2022 Green Section: Weed Control in Small Grains Page #

Winter rye cover crop seeding date and rate impact on soil, weeds and soybean, Carrington, 2022.
(Greg Endres and Mike Ostlie)

The field study is being conducted at the NDSU Carrington Research Extension Center with support from ND Soybean Council to examine impact on soil, weeds, and soybean with winter rye seeded on two fall dates and at three rates grown as a preplant cover crop. Study objective is to identify rye plant populations, using combinations of seeding dates and rates, for reaching goals with the cover crop including soil and weed management while maintaining high potential for soybean seed yield. Experimental design was a randomized complete block (split-plot arrangement for rye: main plot=seeding date; subplot=seeding rate) and four replications. The dryland trial was established on Heimdal-Emrick loam soil with 2.3% organic matter, 8.0 pH, 5 ppm P, 151 ppm K, and 0.24 mmho/cm soluble salts (0- to 6-inch depth). 'ND Dylan' rye (99% germ. and 16,670 seeds/lb) was direct seeded into barley stubble on September 22 and October 8, 2021 at seeding rates of 25, 50, and 75 lb/A (PLS/A: 25 lb=414,320; 50 lb=828,430; 75 lb=1,242,950). Early seeded rye was at 4-leaf growth stage and late-seeded rye was 1 leaf at close of growing season (early November). Jointing to boot stage rye was terminated on June 3, 2022 with glyphosate (Roundup PowerMax at 32 fl oz/A). 'AG03XF2' soybean was direct-planted into barley and rye residue in 22-inch rows on June 6. Weeds were hand-rogued on July 8 and glyphosate POST-applied on July 13 across the trial for general weed control. NDAWN monthly rain (inches) in 2022: May=6.7; June=2.9; July=1.5; August=1.2; September=0.6; and 5-month total=12.8. Seed was harvested with a plot combine on October 4.

Averaged across rye seeding rates, early seeded rye averaged 308,170 plants/A with ground cover at 17% and late seeded at 637,140 plants/A and 8% ground cover when evaluated on May 5 (stand) and May 26 (ground cover), Averaged across seeding dates, rye plant density and ground cover among the three seeding rates: 25 lb/A = 218,370 plants/A and 5%; 50 lb/A = 459,420 plants/A and 11%; and 75 lb/A = 740,180 plants/A and 17%.

Table 1 indicates rye plant density and ground cover, soil moisture, and weed control with the interaction of seeding dates and rates. Plant stand ranged from 187,170 plants/A (4 plants/ft^2) to 1,003,920 plants/A (23 plants/ft^2) with highest density obtained with late seeding at 75 lb/A. Ground cover, evaluated in late May before soybean planting, was similar among treatments. Soil moisture, electronically measured at 4-inch depth at soybean planting time and one month later, generally was similar. Foxtail control, visually evaluated about a month after rye was terminated, was similar (80-89%) among rye treatments.

Table 2 indicates soybean performance with the interaction of rye seeding dates and rates. Soybean plant stand (trial average of 150,210 plants/A), development (emergence, flower and maturity) and canopy closure were similar among rye treatments. Soybean seed yield (trial average of 72.1 bu/A), test weight, seed count, protein and oil generally were similar among treatments.

Table 1. Winter rye plant density and ground cover, soil moisture, and weed suppression with winter rye cover crop seeding dates and rates, Carrington, 2022.

Rye seeding treatment		Rye		Soil moisture[2]		Weed control
		Plant density	Ground cover[1]			Foxtail[3]
	Rate	5-May	26-May	6-Jun	6-Jul	6-Jul
Date	lb/A	plt/A	%			
	25	187,170	15.5	23.2	31.1	84
	50	260,910	14.9	22.0	40.0	80
22-Sep	75	476,440	21.1	23.7	32.7	85
	25	249,560	5.5	21.5	27.5	84
	50	657,940	9.1	22.0	30.2	81
8-Oct	75	1,003,920	10.6	23.3	33.9	89
CV (%)		22.6	24.8	7.9	12.4	10.0
LSD (0.10)		164,570	NS	NS	6.2	NS

[1]Canopeo.

[2]Measured with Extech Instruments MO750 soil moisture meter at 4-inch soil depth.

[3]Green and yellow.

Table 2. Soybean response with winter rye cover crop seeding dates and rates, Carrington, 2022.

Rye seeding treatment		Plant					Seed				
					Canopy closure[3]	Physiological maturity (R8)					
Date	Rate	Stand[1]	Emergence	Flower	28-Jul		Yield	TW	Count	Protein	Oil
(2021)	lb/A	plt/A	Day of year[2]		%	Day of year[2]	bu/A	lb/bu	no./lb	%	
	25	152,310	167	195	91.4	268	71.7	57.9	2,821	34.0	18.5
	50	143,030	168	196	87.8	268	69.6	57.8	2,795	33.9	18.7
22-Sep	75	139,860	166	195	90.7	268	72.2	58.0	2,812	34.1	18.8
	25	150,720	166	195	93.1	268	71.6	58.1	2,802	34.4	18.5
	50	157,960	166	195	93.1	268	73.2	57.9	2,738	35.0	18.1
8-Oct	75	157,360	166	195	92.9	268	74.1	58.1	2,770	34.7	18.4
CV (%)		13.3	0.9	0.3	3.5	0.1	14.0	7.0	2.9	1.4	1.2
LSD (0.10)		NS	NS	NS	NS	NS	NS	NS	NS	NS	0.3

[1]Measured 27-Jun; VC-V1 stages of growth.

[2]166=Jun 15; 195=Jul 14; and 268=Sep 26.

[3]Canopeo.

SP2213 AQ-700 with 2,4-D Amine

Dr. Howatt and Mettler. This trial was established near Fargo, ND. Linkert wheat was planted May 27, 2022. Treatments were applied to 4 to 5 leaf wheat, 3 to 6” waterhemp(wahe), 6 to 8” redroot pigweed (rrpw) and 2-4” Venice mallow(vema). Treatments were applied on June 27, 2022 at 7:15AM at 59°F, 72% relative humidity, 0% cloud-cover, 5 to 7 mph wind velocity at 270°, and damp soil surface at 78°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Evaluations took place at 14 and 28 DA-A.

	Treatment	Rate	7/11 wahe	7/11 vema	7/11 rrpw	7/25 wahe	7/25 vema	7/25 rrpw
		---OZ AI/A, %V---	---------- % Control ----------					
1	2,4-Da + UAN	12 + 5%	68	70	69	48	70	60
2	2,4-De + UAN	12 + 5%	86	85	90	88	93	90
3	2,4-Dc + UAN	12 + 5%	81	79	81	65	78	75
4	2,4-Da +AgSyst90+ UAN	12 + 0.25% + 5%	74	73	76	59	71	65
5	2,4-De +AgSyst90 + UAN	12 + 0.25% + 5%	86	88	88	84	89	89
6	2,4-Dc +AgSyst90 + UAN	12 + 0.25% + 5%	76	74	78	63	76	74
7	2,4-Da + AQ700+ UAN	12 + 0.25% + 5%	60	68	65	48	65	58
8	2,4-De + AQ700 + UAN	12 + 0.25% + 5%	83	81	85	81	83	88
9	2,4-Dc + AQ700 + UAN	12 + 0.25% + 5%	70	75	73	59	69	69
10	2,4-Da + AQ700-16+ UAN	12 + 0.25% + 5%	71	73	71	48	66	70
11	2,4-De + AQ700-16 + UAN	12 + 0.25% + 5%	85	84	86	86	87	91
12	2,4-Dc + AQ700-16 + UAN	12 + 0.25% + 5%	70	70	71	50	69	65
	CV:		4.9	5.6	5.2	9.6	6.5	8.2
	LSD P=0.05		5.4	6.1	5.8	8.9	7.2	8.8

Comments:

The 2,4-D amine formulation in treatments 1, 4, 7, and 10 resulted in relatively low level of weed control at 28 days. Treatment 4, with AgSyst90 provided the most weed control of the amine formulations.

The 2,4-D ester formulations in treatments 2, 5, 8, and 11 resulted in the highest level of weed control compared to all other formulations of 2,4-D. These treatments performed similarly, with adequate levels of weed control.

The 2,4-D choline formulations in treatment 9 and 12 resulted in plugged screens and nozzles. Applications were able to applied; however with a narrowed spray pattern, but cleanout was required prior to the next treatment. The decreased coverage is reflected in the level of weed control at 28 days.

WhtB2201 Broadleaf Weed Control in Wheat

Dr. Howatt and Mettler. Linkert wheat was planted on May 27, 2022 near Fargo, ND. Treatments were applied to tillering wheat with 4-5 leaves, 1 to 2" Venice mallow (vema) and 1 to 3" pigweed species(pgwd) on June 23, 2022 at 8:50 AM at 75°F, 62% relative humidity, 5% cloud-cover, 10 mph wind velocity at 225°, and dry soil surface at 71°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Evaluations took place 13 and 27 days after herbicide application.

			7/6	7/6	7/6	7/13
	Treatment	**Rate**	**Wht**	**pgwd**	**vema**	**pgwd**
		--- OZ AI/A, %V ---	----- % Visible Injury ------			
1	Fenx(Tacoma)+2,4-De(Salvo)	0.8+8	0	76	81	96
2	Fenx+Dcpp-p	0.8+8	0	69	79	60
3	Fenx+Clpy&Flox (WideMatch)	0.8+3	0	30	30	28
4	Fenx+Clpy&Flox&Haux (WideARmatch)	0.8+3.36	0	75	90	90
5	Fenx+Clpy&Flox&MCPA(Weld)	0.8+8	0	66	76	64
6	Fenx+Haux+MSO	0.8+0.07+16	0	83	93	84
7	Fenx+Haux&Flas(Quelex)+NIS	0.80.15+0.25%	0	69	80	65
8	Fenx+Haux&Flox(Pixxaro)	0.8+1.8	0	82	80	89
9	Fenx+Carf(Aim)+2,4-De	0.8+0.128+6	0	79	82	61
10	Fenx+Thif-sg+Trib-sg+2,4-De+NIS	0.8+0.24+0.06+4+0.25%	0	93	96	97
11	Fenx+Thif-sg+Trib-sg+2,4-De+NIS	0.8+0.15+0.15+4+0.25%	0	86	87	97
12	Fenx+Brox&MCPA(Bison)	0.8+8	0	86	93	88
13	Fenx+Brox&Pysf(Huskie)	0.8+3.4	0	93	98	98
14	Fenx+Brox&Pysf&Flox(HuskieFx)	0.8+4.5	0	92	97	98
15	Fenx+CoAct+Brox&Bcpy(Talinor)+COC	0.8+0.91+3+1%	0	91	97	94
16	Fenx+Brox&Flox&2,4-D(Kochiavore)	0.8+10	0	86	90	94
	CV:		0	5	5	8
	LSD P=0.05		-	6	6	10

Comments: This experiment has been conducted annually for the past couple years. The weed species present each year varies. Redroot pigweed is the only reoccurring weed from 2021. There was no visible injury to wheat in either year. In 2021, weed control efficacy was 84% or greater across all herbicide treatments. Levels of control were significantly less in 2022 with 28, 60, 61, 64 and 65% control of redroot pigweed from treatments 3, 2, 9, 5, and 7, respectively.

WideMatch resulted in 28% control, but with the addition of halauxifen in WideARmatch percent control increased to 90% at 27 DA-A.

Treatment 12-16 that included bromoxynil resulted in greater than 88% control.

Thifensulfuron and Tribenuron combinations with fenoxaprop and 2,4-De resulted in 97% control.

WhtF2204 Bromoxynil and Dichlorprop Tank Mix Comparison

Dr. Howatt and Mettler. Linkert wheat was planted on May 25, 2022 near Fargo, ND. Treatments were applied to 4 to 5-leaf wheat, 2 to 4-leaf yellow foxtail, 1 to 3-inch common ragweed, 1 to 3-inch waterhemp, and 1 to 3-inch common cocklebur on June 17, 2022 at 9:35AM at 74°F, 54% relative humidity, 0% cloud-cover, 3 mph wind velocity at 90°, and dry soil surface at 71°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates.

	Treatment	Rate	7/1 Wht	7/1 Yeft	7/1 Corw	7/1 Wahe	7/1 Cocb
		----OZ AI/A, %V----	-% Injury-	----------% Control----------			
1	Untreated		0	0	0	0	0
2	Brox&dcpp-p(Maestro EXT)+NIS	12+0.25	0	25	91	85	95
3	Brox&Pysf(Huskie)+NIS	3.86+0.25	0	78	97	96	96
4	Clpy&Flox(WideMatch)+NIS	3+0.25	0	28	91	83	92
5	Brox&dcpp-p+Flcz3.0+NIS+AMS	12+0.438+0.25+1	0	83	91	90	96
6	Brox&dcpp-p+Flcz3.0+Trib-V+NIS+AMS	12+0.438+0.188+0.25+1	0	92	98	92	96
7	Plxm&Flox&Clpy(PerfectMatch)+NIS+AMS	3.22+0.25+1	0	84	93	80	90
8	Brox&Pysf&Thcz(Huskie Complete)+AMS	3.02+1	0	92	98	95	96
9	Flcz 3.0+NIS+AMS	0.438+0.25+1	0	84	0	28	33
	CV:		0	5	3	4	4
	LSD P=0.05		.	5	3	4	5

	Treatment	Rate	7/19 Yeft	7/19 Corw	7/19 Wahe	7/19 Cocb
		----OZ AI/A, %V----	----------% Control----------			
1	Untreated		0	0	0	0
2	Brox&dcpp-p(Maestro EXT)+NIS	12+0.25	0	96	83	96
3	Brox&Pysf(Huskie)+NIS	3.86+0.25	71	98	95	99
4	Clpy&Flox(WideMatch)+NIS	3+0.25	15	96	81	97
5	Brox&dcpp-p+Flcz3.0+NIS+AMS	12+0.438+0.25+1	86	90	81	97
6	Brox&dcpp-p+Flcz3.0+Trib-V+NIS+AMS	12+0.438+0.188+0.25+1	90	94	85	96
7	Plxm&Flox&Clpy(PerfectMatch)+NIS+AMS	3.22+0.25+1	90	99	84	97
8	Brox&Pysf&Thcz(Huskie Complete)+AMS	3.02+1	90	99	99	98
9	Flcz 3.0+NIS+AMS	0.438+0.25+1	91	30	58	23
	CV:		6	6	7	10
	LSD P=0.05		5	7	8	13

Comments: Flucarbazone alone provides poor control of many broadleaf weeds. Addition of flucarbazone to bromoxynil&Dcpp-p did not antagonize broadleaf weed control and resulted in 86% yellow foxtail control. Bromoxynil&Dcpp-p only gave 81% control of waterhemp. Further addition of tribenuron resulted in 90% foxtail control but no improvement of ragweed or waterhemp control because of ALS-resistance in these species at this site. Bromoxynil&pyrasulfotole&thiencarbazone resulted in the best weed control.

WhtB2204 Bromoxynil and Diclorprop-p Tank Mix Comparison

Dr. Howatt and Mettler. This non-cropped trial was established near Fargo, ND. Treatments were applied to 6 to 8-inch kochia on June 17, 2022 at 8:50AM at 80°F, 45% relative humidity, 0% cloud-cover, 3 mph wind velocity at 360°, and dry soil surface at 68°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with three replicates.

	Treatment	Rate	6/24 Kochia	6/30 Kochia	7/18 Kochia
		----OZ AI/A, %V----	----------% Control----------		
1	Untreated		0	0	0
2	Brox&dcpp-p+NIS	12+0.25	82	83	84
3	Brox&dcpp-p+Thif-sg+Trib-sg+NIS	12+0.15+0.15+0.25	82	82	82
4	Brox&dcpp-p+NIS	18+0.25	82	83	83
5	Brox&dcpp-p+Thif-sg+Trib-sg+NIS	18+0.15+0.15+0.25	87	87	83
6	Brox&Pysf(Huskie)+NIS	3.86+0.25	89	88	82
7	Brox&Pysf&Flox(Huskie FX)+NIS	5.2+0.25	91	92	89
8	Clpy&Flox(WideMatch)+NIS	3+0.25	75	77	91
9	Brox&MCPA(Maestro MA)+NIS	12+0.25	82	75	63
10	Brox&flox(Starane NXT)+NIS	5.1+0.25	87	92	93
11	Brox&flox+NIS	7.65+0.25	90	91	96
	CV:		3	4	4
	LSD P=0.05		5	6	5

Comments: Since this kochia was growing in absence of crop competition and was larger at application than recommended, survival and regrowth was likely. Control with clopyralid&fluroxypyr was slow to develop but did not result in regrowth of kochia by the last evaluation. Bromoxynil&fluroxypyr also provided greater than 90% control but some plants produced new growth, albeit abnormal in appearance. Bromoxynil&Dcpp-p gave 82 to 84% control of kochia.

WhtO2208 Brox&Flox&Flcz Tank Mix Efficiency

Dr. Howatt and Mettler. This non-cropped trial was established near Fargo, ND. Treatments were applied to 3 to 4-leaf wild oat on June 3, 2022 at 10:13AM at 60°F, 32% relative humidity, 0% cloud-cover, 2 mph wind velocity at 315°, and dry soil surface at 60°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates.

	Treatment	Rate	6/10 Wioa	6/17 Wioa	6/23 Wioa	6/30 Wioa
		----OZ AI/A, %V----	----------% Control----------			
1	Untreated Check		0	0	0	0
2	634-01*+NIS+AMS	8.6+0.25+8.5	45	73	83	83
3	634-01+NIS+AMS	6.4+0.25+8.5	38	74	85	84
4	634-01+Thif-sg+Trib-sg+NIS+AMS	8.6+0.1+0.1+0.25+8.5	48	75	84	84
5	634-01+Fenx(Tacoma)+NIS+AMS	8.6+0.8+0.25+8.5	38	74	84	84
6	634-01+Clpy(Stinger)+NIS+AMS	8.6+1.5+0.25+8.5	43	74	80	84
7	634-01+Flox(Starane-U)+NIS+AMS	8.6+1.68+0.25+8.5	48	73	81	81
8	634-01+2,4-D(Saber)+NIS+AMS	8.6+3.8+0.25+8.5	45	70	80	81
9	634-01+MCPA-e(Sword)+NIS+AMS	8.6+4+0.25+8.5	43	68	80	83
10	634-01+Headline+NIS+AMS	8.6+2.1+0.25+8.5	55	76	89	83
11	Brox&Pysf&Thcz(HuskieC)+NIS+AMS	3+0.25+8.5	45	74	84	68
12	Plxm&Flox&Clpy(PerfectM)+NIS+AMS	3.22+0.25+8.5	40	80	80	76
13	Haux&Flox&Pxdn(Rezuvant)+NIS+AMS	2.7+0.25+8.5	35	91	96	97
14	Flcz 3.0(Everest3.0)+NIS+AMS	0.438+0.25+8.5	35	74	83	83
	CV:		11	4	3	4
	LSD P=0.05		6	4	3	4

*634-01 = Batalium Amped

Comments: Batalium Amped provided the same level of wild oat control (~83%) when either applied alone or in a tank mix or with other products by 27 DA-A. Batalium Amped provided greater wild oat control compared to Huskie Complete and PerfectMatch, similar control compared to Everest 3.0, and less control compared to Rezuvant.

WhtB2203 Cereal Cross Spectrum Efficacy

Dr. Howatt and Mettler. Linkert wheat was planted on May 18, 2022 near Fargo, ND. Treatments were applied to 1 to 3-inch common lambsquarters, 1 to 2-inch Venice mallow, 1 to 3-inch redroot pigweed, and 3 to 5-inch wild buckwheat on June 17, 2022 at 9:45AM at 80°F, 40% relative humidity, 0% cloud-cover, 3 mph wind velocity at 360°, and dry soil surface at 70°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates.

	Treatment	Rate	6/24 Wht	6/24 Colq	6/24 Vema	6/24 Rrpw	6/24 Wibw	7/1 Colq	7/1 Vema
		----OZ AI/A, %V----	% Injury	----------% Control----------					
1	Untreated		0	0	0	0	0	0	0
2	Brox&dcpp-p(Maestro EXT)+NIS	9.6+0.5	0	93	90	81	84	98	92
3	Brox&dcpp-p+NIS	12+0.5	0	98	96	93	95	99	95
4	Brox&dcpp-p+NIS	14.4+0.5	0	99	98	93	96	99	96
5	302+NIS	8.7+0.5	0	91	91	73	94	97	92
6	302+NIS	11.2+0.5	0	96	96	91	96	99	98
7	302+NIS	13.7+0.5	0	99	97	96	97	99	98
8	Dcpp-p+NIS	8+0.5	0	93	90	91	88	90	81
9	Brox-2EC+NIS	4+0.5	0	99	98	91	94	66	94
10	006+NIS	0.071+0.5	0	43	69	63	74	61	93
11	107+NIS+UAN	0.438+0.25+32	0	43	63	63	78	53	94
12	109+NIS+UAN	0.438+0.25+32	0	45	69	63	83	61	97
13	004+NIS+UAN	0.438+0.25+32	0	40	66	65	74	53	97
14	Brox&dcpp-p+107+NIS+UAN	12+0.438+0.25+32	0	98	97	93	94	99	99
15	Brox&dcpp-p+109+NIS+UAN	12+0.438+0.25+32	0	98	97	94	96	99	99
16	Brox&dcpp-p+104+NIS+UAN	12+0.438+0.25+32	0	99	98	90	93	99	99
	CV:		0	5	5	6	3	3	2
	LSD P=0.05		.	5	5	7	4	4	3

	Treatment	Rate	7/1 Rrpw	7/1 Wibw	7/14 Colq	7/14 Vema	7/14 Rrpw	7/14 Wibw
		----OZ AI/A, %V----	----------% Control----------					
1	Untreated		0	0	0	0	0	0
2	Brox&dcpp-p(Maestro EXT)+NIS	9.6+0.5	94	95	97	93	91	96
3	Brox&dcpp-p+NIS	12+0.5	99	98	99	99	99	99
4	Brox&dcpp-p+NIS	14.4+0.5	98	98	98	98	98	99
5	302+NIS	8.7+0.5	93	95	99	97	91	99
6	302+NIS	11.2+0.5	94	98	99	96	94	99
7	302+NIS	13.7+0.5	99	99	99	98	99	99
8	Dcpp-p+NIS	8+0.5	84	81	99	80	88	89
9	Brox-2EC+NIS	4+0.5	80	88	99	96	84	99
10	006+NIS	0.071+0.5	73	85	81	91	73	89
11	107+NIS+UAN	0.438+0.25+32	84	88	81	90	86	99
12	109+NIS+UAN	0.438+0.25+32	98	95	87	93	84	92
13	004+NIS+UAN	0.438+0.25+32	97	93	71	95	91	99
14	Brox&dcpp-p+107+NIS+UAN	12+0.438+0.25+32	98	99	99	99	99	99
15	Brox&dcpp-p+109+NIS+UAN	12+0.438+0.25+32	98	99	99	99	99	99
16	Brox&dcpp-p+104+NIS+UAN	12+0.438+0.25+32	98	99	99	99	99	99
	CV:		3	3	2	2	3	2
	LSD P=0.05		3	3	2	2	3	2

Comments: Vigorous wheat growth provided substantial competition to support herbicide activity on weeds. Common lambsquarters was not controlled well by flucarbazone formulations, which is consistent with previous experience. All treatments that included bromoxynil and/or Dcpp-p provided excellent broadleaf weed control, with the medium rate providing optimal activity.

WhtB2202. Cereal Cross Spectrum Efficacy-Kochia

Dr. Howatt and Mettler. This non-cropped trial was established near Fargo, ND. Treatments were applied to 6 to 8-inch kochia on June 17, 2022 at 8:30AM at 74°F, 60% relative humidity, 0% cloud-cover, 4 mph wind velocity at 360°, and dry soil surface at 68°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with three replicates.

	Treatment	Rate	6/24 Kochia	6/30 Kochia	7/18 Kochia
		----OZ AI/A, %V----	----------% Control----------		
1	Untreated		0	0	0
2	Brox&dcpp-p(MeastroEXT)+NIS	9.6+0.5	83	88	84
3	Brox&dcpp-p+NIS	12+0.5	90	93	87
4	Brox&dcpp-p+NIS	14.4+0.5	82	88	83
5	302+NIS	8.7+0.5	82	89	85
6	302+NIS	11.2+05	86	88	80
7	302+NIS	13.7+0.5	87	93	88
8	Dcpp-p+NIS	8+0.5	72	78	92
9	Brox-2EC+NIS	4+0.5	88	93	80
10	006+NIS	0.071+0.5	17	2	0
11	107+NIS+UAN	0.438+0.25+32	10	2	0
12	109+NIS+UAN	0.438+0.25+32	7	2	0
13	004+NIS+UAN	0.438+0.25+32	13	0	0
14	Brox&dcpp-p+107+NIS+UAN	12+0.438+0.25+32	83	87	82
15	Brox&dcpp-p+109+NIS+UAN	12+0.438+0.25+32	82	88	85
16	Brox&dcpp-p+004+NIS+UAN	12+0.438+0.25+32	86	91	92
	CV:		6	4	4
	LSD P=0.05		6	5	4

Comments: Since this kochia was growing in absence of crop competition and was larger at application than recommended, survival and regrowth was likely. Formulation 302 did not antagonize bromoxynil&dcpp-p and neither did tank mixes with flucarbazone formulations 107, 109, or 004. Dcpp-p was slow to elicit full symptom response but was very consistent in preventing kochia recovery. Bromoxynil caused more desiccation initially but new kochia growth was normal in appearance, even when in combination with Dcpp-p. Dcpp-p alone was still inhibiting new growth at the final evaluation.

WhtF2208 Controlling Wheat Volunteers

Dr. Howatt and Mettler. Linkert wheat was planted on May 18, 2022 near Fargo, ND. Treatments were applied 4-leaf wheat on June 17, 2022 at 10:28AM at 80°F, 34% relative humidity, 0% cloud-cover, 0 to 3 mph wind velocity at 360°, and dry soil surface at 72°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Volunteer wheat control was evaluated at

	Treatment	Rate	6/29 v. wht	7/14 v. wht
		---- OZ AI/A ----	-------% Control ------	
1	Untreated Check		0	0
2	Quiz (Assure II)+ PO	0.44 + 20	86	99
3	Quiz + PO	0.088 + 20	89	99
4	Quiz + PO	1.32 + 20	95	99
5	Seth (Poast)+ PO	1.5 + 20	71	79
6	Seth + PO	3 + 20	76	94
7	Seth + PO	4.5 + 20	76	96
8	Cleth-2EC (Select) + PO	1 + 20	83	98
9	Cleth-2EC + PO	1.5 + 20	84	99
10	Cleth-2EC + PO	2 + 20	88	99
	CV:		2.8	1.5
	LSD P=0.05		3.1	1.2

Comments: This experiment compared three different Accase herbicides at three different rates. Typically, the higher the rate the greater amount of volunteer wheat control, as was the case with quizalofop and sethoxydim. That trend was not very apparent with clethodim. Clethodim is one of the more efficacious Accase herbicides, so it was not surprising to see it work well even at the lower rate. Sethoxydim at the low rate was weaker at controlling volunteer wheat compared to the other herbicides at the low rate.

SP2214 Defol 5 Spring Wheat Desiccation

Dr. Howatt and Mettler. Linkert wheat was planted on May 18, 2022 near Fargo, ND. The first application (A) was applied to wheat at the early hard dough stage with 37% moisture on August 8, 2022 at 8:30AM at 65°F, 70% relative humidity, 0% cloud-cover, 4 mph wind velocity at 180°, and dry soil surface at 68°F. The second application (B) was applied to wheat at the hard dough stage with 22% moisture on August 13, 2022 at 2:00PM at 76°F, 70% relative humidity, 90% cloud-cover, 2 mph wind velocity at 360°, and damp soil surface at 80°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots except for treatment 3. Treatment 3 was applied at 17 gpa at 40 psi through 11002 TT nozzles. The experiment was a randomized complete block design with four replicates.

	Treatment	Rate	Spray Volume	Timing	8/11 Wht	8/15 Wht	8/19 Wht	8/22 Wht	8/18 Wht	8/22 Wht	8/22 Wht
		--OZ AI/A, %V--			----------% Desiccation----------				% Moisture	% Moisture	Yield (bu/a)
1	Untreated				84	93	96	98	23	12.4	70
2	Defol 5 + Hot MES	96 + 16.7	8.5	A	86	98	99	99	26	12.5	71
3	Defol 5 + Hot MES	96 + 16.7	17	A	89	98	99	99	22	12.3	70
4	Defol 5 + Glyt-PM + Hot MES	96 + 12.4 + 16.7	8.5	A	95	99	99	99	23	12.5	69
5	Glyt-PM + AMS-All	12.4 + 2.5%	8.5	A	84	96	99	99	24	12.2	69
6	Defol 5 + Hot MES	96 + 16.7	8.5	B	84	95	99	99	-	12.3	73
7	Glyt-PM + AMS-All	12.4 + 2.5%	8.5	B	83	94	99	99	-	12.4	75
	CV:				2	1	.38	.44	14	3	6
	LSD P=0.05				3	2	1	1	5	1	6

Comments: Treatment 5 had a more rapid dry down or desiccation 3 DA-A than all other treatments. Treatment 3 with Defol applied at a higher carrier volume had better desiccation response than all other treatments, apart from treatment 5. Remaining treatments all performed similarly. By 11 DA-A there were no longer differences between treatments, likely due to the natural rapid maturing of the wheat that was observed in 2022. There were no differences in grain moisture or yield at harvest.

WhtB2205 Extended Bare Ground Kochia Control

Dr. Howatt, Mettler, DeSimini. This non-cropped trial was established near Valley City, ND. Treatments were applied various sized kochia. Application A was applied on April 27, 2022 at 11:00AM at 53°F, 42% relative humidity, 10% cloud-cover, 10 to 15 mph wind velocity at 90°, and wet soil surface at 40°F. Application B was applied on June 21, 2022 at 7:50AM at 66°F, 74% relative humidity, 0% cloud-cover, 10 to 12 mph wind velocity at 270°, and damp soil surface at 73°F. Application C was applied on September 16, 2022 at 10:40AM at 60°F, 88% relative humidity, 100% cloud-cover, 2 to 3 mph wind velocity at 300°, and damp soil surface at 73°F. Herbicides were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates.

				6/21	7/14	8/9	9/16	5/19	6/1
	Treatment	**Rate**	**App. timing***	**---------- kochia ----------**					
		--OZ AI/A, %V--		----------% Control----------					
1	Amcl&Imaz&Idzf+Glyt-RPC+NIS	17.5+29.6+12.5	A	99	99	92	94	70	83
2	Glyt-RPC+Flox-V+NIS	29.6+0.25	A	89	85	85	63	0	0
3	Amcl&Imaz&Idzf+Glyt-RPC+Flox-V+NIS	8.8+29.6+0.25	A	99	99	89	93	90	88
4	Amcl&Imaz&Idzf+Glyt-RPC+Flox-V+NIS	13.1+29.6+0.25	A	99	99	92	91	88	86
5	Amcl&Imaz&Idzf+Glyt-RPC+Flox-V+NIS	17.5+29.6+0.25	A	99	99	97	96	98	95
6	Flum-SX+Glyt-RPC+Flox-V+NIS	4.1+29.6+0.25	A	99	99	97	99	90	64
7	Glyt-RPC+NIS	29.6+0.25	B	0	79	78	58	35	20
8	Amcl&Imaz&Idzf+Glyt-RPC+NIS	8.8+29.6+0.25	B	0	92	93	86	61	80
9	Amcl&Imaz&Idzf+Glyt-RPC+NIS	13.1+29.6+0.25	B	0	95	91	86	88	81
10	Amcl&Imaz&Idzf+Glyt-RPC+NIS	17.5+29.6+0.25	B	0	97	92	85	94	91
11	Amcl&Imaz&Idzf+Glyt-RPC+Flox-V+NIS	13.1+29.6+5.6+0.25	B	0	99	99	99	98	90
12	Amcl&Imaz&Idzf+Glyt-RPC+Dica-C+NIS	13.1+29.6+16+0.25	B	0	99	99	98	97	90
13	Glyt-RPC+NIS	29.6+0.25	C	0	0	0	0	0	10
14	Amcl&Imaz&Idzf+Glyt-RPC+NIS	8.8+29.6+0.25	C	0	0	0	0	96	91
15	Amcl&Imaz&Idzf+Glyt-RPC+NIS	13.1+29.6+0.25	C	0	0	0	0	90	91
16	Amcl&Imaz&Idzf+Glyt-RPC+NIS	17.5+29.6+0.25	C	0	0	0	0	97	93
17	Amcl&Imaz&Idzf+Glyt-RPC+Flox-V+NIS	13.1+29.6+5.6+0.25	C	0	0	0	0	90	89
18	Amcl&Imaz&Idzf+Glyt-RPC+Dica-C+NIS	13.1+29.6+16+0.25	C	0	0	0	0	95	89
	CV:			4.6	3.0	6.1	9.5	12	14
	LSD P=0.05			2.1	2.7	5.3	7.8	13	14

* Application A was applied when Kochia was at cotyledon stage; Application B 1 to 3” kochia; Application C 2 to 5-foot kochia

Comments: Amcl&Imaz&Idzf is Plainview herbicide for broad-spectrum bareground vegetative management in non-cropland areas. The last two evaluations took place in 2023. A final evaluation would have taken place on July 5, 2023; however, the railroad company sprayed out the trial area.

WhtO2203 Fall Application of pxsf for Wild Oat, No-till

Dr. Howatt and Mettler. This trial was established near Valley City, North Dakota on November 1, 2021. This fall application was made to 3-4 leaf wild oat, at 9:55AM at 31°F, 67% relative humidity, 5% cloud-cover, 6 mph wind velocity at 315°, and damp soil surface at 45°F. Hard red spring wheat was planted the following Spring on June 1, 2022. Herbicides were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Research was conducted on a Overly-Bearden Silty Clay Loam with 5% organic matter and a pH of 6.9 and CEC of 26 meq/100g.

	Treatment	Rate	5/18 Wioa	5/28 Wioa	6/8 Wht	6/22 Wht
		----OZ AI/A----	----% Control----		---% Injury---	
1	Untreated Check	-	0	0	0	0
2	Pyroxasulfone	1.04	38	20	0	0
3	Pyroxasulfone	1.7	76	65	0	0
4	Pyroxasulfone	2.08	76	73	0	0
5	Triallate	16	43	10	0	0
	CV:		21	22	0	0
	LSD P=0.05		15	12	.	.

Comments: Winter snowfall did not incorporate Zudia at the low rate, or triallate enough to obtain adequate control of wild oat in the Spring. Unlike a similar experiment conducted on conventionally tilled ground, there was no statistical rate benefit from applying Zidua at the 1.7 oz rate to the 2.08 oz rate. There was no visible wheat injury observed.

WhtO2202 Fall Application of pxsf for Wild Oat, Tilled

Dr. Howatt and Mettler. This trial was established in Fargo, North Dakota on October 22, 2021. Wheat variety 9590 was directly seeded with no tillage the following spring on May 23, 2022. The first herbicide application (A and B) was applied on October 22, 2021 at 2:20PM at 49°F, 49% relative humidity, 5% cloud-cover, 2 mph wind velocity at 45°, and damp soil surface at 60°F. The second application (C) was applied to cotyledon to 1-leaf wild oat on May 17, 2022 at 2:55PM at 66°F, 50% relative humidity, 100% cloud-cover, 5 mph wind velocity at 180°, and damp soil surface at 68°F. The third and final application (D) was made to cotyledon to 1-leaf wild oat on May 24, 2022 at 12:20PM at 74°F, 43% relative humidity, 15% cloud-cover, 8 mph wind velocity at 135°, and damp soil surface at 63°F. Fall herbicides were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 10-foot-wide area the length of 10 by 30-foot plots. Spring experiments were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates.

	Treatment	Rate	App Code	5/24 Wioa	6/7 Wioa	6/7 Wht	6/22 Wioa	7/5 Wioa
		----OZ AI/A----		-----% Control-----		-% Injury-	--% Control--	
1	Untreated Check	-	-	0	0	0	0	0
2	Pxsf (Zidua SC)	1.7	A	43	69	0	55	45
3	Pxsf	2.08	A	82	87	8	84	84
4	Pxsf	4.16	A	92	97	19	89	94
5	Triallate (Far-go)	16	A	98	94	6	86	92
6	Pxsf	1.7	B	35	64	3	71	55
7	Pxsf	2.08	B	77	80	6	76	78
8	Pxsf	4.16	B	88	98	10	93	96
9	Pxsf+glyt	1.7+22	C	1	.	0	.	.
10	Pxsf+glyt	2.08+22	C	1	.	0	.	.
11	Pxsf+glyt	4.16+22	C	1	.	10	.	.
12	Triallate+glyt	16+22	C	0	.	11	.	.
13	Pxsf+glyt	1.7+22	D	1	.	3	.	.
14	Pxsf+glyt	2.08+22	D	1	.	6	.	.
15	Pxsf+glyt	4.16+22	D	0	.	21	.	.
	CV:			9	5	65	4	5
	LSD P=0.05			5	5	6	4	5

Application Codes: A: Fall PPI, B: Fall Pre-Plant, C: Spring PPI (Before rain, no mechanical), D: Spring PRE (after rain, no irrigation)
Wioa: Wild Oat, Wht: Wheat

Comments: The experiment was conducted on silty clay with 1.9% sand, 44.3% silt, and 53.8% clay. The soil had 5.9% organic matter, a pH of 7.9, and CEC of 40.4 Meq/100g.

Glyphosate was added to treatments 9 through 15 to kill off any emerged or existing wild oat.

Fall Applications: There was a 5 to 10% advantage to incorporating Zidua (pxsf) at the low and medium rates versus not incorporating Zidua in the Fall. There was no benefit to incorporating Zidua at the higher rate, although there was a rate benefit, with the higher rate of Zidua controlling greater than 94% of the wild oat. Incorporated triallate performed similarly to the high rate of Zidua. The high rates of Zidua did result in greater visible wheat injury (5 to 13%) than triallate on June 6th.

Spring Applications: Wheat injury was the primary characteristic evaluated on Spring application, which occurred before and after a rain. The greatest about of wheat injury (21%) occurred with the high rate of Zidua without incorporating rain. The rain event reduced the overall wheat injury observed.

WhtF2201 Foxtail Control in Wheat

Dr. Howatt and Mettler. Linkert wheat was planted on May 27, 2022 near Fargo, ND. Treatments were applied to tillering wheat, 2 to 3 leaf yellow foxtail on June 23, 2022 at 9:30 AM at 75°F, 62% relative humidity, 5% cloud-cover, 8 mph wind velocity at 225°, and dry soil surface at 71°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Evaluations were taken 14 days after application. Only visible injury to wheat was recorded as yellow foxtail was being choked out by the wheat.

	Treatment	Rate	7/6 Wht
		--- OZ AI/A, %V ---	% Visible Injury
1	Brox&MCPA (Bison)	8	0
2	Flcz 3.0 (Everest)+Brox&MCPA+BB	0.44+8+1%	3
3	Pxlm (TeamMate)+Brox&MCPA+BB	0.21+8+1%	0
4	Plxm&Flox&Clpy(Perfect Match)+BB	3.2+1%	5
5	Pxlm&flox(OpenSky)+Thif-sg+BB	2.1+0.25+1%	10
6	Thcz(Varro)+Brox&MCPA+BB	0.072+8+1%	1
7	Thcz+Trib-sg+2,4-De(Salvo)	0.072+0.11+4	1
8	Brox&Pysf&Thcz(HuskieComplete)+UAN	3+16	1
9	Fenx(Tacoma)+Brox&MCPA	0.8+8	0
10	Fenx&Brox&Pyra(Wolverine Adv.)	5.4	0
11	Pxdn-XL(Axial XL)+Brox&MCPA	0.86+8	0
12	Pxdn&Fenx(Axial Bold)+Brox&MCPA	1.28+8	0
13	Haux&Flox&Pxdn	2.71	0
	CV:		77
	LSD P=0.05		2

Comments: Very little visible injury to wheat occurred on the majority of the wheat Treatment 5, a tank mix of OpenSky and thifensulfuron, resulted in 10% injury. Treatment 4, PerfectMatch, resulted in 5% wheat injury. Yield was not obtained.

A similar experiment was conducted in 2021. In that experiment, herbicides did not cause any visible injury to wheat. This included treatments of OpenSky and PerfectMatch.

SP2209 Grass Control in Spring Rye Loc 2 - Casselton

Dr. Howatt and Mettler. 'SH-05' spring rye was planted on May 23, 2022 near Fargo, ND. Treatments were applied 3 to 4 leaf rye on June 13, 2022 at 3:06 PM at 90°F, 52% relative humidity, 20% cloud-cover, 7-8 mph wind velocity at 135°, and dry soil surface at 82°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 25-foot plots. The experiment was a randomized complete block design with four replicates. Crop safety evaluations were conducted 14 days after herbicide application.

	Treatment	Rate	6/27 rye
		- OZ AI/A, %V -	% Visible Injury
1	Brox&MCPA(Bison)	8	0
2	Flcz 3.0(Everest)+Brox&MCPA+BB	0.35+8+1%	0
3	Pxlm(Teammate)+Brox&MCPA+BB	0.21+8+1%	0
4	Plxm&Flox&Clpy(Perfectmatch)+BB	3.2+1%	0
5	Pxlm&flox(OpenSky)+Thif-sg+BB	2.1+0.25+1%	0
6	Thcz(Varro)+Brox&MCPA+BB	0.072+8+1%	0
7	Thcz+Trib-sg+2,4-D-e (Salvo)	0.072+0.11+4	0
8	Brox&Pysf&Thcz(HuskieComplete)+UAN	3+16	0
9	Brox&Pysf (Huskie)	3.4	0
10	CoAct+Brox&Bcpy(Talinor)+PO	0.91+3+1%	0
11	Fenx(Tacoma)+Brox&MCPA	1.32+8	0
12	Fenx&Brox&Pyra(Wolverine Adv.)	5.4	0
13	Pxdn-XL (Axial XL)+Brox&MCPA	0.86 + 8	0
14	Pxdn&Fenx(Axial Bold)+Brox&MCPA	1.28 + 8	0
15	Haux&Flox&Pxdn(Rezuvant)	2.71	0
16	Mess(Osprey)+Brox&MCPA+BB	0.21+8+1%	29
17	Prcz(Olympus)+Brox&MCPA+BB	0.42+8+1%	0
	CV:		36
	LSD P=0.05		1

Comments: Similar to the Fargo location, few herbicides resulted in crop injury. Osprey, or mesosulfuron-methyl, resulted in significant injury to rye and should not be considered for use in crop. Weed control was not evaluated at this location due to the lack of consistent densities of weeds across plots.

SP2208 Grass Control in Spring Rye Loc 1 - Fargo

Dr. Howatt and Mettler. 'SH-05' spring rye was planted on May 23, 2022 near Fargo, ND. Treatments were applied 3 to 4 leaf rye and 1 to 3 leaf yellow foxtail on June 10, 2022 at 8:30 AM at 64°F, 69% relative humidity, 15% cloud-cover, 3 mph wind velocity at 225°, and dry soil surface at 71°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 25-foot plots. The experiment was a randomized complete block design with four replicates. Evaluations were conducted 13 and 28 days after herbicide application.

	Treatment	Rate	6/23 yeft	6/23 rye	7/8 rye
		- OZ AI/A, %V -	---- % Visible Injury ----		
1	Brox&MCPA(Bison)	8	0	0	0
2	Flcz 3.0(Everest)+Brox&MCPA+BB	0.35+8+1%	79	0	1
3	Pxlm(Teammate)+Brox&MCPA+BB	0.21+8+1%	74	0	0
4	Plxm&Flox&Clpy(Perfectmatch)+BB	3.2+1%	76	1.3	3
5	Pxlm&flox(OpenSky)+Thif-sg+BB	2.1+0.25+1%	76	0	3
6	Thcz(Varro)+Brox&MCPA+BB	0.072+8+1%	78	0	1
7	Thcz+Trib-sg+2,4-D-e (Salvo)	0.072+0.11+4	76	0	2
8	Brox&Pysf&Thcz(HuskieComplete)+UAN	3+16	79	0	0
9	Brox&Pysf (Huskie)	3.4	76	0	0
10	CoAct+Brox&Bcpy(Talinor)+PO	0.91+3+1%	71	0	0
11	Fenx(Tacoma)+Brox&MCPA	1.32+8	83	0	0
12	Fenx&Brox&Pyra(Wolverine Adv.)	5.4	79	0	0
13	Pxdn-XL (Axial XL)+Brox&MCPA	0.86 + 8	93	1	2
14	Pxdn&Fenx(Axial Bold)+Brox&MCPA	1.28 + 8	93	4	6
15	Haux&Flox&Pxdn(Rezuvant)	2.71	89	4	6
16	Mess(Osprey)+Brox&MCPA+BB	0.21+8+1%	75	18	53
17	Prcz(Olympus)+Brox&MCPA+BB	0.42+8+1%	0	0	1
	CV:		7	174	67
	LSD P=0.05		7	4	5

Comments: Treatment 16 with the mesosulfuron (Mess) resulted in significant injury to the rye, both at 13 and 28 days after herbicide application. Applications that included pinoxaden (treatments 13-15) resulted in minor crop injury while all other applications were relatively safe to rye. Treatments 13, 14, and 15 also resulted in the greatest level of yellow foxtail control. Yield was not harvested due to large amounts of grasshopper damage late in the season.

SP2207 Grass Control in Triticale

Dr. Howatt and Mettler. 'Elevator' triticale was planted on May 23, 2022 near Fargo, ND. Treatments were applied 3 to 4 leaf triticale (Trit) on June 10, 2022 at 9:05 AM at 69°F, 57% relative humidity, 50% cloud-cover, 2 mph wind velocity at 225°, and dry soil surface at 71°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 25-foot plots. The experiment was a randomized complete block design with four replicates. Crop safety evaluations were conducted 13 and 28 days after herbicide application.

	Treatment	Rate	6/23 Trit	7/8 Trit	9/6 Grain Yield
		- OZ AI/A, %V -	- % Visible Injury -		bu/a
1	Brox&MCPA (Bison)	8	0	0	22.3
2	Flcz 3.0 (Everest)+Brox&MCPA+BB	0.35+8+1%	0	0	30.2
3	Pxlm (TeamMate)+Brox&MCPA+BB	0.21+8+1%	0	0	33.0
4	Plxm&Flox&Clpy(Perfect Match)+BB	3.2+1%	0	0	32.0
5	Pxlm&flox(OpenSky)+Thif-sg+BB	2.1+0.25+1%	0	0	29.3
6	Thcz(Varro)+Brox&MCPA+BB	0.072+8+1%	0	0	35.7
7	Thcz+Trib-sg+2,4-De(Salvo)	0.072+0.11+4	0	0	36.4
8	Brox&Pysf&Thcz(HuskieComplete)+UAN	3+16	0	0	30.4
9	Fenx(Tacoma)+Brox&MCPA	1.32+8	0	0	25.5
10	Fenx&Brox&Pyra(Wolverine Adv.)	5.4	0	0	30.1
11	Pxdn-XL(Axial XL)+Brox&MCPA	0.86+8	0	0	32.3
12	Pxdn&Fenx(Axial Bold)+Brox&MCPA	1.28+8	0	0	32.2
13	Haux&Flox&Pxdn+NIS	2.71+0.25%	0	0	31.6
	CV:		0	0	13.2
	LSD P=0.05		-	-	5.8

Comments: No visible crop injury was observed from any of the herbicides applied. Grain yield correlated with the level of weed control. Treatment 1 was the lowest yielding treatment as it only controlled broadleaf weeds. Triticale yield, on average, was 6.5 bushels per acre greater when some type of grass inhibiting herbicide was applied.

WhtB2206 Huskie FX Efficacy and Tolerance in Wheat – Location 1

Dr. Howatt and Mettler. Linkert Wheat was planted on May 18, 2022 near Fargo, ND. Treatments were applied to 1 to 3-inch common lambsquarters (colq), 1 to 2-inch Venice mallow (vema), 1 to 3-inch redroot pigweed (rrpw), and 3 to 4-inch wild buckwheat (wibu) on June 17, 2022 at 9:36AM at 80°F, 40% relative humidity, 0% cloud-cover, 0 to 3 mph wind velocity at 360°, and dry soil surface at 70°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 70 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates.

	Treatment	Rate	6/24 wht	6/24 colq	6/24 vema	6/24 rrpw	6/24 wibu	7/14 wht	7/14 colq	7/14 vema
		OZ AI/A	----------% Control----------							
1	Untreated		0	0	0	0	0	0	0	0
2	Brox&Pysf&Flox	4.46	0	95	96	97	88	0	99	99
3	Brox&Pysf&Flox	5.2	0	99	99	99	99	0	99	98
4	clpy&flox&haux+MCPA-e	3.3+5.2	0	96	94	93	86	0	99	98
5	Brox&Bcpy+CoAct+	3.03+2.87	0	99	99	99	90	0	99	99
6	Brox&MCPA	8	0	98	96	91	85	0	99	99
	CV:		0	1.8	1.9	3.2	4.2	0	0	1.4
	LSD P=0.05		.	2.2	2.4	3.8	4.7	.	.	1.7

	Treatment	Rate	7/14 rrpw	7/14 wibu	8/6 wht	8/6 colq	8/6 vema	8/6 rrpw	8/6 wibu
		OZ AI/A	----------% Control ----------						
1	Untreated		0	0	0	0	0	0	0
2	Brox&Pysf&Flox	4.46	98	91	0	99	99	97	90
3	Brox&Pysf&Flox	5.2	99	99	0	99	99	99	99
4	clpy&flox&haux+MCPA-e	3.3+5.2	98	99	0	99	99	99	99
5	Brox&Bcpy+CoAct+	3.03+2.87	98	92	0	99	99	99	80
6	Brox&MCPA	8	90	86	0	99	99	90	83
	CV:		2.7	3.7	0	0	0	2.1	3.0
	LSD P=0.05		2.2	4.4	.	.	.	2.6	3.4

Comments: None of the treatments resulted in visible injury to wheat. At 50 days after herbicide application control of colq, vema, and rrpw were near 99% for all treatments apart from Bison(trt 6) which resulted in only 90% control of rrpw. Bison, Talinor (trt 4), and Huskie FX (trt 1) also had a reduced efficacy at controlling wibu compared to other treatments. Huskie FX was very comparable to other industry standard products for control of broadleaf weeds in wheat.

WhtB2207 Huskie FX Efficacy and Tolerance in Wheat – Location 2

Dr. Howatt and Mettler. This non-cropped trial was established near Fargo, ND. Treatments were applied to 4 to 6-inch kochia on June 17, 2022 at 9:11AM at 82°F, 60% relative humidity, 0% cloud-cover, 0 to 3 mph wind velocity at 360°, and dry soil surface at 69°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 70 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates.

	Treatment	Rate	6/24 kochia	7/8 kochia	8/6 kochia
		OZ AI/A			
1	Untreated		0	0	0
2	Brox&Pysf&Flox	4.46	86	89	81
3	Brox&Pysf&Flox	5.2	88	92	85
4	clpy&flox&haux+MCPA-e	3.3+5.2	74	83	94
5	Brox&Bcpy+CoAct+	3.03+2.87	84	80	64
6	Brox&MCPA	8	81	73	43
	CV:		2.8	4.8	7.1
	LSD P=0.05		2.9	5.0	6.5

Comments: Location 2 of this treatment list focused on kochia control using Huskie FX (trt 1 and 2), while location 1 focused on wheat tolerance and other weeds.

- Both rates of Huskie FX resulted in greater control of kochia at 7 and 21 days after herbicide application (DA-A) compared to the other industry standard treatments.
- However, by 50 DA-A overall efficacy of Huskie FX along with many of the other treatments reduced around 8% or more, while the tank mix of WideARmatch + Sword (trt 4) increase in efficacy.
- WideARmatch + Sword was the most effective control option for kochia at 50 DA-A. Huskie FX still performed better than Talinor (trt 4) and Bison (trt 5).

WhtF2207 Reviton Wheat Program for PRE Control

Dr. Howatt and Mettler. This non-cropped trial was established near Fargo, ND. Treatments were applied as a pre-plant burndown application to 2 to 4-leaf yellow foxtail, 1 to 3-inch waterhemp, 1 to 3-inch redroot pigweed, and V1 volunteer soybean on June 17, 2022 at 11:10AM at 88°F, 31% relative humidity, 2% cloud-cover, 3 mph wind velocity at 360°, and dry soil surface at 72°F. Herbicides were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Evaluations were conducted 3, 6, and 27 days after application (DA-A).

	Treatment	Rate	6/20 Yeft	6/20 Wahe	6/20 Rrpw	6/20 Vol Soy	6/23 Yeft
		----OZ AI/A, %V----	----------% Control----------				
1	Untreated Check		0	0	0	0	0
2	Glyt-PM+AMS	12.4+8.5	90	30	60	1	99
3	Tiaf(Reviton)+DestHC	0.354+1%	95	98	98	98	91
4	Tiaf+DestHC	0.71+1%	97	99	99	99	97
5	Tiaf+Glyt-PM+AMS+DestHC	0.354+12.4+8.5+1%	98	98	98	99	98
6	Flcz-PP(Pre-Pare)+NIS	0.21+0.25%	19	23	23	19	73
7	Flcz-PP+Glyt-PM+AMS	0.21+12.4+8.5	85	43	43	19	99
8	Glyt-PM+Quiz+AMS+COC	12.4+0.55+8.5+1%	81	28	50	8	98
9	Flcz 3.0+AMS+NIS	0.438+8.5+0.25%	26	35	35	24	79
	CV:		4	11	6	6	3
	LSD P=0.05		4	8	5	4	4

	Treatment	Rate	6/23 Wahe	6/23 Rrpw	6/23 Vol Soy	7/14 Yeft	7/14 Wahe	7/14 Rrpw
		----OZ AI/A, %V----	----------% Control----------					
1	Untreated Check		0	0	0	0	0	0
2	Glyt-PM+AMS	12.4+8.5	28	94	6	99	43	96
3	Tiaf(Reviton)+DestHC	0.354+1%	96	99	99	93	84	92
4	Tiaf+DestHC	0.71+1%	99	99	99	96	97	96
5	Tiaf+Glyt-PM+AMS+DestHC	0.354+12.4+8.5+1%	98	99	99	97	94	93
6	Flcz-PP(Pre-Pare)+NIS	0.21+0.25%	40	85	30	78	59	94
7	Flcz-PP+Glyt-PM+AMS	0.21+12.4+8.5	66	94	38	98	73	95
8	Glyt-PM+Quiz+AMS+COC	12.4+0.55+8.5+1%	38	94	11	99	56	95
9	Flcz 3.0+AMS+NIS	0.438+8.5+0.25%	58	88	45	94	76	94
	CV:		11	3	9	2	11	3
	LSD P=0.05		9	4	6	2	10	3

Comments: Treatments 6 and 8 consistently resulted in lower weed control efficacy across nearly all weed species and evaluation timings. Treatment 8 with the addition of quizalofop resulted in similar control of yellow foxtail at 27 DA-A as other high controlling treatments. By 6 DA-A, redroot pigweed was adequately controlled with all herbicide treatments. Treatments that included tiafenacil (3,4,and 5) resulted in better control of waterhemp compared to any of the other treatments.

WhtO2210 Reviton Wheat Program for Wild Oat Control

Dr. Howatt and Mettler. This non-cropped trial was established near Fargo, ND. Treatments were applied to 1-leaf wild oat on May 24, 2022 at 12:30PM at 74°F, 43% relative humidity, 25% cloud-cover, 8 mph wind velocity at 180°, and damp soil surface at 63°F. Herbicides were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Evaluations took place at 3, 7, 14, and 24 days after application (DA-A).

	Treatment	Rate	5/27 Wioa	5/31 Wioa	6/7 Wioa	6/17 Wioa
		--OZ AI/A, %V--	----------% Control----------			
1	Untreated Check		0	0	0	0
2	Glyt-PM+AMS	12.4+8.5	10	80	97	93
3	Tiaf(Reviton)+DestHC	0.354+1%	28	74	81	73
4	Tiaf+DestHC	0.71+1%	30	76	84	80
5	Tiaf+Glyt-PM+AMS+DestHC	0.354+12.4+8.5+1%	35	71	90	85
6	Flcz-PP(Pre-Pare)+NIS	0.21+0.25%	0	38	68	61
7	Flcz-PP+Glyt-PM+AMS	0.21+12.4+8.5	13	78	97	93
8	Glyt-PM+Quiz+AMS+COC	12.4+0.55+8.5+1%	13	76	94	90
9	Flcz 3.0+AMS+NIS	0.438+8.5+0.25%	8	45	75	65
	CV:		25	6	6	5
	LSD P=0.05		6	5	7	5

Comments: This experiment was established as a pre-plant burndown application. By 24 DA-A, treatments 2,7, and 8 resulted in 90% or greater control of wild oat. The low and high rate of tiafenacil resulted in 73 and 80% control, respectively. Wild oat control with tiafenacil increased to 85% when tank mixed with glyphosate. The tank mix with glyphosate was not as effective as glyphosate alone (93% control). Flucarbazone alone (trt 6 and 9) resulted in 61 and 65% control. With the addition of glyphosate to flucarbazone in treatment 7, wild oat control in increased to 93%.

Wht2201 Soil Herbicide Management of Waterhemp in Wheat

Dr. Howatt and Mettler. Linkert wheat was planted on May, 25 2022, near Fargo, ND. PRE herbicides were also applied on May 26, 2022 at 9:00 AM at 68°F, 49% relative humidity, 10% cloud-cover, 2 mph wind velocity at 190°, and damp soil surface at 60°F. PRE herbicides were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. POST herbicides were applied to 3 to 5-inch waterhemp and 3-leaf wheat on June 22, 2022 at 9:51 AM at 75°F, 58% relative humidity, 0% cloud-cover, 6 to 8 mph wind velocity at 270°, and dry soil surface at 74°F. POST herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. The experiment was conducted on silty clay soil with 6.2% organic matter, a pH of 7.6 and CEC of 40.4 meq/100g.

	Treatment*	Rate	6/7 wht	6/22 wht	6/22 wahe	7/5 wht	7/5 wahe	7/20 wahe
		OZ AI/A	----------% Visible Injury ----------					
1	**Saff** (Sharpen) / Brox&Pyst (Huskie)	**1.1** / 3.4	0	0	99	0	99	99
2	**Pend-h** / Brox&Pyst	**22** / 3.4	0	0	85	0	96	99
3	**Pxsf-sc (Zidua SC)** / Brox&Pyst	**2** / 3.4	0	0	81	0	98	99
4	**Acet-w (Warrant)/** Brox&Pyst	**24 /** 3.4	0	0	91	0	97	99
5	**Dime (Outlook)** / Brox&Pyst	**18 /** 3.4	0	0	87	0	99	99
6	**Meto-D2M (Dual II Magnum)**/ Brox&Pyst	**24 /** 3.4	0	0	66	0	97	99
7	**Mest (Callisto)**/ Brox&Pyst	**1.5 /** 3.4	0	0	0	0	90	99
8	Brox&Pyst	3.4	0	0	0	0	83	99
9	Pend-h + Brox&Pyst	22 + 3.4	0	0	0	0	80	99
10	Pxsf-sc + Brox&Pyst	2 + 3.4	0	0	0	0	84	99
11	Acet-w + Brox&Pyst	24 + 3.4	0	0	0	0	81	99
12	Dime + Brox&Pyst	18 + 3.4	0	0	0	0	84	99
13	Meto-D2M + Brox&Pyst	24 + 3.4	0	0	0	0	85	99
14	Mest + Brox&Pyst	1.5 + 3.4	0	0	0	5.3	88	99
	CV:		0	0	5.7	146	2.6	0
	LSD P=0.05		.	.	3.4	0.8	3.3	.

* Herbicides in bold were applied as a PRE while non-bolded herbicides were applied as a delayed PRE, post waterhemp emergence.

Comments: A similar experiment was conducted in 2021, where waterhemp plants were 99% controlled right off the bat, leading to an additional year of research to catch any differences among the treatments. In 2021 and 2022 mesotrione resulted in 19 and 5% visible wheat injury. Mesotrione was the only herbicide to visibly injury wheat in either year. Saflufenacil was the most effective PRE herbicide, controlling 99% of waterhemp at 28 DA-A, followed by acetochlor which controlled 91% of waterhemp. By 28 DA-B all herbicides resulted in 99% control of waterhemp.

WhtF2205 Thiencarbazone and Fluroxypyr Tank Mixes

Dr. Howatt and Mettler. Linkert wheat was planted on May 25, 2022 near Fargo, ND. Treatments were applied to 3 to 5-leaf wheat, 2 to 4-leaf yellow foxtail, 1 to 3-inch waterhemp, 1 to 3-inch Venice mallow, 1 to 3-inch common ragweed. Application was made on June 17, 2022 at 9:45AM at 74°F, 54% relative humidity, 0% cloud-cover, 3 mph wind velocity at 90°, and dry soil surface at 71°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Wheat chlorosis and visible injury was evaluated 3, 6 and 21 days after application (DA-A). Weeds were evaluated for percent control at 6, 21 and 32 DA-A.

	Treatment	Rate	6/20 Wht	6/23 Wht	6/23 Yeft	6/23 Vema	6/23 Corw	6/23 Wahe
		----OZ AI/A, %V----	-% Chlorosis-	-% Injury-	----------% Control----------			
1	Untreated		0	0	0	0	0	0
2	Thcz	0.071	20	3	43	55	38	30
3	Thcz&Flox	2.47	20	5	53	76	64	71
4	Thcz+Brox&Pysf&Flox	0.071+4.46	20	4	55	80	83	84
5	Thcz&Flox +Brox&Pysf	2.47+3.3	20	8	55	80	81	80
6	Thcz&Flox +Brox&MCPA	2.47+8	20	6	53	69	75	68
7	Thcz&Flox +2,4-D-e	2.47+5	20	9	55	75	79	78
8	Thcz&Flox +Thif-sg+Trib-sg+Haux&Flas	2.47+0.1+0.1+0.153	20	5	55	73	71	74
9	Thcz&Flox +Thif-sg+Trib-sg+2,4-D-e	2.47+0.1+0.1+5	20	14	58	79	79	74
	CV:		0	16	11	6	5	7
	LSD P=0.05		.	1	8	5	5	6

	Treatment	Rate	7/8 Wht	7/8 Yeft	7/8 Vema	7/8 Corw	7/8 Wahe	7/19 Yeft	7/19 Vema	7/19 Corw	7/19 Wahe
		----OZ AI/A, %V----	-% Injury-	----------% Control----------							
1	Untreated		0	0	0	0	0	0	0	0	0
2	Thcz	0.071	0	86	93	69	60	88	93	79	61
3	Thcz&Flox	2.47	0	91	98	93	83	89	99	99	83
4	Thcz+Brox&Pysf&Flox	0.071+4.46	0	85	98	98	97	81	99	99	99
5	Thcz&Flox+Brox&Pysf	2.47+3.3	0	81	99	99	97	84	99	99	99
6	Thcz&Flox+Brox&MCPA	2.47+8	0	89	95	94	83	90	99	99	98
7	Thcz&Flox+2,4-D-e	2.47+5	0	87	97	98	93	91	99	99	95
8	Thcz&Flox+Thif-sg+Trib-sg+Haux&Flas	2.47+0.1+0.1+0.153	0	95	99	99	97	91	99	99	98
9	Thcz&Flox +Thif-sg+Trib-sg+2,4-D-e	2.47+0.1+0.1+5	0	86	97	93	89	91	99	99	97
	CV:		0	3	2	3	5	4	2	3	4
	LSD P=0.05		.	4	2	4	6	4	3	4	5

Comments: Treatment 9 resulted in 14% visible wheat injury 6 DA-A. All other herbicides resulted in less than 10% visible injury. By 21 DA-A no visible wheat injury was observed.

At 32 DA-A near 99% control of Venice mallow and common ragweed was achieved by every herbicide combination apart from treatment 2, or thiencarbazone alone. Lower levels of waterhemp control was observed in Treatment 1 and 2. The additions of Huskie or HuskieFX to thiencarbazone actually reduced the level of yellow foxtail control compared to thiencarbazone alone.

WhtO2204 – Use of EZ Formulations of Valor and Fierce in Fall Applied Wild Oat Control

Dr. Howatt and Mettler. This trial was established near Valley City, North Dakota on November 11, 2021. This fall application was made to 3-4 leaf wild oat, at 10:05AM at 31°F, 67% relative humidity, 5% cloud-cover, 6 mph wind velocity at 315°, and damp soil surface at 45°F. Hard red spring wheat was planted the following Spring on June 1, 2022. Herbicides were applied with a backpack sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Research was conducted on a Overly-Bearden Silty Clay Loam with 5% organic matter and a pH of 6.9 and CEC of 26 meq/100g.

		5/18	5/28	6/8	6/21
Treatment	**Rate**	**Wioa**	**Wioa**	**Wht**	**Wht**
	----OZ AI/A----	----------% Control----------			
Untreated		0	0	0	0
Flumioxazin-EZ	1.26	47.5	25	0	0
Flumioxazin&Pyroxasulfone-EZ	2.86	76	42	0	0
CV:		7	17	0	0
LSD P=0.05		5	6	.	.

Comments: There was substantial vegetation cover and residue at the time of fall application. Removal or death of live vegetation could possibly improve spring control of wild oat by enabling more herbicide to reach the soil. Release of these herbicides from vegetation and residue is not known. This work should be continued as producers would prefer a single pass system and application before wild oat germination in the fall would allow substancial time for microbial degradation.

The weather was also very conducive to degradation. Ample precipitation in the fall and extended warm temperatures let to our delay in application to avoid favorable microbial degradation. Excessive precipitation in the spring and extended cool temperatures prolonged the period of wild oat germination. This also delayed wheat seeding by a month and left the landscape open to extended wild oat establishment.

Pyroxasulfone greatly increased the activity on wild oat compared with flumioxazin alone. Residue was waning by mid-May, at which time heavy emergence became noticeable. Wild oat was killed with glyphosate before wheat emergence to allow better evaluation of herbicide residue on wheat. No symptoms or delay in emergence or development of wheat was noted with any treatment.

WhtO2201 Wild Oat Control

Dr. Howatt and Mettler. No crop was planted in this experiment. Plots were established day of herbicide application on June 03, 2022 near Fargo, ND. Treatments were applied to 3 to 4 leaf wild oat at 9:51 AM at 66°F, 42% relative humidity, 0% cloud-cover, 4 mph wind velocity at 315°, and dry soil surface at 60°F. Herbicides were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7-foot-wide area the length of 10 by 30-foot plots. The experiment was a randomized complete block design with four replicates. Evaluations took place at 14 and 27 days after application (DA-A).

	Treatment	Rate	7/17 wioa	7/30 wioa
		--- OZ AI/A, %V ---	% Control	
1	Brox&MCPA (Bison)	8	0	0
2	Flcz 3.0 (Everest)+Brox&MCPA+BB	0.35+8+1%	73	81
3	Pxlm (TeamMate)+Brox&MCPA+BB	0.21+8+1%	73	70
4	Plxm&Flox&Clpy(Perfect Match)+BB	3.2+1%	70	73
5	Pxlm&flox(OpenSky)+Thif-sg+BB	2.1+0.25+1%	74	77
6	Thcz(Varro)+Brox&MCPA+BB	0.072+8+1%	71	71
7	Thcz+Trib-sg+2,4-De(Salvo)	0.072+0.11+4	78	79
8	Brox&Pysf&Thcz(HuskieComplete)+UAN	3+16	76	76
9	Fenx(Tacoma)+Brox&MCPA	1.32+8	70	61
10	Fenx&Brox&Pyra(Wolverine Adv.)	5.4	73	63
11	Pxdn-XL(Axial XL)+Brox&MCPA	0.86+8	85	90
12	Pxdn&Fenx(Axial Bold)+Brox&MCPA	1.28+8	89	95
13	Haux&Flox&Pxdn (Rezuvant)	2.71	94	95
	CV:		3.6	4.4
	LSD P=0.05		3.7	4.5

Comments: A similar experiment was conducted in 2021, with the addition of treatment 13, Rezuvant. In general, 2022 resulted in 10-20% more control of wild oat compared to the same products in 2021. In both years, Axial and Axial bold resulted in the most wild oat control (88 to 95%) followed by flucarbazone which controlled about 80% of the wild oat. Rezuvant, which includes the active ingredient pinoxaden, provided a similar, adequate level of control compared to Axial Bold.