Fall-applied Spartan in wheat. Jenks, Willoughby, and Markle. 'Mountrail' durum was seeded April 23 into 7.5-inch rows at 120 lb/A. Individual plots were 10 x 30 ft and replicated three times. Fall and PRE treatments were applied on November 19 and April 24, respectively, with a bicycle sprayer delivering 20 gpa at 30 psi through XR 80015 nozzles. Air and soil temperatures were 50 and 32 F, respectively, and relative humidity was 63% on November 19. Air and soil temperatures were 70 and 65 F, respectively, and relative humidity was 28% on April 24. POST treatments were applied June 2 with a bicycle sprayer delivering 10 gpa at 40 psi through XR 8001 nozzles to 5-leaf durum. Air and soil temperatures were 66 and 66 F, respectively, and relative humidity was 55%. Weeds evaluated were kochia (Kocz), common lambsquarters (Colq), and redroot pigweed (Rrpw).

		Kocz			Colq			Rrpw				Test
		Jun	Jun	Jul	Jun	Jun	Jul	Jun	Jun	Jul	Yield	Wt
Treatment	Rate	7	17	7	7	17	7	7	17	7	Aug 7	
		% control									bu/A	lb/bu
Fall/POST												
Spartan/ Puma	3 oz/ 0.4 pt	98	96	100	98	99	100	79	85	91	51	60.9
Spartan/ Puma	4 oz/ 0.4 pt	97	98	100	100	100	100	81	90	97	46	59.8
Spartan/ Puma	5.33 oz/ 0.4 pt	100	100	100	100	100	100	82	92	97	55	60.9
Spartan/ Puma + Aim + MCPA ester	3 oz/ 0.4 pt + 0.5 fl oz + 0.75 pt	100	100	100	100	100	100	97	100	100	51	60.6
Spartan/ Puma + Aim + MCPA ester	4 oz/ 0.4 pt + 0.5 fl oz + 0.75 pt	100	100	100	100	100	100	97	100	100	50	60.7
Spartan/ Puma + Aim + MCPA ester	5.33 oz/ 0.4 pt + 0.5 fl oz + 0.75 pt	100	100	100	100	100	100	97	100	100	50	60.8
PRE/POST												
Spartan/ Puma + Aim + MCPA ester	4 oz/ 0.4 pt + 0.5 fl oz + 0.75 pt	100	100	100	100	100	100	96	100	100	46	60.7
POST												
Puma + Bronate[a]	0.4 pt + 0.8 pt		100	100		100	100		98	99	53	60.2
Puma + Harmony GT + MCPA ester + Starane	0.4 pt + 0.3 oz + 0.75 pt + 0.5 pt		96	100		98	100		97	100	52	60.0
Untreated		0	0	0	0	0	0	0	0	0	42	60.0
LSD (0.05)		2	3	--	2	2	--	2	4	3	NS	NS
CV		1	2	0	1	1	0	2	3	3	13	0.8

[a]*Bronate Advanced*

Fall and spring applications of Spartan were evaluated for durum wheat tolerance and weed control. Spartan was applied alone or followed by standard wheat herbicides. These standard wheat herbicides were also applied alone as a comparison to the Spartan treatments.

We could not determine with certainty that any Spartan treatment caused crop injury. There were some crop growth differences within the plot area, but we believe these growth differences were due to variation in soil type and drought stress rather than herbicide injury since they did not follow plot borders.

Wheat response to V10136. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 25 near Fargo, North Dakota. Pre-emergence treatments were applied May 2 with 48° F, 25% relative humidity, clear sky, and 5 mph south wind. Treatments were applied to 4.5- to 5-leaf wheat, 2 to 3 leaf yellow foxtail, and 1- to 2-inch common lambsquarters and redroot pigweed on June 3 with 66° F 32% relative humidity, partly cloudy sky, 8 mph south wind, and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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[a]	Rate		Jun 11 Wheat	Jun 18 Wheat	Jun 18 Yeft	Jun 18 Rrpw	Jun 18 Colq	Jul 14 Yeft	Jul 14 Rrpw	Jul 14 Colq	Jul 14 Wibw	Aug 15 Yield
Name	oz/A						%					bu/A
V10136	1	PRE	0	0	10	40	40	0	45	87	0	46
V10136	2	PRE	0	0	25	91	90	47	98	96	90	49
V10136	3	PRE	0	0	60	95	95	73	99	99	96	52
V10136/Fenx+Thif&Trib+2,4-D+NIS	1/0.8+0.3+6+0.25%	PRE/4L	4	0	81	95	95	98	99	99	98	58
V10136/Fenx+Thif&Trib+2,4-D+NIS	2+0.8+0.3+6+0.25%	PRE/4L	4	0	84	95	92	99	99	99	99	53
V10136+NIS	1+0.25%	4L	42	7	50	50	50	73	98	99	92	47
V10136+Fenoxaprop+NIS	1+0.8+0.25%	4L	34	6	96	55	55	99	99	99	99	52
V10136+Thif&Trib+2,4-D+NIS	1+0.3+6+0.25%	4L	22	7	67	60	60	97	99	99	99	49
Fenoxaprop+Thif&Trib+2,4-D+NIS	0.8+0.3+6+0.25%	4L	0	0	89	95	91	99	99	99	99	56
Untreated	0		0	0	0	0	0	0	0	0	0	59
LSD (P=0.05)			3	1	10	22	21	4	5	3	3	17
CV			20	48	13	14	14	3	3	1	2	22
# of Reps			4	4	4	3	3	3	3	3	3	3

[a]V10136 is an experimental herbicide.

Weed populations were low and likely did not affect grain yield of untreated wheat. The fourth replicate was eliminated from most analysis because there were so few weeds to evaluate. Preemergence application of V10136 did not cause noticeable injury to wheat. Treatments with V10136 PRE followed by POST application of a conventional tank-mix resulted in 4% injury that was expressed as limp wheat stems and leaves. This injury was not present June 18. Postemergence application of V10136 caused significant injury (20 to 45%) that manifested as chlorotic and necrotic leaf tissue. The most injury occurred when V10136 was applied alone. Fenoxaprop or thifensulfuron&tribenuron plus 2,4-D had a safening effect for V10136 on wheat, but the injury was evident and persistent. Noticeable injury of 6 to 7% was recorded on June 18, and some damage on leaves remained on July 14 although injury was not different from untreated plants (data not shown). Weed control with 1 oz/A V10136 PRE generally was poor. Application of 2 oz/A V10136 PRE provided 90% control of broadleaf weeds and suppressed yellow foxtail (47% control). Application of 3 oz/A V10136 PRE provided at least 95% control of broadleaf weeds and gave 73% control of yellow foxtail. Application of 1 oz/A V10136 POST gave similar control as 3 oz/A V10136 PRE, but the injury from POST application was more than a grower is expected to tolerate. Yield tended to be reduced by V10136 compared with fenoxaprop and thifensulfuron&tribenuron with 2,4-D.

Foxtail control in cereal breeding nurseries. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Conlin' 2 row barley, 'Oxen' hard red spring wheat, 'Tradition' 6 row barley, 'Jerry' oat, and 'Lebsock' durum were seeded on May 2 at a location near Fargo, North Dakota. Preemergence treatments were applied May 8 with 64° F, 65% relative humidity, cloudy sky, and southeast wind at 12 mph. Post emergence treatments were applied to 4 to 5 leaf crops on June 3 with 66° F, 35% relative humidity, cloudy sky, 10 mph wind and soil temperature of 61° F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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.

			Jun 20					Jul 14				
			2 row		6 row			2 row		6 row		
Treatment	Rate	Timing	Barley	Wheat	Barley	Oat	Durum	Barley	Wheat	Barley	Oat	Durum
Name	oz/A		%									
Dimethenamid-P	16	PRE	5	6	4	1	35	0	0	0	0	0
Flufenacet	12	PRE	0	0	0	0	2	0	0	0	0	0
Quinclorac	4	PRE	0	0	0	0	1	0	0	0	0	0
Mesotrione	3	PRE	0	0	2	0	15	0	0	0	0	0
Dimethenamid-P	16	POST	0	0	1	1	3	0	0	0	0	0
Flufenacet	12	POST	0	0	0	5	9	0	0	0	8	0
Quinclorac+MSO	4+0.19G	POST	4	1	11	9	9	0	0	0	16	0
Meso+PO+UAN	1.5+1%+2.5%	POST	6	10	5	1	37	0	0	0	0	0
LSD (P=0.05)			6	5	7	8	11	0	0	0	3	0
CV			240	170	194	273	63	0	0	0	67	0

Barley, wheat, and oat were very tolerant of herbicides applied PRE expressing less than 7% injury on June 20. Injury to durum from PRE applications of dimethenamid-P or mesotrione was not evident on July 14. Dimethenamid-P was very safe to all cereal types as a POST application. Quinclorac applied POST injured all cereals on the June 20 evaluation. This injury was expressed as limp vegetation. Only oat still expressed this injury on July 14. Mesotrione caused significant injury to all cereals except oat on June 20, but no injury from mesotrione remained on July 14. Head emergence and grain development did not appear to be affected by any herbicide treatment.

Grass weed control in wheat. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 at Fargo, North Dakota. Treatments were applied to 3.5-leaf wild oat on May 29 with 88° F, 39% relative humidity, clear sky, 7 mph southwest wind and soil temperature of 58° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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 replcates.

Treatment[a]	Rate	Jun 13 Wioa	Jul 1 Wioa	Aug 12 Yield
	oz/A	%		bu/A
Imazamethabenz+thif&trib+2,4-D+NIS	5+0.22+4+0.25%	35	15	17
Flucarbazone+thif&trib+2,4-D+Quad 7	0.42+0.22+4+1%	52	74	18
Propoxycarbazone+thif&trib+2,4-D+Quad 7	0.42+0.22+4+1%	61	71	26
Mesosulfuron+thif&trib+2,4-D+Quad 7	0.036+0.22+4+1%	47	35	20
Clodinafop+bromoxynil&MCPA+Score	0.8+8+1%	62	79	22
Fenoxaprop+bromoxynil&MCPA	1.32+8	66	89	24
Tralkoxydim+brox&MCPA+Supercharge+AMS	2.9+8+0.5%+9.5	67	77	29
Flucarbazone+fenx+brox&MCPA+Quad 7	0.21+0.6+8+1%	57	71	18
Flucarbazone+mesotrione+2,4-D+Quad 7	0.21+0.75+4+1%	52	71	20
Difenzoquat+immb+thif&trib+2,4-D+NIS	3.7+8+0.22+4+0.25%	52	57	26
Untreated	0	0	0	14
LSD (P=0.05)		7	6	5
CV		9	8	16

[a]Bromoxynil&MCPA was 5 lb/gal formulation; mesosulfuron was formulated with safener in 1:6 ratio.

Wild oat control was less than expected with all herbicide treatments. Cool, wet conditions in June inhibited plant growth, which was believed to reduce herbicide efficacy. This was especially true with ALS-inhibiting herbicides and has been seen in previous studies. This environmental stress on herbicide performance accentuated 2,4-D antagonism of mesosulfuron activity on wild oat resulting in less than 50% control. Mesosulfuron antagonism by 2,4-D was known previously, and 2,4-D should not be appearing as a tank-mix option on the label. Fenoxaprop provided the best control of wild oat on July 1 (89%). Clodinafop and tralkoxydim gave 79 and 77% control, respectively, and all other treatments provided less than 75% wild oat control. Wheat treated with tralkoxydim (77% wild oat control) produced the greatest grain yield (29 bu/A), but grain yield did not correlate with wild oat control as it normally does. No injury was evident from the herbicide treatments so the yield response was an emigma.

2003 Wild Oat Control in Spring Wheat at Hettinger. (Eriksmoen) Reeder hard red spring wheat was seeded on April 24. Treatments were applied to 3 ½ leaf wheat and to 2 leaf wild oats on May 28 with 78 F, 30 % RH, partly cloudy sky and 6 mph NW wind. Treatments were applied with a tractor mounted CO^2 propelled plot sprayer delivering 10 gpa at 40psi through 8001.5 flat fan nozzles to a 5 foot wide area the length of 10 by 28 foot plots. The experiment was a randomized complete block design with four replications. Wild oat population was 4 plants per sq. foot. Evaluations for crop injury were on June 12 and July 26, and for wild oat control on June 27 and July 26. The trial was harvested on July 30.

	Treatment	Rate	6/12	6/27	July 26		7/30
			HRSW	Wiot	HRSW	Wiot	Yield
		oz/A ai	--------- % Control ---------				bu/A
1	Immb + Thif&Trib + 2,4-D + NIS	5 + 0.22 + 4 + 0.25%	0.25	87	0	99	26.1
2	Flcz + Thif&Trib + 2,4-D + Quad 7	0.42 + 0.22 + 4 + 1%	8.75	99	1.25	99	23.9
3	AE060 + Thif&Trib + 2,4-D + Quad 7	1.34g + 0.22 + 4 + 1%	5.00	99	0	99	24.7
4	Propoxycarb.+Thif&Trib+2,4-D+Quad 7	0.42 + 0.22 + 4 + 1%	7.50	99	1.25	99	23.2
5	Clodinafop + Brox&MCPA + Score	0.8 + 8 + 1%	0.25	99	0	99	26.3
6	Fenoxaprop + Brox&MCPA	1.32 + 8	0.25	99	0	99	26.0
7	Tral +Brox&MCPA+Supercharge+AMS	2.9 + 8 + 0.5% + 9.52	0.50	99	0	99	25.9
8	Flcz + Fenx + Brox&MCPA + Quad 7	0.21 + 0.6 + 8 + 1%	1.50	99	0	99	29.1
9	Flcz + Mesotrione + 2,4-D + Quad 7	0.21 + 0.75 + 4 + 1%	6.25	99	1.25	99	24.1
10	Dife+Immb+Thif&Trib+2,4-D+NIS	3.7+8+0.22+4+0.25%	1.50	99	0	99	24.5
11	Untreated		0	0	0	0	23.5
C.V. %			61.9	8.3	379	0	13.4
LSD 5%			2.6	11	ns	0	4.9

Summary

Statistically significant crop injury was observed on June 12 for treatments 2, 3, 4 and 9. Crop injury (stunting) tended to diminish through the growing season although these treatments tended to have the lowest yields. Wild oat control was excellent with 99 percent control at crop maturity for all herbicide treatments. Treatment 8 was the only herbicide treatment with a significantly higher yield than the untreated check.

Evaluation of adjuvants for Flucarbazone. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Treatments were applied to 4.5-leaf wheat and 3.5-leaf wild oat on May 31 with 65° F, 25% relative humidity, clear sky, 1.3 mph east wind, and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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[a]	Rate	Jun 13 Wioa	Jul 1 Wioa
	oz/A	%	
Flucarbazone+Activator 90	0.21+0.25%	50	71
Flucarbazone+Class Act NG	0.21+2.5%	50	71
Flucarbazone+Renegade	0.21+1%	50	71
Flucarbazone+Quad 7	0.21+1%	51	71
Flucarbazone+Z64	0.21+1%	50	71
Flucarbazone+One-Ap XL	0.21+13.6G	50	71
Flucarbazone+AG01023	0.21+0.5%	51	70
Flucarbazone+AG01034	0.21+0.25%	45	70
Flucarbazone+ND141260	0.21+1%	50	70
Flucarbazone+Rivet	0.21+0.05%	50	70
Untreated	0	0	0
LSD (P=0.05)		3	3
CV		5	3

[a] AG01023 and AG01034 were experimental adjuvants from Agriliance.

None of the adjuvants included in this study improved yellow foxtail control compared with flucarbazone plus Activator 90. Additional tests under more favorable environment may provide additional information.

Wild oat control in durum with Silverado, Williston 2003. (Neil Riveland) 'Mountrail' durum wheat was planted on re-crop (land cropped to durum wheat in 2002) in 7-inch rows at 90 lbs/a on May 20. The treatments were applied on June 16 to 4 to 5-leaf wheat, 4-5 leaf wild oats and 2-4 leaf green foxtail (very low density) with 75 F, 50% RH, 75% clear sky and 0-3 mph SSE wind and dry topsoil at 66 F. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 10 gals/a at 40 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. First rain received after application was 0.46 inches on June 21. The experiment was a randomized complete block design with four replications. Wild oat density averaged 20 plants/ft2. Green foxtail density was very low and was not rated. Plots were evaluated for crop injury on 6/26/03 and wild oat control on June 29, July 17 and August 13. Durum was machine harvested on August 16.

Treatment [a]	Rate	Crop inj.	6/29 Wioa	7/17 Wioa	8/13 Wioa	Test wght	Yield
	oz/a ai	%[b]		%		lb/bu	bu/A
	0	0	0	0	0	58	5
Untreated	0.25+0.19G	0	63	71	86	60	16
AE F130060+Destiny	0.25+1%	0	68	81	92	60	14
AE F130060+Quad 7	0.25+4+0.19G	0	63	71	84	60	14
AE F13+Brom+MCPA+Destiny	0.25+4+1%	0	66	73	83	60	12
AE F13+Brom+MCPA+Quad 7	0.25+6+2+1%	0	61	74	89	60	12
AE F13+MCPA E+Fluroxypyr+Quad 7	0.25+6+2+0.19G	0	64	71	81	60	10
AE F13+MCPA E+Fluroxypyr+Destiny	0.25+0.3+2+1%	0	55	61	78	60	11
AE F13+Thif+Fluroxypyr+Quad 7	0.25+0.3+2+0.19G	0	63	71	83	60	12
AE F13+Thif+Fluroxypyr+Dest	0.8+0.8%	0	94	97	96	60	20
Clodinafop+Score	1.3	0	86	93	96	60	16
Fenoxaprop-P	1.3+4	0	76	80	90	60	14
Fenoxaprop+Bromoxynil+MCPA	1.3+0.3+2	0	89	95	95	60	18
HIGH MEAN		0	94	97	96	60	20
LOW MEAN		0	0	0	0	58	5
EXP MEAN		0	65	72	81	60	14
C.V. %		0	11	11	7	1	20
LSD 5%		NS	10	11	8	1	4
# OF REPS		4	4	4	4	2	4

[a] - AE F130060 = Silverado. Thif = Thifensulfuron. Destiny - a methylated seed oil adjuvant from Agriliance. Quad 7 - a basic pH blend adjuvant from AGSCO. Score - DSV adjuvant from Monsanto.
[b] - no crop injury observed.

Summary: All treatments eventually gave fair to good control of wild oats. However the Silverado treatments took a longer time to control the wild oats compared to Discover or Puma, perhaps in part because treatment application was delayed beyond the recommended 3-4 leaf stage of wild oats and because there was a very dense infestation of wild oats. Results indicate that treatments controlling wild oats at or near the 90% level within two weeks of application were the best treatments for yield. Yields were relatively low and variable so crop competition was also minimal, perhaps influencing wild oat control and treatment performance also.

Grass Weed Control(Silvarado) in Durum Wheat. (Terry D. Gregoire, 2003) Lebsock wheat was planted May 5th and the wheat was sprayed June 11th between 12:10 pm and 1:15 pm near Langdon, North Dakota. The temperature during application was 65°F, relative humidity near 67%, and cloudy with a later rainfall of 0.33 inches was received between 7:00 and 10:00 pm. The leaf stages of the wheat and weeds were: wheat 5 ½ leaf, wild oat 4-5½ leaf, wild mustard 4-6 leaf and kochia 4 inches and redroot pigweed 4 lf. Treatments were applied with a CO_2 pressurized back pack sprayer using 8.5 gpa at 40 psi and 8001 nozzles. Treatments were arranged in RCBD and replicated 4 times. Treatment evaluation dates were June 27th and July 14th 2003. No wheat injury was observed. Wild mustard control was 100% in all treatments except Discover and Puma alone.

		June 27		July 14	
Treatment	Rate	Wioa	Brdlf	Wioa	KOCZ
	product/A	% control			
untreated		0	0	0	0
Ae f130060+Destiny	1.78oz+1.5pt	40	33	43	0
Ae f130060+Quad 7	1.78oz+1%	43	53	68	10
Ae f130060+Bronate+Advanced+Destiny	1.78oz+0.8pt+1.5 pt	52	77	23	82
Ae f130060+Bronate Advanced+Quad 7	1.78oz+0.8pt+1%	60	63	58	45
Ae f130060+Mcpa Ester+Starane 190+Quad 7	1.78oz+0.75pt/0.665pt/1%	45	63	55	85
Ae f130060+Mcpa Ester+Starane 180+Destiny	1.78oz+0.75pt+0.67pt+1.5 pt	47	87	42	90
Ae f130060+Harmony GT+Starane 180+Quad 7	1.78 oz+0.4 oz +0.665 pt+1 %	17	87	20	92
Ae f130060+Harmony GT+Starane 180+Destiny	1.78oz +0.4oz +0.665pt+1.5pt	47	80	23	78
Discover+Score	3.2 oz+0.8%	85	0	92	0
Puma	0.654 pt	58	0	92	0
Puma+Bronate Advanced	0.654 pt+0.8 pt	23	83	53	93
Puma+Harmony GT+Starane 180	0.654 pt+0.4 oz +0.665 pt/a	50	97	70	95
LSD (P=.05)		33.05	23.50	33	33
Standard Deviation		19.61	13.94	20	19
CV		44.73	24.44	36	37

Wild oat in this plot is suspected to have resistance to some ALS (Assert) mode of action. Wild oat control at the July 14 evaluation date was poor for all treatments containing Ae fl 30060.Puma and Discover wild oat control was acceptable. Quad 7 additive generally provided better wild oat control than Destiny. The Harmony GT tank mix was antagonistic to wild oat control with Ae f l30060. Other tank mix combinations generally reduced wild oat control with Ae fl 30060.

Wild oat control with Mesosulfuron. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Treatments were applied to 4.5-leaf wheat and 3- to 3.5-leaf wild oat on May 31 with 65° F, 25% relative humidity, clear sky, 1.3 mph wind and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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	Jun 13 Wioa	Jul 1 Wioa	Aug 8 Yield
	oz/A	—— % ——		bu/A
Mesosulfuron+Destiny	0.036+0.25G	55	76	33
Mesosulfuron+Destiny	0.054+0.25G	57	77	31
Mesosulfuron+Destiny	0.071+0.25G	65	80	31
Mesosulfuron+Quad 7	0.036+1%	42	69	24
Mesosulfuron+Quad 7	0.054+1%	50	70	23
Mesosulfuron+Quad 7	0.071+1%	55	72	28
Fenoxaprop	1.32	59	97	27
Flucarbazone+NIS	0.42+0.25%	59	72	20
Untreated	0	0	0	12
LSD (P=0.05)		6	5	5
CV		8	5	13

[a] Mesosulfuron was formulated with safener at 1:6 ratio.

Wild oat control increased as mesosulfuron rate increased within both adjuvants tested. Effect of rate increase was greater on June 13 than July 1 meaning faster efficacy with more herbicide applied. Difference between 0.036 and 0.071 oz/A mesosulfuron was a non-significant trend on July 1. Desitny enhanced wild oat control with mesosulfuron more than Quad 7 at each application rate on both evaluation dates. Greater control obtained with Destiny treatments resulted in wheat producing more grain. Flucarbazone gave similar control to the proposed use rate of mesosulfuron, 0.036 oz/A, but fenoxaprop provided 97% control of wild oat on July 1.

Evaluation of mesosulfuron tank-mixes for wild oat control. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Treatments were applied to 4.5-leaf wheat and 3.5-leaf wild oat on May 31 with 65° F, 25% relative humidity, clear sky, 1.3 mph east wind, and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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[a]	Rate	Jun 13 Wioa	Jul 1 Wioa	Aug 4 Wioa	Aug 8 Yield
	oz/A		%		bu/A
Mesosulfuron+Destiny	0.036+0.19G	50	71	89	27
Mesosulfuron+Quad 7	0.036+1%	50	67	88	23
Mesosulfuron+brox&MCPA+Destiny	0.036+8+0.19G	50	71	93	27
Mesosulfuron+brox&MCPA+Quad 7	0.036+8+1%	50	69	87	24
Mesosulfuron+MCPA+flox+Destiny	0.036+6+2+0.19G	55	76	94	31
Mesosulfuron+MCPA+flox+Quad 7	0.036+6+2+1%	50	70	91	25
Mesosulfuron+thif+fluroxypyr+Destiny	0.036+0.3+2+0.19G	56	78	94	32
Mesosulfuron+thif+fluroxypyr+Quad 7	0.036+0.3+2+1%	50	60	80	19
Clodinafop+Score	0.8+1%	54	94	98	27
Flucarbazone+NIS	0.42+0.25%	51	70	67	16
Untreated	0	0	0	0	11
LSD (P=0.05)		3	5	4	6
CV		4	5	3	17

[a]Bromoxynil&MCPA was 5 lb/gal formulation. Mesosulfuron is an experimental herbicide with safener at 1:6 ratio.

Mesosulfuron symptoms on wild oat were slow to develop, likely because June was cool and wet. Mesosulfuron provided better control of wild oat than flucarbazone on August 4. This was consistent with a 2002 study that showed mesosulfuron provided quicker kill of wild oat than flucarbazone, but symptoms developed in half the time in 2002 compared with 2003. Destiny was a more effective adjuvant than Quad 7 across tank-mixes. Thifensulfuron plus fluroxypyr was the only tank-mix that antagonized mesosulfuron activity, and it only antagonized wild oat control when Quad 7 was used as the adjuvant. Other tank-mixes with mesosulfuron tended to improve wild oat control on August 4. Clodinafop provided greater wild oat control than ALS-inhibiting herbicides July 1, 94% compared with 78% control or less.

Grass Weed Control in Durum Wheat. (Terry D. Gregoire, 2003) Lebsock durum wheat was planted May 3rd and the wheat was sprayed June 5th between 2:30 pm and 3:30 pm near Langdon, North Dakota. The temperature during application was 70°F, relative humidity near 50%, with full sunshine. The leaf stages of the wheat and weeds were: wheat 4 ½ leaf, wild oat 4-4½ leaf, wild mustard 2-4 leaf and wild buckwheat 4 leaf and redroot pigweed 2-4 lf, kochia 1" tall. Treatments were applied with a CO_2 pressurized back pack sprayer using 8.5 gpa at 40 psi and 8001 nozzles. Treatments were arranged in RCBD and replicated 4 times. Treatment evaluation dates were June 17th, July 14th, and July 30th 2003. No wheat injury was observed.

Treatment	Rate product/A	Wild Oat % control			Broadleaf % control	
	oz/A	6/17	7/14	7/30	6/17	7/14
Untreated		0	0	0	0	0
Discover 60EC	12.8	98	92	90	0	0
Discover 60 EC+ Curtail M+Starane 1.5 EC	12.8+1.75 pt+5.3	84	50	63	64	97
Discover 60 EC+ Harmony Extra 75 df +Starane	12.8+0.3+5.3	93	67	74	90	94
Discover 60 EC+ MCPA-Ester+ Clarity	12.8+8+2	69	55	47	63	100
Discover 60 EC+ Harmony GT+ Starane	12.8+0.5+5.3	96	85	86	96	93
Discover 60 EC+ Curtail M	12.8 +1.75	83	48	60	85	94
Discover 60 EC+ Bronate Advanced	12.8 +12.8	91	63	72	85	98
Puma	0.5	88	90	93	0	0
Discover 240 + DSV Adjuvant	3.2	95	90	92	0	0
LSD (P=.05)		17.26	31	12	31	13.6
Standard Deviation		11.89	18	7	18	9.4
CV		14.96	28	10	28	19.4

Discover 60EC, Discover 240 and Puma were not different for wild oat control when applied without a tank mix herbicide. All tank mix partners treatments evaluated July 30th, except Harmony 75DF with Starane significantly reduced wild oat control with Discover 60EC.

Fenoxaprop efficacy with broadleaf tank-mixes. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Treatments were applied to 4-leaf wheat and 3.5-leaf wild oat on May 29 with 88° F, 39% relative humidity, clear sky, 7 mph southwest wind, and soil temperature of 58° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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[a]	Rate	Jun 13 Wioa	Jul 1 Wioa	Aug 8 Yield
	oz/A	—— % ——		bu/A
Fenoxaprop	1.32	56	96	29
Fenoxaprop+brox&MCPA	1.32+8	57	89	26
Fenoxaprop+brox&MCPA+fluroxypyr	1.32+6+1	59	90	24
Fenoxaprop+brox&MCPA+thifensulfuron	1.32+6+0.22	50	87	22
Fenoxaprop+thif+fluroxypyr	1.32+0.22+1	62	97	26
Clodinafop+brox&MCPA+Score	0.8+8+1%	59	87	23
Untreated	0	0	0	13
LSD (P=0.05)		6	3	3
CV		8	3	11

[a]Bromoxynil&MCPA was 5 lb/gal formulation.

Bromoxynil&MCPA plus thifensulfuron was the only combination that caused antagonism of wild oat control with fenoxaprop on June 13. Wild oat control with fenoxaprop alone was 96% on July 1. Weed control with this treatment resulted in the most grain yield among treatments (29 bu/A). Thifensulfuron and fluroxypyr did not antagonize fenoxaprop activity (97% control). Bromoxynil&MCPA appeared to antagonize wild oat control with fenoxaprop. The effect was slight (6 to 9 percentage points) but more consistent than the effect of thifensulfuron. Clodinafop provided similar wild oat control to fenoxaprop in this study.

Grass control antagonism with thifensulfuron. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington) 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Treatments were applied to 4.5- to 5-leaf wheat and 3.5- to 4-leaf wild oat on June 3 with 62° F, 38% relative humidity, cloudy sky, 5 mph south wind, and soil temperature of 61° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Thifensulfuron + bromoxynil&MCPA at 0.22+7.5 oz ai/A was applied to entire trial on June 9. The experiment was a randomized complete block design with four replicates.

Treatment[a]	Rate	Jun 13 Wioa	Jul 1 Wioa	Aug 4 Wioa
	oz/A		%	
Fenoxaprop+thifensulfuron	1.32+0.22	59	90	96
Clodinafop+thifensulfuron+Score	0.8+0.22+1%	55	88	95
Flucarbazone+thifensulfuron+NIS	0.42+0.22+0.25%	50	77	62
Fenoxaprop+thifensulfuron+bromoxynil&MCPA	1.32+0.22+8	59	81	90
Clodinafop+thifensulfuron+bromoxynil&MCPA+Score	0.8+0.22+8+1%	52	82	87
Flucarbazone+thifensulfuron+2,4-D+NIS	0.42+0.22+6+0.25%	50	79	72
Fenoxaprop+thifensulfuron+fluroxypyr	1.32+0.22+1	55	93	95
Clodinafop+thifensulfuron+fluroxypyr+Score	0.8+0.22+1+1%	57	91	97
Flucarbazone+thifensulfuron+fluroxypyr+2,4-D+NIS	0.42+0.22+1+6+0.25%	51	80	67
Fenoxaprop+thifensulfuron&tribenuron+fluroxypyr	1.32+0.22+1	54	91	96
Clodinafop+thifensulfuron&tribenuron+fluroxypyr+Score	0.8+0.22+1+1%	54	90	96
Flucarbazone+thifensulfuron&tribenuron+fluroxypyr+2,4-D+NIS	0.42+0.22+1+6+0.25%	54	79	75
Fenoxaprop+bromoxynil&MCPA	1.32+8	56	82	89
Clodinafop+bromoxynil&MCPA+Score	0.8+8+1%	55	86	89
Flucarbazone+bromoxynil&MCPA+NIS	0.42+8+0.25%	50	79	65
Untreated	0	0	0	0
LSD (P=0.05)		6	6	5
CV		8	5	5

[a] Bromoxyynil&MCPA was 5 lb/gal formulation.

Wild oat control on June 13 did not exceed 60% because cool, wet weather in June delayed symptom expression. Fenoxaprop and clodinafop provided similar control of wild oat within broadleaf tank-mix, but control was slightly greater on August 4 compared with July 1. Fenoxaprop and clodinafop gave less wild oat control when applied with bromoxynil&MCPA than when combined with thifensulfuron on August 4, 87 to 90% compared with 95 to 97%, respectively. Fluroxypyr and tribenuron did not antagonize wild oat control. Flucarbazone provided 62 to 75% wild oat control. Differences in control were not consistent with any of the broadleaf herbicides. Performance of flucarbazone under cool conditions has not been very strong in other studies, but it has been very efficacious to wild oat in hotter, drier environments where fenoxaprop and clodinafop performance can lag. Adjuvant load in formulation of some EC herbicides may have improved flucarbazone activity. Control of wild oat with flucarbazone plus thifensulfuron was 5 to 13 percentage points greater when 2,4-D or fluroxypyr was included in the treatment. Bromoxynil&MCPA tended to improve wild oat control, but the difference was non-significant.

Growth stage at initiation of split-application treatments for wild oat control. (Howatt, Kirk A., Ronald F. Roach, and Janet D. Davidson-Harrington). Past experiments have shown the benefit of split-applications of herbicides at reduced rates to control wild oat. This experiment was established to evaluate split-application treatments as growth stage of the initial treatment varied. 'Oxen' hard red spring wheat was seeded April 24 at a location near Fargo, North Dakota. Treatments were applied with a CO_2-pressurized backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Experimental design was randomized complete block with four replicates. Harvest was August 8. Crop and weed stages plus climate conditions at applications were as follows:

Application timing	1 leaf	2 leaf	10 DAT of 1 leaf	10 DAT of 2 leaf; 3 leaf	4 leaf	10 DAT of 3 leaf	10 DAT of 4 leaf
Date	May 13	May 20	May 23	May 29	June 03	June 09	June 13
Crop stage, leaf	1	1 to 1.5	2	3.5	4.5	6	6
Wild oat stage, leaf	1	2	2.5	3.5	3.5 to 4	4.5	3.5
Temperature, ° F	55	44	57	88	62	69	73
Relative humidity, %	-	42	53	39	38	54	46
Sky	Cloudy	Clear	-	Clear	Cloudy	Cloudy	-
Wind velocity, mph	10	4 to 6	12	7	2	8	2.5
Soil temp, ° F	-	47	53	58	61	61	-

Treatment[a]	Rate	Application timing	June 13 Wioa	July 01 Wioa	July 14 Wioa	July 24 Wheat	Aug 08 Yield
	oz/A			%		tillers/m^2	bu/A
Clodinafop+DSV	0.08	4 leaf	35	82	97	57	22
Clodinafop+DSV	0.04	4 leaf	37	85	97	56	20
Clodinafop+DSV	0.02	1 leaf	0	0	0	39	13
Clfp+DSV / Clfp+DSV	0.02 / 0.02	1 leaf / 10 DAT	87	95	96	119	46
Clfp+DSV / Clfp+DSV	0.02 / 0.02	2 leaf / 10 DAT	79	92	96	95	32
Clfp+DSV / Clfp+DSV	0.02 / 0.02	3 leaf / 10 DAT	72	90	96	96	21
Clfp+DSV / Clfp+DSV	0.02 / 0.02	4 leaf / 10 DAT	32	77	95	47	18
Untreated	0		0	0	0	45	10
LSD (P=0.05)			5	6	2	24	5
CV			8	6	2	24	17

[a] DSV was included at 1% v/v for all treatment applications; the symbol "/" indicates portions of the treatment were separated by time.

Cool, wet conditions during the month of June delayed symptom expression and efficacy compared to other environments, resulting in slower than normal control of wild oat treated with 0.05 lb/A clodinafop at the 4 leaf stage. A single application of 0.012 lb/A clodinafop at the 1 leaf stage controlled emerged plants (data not shown), but a large number of wild oat emerged after the 1 leaf application making this treatment indiscernible from the untreated control. Initiating treatment sequence at 1 leaf with a second application 10 DAT provided the best season-long wild oat control. Wild oat competition early in the season correlated well with final wheat yield. Delaying the initial application of 0.012 lb/A clodinafop from the 1 leaf to the 4 leaf stage resulted in a steady reduction in wheat yield with maximum yield loss over 60%. Split-application treatments that were initiated at the 1 leaf or 2 leaf stage improved wheat yield by as much as 110% compared to the labeled rate of 0.05 lb/A clodinafop, but there was not advantage to split-application if the initial application was delayed to the three leaf stage or later.

Interval between clodinafop split-applications to control wild oat. (Howatt, Kirk A., Roach, Ronald F., and Davidson-Harrington, Janet D). Past experiments have shown the benefit of herbicides split applied at reduced rates for wild oat control. This experiment was established to evaluate the effect of length of interval on wild oat control. 'Oxen' hard red spring wheat was seeded April 24, 2003. Treatments were applied with a CO_2-pressurized backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Experimental design was a randomized complete block with four replicates. Harvest was August 8. Crop and weed stages plus climate conditions at applications were as follows:

Application timing	2 leaf	6 DAT	9 DAT	4 leaf and 12 DAT	15 DAT	18 DAT	21 DAT
Date	May 20	May 27	May 29	June 02	June 04	June 06	June 09
Crop stage, leaf	1 to 1.5	3.5	3.5	4.5	4.5	4.5 to 5	6
Wild oat stage, leaf	2	2.5	3.5	3.5 to 4	4.5	4.5	4.5
Temperature, ° F	44	69	88	65	70	62	69
Relative humidity, %	42	36	39	35	80	72	54
Sky	Clear	Cloudy	Clear	Cloudy	Cloudy	Cloudy	Cloudy
Wind velocity, mph	4 to 6	10	7	2	6	4	8
Soil temp, ° F	47	69	58	59	60	59	61

Treatment[a]	Rate	Application timing	Jun 13 Wioa	Jun 20 Wioa	Jul 14 Wioa	Aug 08 Yield
	oz/A			%		bu/A
Clodinafop+DSV	0.8	4 leaf	35	82	97	22
Clodinafop+DSV	0.4	4 leaf	37	85	97	20
Clodinafop+DSV	0.2	2 leaf	74	90	89	34
Clfp+DSV / Clfp+DSV	0.2 / 0.2	2 leaf / 6 DAT	86	96	98	41
Clfp+DSV / Clfp+DSV	0.2 / 0.2	2 leaf / 9 DAT	84	97	98	41
Clfp+DSV / Clfp+DSV	0.2 / 0.2	2 leaf / 12 DAT	75	95	95	36
Clfp+DSV / Clfp+DSV	0.2 / 0.2	2 leaf / 15 DAT	75	92	97	35
Clfp+DSV / Clfp+DSV	0.2 / 0.2	2 leaf / 18 DAT	69	89	95	36
Clfp+DSV / Clfp+DSV	0.2 / 0.2	2 leaf / 21 DAT	72	88	94	39
Untreated	0		0	0	0	9
LSD (P=0.05)			6	4	3	6
CV			8	3	3	14

[a] DSV was included at 1% v/v for all treatments; the symbol "/" indicates portions of the treatment were separated by time.

Cool, wet conditions during June delayed symptom expression and efficacy compared to other environments, resulting in slower than normal control of wild oat treated with clodinafop at the 4-leaf stage. Clodinafop at 0.012 lb/A applied once at the 2-leaf stage provided greater wild oat control on June 13 and 20 than 0.05 lb/A clodinafop applied at the 4-leaf stage. Removing early season wild oat competition with 2-leaf applications resulted in at least a 50% yield increase compared with 4-leaf applications. Clodinafop at 0.012 lb/A applied a second time improved control of existing wild oat compared with a single application. Very few wild oat emerged after the 2-leaf application timing. Split-application with a 6 or 9 day separation in treatments provided the best season-long wild oat control. A longer delay between applications did not greatly affect mid-season weed control or final wheat yield, although wheat yield tended to be less if the second application was delayed beyond 9 days.

Lower rates of Clodinafop or Flucarbazone in split system. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Crop and weed stages plus climate conditions at applications were as follows:

Application timing	2 Leaf	3-4 Leaf and 10 DAT
Date	May 20	May29
Crop stage, leaf	1 to 1.5	3 to 4
Wild oat stage, leaf	2	3
Temperature, ° F	44	88
Relative humidity, %	42	39
Wind velocity, mph	4 to 6	7
Sky	Clear	Clear
Soil temperature, ° F	47	58

Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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	Application timing	Jun 13 Wioa	Jul 1 Wioa	Aug 8 Yield
	oz/A		%		bu/A
Clodinafop+Score	0.8+1%	3-4 L	66	94	31
Clodinafop+Score/clfp+Score	0.25+1%/0.25+1%	2L/10 DAT	72	95	32
Clodinafop+Score/clfp+Score	0.2+1%/0.2+1%	2L/10 DAT	79	92	34
Clodinafop+Score/clfp+Score	0.15+1%/0.15+1%	2L/10 DAT	67	73	24
Clodinafop+Score/clfp+Score	0.1+1%/0.1+1%	2L/10 DAT	69	67	23
Flucarbazone+Quad 7	0.42+1%	3-4 L	61	79	22
Flcz+Quad 7/flcz+Quad 7	0.13+1%/0.13+1%	2L/10 DAT	65	75	31
Flcz+Quad 7/flcz+Quad 7	0.1+1%/0.1+1%	2L/10 DAT	67	72	29
Flcz +Quad 7/flcz +Quad 7	0.075+1%/0.075+1%	2L/10 DAT	66	72	25
Flcz+Quad 7/flcz +Quad 7	0.05+1%/0.05+1%	2L/10 DAT	67	71	27
Untreated	0		0	0	12
LSD (P=0.05)			7	5	8
CV			8	4	20

Split application of 0.2 oz/A clodinafop provided the best wild oat control June 13 at 79%. The labeled rate of clodinafop, 0.8 oz/A, provided 94% control on July 1, which was similar to split application of clodinafop at 0.25 or 0.2 oz/A, 95 and 92% control respectively. Clodinafop split applications at 0.15 oz/A or less provided less than 75% wild oat control. Split applied clodinafop at 0.2 oz/A maximized weed control for the amount of herbicide applied and resulted in better wheat yield than many of the other treatments. Of flucarbazone rates, the labeled rate, 0.42 oz/A, gave the highest wild oat control rating (79%), although control was not greater than flucarbazone split applied at 0.13 oz/A (75%). Clodinafop was a better herbicide than flucarbazone for use in split application systems, but the rate of clodinafop needed to be 0.2 oz/A or greater to compete with the full rate.

Broadleaf tank-mixes with reduced clodinafop rates. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded on April 24 at a location near Fargo, North Dakota. Treatments were applied to 4.5 leaf wheat and 3.5 leaf wild oat on May 31 with 65° F, 25% relative humidity, clear sky, 1.3 mph wind and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan 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. Bromoxynil&MCPA and thifensulfuron was applied for broadleaf weed control.

Treatment[a]	Rate	Jun 13 Wioa	Jul 1 Wioa	Aug 8 Yield
	oz/A	%	%	bu/A
Clodinafop+Score	0.8+1%	59	93	23
Clodinafop+Score+PO	0.54+0.6%+0.4%	60	93	21
Clodinafop+Score+PO	0.4+0.5%+0.5%	59	89	18
Clfp+brox&MCPA+Score	0.8+8+1%	62	89	22
Clfp+brox&MCPA+Score+PO	0.54+8+0.6%+0.4%	61	72	15
Clfp+brox&MCPA+Score+PO	0.4+8+0.5%+0.5%	59	71	17
Clfp+thif&trib+flox&MCPA+Score	0.8+0.22+8+1%	60	91	24
Clfp+thif&trib+flox&MCPA+Score+PO	0.54+0.22+8+0.6%+0.4%	56	88	18
Clfp+thif&trib+flox&MCPA+Score+PO	0.4+0.22+8+0.5%+0.5%	60	84	20
Clfp+dicamba+carfentrazone+Score	0.8+1.5+0.128+1%	60	83	21
Clfp+dicamba+carf+Score+PO	0.54+1.5+0.128+0.6%+0.4%	56	75	18
Clfp+dicamba+carf+Score+PO	0.4+1.5+0.128+0.5%+0.5%	57	72	15
Untreated	0	0	0	12
LSD (P=0.05)		6	4	4
CV		7	4	15

[a] Bromoxynil&MCPA was 5 lb/gal formulation.

All herbicide treatments gave similar control of wild oat on June 13, 56 to 62%. Clodinafop alone provided 89 to 93% wild oat control on July 1. Thifensulfuron&tribenuron with fluroxypyr&MCPA did not antagonize wild oat control with 0.8oz/A clodinafop and only slightly antagonized control, 5 percentage points, at reduced clodinafop rates. Bromoxynil&MCPA was more antagonistic than thifensulfuron&tribenuron. Clodinafop at 0.54 oz/A with bromoxynil&MCPA gave 72% control compared with 93% control for clodinafop alone. Dicamba and carfentrazone was the most antagonistic of the three broadleaf tank-mixes reducing control with 0.8 oz/A clodinafop by 10 points. Control with reduced clodinafop rates was similar when bromoxynil&MCPA or dicamba and carfentrazone was included, 71 to 75% control.

Broadleaf tank-mixes with reduced Fenoxaprop rates. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Treatments were applied to 4.5-leaf wheat and 3.5-leaf wild oat on May 31 with 65° F, 25% relative humidity, clear sky, 1.3 mph wind, and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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. Bromoxynil&MCPA and thifensulfuron was applied for broadleaf weed control.

Treatment[a]	Rate	Jun 13 Wioa	Jul 1 Wioa	Aug 8 Yield
	oz/A	%	%	bu/A
Fenoxaprop	1.32	64	97	22
Fenoxaprop	1	61	94	19
Fenoxaprop+brox&MCPA	1.32+8	60	89	23
Fenx+bromoxynil&MCPA	1+8	62	86	26
Fenx+thif&trib+flox&MCPA	1.32+0.22+8	52	88	21
Fenx+thif&trib+flox&MCPA	1+0.22+8	52	85	18
Fenx+dicamba+carf+NIS	1.32+1.5+0.128+0.25%	59	84	16
Fenx+dicamba+carf+NIS	1+1.5+0.128+0.25	61	79	14
Untreated	0	0	0	11
LSD (P=0.05)		4	4	4
CV		5	3	14

[a] Bromoxynil&MCPA was 5 lb/gal formulation.

Thifensulfuron&tribenuron plus fluroxypyr&MCPA provided the most antagonism of fenoxaprop activity on wild oat on June 13, 12 percentage points. Control with fenoxaprop also was antagonized by this broadleaf tank-mix on June 13, 11 point reduction, but dicamba and carfentrazone was more antagonistic on July 1. All broadleaf tank-mixes caused at least 8% antagonism on July 1. Fenoxaprop provided the greatest wild oat control, 94 to 97%, but wheat treated with fenoxaprop and bromoxynil&MCPA at 1 and 8 oz/A produced the greatest yield.

Broadleaf tank-mixes with reduced Flucarbazone rate. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Treatments were applied to 4.5-leaf wheat and 3.5-leaf wild oat on May 31 with 65° F, 25% relative humidity, clear sky, 1.3 mph wind, and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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. Bromoxynil&MCPA and thifensulfuron was applied for broadleaf weed control.

Treatment[a]	Rate	Jun 13 Wioa	Jul 1 Wioa	Aug 8 Yield
	oz/A	%	%	bu/A
Flucarbazone+NIS	0.42+0.25%	50	75	14
Flcz+NIS	0.28+0.25%	50	76	18
Flcz+brox&MCPA+NIS	0.42+8+0.25%	50	79	16
Flcz+bromoxynil&MCPA+NIS	0.28+8+0.25%	50	79	15
Flcz+thif&trib+fluroxypyr&MCPA+NIS	0.42+0.22+8+0.25%	50	80	19
Flcz+thif&trib+fluroxypyr&MCPA+NIS	0.28+0.22+8+0.25%	50	82	18
Flcz+dicamba+carfentrazone+NIS	0.42+1.5+0.128+0.25%	50	70	14
Flcz+dicamba+carfentrazone+NIS	0.28+1.5+0.128+0.25%	50	64	15
Untreated	0	0	0	10
LSD (P=0.05)		0	4	4
CV		0	4	18

[a] Bromoxynil&MCPA was 5 lb/gal formulation.

All herbicide treatments gave 50% control of wild oat on June 13. Bromoxynil&MCPA or thifensulfuron&tribenuron plus fluroxypyr&MCPA increased wild oat control with flucarbazone on July 1 by 4 to 6 percentage points. Improved flucarbazone efficacy could have resulted from formulation adjuvants. Dicamba did not have the same effect, but dicamba was included at a lower volume of product and would not have had as much formulated adjuvant as bromoxynil&MCPA or fluroxypyr&MCPA. Dicamba antagonized flucarbazone activity by 5 to 12 percentage points. Wheat yield across plots treated with herbicide was similar.

Reduced Rates and Application Timing of Wild Oat Herbicides at Hettinger 2001-2003. (Eriksmoen) The objective of this trial was to look at the relationship between various rates of wild oat herbicides applied at 2 different growth stages of HRSW. The first post-applied treatments were to 3 leaf wheat and the second post-applied treatments were to 5 leaf wheat. All treatments were applied with a tractor mounted CO^2 propelled plot sprayer delivering 17 gpa (10 gpa in 2003) at 40 psi through 8001 flat fan nozzles to a 5 foot wide area the length of 10 by 28 foot plots. The experiment was a randomized complete block design with four replications. Wild oat (Wiot) populations were 44, 22 and 0.4 plants per sq. foot respectively in 2001, 2002 and 2003. Patches of downy brome (Dobr), Japanese brome (Jabr) and foxtail barley (Fxba) were non-uniformly scattered throughout the trial in 2002 and were evaluated for control when observed. The 2001 trial was not harvested due to severe hail damage. The 2002 trial was not harvested due to a thin and short wheat stand caused by severe drought, and the 2003 trial sustained moderate heat and moisture stress.

App. Timing	Treatment	Product Rate	Wild Oat Rate	2001 Wiot	2002 Wiot	2002 Dobr	2002 Jabr	2002 Fxba	2003 Wiot	2003 Crop Inj.	2003 Yield
HRSW		oz/acre		% Control							bu/A
3 leaf	Puma	10.6	Full	72	99	0	0	--	99	0	25.0
3 leaf	Puma	7.9	3/4	59	88	0	0	10	99	0	22.5
3 leaf	Puma	5.3	1/2	25	75	0	15	--	99	0	22.6
5 leaf	Puma	10.6	Full	92	72	--	50	--	99	1	21.6
5 leaf	Puma	7.9	3/4	82	44	--	0	--	99	1	23.6
5 leaf	Puma	5.3	1/2	62	21	--	0	--	99	1	22.0
3 leaf	Everest + NIS	0.60 + 0.25%	Full	90	99	50	96	--	99	1	22.4
3 leaf	Everest + NIS	0.45 + 0.25%	3/4	89	99	50	94	--	99	0	24.8
3 leaf	Everest + NIS	0.30 + 0.25%	1/2	88	97	70	99	--	99	0	22.6
5 leaf	Everest + NIS	0.60 + 0.25%	Full	62	99	--	90	--	99	19	19.8
5 leaf	Everest + NIS	0.45 + 0.25%	3/4	84	99	--	--	--	99	9	17.8
5 leaf	Everest + NIS	0.30 + 0.25%	1/2	72	99	--	90	--	99	3	19.8
3 leaf	Discover + DSV	3.20 + 12.8	Full	90	99	0	0	0	99	0	25.6
3 leaf	Discover + DSV	2.40 + 12.8	3/4	90	98	--	17	--	99	0	21.8
3 leaf	Discover + DSV	1.60 + 12.8	1/2	86	97	50	0	--	99	0	22.8
5 leaf	Discover + DSV	3.20 + 12.8	Full	95	99	--	0	--	99	0	21.3
5 leaf	Discover + DSV	2.40 + 12.8	3/4	95	99	--	50	--	99	0	23.7
5 leaf	Discover + DSV	1.60 + 12.8	1/2	92	99	--	0	--	99	0	22.7
3 leaf	Achieve+SC+AMS	7.0+0.5%+1%	Full	71	79	0	45	--	99	0	22.2
3 leaf	Achieve+SC+AMS	5.25+0.5%+1%	3/4	84	70	--	45	0	99	0	23.0
3 leaf	Achieve+SC+AMS	3.50+0.5%+1%	1/2	75	55	0	48	50	99	0	22.6
5 leaf	Achieve+SC+AMS	7.0+0.5%+1%	Full	81	71	--	0	--	99	0	21.5
5 leaf	Achieve+SC+AMS	5.25+0.5%+1%	3/4	89	82	--	--	--	99	0	22.0
5 leaf	Achieve+SC+AMS	3.50+0.5%+1%	1/2	52	82	--	99	--	99	0	21.4
	Untreated	0		--	0	0	0	0	0	0	23.1
C.V. %				32.9	20.6	74	83	--	0	254	9.6
LSD 5%				25	23	ns	40	--	1	5	3.0

*NIS=non ionic surfactant, DSV adjuvant, SC=super charge, AMS=ammonium sulfate.

Summary

Everest herbicide applied at the 5 leaf growth stage caused significant crop injury and yield loss in 2003. Crop injury was minimal on all other treatments in 2003 and on all treatments in 2001 and 2002 (data not shown). In 2002, full and 3/4 rates of Puma provided good wild oat control when applied at the 3 leaf stage and significantly reduced control at the 5 leaf stage. This is the opposite of what took place in 2001 where Puma applied at the 5 leaf stage resulted in higher wild oat control than when applied at the 3 leaf stage. This was probably due to additional wild oat flushes emerging after the 3 leaf stage application in 2001, with Puma providing good control of small wild oats and less activity on larger wild oats. All application rates and timing of application of Everest provided excellent wild oat control in all three years except for the late application in 2001. This probably indicates that Everest is less effective on larger wild oat plants. Everest treatments also had fair control of downy brome and excellent control of Japanese brome in 2002. All application rates and timing of application of Discover provided excellent wild oat control in all three years, indicating that Discover is effective on both small and large wild oats. Achieve treatments did not provide adequate wild oat control in 2001 or 2002, but provided excellent control in 2003. Achieve treatments also provided fair control of Japanese brome but no activity on downy brome in 2002. Some herbicidal activity was also observed on foxtail barley with Puma and Achieve in 2002.

Wild oat control in durum wheat, Williston 2003. (Neil Riveland) 'Mountrail' durum wheat was planted on re-crop (land cropped to durum wheat in 2002) in 7 inch rows at 90 lbs/a on May 20. The treatments were applied on June 16 to 4 to 5-leaf wheat, 4-5 leaf wild oats and 2-4 leaf green foxtail (very low density) with 79 F, 46% RH, 75% clear sky and 3-5 mph ENE wind and dry topsoil at 70 F. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 8.5 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. First rain received after application was 0.46 inches on June 21. The experiment was a randomized complete block design with four replications. Wild oat density averaged 20 plants/ft^2. Green foxtail density was about 10 plants/ft^2. Plots were evaluated for crop injury on 6/29/03 and wild oat control on June 29, July 17 and August 13. Green foxtail control was rated only on August 13. Durum was machine harvested on August 16.

Treatment[a]	Rate	Crp inj	6/29 Wioa	7/17 Wioa	8/13 Wioa	8/13 Grft	Test wght	Yld
	oz/a			%			lb/bu	bu/A
Immb+Thif&Trib+2,4-D+NIS	5+0.22+4+0.25%	1	18	13	26	0	60	11
Flcz+Thif&Trib+2,4-D+Quad 7	0.42+0.22+4+1%	6	60	85	95	95	61	11
Propoxycarbazone+Thif&Trib+2,4-D+Quad 7	0.42+0.22+4+1%	3	71	91	99	13	61	15
AE060+Thif&Trib+2,4-D+Quad 7	1.34g+0.22+4+1%	1	69	84	83	0	60	15
Clodinafop+Brox&MCPA+Score	0.8+8+1%	0	85	92	91	77	61	19
Fenoxaprop+Brox&MCPA	1.32+8	1	81	93	93	96	61	12
Tral+Brox&MCPA+Supercharge+AMS	2.9+8+0.5%+9.52	0	90	98	97	68	61	21
Flcz+Fenx+Brox&MCPA+Quad 7	0.21+0.6+8+1%	3	65	79	82	84	61	15
Flcz+Mesotrione+2,4-D+Quad 7	0.21+0.75+4+1%	1	70	84	89	85	61	15
Difenzoquat+Immb+Thif&Trib+2,4-D+NIS	3.7+8+0.22+4+0.25%	1	60	66	72	13	60	15
Untreated	0	0	0	0	0	0	59	9
Flucarazone+Brox&MCPA	0.42+8	3	50	80	90	98	61	18
Flucarazone+Dicamba+Quad 7	0.42+1.5+0.5%	5	58	75	94	99	61	16
HIGH MEAN		6	90	98	99	99	61	21
LOW MEAN		0	0	0	0	0	59	9
EXP MEAN		2	60	72	78	56	61	15
C.V. %		15 5	18	12	13	22	1	20
LSD 5%		NS	15	13	14	18	1	4
# OF REPS		4	4	4	4	4	2	4

[a] - AE F130060 = Silverado.
Quad 7 - a basic pH blend adjuvant from AGSCO.
Score - DSV adjuvant from Monsanto.

Summary: Because of weather conditions, the treatments were applied to wild oat in the 5 leaf stage rather than at the more ideal 3-leaf stage. So generally those combinations that control wild oats the quickest also exhibited the best yields.

<u>Adjuvant use with Discover Herbicide at Hettinger, 2002 - 2003</u>. (Eriksmoen)
2002: Russ hard red spring wheat was seeded on April 27. Treatments were applied to 4 leaf wheat and to 3 ½ leaf green foxtail on June 7 with 58 F, 50 % RH, cloudy sky and 8 mph wind. 2003: Reeder hard red spring wheat was seeded on April 24. Treatments were applied to 3 ½ leaf wheat and to 2 leaf wild oats on May 28 with 78 F, 31% RH, partly cloudy sky and 5 mph NW wind. Treatments were applied with a tractor mounted CO^2 propelled plot sprayer delivering 17 gpa (10 gpa in 2003) at 40 psi through 8001 flat fan nozzles to a 5 foot wide area the length of 10 by 28 foot plots. The experiment was a randomized complete block design with four replications (3 in 2002). Green foxtail population was 20 plants per sq. foot and wild oat population was 0.5 plants per sq. foot. Evaluations for crop injury were on June 21, 2002 and June 12, 2003. Evaluations for foxtail control were on July 1, 2002 and for wild oat control on July 26, 2003. The trial was not harvested in 2002 due a short and thin crop caused by severe drought. The 2003 trial was harvested on July 30.

Treatment		Product Rate	7/1/02 Fxtl	7/26/03 Wiot	7/30/03 Yield
		oz /A	----- % control	-----	bu/A
1	Discover + DSV*	3.2 + 12.8	99	99	24.5
2	Discover + DSV	1.6 + 6.4	95	99	24.8
3	Discover + DSV + NIS*	1.6 + 6.4 + .25%	96	99	25.7
4	Discover + DSV + MSO*	1.6 + 6.4 + 16	95	99	25.8
5	Discover + DSV + VOC*	1.6 + 6.4 + 16	98	99	23.5
6	Discover + DSV + Basic Blend*	1.6 + 6.4 + .25%	96	99	24.5
7	Untreated	0	0	0	21.0
C.V. %			3.7	0	9.1
LSD 5%			5	0	3.2

*Adjuvant: DSV=Score, NIS=Non-Ionic Surfactant (Preference), MSO=Methylated Seed Oil (Destiny), VOC=Vegetable Oil Concentrate (Prime Oil EV), Basic Blend=Quad 7.

Summary

The objective of this study was to look for differences in weed control when Discover Herbicide is applied at low rates with various adjuvants. Crop injury was not observed on any treatment (data not shown). Wild oat and green foxtail control was excellent for all herbicide treatments and did not vary significantly between the recommended rate (trt 1), the lower Discover rate (trt 2) or the lower Discover rate plus various adjuvants (trts 3-6). Grain yields did not differ significantly between herbicide treatments.

Flucarbazone and Fenoxaprop with adjuvants for yellow foxtail control. (Kirk Howatt, Ronald Roach, Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Treatments were applied on 4.5- to 5-leaf wheat and 2-leaf yellow foxtail on June 4 with 68° F, 43% relative humidity, overcast sky, 6 mph west wind and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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[a]	Rate	Jun 18 Yeft	Jul 1 Yeft
	oz/A	%	
Flucarbazone+fenoxaprop	0.28+0.37	67	92
Flucarbazone+fenoxaprop+Preference	0.28+0.37+0.25%	75	93
Flucarbazone+fenoxaprop+Activate Plus	0.28+0.37+0.25%	64	94
Flucarbazone+fenoxaprop+AG01010	0.28+0.37+0.25%	65	89
Flucarbazone+fenoxaprop+AG02018	0.28+0.37+0.25%	62	92
Flucarbazone+fenoxaprop+AG02059	0.28+0.37+0.25%	70	89
Flucarbazone+fenoxaprop+ClassActNG	0.28+0.37+2.5%	80	92
Flucarbazone+fenoxaprop+Newtone	0.28+0.37+1%	61	89
Flucarbazone+fenoxaprop+Destiny	0.28+0.37+1%	75	89
Flucarbazone+fenoxaprop+Prime Oil	0.28+0.37+1%	70	90
Flucarbazone+fenoxaprop+Hi-Per-Oil	0.28+0.37+0.5%	77	96
Flucarbazone+fenoxaprop+AG01023	0.28+0.37+0.5%	72	88
Flucarbazone+fenoxaprop+Rivet	0.28+0.37+0.5%	67	92
LSD (P=0.05)		10	6
CV		10	5

[a] AG01010, AG02018, and AG02059 were experimental adjuvants from Agriliance.

An appropriate adjuvant for flucarbazone activity needed to be determined for when fenoxaprop is included to improve yellow foxtail control. Flucarbazone and fenoxaprop at reduced rates gave 67% control of yellow foxtail June 18. ClassAct NG provided the greatest enhancement of activity on foxtail resulting in 80% control. Preference was a better NIS adjuvant than Activate Plus. Newtone only provided 61% control. Oil-based adjuvants provided similar enhancement of yellow foxtail control and tended to result in better control than adding no adjuvant, but only Destiny and Hi-Per-Oil were similar to ClassAct NG in promoting efficacy of flucarbazone and fenoxaprop. Control of yellow foxtail with flucarbazone and fenoxaprop ranged from 88 to 96% on July 1.

Yellow foxtail control with Flucarbazone and adjuvants. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 24 near Fargo, North Dakota. Treatments were applied to 4.5- to 5-leaf wheat and 2- to 3-leaf yellow foxtail on June 4 with 68°F, 43% relative humidity, overcast sky, 6 mph west wind, and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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	Jun 18 Yeft	Jul 1 Yeft
	oz/A	%	
Flucarbazone+R-11	0.42+0.25%	74	87
Flucarbazone+Cayuse Plus	0.42+0.75%	81	88
Flucarbazone+Syl-Tac	0.42+0.25%	65	84
Flucarbazone+Renegade	0.42+1%	76	88
Flucarbazone+Hasten	0.42+0.125G	75	85
R-11+flucarbazone+In-PLace	0.25%+0.42+2	76	90
R-11+flucarbazone+Cayuse +In-Place	0.25%+0.42+0.75%+2	66	86
R-11+flucarbazone+Syl-Tac+In-Place	0.25%+0.42+0.25%+2	66	89
R-11+flucarbazone+Renegade+In-Place	0.25%+0.42+1%+2	70	88
R-11+flucarbazone+Hasten+In-Place	0.25%+0.42+0.125G+2	62	89
Untreated	0	0	0
LSD (P=0.05)		9	6
CV		9	5

No injury was observed from application of flucarbazone to wheat. Selection of the appropriate adjuvant system to control yellow foxtail with flucarbazone is important since flucarbazone efficacy to yellow foxtail can be poor and inconsistent. Flucarbazone treatments that included the deposition agent In-Place (86 to 90% control) tended to provide better control of yellow foxtail than treatments without In-Place (84 to 88% control) on July 1. However, treatments that included In-Place also contained R-11 NIS regardless of the adjuvant treatment. This additional adjuvant cannot be ruled out as contributing to the slight improvement in foxtail control.

Foxtail control in hard red spring wheat, Carrington, 2003. (Endres and Howatt) The experiment was conducted on a Heimdahl loam soil with 7.2 pH and 3.4% organic matter at the NDSU Carrington Research Extension Center. The experimental design was a randomized complete block with three replicates. 'ND751' HRS wheat was planted on May 16. Herbicide treatments were applied with a CO_2-hand-boom plot sprayer delivering 8.5 gal/A at 30 psi through 8001 flat fan nozzles to the center 6.7 ft of 10 by 25 ft plots. Treatments were applied on June 7 with 59 F, 81% RH, 5% clear sky, and 8 mph wind to 4-leaf wheat and 1- to 3-leaf yellow and green foxtail. Average wheat density on June 9 in untreated plots was 6 plants/ft^2 and foxtail density was 38 plants/ft^2. The trial was harvested with a plot combine on August 26.

Herbicide		Weed control		Wheat	
		6/23	7/2	Seed	Test
Treatment	Rate	Fota[a]		yield	weight
	oz a.i./A	---------%---------		bu/A	lb/bu
Imazamethabenz+Thif&Trib+2,4-D+NIS	5+0.22+4+0.25%	25	7	13.5	57.8
Flucarbazone+Thif&Trib+2,4-D+Quad 7	0.42+0.22+4+1%	73	68	22.5	59.1
Propoxycarbazone+Thif&Trib+2,4-D+Quad 7	0.42+0.22+4+1%	86	80	30.5	60.1
Mesosulfuron+Thif&Trib+2,4-D+Quad 7	0.036+0.22+4+1%	66	42	16.1	58.7
Clodinafop+Brox&MCPA+Score	0.8+8+1%	95	90	42.5	60.9
Fenoxaprop+Brox&MCPA	1.32+8	88	78	38.4	60.5
Tralkoxydim+Brox&MCPA+Supercharge+AMS	2.9+8+0.5%+9.52	80	75	28.2	60.0
Flcz+Fenx+Brox&MCPA+Quad 7	0.21+0.6+8+1%	74	66	24.1	59.5
Flcz+Mesotrione+2,4-D+Quad 7	0.21+0.75+4+1%	74	67	22.5	59.0
Difenzoquat+Immb+Thif&Trib+2,4-D+NIS	3.7+8+0.22+4+0.25%	0	17	14.7	58.8
Flcz+Brox&MCPA	0.42+8	63	33	13.6	57.9
Flcz+Dicamba+Quad7	0.42+0.09+0.5%	72	47	19.5	58.3
Flcz+Fluroxypyr+2,4-D+Quad7	0.42+0.75+0.25+0.5%	79	74	27.3	59.5
untreated	0	0	0	12.9	59.3
LSD (0.05)		2	2	8.0	0.9

[a]Fota=yellow and green foxtail.

Clodinafop+Brox&MCPA+Score provided excellent foxtail control (90 to 95%) and high yield and test weight. Propoxycarbazone+Thif&Trib+2,4-D+Quad 7, Fenoxaprop+Brox&MCPA, and Tralkoxydim+Brox&MCPA+Supercharge+AMS provided 80 to 88% foxtail control 2 wk after application and 75 to 80% control 4 wk after application. Low wheat plant density and high foxtail density contributed to decline in foxtail control with time generally among all treatments. Crop injury from herbicides was not detected.

Foxtail control with Discover in HRS wheat, Carrington, 2003. (Endres) The experiment was conducted on a Heimdahl loam soil with 7.2 pH and 3.4% organic matter at the NDSU Carrington Research Extension Center. The experimental design was a randomized complete block with three replicates. 'ND751' HRS wheat was planted on May 16. Herbicide treatments were applied with a CO_2-hand-boom plot sprayer delivering 10 gal/A at 30 psi through 8001 flat fan nozzles to the center 6.7 ft of 10 by 25 ft plots. Treatments were applied on June 6 with 65 F, 53% RH, 30% clear sky, and 5 mph wind to 4-leaf wheat and 1- to 3-leaf yellow and green foxtail. Average wheat density on June 9 in untreated plots was 6 plants/ft^2 and foxtail density was 38 plants/ft^2. The trial was harvested with a plot combine on August 26.

Herbicide		Weed control		HRS wheat	
		6/23	7/2	Seed	Test
Treatment	Rate	Fota[a]		yield	weight
	fl oz product/A	--------%-------		bu/A	lb/bu
untreated check	x	0	0	12.6	59.0
Discover 60EC	12.8	95	96	38.0	60.4
Discover 60EC+Bronate Advanced	12.8+12.8	90	88	39.7	60.6
Discover 60EC+HarmonyExtra+Starane	12.8+0.3 oz+5.3	77	72	29.4	59.8
Discover 60EC+MCPAe+Clarity	12.8+8+2	91	90	31.7	62.4
Discover 60EC+HarmonyGT+Starane	12.8+0.3oz+5.3	69	47	18.8	59.0
Discover 60EC+CurtailM	12.8+28	77	68	25.0	59.5
Discover 2EC	3.2	90	91	39.3	60.4
LSD (0.05)		2	17	8.9	NS

[a]Fota=yellow and green foxtail.

Good to excellent foxtail control (88 to 96%), primarily yellow foxtail, and highest yields were obtained with Discover 60EC alone or with tank mixtures of Bronate Advanced and MCPAe+Clarity, and Discover 2EC. Crop injury from herbicides was not detected.

Broadleaf weed control in wheat. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 25 at Fargo, North Dakota. Treatments were applied to 6-leaf hard red spring wheat and 1- to 2-inch redroot pigweed and common lambsquarters on June 13 with 73° F, 46% relative humidity, clear sky, 2 to 4 mph northwest wind and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Fenoxaprop was applied to entire plot on June 9 for grass weed control. The experiment was a randomized complete block design with four replicates.

Treatment[a]	Rate	Jul 1 Rrpw	Jul 1 Colq	Aug 11 Yield
	oz/A	%	%	bu/A
Fluroxypyr&2,4-D	7.5	99	97	65
Fluroxypyr&MCPA	8	94	96	63
Carfentrazone+fluroxypyr&2,4-D	0.128+7.5	99	99	64
Carfentrazone+fluroxypyr&MCPA	0.128+8	98	98	67
Carfentrazone+dicamba	0.128+1.5	96	96	59
Bromoxynil&MCPA	8	92	98	64
Bromoxynil&MCPA+thifensulfuron&tribenuron	8+0.22	94	97	58
Thifensulfuron&tribenuron+fluroxypyr&2,4-D	0.22+7.5	95	99	62
Thifensulfuron&tribenuron+2,4-D	0.22+6	95	97	61
Thifensulfuron&tribenuron+carfentrazone+2,4-D	0.22+0.128+6	96	99	63
Untreated	0	0	0	58
LSD (P=0.05)		3	2	11
CV		3	2	13

[a]Bromoxynil&MCPA was 5 lb/gal formulation.

Broadleaf weed emergence was delayed compared to the crop. Weeds were small at application resulting in very good efficacy with all treatments. All treatments provided greater than 90% weed control July 1. Treatments with carfentrazone tended to cause more rapid death than treatments with bromoxynil. Wheat treated with herbicides tended to yield more grain, but crop competition provided significant weed suppression resulting in similar yield to herbicide treated wheat in the absence of grass competition.

Broadleaf weed control with Bromoxynil&MCPA. (Kirk Howatt, Ronald Roach, Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 25 near Fargo, North Dakota. Treatments were applied to 4.5- to 5-leaf wheat, 4- to 6-inch rosette curly dock, 1- to 3-leaf wild buckwheat, and 6-leaf wild mustard on June 13 with 69° F, 46% relative humidity, clear sky, 2 mph northwest wind, and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Fenoxaprop was applied to entire trial on June 9 to control grass weeds. The experiment was a randomized complete block design with four replicates.

		Jul 1			Jul 14			Aug 4			Aug 15
Treatment	Rate	Cudo	Wibu	Wimu	Cudo	Wibu	Wimu	Cudo	Wibw	Wimu	Yield
	oz/A					%					bu/A
Bromoxynil&MCPA	10	97	96	99	89	91	99	98	93	99	40
Bromoxynil&MCPA	12	97	98	98	94	95	99	98	95	99	42
Brox&MCPA+fluroxypyr	6+1	95	95	98	87	89	99	97	96	99	38
Brox&MCPA+fluroxypyr	8+1	98	97	99	96	95	99	99	98	99	44
Brox&MCPA+thifensulfuron	8+0.075	94	92	98	94	92	99	97	91	99	46
Brox&MCPA+tribenuron	8+0.125	91	93	99	93	95	99	98	95	99	40
Carfentrazone+2,4-D +thif&trib	0.128+4 +0.22	97	94	93	97	95	99	99	94	99	45
Untreated	0	0	0	0	0	0	0	0	0	0	41
LSD (P=0.05)		3	3	2	4	4	0	3	6	0	10
CV		3	3	1	3	4	0	2	5	0	16

Bromoxynil&MCPA was 5 lb/gal formulation.

All treatments provided exceptional control, generally greater than 90%, of broadleaf weeds sprayed. Bromoxynil&MCPA and fluroxypyr at 8 and 1 oz/A, respectively, provided the greatest and most consistent weed control ratings. Bromoxynil&MCPA was effective at 6 oz/A with fluroxypyr but wheat yield tended to be less than with other treatments.

Evaluation of Thifensulfuron and Tribenuron at 4:1 ratio. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 25. Treatments were applied to 4.5- to 5-leaf wheat 2- to 4-inch redroot pigweed, and 2- to 3-leaf wild buckwheat on June 13 with 69° F, 46% relative humidity, clear sky, 2 mph northwest wind, and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Fenoxaprop was applied to entire trial on June 9 to control grass weeds. The experiment was a randomized complete block design with four replicates.

		Jun 20	Jul 1		Jul 14	
Treatment[a]	Rate	Wheat	Rrpw	Wibw	Rrpw	Wibw
	oz/A	%				
Thif+trib+fluroxypyr+2,4-D ester+NIS	0.2+0.05+1.5+6+0.25%	0	96	96	98	96
Thif+trib+fluroxypyr+2,4-D ester+NIS	0.3+0.075+1.5+6+0.25%	0	94	94	93	93
Thif+trib+fluroxypyr+2,4-D ester+NIS	0.4+0.1+1.5+6+0.25%	0	93	97	98	99
Thif+trib+fluroxypyr+2,4-D ester+NIS	0.45+0.11+1.5+6+0.25%	0	93	96	97	98
Thif+trib+bromoxynil&MCPA+NIS	0.2+0.05+8+0.25%	0	90	97	95	98
Thif+trib+bromoxynil&MCPA+NIS	0.3+0.075+8+0.25%	0	89	96	95	97
Thif+trib+bromoxynil&MCPA+NIS	0.4+0.1+8+0.25%	4	95	97	97	95
Thif+trib+bromoxynil&MCPA+NIS	0.45+0.11+8+0.25%	3	94	95	94	94
Fluroxypyr+2,4-D ester	1.5+6	0	94	97	98	98
Bromoxynil&MCPA	8	0	85	93	92	97
Untreated	0	0	0	0	0	0
LSD (P=0.05)		1	5	5	4	3
CV		105	4	4	3	3

[a]Bromoxynil&MCPA was 5 lb/gal formulation.

Current formulation of thifensulfuron&tribenuron in Harmony Extra/XP is a 2:1 ratio. A 4:1 ratio is under consideration. This experiment was developed to evaluate crop response and weed control with a 4:1 ratio of active ingredients. Thifensulfuron was formulated Harmony GT/XP, and tribenuron was formulated Express. All thifensulfuron plus tribenuron combinations were 4:1 ratios at different rates. Overall, weed control was very high, greater than 85%. Rates of thifensulfuron and tribenuron provided essentially similar weed control within tank-mix partner. Thifensulfuron and tribenuron improved redroot pigweed control with bromoxynil&MCPA, but did not improve weed control with fluroxypyr and 2,4-D. Crop injury on June 20 was 3 to 4% with thifensulfuron and tribenuron at combined rate of 0.5 or greater when tank-mixed with bromoxynil&MCPA. These thifensulfuron and tribenuron rates did not result in injury expression when mixed with fluroxypyr and 2,4-D. Injury was not observed July 1.

Broadleaf weed control with carfentrazone and 2,4-D. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 25. Treatments were applied to 6-leaf hard red spring wheat and 1- to 2-inch redroot pigweed and common lambsquarters on June 13 with 73° F, 46% relative humidity, clear sky, 2 to 4 mph northwest wind and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Fenoxaprop was applied to entire trial on June 9 to control grass weeds. The experiment was a randomized complete block design with four replicates.

		Jun 20			Jul 1	
Treatment	Rate	Wheat	Rrpw	Colq	Rrpw	Colq
	oz/A			%		
AGH 02001+NIS	4.128+0.25%	8	91	87	98	99
Carfentrazone+2,4-D ester+NIS	0.128+4+0.25%	6	90	86	99	99
AGH 02001+thifensulfuron+NIS	4.128+0.22+0.25%	6	94	89	96	97
Carfentrazone+2,4-D ester +thifensulfuron+NIS	0.128+4 +0.22+0.25%	5	89	85	96	97
Bromoxynil&MCPA+fluroxypyr	8+1	0	86	82	89	92
AGH 02001+fluroxypyr+NIS	4.128+1+0.25%	5	91	84	94	95
2,4-D LV6	4	0	89	85	95	94
AGH 02007	4	0	76	70	94	94
2,4-D LV4	4	0	86	82	92	96
PCC 1133+PCC 1174	4+1%	1	89	82	92	95
Untreated	0	0	0	0	0	0
LSD (P=0.05)		1	3	4	3	2
CV		32	3	5	3	2

[a]Bromoxynil&MCPA was 5 lb/gal formulation; AGH02001 was formulated carfentrazone and 2,4-D and AGH02007 was 2,4-D from Agriliance; and PCC1133 was acid formulation of 2,4-D and PCC 1174 was acidifying adjuvant from Loveland Industries.

Carfentazone injury to wheat was not as severe as previously observed. Maximum rating of 8% injury was recorded June 20 whereas injury in past experiments had been 25 to 35%. All treatments containing carfentrazone elicited 5 to 8% injury on June 20, but injury was not observed July 1. Premix formulation of carfentrazone&2,4-D caused slightly more injury than the tank-mix of carfentrazone and 2,4-D. Treatments containing carfentrazone provided greater control of redroot pigweed and common lambsquarters than bromoxynil&MCPA plus fluroxypyr. The formulation of 2,4-D in AGH02007 resulted in much slower symptom expression on weeds than other 2,4-D formulations, but eventual weed control of 94% was similar to other 2,4-D formulations. The acid formulation of 2,4-D in PCC1133 did not improve overall weed control or speed the development of symptoms compared with current 2,4-D formulations.

Weed control in durum with Aim, Williston 2003. (Neil Riveland) 'Mountrail' durum wheat was planted on fallow in 7-inch rows at 90 lbs/a on May 20. The treatments were applied on June 18 to 4 to 5-leaf wheat, 4-5 leaf wild oats, 2-4 leaf green foxtail and 2-3 inch Russian thistle with air temperature at 81 F, 29% relative humidity, clear sky, 5-8 mph SE wind and dry topsoil at 81 F. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 10 gals/a at 40 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. First rain received after application was 0.46 inches on June 21. The experiment was a randomized complete block design with four replications. Wild oat density averaged 1 plant/2ft^2. Green foxtail density was 5-10 plants/ft^2 and Russian thistle 1-4 plants/yard2. Plots were evaluated for crop injury on June 25 and July 17 and weed control on July 17. Durum was machine harvested on August 19.

Treatment[a]	Rate	Plt Ht	6/25 Injury	7/17 Injury	7/17 Wioa	7/17 Grft	7/17 Ruth	Test wght	Yield
	oz product/A	in.	%			%		lb/bu	bu/A
Aim+2,4-D Ester	1.0+0.75pt	29	6	0	0	25	97	60	29
Aim+2,4-D Ester	0.5+0.75pt	27	4	2	10	8	97	60	30
Aim+2,4-D E+NIS	0.5+0.75pt+0.25%	28	8	0	0	6	99	60	29
Aim+2,4-D E+HarmonyGT	1.0+0.75pt+0.3	28	2	1	0	13	99	60	29
Aim+2,4-D E+HarmonyGT	0.5+0.75pt+0.3	28	1	0	0	25	99	60	29
Aim+MCPA E+Puma	0.5+0.75pt+0.4pt	29	4	3	95	97	97	60	34
HarmonyGT+MCPAe+Puma	0.3+0.75pt+0.4pt	29	1	1	97	96	99	60	33
Aim+MCPA+Everest+NIS	0.5+0.75pt+0.6+0.25%	26	6	8	97	93	99	60	32
MCPA+Everest+NIS	0.75pt+0.6+0.25%	28	11	8	99	93	99	60	33
Untreated	0	28	0	0	0	0	0	60	28
HIGH MEAN		29	11	8	99	97	99	60	34
LOW MEAN		26	0	0	0	0	0	60	28
EXP MEAN		28	4	2	40	45	88	60	31
C.V. %		5	70	77	16	35	2	.4	9
LSD 5%		NS	4	2	9	23	4	NS	4
# OF REPS		4	4	4	4	4	2	2	4

[a] - NIS = Activator 90 from Loveland.

Summary: Even though the weed population was generally low, there is a yield response when wild oats and green foxtail are controlled. Significant crop injury occurs when MCPA is added to Aim and/or Everest combinations, especially when adding a non-ionic surfactant.

Canada thistle control with in-crop and post-harvest herbicide treatments in wheat. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Canada thistle has become the most costly invasive weed species for farmers in North Dakota and is estimated to infest over 8.5 million acres in the state. In a recent cropland survey, Canada thistle occurred in 39% of the quadrates used to estimate weed presence and density (20 quadrats per field in over 1500 fields across North Dakota). The purpose of this research was to evaluate Canada thistle control with tribenuron and tribenuron plus thifensulfuron applied in wheat followed by glyphosate applied post-harvest.

The experiment was established on cropland that had been fallow for several years and was heavily infested with Canada thistle. The soil was fertilized, cultivated, and then seeded to wheat on May 10, 2002. The initial herbicide treatments were applied on June 17 when the wheat was in the 4-leaf growth stage and Canad thistle was beginning to bolt and averaged 10 to 12 inches tall. The wheat was harvested on August 14 and glyphosate was applied on Sept. 26, 2002 when Canada thistle was in the rosette or post-flowering growth stage and 6 to 18 inches tall. The herbicides were applied using a hand-held boom sprayer delivering 8.5 gpa at 35 psi. The plots were 10 by 30 feet, and treatments were replicated four times in a randomized complete block design. Canada thistle top growth control was visually evaluated based on percent stand reduction compared to the untreated check.

All treatments evaluated controlled Canada thistle in-crop, which averaged 82 and 91% injury 21 and 35 DAT (days after treatment), respectively (data not shown). Thifensulfuron slightly injured wheat initially, especially when applied with tribenuron, but the crop recovered rapidly and no injury was visible by 21 DAT (Table). All in-crop treatments provided better than 90% Canada thistle control 2 MAT (months after treatment), but the weed began to regrow once the crop was harvested.

Canada thistle control 12 MAT averaged 98% with a post-harvest glyphosate treatment compared to 61% without glyphosate, regardless of the in-crop treatment (Table). Control was similar regardless of the glyphosate rate. Glyphosate provided an average of 98 and 88% Canada thistle control 12 and 15 MAT, respectively, following the first in-crop treatment compared to 99 and 90%, respectively, when no herbicide was applied in-crop. In summary, several herbicide treatments can be used to control Canada thistle in wheat during the growing season, but it is important to apply glyphosate post-harvest for long-term control in crop land.

Table. Canada thistle control in wheat with various herbicides spring-applied followed by glyphosate applied post-harvest.

Spring-applied treatments		Post-harvest		Wheat injury DAT[1]			Control MAT[2]		
Herbicides	Rate	Herbicides	Rate	7	14	21	2	12	15
	oz/A		oz/A	%					
Tribenuron + X-77[3]	0.125 + 0.25%	Glyphosate[f]	16	1	0.5	0	94	99	97
Tribenuron + X-77[3]	0.125 + 0.25%	Glyphosate[f]	32	0	0.5	0	98	99	94
Tribenuron + X-77[3]	0.19 + 0.25%	Glyphosate[f]	32	1	0.5	0	95	97	92
Tribenuron + X-77[3]	0.25 + 0.25%	Glyphosate[f]	32	1	1	0	98	99	85
Tribenuron + X-77[3]	0.25 + 0.25%	• • •	• •	1	1	0	94	63	53
Thifensulfuron + tribenuron[4] + 2,4-D + X-77[c]	0.15 + 0.074 + 6 + 0.25%	Glyphosate[f]	32	3	1.5	0	94	98	89
Thifensulfuron + tribenuron[4] + 2,4-D + X-77[c]	0.2 + 0.1 + 6 + 0.25%	Glyphosate[f]	32	4	2	0	92	98	65
Thifensulfuron + tribenuron[4] + 2,4-D + X-77[c]	0.25 + 0.125 + 6 + 0.25%	Glyphosate[f]	32	3	2.5	0	95	97	84
Thifensulfuron + tribenuron[4] + 2,4-D + X-77[c]	0.3 + 0.15 + 6 + 0.25%	Glyphosate[f]	32	3	1.5	0	95	99	90
Thifensulfuron + tribenuron[4] + 2,4-D + X-77[c]	0.3 + 0.15 + 6 + 0.25%	• • •	• •	4	2	0	98	74	51
Thifensulfuron + tribenuron[4] + X-77	0.3 + 0.15 + 0.25%	• • •	• •	3	2	0	97	70	60
Clopyralid + MCPA[5]	1.7 + 9.4	• • •		1	1	0	96	51	23
Clopyralid + MCPA[5]	1.7 + 9.4	Glyphosate[6]	32	2	2	0	98	97	86
None		Glyphosate[6]	32	0	0	0	0	99	90
Untreated			• •	0	0	0	0	0	0
LSD (0.05)				1	1	NS	7	9[7]	31

[1] Days after treatment (June 17, 2002). Wheat was seeded on May 10 and harvested on August 14, 2002.
[2] Months after the in-crop treatment. Glyphosate was applied on Sept. 26, 2002.
[3] X-77 surfactant from Loveland Industries, Greeley, CO.
[4] Commercial formulation - Harmony Extra by DuPont, Wilmington, DE.
[5] Commercial formulation - CurtailM by Dow AgroSciences Indianapolis, IN.
[6] Glyphosate isopropyl amine formulation was Roundup Ultra Max by Monsanto, St. Louis, MO.
[7] LSD (0.10).

Canada thistle control in wheat. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). Hard red spring wheat was seeded April 25 near Davenport, North Dakota. Treatments were applied to 3.5- to 4-leaf wheat and 6- to 8-inch Canada thistle on June 9 with 74° F, 46% relative humidity, 60% cloud cover, 11 mph south southeast wind, and soil temperature of 63° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete bock design with four replicates. Plots with no Canada thistle were removed from analysis, and three replicates were used in analysis.

Treatment[a]	Rate	Jun 20 Cath	Jul 21 Cath
	oz/A	%	
Clopyralid&2,4-D	9.5	61	56
Clopyralid&MCPA	9.5	84	96
Bromoxynil&MCPA	8	46	47
Tribenuron+2,4-D ester	0.125+6	77	91
Thifensulfuron&tribenuron+2,4-D ester	0.225+6	55	60
Dicamba+2,4-D amine	1.5+4	37	41
2,4-D amine	8	54	59
Bromoxynil&MCPA	8	70	35
Clopyralid+fluroxypyr+MCPA	1.5+1.5+6	86	87
Clopyralid+fluroxypyr	1.5+1.5	34	42
Untreated	0	0	0
LSD (P=0.05)		47	47
CV		59	58

[a]Bromoxynil&MCPA was 5 lb/gal formulation.

Clopyralid and MCPA provided 84% Canada thistle control June 20 and 96% control July 21. MCPA was believed to be an important component because clopyralid and fluroxypyr did not give greater than 45% Canada thistle control during either evaluation and the best rating with clopyralid and 2,4-D was 61%. Tribenuron and 2,4-D provided 91% control July 21, but symptoms were slower to develop than with clopyralid and MCPA. Thifensulfuron&tribenuron included tribenuron at 0.08 oz/A (60% control), and thistle control was much less than when tribenuron was included at 0.125 oz/A (91% control). Other herbicide treatments gave less than 60% control July 21. Bromoxynil&MCPA caused substantial necrosis June 20 (70% control), but many thistle stems had initiated new shoots July 21 (35% control).

Evaluation of herbicides for in-season Canada thistle control. Jenks, Willoughby, and Markle. Mountrail durum was seeded May 21 into 7.5-inch rows at 120 lb/A. Individual plots were 10 x 30 ft and replicated four times. Treatments were applied to 4- to 6-inch Canada thistle (Cath) and 4- to 5-leaf durum on June 16 with a bicycle sprayer delivering 10 gpa at 40 psi through XR 8001 nozzles. Air and soil temperature were 78 and 75 F, respectively, and relative humidity was 54%.

		Wheat		Cath			Yield	Test Wt
Treatment	Rate	Jun 23	Aug 13	Jul 3	Jul 15	Aug 13	Aug 18	
		— % injury —		—— % control ——			lb/A	lb/bu
Curtail	2 pt	0	0	88	86	100	39	61.4
Curtail M	1.75 pt	0	0	86	81	96	37	61.1
Bronate[a]	0.8 pt	0	0	24	29	45	37	61.1
Express + 2,4-D Ester + NIS	0.167 oz + 0.75 pt + 0.25% v/v	0	0	71	72	94	36	60.8
Harmony Extra + 2,4-D Ester + NIS	0.3 oz + 0.75 pt + 0.25% v/v	0	0	68	65	98	43	60.7
Clarity + 2,4-D Amine	3 fl oz+ 0.5 pt	0	0	74	71	91	41	60.7
2,4-D Amine	1 pt	0	0	72	69	97	39	61.0
Bronate	1 pt	0	0	23	30	56	37	61.3
Stinger + Starane + MCPA Ester	4 fl oz + 0.5 pt + 0.75 pt	0	0	88	83	100	40	61.5
Stinger + Starane	4 fl oz + 0.5 pt	0	0	86	80	98	39	61.6
Untreated		0	0	0	0	0	37	60.9
LSD (0.05)		--	--	5	9	19	NS	NS
CV		0	0	5	10	16	8	1.1

[a] *Bronate Advanced*

None of the treatments caused visible crop injury. Canada thistle densities were quite variable throughout the plot area, but almost all individual plots had at least a few plants present.

In the June and July evaluations, Curtail, Curtail M, and Stinger treatments provided 80-88% Canada thistle control. Express, Harmony Extra, and Clarity combined with 2,4-D or 2,4-D alone provided 65-74% Canada thistle control. Bronate or Bronate Advanced provided poor Canada thistle control (23-30%). At the pre-harvest evaluation in August, all treatments except Bronate or Bronate Advanced provided excellent Canada thistle control. However, this excellent control was influenced significantly by the plants being severely drought stress. We would not typically see this level of control under more favorable growing conditions. There were no significant differences in wheat yield between treatments.

Long-term milkweed control 2002-04. Jenks, Willoughby, and Markle. Spring wheat was seeded May 13, 2002 near Wolf Creek, ND. POST and POST II treatments were applied June 7, and 14 2002, respectively, with a bicycle sprayer delivering 10 gpa at 40 psi through XR 8001 nozzles to 4-leaf wheat, and up to 10-inch milkweed. Air and soil temperatures were 79 and 72 F, respectively, and relative humidity was 23% on June 7. Air and soil temperatures were 73 and 72 F, respectively, and relative humidity was 45% on June 14. Pre-harvest treatments were applied Aug 5, 2002 with a handboom delivering 10 gpa at 40 psi through XR 8001 nozzles. Air and soil temperatures were 72 and 71 F, respectively, and relative humidity was 46 % on Aug 5. Individual plots were 10 x 30 ft and replicated four times. All common milkweed plants present in each plot were counted prior to the in-crop herbicide application on June 7, 2002. Canola was planted over the study area April 26, 2003. All milkweed plants present in each plot were counted June 4, 2003 prior to any herbicide application to the canola.

			Common milkweed		
			Control	Density	
Treatment	Rate	Timing	Aug 14 02	Jun 7 02	Jun 4 03
			— % —	— plants/plot —	
Express + 2,4-D	0.33 oz + 0.5 pt	POST	73	56	16
Express + 2,4-D + Banvel	0.33 oz + 0.5 pt + 3 fl oz	POST	74	60	28
Express + 2,4-D + Starane	0.33 oz + 0.5 pt + 0.67 pt	POST	59	98	34
Express + 2,4-D/ Express	0.167 oz + 0.5 pt/ 0.167 oz	POST/ POSTII	61	107	54
Express + Curtail	0.33 oz + 2 pt	POST	64	153	66
Paramount + Curtail	0.25 lb + 2 pt	POST	71	84	49
Express + 2,4-D/ Roundup	0.33 oz + 0.5 pt/ 26 fl oz	POST/ PRE-H	50	154	12
Express + 2,4-D + Banvel/ Roundup	0.33 oz + 0.5 pt + 3 fl oz/ 26 fl oz	POST/ PRE-H	53	60	4
Express + 2,4-D + Starane/ Roundup	0.33 oz + 0.5 pt + 0.67 pt/ 26 fl oz	POST/ PRE-H	79	36	5
Express + 2,4-D/ Express/ Roundup	0.167 oz + 0.5 pt/ 0.167 oz/ 26 fl oz	POST/ POSTII/ PRE-H	68	59	13
Express + Curtail/ Roundup	0.33 oz + 2 pt/ 26 fl oz	POST/ PRE-H	73	75	5
Paramount + Curtail/ Roundup	0.25 lb + 2 pt/ 26 fl oz	POST/ PRE-H	81	61	8
LSD (0.05)			NS	64	29
CV			21	53	82

[a]*Express treatments were applied with Quad 7 at 1% v/v, Paramount treatments were applied with MSO at 24 fl oz, and Roundup treatments were Roundup UltraMax applied with AMS at 2.5 gal/100 gal.*

Several herbicides were evaluated for common milkweed control in wheat. The main focus in this study was on Express, which has shown activity on milkweed in previous studies. The objective was to compare Express tank mixes applied in-crop with and without a pre-harvest application of Roundup to determine the impact on common milkweed densities the following year. Express was also applied as a split application.

The Express tank mixes were applied in June 2002. A visual evaluation of common milkweed control in August 2002 did not provide much useful information. Milkweed control ranged from 50-81%, but was not consistent across the four replications. Milkweed is difficult to control because it emerges at different times throughout the growing season. At the August 2002 evaluation, we observed some dead plants, some sick plants, and many healthy plants. It was not possible to determine whether these live plants were emerged or not at the June 2002 application time.

The most encouraging observations came from the density counts in June 2003. All treatments reduced milkweed densities compared to the initial densities in 2002; however, treatments that received the pre-harvest Roundup application had significantly lower milkweed densities in 2003.

Weed control with imazamox plus MCPA in HRSW. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). An experimental line of imidazolinone-resistant hard red spring wheat was seeded May 1 near Fargo, North Dakota. Treatments were applied to 5-leaf wheat, 5-leaf yellow foxtail, 2- to 4-inch Venice mallow and redroot pigweed, 4-leaf wild buckwheat, and 4-leaf (rosette to bolted) curly dock on June 19 with 78° F, 37% relative humidity, clear sky, 6 to 8 mph southeast wind, and soil temperature of 65° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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. Venice mallow and curly dock populations were sufficient in two replicates to get accurate evaluations.

		Jul 1	Jul 25						Aug 11				Aug 20
Treatment[a]		Wht	Wht	Yeft	Vema	Rrpw	Wibw	Cudo	Yeft	Vema	Wibw	Cudo	Yield
	Rate	%											bu/A
Imazamox+NIS+UAN	0.5+0.25%+1%	1	1	89	82	89	47	77	84	87	76	77	35
Imazamox+NIS+UAN	0.75+0.25%+1%	1	0	89	82	91	49	72	89	85	74	77	32
BAS 777+NIS+UAN	4.5+0.25%+1%	3	1	94	92	96	74	92	91	90	82	87	32
BAS 777+NIS+UAN	6.75+0.25%+1%	3	0	92	87	88	62	91	92	89	47	87	31
Imazamox+MCPA-e+NIS+UAN	0.5+4+0.25%+1%	3	1	90	75	97	45	98	93	90	81	94	36
Imazamox+MCPA-e+NIS+UAN	0.75+6+0.25%+1%	3	0	91	91	91	44	95	94	91	74	95	36
Imazamox+MCPA-e+NIS+UAN	0.5+2.7+0.25%+1%	2	1	90	77	93	35	96	90	89	79	95	33
Imazamox+MCPA-e+NIS+UAN	0.75+4+0.25%+1%	3	0	94	83	90	50	96	97	90	84	95	35
Fenx+Thif&Trib+2,4-De+NIS	1.32+0.22+4+0.25%	3	1	77	98	96	57	99	65	95	80	92	31
Untreated	0%	0	0	0	0	0	0	0	0	0	0	0	25
LSD (P=0.05)		2	2	4	10	10	5	7	4	6	15	7	6
CV		75	225	4	6	14	4	4	4	6	16	4	13
# of Reps		4	4	4	2	4	4	2	4	4	4	2	4

[a]BAS 777 was an experimental formulation of imazamox and MCPA.

Imazamox plus MCPA injured wheat up to 3% on July 1, which was similar to a commercial standard of fenoxaprop plus thifensulfuron&tribenuron and 2,4-D. Wheat essentially showed no injury on July 25. Imazamox provided at least 89% control of yellow foxtail July 25. Foxtail control tended to be improved when MCPA was included. Thifensulfuron&tribenuron with 2,4-D provided the best control of Venice mallow (95 to 98%). Adding MCPA to imazamox tended to increase mallow control compared with imazamox alone. Redroot pigweed control was similar with all herbicides, which provided 99% control of pigweed August 11 (data not shown). The premix of imazamox and MCPA, BAS 777, provided better control of wild buckwheat than tank-mixing the herbicides, 74% compared with 45% respectively. The premix BAS 777 also controlled wild buckwheat better than thifensulfuron&tribenuron and 2,4-D. Imazamox control of curly dock (77%) was improved with the addition of MCPA. The premix BAS 777 gave 87% control of curly dock, but tank-mixing imazamox and MCPA provided 95% control August 11. Weed control from all herbicides resulted in greater yield compared with untreated wheat, but there were no differences among herbicide treated wheat.

Application timing in imazamox-resistant wheat. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). An experimental line of imidazolinone-resistant wheat was seeded May 1 at a location near Fargo, North Dakota. Crop and weed stages and climate conditions at time of application were as follows:

Application timing	1-2 leaf	1-2 tillers	Jointed
Date	June 5	June 19	July 15
Crop stage, leaf	2	5.5	headed
Yellow foxtail, leaf	3	5	NA
Temperature, ° F	65	78	76
Relative humidity, %	66	37	46
Sky conditions	15% cloud cover	Clear	60% cloud cover
Wind velocity, mph	4	6 to 8	1 to 2
Soil temperature, ° F	57	65	68

Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Fenoxaprop and thifensulfuron were applied to control weeds in the entire trial area after June 19 to avoid safening imazamox on wheat. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Application timing	Jun 18 Wheat	Jun 18 Yeft	Jul 1 Wheat	Jul 14 Wheat	Aug 4 Wheat	Aug 21 Yield
Name	oz/A				%			bu/A
Imazamox+NIS+UAN	1+0.25%+1%	1-2 leaf	9	87	6	3	3	27
Imazamox+MSO+UAN	1+1%+1%	1-2 leaf	30	95	17	14	11	30
Imazamox+NIS+UAN	1.5+0.25%+1%	1-2 leaf	60	89	55	37	37	24
Imazamox+MSO+UAN	1.5+1%+1%	1-2 leaf	86	94	70	70	69	10
Imazamox+NIS+UAN	1+0.25%+1%	1-2 tillers			2	0	1	26
Imazamox+MSO+UAN	1+1%+1%	1-2 tillers			5	5	8	24
Imazamox+NIS+UAN	1.5+0.25%+1%	1-2 tillers			3	1	3	37
Imazamox+MSO+UAN	1.5+1%+1%	1-2 tillers			12	27	37	19
Imazamox+NIS+UAN	1+0.25%+1%	Jointed			0	0	0	23
Imazamox+MSO+UAN	1+1%+1%	Jointed			0	0	1	23
Imazamox+NIS+UAN	1.5+0.25%+1%	Jointed			0	0	0	22
Imazamox+MSO+UAN	1.5+1%+1%	Jointed			0	0	1	21
Untreated	0				0	0	0	24
LSD (P=0.05)			12	6	6	6	7	8
CV			17	4	34	34	37	22

Imazamox caused significant damage to wheat depending on application timing, rate, and adjuvant. Proposed label rate was 0.5 oz/A. This experiment investigated response of wheat to overlap and misapplication resulting in two to three times the use rate. Six other locations across the wheat-growing region did not observe more than 25% injury, although trends were similar to this study. Younger wheat was more susceptible to injury. Imazamox applied to 2-leaf wheat caused 9 to 86% injury at Fargo on June 18. Injury expression decreased with time but was still as high as 69% prior to harvest. Injury included stunting, darkened tissue, deformed and missing heads, and plant death. Increasing application rate from 1 to 1.5 oz/A increased injury by more than 50%. Methylated seed oil increased injury 20 to 30% compared with NIS. Only imazamox at 1.5 oz/A with MSO caused unacceptable injury when applied to tillering wheat. Injury increased from 12% on July 1 to 37% on August 4 rather than decreasing as with injury from the earlier application. Plants did not die from imazamox application to tillered wheat but head deformity was common. Imazamox did not cause noticeable injury to headed wheat. Yield was decreased only when imazamox at 1.5 oz/A with MSO was applied to wheat prior to heading.

Imidazolinone-resistant spring wheat and subsequent crop evaluations. (Hendrickson and Henson) The objective of the study was to evaluate the crop tolerance of imidazolinone resistant spring wheat and the subsequent crop (canola, flax, and sunflower) response to imazamox. The study was conducted at the NDSU Carrington Research Extension Center on a loam soil with a 7.5 pH and 3.4% organic matter. Imidazolinone-resistant spring wheat 'Teal 15A' was seeded May 15, 2002 in 7-inch rows at 1.6 million pure live seeds/A. Individual plots were 45 ft by 40 ft and arranged in a randomized complete block design with three replications. Imazamox was applied at 0.0312 and 0.0625 lb/A with a CO_2 pressurized hand-held plot sprayer delivering 10 gal/A at 20 psi through XR80015 flat fan nozzles on June 17, 2002 with 73° F, 58% RH, 90% cloud cover, 11 mph wind, and 77° F soil temperature to 4-leaf spring wheat. A nonionic surfactant 'Preference' and 28% UAN liquid fertilizer were applied with each herbicide treatment at 0.25% v/v and 1% v/v, respectively. To evaluate the subsequent crop response to imazamox, each main plot was split into 15 ft by 40 ft subplots and planted to canola 'DKL 223', flax 'Cathay', or sunflower '8377 NS' in the spring of 2003. The canola and flax were seeded on April 23 in 6-inch rows at 600,000 pls/A and 40 lb/A, respectively. Sunflowers were planted on May 21 in 30-inch rows at 20,000 seeds/A. The canola was swathed on August 4 and harvested on August 12. The flax was also harvested on August 12. The sunflowers were not harvested due to severe deer predation.

Imazamox did not visually injure the spring wheat when evaluated for overall crop injury, chlorosis, and height reduction 30 days after application (data not shown). Individual plots were not harvested due to poor quality and low yield potentials, which were caused by a high incidence of rust and tan spot. Imazamox did not cause any noticeable crop injury to the canola, flax or sunflowers planted the subsequent year (data not shown). The imazamox treatments did not cause a reduction in plant height or seed yield for the canola or flax. Mean plant height and seed yield was 30.5 inches and 1313 lb/A for the canola and 23.6 inches and 19 bu/A for the flax.

Weed Control in glyphosate-resistant wheat. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). Glyphosate-resistant wheat was seeded April 28 near Fargo, North Dakota. Treatments (2-leaf) were applied to 2- to 4-leaf wheat and 4-leaf redroot pigweed and common lambsquarters on June 2 with 65° F, 35% relative humidity, cloudy sky, 2 mph wind and soil temperature of 59°F. Treatments (4-leaf) were applied to 5.5-leaf wheat and 4-leaf redroot pigweed and common lambsquarters on June 9 with 67° F, 52 % relative humidity, cloudy sky, 3 mph wind, and soil temperature of 58°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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.

		Application	Jun 17				Jul 2	Jul 29				Aug 19
Treatment[a]	Rate	timing	Wheat	Rrpw	Colq	Wibw	Wheat	Wheat	Rrpw	Colq	Wibw	Yield
			%									bu/A
Glyphosate+AMS	6+2%	2 leaf	1	97	83	16	0	0	99	99	99	68
Glyphosate+AMS	9+2%	2 leaf	0	99	94	25	0	0	99	99	99	66
Glyphosate+AMS	12+2%	2 leaf	0	98	95	34	0	0	99	99	99	69
Glyphosate+AMS	6+2%	4 leaf	2	98	87	22	0	0	99	98	99	68
Glyphosate+AMS	9+2%	4 leaf	3	96	94	21	1	1	99	99	99	68
Glyphosate+AMS	12+2%	4 leaf	2	98	97	34	1	0	99	99	99	66
Glyphosate+AMS/Glyt+AMS	6+2%/6+2%	2/4 leaf	0	98	89	36	0	0	99	99	99	66
Clodinafop+Brox&MCPA+Score	1+8+1.2%	4 leaf	3	75	72	44	0	0	99	99	99	61
Fenoxaprop+Brox&MCPA	1.32+8	4 leaf	1	76	77	19	1	0	97	99	99	66
Tral+Brox&MCPA+Supercharge	2.88+8+0.5%	4 leaf	1	74	71	44	3	1	97	99	99	62
Flucarbazone+Brox&MCPA+NIS	0.42+8+0.25%	4 leaf	8	83	79	34	7	4	99	99	99	60
Glyphosate+2,4-D Ester+AMS	6+4+2%	4 leaf	3	98	95	26	0	0	99	99	98	61
Glyphosate+Brox&MCPA+AMS	6+8+2%	4 leaf	1	99	94	41	1	1	99	99	99	63
Glyphosate+Thifensulfuron+AMS	6+0.37+2%	4 leaf	2	99	94	46	0	0	99	99	99	64
Glyphosate+Dicamba+AMS	6+1+2%	4 leaf	3	99	94	26	7	4	99	99	99	67
Glyt+Clopyralid&2,4-D+AMS	6+9.28+2%	4 leaf	4	96	90	36	0	0	99	99	99	61
Untreated	0		0	0	0	0	0	0	0	0	0	64
LSD (P=0.05)			3	7	8	27	3	1	2	1	1	NS
CV			102	5	7	64	141	143	2	1	1	7

[a]Bromoxynil&MCPA was 5 lb/gal formulation.

Flucarbazone or dicamba elicited wheat injury that persisted late into the growing season but did not reduce grain yield. Wheat response to other herbicides was minor and generally was not observed on July 2. Treatments containing glyphosate provided at least 97% redroot pigweed control on June 17, while bromoxynil&MCPA gave 74 to 76% control. Adding flucarbazone to bromoxynil&MCPA improved pigweed control to 83%. Common lambsquarters control generally was better where glyphosate was included compared with bromoxynil&MCPA. Control of wild buckwheat was inconsistent across treatments but was less than 50%. Competition from wheat aided weed control and all heabicides provided 97 to 99% control of all weeds evaluated July 29. Wheat yield across the experiment was similar because vigorous wheat growth suppressed weeds and effectively eliminated competition.

Glyphosate-resistant wheat response to herbicides. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). Glyphosate-resistant wheat was seeded April 28 near Fargo, North Dakota. The entire trial was sprayed with Glyphosate and AMS at 11 oz ae/A and 11 oz/A, respectively, on June 9. Treatments (2- to 3-leaf) were applied to 2- to 4-leaf wheat on June 2 with 65° F, 38% relative humidity, cloudy sky, 2 mph wind, and soil temperature of 59° F. Treatments (5 leaf) were applied to 5.5-leaf wheat on June 9 with 67° F, 52% relative humidity, cloudy sky, 3 mph wind, and soil temperature of 58° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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[a]	Rate	Application timing	Jun 17 Wheat	Jul 2 Wheat	Jul 29 Wheat	Aug 4 Wheat	Aug 19 Yield
	oz/A		%				bu/A
Glyphosate+AMS	6+2%	2-3 leaf	2	0	0	0	62
Glyphosate+AMS	9+2%	2-3 leaf	1	0	0	0	61
Glyphosate+AMS	12+2%	2-3 leaf	2	0	0	1	63
Glyphosate+AMS	24+2%	2-3 leaf	1	0	0	0	61
Glyphosate+AMS	6+2%	5 leaf	3	0	0	0	61
Glyphosate+AMS	9+2%	5 leaf	3	0	0	0	63
Glyphosate+AMS	12+2%	5 leaf	4	0	0	0	55
Glyphosate+AMS	24+2%	5 leaf	2	0	0	1	62
Glyt+AMS/glyt+AMS	6+2%/6+2%	2-3/5 leaf	4	0	0	0	62
Clodinafop+brox&MCPA+DSV	0.8+8+1%	5 leaf	4	0	0	0	64
Fenoxaprop+brox&MCPA	1.32+8	5 leaf	3	0	0	0	65
Tral+brox&MCPA+Supercharge	2.88+8+0.5%	5 leaf	3	0	0	0	68
Flcz+bromoxynil&MCPA+NIS	0.42+8+0.25%	5 leaf	15	0	0	0	60
Fluroxypyr+2,4-D Ester	3+4	5 leaf	4	0	0	0	60
Bromoxynil&MCPA	8	5 leaf	3	0	0	0	61
Thifensulfuron+2,4-D Ester	0.37+4	5 leaf	4	0	0	0	61
2,4-D Ester	8	5 leaf	6	0	0	0	59
Dicamba	2	5 leaf	6	0	0	1	63
Dicamba+2,4-D Ester	2+8	5 leaf	15	7	3	2	51
Clodinafop+brox&MCPA+DSV	1.6+16+1%	5 leaf	5	0	0	1	58
Fenoxaprop+brox&MCPA	2.64+16	5 leaf	5	0	0	0	48
Flucarbazone+brox&MCPA+NIS	0.84+16+0.25%	5 leaf	24	4	0	1	62
Tral+brox&MCPA+Supercharge	5.76+16+0.5%	5 leaf	3	0	0	0	56
Untreated	0		1	0	0	0	44
LSD (P=0.05)			3	1	1	1	NS
CV			45	113	140	380	16

[a]Bromoxynil&MCPA was 5 lb/gal formulation.

Herbicides used in conventional wheat caused more injury June 17 than glyphosate treatments. Glyphosate application to 2- to 3-leaf wheat tended to result in less injury than application to 5-leaf wheat. Flucarbazone caused the most injury, 15 and 24% at 0.42 and 0.84 oz/A respectively. Injury from flucarbazone diminished and only the 2x application rate had observable injury on July 2. Wheat injury from dicamba plus 2,4-D at 2 and 8 oz/A was more persistent and was still discernible August 4. Wheat had recovered from effects of all other herbicides by July 2. There was no difference in wheat yield because of variability in emergence as effected by soil moisture.

Weed control in Roundup Ready hard red spring wheat, Carrington, 2003. (Endres, Aberle, and Valenti) The experiment was conducted on a loam soil with 6.8 pH and 3.9% organic matter at the NDSU Carrington Research Extension Center. The experimental design was a randomized complete block with three replicates. An experimental line of glyphosate-resistant HRS wheat was planted at approximately 60 lb seed/A on May 16. Herbicide treatments were applied with a CO_2-hand-boom plot sprayer delivering 10 gal/A at 30 psi through 8001 flat fan nozzles to the center 6.7 ft of 10 by 25 ft plots. EPOST treatments were applied on June 6 with 5 F, 90 % RH, 100% cloudy sky, and 10 mph wind to 2.5- to 3-leaf wheat, 1- to 3-leaf yellow and green foxtail, 1- to 4-inch tall common lambsquarters, 0.5-inch tall redroot and prostrate pigweed, and 1- to 2-inch tall wild mustard. POST treatments were applied on June 13 with 76 F, 45 % RH, 65% clear sky, and 5 mph wind to 4.5- to 5-leaf wheat, 1-leaf to tillering yellow and green foxtail, 1- to 6-inch tall common lambsquarters, 0.5- to 1-inch tall redroot and prostrate pigweed, and 2-inch tall to flowering wild mustard. Average wheat density was 39 plants/ft^2, foxtail density was 18 plants/ft^2, and common lambsquarters, pigweed, and wild mustard density was 1 plant/ft^2. Weed control and wheat response were visually estimated. The trial was harvested for seed yield with a plot combine on August 18.

Glyphosate treatments including tank mixtures provided good to excellent (84 to 99%) foxtail control (Table 1). Tralkoxydim and flucarbazone provided less foxtail control 14 and 21 days after treatment than glyphosate and glyphosate tank mixtures. POST (4.5- to 5-leaf application timing) glyphosate at 0.375 lb/A provided similar control of all weeds compared to higher rates or sequential application of glyphosate.

Table 1. Weed control in glyphosate-resistant wheat.

		14 days after treatment				21 days after treatment				Harvest
Treatment[a]	Rate	Fxtl[b]	Colq	Pigweed[c]	Wimu	Fxtl	Colq	Pigweed	Wimu	Fxtl
	(lb/A)	(% control)								
EPOST										
Glyphosate	0.375	90	94	95	96	90	85	93	98	84
Glyphosate	0.56	92	98	97	97	88	93	93	96	86
Glyphosate	0.75	91	97	96	97	93	95	96	95	88
POST										
Glyphosate	0.375	95	98	99	98	96	99	98	98	95
Glyphosate	0.56	96	96	98	99	97	92	96	98	97
Glyphosate	0.75	96	98	96	92	96	96	93	99	97
Glyphosate(EPOST)/glyphosate	0.375/0.375	97	94	99	99	97	96	99	99	98
Clodinafop+bromoxynil&MCPA+DSV	0.06+0.5+1%	91	99	98	99	91	98	98	99	94
Fenoxaprop+bromoxynil&MCPA	0.08+0.5	87	99	97	99	90	98	93	99	91
Tralkoxydim+Supercharge+bromoxynil &MCPA	0.18+0.5%+0.5	76	99	97	99	75	99	87	99	83
Flucarbazone+bromoxynil&MCPA+NIS	0.026+0.5+0.25%	77	99	99	99	76	99	99	99	80
Glyphosate+2,4-De	0.375+0.25	98	99	99	99	94	98	99	99	97
Glyphosate+bromoxynil&MCPA	0.375+0.5	95	99	99	99	94	99	99	99	97
Glyphosate+thifensulfuron	0.375+0.023	96	98	99	98	94	98	99	99	96
Glyphosate+dicamba	0.375+0.06	97	98	99	98	95	96	98	99	95
Glyphosate+clopyralid&2,4-D	0.375+0.58	94	99	97	99	95	99	96	99	95
Untreated	---	0	0	0	0	0	0	0	0	0
LSD (0.05)		6	4	3	5	8	5	5	3	7

[a]Glyphosate=Roundup UltraMax (3.7 lb ae/gal); All glyphosate treatments included ammonium sulfate at 5% v/v; DSV and Supercharge=adjuvants from Syngenta Crop Protection, Greensboro, SC; NIS=Preference, a nonionic surfactant from Agriliance, St. Paul, MN.

[b]Foxtail spp.=Yellow and green.

[c]Pigweed spp.=Redroot and prostrate.

Minimal or no wheat injury occurred with glyphosate when visually evaluated for chlorosis and growth reduction (Table 2). Wheat seed yield was highest with POST glyphosate, ranging from 53.0 to 59.4 bu/A.

Table 2. Glyphosate-resistant wheat response to herbicide treatments.							
		Crop response (DAT[a])					
		Chlorosis			Growth reduction		Seed
Treatment[a]	Rate	7	14	21	14	21	yield
	(lb/A)	------------------- (%)			------------------------		(bu/A)
EPOST							
Glyphosate	0.375	0	0	0	0	0	51.1
Glyphosate	0.56	0	0	0	0	0	47.9
Glyphosate	0.75	0	0	0	0	0	49.9
POST							
Glyphosate	0.375	0	0	0	0	0	54.0
Glyphosate	0.56	0	0	0	0	0	56.1
Glyphosate	0.75	0	0	0	0	0	57.1
Glyphosate(EPOST)/glyphosate	0.375/0.375	0	0	0	0	0	53.0
Clodinafop+bromoxynil&MCPA+DSV	0.06+0.5+1%	0	0	0	2	1	50.2
Fenoxaprop+bromoxynil&MCPA	0.08+0.5	17	0	0	0	0	46.8
Tralkoxydim+Supercharge+bromoxynil &MCPA	0.18+0.5%+0.5	0	0	0	0	0	51.6
Flucarbazone+bromoxynil&MCPA+NIS	0.026+0.5+0.25	0	0	0	7	2	54.2
Glyphosate+2,4-De	0.375+0.25	0	0	0	0	0	54.3
Glyphosate+bromoxynil&MCPA	0.375+0.5	0	0	0	0	0	59.4
Glyphosate+thifensulfuron	0.375+0.023	0	0	0	5	2	54.3
Glyphosate+dicamba	0.375+0.06	0	0	0	0	0	55.5
Glyphosate+clopyralid&2,4-D	0.375+0.58	0	0	0	0	0	57.2
Untreated	---	0	0	0	0	0	41.9
LSD (0.05)		2	0	0	3	2	7.6

[a]DAT=Days after treatment.

[b]Glyphosate=Roundup UltraMax (3.7 lb ae/gal); All glyphosate treatments included ammonium sulfate at 5% v/v; DSV and Supercharge=adjuvants from Syngenta Crop Protection, Greensboro, SC; NIS=Preference, a nonionic surfactant from Agriliance, St. Paul, MN.

Pre-harvest wheat and weed desiccation with carfentrazone. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington) 'Oxen' hard red spring wheat was seeded April 25 near Fargo, North Dakota. Treatments were applied to physiologically mature wheat with approximate moisture content of 30% on August 1 with 70° F, 60% relative humidity, 65% cloud cover, 8 mph northwest wind, and soil temperature of 67° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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. Moisture content of vegetation was measured from an area 1 m by 0.15 m along the row axis. All weed and crop aboveground biomass was harvested, fresh weight was recorded, material was oven dried, and final sample was weighed for dry weight.

		Moisture content			
Treatment	Rate	0 DAT	3 DAT	6 DAT	11 DAT
	oz/A	%			
Carfentrazone+glyphosate&2,4-D+NIS	0.128+13+0.25%	54	37	42	33
Carfentrazone+glyphosate&2,4-D+NIS	0.256+13+0.25%		43	45	37
Carfentrazone+glyt&2,4-D+2,4-D ester+NIS	0.128+13+4+0.25%		39	45	26
Carfentrazone+glyt&2,4-D+2,4-D ester+NIS	0.256+13+4+0.25%		38	39	24
Carfentrazone+glyt&2,4-D+2,4-D ester+NIS	0.128+13+8+0.25%		41	44	35
Carfentrazone+glyt&2,4-D+2,4-D ester+NIS	0.256+13+8+0.25%		39	43	30
Carfentrazone+PO	0.128+0.25G		43	46	31
Carfentrazone+PO	0.256+0.25G	59	39	42	31
Glyphosate&2,4-D+NIS	13+0.25%		40	43	29
Glyphosate&2,4-D+2,4-D ester+NIS	13+12+0.25%		42	45	31
Carfentrazone+glyphosate&2,4-D+NIS	0.256+20+0.25%	61	41	41	28
Carfentrazone+2,4-D ester+PO	0.256+8+0.25G		39	45	35
Carfentrazone+NIS	0.256+0.25%		37	42	32
Carfentrazone&2,4-D+PO	8.256+0.25G		41	45	32
Ambicarbazone+glyphosate&2,4-D+NIS	7+13+0.25%		45	47	35
Untreated	0	56	39	47	34
LSD (P=0.05)			9	5	9
CV			16	8	20

Very few differences in moisture content between herbicide treatments and the untreated were detected. There was no difference in moisture content 3 DAT. Carfentrazon plus glyphosate&2,4-D plus 2,4-D ester at 0.256, 13, and 4 oz/A, respectively, was the only herbicide combination that resulted in drier vegetation 6 and 11 DAT compared with untreated plants.

Improved burn down with adjuvants. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington) 'Oxen' hard red spring wheat was seeded April 25 near Fargo, North Dakota. Treatments were applied to physiologically mature wheat with approximate moisture content of 30% on August 1 with 70° F, 60% relative humidity, 65% cloud cover, 8 mph northwest wind and soil temperature of 67°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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. Moisture content of vegetation was measured from an area 1 m by 0.15 m along the row axis. All weed and crop aboveground biomass was harvested, fresh weight was recorded, material was oven dried, and final sample was weighed for dry weight.

Treatment[a]	Rate	Moisture content 3 DAT	Moisture content 11 DAT
	oz/A		
Glyphosate+carfentrazone	6+0.128	41	27
Glyphosate+carfentrazone+Placement	6+0.128+3 FL OZ/A	41	35
Glyphosate+carfentrazone+AG 02013	6+0.128+3 FL OZ/A	43	25
Glyphosate+carfentrazone+AG 02056	6+0.128+3 FL OZ/A	40	32
Glyphosate+carfentrazone+ClassAct NG	6+0.128+2.5%	41	26
Glyphosate&AMADS	50	43	26
Glyphosate&AMADS	75	40	30
Glyphosate+ambicarbazone+NIS	6+7+0.25%	41	29
Untreated		39	34
LSD (P=0.05)		4	11
CV		7	27

[a] AG02013 and AG02056 were experimental adjuvants from Agriliance.

Moisture of vegetation when treatments were applied averaged 57%. Significant desiccation had occurred 3 DAT, but herbicide treated vegetation had similar moisture to untreated. Carfentrazone tended to enhance drying, but Placement and AG02056 inhibited this effect as moistures remained higher than when no adjuvant was included. Glyphosate&AMADS provided a single product option that tended to desiccate vegetation. Ambicarbazone did not promote as much drying as carfentrazone or AMADS, although only one treatment was included for comparison. Pre-harvest herbicide application may have had a greater effect if weeds were more prevalent. Crop competition suppressed weed growth resulting in small amounts of weed biomass (8 to 12 inches tall).

Quizalofop for control of glyphosate-resistant wheat. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington). 'Oxen' hard red spring wheat was seeded April 25 near Fargo, North Dakota. Treatments were applied to 4.5- to 5-leaf wheat on June 4 with 69° F, 43% relative humidity, overcast sky, 6 mph west wind, and soil temperature of 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa a 35 psi through 8001 flat-fan 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[a]	Rate	Jun 18 Wheat	Jul 1 Wheat	Jul 8 Wheat
	oz/A		%	
Glyphosate	9	99	99	99
Quizalofop+MON 59112	0.45+0.22%	54	98	99
Quizalofop+MON 59112	0.55+0.22%	50	99	99
Quizalofop+MON 59112	0.66+0.22%	57	99	99
MON 24710+MON 59112	0.45+0.22%	55	98	99
MON 24710+MON 59112	0.55+0.22%	57	99	99
MON 24710+MON59112	0.66+0.22%	61	99	99
Quizalofop+MON 59112+PO	0.45+0.22%+1%	62	99	99
Quizalofop+MON 59112+PO	0.55+0.22%+1%	69	99	99
Quizalofop+MON 59112+PO	0.66+0.22%+1%	64	99	99
MON 24710+MON 59112+PO	0.45+0.22%+1%	65	99	99
MON 24710+MON 59112+PO	0.55+0.22%+1%	71	99	99
MON 24710+MON 59112+PO	0.66+0.22%+1%	70	99	99
Quizalofop+MON 59112+Sure-Mix	0.45+0.22%+0.5%	65	99	99
MON 24710+MON 59112+Sure-Mix	0.45+0.22%+0.5%	57	99	99
LSD (P=0.05)		6	1	0
CV		7	1	0

[a] MON 59112 and MON 24710 were experimental products.

Glyphosate provided complete control of tillered wheat 14 DAT. Quizalofop and MON 24710 provided similar control of wheat at equivalent use rates except when Sure-Mix was added. Quizalofop (65% control) performed better than MON 24710 (57% control) when Sure-Mix was included in the treatment for the June 18 evaluation. Adding PO increased wheat control by an average of 11 percentage points across formulations. Increasing the rate of quizalofop or MON 24710 tended to increase control of wheat, but all treatments provided 98 to 99% control of wheat on July 1. The MON 24710 formulation at 0.55 or 0.66 oz/A with MON 59112 and PO adjuvants caused quicker symptom progression than other non-glyphosate treatments.

Volunteer wheat control with quizalofop. (Kirk Howatt, Ronald Roach, and Janet Davidson-Harrington) 'Oxen' hard red spring wheat was seeded April 25 near Fargo, North Dakota. Treatments were applied to 4.5- to 5-leaf wheat on June 5. Treatments were applied with a tractor sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 30 ft wide area the length of 30 by 150 ft plots. This was a strip-plot demonstration to evaluate quizalofop efficacy to wheat applied with field-scale equipment rather than small-plot equipment.

Treatment[a]	Rate	Jun 18 Wheat	Jul 1 Wheat	Jul 8 Wheat
			%	
Quizalofop+MON 59112	0.45+0.22%	40	95	98
Quizalofop+MON 59112	0.55+0.22%	60	98	99
Quizalofop+MON 59112	0.66+0.22%	60	99	99
# of Reps		1	1	1

[a] MON 59112 was an experimental adjuvant.

Control of wheat was similar with 0.55 and 0.66 oz/A quizalofop. These rates provided more rapid wheat desiccation. Wheat response to quizalofop applied with field equipment was consistent with other studies employing handheld equipment.

Controlling volunteer wheat, Williston 2003. (Neil Riveland) 'Mountrail' Durum wheat was planted on fallow in 7 inch rows at 90 lbs/a on May 20 to simulate volunteer grain. The treatments were applied on June 17 to 5-5.5 leaf wheat with 65 F, 50% RH, 90% clear sky and 3-4 mph NW wind and dry topsoil at 77 F. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 10 gals/a at 40 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. First rain received after application was 0.46 inches on June 21. The experiment was a randomized complete block design with four replications. Durum wheat was planted at 1.1 million seeds/acre with an emergence rate that averaged about 21 plants/ft2. Plots were evaluated for durum wheat control on June 21, June 25 June 29 and July 18.

Treatment[a]	Rate	6-21 Durum	6-25 Durum	6-29 Durum	7-18 Durum
	lb ai/A		% control		
Roundup Ultramax	0.56	75	97	100	100
Assure II+Mon 59112	0.028+0.219	10	42	71	98
Assure II+Mon 59112	0.034+0.219	10	47	71	98
Assure II+Mon 59112	0.041+0.219	10	50	74	98
Mon 24710+Mon 59112	0.028+0.219	10	41	74	95
Mon 24710+Mon 59112	0.034+0.219	10	47	75	98
Mon 24710+Mon 59112	0.041+0.219	10	47	75	99
Assure II+Mon 59112+COC	0.028+0.219+1%	10	50	81	99
Assure II+Mon 59112+COC	0.034+0.219+1%	10	50	82	99
Assure II+Mon 59112+COC	0.041+0.219+1%	10	50	87	100
Mon 24710+Mon 59112+COC	0.028+0.219+1%	10	50	84	100
Mon 24710+Mon 59112+COC	0.034+0.219+1%	10	50	85	100
Mon 24710+Mon 59112+COC	0.041+0.219+1%	10	50	86	99
Assure II+Mon 59112+SureMix	0.028+0.219+0.5%	10	50	81	99
Mon 24710+Mon 59112+SureMix	0.028+0.219+0.5%	10	47	81	99
Untreated Check	0	0	0	0	0
HIGH MEAN		75	97	100	100
LOW MEAN		0	0	0	0
EXP MEAN		13	48	76	93
C.V. %		0	8	4	1
LSD 5%		NS	5	4	2
# OF REPS		4	4	4	4

[a]COC = Herbimax from Loveland, a petroleum oil concentrate

Summary: RoundUp UltraMax gave nearly 100% control in 8 days. Combinations with Assure II and Mon 24710 took more than two weeks to achieve the same level of control of the durum. The lowest rate of Mon 24710+Mon 59112 did not control the wheat as well as when an adjuvant was added (COC or Suremix).

Crop response to soil and foliar application of Flucarbazone. (Kirk Howatt, Ronald Roach, Janet Davidson-Harrington). Preplant incorporated (PPI) and preemergence (PRE) treatments were applied on May 21 with 67° F, 21% relative humidity, cloudy sky, 9 to 12 mph wind and soil temperature of 52° F. Incorporation was performed with hand rakes and PRE treatments were applied immediately after crop seeding. 'Oxen' hard red spring wheat, 'Finch' safflower, 'DKF 29-90' sunflower, 'DKB 06-51' soybean, and pinto bean were seeded at Fargo, North Dakota. POST treatments were applied to 3-leaf wheat, 2- to 4-inch safflower and sunflower, and unifoliolate soybean and pinto bean on June 13 with 77° F, 44% relative humidity, 5% cloud cover, northwest wind at 2 mph and soil temperature of 61° F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 8001 flat-fan 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.

		App.	Jun 20					Jul 15		
Treatment	Rate	timing	Wheat	Safl	Sufl	Sobe	Drbe	Wheat	Safl	Sufl
	oz/A		%							
Flucarbazone	0.42	PPI	0	0	1	6	9	0	2	5
Flucarbazone	0.21	PPI	1	2	9	9	9	0	24	37
Flucarbazone	0.42	PRE	1	0	4	5	10	0	9	11
Flucarbazone	0.21	PRE	0	0	0	6	10	0	9	7
Flucarbazone+NIS	0.42+0.25%	POST	7	12	35	41	37	1	9	39
Flucarbazone+NIS	0.21+0.25%	POST	5	7	19	26	40	1	25	26
Untreated	0		0	0	0	0	0	0	0	0
LSD (P=0.05)				4	17	19	20	2	12	15
CV				133	121	97	82	384	71	56

Flucarbazone applied PPI and PRE resulted in less injury than POST application June 20. Wheat was very tolerant, expressing typical short-term stunting and chlorosis, but plants had recovered by July 15. Sunflower, soybean, and pinto bean were very susceptible to flucarbazone applied POST, expressing 35 to 41% injury with flucarbazone at 0.42 oz/A on June 20. Safflower expressed more injury as the season progressed, but injury rating was not well correlated with application timing or flucarbazone rate. Soybean and pinto bean were severely stunted and accidentally mowed mid-season because they could not readily be seen in the plots.

2003 Crop Tolerance to Fall applied Plateau Herbicide at Hettinger. (Eriksmoen) Plateau herbicide treatments were applied on October 2, 2002 into no-till spring wheat stubble. Hank hard red spring wheat, Ben durum, Drummond barley, Youngs oat , BadgeRR canola and B-90 chickpea were seeded on April 23, 2003. The trial was not replicated. Evaluations for plant height and heads / plants per 3 foot of row were on August 1, 2003. The trial was not harvested.

Treatment	Product Rate	Plant Height	Heads/ Plants
	oz/A	cm	#/3'row
Hank HRSW			
Untreated	0	69	63
Plateau + MSO	4 + 32	63	48
Plateau + MSO	8 + 32	58	49
Plateau + MSO	12 + 32	52	18
Ben Durum			
Untreated	0	72	56
Plateau + MSO	4 + 32	70	49
Plateau + MSO	8 + 32	69	27
Plateau + MSO	12 + 32	57	22
Drummond Barley			
Untreated	0	69	65
Plateau + MSO	4 + 32	61	47
Plateau + MSO	8 + 32	62	44
Plateau + MSO	12 + 32	54	37
Youngs Oat			
Untreated	0	74	48
Plateau + MSO	4 + 32	69	35
Plateau + MSO	8 + 32	54	31
Plateau + MSO	12 + 32	59	33
BadgeRR Canola			
Untreated	0	50	7
Plateau + MSO	4 + 32	--	0
Plateau + MSO	8 + 32	--	0
Plateau + MSO	12 + 32	--	0
B-90 Chickpea			
Untreated	0	32	4
Plateau + MSO	4 + 32	34	5
Plateau + MSO	8 + 32	34	3
Plateau + MSO	12 + 32	29	1

Summary

Spring seeded small grain crops were affected by Fall applied Plateau herbicide. Fall applied Plateau killed spring seeded canola. Spring seeded chickpea had very good tolerance to Fall applied Plateau.

HRSW Varietal Tolerance to Far-Go Herbicide at Hettinger. (Eriksmoen)

Variety	6/10/2003	5/24/2002	5/22/2001	5/22/2000	6/9/1999	5/26/1998	6/18/1997	6/20/1996	6/9/1995
Keene	0	+	+	0	0	+	0	+	0
Russ	0	0	0	0	0	?	0	0	0
Oxen	0	0	0	0	0	0	0	0	0
Gunner	0	0	+	0	0	0	0	+	
Reeder	0	0	0	0	0	0	0	0	
Parshall	0	0	0	0	0	0	0	0	
Ingot	0	0	0	0	0	0			
Norpro	0	0	0	0	0				
Dandy	0	0	0	0	0				
McKenzie	0	0	+	+	0				
Mercury	0	0	0	0	0				
Alsen	0	0	0	0	0				
Dapps	0	+	+	?	0				
Knudson	+	0	+						
Keystone	+	0	0						
AC Superb	?	0	+						
Zeke	0	0	0						
Briggs	0	0	0						
Hanna	0	0	0						
Granite	0	?							
Outlook	0	+							
Hank	0	0							
Amazon	0								
AC Corinne	0								
AC Glenavon	0								
Laser	0								
Walworth		0	0						
Grandin			0	0	0	0	0	0	0
Ivan			+	+	0	+			
Ember			0	0	0	0			
Scholar			+	0	0				
Aurora			0	+	0				
Conan			0	0					
McVey			0		0				
Butte 86				0	0	0	0	0	0
2375				0	0	0	0	0	0
2398				0	0	0	0	0	0
Ernest				+	0	?	0	+	0
HJ98				0	0	0	0		
AC Barrie					0	?	0	+	+
Kulm					0	0	0	+	+
2371					0	0	0	0	0
Argent					0	0	0	0	0
Amidon					0	+	+	+	+
Trenton					0	0	0	0	0
Hammer					0	+	0	+	+
Application Date	4/1	4/11	4/16	3/27	4/12	4/3	4/3	4/18	3/24
Seeding Date	4/8	4/11	4/17	4/4	4/13	4/8	4/29	4/19	4/7
Rate (product)	3 pt	3 pt	3 pt	3 pt	3 pt	3 pt	3 pt	2 pt	2 pt

Stand reduction: + = susceptible, ? = questionable, 0 = tolerant

2003 HRSW Varietal Tolerance to Far-Go Herbicide at Hettinger. (Eriksmoen)

Variety	6/10/2003
Keene	0
Russ	0
Oxen	0
Gunner	0
Reeder	0
Parshall	0
Ingot	0
Norpro	0
Dandy	0
McKenzie	0
Mercury	0
Alsen	0
Knudson	+
Keystone	+
AC Superb	?
Zeke	0
Briggs	0
Hanna	0
Dapps	0
Granite	0
Outlook	0
Hank	0
Amazon	0
AC Corinne	0
AC Glenavon	0
Laser	0
ND741	0
ND747	0
ND749	0
ND751	0
ND752	0
ND753	+
ND755	0
ND756	0
ND800	0
ND801	0
ND802	0
Application Date	4/1
Seeding Date	4/8
Rate (product)	3 pt

Stand reduction: + = susceptible, ? = questionable, 0 = tolerant

HRSW Varietal Tolerance to Avenge Herbicide at Hettinger. (Eriksmoen)

Variety	2003	2002	2000	1999	1998	1997	1996	1995	1994	1993
Keene	0	0	0	0	1	1	1	0	1	0
Russ	0	0	0	0	1	1	1	1	+	
Oxen	0	0	1	0	1	0	1	0		
Gunner	+	+	+	+	+	+	+			
Reeder	1	0	+	1	+	+	+			
Parshall	1	0	0	0	+	+	+			
Ingot	0	0	0	0	1					
Norpro	0	0	0	0						
Dandy	0	0	0	0						
McKenzie	0	0	0	0						
Mercury	0	0	0	0						
Alsen	1	0	+	1						
Dapps	0	0	0	0						
Knudson	0	0								
Keystone	0	0								
AC Superb	0	0								
Zeke	0	0								
Briggs	0	0								
Hanna	0	0								
Granite	0	1								
Outlook	0	0								
Hank	0	0								
Amazon	0									
AC Corinne	0									
AC Glenavon	0									
Laser	0									
Walworth		0								
Grandin			1	1	1	+	+	+	+	+
Ivan			0	0	0					
Ember			1	0	0					
Butte 86			1	1	1	1	1	+	1	0
2375			0	0	1	0	1	1	1	0
2398			0	0	0	0	+	1	1	0
Ernest			1	0	0	0	1	0	1	0
HJ98			0	0	0	0				
Kulm				+	+	0	1	1	1	0
2371				0	1	0	+	1	1	0
Sharp				0	1	0	1	1	1	0
Amidon				1	0	1	1	0	+	0
Trenton				1	+	+	+	+	+	+
Hamer				0	1	0	1	0	1	
Lars				0	1	0	1	1	1	
Verde				+	+	+	+	+	+	
AC Barrie				0	1	0	1	0		
Argent				0	1	+	+	+		
Forge				0	1	1	1			
Nora				+	+	+	+			
McNeal					0	1	1	1	+	0
Application Date:	5/27	5/30	5/15	5/20	5/25	6/2	6/11	5/29	5/20	5/13

Rate (product): 4 pts/A

Crop Injury: + = susceptible, 1 = moderately tolerant, 0 = tolerant

Durum Varietal Tolerance to Avenge Herbicide at Hettinger. (Eriksmoen)

Variety	2003	2002	2000	1999	1998	1997	1996	1995	1994	1993
Rugby	0	0	0	0	1	0	1	0	1	0
Monroe	0	0	0	0	1	0	1	0	1	0
Renville	1	0	1	0	1	1	+	1	+	1
Munich	0	0	0	1	1	0	1	1	1	0
Ben	0	0	0	0	1	0	1	0	1	0
Belzer	1	+	+	+	+	+	+	+	+	+
Maier	0	0	0	0	1	0	1	0	1	0
Mountrail	0	1	+	0	+	1	1	+	+	
Lebsock	0	1	+	0	+	+	+	1	+	
Plaza	0	0	0	0	1	1	1	1		
Pierce	0	0	0	0	1					
Dilse	0	0	0	0	1					
AC Avonlea	0									
Plenty			0	0	1	0	1	1	1	0
AC Melita			0	0	1	0	1	0		
Dressler			0	0	1	1	1			
Kari			+	1	+		+			
Vic				1	+	+	+	+	+	+
Lloyd				0	1	1	1	0		0
Ward					1	0	1	1	1	0
Medora					1	+	1	1	1	0
Sceptre					1	1	1	1	1	0
Laker					+	+	+	+	+	1
Regold					+	1	+	+	+	1
Voss					1	0	+	+	1	0
Application Date:	5/27	5/30	5/15	5/20	5/25	6/2	6/11	5/29	5/20	5/13

Rate (product): 4 pts/A

Crop Injury: + = susceptible, 1 = moderately tolerant, 0 = tolerant

2003 Varietal Tolerance to Avenge Herbicide at Hettinger. (Eriksmoen)

HRSW	7/1/2003
Keene	0
Russ	0
Oxen	0
Gunner	+
Reeder	1
Parshall	1
Ingot	0
Norpro	0
Dandy	0
McKenzie	0
Mercury	0
Alsen	1
Knudson	0
Keystone	0
AC Superb	0
Zeke	0
Briggs	0
Hanna	0
Dapps	0
Granite	0
Outlook	0
Hank	0
Amazon	0
AC Corinne	0
AC Glenavon	0
Laser	0
ND741	+
ND747	0
ND749	0
ND751	1
ND752	0
ND753	0
ND755	0
ND756	0
ND800	+
ND801	0
ND802	0

Durum	7/1/2003
Rugby	0
Monroe	0
Renville	1
Munich	0
Ben	0
Belzer	1
Maier	0
Mountrail	0
Lebsock	0
Plaza	0
Pierce	0
Dilse	0
AC Avonlea	0
D95672	0
D95097	0
D95123	0
D96604	0
D96622	1
D98529	0
D98530	0
D98813	0
D99073	0
D99513	0
D99541	+
D99637	0
D99638	1
D99639	1
D99656	0
D99891	+
D99910	0
D99938	0
D99983	0
D97643	1
D97780	0
D971511	1
D98730	1

Application Date: 5/27 Crop Stage: 4 leaf
Rate (product): 4.0 pt
Crop Injury: + = susceptible, 1 = moderately susceptible, 0 = tolerant

Varietal Tolerance to Treflan Herbicide at Hettinger. (Eriksmoen)

HRSW	2003	2002	2000
Keene	0	0	0
Russ	0	0	+
Oxen	0	0	0
Gunner	0	0	0
Reeder	0	0	0
Parshall	0	0	0
Ingot	0	0	0
Norpro	0	0	+
Dandy	0	+	+
McKenzie	0	0	0
Mercury	0	?	0
Alsen	0	0	0
Knudson	0	+	
Keystone	0	0	
AC Superb	0	0	
Zeke	0	+	
Briggs	0	0	
Hanna	0	0	
Dapps	0	0	
Granite	0	0	
Outlook	0	0	
Hank	0	0	
Amazon	0		
AC Corinne	0		
AC Glenavon	0		
Laser	0		
Walworth		0	
Ernest			0
Butte 86			+
Ivan			+
Ember			0
2375			0
Grandin			+
2398			0
HJ98			0
Aurora			+
Conan			+
Scholar			+
AC Vista			0
AC Impervo			0
Prodigy			0

Durum	2003	2002	2000
Rugby	0	0	0
Monroe	0	0	0
Renville	0	0	0
Munich	0	0	0
Ben	0	0	+
Belzer	0	0	0
Maier	0	0	0
Mountrail	0	0	0
Lebsock	0	0	0
Plaza	0	0	0
Pierce	0	0	0
Dilse	0	0	0
AC Avonlea	0		
1AS/1D2			0
AC Melita			0
Plenty			0
Kari			0
Dressler			0

Application Date: 4/1/03, 4/11/02, 4/4/00
Seeding Date: 4/8/03, 4/11/02, 4/4/00
Application Rate (product): 1.5 pt/A
Stand reduction: + = susceptible, 0 = tolerant, ? = questionable

2003 Varietal Tolerance to Treflan Herbicide at Hettinger. (Eriksmoen)

HRSW	June 10
Keene	0
Russ	0
Oxen	0
Gunner	0
Reeder	0
Parshall	0
Ingot	0
Norpro	0
Dandy	0
McKenzie	0
Mercury	0
Alsen	0
Knudson	0
Keystone	0
AC Superb	0
Zeke	0
Briggs	0
Hanna	0
Dapps	0
Granite	0
Outlook	0
Hank	0
Amazon	0
AC Corinne	0
AC Glenavon	0
Laser	0
ND741	0
ND747	0
ND749	0
ND751	0
ND752	0
ND753	0
ND755	0
ND756	0
ND800	0
ND801	0
ND802	0

Durum	June 10
Rugby	0
Monroe	0
Renville	0
Munich	0
Ben	0
Belzer	0
Maier	0
Mountrail	0
Lebsock	0
Plaza	0
Pierce	0
Dilse	0
AC Avonlea	0
D95672	0
D95097	0
D95123	0
D96604	0
D96622	0
D98529	0
D98530	0
D98813	0
D99073	0
D99513	0
D99541	0
D99637	0
D99638	0
D99639	0
D99656	0
D99891	0
D99910	0
D99938	0
D99983	0
D97643	0
D97780	0
D971511	0
D98730	0

Application Date: April 1 Seeding Date: April 8
Application Rate (product): 1.5 pt/A

Stand reduction: + = susceptible, 0 = tolerant

Varietal Tolerance to Everest Herbicide at Hettinger

Hard Red Spring Wheat

Variety	Crop Injury* 2002	** 2003	*** 2003
Oxen	0	0	0
Ingot	0	0	0
Russ	0	0	0
Briggs	0	0	0
Parshall	0	0	0
Reeder	0	0	0
Alsen	0	0	0
Keene	0	0	0
Mercury	0	0	0
Norpro	0	0	0
Gunner	0	0	0
Dandy	+	0	0
Knudson	0	0	0
Keystone	0	0	0
McKenzie	+	0	0
Hank	0	0	0
Granite	0	0	0
Hanna	0	0	0
Zeke	0	0	0
Dapps	0	0	0
Outlook	0	0	0
Walworth	0		
AC Superb	0		
Amazon		0	0
AC Corinne		0	0
AC Glenavon		0	0
Laser		0	0

* Crop Injury: 0 = none, + = stunting
** Applied at 3 leaf (5/14/03)
***Applied at 4½ leaf (5/27/03)
Application Rate: 0.6 oz/A

Varietal Tolerance to Everest Herbicide at Hettinger

Durum

Variety	Crop Injury* 2002	** 2003	*** 2003
Rugby	0	0	0
Monroe	0	0	0
Renville	0	0	0
Munich	0	0	0
Ben	+	0	0
Belzer	0	0	0
Maier	0	0	0
Mountrail	0	0	0
Lebsock	0	0	0
Plaza	0	0	0
Pierce	0	0	0
Dilse	0	0	0
AC Avonlea		0	0

* Crop Injury: 0 = none, + = stunting
** Applied at 3 leaf (5/14/03)
***Applied at 4½ leaf (5/27/03)
Application Rate: 0.6 oz/A

2003 Varietal Tolerance to Everest Herbicide at Hettinger

Hard Red Spring Wheat

Variety	Crop Injury*			
	3 leaf**		4 ½ leaf***	
	5/28	6/10	6/10	7/1
Oxen	0	0	0	0
Ingot	0	0	+	0
Russ	0	0	0	0
Briggs	0	0	0	0
Parshall	0	0	0	0
Reeder	0	0	0	0
Alsen	0	0	0	0
Keene	0	0	0	0
Mercury	0	0	0	0
Norpro	0	0	0	0
Gunner	0	0	0	0
Dandy	0	0	0	0
Knudson	+	0	+	0
Keystone	+	0	0	0
McKenzie	0	0	0	0
Hank	0	0	0	0
Granite	0	0	0	0
Hanna	0	0	0	0
Zeke	0	0	0	0
Dapps	0	0	0	0
Outlook	0	0	0	0
Amazon	0	0	0	0
AC Corinne	0	0	0	0
AC Glenavon	0	0	0	0
Laser	0	0	0	0
ND741	0	0	0	0
ND747	0	0	0	0
ND749	0	0	0	0
ND751	0	0	0	0
ND752	0	0	0	0
ND753	0	0	0	0
ND755	0	0	0	0
ND756	0	0	0	0
ND800	0	0	0	0
ND801	+	0	0	0
ND802	0	0	0	0
NDSW0246	0	0	0	0

* Crop Injury: 0 = none, + = stunting
** Applied at 3 leaf (5/14/03)
***Applied at 4½ leaf (5/27/03)
Application Rate: 0.6 oz/A

2003 Varietal Tolerance to Everest Herbicide at Hettinger

Durum

Variety	Crop Injury* 3 leaf** 5/28	3 leaf** 6/10	4 ½ leaf*** 6/10	4 ½ leaf*** 7/1
Monroe	0	0	0	0
Renville	0	0	0	0
Munich	0	0	0	0
Ben	+	0	0	0
Belzer	+	0	0	0
Maier	0	0	0	0
Mountrail	0	0	0	0
Lebsock	0	0	0	0
Plaza	0	0	0	0
Pierce	0	0	0	0
Dilse	0	0	0	0
AC Avonlea	+	0	0	0
D95672	+	0	0	0
D95097	+	0	0	0
D95123	0	0	0	0
D96604	+	0	0	0
D96622	+	0	0	0
D98529	0	0	0	0
D98530	0	0	0	0
D98813	0	0	0	0
D99073	0	0	0	0
D99513	0	0	0	0
D99541	0	0	0	0
D99637	+	+	0	0
D99638	+	+	0	0
D99639	+	0	0	0
D99656	+	0	0	0
D99891	+	0	0	0
D99910	0	0	0	0
D99938	+	0	0	0
D99983	0	0	0	0
D97643	+	+	0	0
D97780	+	0	0	0
D971511	0	0	0	0
D98730	+	+	0	0

* Crop Injury: 0 = none, + = stunting
** Applied at 3 leaf (5/14/03)
***Applied at 4½ leaf (5/27/03)
Application Rate: 0.6 oz/A

2003 Varietal Tolerance to Paramount Herbicide at Hettinger. (Eriksmoen)

HRSW	6/10
Keene	0
Russ	0
Oxen	0
Gunner	0
Reeder	0
Parshall	0
Ingot	0
Norpro	0
Dandy	0
McKenzie	0
Mercury	0
Alsen	0
Knudson	0
Keystone	0
AC Superb	0
Zeke	0
Briggs	0
Hanna	0
Dapps	0
Granite	0
Outlook	0
Hank	0
Amazon	0
AC Corinne	0
AC Glenavon	0
Laser	0
ND741	0
ND747	0
ND749	0
ND751	0
ND752	0
ND753	0
ND755	0
ND756	0
ND800	0
ND801	0
ND802	0

Durum	6/10
Rugby	0
Monroe	0
Renville	0
Munich	0
Ben	0
Belzer	0
Maier	0
Mountrail	0
Lebsock	0
Plaza	0
Pierce	0
Dilse	0
AC Avonlea	0
D95672	0
D95097	0
D95123	0
D96604	0
D96622	0
D98529	0
D98530	0
D98813	0
D99073	0
D99513	0
D99541	0
D99637	0
D99638	0
D99639	0
D99656	0
D99891	0
D99910	0
D99938	0
D99983	0
D97643	0
D97780	0
D971511	0
D98730	0

Barley	6/10
Morex	0
Robust	0
Excel	0
Stander	0
Foster	0
Drummond	0
Lacey	0
Legacy	0
Tradition	0
Bowman	0
Conlon	0
Harrington	0
Logan	0
Merit	0
Stark	0
Valier	0
ND16301	0
ND17643	0
ND17655	0
ND18650	0
2ND19119	0
2ND19929	0

Application Date: 5/14 Crop Stage: 3 leaf Rate (product): 4.0 oz/A

Crop Injury: + = susceptible, 0 = tolerant