Green section: **Weed Control in Small Grains** Page*

Green section: **Continued** Page

GWN10293 use in winter wheat. Howatt, Roach, and Harrington. Preemergence treatments were applied and winter wheat was seeded September 18 with 62°F, 87% relative humidity, cloudy sky, 2 mph wind at 180°, and moist soil at 60°F. Post treatments were applied on winter wheat at the 2 leaf stage, with no weeds present, October 9 with 53°F, 68% relative humidity, clear sky, 1 mph wind at 360°, and heavy dew covering plants and soil at 60°F. Treatments were applied with a backpack sprayer delivering 17 and 8.5 gpa at 38 and 35 psi through TT 11001 nozzles to a seven foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with 4 replicates.

Treatment	Rate	Stage	Wwht 1.5 L Injury 10/2	Wwht 2 L Injury 10/9	Wwht 3L/T Chlor 10/23	Wwht T Chlor 11/12	Corw 5/29	Fipc 5/29
	oz ai/A		%	%	%	%	%	%
Handweeded	0		0	0	0	0	0	0
GWN10293+NIS	1.06+0.25%	PRE	0	0	0	0	10	5
GWN10293+NIS	2.12+0.25%	PRE	0	0	0	0	61	22
GWN10293+NIS	3.18+0.25%	PRE	0	0	0	0	35	15
GWN10293+NIS	1.06+0.25%	POST	0	0	2	3	30	5
GWN10293+NIS	2.12+0.25%	POST	0	0	9	9	76	27
GWN10293+NIS	3.18+0.25%	POST	0	0	11	15	80	20
CV			0	0	34	43	28	71
LSD (P=0.05)			0	0	1	2	17	14

Preemergence treatments did not cause visible injury. Post emergence treatments caused chlorosis that increased with increasing GWN10293 rate. Stunting was not observed and chlorosis reached a maximum of 15% with the highest treatment rate. Winter weather caused severe plant loss across the entire study. This prevented spring evaluation of injury.

Common ragweed control in spring was greater with the later fall application of GWN10293, up to 80%. Field pennycress was controlled less than 30% by any rate of GWN10293.

Cereal response to GWN10293. Howatt, Roach, and Harrington. The experiment was established in the greenhouse, planting all species on September 26. Pre treatments were applied on September 27 with 60°F, moist soil, 70% relative humidity, cloudy sky and moist soil at 72°F. Post treatments were applied to 2 leaf species on October 10 with 64°F, 50% relative humidity, cloudy sky, and moist soil at 70°F. All treatments were applied with the cabinet sprayer delivering 10 gpa at 40 psi through 8001E nozzles. The experiment was a randomized design.

Table1 of 3

Treatment	Rate	Oat 10/4	Bar 10/4	Ww 10/4	Dur 10/4	Bartow 10/4	Faller 10/4	Prosper 10/4	Glen 10/4	Wioa 10/4	Grft 10/4
	oz ai/A	%	%	%	%	%	%	%	%	%	%
Handweeded		0	0	0	0	0	0	0	0	0	0
GWN10293+NIS	1.06+0.25%	2	3	3	3	3	8	7	22	40	72
GWN10293+NIS	2.12+0.25%	40	48	23	30	17	22	37	30	67	94
GWN10293+NIS	3.18+0.25%	32	48	47	43	28	33	35	38	86	92
Mesotrione+NIS	1.5+0.25%	8	48	48	50	43	10	80	90	92	95
GWN10293+NIS	1.06+0.25%										
GWN10293+NIS	2.12+0.25%										
GWN10293+NIS	3.18+0.25%										
Mesotrione+NIS	1.5+0.25%										
CV		143	119	125	136	127	111	103	87	52	23
LSD (P=0.05)		60	92	80	72	48	34	68	66	62	34

Table 2 of 3

Traetment	Rate	Oat 10/24	Bar 10/24	Ww 10/24	Dur 10/24	Bartow 10/24	Faller 10/24	Prosper 10/24	Glen 10/24	Wioa 10/24	Grft 10/24
	oz ai/A	%	%	%	%	%	%	%	%	%	%
Handweeded		0	0	0	0	0	0	0	0	0	0
GWN10293+NIS	1.06+0.25%	0	0	5	5	7	7	8	10	40	67
GWN10293+NIS	2.12+0.25%	0	3	7	8	15	13	13	13	50	82
GWN10293+NIS	3.18+0.25%	3	5	30	38	40	33	38	28	50	95
Mesotrione+NIS	1.5+0.25%	0	3	13	14	20	18	19	19	25	35
GWN10293+NIS	1.06+0.25%	0	0	0	0	0	0	0	0	0	43
GWN10293+NIS	2.12+0.25%	0	0	0	0	0	0	0	0	0	55
GWN10293+NIS	3.18+0.25%	0	0	0	0	0	0	0	0	0	63
Mesotrione+NIS	1.5+0.25%	0	0	0	2	9	9	18	18	7	18
CV		268	186	213	135	99	60	101	84	45	21
LSD (P=0.05)		2	4	22	17	17	9	19	14	15	18

Table 3 of 3

		Oat 11/7	Bar 11/7	Ww 11/7	Dur 11/7	Bartow 11/7	Faller 11/7	Prosper 11/7	Glen 11/7	Wioa 11/7	Grft 11/7
Treatment	Rate	%	%	%	%	%	%	%	%	%	%
Handweeded	0	0	0	0	0	0	0	0	0	0	0
GWN10293+NIS	1.06+0.25%										
GWN10293+NIS	2.12+0.25%										
GWN10293+NIS	3.18+0.25%										
Mesotrione+NIS	1.5+0.25%										
GWN10293+NIS	1.06+0.25%	0	0	0	0	0	0	0	0	0	40
GWN10293+NIS	2.12+0.25%	0	0	0	0	9	8	6	7	0	70
GWN10293+NIS	3.18+0.25%	0	0	0	2	11	11	9	9	0	77
Mesotrione+NIS	1.5+0.25%	0	0	6	8	12	12	22	18	0	20
CV		0	0	64	66	37	36	41	41	0	23
LSD (P=0.05)		0	0	1	2	4	4	6	5	0	18

Cereals were more tolerant to POST treatment of GWN10293 than PRE treatment. The four HRSW cultivars were more injured by the POST treatments than other cereals. Even though POST treatment was much less injurious to all species, POST GWN10293 gave up to 77% control of green foxtail. PRE treatment with 1.06 oz/A resulted in less than 10% injury to grain cereals except for Glen at 22% injury initially. This injury diminished over time across all grain cereals.

Barley tolerance to preemergence herbicides. (Jenks, Walter, and Willoughby). Some green foxtail populations across North Dakota are known to be resistant to Group 1 herbicides like Puma, Discover, and Axial XL. The objective of the study was to evaluate barley tolerance to soil-applied preemergence herbicides for foxtail control. This study was conducted in 2012 and 2014. All treatments were applied preemergence (after barley was planted). In 2012, Dual, Pre-Pare, and Valor caused early moderate crop injury; however, the crop generally recovered by mid-July. Zidua, Warrant, and Prowl caused minimal crop injury in 2012. In contrast, Zidua and Warrant caused slight to moderate crop injury in 2014. Pre-Pare and Prowl caused only slight crop injury in 2014. Valor caused moderate crop injury both years. Dual and Outlook caused severe injury in 2014. Despite crop injury in 2012, there was minimal effect on crop yield. In 2014, only Dual and Outlook reduced barley yield.

Table 1. Barley tolerance to preemergence herbicides in 2012. (1208)

		Barley					
		Injury				Yield	Test wt.
Treatment[a]	Rate	5-Jun	25-Jun	11-Jul	21-Jul	6-Aug	6-Aug
		----------%----------				bu/A	lb/bu
Untreated		0	0	0	0	76.3	42.4
Zidua	3 oz	0	0	0	0	70.7	43.3
Warrant	1.5 qt	2	1	1	0	77.6	43.3
Dual II Magnum	1.67 pt	15	13	6	5	74.2	43.1
Pre-Pare	0.3 oz	25	17	5	3	72.9	42.6
Prowl H2O	3 pt	2	1	0	0	72.4	43.5
Valor	3 oz	30	20	5	2	73.8	42.9
LSD (0.05)		6	5	NS	NS	NS	NS
CV		29	40	139	257	10	3

[a] *All treatments applied PRE*

Table 2. Barley tolerance to preemergence herbicides in 2014. (1408)

		Barley					
		Injury				Yield	Test wt.
Treatment[a]	Rate	Jun-09	Jun-18	Jul-03	Jul-15	Aug-20	Aug-20
		----------%----------				bu/A	lb/bu
Untreated		0	0	0	0	66.4	42.9
Zidua	3 oz	13	14	15	12	70.3	43.7
Warrant	1.5 qt	10	12	12	9	70.2	44.3
Dual II Magnum	1.67 pt	26	49	54	55	64.6	44.2
Pre-Pare	0.3 oz	5	6	7	3	76.3	43.1
Prowl H2O	3 pt	9	7	5	1	71.3	44.5
Valor	2 oz	18	17	17	14	76.4	45.2
Outlook	18 oz	23	42	45	45	60.1	42.4
LSD (0.05)		3.7	14.4	16.4	18.6	9.8	1.3
CV		16.3	44.7	48.1	60.8	8.1	1.7

[a] *All treatments applied PRE*

Preemergent treatments for kochia in wheat. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat near Prosper, North Dakota on May 29. Treatments were applied Preemergence on May 30 with 78°F, 46% relative humidity, 30% cloud cover, 6 to 8 mph wind velocity at 165°, and damp soil at 63°F. Del preemergence treatments were applied to 1.25 inch coleoptile shoot to 1 inch emerged wheat, spike yellow foxtail cotyledon common cocklebur and nightshade on June 3 with 81°F, 36% relative humidity, 50% cloud cover, 6 to 8 mph wind velocity at 225°, and damp soil at 69°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replications.

Treatment	Rate	Growth Stage	Wht 6/18	Yeft 6/18	Rrpw 6/18	Colq 6/18	Corw 6/18	Wht 7/3	Yeft 7/3	Hans 7/3	Colq 7/3	Corw 7/3	Yield 9/8
	oz/A		%	%	%	%	%	%	%	%	%	%	bu/A
Saflufenacil	0.72	PRE	0	83	99	98	95	0	69	91	93	59	27
Saflufenacil	1.08	PRE	0	85	98	95	83	0	79	95	96	67	25
Pyroxasulfone	1.4	PRE	0	65	75	65	47	0	66	76	74	17	23
Pyroxasulfone	2.1	PRE	0	71	88	34	33	0	81	77	82	25	35
Pyroxasulfone	2.8	PRE	0	81	93	70	69	0	87	90	91	40	43
Sulfentrazone	2	PRE	0	84	98	95	45	0	87	96	96	32	38
Sulfentrazone	3	PRE	5	92	99	96	64	15	91	98	98	47	33
Flumioxazin	1	PRE	0	82	99	94	57	0	77	92	92	32	33
Flumioxazin	1	Del PRE	7	97	99	98	97	0	96	99	99	89	41
Flumioxazin	1.5	PRE	0	82	99	92	75	0	86	95	95	64	22
Flumioxazin&Pyroxasulfone	2.3	PRE	0	89	99	93	83	0	93	98	96	93	28
Flumioxazin&Pyroxasulfone	2.3	Del PRE	0	91	98	93	85	0	84	93	94	77	26
Flucarbazone	0.21	PRE	0	84	96	85	42	0	67	72	79	0	28
Untreated Check	0		0	0	0	0	0	0	0	0	0	0	18
CV			308	11	13	20	32	481	8	12	11	53	36
LSD (P=0.05)			4	12	19	22	29	7	9	14	14	35	18

Sulfentrazone at 3 oz ai/A resulted in injury to wheat that persisted until July 3, 15%. Treatments containing sulfentrazone or flumioxazin gave excellent broadleaf weed control other than for common ragweed. Pyroxasulfone gave less control of pigweed, lambsquarters, and nightshade than most other herbicides. Flucarbazone often gave similar control to pyroxasulfone but provided 96% control of redroot pigweed. Delayed PRE application of flumioxazin provided better control of yellow foxtail and common ragweed, but delayed PRE application of flumioxazin and pyroxasulfone gave less foxtail control and tended to reduce ragweed control compared with standard PRE.

Preemergence treatments for kochia in wheat. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Barney on May 28. Treatments were applied preemergence on May 28 with 84°F 52% relative humidity, clear sky, 0.5 mph wind velocity at variable directions, and moist soil at 65°F. Delayed preemergence treatments were to 0.5 inch spike wheat on June 2 with 70°F, 60% relative humidity, 90% cloud cover, 15 mph wind velocity at 270°, and moist soil at 70°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Growth Stage	Wht 6/17	Rrpw 6/17	Colq 6/17
	oz ai/A		%	%	%
Saflufenacil	0.72	PRE	0	76	75
Saflufenacil	1.08	PRE	0	95	91
Pyroxasulfone	1.4	PRE	0	96	86
Pyroxasulfone	2.1	PRE	0	93	89
Pyroxasulfone	2.8	PRE	0	93	89
Sulfentrazone	2	PRE	0	97	99
Sulfentrazone	3	PRE	0	99	99
Flumioxazin	1	PRE	0	91	92
Flumioxazin	1	Del PRE	0	95	93
Flumioxazin	1.5	PRE	0	99	99
Flumioxazin&Pyroxasulfone	2.3	PRE	0	97	97
Flumioxazin&Pyroxasulfone	2.3	Del PRE	0	99	99
Flucarbazone	0.21	PRE	0	69	74
Untreated Check	0		0	0	0
CV			0	13	13
LSD (P=0.05)			0	16	16

Herbicides did not elicit response in wheat. Flucarbazone and the lower rate of saflufenacil gave less control than the other herbicide treatments. All other herbicide treatments save similar control that typically exceeded 90% control. However, the primary target of this study, kochia, did not emerge in the study area this season.

Pyroxasulfone premix Preemergence. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 29. Preemergence treatments were applied on May 30 with 68°F, 50% relative humidity, 7 to 8 mph wind velocity at 165°, and damp soil at 64°F. Three leaf treatments were applied to 2 to 4 leaf Venice mallow, 4 to 6 leaf wild mustard and buckwheat, and 3 to 4 leaf yellow foxtail on June 25 with 67°F, 86% relative humidity, 100% cloud cover, 2 to 6 mph wind velocity at 135°, and wet soil at 63°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 feet. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Stage	Wht 6/18	Yeft 6/18	Wht 6/26	Wht 7/3	Yeft 7/3	Wimu 7/3	Vema 7/3	Wibw 7/3	Wioa 7/21
	oz ai/A		%	%	%	%	%	%	%	%	%
F9312-3	1.25	PRE	0	32	0	0	79	65	67	22	17
F9312-3	2	PRE	0	52	0	0	86	75	75	30	37
F9312-3	2.5	PRE	0	60	0	0	92	84	83	25	42
F9312-3+Flcz	1.25+0.21	PRE	0	32	0	0	87	75	77	30	50
Flum&Pxsf	1.5	PRE	0	60	0	0	87	87	87	32	35
Pxdn+Fluth+MCPA+NIS	0.86+0.086+10+0.25%	3L	0		17	0	87	91	92	86	97
Pxdn+Fluth+2,4-D+NIS	0.86+0.086+8+0.25%	3L	0		19	0	84	91	91	85	97
Pxdn+Fluth+Thif+Trib+NIS	0.86+0.086+0.2+0.2+0.25%	3L	0		9	0	81	89	90	82	96
Pxdn+Clpy&Flox+F9312-3+NIS	0.86+3+2.5+0.25%	3L	0		13	0	87	87	90	89	97
Pxdn+Carf+MCPA+NIS	0.86+0.128+10+0.25%	3L	0		16	0	84	91	91	81	96
Untreated Check	0		0		0	0	0	0	0	0	0
CV			0	16	29	0	4	9	9	10	12
LSD (P=0.05)			0	12	3	0	4	10	10	7	11

Treatment	Rate	Stage	Yeft 7/21	Wimu 7/21	Vema 7/21	Wibw 7/21	Wioa 8/4	Yeft 8/4	Vema 8/4	Wibw 8/4	Yield 9/3
	oz ai/A		%	%	%	%	%	%	%	%	bu/A
F9312-3	1.25	PRE	82	42	45	40					42
F9312-3	2	PRE	89	67	60	42					49
F9312-3	2.5	PRE	90	57	62	42					48
F9312-3+Flcz	1.25+0.21	PRE	84	50	42	50					43
Flum&Pxsf	1.5	PRE	84	60	62	42					44
Pxdn+Fluth+MCPA+NIS	0.86+0.086+10+0.25%	3L	92	99	96	90	99	90	92	88	56
Pxdn+Fluth+2,4-D+NIS	0.86+0.086+8+0.25%	3L	92	99	97	91	99	91	96	91	50
Pxdn+Fluth+Thif+Trib+NIS	0.86+0.086+0.2+0.2+0.25%	3L	92	99	98	94	99	91	96	93	48
Pxdn+Clpy&Flox+F9312-3+NIS	0.86+3+2.5+0.25%	3L	95	99	98	96	99	95	98	98	50
Pxdn+Carf+MCPA+NIS	0.86+0.128+10+0.25%	3L	91	99	97	85	99	95	94	69	49
Untreated Check	0		0	0	0	0	0	0	0	0	42
CV			3	5	8	9	0	4	4	3	14
LSD (P=0.05)			4	5	8	8	0	4	5	4	9

F9312 initially gave 30 to 60% control of yellow foxtail. Control increased to 80 to 90% for foxtail as the season progressed. Control of wild mustard and Venice mallow ranged from 65 to 85% early to 45 to 65% control later.

Post emergence treatments gave better control of weeds but also caused moderate injury that was not observed July 3. POST treatments that contained fluthiacet resulted in less yellow foxtail control with pinoxaden, but control was greater than 90%. Better weed control with POST treatments compared with PRE treatments tended to result in more grain yield.

Pyroxasulfone premix Preemergence. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Prosper on May 29. Preemergence treatments were applied on May 30 with 78°F, 46% relative humidity, 20% cloud cover, 6 to 8 mph wind velocity at 165°, and damp soil at 63°F. Three leaf treatments were applied on June 23 with 79°F, 43% relative humidity, 40% cloud cover, 8 to12 mph wind velocity at 290°, and moist soil at 72°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 feet. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Stage	Wht 6/18	Yeft 6/18	Colq 6/18	Hans 6/18	Wht 6/27	Wht 7/2	Yeft 7/2
	oz ai/A		%	%	%	%	%	%	%
F9312-3	1.25	PRE	0	66	45	42	3	0	69
F9312-3	2	PRE	0	75	62	42	2	0	86
F9312-3	2.5	PRE	0	82	77	78	1	0	90
F9312-3+Flcz	1.25+0.21	PRE	0	34	31	31	2	0	71
Flum&Pxsf	1.5	PRE	0	89	96	99	1	0	93
Pxdn+Fluth+MCPA+NIS	0.86+0.086+10+0.25%	3L					16	4	87
Pxdn+Fluth+2,4-D+NIS	0.86+0.086+8+0.25%	3L					12	5	84
Pxdn+Fluth+Thif+Trib+NIS	0.86+0.086+0.2+0.2+0.25%	3L					6	3	81
Pxdn+Clpy&Flox+F9312-3+NIS	0.86+3+2.5+0.25%	3L					7	3	83
Pxdn+Carf+MCPA+NIS	0.86+0.128+10+0.25%	3L					9	3	88
Untreated Check	0						1	0	0
CV			0	28	42	45	41	48	6
LSD (P=0.05)			0	3	4	4	3	1	7

Table 2

Treatment	Rate	Stage	Colq 7/2	Hans 7/2	Yeft 7/21	Colq 7/21	Corw 7/21	Wibw 7/21	Yield 9/8
	oz ai/A		%	%	%	%	%	%	bu/A
F9312-3	1.25	PRE	81	74	79	86	76	74	16
F9312-3	2	PRE	89	81	80	86	86	72	13
F9312-3	2.5	PRE	95	92	84	92	87	80	20
F9312-3+Flcz	1.25+0.21	PRE	84	82	76	87	79	69	16
Flum&Pxsf	1.5	PRE	98	98	86	94	88	85	18
Pxdn+Fluth+MCPA+NIS	0.86+0.086+10+0.25%	3L	92	93	97	97	91	85	20
Pxdn+Fluth+2,4-D+NIS	0.86+0.086+8+0.25%	3L	90	91	93	96	91	90	13
Pxdn+Fluth+Thif+Trib+NIS	0.86+0.086+0.2+0.2+0.25%	3L	86	84	88	95	81	89	17
Pxdn+Clpy&Flox+F9312-3+NIS	0.86+3+2.5+0.25%	3L	91	91	95	95	97	95	17
Pxdn+Carf+MCPA+NIS	0.86+0.128+10+0.25%	3L	91	91	96	97	93	91	22
Untreated Check	0		0	0	0	0	0	0	13
CV			4	6	3	4	5	4	16
LSD (P=0.05)			6	7	4	5	6	5	5

Flumioxazin and pyroxasulfone provided better control of grass and broadleaf weeds than F9312. Flucarbazone did not improve weed control with F9312 and seemed to antagonize F9312 activity on June 18. PRE treatments did not accentuate wheat response, but POST treatments, especially those containing fluthiacet, caused as much as 16% injury. The severity of injury decreased as the season progressed. Weed control with POST treatments generally was greater than with PRE treatments.

Preemergence in wheat. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded on May 29. Preemergence treatments were applied on May 30 with 68°F, 50% relative humidity, 40% cloud cover, 7 to 8 mph wind velocity at 165°, and damp soil at 64°F. Del preemergence treatments were applied to 10 to 15 % emerging wheat on June 4 with 88°F, 32% relative humidity, 40% cloud cover, 3 to 6 mph wind velocity at 180°, and dry soil at 72°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with three replicates.

Treatment	Rate	Growth Stage	Wht 7/14	Yield 9/2
	oz ai/A		%	bu/A
Pendimethalin	16	PRE	0	44
Metribuzin	6	PRE	2	47
Acetochlor	20	PRE	2	46
Alachlor	24	PRE	0	45
Dimethenamid	16	PRE	0	47
Metolachlor	16	PRE	3	44
Pyroxasulfone	1.7	Del PRE	0	40
Saflufenacil	1.08	PRE	2	46
Sulfentrazone	2	PRE	0	45
Flumioxazin	1	PRE	0	45
Flumioxazin	1	Del PRE	0	41
Flumioxazin&Pyroxasulfone	2.3	PRE	0	47
Flumioxazin&Pyroxasulfone	2.3	Del PRE	2	44
Untreated Check	0		3	35
CV			213	15
LSD (P=0.05)			3	11

Treatments did not cause injury to wheat in excess of the response in untreated plots. All herbicide treatments tended to increase grain yield. Several of these herbicides may be of use in weed control programs. These results indicate potential for continued work to expand herbicide options in wheat.

Burndown with sulfonylurea and carfentrazone in spring wheat. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded May 29. Treatments were applied to 4 inch volunteer wheat, 1 to 2 leaf volunteer canola, 14 inch wild buckwheat, 4 inch common ragweed and Venice mallow, and 1 to 5 leaf yellow foxtail on July 3 with 79°F, 46% relative humidity, clear sky, 1 to 3 mph wind velocity at 200°, and moist soil at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 feet plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	VWht 7/18	VCan 7/18	Wibw 7/18	Yeft 7/18	Corw 7/18	Vema 7/18	VCan 8/1
	oz ai/A	%	%	%	%	%	%	%
Trib+Thif+Glyt-ipa+Carf-wg+ NIS+AMS+	0.12+0.03+12+0.1+ 0.25%+32	99	99	99	99	99	99	97
Trib+Thif+Glyt-ipa+Carf-wg+ NIS+AMS	0.12+0.03+12+0.2+ 0.25%+32	99	97	98	99	99	99	97
Trib+Thif+Glyt-ipa+Carf-wg+ NIS+AMS	0.12+0.03+12+0.4+ 0.25%+32	99	99	98	99	99	99	96
Trib+Thif+Glyt-ipa+Carf-wg+ 2,4-D+NIS+AMS	0.12+0.03+12+0.1+ 4+0.25%+32	99	99	98	99	99	99	99
Trib+Thif+Glyt-ipa+Carf-wg+ 2,4-D+NIS+AMS	0.12+0.03+12+0.2+ 4+0.25%+32	99	99	98	99	99	99	99
Trib+Thif+Glyt-ipa+Carf-wg+ 2,4-D+NIS+AMS	0.12+0.03+12+0.4+ 4+0.25%+32	99	99	97	99	99	99	99
Trib+Thif+Glyt-ipa+Carf-wg+ Dica+NIS+AMS	0.12+0.03+12+0.1+ 1.9+0.25%+32	99	96	96	99	99	99	93
Trib+Thif+Glyt-ipa+Carf-wg+ Dica+NIS+AMS	0.12+0.03+12+0.2+ 1.9+0.25%+32	99	98	97	99	99	99	91
Trib+Thif+Glyt-ipa+Carf-wg+ Dica+NIS+AMS	0.12+0.03+12+0.4+ 1.9+0.25%+32	99	98	97	99	99	99	92
Glyt-ipa+2,4-D+NIS+AMS	12+4+0.25%+32	99	98	97	99	99	99	96
Glyt-ipa+Dica+NIS+AMS	12+1.9+0.25%+32	99	0	95	99	99	99	5
Trib+Thif+Glyt-ipa+NIS+AMS	0.12+0.03+12+0.25%+32	99	97	97	99	99	99	95
Glyt-ipa+AMS	12+32	99	0	92	99	99	99	12
Saff+Glyt-ipa+MSO+AMS	0.36+12+1%+32	99	82	97	99	99	99	85
Untreated Check	0	0	0	0	0	0	0	0
CV		0	3	3	0	0	0	10
LSD (P=0.05)		0	3	4	0	0	0	10

Control of all species except volunteer canola was exceptional with all herbicide treatments even though wild buckwheat, common ragweed, and Venice mallow are difficult to control with glyphosate. Volunteer canola was glyphosate resistant and was not controlled by glyphosate or dicamba.

General broadleaf weed control. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Prosper, North Dakota on May 29. Treatments were applied on June 23 with 79°F, 42% relative humidity, 30% cloud cover, 8 to 12 mph wind velocity at 270°, and moist soil at 72°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replications.

Treatment	Rate	Wht 7/3	Hans 7/3	Colq 7/3	Corw 7/3	Cocb 7/3	Wibw 7/3	Colq 7/21	Corw 7/21	Cocb 7/21	Yield 9/8
	oz ai/A	%	%	%	%	%	%	%	%	%	bu/A
Pxdn+Flox+MCPA	0.86+2+6	0	84	55	62	77	85	84	81	92	46
Pxdn+Flox&Dicamba	0.86+2.6	0	87	85	70	81	99	99	98	99	50
Pxdn+Clopyralid&Flox+Thif	0.86+3+0.15	0	87	85	82	82	99	99	98	99	53
Pxdn+Carf+Flox+NIS	0.86+0.128+1.5+0.25%	0	87	85	79	86	94	94	90	98	47
Pxdn+Carf+2,4-D+NIS	0.86+0.128+6+0.25%	0	91	90	85	92	99	99	97	99	46
Pxdn+Brox&MCPA5	0.86+8	0	87	85	79	90	94	96	87	96	49
Pxdn+Brox&Flox	0.86+7.5	0	91	86	85	90	98	97	95	98	47
Pxdn+Brox&Pyst	0.86+3.4	0	91	90	89	91	99	99	99	99	50
Pxdn+Brox&2,4-D	0.86+10	0	95	95	90	94	98	98	93	98	40
Pxdn+Florasulam&MCPA	0.86+6	0	87	84	71	81	97	98	92	97	46
Pxdn+Florasulam&Flox	0.86+1.5	0	87	76	79	85	94	89	90	94	40
Pxdn+Flox&Thif&Trib	1.8	0	87	87	79	89	97	97	90	98	46
Pxdn	0.86	0	0	0	0	0	0	0	0	0	44
CV		0	4	11	9	6	2	2	4	2	12
LSD (P=0.05)		0	5	13	9	7	2	3	5	2	9

Bromoxynil and 2,4-D provided the best control of hairy nightshade, 95%, July 3. This fast-acting combination also gave 95% control of common lambsquarters and common cocklebur but many other herbicide treatments gave similar, although numerically lower, control. Fluroxypyr and MCPA consistently gave the lowest control of broadleaf weeds.

Halauxifen premix use in wheat. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 30. Treatments were applied to 5 leaf/2 tiller crops and 2 to 4 leaf Venice mallow, redroot pigweed, and common lambsquarters on July 2 with 78°F, 23% relative humidity 55% cloud cover, 4.2 wind velocity at 315°, and moist soil at 68°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	WHT 7/5	WHT 7/14	Vema 7/14	Rrpw 7/14	Colq 7/14	WHT 8/1	Vema 8/1	Rrpw 8/1	Colq 8/1
	oz ae/A	%	%	%	%	%	%	%	%	%
Florasulam&Haux+NIS	0.14+0.5%	0	0	82	81	81	0	84	88	98
Florasulam&Haux+NIS	0.29+0.5%	0	0	82	82	82	0	87	94	99
Florasulam&Haux+NIS	0.57+0.5%	0	0	86	89	89	0	91	87	98
Florasulam&Haux+Clpy&Flox	0.14+3	0	0	90	90	90	0	99	99	99
Florasulam&Haux+Clpy&Flox	0.29+6	0	0	90	90	90	0	99	99	99
Florasulam&Haux+Clpy&Flox	0.57+12	0	0	89	90	90	0	99	99	99
Clpy&Flox	12	0	0	84	84	84	0	99	99	99
Quinclorac-F+MSO	4.1+20	0	0	52	45	45	0	85	76	72
Quinclorac-F+MSO	8.3+20	0	0	52	57	52	0	75	72	71
Untreated Check	0	0	0	0	0	0	0	0	0	0
CV		0	0	4	4	4	0	25	3	2
LSD (P=0.05)		0	0	4	4	4	0	3	4	2

Florasulam and halauxifen at the highest rate gave 86 to 89% control of weeds on July 14. Control with lower rates was improved with the addition of clopyralid and fluroxypyr, and these combinations provided 90% control which was greater than control with clopyralid and fluroxypyr alone. Florasulam and halauxifen was very effective against common lambsquarters, but control of Venice mallow and redroot pigweed was improved with clopyralid and fluroxypyr on August 1. Herbicide treatments did not elicit crop response. This area will be seeded with strips of lentil, canola, field pea, flax, and dry bean to evaluate effect of soil residual 10 month after application.

Weed control with Bromoxynil&Pyrasulfotole. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seed near Fargo on May 29. Treatments were applied to 2 to 4 leaf Venice Mallow, 3 to 4 leaf foxtail, 2 to 6 inch wild buckwheat, flowering wild mustard, and 2 to 4 leaf ladysthumb smartweed on June 20 with 80°F, 73% relative humidity, 10% cloud cover, 14 mph wind velocity at 130°, and wet soil at 72°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11002 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with three replicates.

Treatment	Rate	Wht 7/3	Yeft 7/3	Vema 7/3	Wibw 7/3	Wimu 7/3	Ltsw 7/3	Yeft 7/18	Vema 7/18
	oz ai/A	%	%	%	%	%	%	%	%
Pxdn+Brox&Pyst+AMS	0.86+2.9+8	0	83	77	78	78	77	91	92
Pxdn+Brox&Pyst+AMS	0.86+3.6+8	0	83	73	80	83	85	86	87
Brox&Pyst&Thcz+AMS	3+8	0	73	77	80	78	82	86	94
Pxdn+Clpy&Flox+MCPA	0.86+3+4	0	82	86	77	80	73	91	80
Pxdn+Thif+Trib+Clpy&Flox+NIS	0.86+0.24+0.06+3+0.25%	0	75	82	75	80	73	80	94
Pxdn	0.86	0	85	0	0	0	0	96	0
CV		0	4	7	8	10	10	1	3
LSD (P=0.05)		0	6	9	9	12	12	2	5

Treatment	Rate	Wibu 7/18	Wimu 7/18	Ltsw 7/18	Yeft 8/8	Vema 8/8	Wibw 8/8	Wimu 8/8	Ltsw 8/8	Yield 9/3
	oz ai/A	%	%	%	%	%	%	%	%	bu/A
Pxdn+Brox&Pyst+AMS	0.86+2.9+8	95	99	98	89	92	97	99	98	37
Pxdn+Brox&Pyst+AMS	0.86+3.6+8	93	98	98	90	89	90	99	98	35
Brox&Pyst&Thcz+AMS	3+8	92	98	98	83	93	92	99	98	41
Pxdn+Clpy&Flox+MCPA	0.86+3+4	87	98	72	94	80	92	99	82	34
Pxdn+Thif+Trib+Clpy&Flox+NIS	0.86+0.24+0.06+3+0.25%	94	99	98	73	93	97	99	98	33
Pxdn	0.86	0	0	0	98	0	0	0	0	37
CV		4	2	1	4	4	4	0	3	17
LSD (P=0.05)		5	2	2	6	5	6	0	3	11

Treatments did not cause wheat response. The only broadleaf herbicide combination to antagonize yellow foxtail control with pinoxaden on July 3 was thifensulfuron and tribenuron plus clopyralid and fluroxypyr. By July 18, bromoxynil and pyrasulfotole also antagonized pinoxaden activity but not to the extent that thif, trib, clpy, and flox did. By August, bromoxynil and pyrasulfotole provided better then 90% control of broadleaf weeds. Clopyralid and fluroxypyr plus MCPA only gave 80% control of Venice mallow and 82% control of Ladysthumb smartweed.

Weed control with Bromoxynil&Pyrasulfotole. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near prosper North Dakota on May 29. Treatments were applied on June 23 with 79°F, 44% relative humidity, 30% cloud cover, 8 to 12 mph wind velocity at 270°, and moist soil at 72°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Table 1

Treatment	Rate	Wht 6/27	Wht 7/1	Hans 7/1	Colq 7/1	Corw 7/1	Cocb 7/1	Hans 7/14	Colq 7/14
	oz ai/A	%	%	%	%	%	%	%	%
Pxdn+Brox&Pyst+AMS	0.86+2.9+8	3	0	82	81	81	84	99	99
Pxdn+Brox&Pyst+AMS	0.86+3.6+8	2	0	92	92	90	92	99	99
Brox&Pyst&Thcz+AMS	3+8	4	0	89	92	86	89	99	99
Pxdn+Clpy&Flox+MCPA	0.86+3+4	3	0	94	94	92	95	99	99
Pxdn+Thif-sg+Trib-sg+Clpy&Flox+NIS	0.86+0.24+0.06+3+0.25%	1	0	81	82	79	84	97	97
Pxdn	0.86	0	0	0	0	0	0	0	0
CV		76	0	3	4	4	3	1	1
LSD (P=0.05)		2	0	4	4	4	4	1	1

Table 1 continued

Treatment	Rate	Corw 7/14	Cocb 7/14	Hans 8/4	Colq 8/4	Corw 8/4	Cocb 8/4	Yield 9/8
	oz ai/A	%	%	%	%	%	%	bu/A
Pxdn+Brox&Pyst+AMS	0.86+2.9+8	98	98	99	99	99	99	42
Pxdn+Brox&Pyst+AMS	0.86+3.6+8	98	97	99	99	99	99	41
Brox&Pyst&Thcz+AMS	3+8	98	98	99	99	99	99	42
Pxdn+Clpy&Flox+MCPA	0.86+3+4	99	99	99	99	99	99	39
Pxdn+Thif-sg+Trib-sg+Clpy&Flox+NIS	0.86+0.24+0.06+3+0.25%	89	93	99	99	99	99	43
Pxdn	0.86	0	0	0	0	0	0	41
CV		2	2	0	0	0	0	7
LSD (P=0.05)		2	2	0	0	0	0	5

Slight injury to wheat resulted from each herbicide combination. Control was less than 5% and not present by July 1. Clopyralid and fluroxypyr plus MCPA gave 92 to 95% control of broadleaf weeds. This was similar to the high rate of bromoxynil and pyrasulfotole and better than other herbicides. By July 14, all herbicide combinations except that containing thifensulfuron provided 97% or better control. Vigorous wheat helped maintain high levels of control through the season and suppressed weeds in the untreated allowing for good grain yield in the absence of herbicide treatment.

Broadleaf weed control in spring wheat with Huskie and Huskie Complete. (Jenks, Walter, and Willoughby). The objective of the study was to evaluate broadleaf weed control with Huskie and Huskie Complete compare to competitive standards. Treatments were applied May 16 to 4-leaf wheat, 0.5-7 inch common lambsquarters, and 0.5-7 inch redroot pigweed. All treatments provided excellent control of both weeds. The wheat crop was excellent and effectively shaded out the weeds. Crop injury was evident with the Huskie Complete and WideMatch treatments 2-4 weeks after treatment, but disappeared by early July.

Table. Broadleaf weed control in spring wheat with Huskie and Huskie Complete. (1425)

		Wheat		Weed Control[b]			
		Injury		Rrpw		Colq	
Treatment[a]	Rate	Jun-14	Jul-03	Jul-03	Aug-11	Jul-03	Aug-11
		-------%-------		-------%-------		-------%-------	
Untreated		0	0	0	0	0	0
Huskie + AMS	11 fl oz + 1.47 gal	6	0	100	100	100	100
Huskie + AMS	13.5 fl oz + 1.47 gal	3	0	100	100	100	100
Huskie Complete + AMS	13.7 fl oz + 1.47 gal	23	0	100	100	100	100
WideMatch + MCPA	1 pt + 0.5 pt	2	0	70	100	100	100
Aff TM + WideMatch + NIS	0.6 oz + 1 pt + 0.25%	17	0	83	100	99	100
LSD (0.05)		7.6	NS	4.4	0.9	0.0	0.0
CV		49.0	0.0	3.2	0.6	0.0	0.0

[a] *All treatments applied POST; Aff TM=Affinity TankMix*

[b] *Rrpw=Redroot pigweed; Colq=Common lambsquarters*

POST kochia control. Howatt, Roach, and Harrington. No crop was seeded at this location near Rogers North Dakota. Treatments were applied to 4 to 10 inch kochia and 2 to 8 inch common lambsquarters on June 13 with 62°F, 69% relative humidity, 5% cloud cover, 1 to 3 mph wind velocity at 315°, and soil temperature of 52°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Koch 6/20	Koch 6/26	Colq 6/26	Koch 7/15	Colq 7/15
	oz ai/A	%	%	%	%	%
Pxdn+Flox+MCPA	0.86+2+6	75	86	85	91	86
Pxdn+Flox&Dica	0.86+2.6	69	70	0	79	75
Pxdn+Clpy&Flox+Thif-sg+NIS	0.86+3+0.15+0.25%	72	75	64	85	85
Pxdn+Carf+Flox+NIS	0.86+0.128+1+0.25%	87	87	40	93	0
Pxdn+Brox&MCPA5	0.86+8	72	57	86	62	84
Pxdn+Brox&Flox	0.86+7.5	89	87	79	94	57
Pxdn+Brox&2,4-D	0.86+10	76	60	93	69	92
Pxdn+Brox&Pyst+AMS	0.86+3.78+8	84	85	97	89	98
Pxdn+Florasulam&Flox	0.86+1.5	67	62	12	85	0
CV		7	8	15	5	9
LSD (P=0.05)		8	9	14	7	9

Initial control of kochia was greatest with bromoxynil and fluroxypyr, carfentrazone and fluroxypyr, or bromoxynil and pyrasulfotole. Fluroxypyr and MCPA was a little slower but matched control of these treatments by 2 WAT. At this time, Bromoxynil and pyrasulfotole or bromoxynil and 2,4-D provided excellent control of common lambsquarters. Evaluation in July identified similar strengths.

Kochia control. Howatt, Roach, and Harrington. No crop was seeded at this location near Rogers, North Dakota Treatments were applied to 4 to 10 inch kochia, 2 to 8 inch common lambsquarters, and 2 to 6 inch marshelder on June 13 with 62°F, 69% relative humidity, 5% cloud cover, 1 to 5 mph wind velocity at 315°, and moist soil at 52°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Kocz 6/20	Kocz 6/26	Colq 6/26	Kocz 7/15	Colq 7/15
	oz ai/A	%	%	%	%	%
Clpy&Flox+2,4-D	3+6	80	76	85	85	96
Clpy&Flox+2,4-D	4+6	81	79	86	88	98
Dicamba+MSO	2+20	75	84	70	90	89
Flox&Dica+MSO	2.6+20	76	86	65	94	88
Fluroxypyr	2	75	81	0	90	20
Fluroxypyr	2.25	77	82	0	88	7
Pxlm&Flas&Flox+2,4-D	1.69+6	82	79	87	87	98
Untreated Check	0	0	0	0	0	0
CV		4	5	5	3	11
LSD (P=0.05)		4	5	4	3	11

Fluroxypyr and dicamba provided 94% control of kochia in July. Treatment with fluroxypyr or dicamba alone gave only 90% control even though rate was higher than in the combination. Treatments containing 2,4-D gave better than 95% control of common lambsquarters. None of the treatments included was able to maximize control of both kochia and lambsquarters.

Kochia control with residual. Howatt, Roach, and Harrington. No crop was seeded at this location near Rogers North Dakota. Treatments were applied to 4 to 10 inch kochia and 2 to 8 inch common lambsquarters on June 13 with 62°F, 69% relative humidity, 25% cloud cover, 6 to 10 inch wind velocity at 250°, and moist soil at 52°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Kocz 6/20	Kocz 6/26	Colq 6/26	Kocz 7/15	Colq 7/15
	oz ai/A	%	%	%	%	%
Dica+Brox&Pyst+NIS+AMS	1.5+3.4+0.25%+8	82	89	97	89	99
Dica+Pyroxasulfone	1.5+1.7	60	71	35	79	66
Dica+Brox&Pyst+Pysf+NIS+AMS	1.5+3.4+1.7+0.25%+8	82	89	97	85	99
Brox&Pyst+Pysf+NIS+AMS	3.4+1.7+0.25%+8	77	91	98	87	99
Dica+Brox&Pyst+Acet+NIS+AMS	1.5+3.4+18+0.25%+8	76	84	97	81	98
Dica+Acet	1.5+18	45	60	39	69	57
Brox&Pyst+Acet+NIS+AMS	3.4+18+0.25%+8	77	86	97	85	99
Brox&Pyst+2,4-D	3.4+3	82	85	97	77	99
Brox&Flox	9.8	89	92	81	95	45
Dica+2,4-D	1.5+3	82	84	91	90	95
CV		8	6	12	4	9
LSD (P=0.05)		7	7	14	5	11

Additional emergence of kochia or common lambsquarters did not occur so evaluations are restricted to control of emerged plants at application. Bromoxynil and fluroxypyr gave the best control of kochia 7 DAT at 89%. By June 26, several herbicide treatments, typically containing bromoxynil and pyrasulfotole, provided similar control to bromoxynil and fluroxypyr. Bromoxynil and pyrasulfotole treatments also provided 97 to 98% control of common lambsquarters. Bromoxynil and pyrasulfotole allowed kochia to produce regrowth by July 15 but provided complete control of lambsquarters. Bromoxynil and fluroxypyr maintained 95% control of kochia but gave only 45% lambsquarters control.

Metsulfuron control of dandelion. Howatt, Roach, and Harrington. No crop was planted at this location near Fargo. Treatments were applied to 6 to 10 inch rosette common dandelion, cotyledon to 2 leaf common ragweed, and cotyledon to 4 leaf annual smartweed on June 3 with 78°F, 47% relative humidity, 95% cloud cover, 1 to 2 mph wind velocity at 225°, and moist soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 feet plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Dali 6/18	Dali 7/3
	oz ai/A	%	%
Metsulfuron+Tribenuron+NIS	0.01+0.07+0.25%	20	85
Metsulfuron+Tribenuron+NIS	0.02+0.15+0.25%	30	94
Metsulfuron+Tribenuron+NIS	0.03+0.22+0.25%	31	95
Metsulfuron+Tribenuron+NIS	0.04+0.30+0.25%	31	95
Metsulfuron+Tribenuron+NIS	0.06+0.45+0.25%	40	95
Untreated Check	0	0	0
CV		26	2
LSD (P=0.05)		10	3

Metsulfuron and tribenuron at 0.02 + 0.15 oz ai/A gave better control of dandelion than higher rates. However, weed control was not improved with higher herbicide rates.

2,4-D formulations in wheat. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 30. Treatments were applied to 6 leaf, tillering wheat, 8 leaf redroot pigweed, 4 leaf Venice mallow, and 2 to 8 inch common lambsquarters on July 2 with 72°F, mostly clear sky, 6 mph wind velocity at 315° and moist soil at 66°F. Treatments were applied with a sprayer mounted on a 4 wheel all-terrain vehicle delivering 17 gpa at 38 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	Wht 7/15	Vema 7/15	Rrpw 7/15	Colq 7/15	Wht 8/1	Vema 8/1	Rrpw 8/1	Colq 8/1
	fl oz/A	%	%	%	%	%	%	%	%
WE1402+WE1514+WE1002	23+16+0.25%	0	89	90	90	0	99	99	99
WE1402+WE1514	23+16	0	90	89	89	0	99	98	99
WE1396+WE1514	16+16	0	81	74	76	0	99	99	99
WE1514	16	0	87	86	84	0	94	92	95
WE1515+WE1442	1+1%	0	80	82	84	0	98	97	97
WE1515+WE1396+WE1442	1+16+1%	0	93	95	93	0	98	99	99
WE1515+WE1402+WE1442	1+23+1%	0	79	75	72	0	89	93	93
WE1515+WE1402+WE1002	1+23+0.25%	0	75	71	74	0	94	94	96
WE1515+WE1402	1+23	0	91	91	91	0	99	99	99
Untreated Check	0	0	0	0	0	0	0	0	0
CV		0	3	4	4	0	3	3	2
LSD (P=0.05)		0	4	4	4	0	4	3	2

None of the formulations caused response in wheat. WE1002 antagonized WE1515 plus WE1402 but not the combination of WE1402 and WE1514. WE1442 also antagonized WE1515 plus WE1402. All herbicide treatments provided better than 90% control of weeds; however, WE1514 alone or WE1515 plus WE1402 with additional additive gave less control than other herbicides.

Cereal response to 2,4-D formulation. Howatt, Roach, and Harrington. The trial was seeded with 12-foot-wide bioassay strips of 'Prosper' wheat, 'Pinnacle' and 'Celebration' barley, 'Newda K' oat, and triticale near Fargo on May 27. Treatments were applied June 25 with 65°F, 75% relative humidity, 100% cloud-cover, fog, 5 mph wind at 80°, and wet soil at 66°F. Treatments were applied with a sprayer mounted on a 4 wheel all-terrain vehicle delivering 17 gpa at 38 psi through 11003 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Response was consistent across all species and cultivars.

Treatment	Rate	Injury 7/2	Injury 7/14	Stunting 7/14	Chlorosis 7/14	Heading delay	Injury 7/23	Dry delay 8/6
	oz ae/A	%	%	%	%	%	%	%
WE1157	7.6	0	0	0	0	0	0	0
WE1157	11.4	0	0	0	0	0	0	0
WE1157	15.2	0	0	0	0	0	0	0
WE1402	7.7	0	0	0	0	0	0	0
WE1402	11.5	0	0	0	0	0	0	0
WE1402	15.4	0	0	0	0	0	0	0
Untreated Check	0	0	0	0	0	0	0	0
CV		0	0	0	0	0	0	0
LSD (P=0.05)		0	0	0	0	0	0	0

These two herbicide formulations did not cause adverse response to the species and cultivars included in the study.

Spring wheat tolerance to triallate. Hanson, Howatt, Roach, and Harrington. 'Prosper', 'Soren', 'Glenn', 'Stingray', 'Barlow', and 'Faller' hard red spring wheat were seeded near Prosper, North Dakota on May 29. Treatments were soil applied and incorporated twice with a cultivator on May 29 with 80°F, 56% relative humidity, clear sky, 7.5 mph wind velocity at 180°, and dry surface soil at 72°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Prosper 6/9	Soren 6/9	Glenn 6/9	Stingray 6/9	Barlow 6/9	Faller 6/9
	oz ai/A	#/m row					
Untreated Check	0	31	38	35	24	43	38
Triallate	12	25	31	34	20	33	33
Triallate	16	28	32	36	22	39	34
Triallate	24	21	33	32	23	28	24
Triallate	32	19	29	32	19	34	26
CV		22	23	13	22	20	18
LSD (P=0.05)		8	12	7	7	11	4

Treatment	Rate	Prosper 7/2	Soren 7/2	Glenn 7/2	Stingray 7/2	Barlow 7/2	Faller 7/2
		% injury					
Untreated Check	0	11	5	5	15	5	2
Triallate	12	22	17	12	19	6	14
Triallate	16	30	17	19	29	21	15
Triallate	24	60	41	47	67	41	42
Triallate	32	76	65	52	81	70	70
CV		32	33	28	43	32	28
LSD (P=0.05)		20	15	12	28	14	13

Plant establishment was lower than expected in all plots because of the condition of the seedbed. Plots treated with triallate typically had similar establishment of plants to the untreated. Faller had fewer plants established with each herbicide treatment than untreated plots, and 2x rates reduced stand more than 1x rates. Larger plot area is necessary to accurately estimate the yield resulting from this loss of plants.

Minor injury was observed in untreated plots. Moderate injury was observed with triallate at typical field rates. However, injury was severe in plots with rates to mimic spray overlap.

Spring wheat tolerance to triallate. Hanson, Howatt, Roach, and Harrington. 'Prosper', 'Faller', 'Glenn', 'Soren', 'Barlow', and 'Stingray' hard red spring wheat were seeded on campus May 23. Preemergence treatments were applied and incorporated twice with a cultivator on May 23 with 85°F, 32% relative humidity, and clear sky, 15 mph wind at 180°, and dry surface soil over moist soil at 61°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Prosper 6/9	Faller 6/9	Glenn 6/9	Soren 6/9	Barlow 6/9	Stingray 6/9
	oz ai/A	#/m row					
Untreated Check	0	47	63	61	62	61	42
Triallate	12	44	48	56	63	55	37
Triallate	16	36	43	47	57	45	29
Triallate	24	35	39	46	46	43	38
Triallate	32	31	38	41	48	36	32
CV		14	14	15	16	13	25
LSD (P=0.05)		9	10	12	13	9	14

Treatment	Rate	Prosper 7/2	Faller 7/2	Glenn 7/2	Soren 7/2	Barlow 7/2	Stingray 7/2
	oz ai/A	% injury					
Untreated Check	0	1	2	4	0	1	14
Triallate	12	16	11	9	6	7	32
Triallate	16	32	27	24	12	19	37
Triallate	24	54	46	56	46	47	66
Triallate	32	84	65	67	57	66	79
CV		48	61	35	63	52	50
LSD (P=0.05)		28	29	17	24	22	35

Plots treated with triallate had fewer plants established than untreated plots. For most cultivars this occurred with 16 oz/A which is the high end of labeled field rate. Wheat has some capacity for compensation, especially with the stand loss occurring so early in the season. Larger plot area is necessary to accurately estimate the yield resulting from this loss of plants.

Minor injury was observed in untreated plots. Moderate injury was observed with triallate at typical field rates. However, injury was severe in plots with rates to mimic spray overlap.

Soil herbicides for susceptible wild oat control. Hanson, Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 30. Pre-plant incorporated and preemergence treatments were applied on May 30 with 68°F, 50% relative humidity, 30% cloud cover, 5 to 8 mph wind velocity at 180°, and damp soil at 64°F. Incorporation was accomplished after PPI treatments were applied but before PRE treatments were applied with two passes of a cultivator. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Application	Wioa 8/20	Yeft 8/20	Wht Yield
	oz ai/A		%	%	bu/A
Triallate	8	PPI	89	0	23
Triallate	12	PPI	93	0	26
Triallate	16	PPI	95	0	21
Flucarbazone	0.21	PRE	70	71	19
Propoxycarbazone	0.14	PRE	45	72	17
Pyroxasulfone	2.8	PRE	97	99	29
Untreated Check	0		0	0	19
CV			12	11	20
LSD (P=0.05)			14	16	6

Triallate provided excellent control of wild oat, but triallate does not have any activity on yellow foxtail. Pyroxasulfone completely controlled foxtail in this study and also gave 97% control of wild oat. This activity on wild oat has not always been observed in other studies, but pyroxasulfone typically at least suppresses wild oat establishment. Flucarbazone gave about 70% control of both weeds.

Soil herbicides for resistant wild oat control. Hanson, Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Nielsville on May 26 in an area known to have resistant wild oat biotypes. Pre-plant treatments were applied and incorporated twice with a 5-tine cultivator on May 26 with 60°F, 75% relative humidity, 100% cloud cover, 4 to 6 mph wind velocity at 45°, and damp soil at 58°F. Pre-emergence treatments were applied after seeding with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Application	Wht 6/18	Wioa 6/15	Wht 8/4	Wht Yield
	oz ai/A		%	%	%	bu/A
Triallate	8	PPI	0	81	56	18
Triallate	12	PPI	0	86	72	19
Triallate	16	PPI	0	89	80	20
Flucarbazone	0.21	PRE	0	90	52	16
Propoxycarbazone	0.14	PRE	0	37	19	17
Pyroxasulfone	2.8	PRE	0	72	90	22
Untreated Check	0		0	55	0	18
CV			0	8	22	22
LSD (P=0.05)			0	9	17	6

Herbicide treatments did not cause visible response in wheat on June 18. However, excessive and prolonged soil moisture resulted in severe wheat injury with all herbicides. The least injury was noted with flucarbazone at 19% in August. Triallate gave similar control of wild oat to flucarbazone and better control than other herbicides.

Tankmixes for control of resistant wild oat biotypes. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Nielsville on May 26 in an area with known resistant wild oat biotypes. Delayed preemergence treatments were applied to 0.25 to 0.5 inch coleoptile wheat on May 30 with 88°F, 40% relative humidity, 10% cloud cover, 7 to 10 mph wind velocity at 180°, and moist soil at 72°F. Treatments (1L) were applied to 1.5 leaf wheat and wild oats on June 6 with 69°F, 49% relative humidity, 80% cloudcover, 5 to 9 mph wind velocity at 340°, and soupy wet soil at 62°F. Treatments (3L) were applied to 4.5 leaf wheat and wild oats on July 2 with 62°F, 62% relative humidity, clear sky, 5 to 7 mph wind velocity at 340°, and saturated soil at 56°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Growth Stage	Wioa 7/2	Wioa 7/15	Wioa 8/4
	oz ai/A		%	%	%
Pxsf	1.1	Del PRE	62	75	54
Pxsf/Flcz	1.1/0.21	Del PRE	62	72	45
Pxsf/Flcz+NIS+AMS	1.1/0.44+0.25%+16	Del PRE/3L	64	81	84
Pxsf/Pinoxaden	1.1/0.86	Del PRE/3L	67	86	94
Flcz+NIS+AMS/Pinoxaden	0.44+0.25%+16/0.86	1L/3L	86	90	97
Flcz+NIS+AMS/Fenx	0.44+0.25%+16/1.32	1L/3L	82	91	91
Flcz+NIS+AMS/Clfp NG	0.44+0.25%+16/0.8	1L/3L	84	92	92
Flcz+NIS+AMS	0.44+0.25%+16	1L	84	87	84
Flcz+NIS+AMS	0.44+0.25%+16	3L		75	69
Pinoxaden	0.86	3L		81	90
Fenx	1.32	3L		72	66
Clfp NG	0.8	3L		67	60
Flcz+Pinoxaden+AMS	0.44+0.86+16	3L		76	82
Flcz+Fenx+AMS	0.44+1.32+16	3L		71	67
Flcz+Clfp NG+AMS	0.44+0.8+16	3L		72	67
CV			8	5	7
LSD (P=0.05)			9	5	8

Herbicides did not cause injury to wheat. Early post emergence treatments with flucarbazone gave better control of wild oat, 84%, than delayed pre-emergence treatment with pyroxasulfone, 62%, on July 2. This difference became more pronounced as the season progressed. Early application of flucarbazone was important for maximum oat control. Also, pinoxaden, 90% control, was much more effective than fenoxaprop or clodinafop. Therefore, combination of flucarbazone at 1 leaf followed by pinoxaden at 3 leaf provided 97% control of wild oat. Tankmix of the same herbicides at 3 leaf resulted in 82% control. Pyroxasulfone followed by pinoxaden also was effective at 94% control.

POST control of Wild Oat with Pyroxasulfone. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Nielsville on May 26Treatments were applied to 1 to 1.5 leaf wild oats on June 6 with 69°F, 49% relative humidity, 80% cloud cover, 5 to 9 mph wind velocity at 340°, and saturated soil at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wht 6/18	Wioa 6/18
	oz ai/A	%	%
Pyroxasulfone	3.4	0	47
Pinoxaden	0.86	0	85
Pyroxasulfone+Pinoxaden	3.4+0.86	0	86
Pyroxasulfone+Adigor	3.4+20	0	50
Pyroxasulfone+MSO	3.4+20	0	57
Pyroxasulfone+HSMOC	3.4+16	0	47
Pyroxasulfone+MSO+AMS	3.4+20+11	0	59
CV		0	18
LSD (P=0.05)		0	16

Treatments did not cause injury to wheat. Pyroxasulfone gave 47% control of wild oat. Adjuvants did not affect level of control with pyroxasulfone. Pinoxaden provided 87% control, but the combination of pyroxasulfone and pinoxaden gave control similar to pinoxaden alone.

POST control of yellow foxtail with Pyroxasulfone. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 29. Treatments were applied to spike to 1 inch wheat and spike to 2 leaf yellow foxtail on June 11 with 68°F, 68% relative humidity, 100% cloud cover, 5 mph wind velocity at 45°, dry soil at 64°, and a light rain was occurred during final applications. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wht 6/26	Yeft 6/26	Yeft 7/14	Yield 9/2
	oz ai/A	%	%	%	%
Pyroxasulfone	3.4	0	91	90	39
Pinoxaden	0.86	0	96	79	45
Pyroxasulfone+Pinoxaden	3.4+0.86	0	99	94	48
Pyroxasulfone+Adigor	3.4+20	0	93	91	44
Pyroxasulfone+MSO	3.4+20	0	90	89	45
Pyroxasulfone+HSMOC	3.4+16	0	92	87	43
Pyroxasulfone+MSO+AMS	3.4+20+11	0	94	88	40
CV		0	4	6	13
LSD (P=0.05)		0	6	8	8

Herbicide treatments did not cause injury to wheat even though wheat had just emerged at the time of application. All treatments provided better than 90% control of yellow foxtail within 2 weeks of application. Adjuvants did not improve foxtail control with pyroxasulfone. Soil moisture was adequate for availability to plant through the soil so mode of entry to the plant could not be discerned. Pinoxaden alone provided 96% control of emerged foxtail, but new cohorts were noticed before the July evaluation resulting in 79% control while pyroxasulfone control remained around 90%.

Herbicide as adjuvant for Thiencarbazone. Howatt, Roach, and Harrington. No crop was seeded at this location near Fargo. Treatments were applied to 2 to 4 leaf wild oats on June 31 with 80°F, 50% relative humidity, 80% cloud cover, 3 to 7 mph wind velocity at 270°, and moist soil at 64°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 feet plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wioa 6/18	Wioa 6/30
	oz ai/A	%	%
Thcz	0.07	47	60
Thcz+Brox&MCPA	0.07+8	57	61
Thcz+Brox&MCPA+Pref+Interlock	0.07+8+0.25%+4	57	62
Thcz+Brox&MCPA&Flox	0.07+12	57	57
Thcz+Brox&MCPA&Flox+Pref+Interlock	0.07+12+0.25%+4	56	49
Thcz+Clpy&Flox&MCPA	0.07+8.7	59	49
Thcz+Clpy&Flox&MCPA+Pref+Interlock	0.07+8.7+0.25%+4	60	54
CV		9	13
LSD (P=0.05)		8	10

Thiencarbazone control of wild oat was improved with addition of EC broadleaf herbicide during evaluation on June 18. Additional adjuvant did not affect weed control. Effect of tankmix partner on thiencarbazone control of wild oat was varied on June 30. Tankmix with bromoxynil and MCPA or bromoxynil, MCPA, and fluroxypyr did not change control rating, but contrary to several other studies this year, clopyralid, fluroxypyr, and MCPA antagonized wild oat control with thiencarbazone. Addition of adjuvant did not provide control different from its paired tankmix partner treatment based on broadleaf herbicide.

Evaluate adjuvants for thiencarbazone. Howatt, Roach, and Harrington. No crop was seeded at this location near Fargo. Treatments were applied to 2 to 4 leaf wild oats on June 31 with 80°F, 50% relative humidity, 80% cloud cover, 3 to 7 mph wind velocity at 270°, and moist soil at 64°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wioa 6/18	Wioa 6/30
	oz ai/A	%	%
Thcz	0.07	60	75
Thcz+Interlock	0.07+4	61	71
Thcz+AG13064	0.07+4	60	66
Thcz+AG14004	0.07+4	59	66
Thcz+AG13040	0.07+0.25%	56	62
Thcz+AG14019	0.07+0.5%	57	70
Thcz+AG14020	0.07+0.5%	25	72
Thcz+AG14012	0.07+6.4	64	72
Thcz+AG7043	0.07+6.4	65	71
Thcz+NIS	0.07+0.25%	65	67
Thcz+HSMOC	0.07+20	66	67
CV		9	8
LSD (P=0.05)		8	8

Thiencarbazone alone gave 75% control of wild oat on June 30. This treatment provided the highest numerical control value. None of the adjuvants improved control, but five adjuvants, with treatment control values of 67% or less, antagonized thiencarbazone control of wild oat.

Herbicide as adjuvant for Flucarbazone. Howatt, Roach, and Harrington. No crop was seeded to near to this location near Fargo. Treatments were applied to 2 to 4 leaf wild oats on June 3 with 80°F, 50% relative humidity, 80% cloud cover, 3 to 6.8 mph wind velocity at 270°, and moist soil at 64°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wioa 6/18	Wioa 6/30
	oz ai/A	%	%
Flcz	0.43	47	45
Flcz+Brox&MCPA	0.43+8	67	74
Flcz+Brox&MCPA+Pref+Interlock	0.43+8+0.25%+4	65	70
Flcz+Brox&MCPA&Flox	0.43+12	66	69
Flcz+Brox&MCPA&Flox+Pref+Interlock	0.43+12+0.25%+4	61	72
Flcz+Clpy&Flox&MCPA	0.43+8.7	65	60
Flcz+Clpy&Flox&MCPA+Pref+Interlock	0.43+8.7+0.25%+4	60	71
CV		6	6
LSD (P=0.05)		6	6

Flucarbazone alone gave 47% control of wild oat on June 18. Addition of EC broadleaf herbicide increased control with flucarbazone to about 66%, but inclusion of adjuvant did not influence wild oat control beyond the effect of EC herbicide. Similar trends were detected at evaluation on June 30.

Adjuvants to improve resistant-wild oat control. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Nielsville on May 26 in an area known to have resistant wild oat biotypes. Treatments were applied to 4 to 5 leaf wheat and wild oat on July 2 with 57°F, 76% relative humidity, clear sky, 2 to 6 mph wind velocity at 340°, and wet soil at 56°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 38 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wioa 7/15	Wioa 8/4
	oz ai/A	%	%
Flcz+NIS+AMS	0.44+0.25%+16	74	79
Clfp NG	0.8	65	72
Flcz+Clfp NG	0.44+0.8	72	69
Flcz+Clfp NG+Thif+Trib	0.44+0.8+0.1+0.1	71	83
Flcz+Clfp NG+AMS	0.44+0.8+16	71	72
Flcz+Clfp NG+NIS	0.44+0.8+0.25%	74	70
Flcz+Clfp NG+NIS+AMS	0.44+0.8+0.25%+16	71	69
Flcz+Clfp NG+Basic Blend	0.44+0.8+1%	72	66
Flcz+Clfp NG+MSO	0.44+0.8+20	74	65
Flcz+Clfp NG+MSO+AMS	0.44+0.8+20+16	72	67
Flcz+Clfp NG+HSMOC	0.44+0.8+20	69	60
Flcz+Clfp NG+Thif+Trib+NIS+AMS	0.44+0.8+0.1+0.1+0.25%+16	75	76
CV		4	8
LSD (P=0.05)		4	8

The combination of flucarbazone and clodinafop did not give better control than either of the herbicides alone. Adjuvants did not improve control. Addition of thifensulfuron and tribunuron increased wild oat control to 83%.

Wild oat standards. The trial was established with no crop near Fargo, North Dakota. Treatments were applied to 2 to 3 leaf wild oat and 1 to 3 leaf yellow foxtail on July 3 with 78°F, 60% relative humidity, clear sky, 1 to 2 mph wind velocity at 180°, and moist soil at 60°F. Barnyardgrass was not evident at application. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wioa 7/18	Yeft 7/18	Wioa 8/12	Yeft 8/12	Bygr 8/12
	oz ai/A	%	%	%	%	%
Flcz+Brox&MCPA5+BB	0.32+8+1%	67	55	99	74	47
Prcz+Brox&MCPA5+BB	0.42+8+1%	67	52	80	64	89
Prcz&Mess+Brox&MCPA5+BB	0.2+8+1%	66	54	95	65	86
Pyroxsulam+Brox&MCPA5+BB	0.26+8+1%	75	71	95	84	90
Pyroxsulam&Flas&Flox+BB	1.68+1%	75	64	93	77	91
Brox&Pyst&Thcz+UAN	3+16	77	75	95	80	86
Fenoxaprop+Brox&MCPA5	1.32+8	77	60	71	65	76
Clodinfop NG+Brox&MCPA5	0.8+8	77	67	85	74	84
Pinoxaden+Brox&MCPA5	0.86+8	79	74	99	84	62
Fenoxaprop&Pnx+Brox&MCPA5	0.86+8	77	70	97	80	57
Brox&MCPA5	8	0	0	0	0	0
CV		6	15	5	6	6
LSD (P=0.05)		6	13	6	6	7

Initially flucarbazone, propoxycarbazone, and mesosulfuron gave less control of wild oat and yellow foxtail than other grass herbicides. By August, flucarbazone provided 99% control of wild oat but only gave 47% control of barnyardgrass. Pinoxaden also did not control barnyardgrass well, 62%, but gave the highest control values for wild oat and yellow foxtail. Pyroxsulam formulated in Powerflex gave similar control of wild oat and foxtail to pinoxaden but also provided 90% barnyardgrass control. Pyroxsulam formulated in Goldsky onlu gave 77% foxtail control. When all three species were taken into consideration the singular formulation of pyroxsualm was the best treatment with thiencarbazone providing similar control of each species.

Flucarbazone activity with sulfonylurea ratios. Howatt, Roach, and Harrington. No crop was seeded, the trial was established near Fargo. Treatments were applied to 2 to 3 leaf wild oat and 1 to 3 leaf foxtail on July 3 with 70°F, 44% relative humidity, clear sky, 1 to 2 mph wind at 180°, and moist soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wioa 7/18	Yeft 7/18	Wioa 8/12	Yeft 8/12
	oz ai/A	%	%	%	%
Flcz+NIS+AMS	0.33+0.25%+16	71	62	99	66
Flcz+Thif+Trib+NIS+AMS	0.33+0.1+0.1+0.25%+16	80	84	99	87
Flcz+ARY546+ARY547+NIS+AMS	0.33+0.225+0.075+0.25%+16	74	71	99	74
Flcz+ARY547+NIS+AMS	0.33+0.036+0.25%+16	72	67	99	64
Flcz+ARY547+NIS+AMS	0.33+0.071+0.25%+16	70	66	99	64
Flcz+ARY547+NIS+AMS	0.33+0.11+0.25%+16	72	72	99	71
Flcz+ARY547+NIS+AMS	0.33+0.143+0.25%+16	70	70	99	74
Flcz+ARY547+NIS+AMS	0.33+0.22+0.25%+16	72	74	99	70
Flcz+ARY547+NIS+AMS	0.44+0.11+0.25%+16	76	74	99	70
Flcz+ARY547+NIS+AMS	0.44+0.143+0.25%+16	76	76	99	77
Flcz+ARY546+NIS+AMS	0.33+0.22+0.25%+16	71	74	99	81
Flcz+ARY546+NIS+AMS	0.33+0.143+0.25%+16	75	74	99	77
Pxlm&Flas&Flox+NIS+AMS	1.68+0.25%+16	75	74	99	66
Broxl&Pyst&Thcz+NIS+AMS	3+0.25%+16	77	81	99	84
CV		3	4	0	5
LSD (P=0.05)		3	4	0	5

Control of wild oat with flucarbazone was initially enhanced with inclusion of thifensulfuron and tribenuron, but by August, all treatments controlled wild oat completely. Yellow foxtail control also was increased with the addition of thif and trib by about 20 percentage points, 87%. Several treatments with ARY546 or 547 did not increase foxtail control. And those treatments that did provide better control than flucarbazone alone, 66%, were not similar to the best treatment. Thiencarbazone provided similar yellow foxtail control to the best treatment, but pyroxsulam only gave 66% control.

ALS timing for grass control. Howatt, Roach, and Harrington. No crop was seeded at this location near Fargo. Treatments (1.5 leaf) were applied to 2 to 3 leaf wild oat and 1 to 3 leaf foxtail on July 3 with 72°F, 43% relative humidity, clear sky, less than 1 mph wind velocity at 180°, and moist soil at 60°F. Treatments (4 leaf) were applied to 4 to 5 leaf wild oat, 3 to 4 leaf yellow foxtail, and flowering wild mustard on July 10 with 63°F, 70% relative humidity, clear sky, 5.5 to 7 mph wind velocity at 140°, and dry soil at 67°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

			Wioa	Fxtl	Wioa	Fxtl	Wioa	Yeft	Grft
Treatment	Rate	leaf stage	7/18	7/18	7/24	7/24	8/12	8/12	8/12
	oz ai/A		%	%	%	%	%	%	%
Flcz+Clpy&Flox+MCPA+NIS+AMS	0.44+3+4+0.25%+16	1.5	76	76	92	84	98	80	95
Flcz+Thif+Trib+Clpy&Flox+ NIS+AMS	0.33+0.1+0.1+3+ 0.25%+16	1.5	82	84	94	89	99	87	93
Flcz+Thif+Trib+Clpy&Flox+ NIS+AMS	0.44+0.1+0.1+3+ 0.25%+16	1.5	76	82	94	87	99	88	96
Pxlm&Flas&Flox+NIS+AMS	1.68+0.25%+16	1.5	81	79	93	79	99	86	7
Thcz+Clpy&Flox+MCPA+ NIS+AMS	0.5+3+4+ 0.25%+16	1.5	87	90	95	93	99	94	0
Flcz+Clpy&Flox+MCPA+NIS+AMS	0.44+3+4+0.25%+16	4L	70	60	88	83	97	71	96
Flcz+Thif+Trib+Clpy&Flox+ NIS+AMS	0.33+0.1+0.1+3+ 0.25%+16	4L	70	60	88	81	99	75	94
Flcz+Thif+Trib+Clpy&Flox+ NIS+AMS	0.44+0.1+0.1+3+ 0.25%+16	4L	70	60	85	76	99	72	96
Pxlm&Flas&Flox+NIS+AMS	1.68+0.25%+16	4L	70	60	85	77	99	67	35
Thcz+Clpy&Flox+MCPA+NIS+AMS	0.5+3+4+0.25%+16	4L	70	60	88	86	97	87	30
ARY-0454-124+Thif+Trib+ Clpy&Flox+NIS+AMS	0.44+0.1+0.1+ 3+0.25%+16	4L	70	60	87	82	99	75	95
Brox&Pyst&Thcz+AMS	3+8	4L	70	60	88	87	96	83	35
Untreated Check	0		0	0	0	0	0	0	0
CV			5	3	2	4	2	6	9
LSD (P=0.05)			5	3	3	4	2	6	8

Control of weeds was not greatly accelerated with the earlier application timing considering the difference in application dates. Control of wild oat in August exceeded 95% for each herbicide treatment. Best control of yellow foxtail was achieved with thiencarbazone applied to small weeds, 94%. With early application, thifensulfuron and tribenuron enhanced the activity of flucarbazone to yellow foxtail by 8 percentage points, which resulted in similar control to pyroxsulam but still less than thiencarbazone. But thiencarbazone and pyroxsulam did not suppress green foxtail while flucarbazone provided 95% control.

Weed control in spring wheat with Varro tank mixes. (Jenks, Walter, and Willoughby). The objective of the study was to evaluate broadleaf and grassy weed control with Varro tank mixes. All treatments were applied postemergence on May 15 to 4-leaf wheat, 3-leaf wild oat, 0.5-4 inch foxtail, 0.5-2 inch redroot pigweed, and 3-12 inch curly dock. All treatments caused early, temporary chlorosis but the symptoms disappeared by late June. All treatments provided excellent control of all weeds.

Table. Weed control with Varro tank mixes. (1426)

		Wheat			Weed Control[c]							
		Injury			Wild Oat		Green foxtail		Rrpw		Curly dock	
Treatments[abc]	Rate	Jun-12	Jun-17	Jul-02	Jun-17	Aug-09	Jun-17	Aug-09	Jun-17	Jul-02	Jun-17	Jul-02
		----------%----------			----------%----------		----------%----------		------%------		-----%-----	
Untreated		0	0	0	0	0	0	0	0	0	0	0
Bronate + Varro	1 pt + 6.85 oz	10	9	0	84	99	85	97	83	99	67	99
Weld + Varro	1.3 pt + 6.85 oz	11	9	0	85	99	85	98	84	99	87	99
Carnivore + Varro	1 pt + 6.85 oz	9	8	0	85	99	85	98	87	99	68	99
WM + MCPA Ester + Varro	1 pt + 0.5 pt + 6.85 oz	9	8	0	85	99	85	98	86	99	88	99
WM + 2,4-D Ester + Varro	1 pt + 0.5 pt + 6.85 oz	12	8	0	85	99	85	98	87	99	87	99
Affinity + WM + Varro	0.6 oz + 1 pt + 6.85 oz	9	8	0	85	99	85	98	90	99	87	99
Oly + Carnivore + Varro	0.2 oz + 1 pt + 6.85 oz	9	8	0	85	99	85	93	89	99	72	99
Huskie Complete	13.7 oz	9	8	0	85	99	85	92	88	99	87	99
LSD (0.05)		1.6	0.8	NS	1.2	0.0	1.4	3.1	2.5	0.0	4.6	0.0
CV		10.4	6.5	0.0	0.9	0.0	1.1	2.1	1.9	0.0	3.7	0.0

[a] All treatments applied at 3-leaf wild oat

[b] All treatments applied with AMS at 1.47 gal/100 gal

[c] Rrpw=Redroot pigweed; Affinity=Affinity TankMix; WM=WideMatch; Oly=Olympus

Grass control with thiencarbazone tank-mixes. Howatt, Roach, and Harrington. No crop was seeded at this location near Fargo. Treatments were applied to 2 to 3 leaf wild oat and 1 to 3 leaf foxtail on July 3 with 87°F, 30% relative humidity, clear sky, 1 to 2 mph wind velocity at 225°, and moist soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wioa 7/14	Fxtl 7/14	Wioa 7/24	Fxtl 7/24	Wioa 8/12	Grft 8/12	Yeft 8/12
	oz ai/A	%	%	%	%	%	%	%
Thcz+Brox&MCPA+AMS	0.07+8+8	71	80	97	90	99	71	81
Thcz+Clpy&Flox&MCPA+AMS	0.07+7.5+8	74	82	96	92	99	81	93
Thcz+Brox&MCPA&Flox+AMS	0.07+8+8	72	81	97	88	99	71	80
Thcz+Clpy&Flox+MCPA+AMS	0.07+3+4+8	71	82	97	93	99	80	90
Thcz+Clpy&Flox+2,4-D+AMS	0.07+3+3.8+8	74	84	97	90	99	52	82
Thcz+Clpy&Flox+Thif-sg+Trib-sg+AMS	0.07+3+0.24+0.06+8	74	82	97	92	99	77	82
Thcz+Prcz+Brox&MCPA&Flox+AMS	0.07+0.14+8+8	75	81	97	90	99	71	81
Brox&MCPA&Flox+Thif-sg	8+0.24	0	0	0	0	0	0	0
CV		5	3	1	3	0	10	4
LSD (P=0.05)		5	3	1	4	0	9	5

Grass herbicides gave similar control of wild oat within each evaluation with control reaching 99% in August. At this evaluation, foxtail heads enabled separation of green from yellow foxtail. Highest foxtail control values were obtained with thiencarbazone tankmixed with clopyralid, fluroxypyr, and MCPA. The premix of these herbicides, Weld, tended to give slightly higher values than the tankmix of WideMatch plus Sword. Thiencarbazone combined with clopyralid, fluroxypyr, and 2,4-D only gave 52% control of green foxtail while other tankmixes gave at least 71% control.

Grass control with thiencarbazone tankmixes. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 29. Treatments were applied to 3 leaf wheat and 3 to 4 inch foxtail on June 25 with 68°F, 76% relative humidity, 100% cloud cover, 2 to 4 mph wind velocity at 135°, and wet soil at 63°F. Wild oat was not obvious at application and was sparse at evaluation. Treatments were applied with a backpack sprayer delivering 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wht 7/3	Yeft 7/3	Yeft 7/15	Yeft 8/8	Wioa 8/8	Yield 9/3
	oz ai/A	%	%	%	%	%	bu/A
Thcz+Brox&MCPA+AMS	0.07+8+8	0	75	85	89	93	49
Thcz+Clpy&Flox&MCPA+AMS	0.07+7.5+8	0	87	90	96	98	48
Thcz+Brox&MCPA&Flox+AMS	0.07+8+8	0	72	84	86	86	51
Thcz+Clpy&Flox+MCPA+AMS	0.07+3+4+8	0	79	89	92	87	45
Thcz+Clpy&Flox+2,4-D+AMS	0.07+3+3.8+8	0	86	91	86	91	43
Thcz+Clpy&Flox+Thif-sg+Trib-sg+AMS	0.07+3+0.24+0.06+8	0	81	85	90	92	46
Thcz+Prcz+Brox&MCPA&Flox+AMS	0.07+0.14+8+8	0	60	55	42	78	42
Brox&MCPA&Flox+Thif-sg	8+0.24	0	0	0	0	0	43
CV		0	4	5	4	5	12
LSD (P=0.05)		0	4	5	4	7	8

Herbicide treatments did not cause visible wheat response. Addition of propoxycarbazone greatly antagonized control of grasses. With similar broadleaf tankmix partners, inclusion of propoxycarbazone resulted in less than half as much foxtail control and wild oat control was about 10% less than for thiencarbazone alone. Tankmix with the premix of clopyralid, fluroxypyr, and MCPA (Weld) resulted in the highest level of control, 96% for foxtail and 98% for wild oat. This was better than the combined premix of clopyralid and fluroxypyr (Widematch) with MCPA (Sword).

Herbicide as adjuvant for thiencarbazone. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo, North Dakota on May 29. Treatments were applied to 3 leaf wheat and yellow foxtail on June 25 with 70°F, 70% relative humidity, 100% cloud cover, 2 to 5 mph wind velocity at 125°, and wet soil. Treatments were applied with a backpack sprayer delivering 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with three replicates.

Treatment	Rate	Wht 7/3	Yeft 7/3	Yeft 7/14	Yeft 7/23
Thcz	0.07	0	73	78	83
Thcz+Brox&MCPA	0.07+8	0	73	78	85
Thcz+Brox&MCPA+Pref+Interlock	0.07+8+0.25%+4	0	78	77	83
Thcz+Brox&MCPA&Flox	0.07+12	0	78	82	83
Thcz+Brox&MCPA&Flox+Pref+Interlock	0.07+12+0.25%+4	0	72	77	83
Thcz+Clpy&Flox&MCPA	0.07+8.7	0	85	86	91
Thcz+Clpy&Flox&MCPA+Pref+Interlock	0.07+8.7+0.25%+4	0	82	86	91
CV		0	3	3	3
LSD (P=0.05)		0	5	5	4

Herbicide treatments did not cause visible injury to wheat. Thiencarbazone gave 83% control of yellow foxtail on July 23. Thiencarbazone treatments that included the premix clopyralid, fluroxypyr, and MCPA (Weld) provided 91% control of foxtail. This enhancement was observed at all evaluations. Other herbicides did not have the same effect. Addition of NIS to the treatment did not influence the activity of thiencarbazone on yellow foxtail when an EC broadleaf herbicide was already in the treatment.

Evaluation of adjuvants for Thiencarbazone. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded on May 29. Treatments were applied to 4 leaf stage wheat and yellow foxtail on June 25 with 70°F, 70% relative humidity, 100% cloud cover, 2 to 5 mph wind velocity at 120°, and wet soil. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wht 7/3	Yeft 7/3	Yeft 7/14	Yeft 7/23
	oz ai/A	%	%	%	%
Thcz	0.07	0	70	79	87
Thcz+Interlock	0.07+4	0	80	85	87
Thcz+AG13064	0.07+4	0	79	80	86
Thcz+AG14004	0.07+4	0	79	84	88
Thcz+AG13040	0.07+0.25%	0	79	83	88
Thcz+AG14019	0.07+0.5%	0	80	84	88
Thcz+AG14020	0.07+0.5%	0	80	83	89
Thcz+AG14012	0.07+6.4	0	77	83	85
Thcz+AG7043	0.07+6.4	0	77	85	91
Thcz+NIS	0.07+0.25%	0	80	81	86
Thcz+HSMOC	0.07+20	0	84	85	90
CV		0	3	4	3
LSD (P=0.05)		0	4	4	3

Herbicide injury to wheat was not observed. Thiencarbazone alone gave 87% control of yellow foxtail. AG7043 was the only experimental adjuvant to increase thiencarbazone control of yellow foxtail, 91%. A standard high surfactant methylated seed oil adjuvant also enhanced thiencarbazone control to 90%. The treatment that included AG14020 gave similar control to the treatment with AG7043 but was not different from thiencarbazone alone. None of the adjuvants antagonized the activity of thiencarbazone on yellow foxtail.

Herbicide as adjuvant for Flucarbazone. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo, North Dakota on May 29. Treatments were applied to 3 leaf wheat and yellow foxtail on June 25 with 68°F, 70% relative humidity, 100% cloud cover, 2 to 5 mph wind velocity at 125°, and wet soil at 63°F. Treatments were applied with a backpack sprayer delivering 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wht 7/3	Yeft 7/3	Yeft 7/14	Yeft 7/23
	oz ai/A	%	%	%	%
Flcz	0.43	0	60	54	62
Flcz+Brox&MCPA	0.43+8	0	69	70	77
Flcz+Brox&MCPA+Pref+Interlock	0.43+8+0.25%+4	0	70	71	79
Flcz+Brox&MCPA&Flox	0.43+12	0	61	64	76
Flcz+Brox&MCPA&Flox+Pref+Interlock	0.43+12+0.25%+4	0	72	71	79
Flcz+Clpy&Flox&MCPA	0.43+8.7	0	70	72	79
Flcz+Clpy&Flox&MCPA+Pref+Interlock	0.43+8.7+0.25%+4	0	60	71	77
CV		0	3	6	5
LSD (P=0.05)		0	3	6	5

Treatments did not cause visible injury to wheat. Flucarbazone alone gave 62% control of yellow foxtail. Control was improved to nearly 80% when EC herbicides and NIS were included. The formulation components in EC herbicides worked well to enhance flucarbazone activity. Further addition of NIS with flucarbazone and EC broadleaf formulation did not enhance control of yellow foxtail.

Flucarbazone activity with su ratios. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 30. Treatments were applied to 1 to 4 leaf foxtail on June 25 with 75% relative humidity, 100% cloud cover, 2 to 5 mph wind velocity at 150°, and wet soil at 63°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	WHT 7/14	Yeft 7/14	Yeft 7/23
	oz ai/A	%	%	%
Flcz+NIS+AMS	0.33+0.25%+16	0	55	52
Flcz+Thif+Trib+NIS+AMS	0.33+0.1+0.1+0.25%+16	0	76	84
Flcz+ARY546+ARY547+NIS+AMS	0.33+0.225+0.075+0.25%+16	0	70	72
Flcz+ARY547+NIS+AMS	0.33+0.036+0.25%+16	0	65	69
Flcz+ARY547+NIS+AMS	0.33+0.071+0.25%+16	0	64	66
Flcz+ARY547+NIS+AMS	0.33+0.11+0.25%+16	0	64	55
Flcz+ARY547+NIS+AMS	0.33+0.143+0.25%+16	0	67	72
Flcz+ARY547+NIS+AMS	0.33+0.22+0.25%+16	0	69	71
Flcz+ARY547+NIS+AMS	0.44+0.11+0.25%+16	0	67	71
Flcz+ARY547+NIS+AMS	0.44+0.143+0.25%+16	0	67	74
Flcz+ARY546+NIS+AMS	0.33+0.22+0.25%+16	0	65	70
Flcz+ARY546+NIS+AMS	0.33+0.143+0.25%+16	0	62	69
Pxlm&Flas&Flox+NIS+AMS	1.68+0.25%+16	0	74	79
Broxl&Pyst&Thcz+NIS+AMS	3+0.25%+16	0	76	85
CV		0	7	6
LSD (P=0.05)		0	7	6

Herbicides did not cause visible response in wheat. Thifensulfuron and tribenuron substantially increased the control of yellow foxtail with flucarbazone. ARY546 and 547 also increased foxtail control but not to the extent that was achieved with thif and trib. Thiencarbazone in premix provided 85% control, and pyroxsulam in premix gave 79% control.

ALS timing for grass control. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 30. Treatments (1.5L) were applied to foxtail on June 11 with 68°F, 68% relative humidity, 100% cloud cover, 4.5 mph wind velocity at 95°, and dry soil at 64°F. Treatments (4L) were applied to 3 to 4 leaf foxtail, and 4 to 6 leaf wild buckwheat on June 25 with 69°F, 74% relative humidity, 100% cloud cover, 2 to 4 mph wind velocity at 120°, and wet soil at 64°F. All treatments were applied with a backpack sprayer delivering 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Stage	Wht 6/27	Yeft 6/27	Yeft 7/14	Yeft 7/23
	oz ai/A	leaf	%	%	%	%
Flcz+Clpy&Flox+MCPA+NIS+AMS	0.44+3+4+0.25%+16	1.5	1	92	45	66
Flcz+Thif+Trib+Clpy&Flox+ NIS+AMS	0.33+0.1+0.1+3+ 0.25%+16	1.5	1	92	47	66
Flcz+Thif+Trib+Clpy&Flox+ NIS+AMS	0.44+0.1+0.1+3+ 0.25%+16	1.5	1	92	45	67
Pxlm&Flas&Flox+NIS+AMS	1.68+0.25%+16	1.5	1	91	40	47
Thcz+Clpy&Flox+MCPA+ NIS+AMS	0.5+3+4+ 0.25%+16	1.5	1	91	40	61
Flcz+Clpy&Flox+MCPA+NIS+AMS	0.44+3+4+0.25%+16	4	14	27	60	61
Flcz+Thif+Trib+Clpy&Flox+ NIS+AMS	0.33+0.1+0.1+3+ 0.25%+16	4	12	27	71	71
Flcz+Thif+Trib+Clpy&Flox+ NIS+AMS	0.44+0.1+0.1+3+ 0.25%+16	4	14	30	71	79
Pxlm&Flas&Flox+NIS+AMS	1.68+0.25%+16	4	13	27	72	74
Thcz+Clpy&Flox+MCPA+NIS+AMS	0.5+3+4+0.25%+16	4	9	22	60	55
ARY-0454-124+Thif+Trib+ Clpy&Flox+NIS+AMS	0.44+0.1+0.1+ 3+0.25%+16	4	13	30	70	76
Brox&Pyst&Thcz+AMS	3+8	4	7	22	77	83
Untreated Check	0		2	0	0	0
CV			33	7	7	8
LSD (P=0.05)			3	5	5	7

Injury to wheat was not observed at an earlier evaluation date and was not present in July. Herbicides gave much better control when applied to 1.5 leaf plants than when plants approached the 4 leaf stage. The open understory resulting from excellent foxtail control when treated at the 1.5 leaf stage allowed a second flush of yellow foxtail that is the source of evaluation in July for treatments to 1.5 leaf plants while rating of the 4 leaf stage was predominantly emerged plants at application. Flucarbazone residual gave 66% control of the second foxtail flush. Thiencarbazone gave similar control at 61%.

Foxtail at the 4 leaf stage was very difficult to control. Inclusion of thifensulfuron and tribenuron improved flucarbazone activity by 10 to 20 percentage points. Thiencarbazone in premix provided 83% control but in the singular formulation in tankmix only gave 55% control.

Downy brome control in spring wheat. Howatt, Roach, and Harrington. 'Glenn' hard red spring wheat was seeded near Valley City on April 21. Treatments were applied to 2 leaf wheat and 2 to 3 leaf, tillering downy brome on May 23 with 64°F, 56% relative humidity, 60% cloud cover, 10 to 12 mph wind at 180°, and damp soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 feet. The experiment was a randomized complete block design with four replications.

Treatment	Rate	Wht 6/4	Dobr 6/4	Dobr 6/26
	oz ai/A	%	%	%
Flcz+Clpy&Flox+Thif-sg+BB	0.43+3+0.2+1%	0	91	86
Flcz+Clpy&Flox+Thif-sg+HSMOC	0.43+3+0.2+20	0	87	81
Prcz+Clpy&Flox+Thif-sg+BB	0.42+3+0.2+1%	0	87	85
Prcz&Mess+Clpy&Flox+Thif-sg+BB	0.2+3+0.2+1%	0	90	80
Pxlm+Clpy&Flox+Thif-sg+BB	0.26+3+0.2+1%	0	85	82
Pxlm&Flas&Flox+BB	1.68+1%	0	85	81
Thcz+Clpy&Flox+Thif-sg+BB	0.07+3+0.2+1%	0	85	79
Brox&Pyst&Thcz+Clpy&Flox+BB	3+3+1%	0	83	69
Imazamox+Clpy&Flox+BB	0.5+3+1%	89	91	99
Thcz+Pxlm&Flas&Flox+BB	0.07+1.68+1%	0	91	87
Prcz+Thcz+Clpy&Flox+BB	0.14+0.07+3+1%	0	87	74
Flcz+Thcz+Clpy&Flox+BB	0.32+0.07+3+1%	0	89	85
Flcz+Prcz+Clpy&Flox+BB	0.32+0.14+3+1%	0	86	79
CV		10	5	9
LSD (P=0.05)		1	7	11

Imazamox produced 89% injury to wheat which was expected because Clearfield wheat was not used. Imazamox also controlled downy brome exceptionally well. At 99% control, imazamox provided the best brome control. Flucarbazone, propoxycarbazone, and thiencarbazone (as Varro) each gave about 85% control of downy brome, but combinations of these herbicides did not result in better control. Thiencarbazone in premix with bromoxynil and pyrasulfotole only gave 69% control.

Herbicide as adjuvant for Flucarbazone. Howatt, Roach, and Harrington. 'Glenn' hard red spring wheat was seeded near Valley City on April 21. Treatments were applied to wheat and 2 to 3 leaf downy brome on May 23 with 64°F, 56% relative humidity, 60% cloud cover, 10 to 12 mph wind velocity at 180°, and damp soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with 3 replicates of wheat and 2 replicates of downy brome except treatments 2 and 3 which have 3 replicates.

Treatment	Rate	Wht 6/4	Dobr 6/4	Dobr 6/26
	oz ai/A	%	%	%
Flcz	0.43	5	75	75
Flcz+Brox&MCPA	0.43+8	5	85	86
Flcz+Brox&MCPA+Pref+Interlock	0.43+8+0.25%+4	5	87	84
Flcz+Brox&MCPA&Flox	0.43+12	5	80	77
Flcz+Brox&MCPA&Flox+Pref+Interlock	0.43+12+0.25%+4	5	80	75
Flcz+Clpy&Flox&MCPA	0.43+8.7	5	82	85
Flcz+Clpy&Flox&MCPA+Pref+Interlock	0.43+8.7+0.25%+4	5	82	80
CV		0	4	12
LSD		0	6	20

Variability among plots within a treatment led to high LSD for the final evaluation. Addition of Preference NIS and Interlock did not improve downy brome control with flucarbazone. Inclusion of bromoxynil and MCPA or clopyralid and fluroxypyr and MCPA tended to increase control of downy brome, but bromoxynil and MCPA and fluroxypyr did not.

Preharvest saflufenacil in wheat. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 30. Treatments were applied to biologically mature wheat, 4 inch heading Venice mallow, heading green and yellow foxtail, and 3 to 4 leaf wild buckwheat on August 26 with 56°F, 80% relative humidity, partly cloudy sky, and 2 mph wind at 270°, and moist soil at 60°F. Treatments were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 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	Wht 8/29	Yeft 8/29	Vema 8/29	Wht 9/2	Yeft 9/2	Vema 9/2	Wht 9/8	Yeft 9/8	Vema 9/8
	oz ai/A	%	%	%	%	%	%	%	%	%
Saff+MSO+AMS	0.36+1%+11	89	55	72	97	66	92	99	69	97
Saff+MSO+AMS	0.72+1%+11	87	52	80	98	79	93	99	79	97
Glyt+AMS	12+11	87	37	22	97	96	25	99	99	32
Saff+Glyt+MSO+AMS	0.36+12+1%+11	87	55	69	97	96	91	99	97	98
Saff+Glyt+MSO+AMS	0.72+12+1%+11	85	42	79	98	96	94	99	98	99
Saff+Dicamba+MSO+AMS	0.36+4+1%+11	89	45	79	95	57	89	99	80	96
Saff+2,4-D+MSO+AMS	0.36+8.4+1%+11	89	56	79	96	82	90	99	76	97
Saff+Glyt+HSMOC+AMS	0.36+12+20+11	87	50	70	98	96	94	99	95	98
Untreated Check	0	85	0	0	96	0	0	99	42	0
CV		3	14	9	2	7	6	0	4	3
LSD (P=0.05)		3	9	8	2	8	6	0	5	3

By the time field conditions allowed application of treatments, wheat vegetation had lost substantial green color and early stages of senescence were evident. Desiccation of wheat tended to be encouraged by herbicide treatments. Inclusion of saflufenacil greatly increased initial desiccation speed of yellow foxtail and Venice mallow. By September 2, treatments that contained glyphosate provided the best control of yellow foxtail at 96%, but Venice mallow control was more driven by saflufenacil, 89 to 94% control. Combination of glyphosate and saflufenacil provided the best control and desiccation of annual species in this study. Saflufenacil at 0.36 oz ai/A with glyphosate was sufficient to control weeds present.

Wheat response to glyphosate at 2 leaf. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 30. Treatments were applied to 1.5 to 2 leaf wheat on June 13 with 48°F, 66% relative humidity, clear sky, 0 to 0.5 mph wind velocity at variable directions, and moist soil at 53°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wht 6/27	Wht 7/14	Yield 9/3
	oz ae/A	%	%	bu/A
Glyt 4.5+NIS+AMS	1+0.25%+12	97	98	0
Glyt 4.5+NIS+AMS	0.75+0.25%+2	94	93	0
Glyt 4.5+NIS+AMS	0.5+0.25%+12	85	91	13
Glyt 4.5+NIS+AMS	0.35+0.25%+12	82	72	25
Glyt 4.5+NIS+AMS	0.25+0.25%+12	66	71	10
Glyt 4.5+NIS+AMS	0.1+0.25%+12	6	1	18
Glyt 4.5+NIS+AMS	0.05+0.25%+12	0	2	16
Glyt 4.5+NIS+AMS	0.01+0.25%+12	0	0	16
Untreated Check	0	0	0	25
CV		10	19	38
LSD (P=0.05)		8	14	10

Glyphosate rate above 0.5 oz ae/A destroyed wheat and prevented grain production. Comment about yield correlation to wheat injury was difficult because of saturated soil condition that caused poor wheat growth in large areas of the study. Glyphosate at 0.1 oz/A caused minimal visible injury to wheat.

Wheat response to Glyphosate at 4 leaf. Howatt, Roach, and Harrington. "Prosper" hard red spring wheat was seeded near Fargo on May 30. Treatments were applied to 3 to 4 leaf wheat, 2 to 4 leaf Venice mallow, and 3 leaf ladysthumb (smart weed) on July 31 with 76°F, 36% relative humidity, 10% cloud cover, 2 to 4 mph wind velocity at 250°, and wet saturated soil at 67°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with three replicates. Harvest for yield was on September 3.

Treatment	Rate	Wht 7/14	Wht 8/1	Yield 9/3
	oz ae/A	%	%	bu/A
Glyt 4.5+NIS+AMS	1+0.25%+12	95	99	0
Glyt 4.5+NIS+AMS	0.75+0.25%+2	90	97	0
Glyt 4.5+NIS+AMS	0.5+0.25%+12	83	95	0
Glyt 4.5+NIS+AMS	0.35+0.25%+12	78	91	1
Glyt 4.5+NIS+AMS	0.25+0.25%+12	53	50	9
Glyt 4.5+NIS+AMS	0.1+0.25%+12	13	13	16
Glyt 4.5+NIS+AMS	0.05+0.25%+12	0	0	16
Glyt 4.5+NIS+AMS	0.01+0.25%+12	0	0	12
Untreated Check	0	0	0	20
CV		8	16	63
LSD (P=0.05)		7	13	14

Glyphosate rates above 0.35 oz ae/A destroyed wheat and prevented grain production, but even 0.25 oz/A caused 50% visible injury and resulted in 9 bu/A compared with 20 bu/A for untreated wheat. Overall, wheat yield was poor because of saturated soil condition.

Wheat response to Glyphosate at Flag Leaf. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo, North Dakota on May 30. Treatments were applied to flag leaf wheat, 4 to 5 leaf yellow foxtail, Venice mallow, and ladysthumb (smartweed) on July 16 with 84°F, 41% relative humidity, 90% clear sky, 1.5 mph wind velocity at 350°, and dry soil at 78°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment is a randomized complete block design with four replications.

Treatment	Rate	Wht 8/1	Wht 8/13	Yield 9/3
	oz ae/A	%	%	bu/A
Glyt 4.5+NIS+AMS	1+0.25%+12	96	98	0
Glyt 4.5+NIS+AMS	0.75+0.25%+2	89	95	0
Glyt 4.5+NIS+AMS	0.5+0.25%+12	85	88	1
Glyt 4.5+NIS+AMS	0.35+0.25%+12	75	76	2
Glyt 4.5+NIS+AMS	0.25+0.25%+12	62	64	3
Glyt 4.5+NIS+AMS	0.1+0.25%+12	14	9	23
Glyt 4.5+NIS+AMS	0.05+0.25%+12	1	2	26
Glyt 4.5+NIS+AMS	0.01+0.25%+12	0	0	34
Untreated Check	0	0	0	33
CV		8	6	19
LSD (P=0.05)		5	4	5

Glyphosate rate above 0.5 oz ae/A destroyed wheat and prevented grain production, but rate as low as 0.25 oz/A caused 64% visible injury and resulted in only 3 bu/A grain. Glyphosate at 0.05 oz/A did not cause visible injury different from the untreated but resulted in 21% yield loss.

Wheat response to Glyphosate at Anthesis. Howatt, Roach, and Harrington. 'Prosper' hard red spring wheat was seeded near Fargo on May 30. Treatments were applied to anthesis wheat on July 25 with 74°F, 83% relative humidity, 5% cloud cover, 7.5 to 9.5 mph wind velocity at 150°, and moist soil at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 feet plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Wht 8/8	Wht 8/21	Yield 9/3
	oz ae/A	%	%	bu/A
Glyt 4.5+NIS+AMS	1+0.25%+12	93	93	10
Glyt 4.5+NIS+AMS	0.75+0.25%+2	84	80	17
Glyt 4.5+NIS+AMS	0.5+0.25%+12	66	70	29
Glyt 4.5+NIS+AMS	0.35+0.25%+12	14	50	35
Glyt 4.5+NIS+AMS	0.25+0.25%+12	9	41	41
Glyt 4.5+NIS+AMS	0.1+0.25%+12	0	34	45
Glyt 4.5+NIS+AMS	0.05+0.25%+12	0	36	48
Glyt 4.5+NIS+AMS	0.01+0.25%+12	0	34	46
Untreated Check	0	0	31	49
CV		15	11	22
LSD (P=0.05)		7	8	11

Glyphosate caused as much as 93% visible injury but did not prevent grain production. Injury on August 21 included some natural senescence and desiccation providing the 31% rating for the untreated. Glyphosate at 0.25 oz/A produced mild injury response, but grain yield was not low enough to be different than in untreated plots.