Oat response to mesotrione timing. (Howatt and Dvorak) An experiment was established at Fargo and Casselton, ND, to determine oat response to mesotrione applications at various growth stages. 'Jerry' oat was seeded May 3. Application information is as follows:

Fargo							
Date	May 14	May 22	May 31	Jun 3	Jun 5	Jun 12	Jun 17
Timing (leaf)	PRE	Spike	1	2	3	4	5
Crop stage (leaf)	PRE	Spike	2	3	3.5	4.5	6
Temperature (F)							
air	47	58	78	55	75	62	77
soil	54	-	51	56	66	61	-
Wind (mph)	4	17	7	7	7	10	7
Relative humidity (%)	59	59	13	55	19	44	-
Cloudcover (%)	0	75	0	100	30	44	5
Sprayer	Backpack	Backpack	Backpack	Backpack	Backpack	Backpack	Backpack
nozzle size	-	-	8001	8002	8001	8001	11001

Casselton							
Date	May 22	May 31	Jun 3	Jun 12	Jun 14	Jun 17	Jun 23
Timing (leaf)	PRE	Spike	1	2	3	4	5
Crop stage (leaf)	PRE	Spike	1	3.5	3 to 4	4	5.5
Temperature (F)							
air	58	86	56	69	66	67	66
soil	-	64	57	60	62	-	65
Wind (mph)	17	11	8	12	4	2	7
Relative humidity (%)	60	8	53	30	45	-	61
Cloudcover (%)	100	0	100	80	10	10	100
Sprayer	Backpack	Backpack	Backpack	Bicycle-wheel	Backpack	Backpack	Backpack
nozzle size		8001	8001	8001	8001	11001	11001

All treatments were applied in 8.5 gpa at 40 psi 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.

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Table 1. Oat response to mesotrione timing (Fargo).

Treatment	Rate	Timing	Jun 27	Aug 01		
			Injury	Stems	Dry weight	Yield
	oz ai/A		%	no./m row	g/m row	bu/A
Mesotrione	1.5	PRE	0	63	120	72
Mesotrione	3	PRE	0	63	143	73
Mesotrione+PO+UAN	1.5+1%+2.5%	Spike	1	66	142	60
Mesotrione+PO+UAN	1.5+1%+2.5%	1	0	64	136	69
Mesotrione+PO+UAN	1.5+1%+2.5%	2	2	59	127	79
Mesotrione+PO+UAN	1.5+1%+2.5%	3	2	69	119	71
Mesotrione+PO+UAN	1.5+1%+2.5%	4	3	65	136	81
Mesotrione+PO+UAN	1.5+1%+2.5%	5	0	79	126	69
Untreated	0		0	61	136	71
C.V.			181	14	17	11
LSD (0.05)			2	14	33	11

Table 2. Oat response to mesotrione timing (Casselton).

Treatment	Rate	Timing	Jun 21	Aug 08	
			Injury	Stems	Dry weight
	oz ai/A		%	no./m row	g/m row
Mesotrione	1.5	PRE	0	37	97
Mesotrione	3	PRE	0	42	110
Mesotrione+PO+UAN	1.5+1%+2.5%	Spike	0	41	113
Mesotrione+PO+UAN	1.5+1%+2.5%	1	0	37	124
Mesotrione+PO+UAN	1.5+1%+2.5%	2	9	43	112
Mesotrione+PO+UAN	1.5+1%+2.5%	3	6	39	109
Mesotrione+PO+UAN	1.5+1%+2.5%	4	5	43	141
Mesotrione+PO+UAN	1.5+1%+2.5%	5	0	36	114
Untreated	0		0	42	111
C.V.			121	21	29
LSD (0.05)			4	14	59
# of Reps			4	3	3

Oat response was greatest when mesotrione was applied to 2- to 4-leaf oat. This injury was slightly more intense at Casselton than Fargo and manifested as chlorotic and bleached longitudinal stripes on leaf and stem tissue. Injury diminished and was not apparent at before harvest. Herbicide treatments were not different from the untreated control in reproductive tiller production, dry matter accumulation, and yield. The difference in oat response at the two sites may be due to environmental interaction and needs to be studied further.

Oat response to mesotrione rate. (Howatt and Dvorak) This experiment was to establish oat response at various mesotrione rates. 'Jerry' oat was seeded May 3 at Fargo and Casselton, ND. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 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.

	Fargo		Casselton	
Date	May 31	Jun 12	Jun 12	Jun 15
Timing (leaf)	2	4	2	4
Crop stage (leaf)	2.5	6	3	4
Temperature (F)				
air	80	69	69	66
soil	60	66	61	62
Wind (mph)	4	11	12	5
Relative humidity (%)	17	36	29	45
Cloudcover (%)	0	100	60	16

Table 1. Oat response to mesotrione rate (Fargo).

			Jun 20	Jun 28	Jun 27	Aug 06	Aug 06
Treatment	Rate	Timing	Oat	Oat	Oat	Dry weight	Yield
	oz ai/A			%		g/m row	bu/A
Mesotrione+PO+UAN	0.38+1%+2.5%	2	0	0	0	160	86
Mesotrione+PO+UAN	0.75+1%+2.5%	2	0	0	0	167	100
Mesotrione+PO+UAN	1.5+1%+2.5%	2	0	0	0	148	82
Mesotrione+PO+UAN	3+1%+2.5%	2	0	0	0	164	89
Mesotrione+PO+UAN	6+1%+2.5%	2	1	0	0	143	96
Mesotrione+PO+UAN	0.38+1%+2.5%	4	2	0	0	129	87
Mesotrione+PO+UAN	0.75+1%+2.5%	4	3	0	1	146	90
Mesotrione+PO+UAN	1.5+1%+2.5%	4	4	0	1	149	88
Mesotrione+PO+UAN	3+1%+2.5%	4	5	0	1	138	78
Mesotrione+PO+UAN	6+1%+2.5%	4	11	2	1	136	82
Untreated	0		0	0	0	136	91
C.V.			57	74	270	15	11
LSD (0.05)			2	1	1	32	14

Table 2. Oat response to mesotrione rate (Casselton).

			Jun-21	Aug-08	Aug-08
Treatment	Rate	Timing	Oat	Stem cont	Dry weight
	oz ai/A		%	no./m row	g/m row
Mesotrione+PO+UAN	0.38+1%+2.5%	2	3	28	111
Mesotrione+PO+UAN	0.75+1%+2.5%	2	3	29	101
Mesotrione+PO+UAN	1.5+1%+2.5%	2	8	33	106
Mesotrione+PO+UAN	3+1%+2.5%	2	8	37	121
Mesotrione+PO+UAN	6+1%+2.5%	2	17	28	97
Mesotrione+PO+UAN	0.38+1%+2.5%	4	3	34	127
Mesotrione+PO+UAN	0.75+1%+2.5%	4	6	24	83
Mesotrione+PO+UAN	1.5+1%+2.5%	4	10	26	101
Mesotrione+PO+UAN	3+1%+2.5%	4	6	33	114
Mesotrione+PO+UAN	6+1%+2.5%	4	8	29	109
Untreated	0		0	29	98
C.V.			34	25	27
LSD (0.05)			3	11	42

Oat response was greatest when mesotrione was applied at 6 oz/A. This injury was slightly more intense at Casselton than Fargo and manifested as chlorotic and bleached longitudinal stripes on leaf and stem tissue. Injury diminished and was generally not apparent after 10 days. Mesotrione rates from 0.38 to 3 oz/A essentially caused similar injury across location and application timing. Herbicide treatments were not different from the untreated control in reproductive tiller production, dry matter accumulation, and yield.

Oat response to mesotrione tank-mixes. (Howatt and Dvorak) The experiment was established to determine oat response to mesotrione tank-mixes. 'Jerry' oat was seeded May 3 at Fargo and Casselton. At Fargo, treatments were applied to 3.5 leaf tillering oat on June 5 with 77 F, 18% relative humidity, 10% cloudcover, 0 to 2 mph southeast wind, and soil temperature of 63 F. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Harvested area was 4 by 22. The experiment was a randomized complete block design with four replications. At Casselton, treatments were applied to 3.5 leaf oat on June 5 with 77 F, 18% relative humidity, 10% cloudcover, 0 to 2 mph southeast wind and soil temperature of 63 F. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 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 replications.

Table 1. Oat response to mesotrione tank-mixes (Fargo).

Treatment	Rate	Jun 21 Oat	Jun 27 Oat	Aug 1 Stems	Aug 6 Dry weight	Aug 6 Yield
	oz ai/A	%		no./m row	g/m row	bu/A
Mest+PO+UAN	1.5+1%+2.5%	0	0	65	102	74
Brox&MCPA	6	0	0	66	131	71
Mest+brox&MCPA+PO+UAN	1.5+6+1%+2.5%	9	15	70	123	65
MCPA-ester	8	0	1	72	130	77
Mest+MCPA-ester+PO+UAN	1.5+8+1%+2.5%	4	8	75	143	71
Bromoxynil	6	0	4	55	130	69
Mest+brox+PO+UAN	1.5+6+1%+2.5%	22	22	72	143	64
Carfentrazone+NIS	0.128+0.25%	0	1	69	114	76
Mest+carf+PO+UAN	1.5+0.128+1%+2.5%	0	5	76	132	74
Thifensulfuron+NIS	0.22+0.125%	0	1	65	113	69
Mest+thif+PO+UAN	1.5+0.22+1%+2.5%	0	3	58	133	83
Dicamba	1.5	1	0	59	112	92
Mest+dicambaPO+UAN	1.5+1.5+1%+2.5%	6	8	65	123	69
Clopyralid&MCPA	10.8	0	2	60	120	63
Mest+clpy&MCPA+PO+UAN	1.5+10.8+1%+2.5%	0	5	68	148	63
Fluroxypyr	2	0	0	71	155	81
Mest+flox+PO+UAN	1.5+2+1%+2.5%	0	2	57	109	71
Untreated	0	0	0	60	95	79
C.V.		62	58	2	23	15
LSD 5%		2	4	18	41	15

Table 2. Oat response to mesotrione tank-mixes (Casselton).

Treatment	Rate	Jun 21 Oat	Aug 8 Dry weight
	oz ai/A	%	g/m row
Mesotrione+PO+UAN	1.5+1%+2.5%	3	108
Bromoxynil&MCPA	6	4	110
Mesotrione+bromoxynil&MCPA+PO+UAN	1.5+6+1%+2.5%	40	90
MCPA-ester	8	1	109
Mesotrione+MCPA-ester+PO+UAN	1.5+8+1%+2.5%	14	91
Bromoxynil	6	4	103
Mesotrione+bromoxynil+PO+UAN	1.5+6+1%+2.5%	20	98
Carfentrazone+NIS	0.128+0.25%	6	113
Mesotrione+carf+PO+UAN	1.5+0.128+1%+2.5%	15	100
Thifensulfuron+NIS	0.22+0.125%	1	129
Mesotrione+thif+PO+UAN	1.5+0.22+1%+2.5%	9	104
Dicamba	1.5	5	86
Mesotrione+dicambaPO+UAN	1.5+1.5+1%+2.5%	12	106
Clopyralid&MCPA+	10.8	1	124
Mesotrione+clpy&MCPA+PO+UAN	1.5+10.8+1%+2.5%	10	111
Fluroxypyr	2	0	125
Mesotrione+flox+PO+UAN	1.5+2+1%+2.5%	17	119
Untreated	0	0	136
C.V.		6	43
LSD 5%		47	28

Oat response was observed for each herbicide applied alone at one or both locations except fluroxypyr. Combining mesotrione with another chemical caused more injury than either chemical alone. Injury was greatest, 40%, with mesotrione+bromoxynil&MCPA at Casselton (Table 2). At Fargo, oat injury was greatest with mesotrione+bromoxynil, however this rate was twice the recommended field rate of bromoxynil (Table 1). Mesotrione injury was more intense at Casselton than Fargo and manifested as chlorotic and bleached longitudinal stripes on leaf and stem tissue. Injury diminished as the season progressed. Herbicide treatments were not different from the untreated control in reproductive tiller production, dry matter accumulation, and yield. The difference in oat response at the two sites may be due to environmental interaction and needs to be studied further.

Small grain response to Mesotrione. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat, 'Jerry' oat, 'Robust' barley, and 'Ben' durum wheat were seeded May 15 at Fargo. Treatments (2-leaf) were applied to 1.5 leaf wheat, oat, barley, and durum on May 30 with 70 F, 54% relative humidity, 0% cloudcover, 11 mph southwest wind, and soil temperature of 58 F. Treatments (4-leaf) were applied to 5-leaf wheat and barley, 4 leaf oat, and 4.5 leaf durum on June 12 with 59 F, 28% relative humidity, 90% cloudcover, 12 southwest wind, and soil temperature of 66 F. All treatments were hand broadcast with a backpack type sprayer delivering 8.5 gpa at 40 psi through 8001 (2-leaf treatment) and 11001 (4-leaf treatment) 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.

Table. Small grain response to Mesotrione.

Treatment	Rate	Timing	Jun 18			
			HRSW	Oat	Barley	Durum
	oz ai/A		%			
Mesotrione+PO+UAN	0.75+1%+2.5%	2-leaf	2	0	0	5
Mesotrione+PO+UAN	1.5+1%+2.5%	2-leaf	0	0	0	11
Mesotrione+PO+UAN	3+1%+2.5%	2-leaf	1	0	1	12
Mesotrione+PO+UAN	0.75+1%+2.5%	4-leaf	50	7	15	64
Mesotrione+PO+UAN	1.5+1%+2.5%	4-leaf	57	14	42	79
Mesotrione+PO+UAN	3+1%+2.5%	4-leaf	62	12	47	82
Untreated	0		0	0	0	0
CV			25	78	46	20
LSD (P=.05)			9	6	10	11

Oat was the most tolerant of mesotrione treatments. Plant injury was more severe when mesotrione was applied to 4- to 5-leaf cereals than 2-leaf cereals. Hard red spring wheat and barley had visible injury from early season mesotrione application on June 18, but the injury was minor and non-significant. Durum was more susceptible at this application and expressed moderate injury, 11 to 12%, to 1.5 and 3 oz/A. Hard red spring wheat and durum were the most susceptible to late season mesotrione application. Injury was severe, ranging from 50 to 82% depending on rate. Barley response was intermediate, but rates of 1.5 oz/A resulted in greater than 40% injury when applied to 5-leaf barley. Maximum oat injury was 14% when 1.5 oz/A mesotrione was evaluated 6 DAT.

Flucarbazone and fenoxaprop combinations. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Treatments were applied to 6-leaf wheat on June 17 with 69 F, 44% relative humidity, 95% cloudcover, and 9 mph southeast wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 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.

Table. Flucarbazone and fenoxaprop combinations.

Treatment[a]	Rate	Jun 21 Wht	Jul 1 Wht	Jul 15 Wht
	oz ai/A		%	
Flucarbazone+thifensulfuron+Quad 7	0.84+0.22+1%	13	8	4
Flucarbazone+thifensulfuron+fenoxaprop+Quad 7	0.84+0.22+0.33+1%	3	2	2
Flucarbazone+thifensulfuron+fenoxaprop+Quad 7	0.84+0.22+0.25+1%	3	2	2
Flucarbazone+thifensulfuron+fenoxaprop+Quad 7	0.84+0.22+0.12+1%	3	3	2
Flucarbazone+thifensulfuron+fenoxaprop+Quad 7	0.84+0.22+0.06+1%	3	2	2
Flucarbazone+thifensulfuron+fenoxaprop+Quad 7	0.84+0.22+0.03+1%	3	3	2
Untreated	0	0	0	0
CV		28	26	18
LSD (0.05)		2	1	1

[a] Fenoxaprop was formulated as Puma with safener.

Twice the labeled flucarbazone rate was applied, thifensulfuron was added, and application timing was delayed to accentuate flucarbazone injury. Maximum flucarbazone injury of 13% occurred in the absence of fenoxaprop. This injury diminished through the season but was still evident on July 15 and was greater than treatments that included fenoxaprop. All treatments that included fenoxaprop significantly reduced flucarbazone injury but still exhibited injury compared to the untreated control on July 15. Flucarbazone injury, 2 to 3%, was similar regardless of fenoxaprop rate.

Wild oat control with AE F130060. Howatt, Kirk A., Ronald F. Roach, Janet D. Harrington, and Kevin B. Thorsness. An experiment was conducted to evaluate wheat response to AE F130060 and compare wild oat control of this compound with commercial standards. "Oxen" hard red spring wheat was seeded on May 2. Treatments were applied to 3.5 leaf tillering wheat and wild oat on June 4, with 56 F and 27% relative humidity, 10% cloudcover, 7 mph northeast wind and soil temperature of 58 F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Wild oat population was greater than 300 plants/ft^2. A 4 by 30 ft area from each plot was harvested on August 5. The experiment was a randomized complete block design with four replicates.

Treatment[a]	Rate	Jun 13 Wioa	Jul 04 Wioa	Aug 05 Yield
	(oz/A)	(%)	(%)	(bu/A)
AE F130060+AE F137892+MSO	0.036+0.214+0.25G	80	92	50
AE F130060+AE F137892+MSO	0.053+0.32+0.25G	83	95	52
AE F130060+AE F137892+MSO	0.071+0.43+0.25G	79	97	51
AE F130060+AE F137892+BB	0.036+0.21+1%	73	92	55
AE F130060+AE F137892+BB	0.053+0.32+1%	73	96	51
AE F130060+AE F137892+BB	0.071+0.43+1%	75	97	51
Fenoxaprop	1.32	86	99	51
MKH6562+NIS	0.42+0.25%	81	94	51
Untreated	0	0	0	25
CV		5	2	10
LSD (P=.05)		5	3	7

[a] AE F137892 was safener applied in tank-mix from Aventis, Crop Science, Research Triangle Park, NC; MSO, methylated seed oil, was Destiny from Agriliance, St. Paul, MN; BB, basic blend adjuvant, was Quad 7 from AGSCO, Grand Forks, ND; and NIS was Activator 90 from Loveland Industries, Greeley, CO.

Herbicide treatments did not cause noticeable crop injury. On June 13, fenoxaprop provided the greatest wild oat control at 86%. Increasing AE F130060 rate did not improve wild oat control on June 13. At July 4, 0.053 and 0.071 oz/A AE F130060 provided greater control than 0.036 oz/A. Only 0.071 oz/A AE F130060 provided consistently similar control with fenoxaprop at the July 4 evaluation. Methylated seed oil tended to enhance wild oat control compared to basic blend adjuvant at the early evaluation, but adjuvant system was inconsequential on July 4.

Safening propoxycarbazone on wheat. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Treatments were applied to 3.5-leaf wheat and 2- to 4-leaf wild oat on June 5 with 75 F, 25% relative humidity, 2 mph east wind, and soil temperature of 59 F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 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. Wild oat density was 2000 plants/m^2.

Table. Safening propoxycarbazone on wheat.

		Jun 20		Jul 4	Aug 5
Treatment[a]	Rate	Wht	Wioa	Wioa	Yield
	oz ai/A		%		bu/A
Sulfosulfuron+NIS	0.5+0.5%	0	89	91	48
Propoxycarbazone+NIS	0.64+0.25%	0	89	89	50
Propoxycarbazone+NIS	1.93+0.25%	0	90	89	50
Propoxycarbazone&mefenpyr+NIS	0.64&0.064+0.25%	0	87	88	46
Propoxycarbazone&mefenpyr+NIS	1.93&0.19+0.25%	0	88	91	49
Propoxycarbazone+NIS+mefenpyr	0.64+0.25%+0.064	0	86	88	43
Propoxycarbazone+NIS+mefenpyr	1.93+0.25%+0.19	0	88	91	47
Propoxycarbazone+NIS+mefenpyr	0.64+0.25%+0.13	0	87	88	46
Propoxycarbazone+NIS+mefenpyr	1.93+0.25%+0.38	0	86	89	42
Propoxycarbazone+NIS+mefenpyr	0.64+0.25%+0.32	0	89	88	47
Propoxycarbazone+NIS+mefenpyr	1.93+0.25%+0.96	0	89	91	49
Propoxycarbazone+NIS+mefenpyr	0.64+0.25%+0.64	0	89	87	44
Propoxycarbazone+NIS+mefenpyr	1.93+0.25%+1.93	0	92	91	46
Untreated	0	0	0	0	38
CV		0	3	2	10
LSD (0.05)		0	3	2	7

[a] Mefenpyr was a saftener from Aventis.

No wheat injury was observed from any herbicide treatment. Propoxycarbazone provided at least 87% wild oat control. Increasing propoxycarbazone rate had no practical effect on wild oat control. Controlling wild oat with propoxycarbazone increased wheat yield by as much as 32%.

Grass control in wheat. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 3 at Fargo. Treatments for application timing 2 were applied to 2-leaf wheat and emerging to 2-leaf wild oat on May 30 with 72 F, 41% relative humidity, 0% cloudcover, 10 mph southeast wind, and soil temperature 60 F. Treatments for application timing 4 were applied to 4-leaf wheat and 2- to 4-leaf wild oat on June 6 with 62 F, 53% relative humidity, 65% cloudcover, 10 mph south wind, and soil temperature of 60 F. Treatments for application timing 6 were applied to 6-leaf wheat and 3- to 6-leaf wild oat on June 13 with 72 F and 10 mph wind. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles to a 7 ft wide area of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wild oat population was 2000 plants/m^2.

Table. Grass control in wheat.

			Jun 25		Jul 5	Aug 5
Treatment[a]	Rate	Timing	Wht	Wioa	Wioa	Yield
	oz ai/A	leaf		%		bu/A
Immb+thif&trib+NIS	5+0.15&0.07+0.25%	2	0	86	93	58
Flcz+thif&trib+2,4-D-Salvo+NIS	0.42+0.15&0.07+4+0.25%	2	0	93	97	58
Fenx+brox&MCPA	0.8+4&4	4	0	90	92	52
Flcz+Fenx+brox&MCPA+NIS	0.42+0.8+4&4+0.25%	4	0	85	95	54
Flcz+Fenx+brox&MCPA+NIS	0.21+0.6+4&4+0.25%	4	0	80	92	53
Flcz+Clfp+brox&MCPA+Score+NIS	0.42+0.8+4&4+1%0.25%	4	0	87	96	55
Flcz+Clfp+brox&MCPA+Score+NIS	0.21+0.6+4&4+1%+0.25%	4	0	81	90	56
Dife+thif&trib	12+0.15&0.07	6	0	65	78	46
Dife+immb+thif&trib+NIS	3.7+8+0.15&0.07+0.25%	6	0	39	55	46
Untreated	0		0	0	0	32
CV			0	7	8	8
LSD (0.05)			0	6	8	6

[a] NIS was Activator 90 from Loveland Industries.

No wheat injury was observed in this study. Clodinafop and tralkoxydim alone were removed from this report because it was believed that investigator error had confounded the results. Difenzoquat+imazamethabenz at the 6-leaf timing gave poor wild oat control of less than 60%. Difenzoquat provided better wild oat control but control did not reach 80% on July 5. These two treatments resulted in increased wheat yield compared to the untreated, but all other herbicide treatments resulted in greater yield. The highest yields were measured from wheat treated with imazamethabenz or flucarbazone at the 2-leaf application timing indicating the importance of early removal of wild oat competition. All herbicides applied at the 2- or 4-leaf application timing provided at least 90% wild oat control on July 5 and resulted in 52 bu/A or greater wheat yield.

2002 Grassy Weed Control in Spring Wheat at Hettinger. (Eriksmoen) Reeder hard red spring wheat was seeded on April 30. Treatments were applied to 3 leaf wheat and to 3 leaf wild oats on May 31 with 58 F, 79 % RH, clear sky and 7 mph wind. Treatments were applied with a tractor mounted CO2 propelled plot sprayer delivering 17 gpa at 40psi through 8001 flat fan nozzles to a 5 foot wide area the length of 10 by 28 foot plots. The trial was sprayed with 1 pt/A Buctril + 8 oz/A Starane on June 7 to control broadleaf weeds. The experiment was a randomized complete block design with four replications. Wild oat populations were 22 plants per sq. foot. Evaluations for crop injury were on June 14 and for wild oat control on July 2 and on July 16. Areas of downy brome and Japanese brome were scattered throughout the trial site and were evaluated for control when present. The trial was not harvested due a short and thin crop caused by severe drought.

		6/14		7/2		Jul-09	7/16
Treatment	Rate	HRSW	Wioa	Dobr	Jabr	Wioa	Wioa
	oz ai/A	Injury			%		
Prcz+Thif&Trib+Act 90	0.63+0.22+0.25%	0	97	95	--	94.5	99
Flcb+Thif&Trib+2,4-D-Salvo+Act90	0.42+0.22+4+0.25%	0	99	90	99	98.5	99
Clfp+Brox&MCPA5+Score	0.8+8+1%	0	99	45	0	98.5	99
Fenx+Broxl&MCPA5	0.8+8	0	74	80	--	89.3	76
Tral+Brox&MCPA5+Supercharge	2.9+8+0.5%	0	30	5	--	80.0	40
Flcz+Fenx+Brox&MCPA5+Act90	0.42+0.8+8+0.25%	0	99	99	--	98.5	99
Flcb+Fenx+Brox&MCPA5+Act90	0.21+0.6+8+0.25%	0	99	95	--	97.5	99
Flcz+Clfp+Brox&MCPA5+Score+Act90	0.42+0.8+8+1%0.25%	0	99	99	--	98.5	99
Flcz+Clfp+Brox&MCPA5+Score+Act90	0.21+0.6+8+1%+0.25%	0	99	99	99	97.5	99
Dife+Thif&Trib	12+0.22	4	76	--	0	83.8	80
Dife+Immb+Thif&Trib+Act90	3.7+8+0.22+0.25%	0	99	0	--	97.5	99
Untreated	0	0	0	0	0	0.0	0
CV			15.0			2.02	12.6
LSD 5%			17			2.51	15

Summary

Crop injury was minimal on all herbicide treatments with the exception of the Difenzoquat + Thifensulfuron&Tribenuron (trt 10) treatment. Season long wild oat control was excellent for all herbicide treatments except for Fenoxaprop + Bromoxynil&MCPA5 (trt 4), Tralkoxydim + Bromoxynil&MCPA5 + Supercharge (trt 5) and Difenzoquat + Thifensulfuron&Tribenuron (trt 10) which had significantly lower wild oat control than the other treatments. All Flucarbazone treatments (trts 2, 6 - 9) and the Propoxycarbazone treatment (trt 1) provided excellent downy brome and Japanese brome control where noted.

General grass control in wheat, Langdon. (Lukach and Gregoire) 'Alsen' hard red spring wheat was seeded on May 18. Fertility was adequate for a 60 bu/A yield goal. Folicur 4 oz/a was applied on July 8. Treatments were applied to 1 to 5 leaf wild oat and 4 leaf wheat on June 15 with 52°F, 40% RH, and 10 mph west wind. Bronate Advanced 1.2 pint/a in 18 gal/a solution, applied on June 21 over the whole trial gave good control of broadleaf weeds. The sky was partly cloudy and the foliage dry. Wild oat stands were about 25/ft^2. Treatments were applied with a bicycle-wheel-type sprayer delivering 8.5 gpa at 40 psi through XR8001 tips to 7 by 25 foot plots. The experiment was a randomized complete block design with four replicates. Harvest was on September 6.

			Control			
		Crop	28-Jun	24-Jul		Test
Treatment	Rate	Inj	Wioa	Wioa	Yield	Weight
	oz/A	%	%	%	bu/a	lb/bu
Immb+Thif&Trib+Act90	5+0.22+0.25%	0	15	24	17	57.9
Flcb+Thif&Trib+2,4-D-Salvo+Act90	0.42+0.22+4+0.25%	8	70	95	29	58.2
Clfp+Brox&MCPA5+Score	0.8+8+1%	3	81	73	32	58.8
Fenx+Broxl&MCPA5	0.8+8	0	50	60	26	59.0
Tral+Brox&MCPA5+Supercharge	2.9+8+0.5%	11	88	71	29	58.9
Flcb+Fenx+Brox&MCPA5+Act90	0.42+0.8+8+0.25%	6	90	96	35	58.5
Flcb+Fenx+Brox&MCPA5+Act90	0.21+0.6+8+0.25%	3	71	90	31	58.4
Flcb+Clfp+Brox&MCPA5+Score+Act90	0.42+0.8+8+1%0.25%	3	81	94	34	59.0
Flcb+Clfp+Brox&MCPA5+Score+Act90	0.21+0.6+8+1%+0.25%	3	73	90	30	58.3
Dife+Thif&Trib	12+0.22	18	76	84	31	58.5
Dife+Immb+Thif&Trib+Act90	3.7+8+0.22+0.25%	0	45	40	23	58.6
Untreated	0	0	0	0	5	57.6
C.V. %		131	21	18	16	1.2
LSD 5%		8	18	18	6	NS
# OF REPS		4	4	4	4	4

Difenzoquat alone and flucarbazone alone or in combinations gave 84 to 96% control of the ACC-ase resistant wild oats. Difenzoquat and imazamethabenz gave 40% wild oat control.

X

Grassy Weed Control in HRS Wheat. (Terry D. Gregoire, 2002) Gunner wheat was planted May 9th and the wheat was sprayed June 7th between 10:30 am and noon near Webster, North Dakota. The temperature during application was 77°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, yellow foxtail was 2-4 leaf. 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 29th and July 15th, 2001. No wheat injury was observed.

				June 29 Kochia % control	July 15 YEFT % control	Wild Oat % control
Trt No.	Treatment Name	Rate	Rate Unit			
1	untreated			0	0	0
2	Puma	10.6	oz/a	0	78	100
3	Puma	10.6	oz/a	96	80	100
3	Bronate Advanced	12.8	oz/a			
4	Puma	10.6	oz/a	98	65	100
4	Harmony GT	0.3	oz/a			
4	Starane	5.3	fl oz/a			
5	Discover	3.2	oz/a	0	71	100
5	Score	0.8%	v/v			
6	Discover	3.2	oz/a	99	80	100
6	Bronate advanced	12.8	oz/a			
6	Score	0.8%	v/v			
7	Discover	3.2	oz/a	99	36	100
7	Harmony GT	0.3	oz/a			
7	Starane	5.3	fl oz/a			
8	Everest 70 DF	0.6	oz/a	95	18	100
8	2,4-D ester	12	oz/a			
8	NIS	0.25%	v/v			
9	Everest 90 DF	0.6	oz/a	98	18	100
9	Bronate Advanced	12.8	oz/a			
9	Nis	0.25%	v/v			
10	Everest 90 DF	0.6	oz/a	94	18	100
10	Harmony GT	0.3	oz/a			
10	Starane	5.3	fl oz/a			
10	Nis	0.25%	v/v			
LSD (P=.05)				5.43	21.21	0.00
Standard Deviation				3.74	14.62	0.00
CV				5.52	31.61	0.0

Summary

There was no difference among herbicide treatments for wild oat control. Kochia was equally controlled by all broadleaf herbicides. Everest treatments did not control yellow foxtail. Harmony GT plus Starane added to Discover significantly reduced yellow foxtail control compared to other Discover treatments. The Harmony GT/Starane tank mix also reduced yellow foxtail control with Puma although it was not statistically different than other Puma treatments.

Wild oat control in wheat, Williston 2002. Neil R. Riveland and Kirk A. Howatt. "Parshall" hard red spring wheat was planted on recrop (land cropped to hrs wheat in 2000) in 7 inch rows at 80 lbs/A on May . The early 3 to 4 leaf treatments were applied on June 21 to 3-4 leaf wheat and 2 to 5 leaf wild oats (most were in the 3 to 4 leaf stage) with 62 F, 50% RH, 95% clear sky and 2 to 4 mph Southeast wind and dry topsoil at 63 F. Green foxtail and Russian thistle plants were present but very light in density. The late 6 leaf treatments were applied on July 3 to 6-6.5. leaf wheat and 5 to 7 leaf wild oats with 82 F, 30% RH, clear sky, and 3 to 5 mph East-southeast wind with a dry soil surface at 69 F. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.5 gpa 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 0.16 inches on June 22 and 0.04 inches on July 5. The experiment was a randomized complete block design with four replications. Wild oat density was greater than 20 plants/ft^2. Plots were evaluated for crop injury and wild oat control on July 29. Wheat was machine harvested on August 26.

			Jul-10		Jul-29		
Treatment	Rate	G	Wht	Wioa	Wht	Wioa	Yield
	oz ai/A	Stg		%			bu/A
Immb+Thif&Trib+Act90	5+0.22+0.25%	3-4L	0	76	0	35	15
Flcb+Thif&Trib+2,4-D-Salvo+Act90	0.42+0.22+4+0.25%	3-4L	0	85	6	62	17
Clfp+Brox&MCPA5+Score	0.8+8+1%	3-4L	0	96	0	96	23
Fenx+Brox&MCPA5	0.8+8	3-4L	0	87	1	78	18
Tral+Brox&MCPA5+Supercharge	2.9+8+0.5%	3-4L	0	94	1	96	23
Flcz+Fenx+Brox&MCPA5+Act90	0.42+0.8+8+0.25%	3-4L	0	88	6	78	16
Flcb+Fenx+Brox&MCPA5+Act90	0.21+0.6+8+0.25%	3-4L	0	86	4	81	20
Flcz+Clfp+Brox&MCPA5+Score+Act90	0.42+0.8+8+1%0.25%	3-4L	0	91	7	96	18
Flcz+Clfp+Brox&MCPA5+Score+Act90	0.21+0.6+8+1%+0.25%	3-4L	0	87	1	61	22
Dife+Thif&Trib	12+0.22	5-6L	0	20	20	28	10
Dife+Immb+Thif&Trib+Act90	3.7+8+0.22+0.25%	5-6L	0	22	6	50	10
Untreated	0		0	0	0	0	10
C.V.			0	4	109	17	4
LSD 5%			0	4	7	16	6

Summary

All treatments applied at the 3-4-leaf stage of wheat gave yield increase compared to the untreated check. Treatments applied at the 6-leaf stage did not adequately control wild oats and wheat yields were only about equal to the untreated check. Treatments containing flucarbazone tended to give slight crop injury.

X

Yellow foxtail control in wheat. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 3 at Fargo. Treatments were applied to 5-leaf wheat and 2- to 3-leaf yellow foxtail on June 17 with 69 F, 44% relative humidity, 95% cloudcover, and 9 mph southeast wind. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 11001 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. Yellow foxtail population was 200 plants/m^2.

Table. Yellow foxtail control in wheat.

Treatment[a]	Rate	Jul 1 Yeft	Jul 23 Yeft	Aug 8 Yield
	oz ai/A	%		bu/A
Immb+thif&trib+NIS	5+0.15&0.07+0.25%	25	17	42
Flucarbazone+thif&trib+2,4-D-salvo+NIS	0.42+0.15&0.07+4+0.25%	84	86	44
Clodinafop+bromoxynil&MCPA+Score	0.8+4&4+1%	93	96	41
Tralkoxydim+brox&MCPA+Supercharge	2.9+4&4+0.5%	83	86	44
Flcz+fenoxaprop+brox&MCPA+NIS	0.42+0.8+4&4+0.25%	67	60	38
Flcb+fenx+brox&MCPA+NIS	0.21+0.6+4&4+0.25%	71	55	41
Flcz+clfp+brox&MCPA+Score+NIS	0.42+0.8+4&4+1%0.25%	85	95	42
Flcz+clfp+brox&MCPA+Score+NIS	0.21+0.6+4&4+1%+0.25%	89	96	44
Dife+thif&trib	12+0.15&0.07	37	42	43
Dife+immb+thif&trib+NIS	3.7+8+0.15&0.07+0.25%	67	47	41
Untreated	0	25	0	35
CV		8	14	9
LSD (0.05)		7	11	5

[a] NIS was Activator 90 from Loveland Industries.

No wheat injury was observed in this study. Fenoxaprop alone was removed from this report because it was believed that investigator error had confounded the results. Clodinafop at 0.8 oz/A provided excellent yellow foxtail control, 93% on July 1 and 96% on July 23. Imazamethabenz and difenzoquat gave less than 50% foxtail control but were able to suppress foxtail enough that wheat yield was greater than in the untreated. Antagonism occurred with flucarbazone+fenoxaprop. Flucarbazone provided 86% control on July 23, but control with flucarbazone+fenoxaprop was not greater than 60%. Flucarbazone+clodinafop at 0.21+0.6 oz/A provided 96% yellow foxtail control on July 23.

Foxtail control in hard red spring wheat, Carrington, 2002. (Endres and Howatt) The experiment was conducted on a Heimdahl loam soil with 6.9 pH and 3.1% organic matter at the NDSU Carrington Research Extension Center. The experimental design was a randomized complete block with three replicates. 'Munich' durum wheat was planted on May 29. 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 24 with 73 F, 83% RH, 25% clear sky, and 9 mph wind to 3.5- to 4-leaf wheat and 1- to 3-leaf yellow and green foxtail. Average wheat density on July 1 was 10 plants/ft^2 and foxtail density was 21 plants/ft^2. Glyphosate at 0.75 lb/A + AMS at 5% v/v was applied across the trial for preharvest burn-down of foxtail. The trial was harvested for seed yield with a plot combine on September 12.

Herbicide		Weed control 7/9	7/16		8/19	Seed
Treatment	Rate	Fota[a]	Yeft	Grft	Fota	yield
	oz a.i./A	---------- % ----------				bu/A
Imm b+Thif&Trib+Act90	5+0.22+0.25%	76	50	70	48	9.3
Flcz+Thif&Trib+2,4-D-Salvo+Act90	0.42+0.22+4+0.25%	93	93	99	86	9.9
Clfp+Brox&MCPA5+Score	0.8+8+1%	83	86	95	66	8.6
Fenx+Brox&MCPA5	0.8+8	80	70	90	62	12.9
Tral+Brox&MCPA5+Supercharge	2.9+8+0.5%	94	86	94	77	14.2
Flcz+Fenx+Brox&MCPA5+Act90	0.42+0.8+8+0.25%	79	85	90	47	5.2
Flcz+Fenx+Brox&MCPA5+Act90	0.21+0.6+8+0.25%	70	72	88	45	6.2
Flcz+Clfp+Brox&MCPA5+Score+Act90	0.42+0.8+8+1%+0.25%	85	93	98	75	11.3
Flcz+Clfp+Brox&MCPA5+Score+Act90	0.21+0.6+8+1%+0.25%	80	82	95	73	11.7
Dife+Thif&Trib	12+0.22	70	69	72	43	4.8
Dife+Imm b+Thif&Trib+Act90	3.7+8+0.22+0.25%	74	70	73	59	11.8
untreated	0	0	0	0	0	5.2
LSD (0.05)		12	12	9	22	NS

[a]Fota=yellow and green foxtail.

Good to excellent green foxtail control (88 to 99%) was present on July 16 with all treatments except with Assert and Avenge. Yellow foxtail control was 82 to 93% on July 16 with Discover, Achieve, and all Everest treatments except with the reduced rates of Everest + Puma. In August, foxtail control declined with mid-summer rain and as the crop approached physiological maturity. Crop injury from herbicides was not detected.

Wild oat control in hard red spring wheat with Discover, Williston 2002. Neil R. Riveland. "Parshall" hard red spring wheat was planted on recrop (land cropped to hrs wheat in 2000) in 7 inch rows at 80 lbs/A on May 30. The treatments were applied on June 21 to 3 to 4-leaf wheat, 2 to 4 leaf wild oats and 2 to 5 leaf green foxtail (most were in the 3 leaf stage) with 64 F, 45% RH, 95% clear sky and 4 to 6 mph Southeast wind and dry topsoil at 63 F. A few small buckwheat plants were present but very light in density. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 8.6 gpa 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 0.16 inches on June 22. The experiment was a randomized complete block design with four replications. Wild oat density averaged 10 plants/ft^2 and green foxtail density was 30 to 40 plants/ft^2. Plots were evaluated for crop injury and weed control on July 29. Wheat was machine harvested on August 26.

Treatment	Product rate	Wht	Grft	Yield
	oz/A	%		bu/A
Discover+Score	3.2+1% v/v	99	98	29
Discover+Score	2.67+1% v/v	99	96	28
Discover+Score	2.28+1% v/v	98	94	27
Discover+Score	2.0+1% v/v	97	90	26
Discover+Score	1.78+1% v/v	98	88	26
Discover+Puma+Score	2.28+5.3+1% v/v	99	97	30
Discover+Puma+Score	1.78+5.3+1% v/v	99	95	29
Untreated	0	0	0	15
C.V.		1	4	8
LSD 5%		2	5	3

Summary

No crop injury was observed (data not reported). All Discover treatments gave excellent control of wild oats and the two lower application rates of Discover gave the lowest green foxtail control. The addition of Puma to the lower rates of Discover improved green foxtail control.

Yellow foxtail control with flucarbazone and clodinafop combinations. (Howatt, Roach, and Davidson-Harrington) The experiment was established to determine grass control with flucarbazone and clodinafop combinations, no crop was seeded. Treatments were applied to 3-leaf yellow foxtail on June 21 with 65 F, 66% relative humidity, 100% cloudcover, 7 mph south-southeast wind, and soil temperature of 63 F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan nozzles to an 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Yellow foxtail population was 500 plants/m^2.

Table. Yellow foxtail control with flucarbazone and clodinafop combinations.

Treatment[a]	Rate	Jul 1 Yeft	Jul 15 Yeft
	oz/A		
Flucarbazone +NIS	0.42+0.25%	62	52
Flucarbazone +NIS	0.28+0.25%	57	35
Flucarbazone+clodinafop+Score+NIS	0.28+0.5+1%+0.25%	83	82
Flucarbazone+clodinafop+Score+NIS	0.28+0.8+1%+0.25%	82	85
Flucarbazone+clodinafop+Score+NIS	0.35+0.5+1%+0.25%	84	82
Flucarbazone+clodinafop+Score+NIS	0.35+0.8+1%+0.25%	91	89
Flucarbazone+fenoxaprop+NIS	0.28+0.4+0.25	85	87
Flucarbazone+fenoxaprop+NIS	0.28+0.6+0.25%	85	86
Flucarbazone+fenoxaprop+NIS	0.35+0.4+0.25	85	85
Flucarbazone+fenoxaprop+NIS	0.35+0.6+0.25	88	91
Clodinafop +Score	0.8+1%	95	97
Clodinafop +Score	1.0+1.2%	96	98
Fenoxaprop	0.6	97	98
Fenoxaprop	0.8	98	98
Untreated	0	0	0
CV		3	6
LSD (0.05)		4	7

[a] NIS was Activator 90 from Loveland Industries.

Ratings remained consistent from July 1 to July 15 with the exception of flucarbazone alone. Yellow foxtail control with flucarbazone at 0.42 or 0.21 oz/A decreased as the season progressed and was 52 and 35%, respectively, on July 15. Foxtail control was greatest, 97 to 98%, when clodinafop or fenoxaprop was applied without flucarbazone. Adding flucarbazone to clodinafop or fenoxaprop resulted in reduced control by 7 to 12 percentage points. In tank-mixes, increasing the rate of either chemical tended to increase foxtail control. Rate of clodinafop or fenoxaprop needs to be maintained near the current labeled rate to ensure yellow foxtail control of 90% or better when tank-mixing with flucarbazone. This experiment was conducted without crop canopy, but other experiments established in crop have shown the same results.

X

Yellow foxtail control with flucarbazone and fenoxaprop combinations. (Howatt, Roach, and Davidson-Harrington) An experiment was established to determine the rate of fenoxaprop needed to achieve acceptable yellow foxtail control with flucarbazone. A tank-mix of the two chemicals may be needed for grass control in fields with ACC-ase resistant wild oat and high yellow foxtail populations. 'Oxen' hard red spring wheat was seeded May 2. Treatments were applied to 6-leaf wheat and 4- to 5-leaf yellow foxtail, on June 17 with 69 F, 44% relative humidity, and 95% cloudcover. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Yellow foxtail population was 50 plants/ft^2. A 4 by 30 ft area of each plot was harvested on August 8. The experiment was a randomized complete block design with four replicates.

Table. Yellow foxtail control with flucarbazone and fenoxaprop combinations (Howatt, Roach, and Harrington).

		Jun 25		Jul 01	Jul 23	Aug 08
Treatment[a]	Rate	Wheat injury	Yeft	Yeft	Yeft	Yield
	(oz/A)	(%)	(%)	(%)	(%)	(bu/A)
Flucarbazone+NIS	0.42+0.25%	11	78	84	81	33
Flucarbazone+NIS	0.28+0.25%	6	65	69	75	37
Flcz+fenoxaprop+NIS	0.35+0.33+0.25%	0	84	84	90	43
Flcz+fenoxaprop+NIS	0.35+0.5+0.25%	2	86	87	93	40
Flcz+fenoxaprop+NIS	0.35+0.66+0.25%	1	87	90	93	41
Flcz+fenoxaprop+NIS	0.28+0.33+0.25%	1	87	88	90	43
Flcz+fenoxaprop+NIS	0.28+0.5+0.25%	2	88	91	93	40
Flcz+fenoxaprop+NIS	0.28+0.66+0.25%	1	89	93	93	41
Flcz+fenoxaprop+NIS	0.21+0.33+0.25%	1	90	89	93	42
Flcz+fenoxaprop+NIS	0.21+0.5+0.25%	2	91	95	95	42
Flcz+fenoxaprop+NIS	0.21+0.66+0.25%	0	92	96	97	41
Fenoxaprop	0.5	0	97	98	99	38
Fenoxaprop	0.8	0	98	98	99	39
Untreated	0	0	0	0	0	38
LSD 5%		2	2	4	5	14
CV		77	2	4	4	8

[a]NIS was Activator 90 from Loveland Industries, Greeley, CO.

Wheat injury, temporary chlorosis and stunting, was 11% with 0.42 oz/A flucarbazone on June 25. Wheat injury also was observed at 0.28 oz/A flucarbazone alone, but injury from tank-mixes of flucarbazone and fenoxaprop was similar to the untreated control. Wheat injury was not detectable on July 1. Yellow foxtail control tended to increase with increasing fenoxaprop rate, and fenoxaprop activity tended to be reduced by the addition of flucarbazone.

Yellow foxtail control with clodinafop tank-mixes. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 15 at Fargo. Treatments were applied to 5-leaf wheat and 4- to 6-leaf yellow foxtail on June 18 with 68 F, 72% relative humidity, 100% cloudcover, and 13 mph south-southeast wind. Treatments were applied with a bicycle-wheel plot sprayer delivering 8.5 gpa at 40 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. Yellow foxtail population was 200 plants/m^2.

Table. Yellow foxtail control with clodinafop tank-mixes.

		Jun 25		Jul 1	Jul 23	Aug 8	
Treatment[a]	Rate	Wht	Yeft	Yeft	Yeft	Yeft	Yield
	oz ai/A			%			bu/A
Clodinafop+Score	0.8+1%	0	90	94	98	98	38
Clodinafop+Score	1+1.2%	0	93	94	98	98	38
Clfp+PO+2,4-D amine	0.8+1%+6	1	80	87	89	89	42
Clfp+PO+2,4-D amine	1+1.2%+6	1	81	86	90	90	39
Clfp+PO+dicamba-dga	0.8+1%+1.5	0	78	92	93	93	42
Clfp+PO+dicamba-dga	1+1.2%+1.5	1	82	92	95	95	43
Clfp+PO+clopyralid&2,4-D	0.8+1%+12.7	2	84	87	87	87	44
Clfp+PO+clopyralid&2,4-D	1+1.2%+12.7	3	85	89	92	92	42
Clfp+PO+clopyralid&MCPA	0.8+1%+9.7	1	87	86	85	85	44
Clfp+PO+clopyralid&MCPA	1+1.2%+9.7	1	85	89	94	94	44
Clfp+PO+MCPA ester	0.8+1%+6	1	87	91	95	95	43
Clfp+PO+MCPA ester	1+1.2%+6	0	91	92	94	94	40
Clfp+PO+thifensulfuron+MCPA ester	0.8+1%+0.45+6	1	82	80	80	80	45
Clfp+PO+thifensulfuron+MCPA ester	1+1.2%+0.45+6	0	82	81	76	76	40
Clfp+PO+thifensulfuron+fluroxypyr	0.8+1%+0.45+2	0	82	82	72	72	37
Clfp+PO+thifensulfuron+fluroxypyr	1+1.2%+0.45+2	0	85	89	78	78	40
Clfp+PO+clopyralid&MCPA+flox	0.8+1%+9.7+2	1	83	88	89	89	43
Clfp+PO+clopyralid&MCPA+flox	1+1.2%+9.7+2	1	88	91	90	90	39
Clfp+PO+bromoxynil&MCPA+flox	0.8+1%+8+2	1	86	90	91	91	41
Clfp+PO+bromoxynil&MCPA+flox	1+1.2%+8+2	0	89	94	93	93	43
Clfp+PO+thif&tribenuron+MCPA ester	0.8+1%+0.45+6	1	83	84	79	79	41
Clfp+PO+thif&tribenuron+MCPA ester	1+1.2%+0.45+6	2	84	83	81	81	42
Fenoxaprop+thif+MCPA ester	1.32+0.37+6	1	89	91	85	85	41
Flucarbazone+NIS+thif+MCPA ester	0.42+0.25%+0.45+6	0	81	85	75	75	48
Untreated	0	0	0	0	0	0	37
CV		192	4	5	6	5	10
LSD (0.05)		2	5	6	7	6	6

[a] PO was DSV in co-pack with clodinafop; Bromoxynil&MCPA was 5EC formulation; and NIS was Activator 90 from Loveland Industries.

Minor wheat injury, 2 to 3% chlorosis, was recorded following clodinafop+PO+clopyralid&2,4-D and clodinafop+PO+thifensulfuron+MCPA treatments on June 25. This injury was short-lived and not observed at the following evaluation on July 1. Increasing the rate of clodinafop tended to increase yellow foxtail control. Clodinafop+PO at 0.8 and 1 oz/A provided 94 and 98% control, respectively. While dicamba has caused significant antagonism of grass herbicides in past experiments and was very antagonistic in this study reducing foxtail control 13 percentage points on June 25, tank-mixes of clodinafop and dicamba provided 92 to 95% control on mid- and late season evaluation dates. Other tank-mixes that did not result in less control at either clodinafop rate include MCPA and bromoxynil&MCPA+fluroxypyr. When 1 oz/A clodinafop was used, tank-mixes with clopyralid&2,4-D or clopyralid&MCPA provided similar control to clodinafop alone. Thifensulfuron tank-mixes generally reduced clodinafop activity on yellow foxtail by 10 to 15 percentage points. Clodinafop at 0.8 oz/A with thifensulfuron+fluroxypyr gave 72% control on July 23 compared to 98% control with 0.8 oz/A clodinafop. Fenoxaprop provided better foxtail control than clodinafop or flucarbazone when tank-mixed with thifensulfuron+MCPA. Flucarazone at 0.42 oz/A and clodinafop at 1 oz/A gave 75 and 76% control, respectively, while fenoxaprop at 1.32 oz/A provided 85% control on July 23.

Fenoxaprop, clodinafop, and flucarbazone tank-mix comparison. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 16 at Fargo. Treatments were applied to 4-leaf wheat, 3- to 5-leaf yellow foxtail, and 2- to 3-leaf wild oat on June 20 with 70 F, 34% relative humidity, 30% cloudcover, 6 mph northwest wind, and soil temperature of 66 F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 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. Weed populations were 250 yellow foxtail/m^2 and 10 wild oat/m^2.

Table. Fenoxaprop, clodinafop, and flucarbazone tank-mix comparison.

		Jul 1		Jul 12		Aug 14
Treatment[a]	Rate	Wht	Yeft	Yeft	Wioa	Yield
	oz ai/A	%				bu/A
Fenoxaprop	1.32	0	97	98	98	26
Fenoxaprop+bromoxynil&MCPA	1.32+4&4	0	93	96	95	30
Fenx+brox&MCPA+fluroxypyr	1.32+3&3+1	0	93	94	95	30
Fenoxaprop+thifensulfuron+flox	1.32+0.15&0.07+1	0	86	86	94	29
Clodinafop+Score	0.8+0.8%	0	93	94	98	24
Clodinafop+bromoxynil&MCPA+Score	0.8+4&4+0.8%	0	87	90	97	30
Clodinafop+brox&MCPA+flox+Score	0.8+3&3+1+0.8%	0	87	91	96	29
Clodinafop+thif+fluroxypyr+Score	0.8+0.15&0.07+1+0.8%	0	79	57	93	26
Flucarbazone+2,4-D ester+NIS	0.44+6+0.25%	0	86	88	92	28
Flucarbazone+bromoxynil&MCPA+NIS	0.44+4&4+0.25%	0	84	85	94	29
Flucarbazone+brox&MCPA+flox+NIS	0.44+3&3+1+0.25%	0	81	82	91	30
Flucarbazone+thif+flox+NIS	0.44+0.15&0.07+1+0.25%	0	81	87	91	27
Untreated	0	0	0	0	0	21
CV		0	3	14	2	9
LSD (0.05)		0	4	16	2	3

[a] Bromoxynil&MCPA was 5EC formulation; NIS was Activator 90 from Agriliance.

No wheat injury was observed in this study. More antagonism was observed with fenoxaprop and clodinafop tank-mixes than with flucarbazone tank-mixes. Optimum yellow foxtail control with flucarbazone, however, was 88% while fenoxaprop and clodinafop provided 98 and 94% control on July 12. Antagonism of fenoxaprop and clodinafop activity was more pronounced on July 1 than July 12. Bromoxynil&MCPA reduced yellow foxtail control with fenoxaprop and clodinafop by about 5 percentage points, while thifensulfuron lowered foxtail control 11 and 14 points, respectively. Thifensulfuron reduced clodinafop activity so much that control rating decreased from July 1 to July 12, going from 79% to 57% foxtail control. The same trends in weed control and herbicide antagonism was observed on wild oat, but the differences were smaller. All herbicide treatments provided greater than 90% wild oat control.

Yellow foxtail control with Puma, Discover, and Everest tank mixes. Jenks, Willoughby, and Markle. Ben durum was seeded May 3 into 6-inch rows at 110 lb/A. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied postemergence on June 5 to 4-leaf, 2-tiller wheat. The primary weeds were kochia (Kocz), wild buckwheat (Wibw), common lambsquarters (Colq), and yellow foxtail (Yeft). Chlorosis (Chlor), and growth reduction (Growth red) were evaluated in addition to durum injury.

				Durum				
		Yeft control		Chlor	Growth red	Injury		Yield
Treatment[a]	Rate	Jun 22	Jul 5	Jun 15		Jun 22	Jul 5	Aug 19
		%						bu/A
Untreated		0	0	0	0	0	0	31
Puma[b]	0.66 pt	93	92	16	0	11	6	34
Puma + Bronate	0.66 pt + 0.8 pt	78	70	9	0	5	1	37
Puma + Bronate + Starane	0.66 pt + 0.6 pt + 0.33 pt	88	80	8	0	3	1	38
Puma + Harmony GT + Starane	0.66 pt + 0.3 oz + 0.33 pt	83	75	9	0	4	1	35
Discover[b]	3.2 fl oz	92	84	3	0	4	0	37
Discover + Bronate	3.2 fl oz + 0.8 pt	85	79	3	0	1	0	35
Discover + Bronate + Starane	3.2 fl oz + 0.6 pt + 0.33 pt	85	72	4	0	0	0	38
Discover + Harmony GT + Starane	3.2 fl oz + 0.3 oz + 0.33 pt	53	28	2	0	1	0	34
Everest + 2,4-D Ester[b]	0.6 oz + 0.75 pt	87	80	9	13	20	12	35
Everest + Bronate	0.6 oz + 0.8 pt	72	40	6	15	16	11	34
Everest + Bronate + Starane	0.6 oz + 0.6 pt + 0.33 pt	74	50	6	15	18	11	34
Everest + Harmony GT + Starane	0.6 oz + 0.3 oz + 0.33 pt	74	54	7	15	16	9	32
LSD (0.05)		9	17	3	1	3	3	NS
CV		7	16	24	11	23	36	10

[a]*Discover treatments were applied with Score at 0.8% v/v, Everest treatments were applied with NIS at 0.25% v/v, and Bronate = Bronate Advanced 5 EC.*

[b]*Treatments were followed by Harmony GT plus MCPA ester plus Starane at 0.33 oz + 0.75 pt + 0.5 pt/A, respectively, on June 14.*

Puma, Discover, and Everest caused slight chlorosis that remained visible for several weeks. Everest caused slight to moderate stunting throughout the season. All treatments provided excellent control of kochia, wild buckwheat, and lambsquarters. Tank mixing broadleaf herbicides with Puma, Discover, or Everest resulted in slight to severe antagonism of yellow foxtail control. Yellow foxtail was dense and very competitive early; however, dry conditions caused yellow foxtail to wilt and be less competitive in July and August. Wheat yields in Everest treatments did not differ significantly from the Puma or Discover treatments despite the higher injury ratings.

Broadleaf tank-mixes with reduced CGA-184927 rates. **Howatt, Kirk A., Ronald F. Roach, and Janet D. Harrington. An experiment was established to evaluate antagonism when CGA-184927 at reduced rates were applied with broadleaf herbicides. "Oxen" hard red spring wheat was seeded May 2. Treatments were applied to 3.5 leaf wheat and wild oat on June 4 with 71 F, 22% relative humidity, 50% cloudcover, 1 to 8 mph wind, and soil temperature of 59 F. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Wild oat population was greater than 300 plants/ft^2. A 4 by 30 ft area was harvested from each plot on August 5. The experiment was a randomized complete block design with four replicates.**

Treatment[a]	Rate	Jun 20 Wioa	Jul 04 Wioa	Aug 05 Yield
	(oz/A)	(%)	(%)	(bu/A)
CGA-184927+PO(DSV)	0.8+1%	96	99	48
CGA-184927+PO(DSV)+PO	0.54+0.6%+0.4%	95	97	48
CGA-184927+PO(DSV)+PO	0.4+0.5%+0.5%	93	96	44
CGA-184927+brox&MCPA+PO(DSV)	0.8+4&4+1%	93	98	50
CGA-184927+brox&MCPA+PO(DSV)+PO	0.54+4&4+0.6%+0.4%	86	92	48
CGA-184927+brox&MCPA+PO(DSV)+PO	0.4+4&4+0.5%+0.5%	73	86	47
CGA-184927+thif&trib+flox&MCPA+PO(DSV)	0.8+0.15&0.07+1.6&6.4+1%	87	96	49
CGA-184927+thif&trib+flox&MCPA+PO(DSV)+PO	0.54+0.15&0.07+1.6&6.4+0.6%+0.4%	76	86	45
CGA-184927+thif&trib+flox&MCPA+PO(DSV)+PO	0.4+0.15&0.07+1.6&6.4+0.5%+0.5%	74	75	43
CGA-184927+dicamba+carf+PO(DSV)	0.8+1.5+0.128+1%	89	95	51
CGA-184927+dicamba+carf+PO(DSV)+PO	0.54+1.5+0.128+0.6%+0.4%	86	91	49
CGA-184927+dicamba+carf+PO(DSV)+PO	0.4+1.5+0.128+0.5%+0.5%	87	87	52
Untreated	0	0	0	22
CV		4	4	10
LSD 5%		5	4	6

[a]CGA-184927 is Discover with a safener CGA-185072 (cloquintocet); PO(DSV) was in co-pac with CGA-184927 & CGA-185072 from Syngenta, Greensboro, NC; PO was Herbimax, Loveland Industries, Greeley, CO, and was added to attain labeled adjuvant rate.

There was no wheat injury. CGA-184927 at 0.8 oz/A overcame initial broadleaf herbicide antagonism by the July 4 evaluation. CGA-184927 at 0.4 oz/A provided similar control to 0.8 oz/A in the absence of broadleaf herbicides. Thifensulfuron & tribenuron + fluroxypyr & MCPA was the most antagonistic broadleaf combination, reducing wild oat control by 11 and 21 percentage points for 0.54 and 0.4 oz/A CGA-184927, respectively. Bromoxynil & MCPA or dicamba + carfentrazone each reduced wild oat control by about 10% with reduced CGA-184927 rates.

Broadleaf tank-mixes with reduced fenoxaprop rates. Howatt, Kirk A., Ronald F. Roach, Janet D. Harrington. An experiment was established to evaluate antagonism when fenoxaprop at reduced rates was applied with broadleaf herbicides. "Oxen" hard red spring wheat was seeded May 2. Treatments were applied to 3.5 leaf wheat and wild oat on June 4 with 75 F, 17% relative humidity, 25% cloudcover, 0 to 4 mph north-northeast wind and soil temperature of 62 F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Wild oat population was greater than 300 plants/ft^2. 4 by 30 ft area from each plot was harvested on August 5. The experiment was a randomized complete block design with four replicates.

Treatment[a]	Rate	Jun 20 Wioa	Jul 04 Wioa	Aug 05 Yield
	(oz/A)	(%)	(%)	(bu/A)
Fenoxaprop	1.32	95	96	49
Fenoxaprop	1	92	93	48
Fenoxaprop+brox&MCPA	1.32+4&4	89	91	47
Fenoxaprop+brox&MCPA	1+4&4	85	86	47
Fenx+thif&trib+fluroxypyr&MCPA	1.32+0.15&0.07+1.6&6.4	83	85	48
Fenx+thif&trib+fluroxypyr&MCPA	1+0.15&0.07+1.6&6.4	82	81	48
Fenx+dicamba+carfentrazone+NIS	1.32+1.5+0.128+0.25%	80	84	48
Fenx+dicamba+carfentrazone+NIS	1+1.5+0.128+0.25%	76	79	48
Untreated	0	0	0	27
CV		4	3	12
LSD 5%		4	3	8

[a]NIS was Activator 90 from Loveland Industries, Greeley, CO.

There was no wheat injury. Dicamba + carfentrazone antagonized fenoxaprop activity the most reducing wild oat control by 15 to 16 percentage points compared to fenoxaprop alone on June 20. Applying the full rate of fenoxaprop did not prevent antagonism from broadleaf herbicides. Even though reduced fenoxaprop rate and broadleaf tank-mixes resulted in reduced wild oat control, wheat yields from herbicide treated plots were very similar.

Broadleaf tank-mixes with reduced MKH6562 rate. Howatt, Kirk A., Ronald F. Roach, and Janet D. Harrington. An experiment was established to evaluate antagonism when MKH 6562 at reduced rates was applied with broadleaf herbicides. "Oxen" hard red spring wheat was seeded May 2. Treatments were applied to 3.5 leaf wheat and wild oat on June 4 with 72 F, 23% relative humidity, 15% cloudcover, 3 to 7 mph northeast wind, and soil temperature of 65 F. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Wild oat population was greater than 300 plants/ft^2. A 4 by 30 ft area of each plot was harvested on August 5. The experiment was a randomized complete block design with four replicates.

Treatment[a]	Rate	Jun-20 Wioa	Jul-04 Wioa	Aug-05 Yield
	(oz/A)	(%)	(%)	(bu/A)
MKH6562+NIS	0.42+0.25%	89	88	45
MKH6562+NIS	0.28+0.25%	87	87	47
MKH6562+brox&MCPA+NIS	0.42+4&4+0.25%	90	92	48
MKH6562+brox&MCPA+NIS	0.28+4&4+0.25%	89	89	50
MKH6562+thif&trib+flox&MCPA+NIS	0.42+0.15&0.07+1.6&6.4+0.25%	86	89	44
MKH6562+thif&trib+flox&MCPA+NIS	0.28+0.15&0.07+1.6&6.4+0.25%	82	88	43
MKH6562+dicamba+carf+NIS	0.42+1.5+0.128+0.25%	87	83	47
MKH6562+dicamba+carf+NIS	0.28+1.5+0.128+0.25%	79	78	46
Untreated	0	0	0.0	36
CV		2	2	9
LSD 5%		2	3	6

[a]NIS was Activator 90 from Loveland Industries, Greeley, CO.

There was no wheat injury. On July 4, 0.42 oz/A MKH 6562 provided 88% wild oat control. Only dicamba + carfentrazone antagonized MKH 6562, reducing wild oat control by 5 to 9 percentage points. Even though wild oat control generally was less than 90% it was observed that surviving plants produced very few seeds.

2002 Adjuvant use with Clodinafop Herbicide at Hettinger. (Eriksmoen) 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. Treatments were applied with a tractor mounted CO2 propelled plot sprayer delivering 17 gpa at 40psi through 8001 flat fan nozzles to a 5 foot wide area the length of 10 by 28 foot plots. The trial was sprayed with 1 pt/A Bromoxynil + 8 oz/A Fluroxypyr on June 14 to control broadleaf weeds. The experiment was a randomized complete block design with three replications. Green foxtail populations were 20 plants per sq. foot. Evaluations for crop injury were on June 21 and for foxtail control on July 1. The trial was not harvested due a short and thin crop caused by severe drought.

			7/1
Treatment		Product Rate	Fota
		oz /A	% control
1	Clodinafop + DSV*	3.2 + 12.8	99
2	Clodinafop + DSV	1.6 + 6.8	95
3	Clodinafop + DSV + NIS*	1.6 + 6.8 + .25%	96
4	Clodinafop + DSV + MSO*	1.6 + 6.8 + .25%	95
5	Clodinafop + DSV + VOC*	1.6 + 6.8 + .25%	98
6	Clodinafop + DSV + Basic Blend*	1.6 + 6.8 + .25%	96
7	Untreated	0	0
C.V. %			3.7
LSD 5%			5

*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 Clodinafop Herbicide is applied at low rates with various adjuvants. Crop injury was not observed on any treatment (data not shown). Green foxtail control was excellent for all herbicide treatments and did not vary significantly between the recommended rate (trt 1), the lower Clodinafop rate (trt 2) or the lower Clodinafop rate plus various adjuvants (trts 3-6).

X

Fenoxaprop with adjuvants. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Treatments were applied to 5-leaf wheat and 4- to 4.5-leaf wild oat on June 11 with 73 F, 41% relative humidity, 10% cloudcover, 2.5 mph west wind, and soil temperature of 66 F. Treatments were applied with a backpack type plot sprayer delivering 8.5 gpa at 40 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. Wild oat population was 2000 plants/m^2.

Table. Fenoxaprop with adjuvants.

		Jun 25		Jul 5
Treatment[a]	Rate	Wht	Wioa	Wioa
	oz ai/A		%	
Fenoxaprop	1.32	0	88	97
Fenoxaprop	1	0	84	94
Fenoxaprop+Preference	1+0.25%	0	85	96
Fenoxaprop+Prime Oil	1+1%	0	86	96
Fenoxaprop+Hi-Per-Oil	1+0.5%	0	86	97
Fenoxaprop+AG01017	1+0.5%	0	84	95
Fenoxaprop+AG01023	1+0.5%	0	86	96
Fenoxaprop+Rivet	1+0.5%	0	81	96
Fenoxaprop+AG01034	1+0.25%	0	86	96
Fenoxaprop+Class Act NG	1+2.5%	0	85	95
Fenoxaprop+AG02020	1+0.5%	0	87	97
Fenoxaprop+AG02033	1+0.5%	0	85	95
Untreated	0	0	0	0
CV		0	2	1
LSD (0.05)		0	2	1

[a] AG01017, AG01023, AG01034, AG02020, and AG02033 were proprietary adjuvant blends from Agriliance.

No injury was observed from any treatment. While slight differences were detected, the addition of adjuvant did not change the wild oat control rating compared to fenoxaprop alone at 1 oz/A. Fenoxaprop at 1 oz/A provided 84% wild oat control on June 25 and 94% control on July 5.

X

Flucarbazone with adjuvants. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 16 at Fargo. Treatments were applied to 3-leaf wheat and 4- to 5-leaf yellow foxtail on June 17 with 72 F, 44% relative humidity, 0% cloudcover, and 5 mph southeast wind. Treatments were applied with a backpack type plot sprayer delivering 8.5 gpa at 40 psi through 11001 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. Yellow foxtail population was 200 plants/m^2.

Table. Flucarbazone with adjuvants.

Treatment[a]	Rate	Jun 25 Yeft	Jul 1 Yeft	Jul 12 Yeft
	oz ai/A		%	
Flucarbazone+2,4-D+Activator 90	0.42+4+0.25%	90	88	92
Flucarbazone+2,4-D	0.28+4	75	75	82
Flucarbazone+2,4-D+Activator 90	0.28+4+0.25%	84	84	84
Flucarbazone+2,4-D+Preference	0.28+4+0.25%	83	83	85
Flucarbazone+2,4-D+Activate Plus	0.28+4+0.25%	64	62	62
Flucarbazone+2,4-D+AG01010	0.28+4+0.25%	84	84	84
Flucarbazone+2,4-D+AG02018	0.28+4+0.25%	84	83	85
Flucarbazone+2,4-D+Class Act NG	0.28+4+2.5%	82	83	86
Flucarbazone+2,4-D+AG02029	0.28+4+0.25%	83	82	83
Flucarbazone+2,4-D+AG02028	0.28+4+0.25%	83	83	84
Flucarbazone+2,4-D+AG01034	0.28+4+0.25%	82	83	85
Flucarbazone+2,4-D+Class Act NG	0.28+4+1.25%	84	83	87
Flucarbazone+2,4-D+AG02036	0.28+4+0.25%	82	78	84
Untreated	0	0	0	0
CV		15	15	15
LSD (0.05)		17	16	16

[a] AG01010, AG02018, AG02029, AG02028, AG01034, and AG02036 were proprietary adjuvant blends from Agriliance.

Wheat in all treated areas appeared dehydrated for a few days after application. Leaves were limp and had a slight grayish hue. This wheat response was not apparent on June 25, and no other wheat injury was observed. Flucarbazone+2,4-D at 0.28+4 oz/A with 0.25% Activator 90 was used as the standard treatment. This treatment provided 84% yellow foxtail control. Substitution of Activator 90 with other adjuvants did not change weed control except when Activate Plus was used. Yellow foxtail control when Activate Plus was the adjuvant was 62%. Increasing flucarbazone rate to 0.42 oz/A with Activator 90 adjuvant provided 92% yellow foxtail control on July 12.

2002 Reduced Rates and Application Timing of Wild Oat Herbicides at Hettinger. (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. Reeder HRSW was planted on April 30. The first post-applied treatments were applied to 3 leaf wheat and to 3 leaf wild oats on May 31 with 63 F, 66% RH, sunny sky and 10 mph wind. The second post-applied treatments were applied to 5 leaf wheat and to 5 leaf wild oats on June 11 with 45 F, 65% RH, sunny sky and 5 mph wind. All treatments were applied with a tractor mounted CO2 propelled plot sprayer delivering 17 gpa at 40 psi through 8001 flat fan nozzles to a 5 foot wide area the length of 10 by 22 foot plots. The trial was sprayed with 8 ounces/Ac Starane + 1 pint/Ac Buctril on June 7 to control broadleaf weeds. The experiment was a randomized complete block design with four replications. Wild oat populations were 22 plants per sq. foot. Evaluations for wild oat control were on July 2 and July 16. Patches of downy brome, Japanese brome and foxtail barley were non-uniformly scattered throughout the trial and were evaluated for control when observed. The trial was not harvested due to a thin and short wheat stand caused by severe drought.

App.				2001	7/02/2002				7/16/2002
Timing	Treatment	Product Rate	Wioa	Wioa	Wioa	Dobr	Jabr	Foba	Wioa
HRSW		oz/acre	Rate	% Control					
3 leaf	Puma	10.6	Full	72	98	0	0	--	99
3 leaf	Puma	7.9	3/4	59	93	0	0	10	88
3 leaf	Puma	5.3	1/2	25	75	0	15	--	75
5 leaf	Puma	10.6	Full	92	79	--	50	--	72
5 leaf	Puma	7.9	3/4	82	58	--	0	--	44
5 leaf	Puma	5.3	1/2	62	22	--	0	--	21
3 leaf	Everest + NIS	0.60 + 0.25%	Full	90	98	50	96	--	99
3 leaf	Everest + NIS	0.45 + 0.25%	3/4	89	99	50	94	--	99
3 leaf	Everest + NIS	0.30 + 0.25%	1/2	88	98	70	99	--	97
5 leaf	Everest + NIS	0.60 + 0.25%	Full	62	98	--	90	--	99
5 leaf	Everest + NIS	0.45 + 0.25%	3/4	84	98	--	--	--	99
5 leaf	Everest + NIS	0.30 + 0.25%	1/2	72	95	--	90	--	99
3 leaf	Discover + DSV	3.20 + 12.8	Full	90	99	0	0	0	99
3 leaf	Discover + DSV	2.40 + 12.8	3/4	90	99	--	17	--	98
3 leaf	Discover + DSV	1.60 + 12.8	1/2	86	94	50	0	--	97
5 leaf	Discover + DSV	3.20 + 12.8	Full	95	98	--	0	--	99
5 leaf	Discover + DSV	2.40 + 12.8	3/4	95	98	--	50	--	99
5 leaf	Discover + DSV	1.60 + 12.8	1/2	92	98	--	0	--	99
3 leaf	Achieve + SC+ AMS	7.0 + 0.5% + 1%	Full	71	80	0	45	--	79
3 leaf	Achieve + SC+ AMS	5.25 + 0.5% + 1%	3/4	84	62	--	45	0	70
3 leaf	Achieve + SC+ AMS	3.50 + 0.5% + 1%	1/2	75	68	0	48	50	55
5 leaf	Achieve + SC+ AMS	7.0 + 0.5% + 1%	Full	81	65	--	0	--	71
5 leaf	Achieve + SC+ AMS	5.25 + 0.5% + 1%	3/4	89	82	--	--	--	82
5 leaf	Achieve + SC+ AMS	3.50 + 0.5% + 1%	1/2	52	72	--	99	--	82
C.V. %				32.9	20.2	74	83	--	20.6
LSD 5%				25	23	ns	40	--	23

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

Summary

Crop injury was minimal (>1% stunting) and was not consistent across replications (data not shown). Full and 3/4 rates of Puma provided good wild oat control when applied at the 3 leaf stage. Wild oat control was significantly reduced when Puma was applied 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 and Discover provided excellent wild oat control in 2002. Achieve treatments did not provide adequate wild oat control. Everest treatments had fair control of downy brome and excellent control of Japanese brome. Achieve treatments also provided fair control of Japanese brome but no activity on downy brome. Some herbicidal activity was observed on Foxtail barley with Puma and Achieve.

Split application of herbicides for wild oat control, Fargo. Ramsdale, Brad K., Sam J. Lockhart, and Calvin G. Messersmith. 'Oxen' hard red spring wheat was seeded on May 2, 2002. Treatments were a single application at standard timing and two applications at a reduced rate totaling less than the 1X rate. Experimental design was a randomized complete block with four replicates, and plot size was 10 by 30 ft. All treatments were applied at 8.5 gpa with a bicycle-wheel-type plot sprayer equipped with four 8001 flat-fan nozzles at 20-inch spacing. Weed control and wheat injury were evaluated visually where 0 equaled no visible injury and 100 equaled complete plant death.

Treatment Date	1st Split May 24	Single June 4	2nd Split June 11
Air temperature (F)	60	70	72
Relative humidity (%)	20	30	65
Wind (mph)	5	3	7
Cloud cover (%)	50	50	30
Wheat			
Growth stage	1.5 leaf	3-4 leaf and 1-2 tillers	4-5 leaf and 1-2 tillers
Height	2-3 inch	3-5 inch	5-7 inch
Wild oat			
Growth stage	1.5 leaf	2-3 leaf	Variable
Height	1-3 inch	2-5 inch	Variable

Half-rate split-applied treatments (0.25X + 0.25X) of clodinafop, flucarbazone, and tralkoxydim provided similar wild oat control (94% or greater) to full-rates of these herbicides applied once. Bromoxynil plus MCPA or thifensulfuron plus fluroxypyr did not antagonize half-rate split-applied treatments of clodinafop, flucarbazone, or tralkoxydim. Reduced-rate split-applied treatments (0.33X + 0.33X) of fenoxaprop-P plus safener were less effective than the full-rate applied once. Wild oat control by fenoxaprop-P with bromoxynil plus MCPA in the second split application was less than the other split treatments of fenoxaprop-P. Wheat yields were generally similar for all herbicide treatments within each experiment and were substantially greater following herbicide treatment than the untreated control.

Table 1. Reduced-rate split-applied fenoxaprop-P treatments, Fargo.

Treatment	Rate	Wild oat control		Yield
		June 28	July 12	
	oz ai/A	---------- % ----------		bu/A
Fenoxaprop-P	1.32	92	92	49
Fenx-P + brox&MCPA	1.32 + 8	85	90	46
Fenx-P + thif + flox	1.32 + 0.3 + 1	95	95	49
Fenx-P / Fenx-P	0.44 / 0.44	73	78	45
Fenx-P + brox&MCPA / Fenx-P	0.44 + 8 / 0.44	79	83	46
Fenx-P + thif + flox / Fenx-P	0.44 + 0.3 + 1 / 0.44	79	85	45
Fenx-P / Fenx-P + brox&MCPA	0.44 / 0.44 + 8	70	65	42
Fenx-P / Fenx-P + thif + flox	0.44 / 0.44 + 0.3 + 1	78	83	42
Untreated		-	-	28
LSD (5%)		9	6	6

[a] Brox&MCPA = Bronate.

Table 2. Reduced-rate split-applied flucarbazone treatments, Fargo.

Treatment[a]	Rate	Wild oat control June 28	Wild oat control July 12	Yield
	oz ai/A	--- % ---		bu/A
Flucarbazone + Quad 7	0.42 + 1%	98	98	47
Flcz + brox&MCPA + Quad 7	0.42 + 8 + 1%	97	98	47
Flcz + thif + flox + Quad 7	0.42 + 0.3 + 1 + 1%	97	97	48
Flcz + Quad 7 / Flcz + Quad 7	0.1 + 1% / 0.1 + 1%	98	99	49
Flcz + brox&MCPA + Quad 7 / Flcz + Quad 7	0.1 + 8 + 1% / 0.1 + 1%	98	99	52
Flcz + thif + flox + Quad 7 / Flcz + Quad 7	0.1 + 0.3 + 1 + 1% / 0.1 + 1%	99	98	49
Flcz + Quad 7 / Flcz + brox&MCPA + Quad 7	0.1 + 1% / 0.1 + 8 + 1%	99	98	50
Flcz + Quad 7 / Flcz + thif + flox + Quad 7	0.1 + 1% / 0.1 + 0.3 + 1 + 1%	99	99	50
Untreated		-	-	38
LSD (5%)		NS	NS	6

[a] Brox&MCPA = Bronate; Quad 7 = basic blend adjuvant.

Table 3. Reduced-rate split-applied tralkoxydim treatments, Fargo.

Treatment[a]	Rate	Wild oat control June 28	Wild oat control July 12	Yield
	oz ai/A	--- % ---		bu/A
Tralkoxydim + Scoil	2.8 + 1.5 pt	97	99	47
Tral + brox&MCPA + Scoil	2.8 + 8 + 1.5 pt	98	98	44
Tral + thif + flox + Scoil	2.8 + 0.3 + 1 + 1.5 pt	97	98	46
Tral + Scoil / Tral + Scoil	0.7 + 1.5 pt / 0.7 + 1.5 pt	99	99	49
Tral + brox&MCPA + Scoil / Tral + Scoil	0.7 + 8 + 1.5 pt / 0.7 + 1.5 pt	98	99	50
Tral + thif + flox + Scoil / Tral + Scoil	0.7+0.3+1+1.5 pt / 0.7+1.5 pt	98	99	48
Tral + Scoil / Tral + brox&MCPA + Scoil	0.7 + 1.5 pt / 0.7 + 8 + 1.5 pt	99	96	49
Tral + Scoil / Tral + thif + flox + Scoil	0.7+1.5 pt / 0.7+0.3+1+1.5 pt	95	95	45
Untreated		-	-	27
LSD (5%)		NS	3	5

[a] Brox&MCPA = Bronate; Scoil = methylated vegetable oil.

Table 4. Reduced-rate split-applied clodinafop treatments, Fargo.

Treatment[a]	Rate	Wild oat control June 28	Wild oat control July 12	Yield
	oz ai/A	--- % ---		bu/A
Clodinafop + PO	0.8 + 1.5 pt	99	97	49
Clfp + brox&MCPA + PO	0.8 + 8 + 1.5 pt	98	98	47
Clfp + thif + flox + PO	0.8 + 0.3 + 1 + 1.5 pt	97	95	48
Clfp + PO / Clfp + PO	0.2 + 1.5 pt / 0.2 + 1.5 pt	94	97	52
Clfp + brox&MCPA + PO / Clfp + PO	0.2 + 8 + 1.5 pt / 0.2 + 1.5 pt	98	99	50
Clfp + thif + flox + PO / Clfp + PO	0.2 + 0.3 + 1 + 1.5 pt / 0.2 + 1.5 pt	98	98	43
Clfp + PO / Clfp + brox&MCPA + PO	0.2 + 1.5 pt / 0.2 + 8 + 1.5 pt	94	95	49
Clfp + PO / Clfp + thif + flox + PO	0.2 + 1.5 pt / 0.2 + 0.3 + 1 + 1.5 pt	98	99	50
Untreated		-	-	29
LSD (5%)		NS	NS	5

[a] Brox&MCPA = Bronate; PO = Herbimax petroleum oil concentrate

Broadleaf weed control in wheat. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Treatments were applied to 6-leaf wheat, 6-leaf wild mustard, and 2- to 4-inch redroot pigweed on June 17 with 82 F, 40% relative humidity, 60% cloudcover, and 6 mph southeast wind. Treatments were hand broadcast with a backpack type sprayer delivering 8.5 gpa at 40 psi through 11001 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. Weed populations were 10 wild mustard/m^2 and 25 redroot pigweed/m^2.

Table. Broadleaf weed control in wheat.

		Jul 1		Aug 8
Treatment	Rate	Wimu	Rrpw	Yield
	oz ai/A	%		bu/A
Fluroxypyr+Liberate	0.5+0.25%	42	22	40
Fluroxypyr+Liberate	1+0.25%	57	57	44
Fluroxypyr+Liberate	1.5+0.25%	79	75	48
Fluroxypyr&2,4-D+Liberate	1.5&6+0.25%	90	91	47
Fluroxypyr&MCPA+Liberate	1.5&6.5+0.25%	93	93	47
Bromoxynil&MCPA	3&3	94	86	46
Bromoxynil&MCPA5	3&3	94	77	49
Carf+2,4-D-Salvo+NIS	0.128+6+0.25%	95	95	42
Thif&trib+MCPA	0.15&0.07+6	87	91	48
Thifensulfuron+MCPA	0.22+6	89	93	53
Untreated	0	0	0	43
CV		7	8	15
LSD (0.05)		8	8	10

No wheat injury was observed in this experiment. Carfentrazone+2,4-D with NIS provided 95% control of wild mustard and redroot pigweed on July 1. The 5EC formulation of bromoxynil&MCPA did not provide as effective pigweed control, 77%, as the 4EC formulation, 85%, but wild mustard control was similar for both formulations. Plot treatment with thifensulfuron+MCPA provided 89% wild mustard control and 93% redroot pigweed control, resulting in the highest wheat yield of 53 bu/A. In general, herbicide treatment did not lead to greater yield than the untreated control partially because the wheat was very competitive early in the season.

Broadleaf control in wheat, Langdon, (Lukach and Gregoire) 'Alsen' hard red spring wheat was seeded on May 18. Fertility was adequate for a 60 bu/A yield goal. Folicur 4 oz/a was applied on July 8. Treatments were applied to 4-4.5 leaf wheat on June 15 with 75°F, 42% RH, and 13 mph southeast wind. The sky was partly cloudy and the foliage dry. Application was complete at 2 pm with 0.04 inch rain received at 9 pm. Puma 0.67 pint/a, applied on June 21 over the whole trial gave good control of wild oats. Kochia was two inches tall, wild buckwheat up to four leaf and wild mustard five leaf with 1-2 kochia and wild buckwheat per ft^2. Treatments were applied with a bicycle-wheel-type sprayer delivering 8.5 gpa at 40 psi through XR8001 tips to 7 by 25 foot plots. The experiment was a randomized complete block design with four replicates. Harvest was on September 6.

		Control								
Treatment	Rate	Crop Injury	28-Jun Kocz	28-Jun Wimu	28-Jun Wibw	24-Jul Kocz	24-Jul Wimu	24-Jul Wibw	Yield	Test Weight
	oz ai/A	%	%	%	%	%	%	%	bu/A	lb/bu
Fluroxypyr+Liberate	0.5+0.25%	0	88	93	40	100	50	25	35	57.6
Fluroxypyr+Liberate	1+0.25%	0	100	100	88	100	100	73	39	58.4
Fluroxypyr+Liberate	1.5+0.25%	0	100	100	95	100	100	79	36	58.4
Fluroxypyr&2,4-D +Liberate	7.5+0.25%	0	100	100	98	100	100	85	40	58.6
Fluroxypyr&MCPA +Liberate	8+0.25%	0	100	100	100	100	100	98	38	58.3
Bromoxynil&MCPA	6	0	98	99	95	94	100	88	35	58.0
Bromoxynil&MCPA5	6	0	100	100	98	98	100	93	36	58.7
Carf+2,4-D-Salvo +Activator 90	0.128+6 +0.25%	0	83	100	65	100	100	78	30	58.2
Thif&Trib+MCPA	0.22+6	0	25	100	25	56	100	10	31	56.7
Thifensulfuron+MCPA	0.22+6	0	20	100	30	38	100	8	26	56.7
Untreated	0	0	0	0	0	0	0	0	12	53.6
Dicamba+2,4-D	1 + 8	0	95	100	94	100	100	79	32	58.1
Clopyralid&2,4-D	1.44 +8	0	28	100	81	55	100	86	31	58.2
C.V. %		--	9	1	17	20	18	27	21	1.6
LSD 5%		--	9	2	17	23	23	24	10	1.3
# OF REPS		4	4	4	4	4	4	4	4	4

Harmony Extra or HarmonyGT with MCPA and Curtail gave poor control of the ALS resistant kochia, 20 to 25%. Harmony Extra or HarmonyGT with MCPA also gave low control of wild buckwheat, 8-10%.

2002 Broadleaf Weed Control in Spring Wheat at Hettinger. (Eriksmoen) Reeder hard red spring wheat was seeded on April 30. Treatments were applied to 4 leaf wheat and to 2 inch tall kochia and 3 leaf wild buckwheat on June 5 with 39 F, 95 % RH, clear sky and 1 mph wind. Treatments were applied with a tractor mounted CO2 propelled plot sprayer delivering 17 gpa at 40psi through 8001 flat fan nozzles to a 5 foot wide area the length of 10 by 28 foot plots. The trial was sprayed with 1 pt/A Assert on June 7 to control wild oats. The experiment was a randomized complete block design with four replications. Kochia and wild buckwheat populations were 26 and 3.25 plants per sq. foot, respectively. Evaluations for crop injury were on June 19, for kochia and wild buckwheat control on July 5 and on July 16. The trial was not harvested due a short and thin crop caused by severe drought.

		6/19	7/5		Jul-09		7/16
Treatment	Rate	HRSW	Kocz	Wibw	Kochia	Ruth	Kocz
	oz ai/A	Injury				%	
Fluroxypyr+Liberate	0.5+0.25%	0	78	96	72.0	27.5	75
Fluroxypyr+Liberate	1+0.25%	0	89	96	76.3	27.5	90
Fluroxypyr+Liberate	1.5+0.25%	0	84	87	69.8	27.5	92
Fluroxypyr&2,4-D+Liberate	7.5+0.25%	0	80	99	63.5	50.0	88
Fluroxypyr&MCPA+Liberate	8+0.25%	0	88	99	91.8	66.3	96
Bromoxynil&MCPA	6	0	87	99	77.5	40.0	85
Bromoxynil&MCPA5	6	0	62	99	66.3	49.3	57
Carf+2,4-D-Salvo+Activator 90	0.128+6+0.25%	0	80	99	48.8	45.0	68
Thif&Trib+MCPA	0.22+6	0	53	93	60.5	61.3	33
Thifensulfuron+MCPA	0.22+6	0	58	91	50.0	45.0	32
Untreated	0	0	0	0	0.0	0.0	0
CV			24.5	11.0	35.7	57.51	32.5
LSD 5%			24	14	31.69	33.16	31

Summary

None of the treatments caused crop injury. All herbicide treatments provided excellent wild buckwheat control. The low rate of Fluroxypyr (trt 1), Bromoxynil & MCPA5 (trt 7) and the Carf + Salvo (trt 8) treatments did not provide adequate kochia control. Thif & Trib (trt 9) and thifensulfuron (trt 10) treatments also provided little control which may be a result of SU resistant kochia. Fluroxypyr treatments with the exception of the low rate (trt 1) provided good kochia control.

Wild buckwheat control with clopyralid&MCPA and adjuvants. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Treatments were applied to 4- to 5-leaf wheat and 4-leaf wild buckwheat on June 13 with 72 F and 10 mph southwest wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.6 gpa at 35 psi through 8001 flat fan nozzles to an 7 ft wide area the length of 10 by 30 ft plots. Wild buckwheat population was 15 to 20 plants/m^2.

Table. Wild buckwheat control with clopyralid&MCPA and adjuvants.

Treatment[a]	Rate	Jun 25	Jul 15	Aug 5	
		Wibw	Wibw	Wibw	Wht yield
	oz ai/A	%	%	%	bu/A
Clopyralid&MCPA	1.5&8.2	77	92	92	29
Clopyralid&MCPA+fenoxaprop	1.5&8.2+1.32	85	92	84	38
Clopyralid&MCPA+MSO	1.5&8.2+0.25G	79	95	93	35
Clopyralid&MCPA+PO	1.5&8.2+0.25G	78	91	89	35
Clopyralid&MCPA+NIS	1.5&8.2+0.25%	80	91	89	29
Untreated	0	0	0	0	26
CV		3	4	6	27
LSD (0.05)		3	5	7	13

[a] MSO was Sun-it II, PO was Herbimax, and NIS was Activator 90.

Clopyralid&MCPA at 1.5&8.2 oz/A provided 92% wild buckwheat control on July 15. Adjuvants did not improve or antagonize wild buckwheat control on this date. The addition of fenoxaprop to clopyralid&MCPA resulted in better weed control, 85%, compared to clopyralid&MCPA, 77%, on June 25.

Canada thistle control with clopyralid&MCPA and adjuvants. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 16 at Fargo. Treatments were applied to 6- to 8-inch bolting Canada thistle on June 13 with 72 F and 10 mph southwest wind. Treatments were applied with a bicycle-wheel-type plot 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 three replicates.

Table. Canada thistle control with clopyralid&MCPA and adjuvants.

Treatment[a]	Rate	Jun 6 Cath	Jun 25 Cath	Jul 12 Cath	Aug 2 Cath
	oz ai/A	pl/sq m		%	
Clopyralid&MCPA	1.5&8.2	8	83	92	93
Clopyralid&MCPA+fenoxaprop	1.5&8.2+1.32	7	86	91	91
Clopyralid&MCPA+MSO	1.5&8.2+0.25G	14	80	90	95
Clopyralid&MCPA+PO	1.5&8.2+0.25G	2	77	86	94
Clopyralid&MCPA+NIS	1.5&8.2+0.25%	3	78	86	93
Untreated	0	5	0	0	0
CV		62	4	4	2
LSD (0.05)		8	5	6	3

[a] MSO was Sun-it II, PO was Herbimax, and NIS was Activator 90.

Clopyralid&MCPA at 1.5&8.2 oz/A provided 92% Canada thistle control on July 12. Formulated fenoxaprop or MSO did not alter control obtained with clopyralid&MCPA, although the addition of formulated fenoxaprop with clopyralid&MCPA provided better control, 86%, than the addition of MSO, 80%, on June 25. PO and NIS adjuvants reduced thistle control on early evaluation dates by 6 to 9 percentage points. On August 2, all herbicide treatments with additional adjuvant provided similar control, 91 to 95%, to clopyralid&MCPA alone, 93%.

Canada thistle control in small grains. (Howatt, Roach, Davidson-Harrington) "Oxen" hard red spring wheat was seeded May 16 at Fargo. Treatments were applied to 3- to 4-leaf wheat and 6- to 8-inch Canada thistle on June 13 with 72 F and 11 mph wind. Preharvest treatments follow the "/" and were applied to soft dough wheat and 10 to 14 inch Venice mallow and Canada thistle on August 2 with 58 F, 63% relative humidity, 0% cloudcover, 3 mph northwest wind and soil temperature of 65 F. All treatments were hand broadcast with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 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.

Table. Canada thistle control in small grains.

		Jun 6	Jun 21		Jun 28		Jul 12		Aug 2		Aug 14
Treatment[a]	Rate	Cath	Cath	Vema	Cath	Vema	Cath	Vema	Cath	Vema	Yield
	oz ai/A	pl/sq m				%					bu/A
Tribenuron+Activator 90/glyphosate	0.125+0.25%/12	10	32	40	83	89	90	90	94	77	27
Tribenuron+Activator 90/glyphosate	0.125+0.25%/6	18	32	35	85	90	88	90	88	90	29
Tribenuron+Activator 90/glyphosate	0.188+0.25%/12	9	32	30	87	90	88	89	90	88	28
Tribenuron+Activator 90/glyphosate	0.25+0.25%/12	12	37	42	87	90	87	91	86	91	27
Tribenuron+Activator 90	0.25+0.25%	8	32	45	90	92	89	93	89	90	31
Tribenuron+Quad 7	0.25+1%	10	35	42	91	91	90	90	92	90	27
Thif&trib+2,4-D+Activator 90/glyphosate	0.15&0.07+6+0.25%/12	15	37	37	82	90	85	91	81	94	26
Thif&trib+2,4-D+Activator 90/glyphosate	0.2&0.1+6+0.25%/12	6	40	37	86	93	90	95	93	94	26
Thif&trib+2,4-D+Activator 90/glyphosate	0.25&0.12+6+0.25%/12	5	40	40	86	90	90	94	93	95	26
Thif&trib+2,4-D+Activator 90/glyphosate	0.3&0.15+6+0.25%/12	12	40	45	87	90	90	96	91	96	24
Thif&trib+2,4-D+Activator 90	0.3&0.15+6+0.25%	11	47	37	86	94	89	94	88	91	28
Thifensulfuron&tribenuron+Activator 90	0.3&0.15+0.25%	14	37	42	88	92	85	93	84	83	28
Clopyralid&MCPA	11	8	64	22	93	72	91	92	94	89	31
Clopyralid&MCPA/glyphosate	11/12	7	67	20	93	75	91	91	94	89	27
Untreated/glyphosate	0/12	10	0	0	0	0	0	0	0	0	22
Untreated	0	6	0	0	0	0	0	0	0	0	26
CV		84	17	22	4	5	4	4	6	9	8
LSD (0.05)		12	9	10	4	5	5	5	7	10	3

[a] Herbicides following the "/" were applied preharvest, 2,4-D is the ester formulation.

Differences in Canada thistle and Venice mallow control among rates of tribenuron or thifensulfuron&tribenuron were subtle and inconsistent. Weed control with sulfonylureas was not noticeably improved with 6 oz/A 2,4-D. Clopyralid&MCPA provided rapid and consistently greatest control of Canada thistle during the growing season, but Venice mallow control with clopyralid&MCPA was 20 percentage points less than with sulfonylurea treatments until July 12 when all herbicide treatments provided 89 to 96% mallow control. On this date, Canada thistle control was similar, 87 to 91%, for all herbicides except the lowest rate of thifensulfuron&tribenuron+2,4-D or the highest rate of thifensulfuron&tribenuron without 2,4-D, 85% each. At harvest on August 14, preharvest glyphosate provided 75% control of Canada thistle and 95% control of Venice mallow that survived in crop treatments. Canada thistle stem population will be measured again in the spring, 12 months after application.

Long-term Canada Thistle control in wheat. Jenks, Willoughby, and Markle. Alsen wheat was planted May 4, 2001 into 6-inch rows in a conventional tillage system. Individual plots were 10 x 50 ft and replicated three times. Herbicide treatments were applied postemergence (5-leaf) on June 7, 2001 and pre-harvest on August 10, 2001. The wheat was harvested on August 16, 2001. We intended to apply a post-harvest treatment, but there was no Canada thistle regrowth due to very dry conditions. Canada thistle plants were counted in each 10 x 50 ft plot prior to herbicide application in 2001 and again in 2002 to determine the long-term impact of the 2001 herbicide treatments.

Treatment	Rate	Wheat stage	Canada thistle density per plot	
			2001	2002
2,4-D amine / Roundup	0.5 pt / 1 qt	5-leaf / Pre-H	12	6
Banvel + 2,4-D ester / Roundup	3 fl oz + 0.5 pt / 1 qt	5-leaf / PRE-H	19	17
Express + 2,4-D ester	0.167 oz + 0.75 pt	5-leaf	15	41
Express + 2,4-D ester / Roundup	0.167 oz + 0.75 pt / 1 qt	5-leaf / PRE-H	18	9
Bronate / Roundup	1 pt / 1 qt	5-leaf / PRE-H	4	2
Curtail	2 pt	5-leaf	11	7
Express + 2,4-D ester + Starane	0.167 oz + 0.5 pt + 0.33 pt	5-leaf	32	60
Express + 2,4-D ester + Starane[a]	0.167 oz + 0.5 pt + 0.33 pt	5-leaf	69	195
Banvel + 2,4-D ester[a]	3 fl oz + 0.5 pt	5-leaf	12	25
2,4-D ester / Roundup	0.75 pt / 2 qt	5-leaf / PRE-H	46	16
Curtail[a]	2 pt	5-leaf	28	19
Banvel + 2,4-D ester / Distinct	3 fl oz + 0.5 pt / 6 oz	5-leaf / PRE-H	32	45
2,4-D ester / Roundup + Distinct	0.75 pt / 1 qt + 6 oz	5-leaf / PRE-H	46	18
2,4-D ester[a]	0.75 pt	5-leaf	40	40
Untreated			81	356

[a]*Did not receive a post-harvest application of Roundup due to dry conditions and no weed regrowth.*

Curtail applied in-crop or any in-crop treatment followed by Roundup applied pre-harvest reduced Canada thistle densities in 2002 compared to initial densities in 2001. In contrast, Canada thistle densities increased where in-crop treatments (other than Curtail) were not followed by a pre-harvest application of Roundup. Canada thistle densities increased where Distinct was applied pre-harvest, but decreased where Roundup was applied with Distinct pre-harvest.

Control of volunteer Roundup Ready canola in wheat. Jenks, Willoughby, and Markle. Wheat was seeded April 29 over an area that had been in Roundup Ready canola in 2001. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied to canola cotyledons on May 17, 3- to 4-leaf on June 4, or 5-leaf canola on June 14.

			Volunteer canola control		
Treatment[a]	Rate	Canola stage	Jun 8	Jun 24	Jul 24
				%	
Harmony GT	0.075 oz	Cotyledon	65	96	100
Harmony GT	0.15 oz	Cotyledon	68	97	100
Harmony GT	0.3 oz	Cotyledon	79	97	100
2,4-D ester	0.5 pt	Cotyledon	94	98	100
Aim	0.33 oz	Cotyledon	42	96	100
Aim + MCPA ester	0.33 oz + 0.5 pt	3 to 4-leaf		94	100
Bronate Advanced	0.8 pt	3 to 4-leaf		100	100
Harmony GT + Starane	0.3 oz + 0.33 pt	3 to 4-leaf		97	100
Harmony GT + MCPA ester	0.3 oz + 0.5 pt	3 to 4-leaf		99	100
Starane + MCPA ester	0.5 pt + 0.75 pt	3 to 4-leaf		95	100
Express + MCPA ester	0.33 oz + 0.5 pt	3 to 4-leaf		98	100
Aim + MCPA ester	0.33 oz + 0.5 pt	5-leaf		95	100
Bronate Advanced	0.8 pt	5-leaf		100	100
Harmony GT + Starane	0.3 oz + 0.33 pt	5-leaf		87	100
Harmony GT + MCPA ester	0.3 oz + 0.5 pt	5-leaf		92	100
Harmony GT + MCPA ester	0.4 oz + 0.5 pt	5-leaf		93	100
Starane + MCPA ester	0.5 pt + 0.75 pt	5-leaf		83	100
Express + MCPA ester	0.33 oz + 0.5 pt	5-leaf		89	100
Untreated				0	0
LSD (0.05)			13	3	--
CV			10	2	0

[a]*All Harmony GT, Aim, and Express treatments were applied with NIS at 0.125 or 0.25% v/v.*

On June 8, three weeks-after-treatment (WAT), 2,4-D ester provided more volunteer canola control than Harmony GT or Aim applied at the cotyledon stage. Volunteer canola control with Harmony GT increased with application rate. However, all herbicide treatments applied at the cotyledon stage provided more than 96% control of volunteer canola at the June 24 and July 24 evaluations.

Herbicide treatments applied at the 3- to 4-leaf canola stage provided 94-100% control of volunteer canola at the June evaluation. The same treatments applied at 5-leaf canola provided 83-100% volunteer canola control. Aim plus MCPA ester and Bronate Advanced provided equal control at either the 3- to 4-leaf or 5-leaf stages. However, for other herbicides, volunteer canola control was 6-12% lower when applied to larger canola (5-leaf) compared to the 3- to 4-leaf stage application. All treatments provided 100% control at the July evaluation. Dry conditions and crop competition contributed to the volunteer canola control.

Weed control with bromoxynil&MCPA 5EC formulation. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Treatments were applied to 6-leaf wheat, 6- to 8-leaf wild mustard, and 2- to 5-inch redroot pigweed on June 17 with 79 F, 40% relative humidity, 50% cloudcover, and 12 mph southeast wind. Treatments were applied with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 11001 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. Plant populations were 10 wild mustard/m^2 and 25 redroot pigweed/m^2.

Table. Weed control with bromoxynil&MCPA 5EC formulation.

		Jun 28			Jul 22	Aug 8
Treatment	Rate	Wht	Wimu	Rrpw	Rrpw	Yield
	oz ai/A			%		
Bromoxynil&MCPA5	8	0	91	89	79	35
Bromoxynil&MCPA4	8	0	94	99	88	33
Bromoxynil&MCPA5+Fluroxypyr	6+1	0	91	99	84	38
Bromoxynil&MCPA5+Thifensulfuron	8+0.11	0	96	99	90	33
Thifensulfuron+Fluroxypyr	0.22+1	0	84	99	88	35
Clopyralid&MCPA	9.6	0	83	97	81	39
Untreated	0	0	0	0	0	34
CV		0	3	3	6	9
LSD (0.05)		0	3	4	7	5

No wheat injury was observed in this study. On June 28, treatments that contained bromoxynil provided better wild mustard control, 91% or greater, than other herbicide treatments, 83%. The 4EC formulation of bromoxynil&MCPA provided slightly better wild mustard control and gave redroot pigweed control that was 10 percentage points greater than the 5EC formulation. On July 22, the 4EC formulation still provided better control of pigweed than the 5EC formulation. This response is consistent with formulation comparisons in other studies at this location. All herbicides provided 99% wild mustard control on July 22.

Carfentrazone tank-mixes for broadleaf weed control. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Treatments were applied to 5-leaf wheat and 2- to 4-leaf redroot pigweed, wild mustard, and common lambsquarters on June 17 with 83 F, 40% relative humidity, 65% cloudcover, and 7 mph southeast wind. Treatments were broadcast with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 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.

Table. Carfentrazone tank-mixes for broadleaf weed control.

Treatment[a]	Rate	Jun 21				Aug 8
		Wht	Rrpw	Wimu	Colq	Yield
	oz ai/A	%				bu/A
Carfentrazone+thifensulfuron+NIS	0.125+0.225+0.25%	1	86	79	82	49
Carfentrazone+thifensulfuron+NIS	0.125+0.225+0.25%	3	88	80	82	49
Carfentrazone+2,4-D(LV6)+dica+NIS	0.125+4.27+1.5+0.25%	9	92	85	87	46
Carfentrazone+bromoxynil&MCPA	0.125+6	17	87	85	84	47
Carfentrazone+clodinafop+MCPAester+PO	0.125+1+4+1.18%	6	91	87	87	48
Carfentrazone+2,4-D ester+NIS	0.125+1.9+0.25%	12	89	87	84	50
Carfentrazone+fluroxypyr&2,4-D+NIS	0.125+7.5+0.25%	9	89	86	87	50
Bromoxynil&MCPA	8	0	76	84	74	50
Thifensulfuron+fluroxypyr&2,4-D+NIS	0.225+9.75+0.25%	0	78	76	76	52
Untreated	0	0	0	0	0	52
CV		33	6	6	7	9
LSD (0.05)		3	7	7	8	7

[a] First carfentrazone treatment was 40 WG formulation all others treatments with carfentrazone used the 2EW formulation; NIS was Activator 90 and PO was DSV co-pack with clodinafop; Dica was dicamba-dga formulation; Bromoxynil&MCPA was the 5EC formulation.

Wheat injury of small necrotic lesions resulted from carfentrazone application. Wheat injury from carfentrazone was least, 1 to 3%, when thifensulfuron was included. On June 21, carfentrazone+bromoxynil&MCPA resulted in the most wheat injury, 17%, while no injury was observed following application of bromoxynil&MCPA alone. No observable wheat injury remained on July 1 (data not shown). Tank-mixes with carfentrazone increased control of redroot pigweed and common lambsquarters by 10 percentage points compared to bromoxynil&MCPA or thifensulfuron+fluroxypyr&2,4-D on June 21. Carfentrazone also improved control of wild mustard with thifensulfuron+fluroxypyr&2,4-D by 10 percentage points. The 2EW formulation of carfentrazone performed similar to the 40 WG formulation. Wheat yield was similar across all treatments.

Carfentrazone&2,4-D crop safety and weed control. (Howatt, Roach, and Davidson-Harrington) Oxen hard red spring wheat was seeded May 2. Treatments were applied to 6.5-leaf wheat, 0.5- to 2-inch redroot pigweed, and 1- to 2-inch common lambsquarters on June 17 with 79 F, 40% relative humidity, 50% cloudcover, and 12 mph southeast wind. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 11001 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. Weed densities were 10 redroot pigweed/m^2 and 5 common lambsquarters/m^2.

Table. Carfentrazone&2,4-D crop safety and weed control.

		Jun 24	Jul 3		
Treatment[a]	Rate	Wht	Wht	Rrpw	Colq
	oz ai/A		%		
AGH02001+Preference	4.128+0.25%	0	0	98	98
Carf+2,4-D-Salvo+Preference	0.128+4+0.25%	0	0	98	98
AGH02001+Preference	4.128+0.125%	0	0	98	98
AGH02001+Thif+Preference	4.128+0.22+0.25%	0	0	98	98
AGH02001+Thif&Trib+Preference	4.128+0.22+0.25%	0	0	98	98
AGH02001+Trib+Preference	4.128+0.22+0.25%	0	0	98	98
Carf+2,4-D-Salvo+Thif+Preference	0.128+4+0.22+0.25%	0	0	98	98
AGH02001+Preference	6.2+0.25%	0	0	98	98
Carf+2,4-D-Salvo+Preference	0.2+6+0.25%	0	0	98	98
AGH02001+Thif+Preference	6.2+0.22+0.25%	0	0	98	98
Carf+2,4-D-Salvo+Thif+Preference	0.2+6+0.22+0.25%	0	0	98	98
Untreated	0	0	0	0	0
LSD		0	0	1	1

[a] AGH02001 was carfentrazone&2,4-D premix formulation from Agriliance.

The premix of carfentrazone and 2,4-D performed the same as tank-mix treatments in crop response and weed control. Injury from carfentrazone was not apparent on June 24 or on July 3. On July 3, weed control with carfentrazone and 2,4-D was equal for all herbicide treatments regardless of chemical rate, tank-mix partner, or adjuvant rate.

Sulfonylurea tank-mixes for broadleaf weed control. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Treatments were applied to 6-leaf wheat, 5-inch common lambsquarters, and 0.5- to 2-inch redroot pigweed on June 17 with 79 F, 40% relative humidity, 50% cloudcover, and 12 mph southeast wind. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 11001 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. Plant populations were 5 common lambsquarters/m^2 and 10 redroot pigweed/m^2.

Table. Sulfonylurea tank-mixes for broadleaf weed control.

		Jul 1			Jul 23	
Treatment	Rate	Wht	Rrpw	Colq	Rrpw	Colq
	oz ai/A			%		
Bromoxynil&MCPA+fenoxaprop	4&4+1.32	0	91	97	86	96
Thif+brox&MCPA+fenoxaprop	0.225+3&3+1.32	0	91	96	97	99
Thif+carfentrazone+2,4-D+fenoxaprop	0.225+0.128+4+1.32	0	95	95	99	99
Thif+fluroxypyr+clodinafop+Score	0.225+1+1+1%	0	91	94	97	96
Thif&trib+flox+clfp+Score	0.2&0.1+1+1+1%	0	89	92	95	98
Thif&trib+2,4-D+carf	0.2&0.1+3&3+0.128	0	96	96	99	99
Thif&trib+brox&MCPA+fenoxaprop	0.2&0.1+3&3+1.32	0	89	94	97	99
Trib+brox&MCPA+fenoxaprop	0.125+3&3+1.32	0	86	94	88	97
Untreated	0	0	0	0	0	0
CV		0	4	3	2	2
LSD (0.005)		0	5	4	3	3

No wheat injury was observed for any treatment. All herbicide treatments essentially provided similar control of redroot pigweed and common lambsquarters on July 1. Bromoxynil&MCPA+fenoxaprop or tribenuron+bromoxynil&MCPA+fenoxaprop gave less than 90% pigweed control while all other herbicide treatments provided 95% control or better on July 23. All herbicide treatments provided greater than 95% common lambsquarters control on July 23.

Crop safety of glyphosate on glyphosate-resistant wheat. (Howatt, Roach, and Davidson-Harrington) Glyphosate-resistant wheat was seeded May 14 at Fargo. Treatments for 3-leaf application timing were applied to 2.5- to 3-leaf wheat on June 5 with 75 F, 24% relative humidity, 5% cloudcover, 3 mph northeast wind, and soil temperature of 61 F. Treatments for 5-leaf application timing were applied to 5- to 6-leaf wheat on June 17 with 76 F, 85% cloudcover, and 6 mph east wind. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 8001 (3-leaf) and 11001 (5-leaf) 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.

Table. Crop safety of glyphosate on glyphosate-resistant wheat.

Treatment	Rate	Timing	Jun 24 Wht	Jul 1 Wht	Jul 15 Wht	Sep 4 Yield
	oz ai/A	leaf		%		bu/A
Glyphosate	6	3	0	0	0	25
Glyphosate	9	3	0	0	0	27
Glyphosate	12	3	1	0	0	28
Glyphosate	6	5	1	0	0	28
Glyphosate	9	5	0	0	0	29
Glyphosate	12	5	0	0	0	31
Glyphosate/glyphosate	6/6	3/5	0	0	0	29
Clodinafop+DSV+bromoxynil&MCPA	0.8+1%+8	5	0	0	0	29
Fenoxaprop+bromoxynil&MCPA	1.32+8	5	1	0	0	27
Tralkoxydim+Supercharge+brox&MCPA	2.88+0.5%+8	5	1	0	0	28
Flucarbazone+brox&MCPA+Act90	0.42+8+0.25%	5	22	9	3	25
Fluroxypyr+2,4-D ester	3+4	5	1	0	0	28
Bromoxynil&MCPA	8	5	1	0	0	27
Thifensulfuron+2,4-D LV ester	0.37+4	5	3	0	0	26
2,4-D ester	4	5	0	0	0	27
Dicamba	1	5	0	0	0	27
Untreated	0		0	0	0	25
CV			100	53	118	13
LSD (0.05)			3	1	1	5

Wheat was not visibly injured from glyphosate application. Thifensulfuron+2,4-D caused minor chlorosis on June 24 but was not observed on later evaluation dates. Flucarbazone+bromoxynil&MCPA caused significant stunting that diminished, but persisted, through the growing season. Wheat yields were essentially similar for all treatments and ranged from 25 to 31 bu/A.

Crop safety of glyphosate on Roundup Ready hard red spring wheat. (Hendrickson, Endres, and Valenti) The objective of the study was to evaluate crop safety of Roundup Ultramax against competitive treatments in weed free Roundup Ready hard red spring wheat. The experiment was conducted at the NDSU Carrington Research Extension Center on a loam soil with a 6.8 pH and 3.9% organic matter. 'SD99' glyphosate resistant hard red spring wheat was planted at approximately 120 lb seed/A on May 14, 2002. EPOST herbicide treatments were applied to 2.5-leaf wheat on May 31 with 85° F, 20% RH, 95% cloud cover, 5 mph wind, and 79° F soil temperature. POST herbicide treatments were applied to 4- to 5-leaf wheat on June 17 with 75° F, 24% RH, 90% cloud cover, 8 mph wind, and 75° F soil temperature. A blanket application of Roundup Ultramax at 0.75 lb ae/A was applied June 7 to eliminate potential weed problems. Individual plots were 8 ft by 25 ft and arranged in a randomized complete block design with three replications. Herbicide treatments were applied with a CO_2–hand boom sprayer delivering 10 gpa at 26 psi through XR 80015 flat fan nozzles. Crop injury was visually evaluated for chlorosis, necrosis, and growth reduction 7, 14, and 21 days after application. The trial was harvested for seed yield with a plot combine on September 6.

Table.

Treatment[a]	Rate[b]	Timing	Seed yield
	lb ai/A		bu/A
Roundup Ultramax	0.375	EPOST	38
Roundup Ultramax	0.56	EPOST	40
Roundup Ultramax	0.75	EPOST	39
Roundup Ultramax	0.375	POST	41
Roundup Ultramax	0.56	POST	37
Roundup Ultramax	0.75	POST	39
Roundup Ultramax / Roundup Ultramax	0.375 / 0.375	EPOST / POST	41
Discover+Bronate Advantage+DSV	0.05+0.5+1%v/v	POST	35
Puma+Bronate Advantage	0.08+0.5	POST	38
Achieve+Bronate Advantage+Supercharge	0.18+0.5+0.5%v/v	POST	36
Everest+Bronate Advantage+NIS	0.026+0.5+0.25%v/v	POST	35
Starane+2,4-D Ester	0.1875+0.25	POST	39
Bronate Advantage	0.5	POST	38
Harmony GT+2,4-D Ester	0.023+0.25	POST	35
2,4-D Ester	0.25	POST	41
Banvel	0.06	POST	39
Untreated check	0	-	38
LSD (P=.05)			NS

[a]DSV and Supercharge=adjuvants from Syngenta, NIS=nonionic surfactant=Preference.

[b]Rates for Roundup Ultramax are in lb ae/A.

Glyphosate did not injure the wheat when visually evaluated for chlorosis, necrosis, or growth reduction (data not shown). Everest caused a 7% reduction in growth when evaluated 7 DAT (data not shown.). Wheat seed yield ranged from 35 to 41 bu/A (Table).

Crop safety of Roundup Ultramax on Roundup Ready Wheat, Langdon. (Lukach) Glyphosate tolerant hard red spring wheat was seeded on May 18. Fertility was adequate for an 80 bu/A yield goal. Treatments were applied to 3.5 leaf wheat on June 12 with 56°F, 78% RH, and 12 mph southwest wind. Treatments were applied to 5-5.5 leaf wheat on June 17 with 69°F, 56% RH, and 8 mph southeast wind. Roundup Ultramax at 20 oz/a plus 1.7 lb/a AMS was applied on June 4 to the entire trial. Between June 8 to 24, 6.37 inches of precipitation was recorded. Treatments were applied June 12 with a bicycle-wheel-type sprayer and a hand held boom on June 17. Both systems used DG80015 tips delivering 10 gpa at 35 psi. Plot size was 10 by 30 feet with 4.5 by 24 feet harvested. The experiment was a randomized complete block design with four replicates. Harvest was on September 13.

Treatment	Rate	leaf stage	25-Jun Injury	10-Jul Injury	July Head	Heading delay	Height	Yield
	lb ai/a		%	%	Date	days	cm	bu/a
Roundup Ultramax + AMS	0.375+1.#	3.5	0	0	11	0	81	54
Roundup Ultramax + AMS	0.56+1.7#	3.5	0	0	11	0	79	56
Roundup Ultramax + AMS	0.75+1.7#	3.5	1	1	12	1	76	56
Roundup Ultramax + AMS	0.375+1.7#	5	0	0	11	0	78	61
Roundup Ultramax + AMS	0.56+1.7#	5	0	0	11	0	78	58
Roundup Ultramax + AMS	0.75+1.7#	5	0	0	11	0	78	63
Roundup Ultramax + AMS	0.375+1.7#	3.5 & 5	1	0	12	0	74	63
Discover+Bronate+DSV	0.05+0.5+1%	5	1	2	12	1	77	59
Puma+Bronate	0.08+0.5	5	2	1	12	1	77	57
Achieve+Bronate+ Supercharge	0.18+0.5+ 0.5%	5	21	5	13	2	75	56
Everest+Bronate+NIS	0.026+0.5 +0.25%	5	7	5	12	1	75	58
Starane+2,4-D LVester	0.1875+0.25	5	0	0	12	0	81	55
Bronate	0.5	5	1	0	12	0	79	59
HarmonyGT+ 2,4-D Lvester	0.023+0.25	5	0	1	12	0	76	57
2,4-D LVester	0.25	5	0	0	12	0	78	53
Clarity	0.06	5	0	1	12	0	80	58
No Control	0	5	0	0	12	0	81	56
C.V. %			67	154	4	124	4	8
LSD 5%			2	2	1	1	4	NS
# OF REPS			4	4	4	4	4	4

2,4-D LVester= Agsco MXL, Bronate is the 4EC formulation, NIS = Activator 90

Achieve caused yellowing and striped leaves. Everest and Puma caused chlorosis but not yellowing. All yellowing and chlorosis were gone by June 10. Injury notes are reduction in plant growth. The heading delay is a comparison to the unsprayed borders on each plot.

Broadleaf weed control in glyphosate-resistant spring wheat. (Howatt, Roach, and Davidson-Harrington) Glyphosate-resistant hard red spring wheat was planted May 14 at Fargo. Treatments for 3-leaf application timing were applied to 2.5- to 3-leaf wheat, 4-inch Canada thistle in early bolt, 1- to 2-inch common lambsquarters, and 2- to 4-leaf wild mustard on June 5 with 76 F, 24% relative humidity, 5% cloudcover, 2 mph northeast wind, and soil temperature of 61 F. Treatments for 5-leaf application timing were applied to 5-leaf wheat, 6-inch bolting Canada thistle, 2- to 3-inch common lambsquarters, and 4- to 8-leaf wild mustard on June 13 with 59 F, 80% cloudcover, and 9 northwest wind. All treatments were applied with a backpack type sprayer delivering 8.5 gpa at 35 psi through 8001 (3-leaf) and 11001 (5-leaf) 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 three replicates.

Table. Broadleaf weed control in glyphosate-resistant spring wheat.

			Jun 24				Jun 29		Aug 6		Sep 4
Treatment[a]	Rate	Timing	Wht	Cath	Colq	Wimu	Cath	Wimu	Cath	Colq	Yield
	oz ai/A	leaf				%					bu/A
Glyphosate+AMS	6+23	3	0	80	90	89	88	87	83	88	26
Glyphosate+AMS	9+23	3	0	88	91	88	89	82	88	91	32
Glyphosate+AMS	12+23	3	0	85	93	92	85	88	88	94	30
Glyphosate+AMS	6+23	5	0	89	91	94	93	95	88	94	28
Glyphosate+AMS	9+23	5	0	87	92	95	89	94	89	94	28
Glyphosate+AMS	12+23	5	0	91	95	95	93	96	87	93	31
Glyt+AMS/glyt+AMS	6+23/6+23	3/5	0	92	96	98	88	95	82	87	30
Clfp+brox&MCPA+Score	1+8+1%	5	0	88	94	97	87	93	84	96	27
Fenx+brox&MCPA	1.32+8	5	0	89	95	98	89	97	80	96	27
Tral+Supercharge+brox&MCPA	2.88+0.5%+8	5	0	61	96	97	75	96	88	93	28
Flcz+brox&MCPA+Act90	0.42+8+0.25%	5	0	61	96	97	93	97	92	94	22
Glyt+2,4-D ester+AMS	6+4+23	5	0	90	93	94	91	96	93	93	22
Glyt+brox&MCPA+AMS	6+8+23	5	0	28	62	62	62	65	57	58	28
Glyt+thif+AMS	6+0.37+23	5	0	86	89	92	94	96	87	95	27
Glyt+dica-dga+AMS	6+1+23	5	0	59	93	88	91	94	89	94	27
Glyt+clpy&2,4-D+AMS	6+9.3+23	5	0	89	87	88	90	96	94	97	23
Untreated	0		0	0	0	0	0	0	0	0	14
CV			0	33	16	16	18	16	16	15	8
LSD (0.05)			0	41	22	22	25	23	21	22	17

[a] "/" indicates sequential treatment components separated in time.

Two applications of glyphosate provided at least 92% control of weeds present on June 24. Other herbicide treatments performed well, but glyphosate+bromoxynil&MCPA exhibited antagonism resulting in 28% Canada thistle control and 62% common lambsquarters and wild mustard control on June 24. This antagonistic response was evident throughout the growing season, but the poor weed control did not result in wheat yield reduction. On June 29, glyphosate applications at the 5-leaf timing tended to provide better weed control than the 3-leaf application treatments. Glyphosate+clopyralid&2,4-D, glyphosate+2,4-D, and flucarbazone+bromoxynil&MCPA gave greater than 90% control of all three weed specieas at the end of the season.

Grass control with tank-mixes of imazamox and broadleaf herbicides. (Howatt, Roach, and Davidson-Harrington) Imidazolinone-resistant hard red spring wheat was seeded May 2 at Fargo. Treatments were applied to 5-leaf wheat and 5-leaf yellow foxtail on June 20 with 59 F, 54% relative humidity, 9 mph northwest wind, and soil temperature of 62 F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 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. Yellow foxtail population was 400 plants/m^2. A non-commercial wheat cultivar was used in this experiment; therefore, yield was expressed as percent of untreated control.

Table. Grass control with tank-mixes of imazamox and broadleaf herbicides.

		Jul 5		Jul 22		Aug 6	Aug 14
Treatment[a]	Rate	Wht	Yeft	Wht	Yeft	Yeft	Yield
	oz ai/A			%			%
Imazamox+NIS+UAN	0.5+0.25%+1%	1	88	0	86	85	100
Immx+MCPA+NIS+UAN	0.5+4+0.25%+1%	1	88	0	85	83	100
Immx+brox+MCPA+NIS+UAN	0.5+3+4+0.25%+1%	2	88	0	85	83	112
Immx+brox+MCPA+NIS	0.5+3+4+0.25%	1	88	1	80	76	106
Immx+2,4-D+NIS+UAN	0.5+4+0.25%+1%	1	85	0	85	82	94
Imazamox+2,4-D+NIS+UAN	0.5+6+0.25%+1%	1	85	1	83	80	100
Immx+dica-dga+NIS+UAN	0.5+1+0.25%+1%	4	84	1	79	76	94
Immx+fluroxypyr+NIS+UAN	0.5+2+0.25%+1%	0	85	0	84	83	112
Immx+carfentrazone+NIS+UAN	0.5+0.128+0.25%+1%	0	88	0	82	78	106
Immx+imazethapyr+NIS+UAN	0.384+0.384+0.25%+1%	0	86	0	85	81	106
Clodinafop+PO	1+1.2%	1	96	0	87	89	119
Clodinafop+PO+dicamba-dga	1+1.2%+1	2	93	1	89	86	94
Untreated	0	0	0	0	0	0	100
CV		151	3	337	3	5	12
LSD (0.05)		2	3	1	3	5	75

[a] NIS was Activator 90; UAN was 28%; MCPA was the ester formulation; 2,4-D was the ester formulation; and PO was DSV in co-pack with clodinafop.

Imazamox with bromoxynil+MCPA+NIS+UAN or dicamba+NIS+UAN resulted in slight, 2 to 4%, stunting of wheat. Dicamba also caused this injury when tank-mixed with clodinafop. Wheat injury did not persist and there was no evidence that yield was reduced because of it. Imazamox at 0.5 oz/A with NIS and UAN provided 86% yellow foxtail control on July 22. This control was reduced to 79% by the addition of dicamba. Removing UAN from imazamox+bromoxynil+MCPA+NIS+UAN changed foxtail control from 85% with UAN to 80% without UAN. Increasing the rate of 2,4-D from 4 oz/A to 6 oz/A did not affect yellow foxtail control with imazamox.

Preharvest desiccation in wheat. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Early season weed control was obtained with fenoxaprop+bromoxynil&MCPA at 1.32+3&3 oz/A applied to the entire study area. Treatments were applied wheat near 30% grain moisture and 6- to 12-inch weeds on July 30 with 69 F, 84% relative humidity, 0% cloudcover, 6 mph northeast wind, and soil temperature of 75 F. Treatments were applied with a backpack sprayer delivering 8.5 gpa (17 gpa for paraquat) at 40 psi through 11001 flat fan nozzles (8002 twinjet nozzles for paraquat) 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. Wheat moisture calculations were based on whole plant moisture content sampling 1 ft^2 in the first three replicates. Moisture content was primarily for wheat vegetation because weed populations were low.

Table. Preharvest desiccation in wheat.

		Aug 2				Aug 5	Aug 8				Aug 28
		Wheat dry down		Weed control		Wheat	Wheat dry down		Weed control		Weeds
Treatment[a]	Rate	Visible	Moisture	Grass	Broadleaf	Moisture	Visible	Moisture	Grass	Broadleaf	All
	oz ai(ae)/A					%					
Glyphosate-ipa+AMS	9+10	93	45	81	77	31	99	26	98	97	98
Glyphosate-dam+AMS	9+10	95	60	95	91	32	99	25	98	97	98
Glyphosate&AMADS	75	95	44	87	91	25	99	24	98	97	99
Paraquat	9	96	41	96	93	33	99	36	90	91	93
Glyphosate-ipa+Class Act NG	9+2.5%	93	42	87	85	29	99	25	98	97	98
Glyt-ipa+AGH02001+Class Act NG	9+4.13+2.5%	94	43	93	92	34	99	24	99	97	98
Glyt-ipa+AGH02001+Placement +Class Act NG	9+4.13+0.1G +2.5%	93	45	84	89	28	99	27	97	97	97
Glyphosate-k+AMS	9+10	92	47	81	84	30	99	26	99	96	98
Untreated	0	88	46	0	0	30	99	33	0	0	0
C.V.		1	22	3	3	16	0	15	2	2	1
LSD (0.05)		2	18	3	3	9	0	7	2	2	1

[a] Fromulations: -ipa was isopropylamine, -dam was diammonium, and –k was potassium; AGH02001 was carfentrazone&2,4-D from Agriliance.

Glyphosate-ipa+AMS gave 10 to 15% less weed control on August 2 than other herbicide treatments. On this date, paraquat provided at least 93% control of weeds present. On subsequent evaluation dates, some weeds recovered from paraquat treatment resulting in less weed control than glyphosate treatments. Weed control with paraquat was at least 90% for all evaluations. Glyphosate formulation did not affect weed control, 96 to 99%, on August 8 and 28. Wheat moisture, 24 to 26%, on August 8 was lower in plots treated with all glyphosate formulations than the untreated control, 33%, while wheat treated with paraquat, 36%, had similar moisture content to the untreated control.

Paraquat weed control and as a harvest aid in wheat. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Early season weed control was obtained with fenoxaprop+bromoxynil&MCPA at 1.32+3&3 oz/A applied to the entire study area. Treatments 10 to 14 days before harvest (DBH) were applied to early hard dough stage wheat and 6- to 12-inch weeds on July 26 with 78 F, 72% relative humidity, 5 mph north wind, and soil temperature of 71 F. Treatments 7 DBH were applied to hard dough stage wheat and 6- to 12-inch weeds on August 2 with 63 F, 50% relative humidity, 0% cloudcover, 3.5 mph northwest wind, and soil temperature of 63 F. Treatments 3 DBH were applied to mature wheat and 6- to 12-inch weeds on August 6 with 64 F, 100% cloudcover, and 6 mph east wind. Treatments were hand broadcast with a backpack type sprayer delivering 8.5 gpa (17 gpa for paraquat) at 40 psi through 11001 flat fan nozzles (8002 twin jet nozzles for paraquat) 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. Wheat moisture calculations were based on whole plant moisture content sampling 1 ft^2 in the first three replicates. Moisture content was primarily for wheat vegetation because weed populations were low.

Table. Paraquat weed control and as a harvest aid in wheat.

			Aug 2				Aug 8				Aug 28
			Wheat dry down		Weed control		Wheat dry down		Weed control		Weeds
Treatment[a]	Rate	Timing	Visible	Moisture	Grass	Broadleaf	Visible	Moisture	Grass	Broadleaf	All
	oz ai(ae)/A	DBH					%				
Paraquat	7.5	10 to 14	98	45	96	92	99	28	87	93	92
Glyphosate-ipa	12	10 to 14	95	44	85	83	99	24	99	96	98
Paraquat	7.5	7					99	31	87	89	91
Glyphosate-ipa	12	7		46			99	30	92	91	97
Glyphosate-ipa	7.5	7					99	28	87	88	97
Glyphosate-dam	12	7					99	25	91	94	97
Glyphosate-dam	7.5	7					99	32	86	94	97
Paraquat+2,4-D	7.5+9.3	7					99	35	89	94	95
Paraquat+dicamba-dga	7.5+4	7					99	31	86	96	94
Glyphosate-ipa+2,4-D	12+8	7					99	30	88	92	98
Glyphosate-ipa+dica-dga	12+4	7		50			99	30	89	93	98
Metsulfuron+2,4-D ester	0.06+8	7					99	35	0	27	42
Paraquat	7.5	3					99	31	79	83	92
Paraquat+2,4-D ester	7.5+8	3					99	29	82	91	91
Untreated	0		88	44	0	0	99	31	0	0	0
CV			1	8	1	2	0	15	3	3	4
LSD (0.05)			2	7	1	2	0	7	4	4	5

[a] Formulations: -ipa was isopropylamine, -dam was diammonium, and –dga was diglycolamine.

For the 10 to 14 DBH treatments, paraquat provided better weed control on August 2, but some weeds recovered from the paraquat treatment and on August 8 glyphosate provided better weed control than paraquat. Even though wheat was visibly drier in the field on August 2, moisture content was not different from wheat in plots that had not been sprayed. On August 8, metsulfuron+2,4-D gave very poor broadleaf weed control, 27%, and did not affect grasses. Weed control with metsulfuron+2,4-D increased to 42% on August 8 due to activity on broadleaf weeds. When applied 7 DBH, paraquat alone or in tank-mixes provided similar control to glyphosate alone or in tank-mixes on August 8. Glyphosate formulations performed similar to each other, and weed control increased as glyphosate rate increased on August 8. Both glyphosate formulations provided better weed control than paraquat on August 28. There was no evidence to support using preharvest herbicide treatments to increase speed of wheat dry down, but weed control generally exceeded 85% at harvest, which could aid harvest in weedy fields.

Glyphosate&AMADS preharvest desiccation. (Howatt, Roach, and Davidson-Harrington) 'Oxen' hard red spring wheat was seeded May 2 at Fargo. Early season weed control was obtained with fenoxaprop+bromoxynil&MCPA at 1.32+3&3 oz/A applied to the entire study area. Treatments were applied to wheat near 35% grain moisture and 6- to 12-inch weeds on July 26 with 78 F, 72% relative humidity, 5 mph north wind, and soil temperature of 71 F. Treatments were applied to wheat near 20% grain moisture and 6- to 12-inch weeds on August 2 with 71 F, 29% relative humidity, 5% cloudcover, 5 mph west wind, and soil temperature of 63 F. Treatments were hand broadcast with a backpack type sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Wheat moisture calculations were based on whole plant moisture content sampling 1 ft^2 in the first three replicates. Moisture content was primarily for wheat vegetation.

Table. Glyphosate&AMADS preharvest desiccation.

			Aug 2				Aug 8				Aug 28
			Wheat dry down		Weed control		Wheat dry down		Weed control		Weeds
Treatment[a]	Rate	Timing	Visible	Moisture	Grass	Broadleaf	Visible	Moisture	Grass	Broadleaf	All
	oz ai/A	%	%				%				
Glyphosate&AMADS+Liberate	50+0.25%	35	96	41	91	91	99	24	98	97	98
Glyphosate&AMADS+Liberate	100+0.25%	35	97	47	72	68	99	27	74	72	73
Glyphosate+AMS	6+10.88	35	96	37	86	86	99	25	99	96	97
Glyphosate+AMS	12+10.88	35	96	37	91	85	99	22	99	96	98
ETK 2350+Liberate	12+0.25%	35	94	42	0	17	99	31	17	25	75
ETK 2350+Liberate	18+0.25%	35	92	43	0	30	99	28	15	30	79
Glyphosate+2,4-D LV4+AMS	6+6+10.88	35	95	42	84	74	99	25	97	95	97
Glyphosate+2,4-D LV4+AMS	9+9+10.88	35	96	38	82	82	99	28	99	97	99
Glyt&AMADS+Liberate	50+0.25%	20					99	29	84	89	96
Glyt&AMADS+Liberate	100+0.25%	20					99	30	92	94	98
Glyphosate+AMS	6+10.88	20					99	33	87	90	98
Glyphosate+AMS	12+10.88	20					99	29	88	88	97
ETK 2350+Liberate	12+0.25%	20					99	31	12	15	70
ETK 2350+Liberate	18+0.25%	20					99	30	17	30	79
Glyphosate+2,4-D LV4+AMS	6+6+10.88	20					99	27	86	91	97
Glyphosate+2,4-D LV4+AMS	9+9+10.88	20					99	28	87	90	98
Untreated	0	20	88	46	0	0	99	29	0	0	0
CV			1	25	28	26	0	15	18	18	14
LSD 5%			2	23	23	227	0	7	17	18	18

[a] ETK 2350 was an acid formulation of glyphosate&2,4-D in 1:1 ratio.

Weed control on August 8 was similar for each herbicide treatment when applied at 35 or 20% grain moisture, except glyphosate&AMADS at 100 oz/A applied at 35% grain moisture provided 73% control compared to 93% control when applied at 20% moisture. Weed control did not increase as herbicide rate increased. ETK 2350 gave poor weed control, 15 to 30% on August 8, and symptoms developed very slowly compared to glyphosate+2, 4-D, 86 to 99% control. There was no evidence to support using preharvest herbicide treatments to increase speed of wheat dry down, but weed control with effective treatments generally exceeded 85% at harvest, which could aid harvest in weedy fields.

VARITAL TOLERANCE TO FAR-GO HERBICIDE AT HETTINGER (Eriksmoen)
Stand reduction: + = susceptible, ? = questionable, 0 = tolerant

Variety	5/24/02	5/22/01	5/22/00	6/9/99	5/26/98	6/18/97	6/20/96	6/9/95
Keene	+	+	0	0	+	0	+	0
Russ	0	0	0	0	?	0	0	0
Oxen	0	0	0	0	0	0	0	0
Gunner	0	+	0	0	0	0	+	
Reeder	0	0	0	0	0	0	0	
Parshall	0	0	0	0	0	0	0	
Ingot	0	0	0	0	0			
Norpro	0	0	0	0				
Dandy	0	0	0	0				
McKenzie	0	+	+	0				
Mercury	0	0	0	0				
Alsen	0	0	0	0				
Walworth	0	0						
Knudson	0	+						
Keystone	0	0						
AC Superb	0	+						
Zeke	0	0						
Hank	0							
Briggs	0	0						
Hanna	0	0						
Granite	?							
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 HWSW				0	0	0	0	0
Amidon				0	+	+	+	+
Trenton				0	0	0	0	0
Hammer				0	+	0	+	+
Lars				0	0	0	0	0
Sharp				0	0	0	0	0
Verde				0	0	0	0	0
Nora				0	0	0	0	
Forge				0	0	0	+	
AC Cadillac				0	0	0		
Sharpshooter				0	0	0		
Hager				0	+	0		
AC Eatonia					0	0	0	+
McNeal					0	0	0	0

Planting date: 4/11/02, 4/17/01, 4/4/00, 4/13/99, 4/8/98, 4/29/97, 4/19/9
4/7/95
Date of Application: 4/11/02, 4/16/01, 3/27/00, 4/12/99, 4/3/98, 4/3/97,
4/18/96, 3/24/95
Rate of Application: 1997-02 = 3 pts/A, 1995/6 = 2 pts/A

2002 VARITAL TOLERANCE TO FAR-GO HERBICIDE AT HETTINGER

Stand reduction: + = susceptible, 0 = tolerant

Variety	5/24/02 (3 leaf)
Oxen	0
Ingot	0
Walworth	0
Russ	0
Briggs	0
Parshall	0
Reeder	0
Alsen	0
Keene	+
Mercury	0
Norpro	0
Gunner	0
Dandy	0
Knudson	0
Keystone	0
McKenzie	0
Hank	0
Granite	0
AC Superb	0
Hanna	0
ND724	+-
ND722	+
ND729	+
ND731	0
ND738	0
ND743	0
ND745	0
ND744	0
ND739	0
ND741	0
ND749	0
ND750	0
ND746	0
MT9874	+
Zeke	0

Planting date: 4/11/02
Date of Application: 4/11/02
Rate of Application: 3 pts/A

HRSW VARIETY TOLERANCE TO AVENGE HERBICIDE AT HETTINGER (Eriksmoen)

Injury: + = susceptible, 1 = moderate tolerance, 0 = tolerant

HRSW	1993	1994	1995	1996	1997	1998	1999	2000	2002
Keene	0	1	0	1	1	1	0	0	0
Russ		+	1	1	1	1	0	0	0
Oxen			0	1	0	1	0	1	0
Gunner				+	+	+	+	+	+
Reeder				+	+	+	1	+	0
Parshall				+	+	+	0	0	0
Ingot						1	0	0	0
Norpro							0	0	0
Dandy							0	0	0
McKenzie							0	0	0
Mercury							0	0	0
Alsen							1	+	0
Granite									1
Walworth									0
Briggs									0
Knudson									0
Keystone									0
Hank									0
AC Superb									0
Hanna									0
Zeke									0
Butte 86	0	1	+	1	1	1	1	1	
Grandin	+	+	+	+	+	1	1	1	
2375	0	1	1	1	0	1	0	0	
2398	0	1	1	+	0	0	0	0	
Ernest	0	1	0	1	0	0	0	1	
HJ98					0	0	0	0	
Ivan						0	0	0	
Ember						1	0	0	
Scholar							0	0	
Aurora							0	0	
2371	0	1	1	+	0	1	0		
Sharp	0	1	1	1	0	1	0		
Kulm	0	1	1	1	0	+	+		
Amidon	0	+	0	1	1	0	1		
Trenton	+	+	+	+	+	+	1		
Hamer		1	0	1	0	1	0		
Lars		1	1	1	0	1	0		
Verde		+	+	+	+	+	+		
AC Barrie			0	1	0	1	0		
Argent HWSW			+	+	+	1	0		
Forge				1	1	1	0		
Nora				+	+	+	+		
AC Cadillac					0	1	0		
Sharpshooter					0	1	0		
Hager					0	1	0		
McNeal	0	+	1	1	1	0			
AC Eatonia		+	0	1	0	1			

Date of Application: 5/13/93, 5/20/94, 5/29/95, 6/11/96, 6/2/97, 5/25/98, 5/20/99, 5/15/00, 5/30/02

Rate of Application: 4 pts/A, (1999=3.5 pts/A)

DURUM VARIETY TOLERANCE TO AVENGE HERBICIDE AT HETTINGER (Eriksmoen)

Injury: + = susceptible, 1 = moderate tolerance, 0 = tolerant

Durum	1993	1994	1995	1996	1997	1998	1999	2000	2002
Rugby	0	1	0	1	0	1	0	0	0
Ben	0	1	0	1	0	1	0	0	0
Monroe	0	1	0	1	0	1	0	0	0
Renville	1	+	1	+	1	1	0	1	0
Munich	0	1	1	1	0	1	1	0	0
Belzer	+	+	+	+	+	+	+	+	+
Maier	0	1	0	1	0	1	0	0	0
Mountrail		+	+	1	1	+	0	+	1
Lebsock		+	1	+	+	+	0	+	1
Plaza			1	1	1	1	0	0	0
Pierce						1	0	0	0
Dilse						1	0	0	0
Plenty	0	1	1	1	0	1	0	0	
AC Melita			0	1	0	1	0	0	
Dressler				1	1	1	0	0	
Kari				+		+	1	+	
Vic	+	+	+	+	+	+	1		
Lloyd	0		0	1	1	1	0		
Ward	0	1	1	1	0	1			
Medora	0	1	1	1	+	1			
Sceptre	0	1	1	1	1	1			
Laker	1	+	+	+	+	+			
Regold	1	+	+	+	1	+			
Voss	0	1	+	+	0	1			

Date of Application: 5/13/93, 5/20/94, 5/29/95, 6/11/96, 6/2/97, 5/25/98, 5/20/99, 5/15/00, 5/30/02

Rate of Application: 4 pts/A (1999=3.5 pts/A)

2002 VARITAL TOLERANCE TO AVENGE HERBICIDE AT HETTINGER

Injury: 2 = susceptible, 1 = moderate tolerance, 0 = tolerant

HRSW	6/14
Oxen	0
Ingot	0
Walworth	0
Russ	0
Briggs	0
Parshall	0
Reeder	0
Alsen	0
Keene	0
Mercury	0
Norpro	0
Gunner	2
Dandy	0
Knudson	0
Keystone	0
McKenzie	0
Hank	0
Granite	1
AC Superb	0
Hanna	0
Zeke	0
ND724	0
ND722	0
ND729	0
ND731	0
ND738	2
ND743	0
ND745	0
ND744	0
ND739	0
ND741	1
ND749	0
ND750	1
ND746	0
MT9874	0

Durum	6/14
Rugby	0
Monroe	0
Renville	0
Munich	0
Ben	0
Belzer	2
Maier	0
Mountrail	1
Lebsock	1
Plaza	0
Pierce	0
Dilse	0
D95077	2
D95672	0
D95097	0
D96604	0
D96622	1
D98529	0
D95123	0
D98015	0
D98062	1
D98530	0
D98682	0
D98813	0
D98867	0
D98908	0

Planting date: 4/11/02
Date of application: 5/30/02
Crop: 3.5 leaf
Rate of application: 4 pts/A

2002 VARITAL TOLERANCE TO TREFLAN HERBICIDE AT HETTINGER

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

HRSW	5/24
Oxen	0
Ingot	0
Walworth	0
Russ	0
Briggs	0
Parshall	0
Reeder	0
Alsen	0
Keene	0
Mercury	?
Norpro	0
Gunner	0
Dandy	+
Knudson	+
Keystone	0
McKenzie	0
Hank	0
Granite	0
AC Superb	0
Hanna	0
Zeke	+
ND724	0
ND722	0
ND729	0
ND731	0
ND738	0
ND743	0
ND745	0
ND744	0
ND739	0
ND741	0
ND749	?
ND750	1
ND746	0
MT9874	0

Durum	5/24
Rugby	0
Monroe	0
Renville	0
Munich	0
Ben	0
Belzer	0
Maier	0
Mountrail	0
Lebsock	0
Plaza	0
Pierce	0
Dilse	0
D95077	0
D95672	0
D95097	0
D96604	0
D96622	0
D98529	0
D95123	0
D98015	0
D98062	0
D98530	0
D98682	0
D98813	0
D98867	+
D98908	0

Planting date: 4/11/02
Date of application: 4/11/02
Rate of application: 1.5 pts/A

VARITAL TOLERANCE TO TREFLAN HERBICIDE AT HETTINGER

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

HRSW	2000	2002
Oxen	0	0
Ingot	0	0
Walworth		0
Russ	+	0
Briggs		0
Parshall	0	0
Reeder	0	0
Alsen	0	0
Keene	0	0
Mercury	0	?
Norpro	+	0
Gunner	0	0
Dandy	+	+
Knudson		+
Keystone		0
McKenzie	0	0
Hank		0
Granite		0
AC Superb		0
Hanna		0
Zeke		+
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	2000	2002
Rugby	0	0
Monroe	0	0
Renville	0	0
Munich	0	0
Ben	+	0
Belzer	0	0
Maier	0	0
Mountrail	0	0
Lebsock	0	0
Plaza	0	0
Pierce	0	0
Dilse	0	0
1AS/1D2	0	
AC Melita	0	
Plenty	0	
Kari	0	
Dressler	0	

Planting date: 4/4/00, 4/11/02
Date of application: 3/27/00, 4/11/02
Rate of application: 1.5 pts/A

2002 VARITAL TOLERANCE TO EVEREST HERBICIDE AT HETTINGER

Injury: + = stunting, 0 = none

HRSW	7/9
Oxen	0
Ingot	0
Walworth	0
Russ	0
Briggs	0
Parshall	0
Reeder	0
Alsen	0
Keene	0
Mercury	0
Norpro	0
Gunner	0
Dandy	+
Knudson	0
Keystone	0
McKenzie	+
Hank	0
Granite	0
AC Superb	0
Hanna	0
Zeke	0
ND724	0
ND722	0
ND729	0
ND731	0
ND738	0
ND743	+
ND745	0
ND744	+
ND739	0
ND741	+
ND749	0
ND750	0
ND746	0
MT9874	0

Durum	7/9
Rugby	0
Monroe	0
Renville	0
Munich	0
Ben	+
Belzer	0
Maier	0
Mountrail	0
Lebsock	0
Plaza	0
Pierce	0
Dilse	0
D95077	0
D95672	0
D95097	+
D96604	0
D96622	0
D98529	0
D95123	0
D98015	0
D98062	0
D98530	+
D98682	0
D98813	+
D98867	+
D98908	0

Planting date: 4/11/02
Date of application: 5/30/02
Crop: 3.5 leaf
Rate of application: 0.6 oz/A

X

2002 VARITAL TOLERANCE TO PARAMOUNT HERBICIDE AT HETTINGER

Injury: + = stunting, 0 = none

HRSW	6/14
Oxen	0
Ingot	0
Walworth	0
Russ	0
Briggs	0
Parshall	0
Reeder	0
Alsen	0
Keene	0
Mercury	0
Norpro	0
Gunner	0
Dandy	0
Knudson	0
Keystone	0
McKenzie	0
Hank	0
Granite	0
AC Superb	0
Hanna	0
Zeke	0
ND724	0
ND722	0
ND729	0
ND731	0
ND738	0
ND743	0
ND745	0
ND744	0
ND739	0
ND741	0
ND749	0
ND750	0
ND746	0
MT9874	0

Durum	6/14
Rugby	0
Monroe	0
Renville	0
Munich	0
Ben	0
Belzer	0
Maier	0
Mountrail	0
Lebsock	0
Plaza	0
Pierce	0
Dilse	0
D95077	0
D95672	0
D95097	0
D96604	0
D96622	0
D98529	0
D95123	0
D98015	0
D98062	0
D98530	0
D98682	0
D98813	0
D98867	0
D98908	0

Barley	6/14
Bowman	0
Stark	0
Logan	0
Harrington	0
Conlon	0
Merit	0
Valier	+
Drummond	+
Lacey	0
Legacy	0
Morex	+
Robust	0
Excel	0
Stander	0
Foster	0
2ND18365	+
ND16922	0

Planting date: 4/11/02
Date of application: 5/30/02
Crop: 3.5 leaf
Rate of application: 4.0 oz/A

X