84	93	90
Brox&Pyst&Thcz+AMS	3+8	4	0	99	96	89	95	89
Fenx&Brox&Pyrst	3.9	4	0	99	98	86	92	91
Flcz+Thif-sg+Trib-sg+Flox+BB	0.23+0.24+0.06+1+1%	5	0	79	69	80	74	85
Untreated Check	0	0	0	0	0	0	0	0
CV		37	34	2	5	3	4	6
LSD 5%		2	3	2	7	4	5	6

Injury with all herbicide treatments manifested as mainly chlorosis of 3 to 6% injury 2 DAT (Table 1). This response was not present 7DAT but stunting was recorded for treatments that included propoxycarbazone and mesosulfuron. This grass herbicide has caused injury in the past, especially when cool and wet soil conditions persist. Injury was greater when the broadleaf partner was also ALS-inhibitor, 26% injury with thifensulfuron and tribenuron compared with 12% injury with bromoxynil and pyrasulfotole. A heavy rain event in June accentuated the injury, resulting in as much as 84% injury in July (Table 2). By the end of July, wheat treated with propoxycarbazone and mesosulfuron plus thifensulfuron and tribenuron appeared to be recovering (Table 2), but wheat yield was 35% less than wheat treated with other herbicides (Table 3). Wheat expressing in excess of 80% injury when treated with propoxycarbazone and mesosulfuron plus thifensulfuron and tribenuron suffered severe stand loss in addition to stunting and head damage (Table 2), leading to 86% less grain yield than the highest-yielding treatment (Table 3).

Broadleaf weed control was a little slower to develop with treatments that included thifensulfuron and tribenuron (Tables 1 and 2), but all treatments except propoxycarbazone and mesosulfuron plus thifensulfuron and tribenuron provided excellent control of the broadleaf weeds present (Table 3).

Green foxtail control with thiencarbazone or fenoxaprop was near 90% 7 DAT (Table 1). Flucarbazone gave 85% control. Thiencarbazone or flucarbazone provided the best control of green foxtail in late July, but fenoxaprop also provided 98% control (Table 3). The presence of wild oat was noticed in late July. All treatments including ALS-inhibiting grass herbicides provided 99% control of wild oat with fenoxaprop giving only 91% control. Thiencarbazone combinations did not cause injury to wheat and generally gave excellent weed control.

Table 2. Mid-season wheat response and weed control.

Treatment	Rate	7/3 Wht	7/3 Wimu	7/3 Corw	7/3 Vema	7/3 Wibw	7/3 Grft	7/23 Wht
	oz/A	%	%	%	%	%	%	%
Prcz&Mess+Brox&Pyst+BB	0.2+2.9+1%	35	99	96	92	96	92	15
Prcz&Mess+Brox&Pyst+ HSOC	0.2+2.9+12	35	99	96	90	95	85	10
Prcz&Mess+Thif-sg+Trib-sg+Flox+BB	0.2+0.24+0.06+1+1%	84	99	85	89	92	83	81
Thcz+Brox&MCPA5	0.072+8	0	99	89	88	93	95	0
Thcz+Brox&Pyst	0.072+2.9	0	99	96	95	96	95	0
Brox&Pyst&Thcz+AMS	3+8	0	99	95	90	94	92	0
Fenx&Brox&Pyrst	3.9	0	99	95	93	89	94	0
Flcz+Thif-sg+Trib-sg+Flox+BB	0.23+0.24+0.06+1+1%	0	99	89	92	96	91	0
Untreated Check	0	0	0	0	0	0	0	0
CV		19	1	6	4	4	6	24
LSD 5%		5	1	7	5	5	7	4

Table 3. Late season weed control and wheat grain yield.

Treatment	Rate	7/23 Wioa	7/23 Grft	7/23 Vema	7/23 Corw	7/23 Wibw	8/16 Yield
	oz/A	%	%	%	%	%	bu/A
Prcz&Mess+Brox&Pyst+BB	0.2+2.9+1%	99	0	93	95	94	39
Prcz&Mess+Brox&Pyst+ HSOC	0.2+2.9+12	99	0	94	96	87	46
Prcz&Mess+Thif-sg+Trib-sg+Flox+BB	0.2+0.24+0.06+1+1%	99	0	86	55	85	9
Thcz+Brox&MCPA5	0.072+8	99	98	94	93	95	66
Thcz+Brox&Pyst	0.072+2.9	99	99	97	98	96	66
Brox&Pyst&Thcz+AMS	3+8	99	99	99	99	98	62
Fenx&Brox&Pyrst	3.9	91	97	94	98	95	60
Flcz+Thif-sg+Trib-sg+Flox+BB	0.23+0.24+0.06+1+1%	99	99	96	94	98	63
Untreated Check	0	0	0	0	0	0	55
CV		3	2	4	6	6	15
LSD 5%		4	1	5	8	7	13

Foxtail barley control with Roundup, Olympus, Rimfire Max, and Huskie Complete tank mixes applied in the fall or spring. (Jenks, Walter, and Willoughby). The objective of the study was to evaluate fall- or spring-applied herbicides for foxtail barley control. Fall treatments were applied October 1, 2012 to 3- to 6-inch foxtail barley (up to 3 per sq ft). A blanket glyphosate application was made over the entire study on May 29, 2013. Postemergence treatments were applied June 27, 2013.

Glyphosate and Olympus applied in the fall provided good foxtail barley suppression (65-81%) at the June 1 evaluation. Fall treatments followed by spring treatments containing propoxycarbazone (Rimfire Max and Olympus) provided excellent foxtail barley control (99%).

Table. Foxtail barley control with Roundup, Olympus, and Huskie Complete tank mixes applied in the fall or spring. (1332)

			Weed Control		
			Foxtail barley		
Treatment[a]	Rate	Timing	Jun-1	Jul-10	Aug-1
			----------%----------		
Gly / Huskie[b]	28 oz / 13.5 oz	Fall/POST	68	83	68
Gly + Olympus / Huskie Complete[b]	28 oz + 0.2 oz / 13.7 oz	Fall/POST	66	97	89
Gly + Olympus / Rimfire Max + Huskie[c]	28 oz + 0.2 oz / 3 oz + 13.5 oz	Fall/POST	73	99	99
Gly + Olympus / Huskie Complete + Olympus[b]	28 oz + 0.2 oz / 13.7 oz + 0.2 oz	Fall/POST	76	99	99
Gly + Olympus / Huskie Complete[b]	28 oz + 0.4 oz / 13.7 oz	Fall/POST	76	99	96
Gly + Olympus / Rimfire Max + Huskie[c]	28 oz + 0.4 oz / 3 oz + 13.5 oz	Fall/POST	81	99	99
Gly + Olympus / Huskie Complete + Olympus[b]	28 oz + 0.4 oz / 13.7 oz + 0.2 oz	Fall/POST	81	99	99
Gly / Huskie Complete + AMS	28 oz / 13.7 oz + 5%	Fall/POST	70	96	87
Gly / Rimfire Max + Huskie[c]	28 oz / 3 oz + 13.5 oz	Fall/POST	65	97	99
Gly / Huskie Complete + Olympus[b]	28 oz / 13.7 oz + 0.2 oz	Fall/POST	65	99	99
LSD (0.05)			7.6	7.2	7.4
CV			7.3	5.1	5.5

[a] *Gly=Glyphosate applied with AMS (5.0%)*

[b] *Applied with AMS (1.47%)*

[c] *Applied with MSO (1.3 pt)*

Foxtail barley control with Huskie Complete and Olympus (spring applied). (Jenks, Walter, and Willoughby). The objective of the study was to evaluate preplant and postemergence herbicides for foxtail barley control. Preplant treatments were applied May 17 to 3- to 5-inch foxtail barley (1 per ft^2). Spring wheat was seeded May 29. Postemergence treatments were applied June 18 to 4-leaf wheat. All preplant treatments were applied with glyphosate at 16 fl oz. None of the treatments caused significant crop injury. We received over 4 inches of rain within three days after the preplant application, which may have affected residual control. Treatments containing Huskie Complete provided about 70% foxtail barley control. However, POST tank mixes containing Olympus or Rimfire Max provided 85-87% foxtail barley control. Olympus and Rimfire Max both contain propoxycarbazone, which is likely the component enhancing the foxtail barley control. Olympus applied preplant did not enhance control as it did POST.

Table. Foxtail barley control with Huskie Complete and Olympus (spring applied). (1315)

Treatment[ab]	Rate	Timing[a]	Foxtail barley control			
			Jun-7	Jun-19	Jul-9	Aug-1
			----------%----------			
Gly / Huskie[c]	16 oz / 11 oz	PP / POST	85	77	57	35
Gly / HC	16 oz / 13.7 oz	PP / POST	85	78	78	71
Gly / HC[c]	16 oz / 13.7 oz	PP / POST	85	78	79	70
Gly / HC + Oly + AMS	16 oz / 13.7 oz +0.2 oz + 5 %	PP / POST	86	79	85	85
Gly + Oly / HC[c]	16 oz + 0.2 oz /13.7 oz	PP / POST	86	81	79	72
Gly + Oly / HC + Oly[c]	16 oz + 0.2 oz / 13.7 oz + 0.2 oz	PP / POST	87	81	86	86
Gly / RM + Huskie[b]	16 oz / 3 oz + 11 oz	PP / POST	86	80	83	85
Gly + Oly / RM + Huskie[b]	16 oz + 0.2 oz / 3 oz + 11 oz	PP / POST	86	81	85	87
Gly / Ever 2.0 + Huskie[e]	16 oz / 1 oz + 11 oz	PP / POST	85	78	70	64
Gly + PreP / Ever 2.0 + Huskie[e]	16 oz + 0.3 oz / 0.5 oz + 11 oz	PP / POST	81	74	66	56
LSD (0.05)			2.2	NS	4.9	5.2
CV			1.9	3.9	3.7	5.2

[a] *Gly= Roundup WeatherMax (16 fl oz) applied preplant (PP) with AMS (5%)*

[b] *HC=Huskie Complete; Ever 2.0=Everest 2.0; RM=Rimfire Max; RU=Roundup; PreP=Pre-Pare; Oly=Olympus*

[c] *Applied with AMS (1.47%)*

[d] *Applied with MSO (1.3 pt)*

[e] *Applied with NIS (0.25%)*

Drought conditions in barley. Howatt, Roach, and Harrington. Innovation barley was seeded May 28 near Montpeliar, North Dakota. Treatments (4L) were applied to 4 leaf barley on June 28 with 72°F, 57% relative humidity, clear sky, 10 to 12 mph wind at 315°, and dry soil at 70°F, Joint treatment was applied to jointing barley on July 9 with 73°F, 58% relative humidity, 50% cloud-cover, 5 mph wind at 315°, and dry soil at 74°F. Fluroxypyr at 2 oz/A and tribenuron at 0.14 oz/A were applied to the entire study area to control kochia and volunteer soybean. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate		7/3 Bar	7/9 Bar	7/16 Bar	7/30 Bar
Trinexapac	0.75	4L	0	0	0	0
Trinexapac	1.79	4L	0	0	0	0
Trinexapac+Cyproconazole	0.75+0.42	4L	0	0	0	0
Trinexapac+Propiconazole	0.75+0.89	4L	0	0	0	0
Trinexapac/Trinexapac	0.75/0.88	4L/joint	0	0	0	0
Untreated Check	0		0	0	0	0
CV			0.0	0.0	0.0	0.0
LSD 5%			0.0	0.0	0.0	0.0

Treatments did not cause injury or adverse growth. Herbicide residue from the previous year became apparent midseason and prevented continuation of evaluation through harvest.

Post harvest control of glyphosate-resistant kochia. Howatt, Roach, and Harrington. Innovation barley was seeded May 28 near Montpeliar, North Dakota. Treatments were applied to harvested barley and 12 to 18 inch kochia on August 22 with 70°F, 42% relative humidity, 5% clouds, 6 to 8 mph wind at 90°, and dry soil at 70°F. Treatment components were mixed in the order listed. Treatments were applied with a backpack sprayer delivering 17 gpa at 35 psi 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	9/11 Kocz	9/25 Kocz
	oz/A	%	%
NPak AMS+Glyt4.17	2.5%+16.7	13	35
Induce NIS+Para	0.25%+12	94	94
Dica+Induce NIS	8+0.25%	38	64
Induce NIS+Dica+Para	0.25%+8+8	95	95
NPakAMS+Induce NIS+Trib sg+Para	4%+0.25%+0.4+12	94	94
NPak AMS+Saff+Dica+MSO	2.5%+0.36+8+1%	83	86
Dica&Flox+Induce NIS	2.6+0.25%	33	65
Flas&MCPA+Dica&Flox+Induce NIS	5+2.6+0.25%	35	60
Induce NIS+Linuron+Para	0.25%+8+12	96	96
NPakAMS+Brox&Pyst+Flox+Induce NIS	1%+2.9+1.5+0.25%	80	84
Induce NIS+Atra+Para	0.25%+4+12	97	96
Induce NIS+Metr+Para	0.25%+8+12	99	99
NPak AMS+Temb+Atra+MSO	2.5%+1.3+4+1%	74	76
Untreated Check	0	0	0
		5	5
		5	6

Only treatments with paraquat provided 94% or better control of kochia. Combinations with paraquat provided similar control to paraquat alone with slight differences in growth from the base of kochia plants. Paraquat plus metribuzin resulted in the cleanest plots, 99% control, because no green tissue was present on kochia. Saflufenacil and dicamba or bromoxynil and pyrasulfotole plus fluroxypyr gave similar control of about 85% and other treatments gave 76% control or less. Post harvest control of glyphosate-resistant kochia should include paraquat for optimal activity with translocating tankmix partner to help inhibit growth from meristems at the base of the plant.

Kochia control post wheat harvest. Howatt, Roach, and Harrington. Innovation barley was seeded May 28 near Montpeliar, North Dakota. POST treatments were applied to 3 leaf barley and 1 to 6 inch kochia on July 2 with 85°F, 48% relative humidity, 20% cloud-cover, 1 to 2 mph wind at 315°, and dry soil. PHAR (post harvest) treatments were applied to harvested barley and 12 to 18 inch kochia on August 22 with 70°F, 42% relative humidity, 5% clouds, 6 to 8 mph wind at 90°, and dry soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi though TT11001 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	Appl Code	7/16 Barley	7/16 Kocz	9/11 Kocz	9/25 Kocz
	oz/A		%	%	%	%
Dica+2,4-DeLV/ Dica+2,4-DeLV+ AMS+NIS	2+6/ 8+8+40+0.125%	POST/ PHAR	0	75	96	94
Dica+2,4-DeLV+Metr/ Dica+2,4-DeLV+AMS+NIS	2+6+3.7/ 8+8+40+0.125%	POST/ PHAR	25	66	93	96
Dica+Metr/ Dica+2,4-DeLV+AMS+NIS	2+3.7/ 8+8+40+0.125%	POST/ PHAR	0	60	70	93
Dica+Brox&Pyst+NIS+AMS/ Dica+2,4-DeLV+AMS+NIS	2+3.8+0.25%+16/ 8+8+40+0.125%	POST/ PHAR	4	90	97	98
Dica+Trib+NIS/ Dica+2,4-DeLV+AMS+NIS	2+0.4+0.25%/ 8+8+40+0.125%	POST/ PHAR	0	74	96	95
Clpy&Flox/ Dica+2,4-DeLV+AMS+NIS	4/ 8+8+40+0.125%	POST/ PHAR	0	71	93	95
2,4-DeLV/ Dica&Diflu+Dica+2,4-DeLV+AMS+NIS	8/ 4.6+8+8+40+0.125%	POST/ PHAR	0	50	40	71
2,4-DeLV/ Dica+Atrazine+MSO	8/ 8+8+24	POST/ PHAR	0	53	85	90
2,4-DeLV/ Dica+Atra+Saff+MSO+UAN	8/ 8+8+0.72+24+2.5%	POST/ PHAR	0	53	94	91
2,4-DeLV/ Dica+Atra+Topr+MSO+UAN	8/ 8+8+0.35+24+2.5%	POST/ PHAR	0	55	84	88
2,4-DeLV/ Atrazine+Topr+MSO+UAN	8/ 8+0.35+24+2.5%	POST/ PHAR	0	53	93	93
2,4-DeLV/ Para+Atra+MSO	8/ 12+4+24	POST/ PHAR	0	50	96	92
2,4-DeLV/ Para+Linuron+NIS	8/ 12+12+0.5%	POST/ PHAR	0	50	98	97
2,4-DeLV/ Dica+2,4-DeLV+AMS+NIS	8/ 8+8+40+0.125%	POST/ PHAR	0	53	38	68
2,4-DeLV/ Para+MSO	8/ 12+24	POST/ PHAR	0	53	94	88
2,4-DeLV (as untreated)	8	POST	0	53	0	0
CV			66	7	5	4
LSD 5%			2	6	6	5

Dicamba plus bromoxynil and pyrasulfotole provided the best in-season control of kochia at 90% but caused slight barley injury, 4%. Metribuzin caused substantial barley injury, 25%, when 2,4-D ester and dicamba was included, but not when only dicamba was included. Also, addition of metribuzin resulted in less kochia control than with dicamba and 2,4-D. In-season control of at least 60% allowed for better post harvest kochia control. Dicamba and 2,4-D following 2,4-D gave 68%

post harvest kochia control, while dicamba and 2,4-D following bromoxynil and pyrasulfotole provided 98% control. Paraquat and linuron provided the best control, 97%, when only 2,4-D was used in-season. Paraquat alone initially was rated as 94% control but growth from buds at the base of the plant resulted in 88% control at the final evaluation. Atrazine was included in several treatments with average control of 91%.