2001 VARITAL TOLERANCE TO FAR-GO HERBICIDE AT HETTINGER
Stand reduction: + = susceptible, 0 = tolerant

Variety	5/22/01
Ernest	+
Russ	0
Oxen	0
Ingot	0
Ember	0
Gunner	+
Norpro	0
Ivan	+
McVey	0
Dandy	0
Mercury	0
Aurora	0
Grandin	0
Parshall	0
Reeder	0
Alsen	0
Keene	+
ND722	0
Walworth	0
Knudson	+
Keystone	0
AC Superb	+
McKenzie	+
Scholar	+
Conan	0
Zeke	0
ND724	+
ND729	0
ND731	0
ND738	0
ND739	0
ND741	0
ND743	0
ND744	0
ND745	0
ND746	+
SD3367	0
□N96-2444	0

Planting date: 4/17/01
Date of Application: 4/16/01
Rate of Application: 3 pts/A

Green

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

Variety	5/22/01	5/22/00	6/9/99	5/26/98	6/18/97	6/20/96	6/9/95
Grandin	0	0	0	0	0	0	0
Keene	+	0	0	+	0	+	0
Russ	0	0	0	?	0	0	0
Oxen	0	0	0	0	0	0	0
Gunner	+	0	0	0	0	+	
Reeder	0	0	0	0	0	0	
Parshall	0	0	0	0	0	0	
Ingot	0	0	0	0			
Ivan	+	+	0	+			
Ember	0	0	0	0			
Norpro	0	0	0				
Scholar	+	0	0				
Dandy	0	0	0				
McKenzie	+	+	0				
Mercury	0	0	0				
Aurora	0	+	0				
Alsen	0	0	0				
Conan	0	0					
McVey	0		0				
ND722	0	0					
Walworth	0						
Knudson	+						
Keystone	0						
AC Superb	+						
Zeke	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		
Majestic			0				
AC Eatonia				0	0	0	+
McNeal				0	0	0	0
BacUp				0	0		
AC Crystal				+			

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

Response of durum and spring wheat to Avenge, Assert and Paramount herbicides, Prosper ND, 2001. Michael D. Peel and Kirk Howatt. Released and experimental varieties of hard red spring wheat and durum were evaluated for their response to Avenge, Avenge plus Assert, and Paramount herbicides. The trial, planted on May 15, was a split plot design. Treatments constituted whole plots and varieties sub plots. All plots were rated for visual injury on a scale of 0-100 (0= no injury) on June 29.

Treatments were applied on June 12, when the crop was in the 4 to 5 leaf stage. Treatments included Avenge 4 pt/A, Avenge 6 pt/A, Avenge 2 pt/A plus Assert 0.75 pt/A plus a none ionic surfactant (NIS), and Paramount 4 oz/A plus a NIS. Average wind speed was 8 mph, and maximum air temp was 74° F. The week following the treatment was typified by daily high temperatures of 68° to 72° F and daily low temperatures of 51°° to 57 F. At the time treatments were applied plant stands averaged 1.1 million plants/A and all varieties were healthy.

Significance variation due to treatments was detected using an approximate *F* test. Least significant differences (α=0.05) were used to separate means. Overall Avenge at 4 pt/A, Avenge at 6 pt/A, and Avenge 2 pt/A plus Assert 0.75 pt/A resulted in significant injury. On an entry mean basis, significant injury from Avenge was observed on Alsen, Gunner, Reeder and Verde spring wheat varieties and on Belzer, Kari, Lebsock, and Mountrail durum varieties. Less sever injury from Avenge was observed on Aurora, Keystone, Knudson, ND724, and Parshall spring wheat varieties (Tables 1 and 2). Due to sever lodging height and yield data were not collected, however, in previous years (1998 North Dakota Weed Control Research) such severe injury has been associated with significant reductions in yield.

Paramount did not cause any injury to the spring wheat varieties tested, and did not cause significant injury to the durum varieties tested.

These results are comparable with observations in 1998, and 2000 where injury was observed, but is in contrast with 1999 where injury was not observed. Consistent with the injury observed in 1998 and 2000 was temperatures that ranged from the 40's (F) during the night to highs in the 70's during the day. Compared with 1999 where night time temperatures were similar to slightly higher and daytime temperatures in the 80's (F). Also consistent with injury in 1998 and 2000 was substantial rain fall following treatments, 1.2" in 1998 and 0.8" in 2000. This compare with 1999 where no rain was received for the 12 days following treatment. The factor associated with injury from Avenge appears to be cool weather following application.

Table 1. Mean injury to HRSW of Avenge, Assert and Paramount herbicides. Treatments included: 1=Check, 2=Avenge 4 pt/A, 3=Avenge 6pt/A, 4=Avenge 2 pt/A plus Assert 0.75pt/A plus NIS, 5=Paramount 4oz/A plus

Cultivar	Treatment	N	Stunting
			%
Alsen	1	3	0.0
	2	3	81.7
	3	3	96.0
	4	3	58.3
	5	3	0.0
Aurora	1	3	0.0
	2	3	11.7
	3	3	33.3
	4	3	13.3
	5	3	0.0
Gunner	1	3	0.0
	2	3	91.7
	3	3	96.0
	4	3	65.0
	5	3	0.0
Keystone	1	3	0.0
	2	3	1.7
	3	3	15.0
	4	3	6.7
	5	3	0.0
Knudson	1	3	0.0
	2	3	10.0
	3	3	38.3
	4	3	6.7
	5	3	0.0
McKenzie	1	3	0.0
	2	3	1.7
	3	3	3.3
	4	3	1.7
	5	3	0.0
Mercury	1	3	0.0
	2	3	5.0
	3	3	11.7
	4	3	6.7
	5	3	0.0
ND722	1	3	0.0
	2	3	0.0
	3	3	8.3
	4	3	0.0
	5	3	0.0
ND724	1	3	0.0
	2	3	18.3
	3	3	30.0
	4	3	6.7
	5	3	0.0
Norpro	1	3	0.0
	2	3	13.3
	3	3	18.3
	4	3	6.7
	5	3	0.0
Parshall	1	3	0.0
	2	3	20.0
	3	3	40.0
	4	3	10.0
	5	3	0.0
Reeder	1	3	0.0
	2	3	98.3
	3	3	98.0
	4	3	88.3
	5	3	0.0
Walworth	1	3	0.0
	2	3	1.7
	3	3	8.3
	4	3	6.7
	5	3	0.0
Verde	1	3	0.0
	2	3	99.3
	3	3	99.7
	4	3	81.7
	5	3	0.0
Entry LSD (0.05)		4	57.1

Table 1. Continued.

Trial Mean	1	42	0.0
	2	42	32.5
	3	42	42.6
	4	42	25.6
	5	42	0.0
Treatment LSD (0.05)			16.8
R^2			0.96

Table 2. Mean injury to durum wheat of Avenge, Assert and Paramount herbicides. Treatments included: 1=Check, 2=Avenge 4 pt/A, 3=Avenge 6pt/A, 4=Avenge 2 pt/A plus Assert 0.75pt/A plus NIS, 5=Paramount

Cultivar	Treatment	N	Stunting
			%
Belzer	1	3	0.0
	2	3	99.7
	3	3	99.7
	4	3	96.7
	5	3	3.3
Ben	1	3	0.0
	2	3	6.7
	3	3	13.3
	4	3	1.7
	5	3	3.3
D94103	1	3	0.0
	2	3	10.0
	3	3	23.3
	4	3	6.7
	5	3	3.3
D941261	1	3	0.0
	2	3	3.3
	3	3	13.3
	4	3	10.0
	5	3	3.3
Kari	1	3	0.0
	2	3	93.3
	3	3	98.0
	4	3	73.3
	5	3	3.3
Lebsock	1	3	0.0
	2	3	96.7
	3	3	100.0
	4	3	80.0
	5	3	3.3
Maier	1	3	0.0
	2	3	6.7
	3	3	13.3
	4	3	3.3
	5	3	3.3
Mountrai	1	3	0.0
	2	3	85.0
	3	3	99.7
	4	3	58.3
	5	3	3.3
Plaza	1	3	0.0
	2	3	6.7
	3	3	23.3
	4	3	6.7
	5	3	6.7
Entry LSD (0.05)			66.2
Trial Mean	1	27	0.0
	2	27	45.3
	3	27	53.8
	4	27	37.4
	5	27	3.7
Treatment LSD (0.05)			14.4
R^2			0.98

HRSW and weed response to grass herbicides tank-mixed with carfentrazone. (Howatt, Roach, and Davidson-Harrington) 'Alsen' hard red spring wheat was seeded May 15. Treatments were applied to 4 leaf wheat and 2 to 4 leaf yellow foxtail on June 26 with 80 F, 49% RH, 20% cloudcover, 4 to 8 mph wind, and 72 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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 75 plants/m^2.

		6/29		7/07	
Treatment[a]	Rate	Wht	Yeft	Wht	Yeft
	oz/A		%		
Carfentrazone+MCPA+NIS+UAN	0.128+4+0.25%+4%	19	19	4	3
Carfentrazone+Fenoxaprop+MCPA	0.128+1.32+4	7	73	2	94
Carfentrazone+Imazamethabenz+MCPA+NIS+UAN	0.128+5+4+0.25%+4%	14	50	3	33
Carfentrazone+Clodinafop+MCPA+DSV	0.128+0.8+4+0.8%	7	74	2	92
Carf+Tralkoxydim+MCPA+Supercharge+AMS	0.128+2.9+4+0.5%+20	26	66	5	88
Carfentrazone+Flucarbazone+MCPA+NIS+UAN	0.128+0.42+4+0.25%+4%	4	61	0	89
Fenoxaprop+MCPA	1.32+4	0	68	0	95
Imazamethabenz+MCPA+NIS	5+4+0.25%	2	43	0	18
Clodinafop+MCPA+DSV	0.8+4+0.8%	2	66	1	90
Tralkoxydim+MCPA+SC+AMS	2.9+4+0.5%+20	2	48	0	86
Flucarbazone+MCPA+NIS	0.42+4+0.25%	3	63	4	88
Untreated	0	0	0	0	0
C.V. %		30	12	71	6
LSD 5%		3	9	2	6
# OF REPS		4	4	4	4

[a] DSV was petroleum oil adjuvant in co-pack with Discover from Syngenta, SC was supercharge methylated vegetable oil adjuvant from Syngenta.

Carfentrazone+MCPA caused bleached and necrotic lesions to form on exposed wheat and yellow foxtail leaf tissue. Injury was rated as 19% for both species but diminished to 4 and 3%, respectively, on July 7. Flucarbazone reduced this injury by 79% resulting in 4% observed injury on June 29. Fenoxaprop and clodinafop reduced the amount of injury to 7%, possibly because these herbicides are formulated with a safener. Wheat injury from carfentrazone+imazamethabenz+MCPA, 14%, was slightly less than carfentrazone alone. Injury was much less on July 7, but relative ranking of the carfentrazone tank-mixes remained the same. Flucarbazone caused slight stunting of wheat that was recorded as 4% injury on July 7. Carfentrazone did not antagonize yellow foxtail control with grass herbicides.

Wheat response to tank-mixes of carfentrazone and ALS inhibiting herbicides, Exp 1. (Howatt, Roach and Davidson-Harrington) "ND722" hard red spring wheat was seeded May 17. Treatments were applied to 5 leaf wheat on June 19 with 73 F, 45% RH, 0% cloudcover, 6 mph wind, and 57 F soil temperature. 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.

Treatments	Rate	6/23 WHT	6/28 WHT	7/07 WHT
	oz/A		%	
Carfentrazone+MCPAester+NIS+UAN	0.256+4+0.25%+4%	14	9	4
Carfentrazone+MCPA+Imazamethabenz+NIS+UAN	0.256+4+5+0.25%+4%	18	8	4
Carfentrazone+MCPA+Flucarbazone+NIS+UAN	0.256+4+0.42+0.25%+4%	6	5	2
Carfentrazone+MCPA+Thifensulfuron+NIS+UAN	0.256+4+0.22+0.25%+4%	5	5	2
Carfentrazone+MCPA+Tribenuron+NIS+UAN	0.256+4+0.188+0.25%+4%	9	5	3
Carfentrazone+MCPA+Thif&Trib+NIS+UAN	0.256+4+0.22+0.25%+4%	4	3	0
Carfentrazone+MCPA+Imazamox+NIS+UAN	0.256+4+0.5+0.25%+4%	8	14	7
Carfentrazone+MCPA+Metsulfuron+NIS+UAN	0.256+4+0.06+0.25%+4%	8	6	3
Untreated	0	0	0	0
C.V. %		26	22	38
LSD 5%		3	2	1
# OF REPS		4	4	4

Injury manifested as bleached and necrotic lesions on exposed leaves. There were no differences in height, grain maturity, or plant drying. Sulfonylurea herbicides and flucarbazone reduce carfentrazone injury by 50 to 70%. Imidazolinone herbicides, imazamethabenz and imazamox, increased carfentrazone injury by as much as 75% on July 7.

Wheat response to tank-mixes of carfentrazone and ALS inhibiting herbicides, Exp 2. (Howatt, Roach, and Davidson-Harrington) "ND722" hard red spring wheat was seeded May 17. Treatments were applied to 4 to 5 leaf wheat on June 20 with 67 F, 38% RH, 60% cloudcover, 2 to 5 mph wind, and 61 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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.

Treatments	Rate	6/23 WHT	6/27 WHT	7/03 WHT
	oz/A		%	
Carfentrazone+MCPAester+NIS+UAN	0.256+4+0.25%+4%	21	10	4
Carfentrazone+MCPA+Imazamethabenz+NIS+UAN	0.256+4+5+0.25%+4%	18	9	4
Carfentrazone+MCPA+Flucarbazone+NIS+UAN	0.25+4+0.42+0.25%+4%	7	4	2
Carfentrazone+MCPA+Thifensulfuron+NIS+UAN	0.256+4+0.22+0.25%+4%	4	5	2
Carfentrazone+MCPA+Tribenuron+NIS+UAN	0.256+4+0.188+0.25%+4%	3	5	2
Carfentrazone+MCPA+Thif&Trib+NIS+UAN	0.256+4+0.22+0.25%+4%	5	5	1
Carfentrazone+MCPA+Imazamox+NIS+UAN	0.256+4+0.5+0.25%+4%	16	13	6
Carfentrazone+MCPA+Metsulfuron+NIS+UAN	0.256+4+0.06+0.25%+4%	6	5	3
Untreated	0	0	0	0
C.V. %		18	22	47
LSD 5%		2	2	2
# OF REPS		4	4	4

Injury manifested as bleached and necrotic lesions on exposed leaves. There were no differences in height, grain maturity, or plant drying. Sulfonylurea herbicides and flucarbazone reduced carfentrazone injury by 35 to 85%. Imidazolinone herbicides, imazamethabenz and imazamox, initially reduced carfentrazone injury 15 to 20%, but injury persisted longer and there was no injury reduction on June 27 and July 3 from the addition of imidazolinone herbicides to carfentrazone. Carfentrazone injury on July 3 was slightly greater with the addition of imazamox.

Durum response to grass-control products. (Howatt, Roach, and Davidson-Harrington). "Ben" durum wheat was seeded May 18. Fenoxaprop+Bromoxynil&MCPA were applied at 0.4+1 pt/A to entire plot on June 6 for weed control. Treatments were applied to 4 leaf durum on June 19 with 59 F, 63% RH, 0% cloudcover, 8 mph wind, and 57 F soil temperature. Treatments were applied with a backpack sprayer delivering 35 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.

Treatment	Rate	7/13 Wheat
	oz/A	%
Imazamethabenz+NIS	5+0.25%	0
Difenzoquat	12	0
Tralkoxydim+Supercharge+AMS	2.9+0.5%+10	0
Clodinafop+Score	1.0+1.2%	0
Fenoxaprop	1.32	0
Flucarbazone+NIS	0.42+0.25%	16
C.V. %		43
LSD 5%		2
# OF REPS		4

Flucarbazone was the only herbicide to cause injury. Injury appeared as stunting but not chlorosis. Plants recovered and no maturity difference was detected. Durum was not harvested.

Barley response to grass-control products. (Howatt, Roach, and Davidson-Harrington) "Foster" barley was seeded May 17. Treatments were applied to 5 leaf barley on June 19 with 58 F, 63% RH, 0% cloudcover, 8 mph wind, and 57 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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.

Treatment	Rate	7/07 Barley	8/21 Yield
	oz/A		bu/A
Imazmethabenz+NIS	5+0.25%	1	70
Difenzoquat	12	1	62
Tralkoxydim+Supercharge+AMS	2.9+0.5%+10	1	75
Clodinafop+Score	1.0+1.2%	60	49
Fenoxaprop	1.32	0	69
Flucarbazone+NIS	0.42+0.25%	70	48
Imazamethabenz+Difenzoquat+NIS	3.7+8+0.25%	0	70
Untreated	0	0	74
C.V. %		5	13
LSD 5%		1	12
# OF REPS		4	4

The study area had very low weed pressure. Imazamethabenz, difenzoquat, and tralkoxydim each produced a small response in barley. Barley in these plots quickly recovered. Fenoxaprop did not cause barley injury. Clodinafop and flucarbazone caused 60 and 70% injury, respectively. Plants expressed general chlorosis and were severely stunted for most of the season. Maturity was delayed by more than a week and there was a low to moderate occurrence of deformed heads. Barley seed yield with clodinafop and flucarbazone was 35% less than untreated barley.

General grass control in wheat, Fargo. (Howatt, Roach, and Davidson-Harrington) 'Alsen' hard red spring wheat was seeded May 15. Treatments were applied to 3 to 4 leaf wheat, 1 to 4 leaf wild oat, and emerging to 3 leaf yellow foxtail on June 9 with 80 F air, 63% RH, 95% cloud cover, 3 to 5 mph SE wind, and 61 F soil temperature at 2 inches. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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 wild oat 150 plants/ft^2 and yellow foxtail 10 plants/ft^2.

		6/20		7/09	8/14
Treatment	Rate	Wioa	Yeft	Wioa	Yield
	oz/A		%		bu/A
Imazamethabenz+Thif&Trib+NIS	5+0.22+0.25%	43	23	59	19
Difenzoquat+Thifesulfuron&Tribenuron	12+0.22	48	28	89	16
Tralkoxydim+Brox&MCPA+Supercharge+AMS	2.9+8+0.5%+20.4	89	88	96	27
Clodinafop+Bromoxynil&MCPA+Score	0.8+8+0.8%	88	84	99	36
Fenoxaprop+Bromoxynil&MCPA	1.32+8	93	89	98	32
Flucarbazone+Thif&Trib+2,4-Dioe+NIS	0.42+0.22+4+0.25%	85	85	94	28
Immb+Difenzoquat+Thif&Trib+NIS	3.7+8+0.22+0.25%	66	53	86	23
Flucarbazone+Fenx+Brox&MCPA+NIS	0.28+0.48+8+0.25%	83	80	88	22
Flucarbazone+Fenx+Brox&MCPA+NIS	0.28+0.66+8+0.25%	84	79	91	22
Flucarbazone+Fenoxaprop+Bromoxynil&MCPA	0.28+0.66+8	86	81	91	28
Flcz+Clodinafop+Brox&MCPA+Score+NIS	0.28+0.5+8+0.8%+0.25%	75	69	89	30
Untreated	0	0	0	0	16
C.V. %		10	10	3	19
LSD 5%		10	9	4	7
# OF REPS		4	4	4	4

No wheat injury was observed. Fenoxaprop and tralkoxydim each gave better than 86% yellow foxtail control on June 20. Plant competition removed foxtail from untreated plots by July 9, and no foxtail was found in herbicide treated plots on this date. On June 20, 1.32 oz/A fenoxaprop provided 93% wild oat control while 5 oz imazamethabenz and 12 oz difenzoquat gave less than 50% control. Labeled rates of tralkoxydim, clodinafop, fenoxaprop, and flucarbazone provided greater than 93% wild oat control on July 9. Labeled rates clodinafop or fenoxaprop resulted in the most wheat seed yield, respectively 36 and 32 bu/A. Locations with ACC-ase resistant wild oat and known yellow foxtail problems could benefit from reduced rate tank-mixes of flucarbazone and fenoxaprop or clodinafop; however, use rates would need to be greater than investigated here to maximize weed control and seed yield.

Foxtail control in hard red spring wheat, Carrington, 2001. **(Endres and Howatt) The experiment was conducted on a 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 four replicates. 'Parshall' HRS wheat was planted on May 5. Herbicide treatments were applied with a CO_2-hand-boom plot sprayer delivering 10 gal/A at 30 psi through 8001 flat fan nozzles to the center 6.7 ft of 10 by 25 ft plots. Treatments were applied on May 31 with 58 F, 92% RH, 25% clear sky, and 8 mph wind to 3.5-leaf wheat and 2- to 4-leaf yellow and green foxtail. Average wheat density was 14 plants/ft^2 and foxtail density was 61 plants/ft^2. Weed control and wheat injury were visually estimated. The trial was harvested for seed yield with a plot combine on August 17.**

Herbicide		Weed control			HRS	
		6/14	7/19			Seed
Treatment	Rate	Fota[a]	Yeft	Grft	Injury	yield
	oz a.i./A	———	%	———	%	bu/A
Immb+Thif&Trib+Act90	5+0.22+0.25%	71	18	13	0	45.4
Dife+Thif&Trib	12+0.22	63	3	0	11	33.1
Tral+Brox&MCPA+Supercharge+AMS	2.9+8+0.5%+20.4	90	92	98	6	48.0
Clfd+Brox&MCPA+DSV	0.8+8+0.8%	91	93	97	0	47.3
Fenx-P+Brox&MCPA	1.32+8	88	86	93	4	44.4
Flcz+Thif&Trib+24-Dioe+Act90	0.42+0.22+4+0.25%	87	90	96	0	50.4
Immb+Dife+Thif&Trib+Act90	3.7+8+0.22+0.25%	64	18	15	0	38.1
Flcz+Fenx-P+Brox&MCPA+Act90	0.28+0.48+8+0.25%	74	41	91	0	42.4
Flcz+Fenx-P+Brox&MCPA+Act90	0.28+0.66+8+0.25%	77	55	92	0	40.4
Flcz+Fenx-P+Brox&MCPA	0.28+0.66+8	83	58	88	0	41.6
Flcz+Clfd+Brox&MCPA+DSV+Act90	0.28+0.5+8+0.8%+0.25%	83	58	91	3	42.5
untreated	0	0	0	0	0	20.4
LSD (0.05)		6	21	8	5	6.8

[a]Fota=yellow and green foxtail.

Tralkoxydim+bromoxynil&MCPA, Clodinafop+bromoxynil&MCPA, Fenoxaprop-P+ bromoxynil&MCPA, and Flucarbazone-Na+thifensulfuron&tribenuron+2,4-Dioe provided 86 to 98% foxtail control and generally the highest wheat seed yield. Also, green foxtail was controlled 88 to 96% with Flucarbazone-Na plus fenoxaprop-P+bromoxynil&MCPA or clodinafop+bromoxynil%MCPA tank mixtures. Wheat injury (reduced plant height) was minimal.

2001 Wild Oat Control in Spring Wheat at Hettinger. (Eriksmoen) Reeder hard red spring wheat was seeded on April 26. Treatments were applied to 3 ½ leaf wheat and to 2 to 3 ½ leaf wild oats on May 25 with 40 F, 96 % RH, clear sky and 2 mph wind. There was a light frost 2 hours prior to application. 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 experiment was a randomized complete block design with four replications. Wild oat population was 47 plants per sq. foot. The trial was sprayed with 10 oz/A Starane + 1 pt/A Buctril + 1/3 oz/A Express on June 7 to control Broadleaf weeds. Evaluations for crop injury were on June 7, and for wild oat control on June 12, July 3 and on July 18. The trial was severely damaged by hail on June 18 and was not harvested.

Treatment		Product Rate	6/12	7/3	7/18
			Wioa	Wioa	Wioa
		oz/A	----- % Control -----		
1	Immb+Thif&Trib+Act 90	5+0.22+0.25%	76	85	96
2	Dife+Thif&Trib	12+0.22	68	60	50
3	Tral+Brox&MCPA+Supercharge+AMS	2.9+8+0.5%+20.4	85	85	81
4	Clodinafop+Brox&MCPA+DSV	0.8+8+0.8%	90	90	85
5	Fenoxaprop+Brox&MCPA	1.32+8	72	76	82
6	Flcz+Thif&Trib+2,4-Dioe+Act 90	0.42+0.22+4+0.25%	90	94	99
7	Immb+Dife+Thif&Trib+Act 90	3.7+8+0.22+0.25%	78	74	88
8	Flcz+Fenoxaprop+Brox&MCPA+Act 90	0.28+0.48+8+0.25%	86	91	92
9	Flcz+Fenoxaprop+Brox&MCPA+Act 90	0.28+0.66+8+0.25%	91	88	92
10	Flucarbazone+Fenoxaprop+Brox&MCPA	0.28+0.66+8	78	94	96
11	Flcz+Clodinafop+Brox&MCPA+DSV+Act 90	0.28+0.5+8+0.8%+0.25%	89	96	97
12	Untreated	0	0	0	0
C.V. %			16.3	18.3	13.1
LSD 5%			18	20	15

Summary

Crop injury was not observed on any treatment (data not shown). The difenzoquat treatment (trt 2) had poor season long wild oat control and had significantly lower wild oat control than the other treatments. Flucarbazone treatments (trts 6, 8, 9, 10 & 11) provided excellent season long wild oat control. Flucarbazone tank mix partners did not enhance or decrease wild oat control.

General Grass Control in Wheat, Langdon . (Lukach and Howatt) Following soil test, 200 lb/A of 11-52-0 fertilizer and 200 lb/A of urea were applied PPI. 'Lebsock' durum was seeded on May 11. Folicur was applied the study area by air on July 21. Treatments were applied to 2 to 3 leaf durum and wild oat on June 2 with 52 F, 88% relative humidity, and 7 mph N wind. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through XR8001 flat fan nozzles to a 7 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replicates. Because of severe lodging and disease study was terminated after the July 17 evaluation.

Treatment[a]	Rate	7/17 WIOA
	oz/A	%
Imazamethabenz+Thifensulfuron&Tribenuron+NIS	5+0.22+0.25%	30
Difenzoquat+Thifensulfuron&Tribenuron	12+0.22	65
Tralkoxydim+Bromoxynil&MCPA+Supercharge+AMS	2.9+8+0.5%+20.4	82
Clodinafop+Bromoxynil&MCPA+DSV	0.8+8+0.8%	86
Fenoxaporp+Bromoxynil&MCPA	1.32+8	85
Flucarbazone+Thifensulfuron&Tribenuron+2,4-Dioe+NIS	0.42+0.22+4+0.25%	90
Imazamethabenz+Difezoquat+Thifensulfuron&Tribenuron+NIS	3.7+8+0.22+0.25%	81
Flucarbazone+Fenoxaprop+Bromoxynil&MCPA+NIS	0.28+0.48+8+0.25%	87
Flucarbazone+Fenoxaprop+Bromoxyni&IMCPA+NIS	0.28+0.66+8+0.25%	92
Flucarbazone+Fenoxaprop+Bromoxynil&MCPA	0.28+0.66+8	89
Flucarbazone+Clodinafop+Bromoxynil&MCPA+DSV+NIS	0.28+0.5+8+0.8%+0.25%	92
Untreated	0	0
C.V. %		6
LSD 5%		7
# OF REPS		4

[a] DSV was in co-pack with Discover from Syngenta, Supercharge was in co-pack with Achieve from Syngenta.

Of the grass herbicide treatments applied at full rates, only flucarbazone provided 90% wild oat control. Imazamethabenz and difenzoquat individually were ineffective at controlling wild oat providing at most 65% control, but the combination of imazamethabenz and difenzoquat each at lower rates provided 81% control. Tank-mixes of flucarbazone and fenoxaprop or clodinafop offer viable alternatives for controlling ACC-ase resistant wild oat, providing as much as 92% control.

Wild oat control in wheat, Williston 2001. (Neil Riveland and Gordon Bradbury) 'Maier' durum wheat was planted on recrop (land cropped to hrs wheat in 2000) in 7 inch rows at 90 lbs/a on May 8. Treatments were applied on June 8 to 4.5-leaf wheat and 1-5 leaf wild oats (most were in the 3-5 leaf stage) with 70 F, 40% RH, 95% clear sky and 5 mph SW wind with dry topsoil at 59 F. Green foxtail and Russian thistle plants were present but very light in density. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Wild oat density was greater than 25 plants/ft^2. Plots were evaluated for crop injury and wild oat control on June 14 and wild oat control again on August 19. Wheat was machine harvested on August 19.

Treatment[a]	Rate	Crop Inj	% Wioa Control		Test Weight	Yield
	oz/a ai	%	7-14	8-19	lbs/b	bus/a
Immb+Thif&Trib+Act90	5+0.22+0.25%	0	87	88	62.6	43.0
Dife+Thif&Trib	12+0.22	0	46	77	62.3	41.9
Tral+Brox&MCPA+Supercharge+AMS	2.9+8+0.5%+20.4	0	61	71	62.9	41.7
Clodinafop+Brox&MCPA+DSV	0.8+8+0.8%	0	60	65	62.3	38.1
Fenoxaprop+Brox&MCPA	1.32+8	4	61	60	62.5	34.2
Flcz+Thif&Trib+24-Dioe+Act90	0.42+0.22+4+0.25%	9	90	85	62.4	40.4
Immb+Dife+Thif&Trib+Act90	3.7+8+0.22+0.25%	0	83	84	62.4	41.4
Flcz+Fenoxaprop+Brox&MCPA+Act90	0.28+0.48+8+0.25%	6	73	75	62.5	35.7
Flcz+Fenoxaprop+Brox&MCPA+Act90	0.28+0.66+8+0.25%	3	81	81	62.0	38.3
Flcz+Fenoxaprop+Brox&MCPA	0.28+0.66+8	11	64	56	62.9	31.8
Flcz+Clodinafop+Brox&MCPA+DSV+Act90	0.28+0.5+8+0.8%+0.25%	6	75	69	62.8	34.3
Untreated	0	0	0	0	61.9	17.6
C.V. %		109	12	13	.7	15.9
LSD 5%		5	11	13	NS	8.4
# OF REPS		4	4	4	2	4

[a] - Act90 = Activator 90 nonionic surfactant from Loveland.

Summary: All treatments resulted in yield increases compared to the untreated check. Treatments containing Flucarbazone generally resulted in slight crop injury. Imazamethabenz generally gave good wild oat control. The addition of the surfactant to Flucarbazone+Fenoxyprop+Brox&MCPA resulted in less crop injury and better control of wild oats.

MKH6562 and fenoxaprop-P tank-mix control of wild oat and yellow foxtail. Howatt, Kirk A., Brian M. Jenks, Ronald F. Roach, and Janet D. Davidson-Harrington. An experiment was established at Fargo and Minot, ND, to evaluate grass weed control and crop response to combinations of MKH6562 and fenoxaprop-P. At Fargo, 'Alsen' hard red spring wheat was seeded May 15. Treatments were applied to 3 to 4 leaf wheat, 1 to 4 leaf wild oat, and emerging to 3 leaf yellow foxtail with 79 F air, 53% relative humidity, 95% cloudcover, 3 to 5 mph SE wind, and 60 F soil temperature at 2 inches. 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. Weed densities were 150 wild oat plants/ft^2 and 10 yellow foxtail plants/ft^2. At Minot, 'Grandin' hard red spring wheat was seeded May 4. Treatments were applied to 3 leaf yellow foxtail on June 7 with 71 F air, 43% relative humidity, and 65 F soil temperature at 2 inches. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 10 gpa at 40 psi through XR 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. Yellow foxtail density was 15 plants/ft^2.

No wheat injury was observed at Fargo (Table1). At Minot, wheat injury from MKH6562 alone was 17% stunting, but injury was reduced to 3% with the addition of 0.25 oz/A fenoxaprop-P (Table 2). Minor injury, at least 2% stunting, in the Minot experiment occurred from all rates and combinations of MKH6562. Increasing the ratio of fenoxaprop-P to MKH6562 increased weed control at both locations. Fenoxaprop-P at 1.32 oz/A provided the best weed control across both locations. (Department of Plant Sciences, North Dakota State University, Fargo).

Table 1. MKH6562 and fenoxaprop-P tank-mix control of wild oat and yellow foxtail, Fargo (Howatt, Jenks, Roach, and Davidson-Harrington).

		6/20		7/09	7/27
Treatment[a]	Rate	AVEFA	SETLU	AVEFA	SETLU
	(oz/A)	(%)	(%)	(%)	(%)
MKH6562+NIS	0.42	68	61	91	58
MKH6562+fenoxaprop-P+NIS	0.34+0.25	74	68	94	69
MKH6562+fenoxaprop-P+NIS	0.35+0.38	81	74	94	79
MKH6562+fenoxaprop-P+NIS	0.28+0.5	83	78	95	80
MKH6562+fenoxaprop-P+NIS	0.28+0.63	83	80	95	86
MKH6562+fenoxaprop-P+NIS	0.14+0.87	84	83	97	86
MKH6562+fenoxaprop-P+NIS	0.14+1	84	83	97	92
MKH6562+fenoxaprop-P+NIS	0.07+1	84	85	97	95
MKH6562+fenoxaprop-P+NIS	0.07+1.13	84	88	97	89
Fenoxaprop-P	1.32	91	93	98	95
Untreated	0	0	0	0	0
C.V. %		4	4	2	9
LSD 5%		4	4	2	10
# OF REPS		4	4	4	4

[a]NIS, included at 0.25% V/V, was Activator 90, a nonionic surfactant from Loveland Industries, Greeley, CO.

Table 2. MKH6562 and fenoxaprop-P tank-mix control of wild oat and yellow foxtail, Minot (Howatt, Jenks, Roach, and Davidson-Harrington).

Treatment[a]	Rate	7/05	
		TRZAX	SETLU
	(oz/A)	(%)	(%)
MKH6562+NIS	0.42	17	88
MKH6562+fenoxaprop-P+NIS	0.35+0.25	3	88
MKH6562+fenoxaprop-P+NIS	0.35+0.38	3	88
MKH6562+fenoxaprop-P+NIS	0.28+0.5	3	86
MKH6562+fenoxaprop-P+NIS	0.28+0.63	2	84
MKH6562+fenoxaprop-P+NIS	0.14+0.87	2	83
MKH6562+fenoxaprop-P+NIS	0.14+1	2	89
MKH6562+fenoxaprop-P+NIS	0.07+1	2	85
MKH6562+fenoxaprop-P+NIS	0.07+1.13	2	92
Fenoxaprop-P	1.32	0	98
Untreated	0	0	0
C.V.		29	5
LSD 5%		1	6
# of Reps		3	3

[a]NIS, included at 0.25% V/V, was Activator 90, a nonionic surfactant from Loveland Industries, Greeley CO.

Evaluation of clodinafop formulation. (Howatt, Roach, and Davidson-Harrington) 'Alsen' hard red spring wheat was seeded May 15. Bromoxynil&MCPA was applied to the study area for broadleaf weed control. Treatments were applied to 4 leaf wheat, 3 to 5 leaf wild oat, and 1 to 3 leaf yellow foxtail on June 12 with 68 F, 66% RH, and NE wind at 6 mph. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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 wild oat 150 plants/ft^2 and yellow foxtail 10 plants/ft^2.

		6/19			6/26		7/09	8/14
Treatment[a]	Rate	Wht	Wioa	Yeft	Wioa	Yeft	Wioa	Yield
	oz/A				%			bu/A
Clodinafop+DSV	0.8+1%	1	63	53	92	91	98	24
Clodinafop-N	0.8	0	64	50	91	89	99	29
Clodinafop+Thifensulfuron+ MCPA+DSV	0.8+0.37+ 6+1%	2	61	53	90	86	96	25
Clodinafop-N+Thifensulfuron+MCPA	0.8+0.37+6	2	59	46	91	84	97	24
Clodinafop+Bromoxynil&MCPA+DSV	0.8+8+1%	0	60	53	87	85	97	32
Clodinafop-N+Bromoxynil&MCPA	0.8+8	0	60	48	85	86	97	31
Clodinafop+Dicamba+DSV	0.8+1.5+1%	2	64	53	87	84	96	25
Clodinafop-N+Dicamba	0.8+1.5	0	60	54	86	84	97	26
Clodinafop+Fluroxypyr&MCPA+DSV	0.8+10.7+1%	1	64	55	88	85	98	25
Clodinafop-N+Fluroxypyr&MCPA	0.8+10.7	1	66	60	90	88	99	29
Fenoxaprop	1.32	0	61	59	90	90	99	21
Fenoxaprop+Thifensulfuron+MCPA	1.32+0.37+6	0	50	45	84	83	98	30
Flucarbazone+NIS	0.42+0.25%	1	50	45	75	70	91	20
Flucarbazone+Thifensulfuron+ MCPA+NIS	0.42+0.37+ 6+0.25%	1	59	45	70	65	90	21
Clodinafop+DSV	1.6+2%	3	64	55	94	91	98	28
Clodinafop-N	1.6	0	61	53	93	91	99	28
Untreated	0	0	0	0	0	0	0	14
C.V. %		182	11	13	4	5	2	17
LSD 5%		NS	9	9	5	6	2	6
# OF REPS		4	4	4	4	4	4	4

[a] Clodinafop-N was 0.48 lb full adjuvant formulation of clodinafop from Syngenta, DSV was in co-pack with Discover from Syngenta.

Non-significant injury as chlorosis was observed on June 19 but not on June 26. No difference between the clodinafop formulations was measured for weed control or wheat yield. On June 26, wild oat control with both clodinafop formulations was antagonized 5 to 6% by bromoxynil&MCPA and dicamba. This antagonism did not result in less wheat seed yield compared with clodinafop alone. Flucarbazone provided less weed control at all evaluations than fenoxaprop and clodinafop, and wheat treated with flucarbazone tended to produce the less seed yield than the other grass herbicides. Thifensulfuron antagonized fenoxaprop control of wild oat and yellow foxtail on June 19 and 26, but wheat treated with fenoxaprop+thifensulfuron yielded 9 bu/A more seed than wheat treated with just fenoxaprop.

Comparison of clodinafop and flucarbazone in tank-mixes. (Howatt, Roach, Davidson-Harrington) 'HJ98' hard red spring wheat was seed at 2.06 bu/A on May 3. Treatments were applied to 4 to 5 leaf wheat and 1.5 to 3 leaf wild oat on June 4 with 79 F, 26% RH, 25% cloudcover, 2 to 6 mph wind, and 60 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 30 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. Wild oat density was 50 to 300 plants/ft^2.

		6/19		7/03	
Treatment[a]	Rate	Wht	Wioa	Wht	Wioa
	oz/A		%		
Clodinafop+DSV	0.8+1%	0	93	0	99
Flucarbazone+NIS	0.42+0.25%	4	87	2	95
Clodinafop+Thifensulfuron+MCPA+DSV	0.8+0.37+6+1%	1	78	1	94
Flucarbazone+Thifensulfuron+MCPA+NIS	0.42+0.37+6+0.25%	8	70	6	87
Clodinafop+Bromoxynil&MCPA+DSV	0.8+8+1%	2	90	1	94
Flucarbazone+Bromoxynil&MCPA+NIS	0.42+8+0.25%	3	52	3	91
Clodinafop+Triasulfuron+MCPA+DSV	0.8+0.21+6+1%	0	83	0	96
Flucarbazone+Triasulfuron+MCPA+NIS	0.42+0.21+6+0.25%	4	63	3	88
Clodinafop+2,4-Dioe+DSV	0.8+8+1%	1	78	1	91
Flucarbazone+24-Dioe+NIS	0.42+8+1%	2	85	1	91
Clodinafopp+Thifensulfuron&Tribenuron+DSV	0.8+0.3+1%	0	88	0	95
Flucarbazone+Thifensulfuron&Tribenuron+NIS	0.42+0.3+0.25%	7	82	5	89
Fenoxaprop	1.32	0	83	0	99
Fenoxaprop+Thifensulfuron+MCPA	1.32+0.37+6	0	85	0	97
Untreated	0	0	0	0	0
C.V. %		70	9	94	3
LSD 5%		2	11	2	4
# OF REPS		3	3	4	4

[a] DSV was petroleum oil adjuvant in co-pack with Discover from Syngenta.

Flucarbazone control of wild oat was antagonized the most by bromoxynil&MCPA on June 19 resulting in 52% control compared with 87% control with flucarbazone alone. Thifensulfuron reduced control with clodinafop and flucarbazone by 15 and 17%, respectively. At this evaluation, triasulfuron was antagonistic to flucarbazone, and 2,4-D was antagonistic to clodinafop. On July 3, only clodinafop+triasulfuron did not antagonized wild oat control compared with similar treatment lacking a broadleaf herbicide. All other tank-mixes that included clodinafop or flucarbazone resulted in less weed control than clodinafop or flucarbazone alone. Flucarbazone+thifensulfuron+MCPA gave the lowest weed control at 87%. Fenoxaprop activity on wild oat was not antagonized by thifensulfuron+MCPA. On August 1, all herbicide treatments provided 99% wild oat control.

Evaluation of flucarbazone formulations. (Howatt, Roach, Davidson-Harrington) 'Alsen' hard red spring wheat was seeded May 15. Treatments (1-2lf) were applied to 1.5 to 2 leaf wheat and emerging to 1.5 leaf wild oat on June 5 with 60 F air, 61% RH, 100% cloudcover, 5 to 8 mph ESE wind, and 58 F soil temperature at 2 inches. Treatments (3-4lf) were applied to 3 to 4 leaf wheat and 1 to 4 leaf wild oat on June 9 with 75 F air, 50% RH, 20% cloudcover, 1 to 3 mph ESE wind, and 61 F soil temperature at 2 inches. Treatments (6lf) were applied to 6 leaf wheat and 3 to 5 leaf wild oat on June 12 with 68 F air, 66% RH, and 6 mph NE wind. Treatments (1-2lf) were applied with a bicycle-wheel-type plot sprayer at 40 psi through 8001 flat fan nozzles, and treatments (3-4lf) and (6lf) were applied with a backpack sprayer at 35 psi through 11001 flat fan nozzles. All treatments were delivered at 8.5 gpa 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 averaged 10 plants/ft^2.

		6/20		6/29		7/25	8/20	
Treatment	Rate	Wht	Wioa	Wht	Wioa	Wht	Tstw	Yield
	oz/A			%			lb/bu	bu/A
Flucarbazone +NIS (1-2lf)	0.42+0.25%	4	94	4	96	2	60	39
Flucarbazone +NIS (1-2lf)	0.84+0.25%	4	94	7	98	4	59	38
MKH6562P+NIS (1-2lf)	0.42+0.25%	2	91	5	96	2	59	42
MKH6562P+NIS (1-2lf)	0.84+0.25%	4	95	6	98	4	59	38
Clodinafop+Score (1-2lf)	0.8+1%	0	93	1	93	0	60	42
Flucarbazone +NIS (3-4lf)	0.42+0.25%	0	90	0	94	1	60	42
Flucarbazone +NIS (3-4lf)	0.84+0.25%	1	85	0	97	3	60	43
MKH6562P+NIS (3-4lf)	0.42+0.25%	0	85	1	96	1	60	42
MKH6562P+NIS (3-4lf)	0.84+0.25%	2	90	2	97	4	60	44
Clodinafop+Score (3-4lf)	0.8+1%	0	95	0	99	0	60	39
Flucarbazone +NIS (6lf)	0.42+0.25%	0	79	0	91	0	60	42
Flucarbazone +NIS (6lf)	0.84+0.25%	0	79	0	93	3	60	42
MKH6562P+NIS (6lf)	0.42+0.25%	0	83	0	89	1	60	38
MKH6562P+NIS (6lf)	0.84+0.25%	0	80	0	95	1	60	40
Clodinafop+Score (6lf)	0.8+1%	0	90	0	97	0	60	39
Untreated (6lf)	0	0	0	0	0	0	60	37
C.V. %		88	4	96	2	64	1	12
LSD 5%		1	4	2	3	1	NS	NS
# OF REPS		4	4	4	4	4	4	4

MKH6562P was a different formulation process than commercially available flucarbazone. The two formulations of flucarbazone, flucarbazone and MKH6562P, performed similarly. Flucarbazone formulations applied to 1.5 to 2 leaf wheat elicited more wheat stunting than later applications. Flucarbazone at 0.84 oz/A, twice the labeled rate, tended to cause slightly more injury than 0.42 oz/A. While wheat injury was generally observed as shorter plants, on July 25, plots with shorter plants retained more green color indicating a possible maturity and desiccation delay of one to three days. No difference in heading date was observed. Neither flucarbazone formulation nor rate influenced grain test weight or yield. On June 29 it was observed that flucarbazone formulations had residual activity on Venice mallow and common lambsquarters, but weed populations were not consistent enough to evaluate performance. All herbicide treatments provided complete wild oat control on July 25.

Comparison of liquid and dry tralkoxydim. (Howatt, Roach, and Davidson-Harrington) 'Alsen' hard red spring wheat was seeded May 15. Treatments were applied to 4.5 to 5 leaf wheat, 5 leaf wild oat, and 2 to 4 leaf yellow foxtail on June 18 with 68 F, 72% RH, 70% cloudcover, and light wind. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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 wild oat 150 plants/ft^2 and yellow foxtail 10 plants/ft^2.

		6/26			7/15
Treatment[a]	Rate	Wht	Wioa	Yeft	Wioa
	oz/A		%		
Tralkoxydim-SC+SC	2.9+0.5%	0	69	64	96
Tralkoxydim-SC+SC	4+0.5%	0	65	61	89
Tralkoxydim+SC	2.9+0.5%	0	66	61	95
Tralkoxydim+SC	4+0.5%	0	66	60	94
Clodinafop+Score	0.8+0.8%	0	68	63	95
Untreated	0	0	0	0	0
C.V. %		0	6	4	2
LSD 5%		NS	5	3	2
# OF REPS		4	4	4	4

[a] Tralkoxydim-SC was soluble concentrate formulation from Syngenta, SC was Supercharge in co-pack with Achieve from Syngenta.

No wheat injury was observed. Weed control on June 26 was essentially similar among all herbicide treatments. There was no difference among field use rates of 2.9 oz/A tralkoxydim-SC, 2.9 oz tralkoxydim, and 0.8 oz clodinafop for wild oat control on July 15.

Comparison of liquid and dry tralkoxydim in tank mixes. (Howatt, Roach, and Davidson-Harrington) 'Alsen' hard red spring wheat was seeded May 15. Treatments were applied to 5 leaf wheat and 4 to 5 leaf wild oat on June 18 with 68 F, 72% RH, 90% cloudcover, and light and variable wind. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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. Wild oat density was 150 plants/ft^2.

Treatment[a]	Rate	6/20 Wioa	7/15 Wioa
	oz/A	%	
Tralkoxydim-SC+Supercharge	202+0.5%	61	87
Tralkoxydim-SC+Supercharge	280+0.5%	60	89
Tralkoxydim+Supercharge	202+0.5%	63	85
Tralkoxydim+Supercharge	280+0.5%	66	86
Tralkoxydim-SC+2,4-Dioe+Supercharge	202+560+0.5%	68	86
Tralkoxydim-SC+2,4-Dioe+Supercharge	280+560+0.5%	68	87
Tralkoxydim+2,4-Dioe+Supercharge	202+560+0.5%	64	87
Tralkoxydim+2,4-Dioe+Supercharge	280+560+0.5%	64	87
Tralkoxydim-SC+Brox&MCPA+Supercharge	202+560+0.5%	65	85
Tralkoxydim-SC+Brox&MCPA+Supercharge	280+560+0.5%	64	89
Tralkoxydim+Bromoxynil&MCPA+Supercharge	280+560+0.5%	68	88
Fenoxaprop+2,4-Dioe	92+560	71	86
Clodinafop+Bromoxynil&MCPA+DSV	56+560+0.8%	66	92
Untreated	0	0	0
C.V. %		5	2
LSD 5%		4	2
# OF REPS		4	4

[a] Tralkoxydim-SC was liquid formulated tralkoxydim from Syngenta, Supercharge was in co-pack with Achieve from Syngenta, DSV was in co-pack with Discover from Syngenta.

Liquid and dry formulations of tralkoxydim performed similar to each other in comparable treatments. On June 20, fenoxaprop+2,4-Dioe gave the most wild oat control at 71%. On July 15, clodinafop+bromoxynil&MCPA provided the best wild oat control, which was 92%.

2001 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 3 different growth stages of HRSW. Reeder HRSW was planted on April 26. The first post-applied treatments were applied to 1 leaf wheat and to 1 leaf wild oats on May 8 with 65 deg. F, 26% RH, sunny sky and 10 mph wind. The second post-applied treatments were applied to 3 leaf wheat and to 1 to 3 leaf wild oats on May 17 with 44 deg. F, 53% RH, sunny sky and 12 mph wind. The third post-applied treatments were applied to 5 leaf wheat and to 2 to 5 leaf wild oats on June 11 with 63 deg. F, 44% 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 10 ounces/Ac Starane + 1 pint/Ac Buctril + 1/3 ounce/Ac Express on June 7 to control broadleaf weeds. The experiment was a randomized complete block design with four replications. Wild oat populations were 8 plants per sq. foot on May 8, 38 plants per sq. foot on May 17 and 44 plants per sq. foot on June 11. Evaluations for wild oat control were on June 12 for the first two application dates and on July 3 for the third application date. The trial sustained severe hail damage on June 18 and was not harvested.

Summary

Crop injury was not observed on any treatment (data not shown). All treatments applied at the one leaf growth stage provided poor season long wild oat control, although there does appear to be some residual control with the Everest treatments. Wild oats at the first application were still emerging and the crop did not provide much competition. Wild oat control with Puma treatments tended to increase with the higher rates and later applications. Everest treatments were very effective at controlling wild oats at all treatment rates when applied at the 3 leaf stage. Everest treatments were less effective when applied at the 5 leaf stage than at the 3 leaf stage. Discover treatments provided excellent wild oat control at all three treatment rates when applied at the 3 and 5 leaf stages. The 5.25 ounce per acre rate of Achieve had better wild oat control (although not significantly) than the 7 ounce per acre rate when applied at the 3 and 5 leaf stages. The trial sustained severe hail damage on June 18 and was not harvested.

2001 Reduced Rates and Application Timing of Wild Oat Herbicides at Hettinger.

App. Timing	Treatment	Product Rate	Wild Oat RateBasis	Wild Oat Control
HRSW		oz/acre		%
1 leaf	Puma	10.6	Full	2
1 leaf	Puma	7.9	3/4	0
1 leaf	Puma	5.3	1/2	2
3 leaf	Puma	10.6	Full	72
3 leaf	Puma	7.9	3/4	59
3 leaf	Puma	5.3	1/2	25
5 leaf	Puma	10.6	Full	92
5 leaf	Puma	7.9	3/4	82
5 leaf	Puma	5.3	1/2	62
1 leaf	Everest + NIS*	0.60 + 0.25%	Full	40
1 leaf	Everest + NIS	0.45 + 0.25%	3/4	31
1 leaf	Everest + NIS	0.30 + 0.25%	1/2	25
3 leaf	Everest + NIS	0.60 + 0.25%	Full	90
3 leaf	Everest + NIS	0.45 + 0.25%	3/4	89
3 leaf	Everest + NIS	0.30 + 0.25%	1/2	88
5 leaf	Everest + NIS	0.60 + 0.25%	Full	62
5 leaf	Everest + NIS	0.45 + 0.25%	3/4	84
5 leaf	Everest + NIS	0.30 + 0.25%	1/2	72
1 leaf	Discover + DSV*	3.20 + 12.8	Full	10
1 leaf	Discover + DSV	2.40 + 12.8	3/4	18
1 leaf	Discover + DSV	1.60 + 12.8	1/2	1
3 leaf	Discover + DSV	3.20 + 12.8	Full	90
3 leaf	Discover + DSV	2.40 + 12.8	3/4	90
3 leaf	Discover + DSV	1.60 + 12.8	1/2	86
5 leaf	Discover + DSV	3.20 + 12.8	Full	95
5 leaf	Discover + DSV	2.40 + 12.8	3/4	95
5 leaf	Discover + DSV	1.60 + 12.8	1/2	92
1 leaf	Achieve + SC*+ AMS*	7.0 + 0.5% + 1%	Full	12
1 leaf	Achieve + SC+ AMS	5.25 + 0.5% + 1%	3/4	2
1 leaf	Achieve + SC+ AMS	3.50 + 0.5% + 1%	1/2	6
3 leaf	Achieve + SC+ AMS	7.0 + 0.5% + 1%	Full	71
3 leaf	Achieve + SC+ AMS	5.25 + 0.5% + 1%	3/4	84
3 leaf	Achieve + SC+ AMS	3.50 + 0.5% + 1%	1/2	75
5 leaf	Achieve + SC+ AMS	7.0 + 0.5% + 1%	Full	81
5 leaf	Achieve + SC+ AMS	5.25 + 0.5% + 1%	3/4	89
5 leaf	Achieve + SC+ AMS	3.50 + 0.5% + 1%	1/2	52
C.V. %				32.9
LSD 5%				25
# of Reps				4

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

Yellow foxtail control in HRSW. Jenks, Willoughby, and Markle. 'Grandin' spring wheat was seeded May 4, 2001 into 6-inch rows in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replications. Postemergence (POST) treatments were applied to 4 to 5-leaf wheat on June 7 with XR8001 flat fan nozzles at 10 gpa and 40 psi. Weeds at application were yellow foxtail (3-lf, 4/ft^2), kochia (3 to 4-inch, 1/ft^2), lambsquarters (4-inch, 1/ft^2), wild buckwheat (5-lf, 5/ft^2), and redroot pigweed (2 to 3-inch, 5/ft^2).

Treatment	Rate	Yeft		Crop injury		Yield	Test wt.
		Jul 5	Jul 18	Jul 5	Jul 18	Aug 17	
		% control		— % —		bu/A	lb/bu
Untreated		0	0	0	0	25	53.8
Puma	0.66 pt	96	95	0	0	30	53.5
Puma + Bronate	0.66 pt + 1 pt	64	43	0	0	36	55.4
Puma + Bronate 5	0.66 pt + 0.8 pt	65	45	0	0	36	55.6
Puma + Harmony GT + Starane + MCPA Ester + NIS	0.66 pt + 0.15 oz + 0.66 pt + 0.75 pt + 0.25 %	64	45	0	0	37	55.9
Puma + Harmony GT + Starane + NIS	0.66 pt + 0.3 oz + 0.33 pt + 0.25 %	81	60	0	0	39	56.1
Puma + Harmony GT + Aim + MCPA + Ester	0.66 pt + 0.3 oz + 0.33 oz + 0.5 pt	63	42	0	5	33	55.8
Discover + Score	4 fl oz + 0.8 %	91	90	0	0	33	53.5
Discover + Bronate + Score	4 fl oz + 1 pt + 0.8 %	75	58	0	0	40	56.5
Discover + Harmony GT + Starane + Score	4 fl oz + 0.3 oz + 0.33 pt + 0.8 %	68	53	0	0	40	56.6
Everest + NIS	0.6 oz + 0.25 %	85	73	15	13	36	55.7
Everest + Bronate + NIS	0.6 oz + 1 pt + 0.25 %	81	58	13	12	37	56.6
Everest + Harmony GT + Starane + NIS	0.6 oz + 0.3 oz + 0.33 pt + 0.25 %	86	60	18	15	36	56.2
LSD		8	10	2	2	6	2.0
CV		6	11	26	38	10	2

Everest caused severe stunting, as much as 4 to 6-inch height reduction; however, the wheat yields in Everest-treated plots were similar to other treatments. Everest alone provided only fair yellow foxtail control. Puma and Discover alone provided excellent yellow foxtail control, but yielded slightly lower due to no broadleaf weed control. We observed moderate to severe antagonism when Puma, Discover, and Everest were tank mixed with broadleaf herbicides.

Grass control with flucarbazone tank-mixes. (Howatt, Roach, and Davidson-Harrington) 'Alsen' hard red spring wheat was seeded May 15. Treatments were applied to 3 to 4 leaf wheat, 1 to 4 leaf wild oat, and emerging to 3 leaf yellow foxtail on June 9 with 80 F, 53% RH, 95% cloudcover, and 3 to 5 mph 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. Weed populations at time of application were wild oat 150 plants/ft^2 and yellow foxtail 10 plants/ft^2.

		6/20		7/09	8/14
Treatment	Rate	Wioa	Yeft	Wioa	Yield
	oz/A		%		bu/A
Flucarbazone+2,4-Dioe+NIS	0.42+8+0.25%	86	84	95	29
Flucarbazone+Bromoxynil&MCPA+NIS	0.42+8+0.25%	80	80	89	27
Flucarbazone+Carfentrazone+2,4-Dioe+NIS	0.42+0.128+6+0.25%	84	85	92	17
Flucarbazone+Thifensulfuron+2,4-Dioe+NIS	0.42+0.22+6+0.25%	86	81	96	24
Flucarbazone+Fluroxypyr+2,4-Dioe+NIS	0.42+1.5+6+0.25%	84	80	94	26
Flucarbazone+Tribenuron+24-Dioe+NIS	0.42+0.125+6+0.25%	89	85	97	26
Flucarbazone+FOE5043+2,4-Dioe+NIS	0.42+2.4+8+0.25%	81	78	96	23
Fenoxaprop+Bromoxynil&MCPA	1.32+8	89	88	97	25
Clodinafop+Bromoxynil&MCPA+Score	0.8+8+0.8%	91	90	99	31
FOE5043	7.5	33	30	66	23
Untreated	0	0	0	0	19
C.V. %		8	9	3	21
LSD 5%		8	9	3	7
# OF REPS		4	4	4	4

No wheat injury was observed. Flucarbazone provided less control of wild oat and yellow foxtail than fenoxaprop or clodinafop when each was applied with bromoxynil&MCPA although wheat yield following these treatments was not different. No antagonism of flucarbazone activity was detected on June 20 when comparing each tank-mix with the standard of flucarbazone+2,4-Dioe alone. On July 9, only bromoxynil&MCPA antagonized wild oat control with flucarbazone. Wheat treated with flucarbazone+carfentrazone+2,4-Dioe produced the least seed yield, 17 bu/A, even though weed control was similar to treatments where wheat yielded 26 to 29 bu.

Broad spectrum weed control in wheat. (Howatt, Roach, and Davidson-Harrington). "Lars" hard red spring wheat was seeded May 15. Treatments were applied to 3 to 4 leaf wheat, 1 to 4 leaf wild oat, and emerging to 3 leaf yellow foxtail on June 9 with 80 F, 53% RH, 95% cloud cover, 3 to 5 mph wind and 61 F soil temperature. 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 plot. The experiment was a randomized complete block design with four replicates. Weed densities were wild oat 150 plants/ft^2 and yellow foxtail 10 plants/ft^2.

		6/20		7/09
Treatments	Rate	Wioa	Yeft	Wioa
	oz/A		%	
Flucarbazone+NIS	0.42+0.25%	80	75	95
Flucarbazone+Bromoxynil&MCPA(4 lb)+NIS	0.42+8+0.25%	84	81	94
Flucarbazone+Thifensulfuron+Fluroxypyr+NIS	0.42+0.22+1+0.25%	84	79	92
Fenxoxaprop-P	1.32	90	88	97
Fenxoxaprop-P+Brox&MCPA(4 lb)	1.32+8	89	84	97
Fenxoxaprop-P+Brox&MCPA(5 lb)	1.32+8	90	86	98
Fenxoxaprop-P+Thifensulfuron+Flox+NIS	1.32+0.22+1+0.25%	89	85	97
Fenxoxaprop-P+Thif+Flox+MCPA+NIS	1.32+0.11+2+6+0.25%	84	81	96
Fenxoxaprop-P+Thif+Carf+MCPA	1.32+0.22+0.128+4	90	88	98
Clodinafop+Score	0.8+0.8%	90	86	98
Clodinafop+Brox&MCPA(4 lb)+Score	0.8+8+0.8%	90	85	97
Clodinafop+Thif+Flox+Score	0.8+0.22+1+0.8%	89	81	96
Untreated	0	0	0	0
C.V. %		4	5	2
LSD 5%		5	5	2
# OF REPS		4	4	4

No crop injury was observed. Yellow foxtail ratings were not included for the July 9 evaluation because it was believed that wild oat competition killed the foxtail plants. Fenoxaprop and clodinafop provided more rapid and greater wild oat and yellow foxtail control than flucarbazone. There was no fenoxaprop antagonism from either bromoxynil&MCPA formulation. Thifensulfuron+fluroxypyr slightly antagonized flucarbazone and clodinafop wild oat control on July 9. Thifensulfuron+fluroxypyr did not antagonize fenoxaprop activity; however, fenoxaprop+thifensulfuron+fluroxypyr+MCPA gave less grass control than fenoxaprop alone on June 20 while fenoxaprop+thifensulfuron+carfentrazone+MCPA grass control was equal to fenoxaprop. Past research has not indicated that fluroxypyr is antagonistic, but fluroxypyr may be enhancing antagonism from other broadleaf chemicals in this study.

Grass herbicide evaluation with dry and liquid dicamba formulations. (Howatt, Roach, and Davidson-Harrington) 'HJ98' hard red spring wheat was seeded at 2.06 bushels per acre on May 3. Treatments were applied to 4 to 5 leaf wheat and 1.5 to 3 leaf wild oat on June 4 with 79 F, 26% RH, 20% cloudcover, 1 to 3 mph wind and 59 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 30 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. Wild oat population was 25 to 300 plants/ft^2.

		6/19		7/03		8/01
Treatment[a]	Rate	Wht	Wioa	Wht	Wioa	Wioa
	oz/A			%		
Fenoxaprop	1.32	0	90	0	98	99
Fenoxaprop+Dicamba	1.32+0.125	0	86	0	97	99
Fenoxaprop+Dicamba-d	1.32+0.125	0	80	0	96	99
Fenoxaprop+MCPA	1.32+8	0	86	0	98	99
Clodinafop+DSV	0.8+0.8%	0	89	0	96	99
Clodinafop+Dicamba+DSV	0.8+0.125+0.8%	0	85	0	96	99
Clodinafop+Dicamba-d+DSV	0.8+0.125+0.8%	0	90	0	94	99
Clodinafop+MCPA+DSV	0.8+8+0.8%	0	90	0	96	99
Imazamethabenz+NIS	6+0.25%	0	80	1	91	84
Imazamethabenz+Dicamba+NIS	6+0.125+0.25%	2	76	2	75	79
Imazamethabenz+Dicamba-d+NIS	6+0.125+0.25%	2	73	0	64	43
Imazamethabenz+MCPA+NIS	6+8+0.25%	1	78	1	81	90
Flucarbazone+NIS	0.42+0.25%	5	71	2	89	99
Flucarbazone+Dicamba+NIS	0.42+0.125+0.25%	4	75	1	91	99
Flucarbazone+Dicamba-d+NIS	0.42+0.132+0.25%	4	70	1	86	96
Flucarbazone+MCPA+NIS	0.42+8+0.25%	8	75	5	91	99
Untreated	0	0	0	0	0	0
C.V. %		89	6	214	5	6
LSD 5%		2	7	2	6	7
# OF REPS		4	4	4	4	4

[a] Dicamba-d was dry formulated dicamba from BASF, DSV was petroleum oil adjuvant in co-pack with Discover from Syngenta.

Flucarbazone caused 4 to 8% stunting of wheat plants on June 19. Plants recovered in height by July 3 except for flucarbazone+MCPA treated plants, which were still shorter than other treatments. No height difference was observed on August 1. Consistent wild oat control was obtained across clodinafop or flucarbazone treatments at every evaluation. The dry formulation of dicamba antagonized wild oat control with fenoxaprop and with imazamethabenz on June 19. This effect got progressively worse for imazamethabenz+dicamba-d, which only gave 43% control on August 1 compared with 84% control with imazamethabenz.

Carfentrazone tank-mixes in hard red spring wheat. (Howatt, Roach, and Davidson-Harrington) 'HJ98' hard red spring wheat was seeded at 2.06 with 16-20-0 liquid fertilizer at 15 gallon/A on May 3. Treatments were applied to 4 to 5 leaf wheat and 1.5 to 4 leaf wild oat on June 4 with 70 F, 40% RH, 80% cloudcover, 3 to 6 mph wind, and 60 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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. Wild oat population was 25 to 300 plants/ft^2.

Treatment[a]	Rate	6/19		7/03	
		Wht	Wioa	Wht	Wioa
	oz/A	%			
Fenoxaprop+Carfentrazone+MCPA	1.32+0.128+4	0	88	0	97
Fenoxaprop+Carfentrazone&MCPA	1.32+0.128&4	0	83	0	97
Fenoxaprop+Carf+MCPA+Thifensulfuron	1.32+0.128+4+0.22	0	83	0	96
Fenxoxaprop+Carf&MCPA+Thifensulfuron	1.32+0.128&4+0.22	0	85	0	97
Fenoxaprop	1.32	0	92	0	98
Clodinafop+Carf+MCPA+DSV	0.8+0.128+4+1%	0	90	1	95
Clodinafop+Carf&MCPA+DSV	0.8+0.128&4+1%	0	87	1	96
Clodinafop+Carf+MCPA+Thif+DSV	0.8+0.128+4+0.22+1%	0	85	0	96
Clodinafop+Carf&MCPA+Thif+DSV	0.8+0.128&4+0.22+1%	1	83	2	95
Clodinafop+DSV	0.8+1%	1	82	1	97
Flucarbazone+Carf+2,4-Dioe+NIS	0.42+0.128+4+0.25%	0	80	0	93
Flucarbazone+Carf&MCPA+NIS	0.42+0.128&4+0.25%	0	80	2	88
Flucarbazone+Carf+2,4-Dioe+Thif+NIS	0.42+0.128+4+0.22+0.25%	0	78	0	92
Flucarbazone+Carf&MCPA+Thif+NIS	0.42+0.128&4+0.22+0.25%	1	73	2	92
Flucarbazone+NIS	0.42+0.25%	11	75	4	93
Imazamethabenz+Carf+MCPA+NIS	6+0.128+4+0.25%	2	73	1	88
Imazamethabenz+Carf&MCPA+NIS	6+0.128&4+0.25%	1	80	0	92
Imazamethabenz+Carf+MCPA+Thif+NIS	6+0.128+4+0.22+0.25%	1	80	0	80
Imazamethabenz+Carf&MCPA+Thif+NIS	6+0.128&4+0.22+0.25%	0	70	1	80
Imazamethabenz+NIS	6+0.25%	0	77	0	89
Untreated	0	0	0	0	0
C.V. %		144	6	211	4
LSD 5%		2	7	2	6
# OF REPS		3	3	4	4

[a] DSV was in co-pack with Discover from Syngenta.

There was no wild oat control difference between similar treatments that compared carfentrazone+MCPA and carfentrazone&MCPA. Flucarbazone applied alone caused 11% wheat injury on June 19, which manifested as stunting and chlorotic tissue. By July 3, injury was only 4% stunting. Flucarbazone tank-mixes did not elicit more wheat injury than untreated on June 19. 2,4-D was a slightly better safener of flucarbazone-induced injury than MCPA according to the July 3 evaluation. Fenoxaprop provided 92% wild oat control on June 19. Clodinafop gave less control, 82%, than fenoxaprop but better control than flucarbazone or imazamethabenz at this evaluation. On July 3, clodinafop and fenoxaprop provided 97 to 98% control, which was better than imazamethabenz. Thifensulfuron antagonized wild oat control by 7 to 9% with fenoxaprop on June 19 and 9% with imazamethabenz on July 3.

Carfentrazone tank-mixes in barley. (Howatt, Roach, and Davidson-Harrington) "Foster" barley was seeded May 17. Treatments were applied to 5 to 6 leaf barley, emerging to 2 inch redroot pigweed, emerging to 3 inch common lambsquarters, and 1 to 2 leaf yellow foxtail on June 18 with 68 F, 75% RH, 100% cloudcover, 0 to2 mph wind, and 60 F soil temperature. Treatments were applied with a backpack plot sprayer delivering 8.5 gpa at 35 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.

		6/26				7/07			7/15		
Treatment	Rate	Barley	Rrpw	Colq	Yeft	Barley	Rrpw	Yeft	Yeft	Rrpw	Colq
	oz/A					%					
Fenoxaprop+Carf+MCPA-ester	0.66+0.128+4	6	95	90	94	2	96	99	99	99	99
Fenx+Carfentrazone&MCPA	0.66+0.128&4	5	96	90	90	1	99	99	99	99	99
Fenx+Carf+MCPA-ester+Thifensulfuron	0.66+0.128+4+0.22	4	93	88	91	0	99	99	99	99	99
Fenoxaprop+Carf&MCPA+Thif	0.66+0.128&4+0.22	5	97	94	86	0	99	99	99	99	99
Fenoxaprop	0.66	0	33	18	88	0	5	99	99	0	0
Tral+Carf+MCPAester+Supercharge+AMS	2.9+0.128+4+0.5%+10	0	69	69	86	3	35	98	99	99	99
Tral+Carf&MCPA+Supercharge+AMS	2.9+0.128&4+0.5%+10	7	98	91	85	3	99	99	99	99	99
Tral+Carf+MCPAester+Thif+Supercharge+AMS	2.9+0.128+4+0.22+0.5%+10	7	95	91	87	0	99	99	99	99	99
Tral+Carf&MCPA+Thif+Supercharge+AMS	2.9+0.128&4+0.22+0.5%+10	6	96	93	84	3	99	98	99	99	99
Tralkoxydim+Supercharge+AMS	2.9+0.5%+10	0	30	23	83	1	5	99	99	0	0
Untreated	0	0	0	0	0	0	0	0	0	0	0
C.V. %		28	6	6	4	252	3	1	0	0	0
LSD 5%		1	6	6	5	NS	3	1	NS	NS	NS
# OF REPS		4	4	4	4	4	4	4	4	4	4

Carfentrazone caused 4 to 7% necrotic injury to barley leaves, but injury had diminished by July 7. Injury observed on broadleaf weeds was caused by burn from formulated and added adjuvants and plants recovered. Carfentrazone+MCPA performance was similar to the premix carfentrazone&MCPA in weed control and no antagonism of yellow foxtail control occurred. Only tralkoxydim+carfentrazone+MCPA was different from similar treatments. Broadleaf control reached 99% by July 15, but it is not known why earlier season evaluations of broadleaf control were 20 to 60% lower for this treatment.

Antagonism from thifensulfuron tank-mixes on wild oat control. (Howatt, Roach, and Davidson-Harrington) 'HJ98' hard red spring wheat was seeded at 2.06 bu/A on May 3. Treatments were applied to 4-5 leaf wheat and 1.5 to 4 leaf wild oat on June 4 with 70 F, 40% RH, 90% cloudcover, 5 to 8 mph wind, and 60 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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. Wild oat population was 25 to 300 plants/ft^2.

		6/19		6/25		7/03	
Treatment[a]	Rate	Wht	Wioa	Wht	Wioa	Wht	Wioa
	oz/A			%			
Fenoxaprop+Bromoxynil&MCPA	1.32+8	0	90	0	97	0	97
Fenoxaprop+Thif+Carfentrazone	1.32+0.22+0.128	0	94	0	99	2	99
Fenx+Thifensulfuron&Trib+Carf	1.32+0.22+0.128	0	90	0	95	1	98
Fenoxaprop+Thif+Carf+MCPA	1.32+0.22+0.128+8	0	90	0	96	0	97
Fenoxaprop+Thif&Trib+Carf+MCPA	1.32+0.22+0.128+8	1	90	0	96	2	96
Clodinafop+Brox&MCPA+DSV	0.8+8+0.8%	0	84	0	91	1	95
Clodinafop+Thif+Carf+DSV	0.8+0.22+0.128+0.8%	0	88	0	95	0	98
Clodinafop+Thif&Trib+Carf+DSV	0.8+0.22+0.128+0.8%	0	86	0	96	0	98
Clodinafop+Thif+Carf+MCPA+DSV	0.8+0.22+0.128+8+0.8%	0	86	0	89	2	95
Clfp+Thif&Trib+Carf+MCPA+DSV	0.8+0.22+0.128+8+0.8%	0	86	0	90	1	95
	0	0	0	0	0	0	0
C.V. %		663	5	0	3	195	2
LSD 5%		NS	5	NS	3	NS	2
# OF REPS		4	4	4	4	4	4

[a] DSV was petroleum oil adjuvant in co-pack with Discover from Syngenta.

Considering bromoxynil&MCPA as the standard, no antagonism was measured for any treatment within grass herbicide. On June 19 and 25, fenoxaprop provided better wild oat control than clodinafop. On July 3, all herbicide tank-mixes provided 95% wild oat control or better.

Antagonism from thifensulfuron tank-mixes on wild oat control. (Howatt, Roach, Davidson-Harrington) 'Alsen' wheat was seeded May 17. Treatments were applied to 5 leaf wheat and 3 to 4 leaf wild oat on June 19 with 74 F, 35% RH, 15% cloudcover, 7 mph wind, and 60 F soil temperature. 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 are the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Wild oat population was 75 plants/m^2.

Treatment[a]	Rate	7/10 Wioa	7/25 Wioa
	oz/A	%	
Fenoxaprop+Bromoxynil&MCPA	1.32+8	96	94
Fenoxaprop+Thifensulfuron+Fluroxypyr+Quad7	1.32+0.22+1+1%	94	98
Fenoxaprop+Thifensulfuron&Tribenuron+Flox+Quad7	1.32+0.22+1+1%	93	98
Fenoxaprop+Thifensulfuron+MCPA+Flox+Quad7	1.32+0.22+8+1+1%	92	96
Fenoxaprop+Thifensulfuron&Tribenuron+MCPA+Flox	1.32+0.22+8+1	88	93
Clodinafop+Bromoxynil&MCPA+DSV	0.8+8+0.8%	94	95
Clodinafop+Thifensulfuron+Fluroxypyr+DSV	0.8+0.22+1+0.8%	89	98
Clodinafop+Thifensulfuron&Tribenuron+Fluroxypyr+DSV	0.8+0.22+1+0.8%	92	98
Clodinafop+Thifensulfuron+MCPA+Fluroxypyr+DSV	0.8+0.22+8+1+0.8%	90	99
Clfp+Thif&Trib+MCPA+Fluroxypyr+DSV	0.8+0.22+8+1+0.8%	89	97
Untreated	0	0	0
C.V. %		2	3
LSD 5%		3	4
# OF REPS		4	4

[a] DSV was petroleum oil adjuvant in co-pack with Discover from Syngenta.

Thifensulfuron+MCPA+fluroxypyr resulted in slightly less, 92%, wild oat control with fenoxaprop than bromoxynil&MCPA, 96%, on July 10. Addition of tribenuron further antagonized control and reduced control to 88% with fenoxaprop. The same trend occurred for clodinafop. Clodinafop+thifensulfuron& tribenuron+MCPA gave 89% control while clodinafop+bromoxynil&MCPA provided 94% wild oat control on July 10. Clodinafop+thifensulfuron+fluroxypyr also gave 89% control. On July 25, all thifensulfuron containing tank-mixes were equal to or better than bromoxynil&MCPA tank-mixes for wild oat control.

Antagonism from thifensulfuron tank-mixes on yellow foxtail control. (Howatt, Roach, and Davidson-Harrington) "Alsen" hard red spring wheat was seeded May 31. Treatments were applied to 3.5 leaf wheat and 2 to 3 leaf yellow foxtail on June 21 with 66 F, 49% RH, 0% clouds and 4 to 5 mph wind. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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 50 to 75 plants/m^2.

Treatment	Rate	6/29 Yeft	7/13 Yeft	7/25 Yeft
	oz/A		%	
Fenoxaprop-P+Bromoxynil&MCPA	0.8+8	89	93	95
Fenoxaprop-P+Thifensulfuron+Fluroxypyr+Quad7	0.8+0.22+1+1%	86	91	90
Fenoxaprop-P+Thifensulfuron&Tribenuron+Fluroxypyr+Quad7	0.8+0.22+1+1%	84	89	87
Fenoxaprop-P+Thifensulfuron+Fluroxypyr+MCPA+Quad7	0.8+0.22+1+8+1%	81	86	86
Fenoxaprop-P+Thifensulfuron&Tribenuron+Fluroxypyr+MCPA	0.8+0.22+1+8	84	85	87
Clodinafop+Bromoxynil&MCPA+Score	1+8+1%	88	91	90
Clodinafop+Thifensulfuron+Fluroxypyr+Score	1+0.22+1+1%	83	89	89
Clodinafop+Thifensulfuron&Tribenuron+Fluroxypyr+Score	1+0.22+1+1%	85	83	76
Clodinafop+Thifensulfuron+Fluroxypyr+MCPA+Score	1+0.22+1+8+1%	82	81	80
Clodinafop+Thifensulfuron&Tribenuron+Fluroxypyr+MCPA+Score	1+0.22+1+8+1%	84	82	86
Untreated	0	0	0	0
C.V. %		4	3	4
LSD 5%		5	4	5
# OF REPS		4	4	4

Antagonism occurred more consistently for fenoxaprop than for clodinafop because fenoxaprop provided greater yellow foxtail control than clodinafop with bromoxynil&MCPA, 95 and 90% on July 25. Clodinafop activity was antagonized the most. Clodinafop+thifensulfuron&tribenuron+fluroxypyr+MCPA provided 76% control, which is 14% less than clodinafop+bromoxynil&MCPA.

Weed control with grass herbicides tank-mixed with BAS635. (Howatt, Roach, and Davidson-Harrington) 'Alsen' hard red spring wheat was seeded May 15. Treatments were applied to 5 leaf wheat, 4 to 12 inch wild mustard, and 3 to 4 leaf wild oat on June 19 with 74 F, 35% RH, 15% cloudcover, 7 mph wind, and 60 F soil temperature. Treatments after (/) were applied on June 21 with 66 F, 49% RH, 0% cloudcover, 4 to 5 mph wind, and 60 F soil temperature. All 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. Wild oat population was 25 plants/ft^2 and wild mustard population was 3 to 5 plants/ft^2.

Treatment[a]	Rate	7/10		7/25
		Wioa	Wimu	Wioa
	oz/A		%	
BAS635+NIS	0.72+0.25%	0	97	0
BAS635+Imazamethabenz+NIS	0.72+7.5+0.25%	80	93	81
BAS635+ Imazamethabenz +NIS	0.72+5+0.25%	85	96	83
BAS635+ Imazamethabenz +Dife+NIS	0.72+3.7+8+0.25%	84	97	88
BAS635+Difenzoquat+NIS	0.72+16+0.25%	83	95	90
BAS635+Flucarbazone+NIS	0.72+0.34+0.25%	87	94	99
BAS635+ Flucarbazone+NIS	0.72+0.47+0.25%	88	96	99
BAS635+Fenoxaprop+NIS	0.72+0.66+0.25%	94	95	98
BAS635+ Fenoxaprop +NIS	0.72+1.32+0.25%	95	98	99
BAS635+Clodinafop+DSV	0.72+0.8+0.8%	96	93	99
BAS635+Tralkoxydim+SC	0.72+2.9+0.5%	95	93	97
Imazamethabenz+NIS/Bromoxynil&MCPA	7.5+0.25%/8	87	97	86
Difenzoquat/Bromoxynil &MCPA	16/8	85	95	77
Flucarbazone+NIS/Bromoxynil&MCPA	0.42+0.25%/8	91	98	99
Fenoxaprop/Bromoxynil&MCPA	1.32/8	95	99	97
Clodinafop+DSV/Bromoxynil&MCPA	0.8+0.8%/8	96	97	98
Tralkoxydim+SC/Bromoxynil&MCPA	2.9+0.5%/8	90	96	98
C.V. %		4	3	5
LSD 5%		4	3	6
# OF REPS		4	4	4

[a] DSV was petroleum oil adjuvant in co-pack with Discover from Syngenta, SC was supercharge methylated vegetable oil adjuvant from Syngenta.

No crop injury was observed. BAS635 caused no antagonism that was measured on July 25. Flucarbazone, fenoxaprop, clodinafop, and tralkoxydim provided 97% wild oat control or better when applied alone or in a tank-mix with BAS635.

SU's in combination with grass herbicides for wild oat control in durum wheat, Williston 2001. (Neil Riveland and Gordon Bradbury) The purpose of the study was to determine if antagonism exists with Dupont cereal SU's and selected cereal grass herbicides. 'Maier' durum was planted on recrop (land cropped to durum wheat in 2000) in 7 inch rows at 90 lbs/a on May 8. Treatments were applied on June 8 to 4 to 5-leaf wheat, 1-5 leaf wild oats (most were in the 3 to 5-leaf stage) with 70 F temps, Relative humidity 40%, clear sky and 3 to 8 mph WSW wind. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 10 gals/a at 40 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Wild oat density was heavy; greater than 20 plants/ ft^2. Plots were evaluated for wild oat control on July 14 and August 19. Durum was machine harvested on August 28.

Treatment[a]	Rate	Crop Inj	Wioa Cntrl 7-14	8-19	Test Wt	Yield
	oz/a product	%	--- %	---	lbs/b	bus/a
Puma+H GT+Starane+Quad 7	0.67+0.30+0.33+1.0%	0	74	74	63.2	32.5
Puma+Harmony Extra+Starane+Quad 7	0.67+0.30+0.33+1.0%	0	69	79	63.1	37.0
Puma+H GT+Starane+MCPA Ester+Quad 7	0.67+0.30+1.0+0.33+1.0%	1	66	73	63.6	31.9
Puma+Harmony Extra+Starane+MCPA E	0.67+0.30+0.33+1.0	13	71	53	62.6	25.8
Discover+DSV+H GT+Starane	4.0+1.0+0.30+0.33	6	72	73	62.9	35.8
Discover+DSV+H Extra+Starane	4.0+1.0+0.30+0.33	8	72	69	62.9	33.3
Discover+DSV+H GT+Starane+MCPA E	4.0+1.0+0.30+0.33+1.0	3	76	79	62.4	31.1
Discover+DSV+H Extra+Starane+MCPA E	4.0+1.0+0.30+0.33+1.0	9	70	66	63.3	28.2
Untreated Check	0.0	0	0	0	62.4	11.1
C.V. %		74	12	11	.9	16.8
LSD 5%		5	11	10	NS	7.3
LSD 1%		6	14	14	NS	9.9
# OF REPS		4	4	4	4	4

[a] - Quad 7 = A basic blend adjuvant from AGSCO.

Comments: May was dry. There was no significant precipitation until May 30. Therefore seedling and weed emergence occurred over a longer period of time than normal.
This experiment conducted cooperatively with Dr. James Harbour, Dupont.

Green foxtail control with SU/Grass herbicide tankmixes. Jenks, Willoughby, and Markle. 'Alsen' spring wheat was seeded May 22, 2001 into 6-inch rows in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replications. Postemergence (POST) treatments were applied to 4 to 5-leaf wheat on June 25 with XR8001 flat fan nozzles at 10 gpa and 40 psi. Weeds at application were green foxtail (3 to 4-lf, 65/ft^2), kochia (3-inch, 5/ft^2), and wild buckwheat (2-lf, 2/ft^2). The crop was not harvested.

		Injury	Kocz	Rrpw	Wibw	Colq	Grft	
Treatment	Rate		Jul 10				Jul 10	Jul 18
		%	% control					
Puma + Harmony GT + Starane + Quad 7	0.67 pt + 0.3 oz + 0.33 pt + 1 %	0	95	94	93	95	97	98
Puma + Harmony Extra + Starane + Quad 7	0.67 pt + 0.3 oz + 0.33 pt + 1 %	0	95	95	92	95	93	97
Puma + Harmony GT + MCPA Ester + Starane + Quad 7	0.67 pt + 0.3 oz + 1 pt + 0.33 pt + 1 %	0	96	94	93	94	95	98
Puma + Harmony Extra + MCPA Ester + Starane + Quad 7	0.67 pt + 0.3 oz + 1 pt + 0.33 pt + 1 %	0	95	95	93	95	92	95
Discover + DSV + Harmony GT + Starane	4 fl oz + 1 pt + 0.3 oz + 0.33 pt	0	94	94	93	95	82	91
Discover + DSV + Harmony Extra + Starane	4 fl oz + 1 pt + 0.3 oz + 0.33 pt	0	93	94	92	91	76	82
Discover + DSV + Harmony GT + Starane + MCPA Ester	4 fl oz + 1 pt + 0.3 oz + 0.33 pt + 1 pt	0	95	94	93	95	79	87
Discover + DSV + Harmony Extra + Starane + MCPA Ester	4 fl oz + 1 pt + 0.3 oz + 0.33 pt + 1 pt	0	94	94	93	95	70	76
Untreated		0	0	0	0	0	0	0
LSD		NS	2	2	2	1	5	4
CV		0	1	1	1	1	4	3

All treatments provided excellent broadleaf weed control. Puma tank mixes provided greater than 95% green foxtail control. Discover tank mixes provided 76 to 91% green foxtail control. In the Discover treatments, there appeared to be more antagonism from the Harmony Extra and/or MCPA ester. None of the treatments caused visible crop injury.

Yellow foxtail control with SU/Grass herbicide tankmixes. Jenks, Willoughby, and Markle. 'Grandin' spring wheat was seeded May 4, 2001 into 6-inch rows in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replications. Postemergence (POST) treatments were applied to 4 to 5-leaf wheat on June 7 with XR8001 flat fan nozzles at 10 gpa and 40 psi. Weeds at application were yellow foxtail (3-lf, 15/ft^2), kochia (2-inch, 1/ft^2), lambsquarters (2 to 3-inch, 2/ft^2), wild buckwheat (3-lf, 1/ft^2), and redroot pigweed (1-inch, 1/ft^2).

Treatment	Rate	Injury	Yeft Control	
		Jul 5	Jul 5	Jul 18
		— % —	—— % control ——	
Puma + Harmony GT + Starane + Quad 7	0.67 pt + 0.3 oz + 0.33 pt + 1 %	0	88	67
Puma + Harmony Extra + Starane + Quad 7	0.67 pt + 0.3 oz + 0.33 pt + 1 %	0	87	67
Puma + Harmony GT + MCPA Ester + Starane + Quad 7	0.67 pt + 0.3 oz + 1 pt + 0.33 pt + 1 %	0	87	68
Puma + Harmony Extra + MCPA Ester + Starane + Quad 7	0.67 pt + 0.3 oz + 1 pt + 0.33 pt + 1 %	0	84	65
Discover + DSV + Harmony GT + Starane	4 fl oz + 1 pt + 0.3 oz + 0.33 pt	0	71	50
Discover + DSV + Harmony Extra + Starane	4 fl oz + 1 pt + 0.3 oz + 0.33 pt	0	74	57
Discover + DSV + Harmony GT + Starane + MCPA Ester	4 fl oz + 1 pt + 0.3 oz + 0.33 pt + 1 pt	0	64	46
Discover + DSV + Harmony Extra + Starane + MCPA Ester	4 fl oz + 1 pt + 0.3 oz + 0.33 pt + 1 pt	0	74	53
Untreated		0	0	0
LSD		NS	18	19
CV		0	15	21

All treatments provided excellent broadleaf weed control. Puma and Discover tank mixes did not control yellow foxtail. Yellow foxtail was suppressed temporarily early, but the weeds continued to grow and were as tall as the wheat in some treatments by harvest time. Yellow foxtail control with Puma tank mixes was 10-20% higher than Discover tank mixes. None of the treatments caused visible crop injury.

General Broadleaf Control In Wheat, Oriska. (Howatt, Roach, Davidson-Harrington) "Oxen" hard red spring wheat was seeded at 110 lbs/A on May 8. Treatments were applied to 2.5 leaf wheat and 0.5 to 3 inch kochia on May 29 with maximum temperature of 74 and minimum 49 F, 51 F Dew point, 10% cloudcover, 10 mph wind, and 62 F soil temperature. Treatments were applied with backpack sprayer delivering 8.5 gpa at 35 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. Kochia population was 15 to 25 plants/ft^2.

Treatment	Rate	6/13 Kocz	6/29 Kocz
	oz/A	%	
Fluroxypyr	0.25	33	78
Fluroxypyr	0.5	71	93
Fluroxypyr	1	75	98
Fluroxypyr	1.5	88	99
Fluroxypyr	2	90	99
Bromoxynil&MCPA (4# FORMULATION)	8	98	99
Bromoxynil&MCPA (5# FORMULATION)	8	98	97
Fluroxypyr&MCPA	8	89	98
Fluroxypyr&24-D	7.5	88	99
Dicamba+MCPA	1.5+4	90	99
Thifensulfuron&Tribenuron+Fluroxypyr&MCPA	0.22+5.4	94	99
Thif&Trib+Carfentrazone+MCPA+Act90+UAN	0.22+0.128+4+0.25%+4%	99	99
C.V. %		7	4
LSD 5%		7	5
# OF REPS		4	4

This location had a kochia population that was largely resistant to ALS inhibiting herbicides. Vigorous crop growth enhanced herbicide activity. Of the fluroxypyr rates, 1.5 oz/A was needed to achieve 88% kochia control on June 13. With crop competition, 0.5 oz fluroxypyr provided over 90% control by June 29. There was no difference in control between the 4 lb and 5 lb formulations of bromoxynil&MCPA, each gave 98% control on June 13. Treatments that contained bromoxynil or carfentrazone caused more rapid kochia desiccation than other herbicide treatments.

2001 Broadleaf Weed Control in Spring Wheat at Hettinger. (Eriksmoen) Reeder hard red spring wheat was seeded on April 26. Treatments were applied to 3 ½ leaf wheat and to ½ inch tall kochia on May 25 with 47 F, 78 % RH, clear sky and 5 mph wind. There was a light frost 2 ½ hours prior to application. 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 experiment was a randomized complete block design with four replications. Kochia population was 24 plants per sq. foot. The trial was sprayed with 10 oz/A Puma on June 7 to control wild oats. Evaluations for crop injury were on May 29 and June 7, and for kochia control on June 12 and July 30. The trial was severely damaged by hail on June 18 and was not harvested.

Treatment		Product Rate	5/29	6/7	6/12	7/30
			HRSW	HRSW	Kocz	Kocz
			% Injury		% Control	
1	Fluroxypyr	0.25	0	0	86	70
2	Fluroxypyr	0.5	0	0	94	86
3	Fluroxypyr	1	0	0	94	89
4	Fluroxypyr	1.5	0	0	95	79
5	Fluroxypyr	2	0	5	95	82
6	Brox&MCPA (4 lb formulation)	8	0	1	95	94
7	Brox&MCPA (5 lb formulation)	8	2	1	95	92
8	Fluroxypyr&MCPA	8	0	2	95	95
9	Fluroxypyr&2,4-D	7.5	1	0	95	94
10	Dicamba+MCPA	1.5 + 4	2	7	95	94
11	Thif&Trib+Flox&MCPA	0.22 + 5.4	6	3	95	94
12	Thif&Trib+Carf+MCPA+Act 90+UAN	0.22+0.128+4+.25%+4%	6	5	95	94
13	Carf+MCPA+Act 90+UAN	0.128 + 6 + .25% + 4%	14	4	94	95
14	Carf+Flox&MCPA+Act 90+UAN	0.128 + 5.6 + .25% + 4%	15	0	95	91
15	Untreated	0	0	0	0	0
C.V. %			47.9	230	2.6	14.7
LSD 5%			2	ns	3	17

Summary

Carfentrazone treatments (trts 13 & 14) caused significant but temporary crop injury (chlorosis). All herbicide treatments provided excellent season long kochia control except for the low rate of Fluroxypyr (trt 1) and the two high rates of Fluroxypyr (trts 4 & 5) which had good initial levels of control but declined after that point.

Broadleaf weed control in hrs wheat, Williston 2001. (Neil Riveland, Gordon Bradbury) The experiment was conducted to evaluate several herbicides for broadleaf weed control in hrs wheat. 'Parshall' hrs wheat was planted on fallow in 7 inch rows at 80 lbs/a on May 17. Treatments were applied on June 21 to 5-leaf wheat, 2-3 leaf green foxtail, 1 inch Russian thistle and 1-4 inch kochia with 50 F, 85% RH, clear sky, and less than 2mph E wind with dry topsoil at 58 F. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed densities were very light for green foxtail and Russian thistle and were not rated. Densities for kochia ranged from 1/yd^2 in rep 4 to an average of 3/yd^2 in the other reps. Plots were evaluated on July 1 and July 19 for injury and on July 19 and August 25 for kochia control. Wheat was machine harvested on August 29. Only 3 reps were used in the statistical analysis, with rep 4 not used because of lighter weed density.

Treatment[a]	Rate	Crop Inj	Kocz Control 7-19	8-19	Test Weight	Yield
	oz/a ai	%	---- % ----		lbs/bu	bus/a
Fluroxypyr	0.25	0	63	45	63.4	36.5
Fluroxypyr	0.50	1	82	88	63.1	39.1
Fluroxypyr	1.00	2	88	93	63.3	40.9
Fluroxypyr	1.50	2	93	92	63.9	40.4
Fluroxypyr	2.00	4	98	99	63.3	38.5
Brox&MCPA (4# FORM.)	8.0	0	67	56	63.4	41.8
Brox&MCPA (5# FORM.)	8.0	1	40	38	63.2	44.1
Fluroxypyr&MCPA	8.0	1	94	97	63.1	45.5
Fluroxypyr&2,4-D	7.5	1	97	96	63.1	42.3
Dicamba+MCPA	1.5+4	2	94	96	63.3	41.5
Thif&Trib+Flox&MCPA	0.22+5.4	1	93	98	62.9	43.6
Thif&Trib+Carf+MCPA +Act90+UAN	0.22+0.128+4 +0.25%+4%	2	87	85	63.3	42.9
Carf+MCPA+Act90+UAN	0.128+6+0.25%+4%	4	52	52	63.1	38.4
Carf+Flox&MCPA+Act90+UAN	0.128+5.4+0.25%	5	96	96	63.4	41.7
Untreated	0.0	0	0	0	63.0	36.3
C.V. %		84	9	13	.4	7.5
LSD 5%		2	11	17	NS	5.1
# OF REPS		3	3	3	2	3

[a] - Act90 = Activator 90 nonionic surfactant from Loveland.
Thif&Trib = Thifensulfuron & Tribenuron (Express)
Carf = Carfentrazone Flox = Fluroxypry

Comments and Summary: Only the Dicamba + MCPA showed any injury symtoms on July 1, rated as 10% crop injury because of yellowing of crop foliage. Floroxypyr applied at 0.25 oz/a ai did not adequately control kochia nor did the Bromoxynil+MCPA and Carfentrazone+MCPA treatments. Fluroxypyr&MCPA gave very good kochia control and highest grain yield. The Carfentrazone and Dicamba generally showed slight crop injury in the form delayed maturity and stunting.

Broadleaf weed control with comparison of 4 and 5 lb formulations of Bromoxynil&MCPA, Oriska. (Howatt, Roach, and Davidson-Harrington) "Oxen" hard red spring wheat was seeded at 110 lbs/A on May 8. Treatments were applied to 2.5 leaf wheat and 0.5 to 3 inch tall kochia on May 29 with air temperature of 74 F, dew point 51, average wind speed of 10 mph and 62 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 30 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. Kochia density was 15 to 25 plants/ft^2.

Treatment	Rate	6/13 Kocz	6/29 Kocz
	oz/A	%	
Bromoxynil&MCPA(4 lb)	8	97	99
Bromoxynil&MCPA(5 lb)	8	98	92
Bromoxynil&MCPA(4 lb)+Thifensulfuron	6+0.22	97	98
Bromoxynil&MCPA(5 lb)+Thifensulfuron	6+0.22	96	97
Bromoxynil&MCPA(4 lb)+Fluroxypyr	8+0.75	99	99
Bromoxynil&MCPA(5 lb)+Fluroxypyr	8+0.75	99	99
Carfentrazone+Fluroxypyr&MCPA+Activator 90+UAN	0.128+5.4+0.25%+4%	99	99
Thifensulfuron&Tribenuron+Fluroxypyr&MCPA	0.22+5.4	96	99
Untreated	0	0	0
C.V. %		3	4
LSD 5%		4	5
# OF REPS		4	4

No crop injury was observed. Vigorous crop growth promoted herbicide efficacy. All treatments provided greater than 90% kochia control, and no kochia plants were observed in herbicide treated plots on August 2. Speed of kochia removal was the primary difference in herbicide treatment. The 5 lb bromoxynil&MCPA formulation generally performed similar to the 4 lb formulation. Severely injured but surviving kochia was more common in 5 lb bromoxynil&MCPA plots than in 4 lb bromoxynil&MCPA plots. Tank-mixes containing bromoxynil&MCPA (either formulation) and fluroxypyr or carfentrazone and fluroxypyr provided the most rapid control and desiccation of kochia, eliminating live kochia plants by June 13.

Bronate for broadleaf weed control in HRSW. Jenks, Willoughby, and Markle. 'Alsen' spring wheat was seeded May 22, 2001 into 6-inch rows in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replications. Postemergence (POST) treatments were applied to 4 to 5-leaf wheat on June 25 with XR8001 flat fan nozzles at 10 gpa and 40 psi. Weeds at application were redroot pigweed (2 to 3-inch, 25/ft^2), kochia (3-inch, 2/ft^2), and lambsquarters (5-inch, 1/ft^2). The crop was not harvested.

		Rrpw		Kocz		Colq	
Treatment	Rate	Jul 5	Aug 6	Jul 5	Aug 6	Jul 5	Aug 6
		% control					
Bronate	1 pt	82	98	90	100	100	92
Bronate 5	0.8 pt	81	83	90	95	100	91
Bronate + Harmony GT	0.75 pt + 0.3 oz	81	100	91	100	100	92
Bronate 5 + Harmony GT	0.6 pt + 0.3 oz	82	100	88	100	100	91
Bronate + Starane	1 pt + 0.25 pt	84	96	95	100	100	94
Bronate 5 + Starane	0.8 pt + 0.25 pt	83	100	95	100	100	93
Untreated		0	0	0	0	0	0
LSD		2	13	4	5	--	2
CV		2	9	3	4	0	1

All Bronate treatments alone or tank mixed with Harmony GT or Starane provided excellent control of redroot pigweed, kochia, and common lambsquarters. No crop injury was observed with any treatment.

Carfentrazone tank-mixes for broadleaf control in HRSW. (Howatt, Roach, and Davidson-Harrington) "Oxen" hard red spring wheat was seeded May 8. Treatments were applied to 2.5 leaf wheat and 0.5 to 3 inch kochia on May 29 with a temperature high of 74 and low 49 F, 51 F dew point, 20% cloudcover, 1 to 5 mph wind, and 62 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 30 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. Kochia density was 15 to 25 plants/ft^2.

Treatment	Rate	6/13 KOCZ	6/29 KOCZ
	oz/A	%	
Carfentrazone+2,4-DLV6+NIS	0.128+4+0.25%	99	99
Carfentrazone+2,4-DLV6+Dicamba+NIS	0.128+4+1.5+0.25%	99	99
Carfentrazone+2,4-DLV6+Thif&Tribenuron+NIS	0.128+4+0.22+0.25%	98	99
Carfentrazone+Fluroxypyr&2,4-D+NIS	0.128+7.5+0.25%	98	99
Carfentrazone+2,4-DLV6+Tribenuron+NIS	0.128+4+0.188+0.25%	99	99
Carfentrazone+2,4-DLV6+Thifensulfuron+NIS	0.128+4+0.22+0.25%	99	99
Carfentrazone+Bromoxynil&MCPA	0.128+6	99	99
Carfentrazone+Bromoxynil&MCPA+NIS	0.128+6+0.25%	99	99
Carfentrazone+MCPA+NIS	0.128+4+0.25%	99	99
Carfentrazone+MCPA+Thifensulfuron+NIS	0.128+4+0.22+0.25%	99	99
Thifensulfuron+NIS	0.22+0.25%	25	49
Bromoxynil&MCPA	6	80	99
Bromoxynil&MCPA	8	83	99
Untreated	0	0	0
C.V. %		4	5
LSD 5%		5	6
# OF REPS		4	4

Tank-mixes containing carfentrazone controlled kochia more quickly than other herbicide treatments, providing 98% kochia control or better June 13. Carfentrazone+MCPA provided 99% control on June 13 compared to 83% control with bromoxynil&MCPA. The location had ALS-resistant kochia and all herbicides provided 99% control on June 29 except thifensulfuron.

Carfentrazone tank-mixes for broadleaf control in barley, Fargo. (Howatt, Roach, and Davidson-Harrington) "Foster" barley was seeded May 17. Treatments were applied to 5 to 6 leaf barley, emerging to 2 inch redroot pigweed, and emerging to 3 inch common lambsquarters on June 18 with 68 F, 75% RH, 100% cloudcover, light and variable wind, and 60 F soil temperature. 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 four replicates.

		6/26			7/07		7/15		8/21
Treatment	Rate	Barley	Rrpw	Colq	Rrpw	Colq	Rrpw	Colq	Yield
	oz/A%				%				bu/A
Carfentrazone+2,4-DLV6+NIS	0.128+4+0.25%	5	94	90	97	98	99	99	58
Carfentrazone+2,4-DLV6+Dicamba+NIS	0.128+4+1.5+0.25%	5	95	93	99	99	99	99	49
Carf+2,4-DLV6+Thif&Trib+NIS	0.128+4+0.22+0.25%	4	95	90	99	99	99	99	56
Carfentrazone+Fluroxypyr&2,4-D+NIS	0.128+6&1.5+0.25%	5	97	95	97	96	99	99	57
Carf+2,4-DLV6+Tribenuron+NIS	0.128+4+0.188+0.25%	4	98	95	99	99	99	99	55
Carf+2,4-DLV6+Thifensulfuron+NIS	0.128+4+0.22+0.25%	3	95	89	97	96	99	99	56
Carfentrazone+Bromoxynil&MCPA	0.128+6	7	96	93	98	98	99	99	59
Carfentrazone+Bromoxynil&MCPA+NIS	0.128+6+0.25%	9	95	92	97	98	99	99	56
Carfentrazone&MCPA+NIS	0.128&4+0.25%	5	93	92	98	98	99	99	60
Carfentrazone&MCPA+Thif+NIS	0.128&4+0.22+0.25%	4	95	91	99	99	99	99	63
Thifensulfuron+NIS	0.22+0.25%	0	55	30	89	90	48	38	63
Bromoxynil&MCPA	6	0	79	85	90	91	99	99	63
Bromoxynil&MCPA	8	0	73	70	93	94	99	99	57
Untreated	0	0	0	0	0	0	0	0	56
C.V. %		21	7	7	3	3	2	2	12
LSD 5%		1	8	8	4	4	2	2	NS
# OF REPS		4	4	4	4	4	4	4	4

All treatments containing carfentrazone caused injury to barley with carfentrazone+bromoxynil&MCPA+NIS causing the most injury. Injury was small necrotic spots on upper canopy leaves and was not detected on July 7. Yield was not effected by carfentrazone injury or weed competition. All herbicide treatments except thifensulfuron+NIS provided 99% control of redroot pigweed and common lambsquarters. Carfentrazone tank-mixes controlled weeds more quickly than treatments without carfentrazone.

Broadleaf weed control with BAS635, Fargo. (Howatt, Roach, and Davidson-Harrington) 'Alsen' hard red spring wheat was seeded on May 15 . Treatments were applied to 4 to 5 leaf wheat, emerging to 2 inch redroot pigweed, and emerging to 3 inch common lambsquarters on June 20 with 65 F, 56% RH, 70% cloudcover, 2 to 5 mph wind, and 59 F soil temperature. Treatments were applied with a bicycle-wheel-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.

Treatment[a]	Rate	7/09	
		Rrpw	Colq
	oz/A	%	
BAS635+NIS	0.54+0.25%	91	87
BAS635+NIS	0.72+0.25%	93	91
BAS635+MSO	0.72+1%	95	90
Dicamba+BAS655+NIS	1.08+0.54+0.25%	95	94
Dicamba+BAS655+NIS	1.44+0.72+0.25%	95	90
Dicamba+BAS655+MSO	1.44+0.72+1%	96	94
Thifensulfuron&Tribenuron+NIS	0.3+0.125%	88	90
Carf+Flox&MCPA	0.128+8	98	96
Untreated	0	0	0
C.V. %		2	3
LSD 5%		3	4
# OF REPS		3	3

[a] A dry formulation of dicamba was used from BASF.

No wheat injury was observed. Carfentrazone+fluroxypyr&MCPA provided the most control of redroot pigweed and common lambsquarters, 98 and 96%. BAS635 gave greater control of redroot pigweed than thifensulfuron& tribenuron, but lambsquarters control was not different. Addition of dicamba to BAS635 tended to increase weed control. The study was terminated after the first evaluation because weather conditions and competition reduced weed pressure in untreated plots.

Flucarbazone tank mixes for wild buckwheat control, Fargo. (Howatt, Roach, and Davidson-Harrington) "Alsen" hard red spring wheat was seeded May 15. Treatments were applied to leaf wheat and 1 to 3 leaf wild buckwheat on June 7 with a temperature high of 75 F and low 54 F, 56 F dew pt., 45% cloudcover, 0 to 3 mph wind, and 65 F soil temperature. 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 four replicates.

Treatments	Rate	7/13 Wibw	7/27 Wibw
	(oz/A)	%	
Fenoxaprop	1.32	0	0
Fenoxaprop+Thifensulfuron+NIS	1.32+0.22+0.25%	98	91
Fenoxaprop+Bromoxynil&MCPA	1.32+8	97	91
Fenoxaprop+Fluroxypyr&MCPA	1.32+10.7	98	96
Fenoxaprop+Dicamba	1.32+4	98	97
Fenoxaprop+2,4-Dioe	1.32+8	98	91
Flucarbazone+NIS	0.42+0.25%	98	76
Flucarbazone+Thifensulfuron+NIS	0.42+0.22+0.25%	98	92
Flucarbazone+Bromoxynil&MCPA+NIS	0.42+8+0.25%	98	86
Flucarbazone+Fluroxypyr&MCPA+NIS	0.42+10.7+0.25%	98	90
Flucarbazone+Dicamba+NIS	0.42+4+0.25%	99	93
Flucarbazone+2,4-Dioe+NIS	0.42+8+0.25%	99	84
Untreated	0	0	0
C.V. %		1	4
LSD 5%		1	4
# OF REPS		4	4

This experiment was established to determine the activity of flucarbazone and flucarbazone tank-mixes on wild buckwheat. Less wild buckwheat control on July 27 was primarily because of recovering plants. Late wild buckwheat emergence was minimal. While flucarbazone gave 76% wild buckwheat control on July 27, flucarbazone antagonized the activity of other broadleaf herbicides. Tank-mixes with flucarbazone averaged 5% less control than tank-mixes with fenoxaprop. Dicamba provided the most wild buckwheat control at 97%.

Wild buckwheat control in small grains, Cando Exp. 1. (Howatt, Roach, and Davidson-Harrington) Durum wheat was seeded Early May. Fenoxaprop was applied to the study area to control wild oat and foxtails. Treatments were applied to 2.5 to 3.5 leaf durum, cotyledon to 2.5 leaf wild buckwheat, and cotyledon to 2 leaf redroot pigweed on June 7 with 74 F, 20% RH, 35% cloudcover, 2 to 4 mph wind and 59 F soil temperature. Treatments were applied with a backpack sprayer delivering 35 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 wild buckwheat 10 to 25 plants/ft^2 and redroot pigweed 5 plants/ft^2.

Treatment[a]	Rate	6/22		7/11
		Wibw	Rrpw	Wibw
	oz/A		%	
Fluroxypyr+LI700	1.5+0.25%	50	33	96
Fluroxypyr +LI700	2+0.25%	51	33	74
Fluroxypyr&2,4-De+LI 700	7.5+0.25%	71	79	78
Fluroxypyr&2,4-De+LI 700	10+0.25%	76	73	99
Fluroxypyr&MCPA+LI 700	8+0.25%	70	74	99
Fluroxypyr&MCPA+LI 700	10.7+0.25%	83	80	99
Fluroxypyr +Clopyralid&24-D+LI 700	1.5+9.5+0.25%	86	92	98
Clopyralid&2,4-D+LI 700	9.5+0.25%	80	79	99
Fluroxypyr +Thifensulfuron&Tribenuron+Liberate	1.5+0.22+0.25%	92	95	99
Fluroxypyr&2,4-De+Thifensulfuron&Tribenuron+Liberate	7.5+0.22+0.25%	92	95	98
Thifensulfuron&Tribenuron+Liberate	0.22+0.25%	95	98	99
Fluroxypyr +Thifensulfuron+Liberate	1.5+0.22+0.25%	94	96	99
Fluroxypyr&2,4-De+Thifensulfuron+Liberate	7.5+0.22+0.25%	96	98	98
Thifensulfuron+Liberate	0.22+0.25%	93	96	99
Fluroxypyr +Bromoxynil&MCPA+Liberate	1.5+8+0.25%	96	98	96
Fluroxypyr&2,4-De+Bromoxynil&MCPA+Liberate	7.5+8+0.25%	96	97	96
Bromoxynil &MCPA+Liberate	8+0.25%	95	99	95
2,4-Dester+LI 700	8+0.25%	75	68	56
Untreated	0	0	0	0
C.V. %		5	8	9
LSD 5%		6	9	11
# OF REPS		4	4	4

[a] LI700 was NIS from Loveland, Liberate was neutral pH NIS from Loveland.

Fluroxypyr provided poor redroot pigweed control on June 22, but vigorous crop growth helped eliminate pigweed from all herbicide treated plots by July 11. Crop competition also enhanced wild buckwheat control. All treatments containing thifensulfuron or fluroxypyr&MCPA provided 98 to 99% wild buckwheat control.

Wild buckwheat control in small grain, Cando Exp. 2. (Howatt, Roach, and Davidson-Harrington) Durum wheat was seeded in late May. Fenoxaprop was applied to the study area to control wild oat and foxtails. Treatments were applied to 2 to 2.5 leaf durum and cotyledon to 2 leaf wild buckwheat on June 7 with 78 F, 24% RH, 40% cloudcover, 1 to 4 mph wind, and 62 F soil temperature. Treatments were applied with a backpack sprayer delivering 35 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. Wild buckwheat density was 2 to 20 plants/ft^2.

Treatment[a]	Rate	6/22 Wibw	7/11 Wibw
	oz/A	%	
Fluroxypyr+LI700	1.5+0.25%	59	66
Fluroxypyr+LI700	2+0.25%	74	89
Fluroxypyr&2,4-De+LI700	7.5+0.25%	80	77
Fluroxypyr&2,4-De+LI700	10+0.25%	84	93
Fluroxypyr&MCPA+LI700	8+0.25%	88	88
Fluroxypyr&MCPA+LI700	10.7+0.25%	90	86
Fluroxypyr+Clopyralid&2,4-D+LI700	1.5+9.5+0.25%	90	90
Clopyralid&2,4-D+LI700	9.5+0.25%	88	92
Fluroxypyr+Thifensulfuron&Trib+Liberate	1.5+0.22+0.25%	89	86
Flox&2,4-De+Thif&Tribenuron+Liberate	7.5+0.22+.25%	93	92
Thifensulfuron&Tribenuron+Liberate	0.22+0.25%	90	89
Fluroxypyr+Thifensulfuron+Liberate	1.5+0.22+0.25%	91	86
Fluroxypyr&2,4-De+Thifensulfuron+Liberate	7.5+0.22+0.25%	93	88
Thifensulfuron+ Liberate	0.22+0.25%	92	88
Fluroxypyr+Bromoxynil&MCPA+Liberate	1.5+8+0.25%	92	85
Fluroxypyr&2,4-De+Brox&MCPA+Liberate	7.5+8+0.25%	70	82
Bromoxynil&MCPA+Liberate	8+0.25%	95	84
2,4-Dester+LI700	8+0.25%	74	50
Untreated	0	0	0
C.V. %		15	10
LSD 5%		17	11
# OF REPS		4	4

[a] LI700 was NIS from Loveland, Liberate was neutral pH NIS from Loveland.

Fluroxypyr&2,4-D at 10 oz/A provided 93% wild buckwheat control on July 11. Treatments containing thifensulfuron or fluroxypyr&MCPA gave at least 86% control. Low durum population and stressed plants allowed several other weeds and a post-treatment flush of wild buckwheat to emerge.

Canada thistle control in small grains. (Howatt, Roach, and Davidson-Harrington) "Oxen" hard red spring wheat was seeded May 14. Treatments were applied to 2.5 leaf wheat and 2 to 8 inch Canada thistle on May 30 with 73 F, 20% RH, 90% cloudcover, and 1 to 3 mph wind. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 30 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 three replicates.

Treatment[a]	Rate	6/05 Cath	6/19 Cath	6/25 Cath
	oz/A	Stem/m^2	%	
Fluroxypyr+LI700	1.5+2.5%	21	13	33
Fluroxypyr +LI700	2+0.25%	15	13	33
Fluroxypyr&2,4-De+LI700	7.5+0.25%	13	70	85
Fluroxypyr&2,4-De+LI700	10+0.25%	31	58	58
Fluroxypyr&MCPA+LI700	8+0.25%	26	53	90
Fluroxypyr&MCPA+LI700	10.7+0.25%	30	70	90
Fluroxypyr +Clopyralid&24-D+LI700	1.5+9.5+0.25%	30	83	92
Clopyralid&2,4-D+LI700	9.5+0.25%	12	78	92
Fluroxypyr +Thif&Trib+Liberate	1.5+0.22+0.25%	35	72	87
Fluroxypyr&2,4-De+Thif&Trib+ Liberate	7.5+0.22+.25%	36	80	87
Thifensulfuron&Tribenuron+ Liberate	0.22+.25%	23	71	91
Fluroxypyr+Trib+ Liberate	1.5+0.188+.25%	49	85	88
Fluroxypyr&2,4-De+Trib+ Liberate	7.5+0.188+.25%	16	74	89
Tribenuron+ Liberate	0.188+0.25%	18	83	90
Flox+Bromoxynil&MCPA+ Liberate	1.5+8+0.25%	34	58	78
Fluroxypyr&2,4-De+Brox&MCPA+ Liberate	7.5+8+0.25%	18	51	82
Bromoxynil&MCPA+ Liberate	8+0.25%	15	58	78
2,4-Dester+LI700	8+0.25%	19	80	85
Untreated	0	51	0	0
C.V. %		87	11	12
LSD 5%		NS	12	15
# OF REPS		3	3	3

[a] LI700 was NIS from Loveland, Liberate was neutral pH NIS from loveland

No wheat injury was observed. Stem number will be counted in the spring to determine treatment effect on the Canada thistle root system. Treatments containing clopyralid tended to provide the most Canada thistle control, 92% on June 25. Fluroxypyr was ineffective in controlling Canada thistle; however, fluroxypyr&MCPA provided 90% control. Tribenuron also gave 90% control.

Broadleaf weed control in glyphosate-resistant spring wheat. (Howatt, Roach, and Davidson-Harrington) Glyphosate-resistant hard red spring wheat was seeded May 31. Treatments (2-3lf) were applied to 2 leaf wheat and 1 inch redroot pigweed on June 18 with 66 F, 72% RH, 30% cloudcover, 3 to 5 mph wind, and 60 F soil temperature. Treatments (4-5lf) were applied to 4 to 5 leaf wheat and 2 to 6 leaf redroot pigweed on June 26 with 76 F, 59% RH, 30% cloudcover, 5 to 7 mph wind, and 70 F soil temperature. All 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 four replicates. Redroot pigweed population was 5 plants/ft^2.

		6/25		7/07		8/20	
Treatment[a]	Rate	Wht	Rrpw	Wht	Rrpw	Yield	Tswt
	oz/A	%		%		bu/A	lbs/bu
Glyphosate-ipa(2-3lf)	6	0	96	0	97	40	58
Glyphosate-ipa(2-3lf)	9	0	98	0	94	35	58
Glyphosate-ipa(2-3lf)	12	0	97	0	95	39	58
Glyphosate-ipa(4-5lf)	6	-	-	0	98	42	57
Glyphosate-ipa(4-5lf)	9	-	-	0	99	40	59
Glyphosate-ipa(4-5lf)	12	-	-	0	99	44	57
Glyt-ipa(2-3lf)/Glyt-ipa(4-5lf)	6/6	0	94	0	99	45	57
Clodinafop+Brox&MCPA+DSV(4-5lf)	1+8+1%	-	-	0	63	41	58
Fenoxaprop+Brox&MCPA(4-5lf)	1.32+8	-	-	0	76	38	58
Tral+Supercharge+Brox&MCPA(4-5lf)	2.9+0.5%+8	-	-	0	91	42	57
Flcz+Brox&MCPA+NIS(4-5lf)	0.42+8+0.25%	-	-	10	94	36	58
Glyphosate-ipa+2,4-Dester(4-5lf)	6+4	-	-	0	99	46	57
Glyt-ipa+Brox&MCPA(4-5lf)	6+8	-	-	0	97	44	57
Glyphosate-ipa+Thif(4-5lf)	6+0.368	-	-	0	97	46	57
Glyphosate-ipa+Dicamba(4-5lf)	6+1	-	-	0	98	45	59
Glyt-ipa+Clopyralid&2,4-D(4-5lf)	6+9.28	-	-	0	98	41	57
Untreated	0	0	0	0	0	42	57
C.V. %		0	3	43	3	9	2.6
LSD 5%		NS	3	0	4	6	NS
# OF REPS		4	4	4	4	4	4

[a] DSV was in co-pack with Discover from Syngenta.

Wheat was 10% stunted with flucarbazone on July 7, but on July 25, no injury was observed. The majority of treatments provided 95% redroot pigweed control or better on July 7. Bromoxynil&MCPA gave 63 and 76% control when applied with clodinafop and fenoxaprop, respectively. Bromoxynil&MCPA applied with tralkoxydim or flucarbazone provided more than 90% control. By August 16, all herbicide treatments provided 99% redroot pigweed control (data not shown). Wheat yield was 46 bu/A when glyphosate was applied with 2,4-D or thifensulfuron at the 4 to 5 leaf stage. This was 8 to 11 bu more seed than wheat treated with glyphosate at the 2 to 3 leaf stage or treatment at the 4 to 5 leaf stage with fenoxaprop+bromoxynil&MCPA or flucarbazone+bromoxynil&MCPA. There was no difference in grain test weight.

Weed control in glyphosate-resistant spring wheat. (Howatt, Roach, and Davidson-Harrington) Glyphosate-resistant hard red spring wheat was seeded May 31. Treatments were applied to 3 to 4 leaf wheat, emerging to 2 inch redroot pigweed, emerging to 3 inch yellow foxtail, and 4 to 6 inch rosette dandelion on June 21 with 66 F, 49% RH, 0% cloudcover, and 58 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 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 5 redroot pigweed/ft^2, and scattered yellow foxtail and dandelion.

		6/28				7/07				8/16	8/20	
Treatments[a]	Rate	Wht	Rrpw	Yeft	Dali	Wht	Rrpw	Yeft	Dali	Yeft	Yield	Tswt
	oz/A					%					bu/A	lb/bu
Glyphosate-ipa	12	0	98	99	67	0	95	98	51	99	38	60
Glyt-ipa+2,4-Dioe	12+4	0	99	99	71	0	99	97	55	99	39	59
Glyt-ipa+Thif	12+0.368	0	98	98	65	0	97	97	55	98	36	59
Glyt-ipa+ Brox&MCPA	12+ 8	0	99	99	71	0	98	98	56	99	33	60
Glyt-ipa+Dicamba	12+1	0	99	99	70	0	94	98	73	99	40	59
Glyt-ipa+Flox	12+3	0	99	99	80	0	94	98	75	99	42	59
Clfp+DSV+ Brox&MCPA	0.8+0.8%+ 8	0	96	97	69	0	96	98	46	99	39	59
Fenx+Brox&MCPA	1.32+8	0	90	94	65	0	94	97	58	99	37	58
Tral+Supercharge+ Brox&MCPA	2.9+0.5%+ 8	0	97	98	69	0	97	98	48	99	32	65
Flcz+Brox&MCPA+ NIS	0.42+8+ 0.25%	5	99	97	73	1	97	96	48	98	35	59
Flouroxypyr+ 2,4-Dioe	3+4	0	96	--	76	0	99	--	51	--	39	58
Bromoxynil&MCPA	8	2	96	--	70	0	96	--	48	--	39	59
Thifensulfuron+ 2,4-Dioe	0.368+ 4	0	98	--	66	0	98	--	54	--	36	59
2,4-Dioe	4	0	93	--	69	0	94	--	61	--	42	58
Dicamba	1	0	87	--	55	0	93	--	60	--	36	59
Untreated	0	0	0	0	0	0	0	0	0	0	36	58
C.V. %		272	4	3	10	800	3	3	17	2	10	4.3
LSD 5%		2	5	4	9	NS	4	4	13	3	5	NS
# OF REPS		4	4	4	4	4	4	4	4	4	4	4

[a] DSV was in co-pack with Discover from Syngenta, Supercharge was in co-pack with Achieve from Syngenta.

Flucarbazone caused 5% stunting of wheat on June 28, but injury was non-significant on July 7. Bromoxynil&MCPA caused slight chlorosis resulting in 2% injury on June 28, but injury was not observed on July 7. Glyphosate provided equal or greater redroot pigweed control than other broadleaf herbicides. Glyphosate+fluroxypyr provided 80% dandelion control on June 28, which was the only glyphosate tank-mix providing better dandelion control than glyphosate alone. There was no difference in Yellow foxtail control or wheat seed test weight. Differences in seed yield could not be explained by differences in weed pressure.

Weed control in Roundup Ready wheat, Williston 2001. (Neil Riveland and Gordon Bradbury) The experiment was conducted to evaluate several herbicides combinations and application timing for weed control in a Roundup Ready wheat, provided by Monsanto. The wheat was planted on fallow in 7 inch rows at 80 lbs/a on May 11. Initial treatments were applied on June 8 to 4.5-leaf wheat (some 1-2 leaf), green foxtail that was just emerging, < 1 inch Russian thistle and cotyledon wild mustard with 75 F, 35% RH, clear sky, and 5-10 mph SW wind with dry topsoil at 61 F. Treatments to be applied later (at the 6 leaf ideally) were applied on June 19 to 60.5-7 leaf wheat (some 4-leaf), 2-leaf green foxtail and 1 inch tall Russian thistle with 73 F, 35% RH 95% clear sky and wind W at 3-6 mph with damp topsoil at 65 F. All treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 10 gals/a at 40 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with three replications. Weed densities were moderate for green foxtail. Russian thistle density was very light and was not rated. Plots were evaluated on June 19, July 2 and July 18 for crop injury and on July 18 for weed control. Wheat was machine harvested on August 20. All crop was buried in a pit at that time.

Treatment[a]	Rate	Applic. Timing	Crop Injury 6-19	7-2	7-18	Cont. Grft	Yield
	lbs/a ai	leaf stg	-------%---------			%	bus/a
Roundup Ultramax	0.375	4	0.0	0.0	1.7	36.7	59.48
Roundup Ultramax	0.56	4	0.0	0.0	0.0	8.3	58.23
Roundup Ultramax	0.75	4	0.0	0.0	2.0	36.7	64.70
Roundup Ultramax	0.375	7	-	0.0	1.0	97.3	63.53
Roundup Ultramax	0.56	7	-	0.0	2.3	98.3	62.86
Roundup Ultramax	0.75	7	-	0.0	3.0	99.0	56.82
Rdup Ultramax+Rdup Ultramax	0.375+0.375	4+7	0.0	0.0	1.0	97.3	55.14
Discover+Bronate+DSV Adj	0.06+0.5+1	7	-	0.0	6.7	86.7	51.31
Puma+Bronate	0.08+0.5	7	-	0.0	0.0	98.7	62.82
Acheive+Supercharge+Bronate	0.18+0.5+0.5	7	-	0.0	6.0	93.0	56.73
Everest+Bronate+Activator 90	0.026+0.5+0.25	7	-	23.3	12.3	86.7	54.96
Roundup Ultramax+2,4-D LVE	0.375+0.25	7	-	0.0	0.0	97.7	60.68
Roundup Ultramax+Bronate	0.375+0.5	7	-	0.0	2.3	92.0	59.77
Roundup Ultramax+Harmony GT	0.375+0.023	7	-	0.0	3.7	95.3	50.40
Roundup Ultramax+Banvel	0.375+0.06	4	23.3	13.3	4.3	10.0	58.48
Roundup Ultramax+Curtail	0.375+0.58	7	-	0.0	2.0	98.0	62.44
Untreated Check	0.0	0	0.0	0.0	0.0	0.0	56.02
C.V. %			30.3	46.6	56.9	11.9	8.42
LSD 5%			2.1	1.7	2.7	14.3	8.19
# OF REPS			3	3	3	3	3

[a] - Activator 90 nonionic surfactant from Loveland.

WEED CONTROL IN ROUNDUP READY WHEAT, WILLISTON 2001. (cont.)

Summary and Comments: May was a very dry month with no significant precipitation received until May 30. Consequently the soil seedbed was dry, resulting in uneven wheat emergence. Broadleaf weeds (kochia and Russian thistle) and green foxtail were broadcast planted on the plot area. Kochia and Russian thistle did not germinate in sufficient numbers to rate. Most of the green foxtail emerged after the early treatment application on June 8 so late emergence is the reason that little or no green foxtail control was recorded for the early application date. Application timing was delayed also because of the dry May conditions. In the Protocol most of the treatments were to be applied at the 3-leaf stage. Instead many were delayed until the later date, hoping for better weed emergence. Dicamba showed early crop injury yellowing and stunting) and the crop was shorter even when evaluated on July 18th. Everest showed the most crop injury with symptoms of shorter, curved lax and nodding heads. Nearly all the other combinations with Roundup Ultramax and higher rates of Roundup Ultramax alone showed slight crop injury, and in all cases the symptom was weak stems with lodging-like characteristics. Only the combination with 2,4-D did not exhibit this symptom. Achieve and Discover also exhibited some tiller damage. Crop yields were very high, showing that crop competition is important for weed control and over riding the injury effect of herbicides and the combinations. Mostly crop yields do not reflect weed control or crop injury.

Weed control and crop tolerance in Roundup Ready hard red spring wheat, Carrington, 2001. (Endres, Hendrickson, and Valenti) The experiment was conducted on a loam soil with 6.2 pH at the NDSU Carrington Research Extension Center. The experimental design was a randomized complete block with three replicates. 'Oxen-derived' glyphosate-resistant HRS wheat was planted at approximately 75 lb seed/A on May 11. Herbicide treatments were applied with a CO_2-hand-boom plot sprayer delivering 10 gal/A at 30 psi through 8001 flat fan nozzles to the center 6.7 ft of 10 by 25 ft plots. EPOST treatments were applied on May 30 with 62 F, 76 % RH, 10% clear sky, and 4 mph wind to 3-leaf wheat, 1- to 4-leaf yellow and green foxtail, 0.5- to 3-inch tall volunteer flax, 0.5- to 1-inch tall redroot and prostrate pigweed, and 0.5- to 2-inch tall wild buckwheat. POST treatments were applied on June 7 with 61 F, 87 % RH, clear sky, and 7 mph wind to 4.5-leaf wheat, 1- to 5-leaf yellow and green foxtail, 0.5- to 3-inch tall volunteer flax, 0.5- to 1-inch tall redroot and prostrate pigweed, and 1- to 3-inch tall wild buckwheat. Average wheat density was 18 plants/ft^2, foxtail density was 18 plants/ft^2, volunteer flax density was 2 plants/ft^2, pigweed density was 6 plants/ft^2, and wild buckwheat density was 1 plant/ft^2. Weed control and wheat injury were visually estimated. The trial was harvested for seed yield with a plot combine on August 14.

Glyphosate treatments including tank mixtures provided excellent foxtail control (90 to 97%) 14 and 21 days after treatment (Table 1). Glyphosate at 0.375 lb/A generally provided similar control of all weeds compared to higher rates or sequential application of glyphosate. An exception was glyphosate at 0.75 lb/A or a sequential application was required to provide excellent wild buckwheat control (93 to 99%) compared to lower glyphosate rates when applied at the later wheat growth stage. Tank mixtures with glyphosate improved wild buckwheat control compared to glyphosate alone at 0.375 lb/A while control of other weed species was similar. Glyphosate generally provided greater weed control, except with wild buckwheat, than conventional herbicide tank mixtures.

Table 1. Weed control in Roundup Ready wheat.

Treatment[a]	Rate	14 days after treatment				21 days after treatment				Harvest
		SETSS[b]	LINUX	AMASS[c]	POLCO	SETSS	LINUX	AMASS	POLCO	SETSS
	(lb/A)	(% control)								
EPOST										
Glyphosate	0.375	97	99	98	98	97	98	98	93	88
Glyphosate	0.56	97	98	99	97	97	98	98	97	88
Glyphosate	0.75	95	99	99	98	94	98	99	96	81
POST										
Glyphosate	0.375	97	99	98	83	94	96	91	78	90
Glyphosate	0.56	97	97	98	82	91	93	95	70	83
Glyphosate	0.75	97	97	99	97	95	94	98	93	89
Glyphosate(EPOST)/glyphosate	0.375/0.375	95	98	97	99	90	96	95	96	76
Clodinafop+bromoxynil&MCPA+DSV	0.06+0.5+1%	73	81	89	99	82	57	86	99	80
Fenoxaprop+bromoxynil&MCPA	0.08+0.5	86	65	94	99	85	48	89	90	73
Tralkoxydim+Supercharge+bromoxynil &MCPA	0.18+0.5%+0.5	74	48	91	95	79	27	83	95	80
Flucarbazone+bromoxynil&MCPA+NIS	0.026+0.5+0.25%	69	90	99	98	68	86	99	98	40
Glyphosate+MCPAioe	0.375+0.25	96	99	96	95	92	96	91	86	81
Glyphosate+bromoxynil&MCPA	0.375+0.5	95	99	95	99	90	97	93	85	79
Glyphosate+thifensulfuron	0.375+0.023	97	99	98	97	94	95	97	88	86
Glyphosate+dicamba	0.375+0.06	96	99	95	93	89	98	89	90	79
Glyphosate+clopyralid&2,4-D	0.375+0.58	97	98	97	99	96	94	95	99	91
Untreated	---	0	0	0	0	0	0	0	0	0
LSD (0.05)		4	9	7	5	8	13	10	13	13

[a]Glyphosate=Roundup UltraMax (3.7 lb ae/gal); DSV and Supercharge=adjuvants from Syngenta, Wilmington, DE; NIS=Induce, a nonionic surfactant from Helena Chemical Co., Memphis, TN.

[b]Foxtail spp.=Yellow and green.

[c]Pigweed spp.=Redroot and prostrate.

Glyphosate did not injure wheat when visually evaluated for chlorosis, necrosis or growth reduction (Table 2). Wheat seed yield ranged from 34.3 to 40.5 bu/A with glyphosate or glyphosate tank mixtures with MCPAioe, thifensulfuron, or clopyralid&2,4-D. Wheat yield was reduced with glyphosate tank mixtures of bromoxynil&MCPA or dicamba compared to the yield with EPOST application of glyphosate at 0.56 lb/A.

Table 2. Roundup Ready wheat response to herbicide treatments.

		Crop response				
		Chlorosis	Necrosis	Growth reduction		Seed
Treatment[a]	Rate	7DAT[b]	7DAT	14 DAT	21 DAT	yield
	(lb/A)	(%)				(bu/A)
EPOST						
Glyphosate	0.375	0	0	0	0	38.3
Glyphosate	0.56	0	0	0	0	40.5
Glyphosate	0.75	0	0	0	0	37.0
POST						
Glyphosate	0.375	0	0	0	0	39.3
Glyphosate	0.56	0	0	0	0	34.3
Glyphosate	0.75	0	0	0	0	39.8
Glyphosate(EPOST)/glyphosate	0.375/0.375	0	0	0	0	36.5
Clodinafop+bromoxynil&MCPA+DSV	0.06+0.5+1%	0	1	0	0	37.7
Fenoxaprop+bromoxynil&MCPA	0.08+0.5	0	1	0	0	31.9
Tralkoxydim+Supercharge+bromoxynil&MCPA	0.18+0.5%+0.5	0	1	0	0	35.5
Flucarbazone+bromoxynil&MCPA+NIS	0.026+0.5+0.25	12	1	9	3	26.5
Glyphosate+MCPAioe	0.375+0.25	0	0	0	0	37.0
Glyphosate+bromoxynil&MCPA	0.375+0.5	0	0	0	0	32.8
Glyphosate+thifensulfuron	0.375+0.023	13	0	0	0	35.1
Glyphosate+dicamba	0.375+0.06	9	0	0	0	31.8
Glyphosate+clopyralid&2,4-D	0.375+0.58	7	3	0	0	38.3
Untreated	---	0	0	0	0	16.9
LSD (0.05)		5	1	1	1	7.2

[a]Glyphosate=Roundup UltraMax (3.7 lb ae/gal); DSV and Supercharge=adjuvants from Syngenta, Wilmington, DE; NIS=Induce, a nonionic surfactant from Helena Chemical Co., Memphis, TN.
[b]DAT=Days after treatment.

Crop safety of glyphosate on Roundup Ready hard red spring wheat, Carrington, 2001. (Hendrickson, Endres, and Valenti) The experiment was conducted at the NDSU Carrington Research Extension Center on a loam soil with a 6.2 pH. Roundup Ready hard red spring wheat was planted at approximately 75 lb seed/A on May 11. Herbicide treatments were applied at the 4.5-leaf stage on June 7, 2001 with 50° F, 100% RH, light fog, 5 mph wind, and 54° F soil temperature. Individual plots were 10 by 25 ft 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 20 psi through XR 80015 flat fan nozzles. Wheat injury was visually evaluated for chlorosis and necrosis 7, 14, and 21 days after treatment, and for growth reduction 14 and 21 days after treatment. The trial was harvested for seed yield with a plot combine on August 14, 2001.

The objective of the study was to evaluate glyphosate against competitive treatments in weed free Roundup Ready hard red spring wheat for crop safety. Initial wheat injury evaluated as chlorosis and necrosis was evident 7 days after treatment from treatments including flucarbazone and thifensulfuron. The initial leaf injury disappeared 14 days after treatment (data not shown) but there was a 12% reduction in growth from the bromoxynil & MCPA + flucarbazone treatment. Glyphosate did not injure wheat when visually evaluated for chlorosis, necrosis, and growth reduction. Wheat seed yields for all treatments were greater than or equal to the untreated check with yields ranging from 31 to 41 bu/A. Wheat seed yields were greatest for MCPA Ester + fluroxypyr, glyphosate + dicamba, bromoxynil & MCPA + tralkoxydim, and bromoxynil & MCPA.

Table. Wheat injury and yield with glyphosate and competitive treatments in Roundup Ready hard red spring wheat.

Treatment[a]	Rate	Chlorosis	Necrosis	Growth reduction		Seed yield
		7 DAT[c]	7 DAT[c]	14 DAT	21 DAT	
	lb ai/A[b]	%	%	%	%	bu/A
Glyphosate	0.75	0	0	0	0	32
Glyphosate + MCPA Ester	0.75 + 0.25	0	0	0	0	32
Glyphosate + thifensulfuron	0.75 + 0.023	8	0	2	1	31
Glyphosate + bromoxynil & MCPA	0.75 + 0.5	0	0	0	0	35
Glyphosate + dicamba	0.75 + 0.06	0	0	0	0	38
Glyphosate + fluroxypyr	0.75 + 0.1875	1	0	5	4	33
Bromoxynil & MCPA + clodinafop	0.5 + .05	0	0	2	0	33
Bromoxynil & MCPA + fenoxaprop	0.5 + .08	0	0	0	0	33
Bromoxynil & MCPA + tralkoxydim	0.5 + .18	0	0	0	0	37
Bromoxynil & MCPA + flucarbazone	0.5 + .026	27	10	12	4	35
MCPA Ester + fluroxypyr	0.25 + 0.1875	0	0	7	0	41
Bromoxynil & MCPA	0.5	0	0	0	0	37
MCPA Ester + thifensulfuron	0.25 + 0.023	4	0	0	1	33
MCPA Ester	0.25	0	0	0	0	34
Dicamba	0.06	0	0	0	0	36
Untreated Check	0	0	0	0	0	33
LSD (0.05)		3	0	8	2	5

[a]Glyphosate is the Roundup Ultramax formulation. Clodinafop was applied with the adjuvant DSV at 1% v/v. Tralkoxydim was applied with the adjuvant Supercharge at 0.5% v/v. Flucarbazone was applied with the non-ionic surfactant Preference at 0.25% v/v.

[b]Rates for all glyphosate treatments are in lb ae/A.

[c]DAT=days after treatment.

Glyphosate-resistant wheat response to glyphosate timing and sequential applications. (Howatt, Roach, and Davidson-Harrington) Glyphosate-resistant hard red spring wheat was seeded May 31. Treatments (A) were applied to 2 leaf wheat on June 18 with 66 F, 72% RH, 40% cloudcover, 3 to 5 mph E wind, and 60 F soil temperature. Treatments (B) were applied to 3 leaf wheat on June 21 with 66 F, 49% RH, 0% cloudcover, 4 to 5 mph N wind, and 58 F soil temperature. Treatments (C) were applied to 4 leaf wheat on June 26 with 76 F, 59% RH, 30% cloudcover, 5 to 7 mph N wind, and 70 F soil temperature. Treatments (D) were applied to 6 leaf wheat on July 5 with 69 F, 42% RH, 5% cloudcover, 0 mph wind, and 61 F soil temperature. Treatments A and B were applied with a backpack type sprayer through 11001 flat fan nozzles and treatments C and D were applied using a bicycle-wheel-type plot sprayer through 8001 flat fan nozzles, both delivering 8.5 gpa at 35 psi. Applications were 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. Study area was essentially weed free.

		8/20	
			Wheat
Treatment	Rate	yield	test weight
	oz/A	bu/A	lbs/bu
Glyphosate-ipa(A)	9	44	58
Glyphosate-ipa(A)/Glyphosate-ipa(B)	9/9	42	58
Glyphosate-ipa(A)/Glyphosate-ipa(B)/Glyphosate-ipa(C)	9/9/9	42	58
Glyphosate-ipa(A)/Glyphosate-ipa(B)/Glyt-ipa(C)/Glyt-ipa(D)	9/9/9/9	43	58
Glyphosate-ipa(B)/Glyphosate-ipa(C)/Glyphosate-ipa(D)	9/9/9	45	59
Glyphosate-ipa(C)/Glyphosate-ipa(D)	9/9	45	59
Glyphosate-ipa(D)	9	44	58
Untreated	0	42	57
C.V. %		7	1.07
LSD 5%		NS	NS
# OF REPS		4	4

No wheat injury was observed from any timing or sequence of glyphosate application. There was no difference in maturity or plant drying from any treatment.

Imazamox tank-mixes for broadleaf weed control in imidazolinone-resistant wheat. (Howatt, Roach, and Davidson-Harrington) 'ND722' hard red spring wheat was seeded May 17. Treatments were applied to 5 leaf wheat, emerging to 2 leaf green and yellow foxtail, and emerging to 3 inch redroot pigweed on June 19 with 68 F, 49% RH, 0% cloudcover, 8 mph wind, and 57 F soil temperature. 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. Weed populations were 25 foxtail/ft^2 and 5 redroot pigweed/ft^2.

		6/28	7/09			7/25/01		
Treatment	Rate	Wht	Wht	Fota	Rrpw	Wht	Fota	Rrpw
	oz/A				%			
Imazamox+NIS+UAN	0.5+0.25%+1.25%	2	2	95	85	0	90	88
Immx+Carfentrazone+NIS+UAN	0.5+0.128+0.25%+4%	3	3	94	94	2	89	94
Imazamox+Bromoxynil+NIS+UAN	0.5+8+0.25%+1.25%	4	10	88	95	4	85	96
Immx+Brox&MCPA+NIS+UAN	0.5+8+0.25%+1.25%	2	6	88	95	2	87	91
Imazamox+Fluroxpyr+NIS+UAN	0.5+2+0.25%+1.25%	0	1	87	93	0	88	89
Immx+Flox&MCPA+NIS+UAN	0.5+10+0.25%+1.25%	1	1	92	97	2	93	99
Imazamox+MCPA+NIS+UAN	0.5+8+0.25%+1.25%	0	5	95	94	4	95	95
Imazamox+2,4-Dioe+NIS+UAN	0.5+8+0.25%+1.25%	3	5	90	98	2	90	97
Imazamox+Thif+NIS+UAN	0.5+0.3+0.25%+1.25%	3	4	92	90	2	90	90
Imazamox+Dicamba+NIS+UAN	0.5+2+0.25%+1.25%	2	2	90	95	1	88	93
Untreated	0	0	0	0	0	0	0	0
C.V. %		113	94	4	4	88	4	4
LSD 5%		NS	4	5	5	2	5	5
# OF REPS		4	4	4	4	4	4	4

Wheat injury from herbicide treatment was not different from untreated plants until July 9. Imazamox+ bromoxynil was the most injurious treatment causing 10% injury, expressed as chlorosis and stunting. Bromoxynil&MCPA, MCPA, and 2,4-D also increased injury with imazamox compared with the untreated. Additional broadleaf herbicide increased the level of redroot pigweed control by 5 to 13% compared with imazamox alone on July 9, and on July 25, treatments with an additional broadleaf herbicide tended to give better control than imazamox alone. Bromoxynil, bromoxynil&MCPA, and fluroxypyr each antagonized imazamox control of foxtails by 7 to 8% on July 9, but only bromoxynil was antagonistic on July 25.

Evaluation of adjuvants for imazamox in imidazolinone-resistant wheat. (Howatt, Roach, and Davidson-Harrington) 'ND722' hard red spring wheat was seeded May 17. Treatments were applied to 5 leaf wheat, emerging to 2 leaf green and yellow foxtail, emerging to 3 inch redroot pigweed, emerging to 6 inch wild mustard, and emerging to 12 inch Canada thistle on June 19 with 74 F, 45% RH, 0% cloudcover, 8 mph wind, and 57 F soil temperature. 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.

		6/28						7/09			8/16
Treatment[a]	Rate	Wht	Grft	Yeft	Rrpw	Wimu	Cath	Wht	Yeft	Rrpw	Yeft
	oz/A	%									
Imazamox+NIS	0.38+0.25%	0	80	81	83	84	60	0	89	87	61
Immx+NIS+ UAN	0.38+0.25%+ 2.5%	0	83	83	84	86	72	0	86	91	74
Immx+MSO	0.38+1%	0	83	84	85	86	65	0	92	94	78
Immx+MSO+UAN	0.38+1%+2.5%	0	84	84	84	88	62	0	92	95	84
Immx+ClassAct	0.38+2.5%	0	84	84	83	85	70	0	88	90	81
Immx+NIS	0.5+0.25%	0	83	84	86	85	63	2	90	92	79
Immx+NIS+UAN	0.5+0.25%+2.5%	0	84	83	83	81	58	0	92	95	75
Immx+MSO	0.5+1%	0	84	85	84	86	60	0	91	91	86
Immx+MSO+UAN	0.5+1%+2.5%	0	83	81	84	84	50	1	96	96	85
Immx+ClassAct	0.5+2.5%	0	84	81	84	83	65	0	90	94	86
Clfp+Brox&MCPA+ DSV	0.8+8+ 0.8%	0	82	83	79	89	79	1	91	94	71
Untreated	0	0	0	0	0	0	0	0	0	0	0
C.V. %		0	5	4	4	4	13	319	4	3	6
LSD 5%		NS	6	5	5	5	13	NS	4	4	6
# OF REPS		4	4	4	4	4	3	4	4	4	4

[a]ClassAct was Class Act Next Generation from Agriliance, DSV was in co-pack with Discover from Syngenta.

No wheat injury was measurable. There were only minor differences in weed control with the different adjuvant systems for imazamox. Weed control was essentially similar for all imazamox rate and adjuvant treatments. On August 8, increasing imazamox rate or using MSO instead of NIS tended to increase yellow foxtail control. Imazamox at 0.38 oz/A with NIS gave 61% control while imazamox at 0.5 oz with MSO provided 86% control.

Imidazolinone-resistant wheat tolerance to imazamox application and overlap. (Howatt, Roach, and Davidson-Harrington) 'ND722' and 'IMI-A' hard red spring wheat were seeded within each plot separated by 1 to 2 ft weed free area on May 17. Treatments were applied to 5 leaf wheat and emerging to 2 leaf yellow foxtail on June 19 with 68 F, 49% RH, 0% cloudcover, 8 mph wind, and 57 F soil temperature. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 40 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. Sprayer over-lap was simulated in treatments 3 and 6 by applying the spray solution twice, separated by 5 minutes. The experiment was a randomized complete block design with four replicates. Yellow foxtail population was 25 plants/ft^2.

		6/28/01				7/09					8/22			
		ND722		IMI-A		ND722	IMI-A		8/16		ND722		IMI-A	
	Rate	Stunt	Burn	Stunt	Burn	Stunt	Stunt	Yeft	ND722	IMI-A	Tswt	Yield	Tswt	Yield
	oz/A	%									lb/bu	bu/A	lb/bu	bu/A
Imazamox+NIS	0.5+0.25%	0	0	0	3	1	1	84	0	0	60	37	58	39
Imazamox+NIS+UAN	0.5+0.25%+2.5%	1	1	2	4	3	3	88	2	2	60	33	58	39
Imam+NIS+UAN/ Imam+NIS+UAN	0.5+0.25%+2.5%/ 0.5+0.25%+2.5%	4	4	10	8	24	27	93	6	3	59	28	57	26
Imazamox+MSO	0.5+1%	1	2	2	5	2	2	74	2	1	60	29	58	37
Imazamox+MSO+UAN	0.5+1%+2.5%	3	3	3	6	8	6	87	3	2	60	30	59	34
Imam+MSO+UAN/ Imam+MSO+UAN	0.5+1%+2.5%/ 0.5+1%+2.5%	11	7	23	17	51	43	96	48	39	57	18	56	20
Untreated	0	0	0	0	0	0	0	0	0	0	59	28	60	29
C.V. %		125	89	123	61	62	68	16	41	56	1	20	2	13
LSD 5%		4	2	7	4	8	8	12	4	4	1	7	1	5
# OF REPS		8	8	8	8	8	8	8	8	8	6	6	6	6

IMI-A tended to exhibit more injury immediately, while injury in ND722 tended to express more injury later in the season. Urea ammonium nitrate did not increase injury. Methylated seed oil tended to increase injury, especially in simulated over-lap treatment. Wheat injury with imazamox+MSO+UAN over-lap treatment was severely stunted but also manifested deformed heads and sterile florets. Yellow foxtail control did not exceed 90% except in plots with over-lap applications. Spray over-lap resulted in 2 to 3 lb/bu less in test weight than single applications. Wheat yield was as much as 45% less with double application of imazamox compared with single application.

Imidazolinone-resistant wheat cultivar response to imazamox. Howatt, Kirk A., Ronald F. Roach, and Janet D. Davidson-Harrington. An experiment was established at Fargo, ND, to evaluate response of IMI-wheat development lines to imazamox application. 'IMI-A', 'IMI-B', 'IMI-C', 'IMI-D', 'CON-BD' and 'CON-A' hard red spring wheat cultivars were seeded in designated plots on May 17. Treatments were applied to 5 leaf wheat, 1 to 3 leaf yellow foxtail, 4 to 8 inch redroot pigweed, and 2 to 6 leaf wild mustard on June 19 with 72 F air, 45% relative humidity, 0% cloudcover, 4 mph W wind, and 57 F soil temperature at 2 inches. 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 27 ft plots. The experiment was a randomized complete block design with four replicates.

		6/28		7/09	7/17	8/22	
Treatment[a]	Rate	Stunt	Burn	Wheat	Smut	Yield	Tswt
	(oz/A)			%		(bu/A)	(lb/bu)
Imazamox+NIS+UAN(IMI-A)	0.5+0.25%+2.5%	0	0	5	3	51	60.7
Imazamox+NIS+UAN(IMI-B)	0.5+0.25%+2.5%	0	11	4	0	52	59.9
Imazamox+NIS+UAN(IMI-C)	0.5+0.25%+2.5%	0	24	6	0	47	59.8
Imazamox+NIS+UAN(IMI-D)	0.5+0.25%+2.5%	0	28	5	0	45	60.7
Clodinafop+brox&MCPA +DSV(IMI-A)	0.8+4&4+0.8%	0	0	4	2	51	60.0
Clodinafop+brox&MCPA +DSV(IMI-B)	0.8+4&4+0.8%	0	14	3	0	53	59.5
Clodinafop+brox&MCPA +DSV(IMI-C)	0.8+4&4+0.8%	0	18	4	0	49	59.1
Clodinafop+brox&MCPA +DSV(IMI-D)	0.8+4&4+0.8%	0	14	4	0	50	60.2
Clodinafop+brox&MCPA +DSV(CON-BD)	0.8+4&4+0.8%	0	18	4	0	50	60.5
Clodinafop+brox&MCPA +DSV(CON-A)	0.8+4&4+0.8%	0	0	4	1	54	60.4
C.V. %		0	27	34	84	6	0.7
LSD 5%		NS	5	NS	1	4	0.6
# OF REPS		4	4	4	4	4	4

[a]DSV is a petroleum oil concentrate in co-pac with Discover from Syngenta, Greensboro, NC.

Imidazolinone-tolerant wheat lines were indicated by "IMI" in the variety name. Conventional cultivars were coded with "CON". 'CON-A' was a parent line of 'IMI-A'. 'CON-BD' was a parent line of 'IMI-B' and 'IMI-D'. Advanced imidazolinone-tolerant lines, 'IMI-A' and 'IMI-B', did not express greater injury to herbicide application than respective parent lines. Advanced line yield and test weight in either herbicide program were similar to parent lines. Smut incidence on 'IMI-A' was slightly higher, 1%, when treated with imazamox than when treated with CGA184927. Only 'IMI-D', an early development line, expressed greater leaf tip burning and subsequently produced less yield in the imazamox program. Wheat injury on July 9 was leaf-tip necrosis of older tissue, and all treatments controlled yellow foxtail, redroot pigweed, and wild mustard present in plots.

2001 Beyond Herbicide on Spring Wheat at Hettinger. (Eriksmoen) ND722 hard red spring wheat was seeded on April 27. Treatments were applied to 2 ½ leaf wheat and to 1 - 2 leaf wild oats on May 17 with 67 F, 21% RH, clear sky and 9 mph W wind. A trace of precipitation was recorded 24 hours after application. 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 experiment was a randomized complete block design with four replications. Wild oat population was 35 plants per sq. foot. Evaluations for crop injury were on May 24 and June 7, and for wild oat control on June 12 and July 18. The trial was severely damaged by hail on June 18 resulting in a reduced and open stand. The trial was harvested on August 21.

Treatment		Product Rate	6/6	6/12	7/17	
			HRSW	Wioa	Wioa	Yield
		oz/acre	%	% Control		bu/A
1	Untreated	0	0	0	0	7.3
2	Beyond+Clarity+AMS	3.0+4.0+1%	5	42	42	11.6
3	Beyond+2,4-D+AMS	3.0+12+1%	14	91	92	21.0
4	Beyond+Buctril+AMS	3.0+16+1%	21	90	96	22.7
5	Beyond+Starane+AMS	3.0+8+1%	1	72	94	22.9
6	Beyond+Harmony GT+AMS+NIS	3.0+0.33+1%+ 0.25%	1	55	68	11.6
7	Beyond+AMS+NIS	4.0+1%+0.25%	8	91	96	21.7
8	Beyond+AMS+NIS	3.0+1%+0.25%	12	91	91	16.1
9	Beyond+AMS+NIS	2.0+1%+0.25%	6	89	90	18.2
10	Beyond+AMS+NIS	1.0+1%+0.25%	1	78	86	18.4
11	Beyond+AMS+MSO	1.0+1%+1%	5	86	89	15.9
12	Beyond+AMS+Basic Blend	1.0+1%+ 1%	4	86	89	16.0
C.V. %			104	20	18	37.0
LSD 5%			10	20	20	9.1

AMS = liquid ammonium sulfate, 2,4-D = 4 lb ester, NIS = Class Preference, MSO = Class Destiny, Basic Blend = Quad 7.

Summary

Yield data from this trial should be viewed with caution as there was considerable variability within individual treatments. Crop injury 7 days after application was not observed on any treatment (data not shown). 2,4-D (trt 3) and Buctril (trt 4) tank mixes caused significant crop injury however, this did not result in reduced yields. Clarity (trt 2) and Harmony GT (trt 6) tank mixes resulted in significantly reduced wild oat control. The 2 oz/A Beyond treatment (trt 9) had similar wild oat control to the 3 and 4 oz/A rates (trts 8 & 7) with less crop injury. The 1 oz/A Beyond treatments with MSO (trt 11) and basic blend (trt 12) had slightly higher wild oat control, slightly higher crop injury and slightly lower yields than the 1 oz/A Beyond with NIS (trt 10).

2001 Clearfield HRWW Trial at Hettinger. (Eriksmoen) CO980875 Clearfield HRWW was planted into dry soil on September 28, 2000. The trial received rain during the last couple of days of October and the HRWW did not emerge prior to freeze up. Spring HRWW stands were relatively thin and uneven. Four post-emergence applications were made at 8 to 11 day intervals. The first post-applied treatments were applied to 2 leaf HRWW and to 2 leaf downy brome (*Bromus tectorum L.*) and to 1 leaf wild oats on April 27 with 82 deg. F, 22% RH, partly cloudy sky and 10 mph wind. The second post-applied treatments were applied to 4 ½ leaf HRWW and to tillering downy brome and to 1 to 2 leaf wild oats on May 8 with 39 deg. F, 62% RH, sunny sky and 2 mph wind. The third post-applied treatments were applied to tillering HRWW and to heading downy brome and to 3 to 4 leaf wild oats on May 17 with 65 deg. F, 23% RH, sunny sky and 8 mph wind. The fourth post-applied treatments were applied to jointing HRWW and to flowering downy brome and to 5 ½ leaf wild oats on May 25 with 62 deg. F, 40% RH, sunny sky and 8 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 experiment was a randomized complete block design with four replications. Downy brome populations were 9 plants per sq. foot and wild oat populations were 4 plants per sq. foot. Evaluations were on June 7 and June 12 for crop injury and weed control, and on July 31 for weed control. The trial was not harvested.

App. Timing	Treatment	Rate	June 7	June 12		July 31
			Dobr	Dobr	Wioa	Dobr
		LB AI/acre	---------- % Control ----------			
	Untreated	0	0	0	0	0
1	Immx + MSO + AMS	0.032 + 1% + 1%	100	100	72	100
1	Immx + MSO + AMS	0.040 + 1% + 1%	100	100	45	100
1	Immx + MSO + AMS	0.048 + 1% + 1%	100	100	50	100
2	Immx + MSO + AMS	0.032 + 1% + 1%	100	100	88	100
2	Immx + MSO + AMS	0.040 + 1% + 1%	100	100	90	100
2	Immx + MSO + AMS	0.048 + 1% + 1%	100	100	89	100
3	Immx + MSO + AMS	0.032 + 1% + 1%	100	100	94	100
3	Immx + MSO + AMS	0.040 + 1% + 1%	100	100	94	100
3	Immx + MSO + AMS	0.048 + 1% + 1%	100	100	93	100
4	Immx + MSO + AMS	0.032 + 1% + 1%	100	100	92	100
4	Immx + MSO + AMS	0.040 + 1% + 1%	98	98	90	99
4	Immx + MSO + AMS	0.048 + 1% + 1%	100	100	94	100
C.V. %			1.6	1.6	16.6	0.8
LSD 5%			2	2	18	1
# of Reps			4	4	4	4

Summary

Crop injury was not observed on any treatment (data not shown). All imazamox treatment application timings and application rates provided excellent downy brome control. Wild oat control was very good for all treatments except for treatments applied during the first application which were significantly lower. There were no differences in downy brome control between application rates. The data above shows the effectiveness of imazamox in controlling downy brome at all growth stages and this variety's tolerance to imazamox. An early application for downy brome control would be advised to limit this weed's competitive nature.

Clearfield wheat response to Raptor. Jenks, Willoughby, and Markle. Clearfield wheat 'ND722' was seeded May 11, 2001 into 6-inch rows in a conventional tillage system. Individual plots were 10 by 30 ft arranged in a RCBD with three replications. Postemergence (POST) treatments were applied to 4 to 5-leaf wheat on June 8 with XR8001 flat fan nozzles at 10 gpa and 40 psi. Weeds at application were green foxtail (1 to 2-inch), wild oat (2-lf), and wild mustard (3 to 4-lf). The crop was not harvested.

		HRSW Injury			Jun 29		
Treatment	Rate	Jun 29	Jul 18	Aug 13	Grft	Wioa	Wimu
		%			% control		
Untreated		0	0	0	0	0	0
Raptor + NIS + 28% N	0.024 lb ai + 0.25% + 2.5%	9	9	3	100	100	100
Raptor + NIS	0.024 lb ai + 0.25%	3	2	0	100	100	100
Raptor + Sun-It II	0.024 lb ai + 1%	15	13	10	100	100	100
Raptor + Sun-It II + 28% N	0.024 lb ai + 1% + 2.5%	27	19	10	100	100	100
Raptor + NIS + 28% N	0.032 lb ai + 0.25% + 2.5%	17	15	11	100	100	100
Raptor + NIS	0.032 lb ai + 0.25%	7	7	3	100	100	100
Raptor + Sun-It II	0.032 lb ai + 1%	22	17	11	99	100	100
Raptor + Sun-It II + 28% N	0.032 lb ai + 1% + 2.5%	28	25	16	100	100	100
Puma + Harmony GT + Starane	0.4 pt + 0.3 oz + 0.33 pt	0	0	0	98	98	98
LSD		7	1	1	2	2	2
CV		34	21	29	1	1	1

Crop injury increased with Raptor rate and when applied with 28% N and/or Sun-It II. Raptor provided excellent control of green foxtail, wild oat, and wild mustard.

Quizalofop timing with and without COC for volunteer spring wheat control, Carrington, 2001.
(Hendrickson, Endres, and Valenti) The experiment was conducted on a loam soil at the NDSU Carrington Research Extension Center. 'Kulm' hard red spring wheat was broadcast seeded May 28, 2001 at 1.5 bu/A. Herbicide treatments were applied at the 1.5- to 2-leaf stage on June 12, 2001 with 52° F, 96% RH, 80% cloud cover, 3 mph wind, and 61° F soil temperature and at the 5-leaf stage on June 26, 2001 with 72° F, 65% RH, 10% cloud cover, 7 mph wind, and 78° F soil temperature. Individual plots were 10 x 25 ft arranged in a RCBD with three replications. Herbicide treatments were applied with a CO_2–hand boom sprayer delivering 10 gpa at 20 psi through XR 80015 flat fan nozzles.

On 6/26/01, when quizalofop was applied applied with a COC to 1.5- to 2-leaf hard red spring wheat, control was 88 to 96%. When applied without a COC control ranged from 13 to 77%. Hard red spring wheat control was lower at the second and third evaluation dates due to a second flush of spring wheat. At the 5-leaf application timing, all treatments provided 88 to 100% hard red spring wheat control.

Table. Volunteer hard red spring wheat control.

Treatment[a]	Rate	Application timing	Hard red spring wheat control 6/26/2001	7/11/2001	7/25/2001
	lb ai/A[b]		---------- % ----------		
Glyphosate	0.56	1.5- to 2-leaf	92	63	53
Quizalofop	0.013	1.5- to 2-leaf	13	20	13
Quizalofop	0.021	1.5- to 2-leaf	33	33	27
Quizalofop	0.028	1.5- to 2-leaf	70	50	57
Quizalofop	0.034	1.5- to 2-leaf	77	58	60
Quizalofop + COC	0.013 + 1%	1.5- to 2-leaf	88	60	60
Quizalofop + COC	0.021 + 1%	1.5- to 2-leaf	94	63	60
Quizalofop + COC	0.028 + 1%	1.5- to 2-leaf	95	72	73
Quizalofop + COC	0.034 + 1%	1.5- to 2-leaf	96	72	75
Glyphosate	0.56	5-leaf		100	100
Quizalofop	0.013	5-leaf		88	90
Quizalofop	0.021	5-leaf		100	100
Quizalofop	0.028	5-leaf		99	100
Quizalofop	0.034	5-leaf		99	100
Quizalofop + COC	0.013 + 1%	5-leaf		98	100
Quizalofop + COC	0.021 + 1%	5-leaf		100	100
Quizalofop + COC	0.028 + 1%	5-leaf		100	100
Quizalofop + COC	0.034 + 1%	5-leaf		100	100
Untreated Check	0		0	0	0
LSD (0.05)			11	12	10

[a]Glyphosate is the Roundup Ultra formulation. Glyphosate and quizalofop were applied with ammonium sulfate at 17.5 lb/100 gal. Quizalofop was applied with the Monsanto adjuvant MON 59112 at 0.272% v/v. COC=crop oil concentrate (Herbimax).

[b]Rates for all glyphosate treatments are in lb ae/A.