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Preemergence weed control alternatives in barley. (Minot). The objective of the study was to evaluate barley tolerance to soil-applied herbicides. Only Group 1 grass herbicides such as Puma (fenoxaprop) and Axial XL (pinoxaden) can be used in barley. Many farmers have wild oat and green foxtail that are resistant to these Group 1 herbicides. This study was conducted to evaluate barley tolerance to soil-applied herbicides that have different modes of action, which could provide suppression or control of wild oat or green foxtail. The soil was a loam with pH 5.3 and 3.5% organic matter. Herbicide treatments were applied preemergence on May 14, 2019. We received 0.59 inches of rain 10 days after application and 0.34 inches 4 weeks after application.

Dual, Outlook, and Pre-Pare caused severe injury at the June and early July evaluations. Although barley in these treatments recovered somewhat over time, barley density and yield tended to be lower in these treatments. All herbicide treatments tended to be slightly lower in density, height, yield, and test weight compared to the untreated.

Table. Preemergence Weed Control Alternatives in Barley. (1908)										
Treatment ^a	Rate	Timing	Injury			Density	Height		Yield	Test wt
			22-Jun	8-Jul	24-Jul	4-Jun	27-Jun	23-Jul	16-Aug	16-Aug
			-----%-----			# per m of row	----cm----		bu/A	lb/bu
Untreated			0	0	0	27.7	45.3	80.4	95	45.1
Zidua	3 oz	PRE	14	11	11	24.8	42.5	77.7	87	44.7
Warrant	1.5 qt	PRE	2	3	2	25.7	43.8	73.6	89	44.8
Dual II Magnum	1.67 pt	PRE	34	21	13	21.6	42.3	76.6	81	44.6
Pre-Pare	0.3 oz	PRE	47	35	24	20.4	31.3	74.4	79	43.4
Prowl H2O	3 pt	PRE	5	3	1	26.8	42.2	74.4	87	44.9
Valor	2 oz	PRE	11	10	9	25.3	42.5	68.6	84	44.6
Outlook	18 oz	PRE	58	46	26	20.4	39.1	74.2	70	44.7
Fierce	3 oz	PRE	16	9	8	25.9	42.4	75.6	91	44.2
LSD			17.4	17.8	13.2	4.1	7.4	NS	NS	0.90
^a All treatments applied preemergence										

Oat tolerance to herbicides applied PRE and early POST. (Minot). The objective of the study was to evaluate oat tolerance to preemergence (PRE) and postemergence herbicides (POST). There are no herbicides labeled for use in oat to control grasses. In this study, herbicides were applied PRE (May 14) or at the 1-leaf (May 29) or 4-leaf (June 18) oat stage. Soil conditions were generally dry through most of May and June. The only rain received in the first month after planting was May 24 (0.59 inches) and June 14 (0.34 inches). Significant rains fell on June 29 (1.71 inches) and July 9 (1.00 inches).

Zidua and Outlook applied PRE caused severe oat injury. The other herbicides applied PRE caused 16% visible crop injury or less. None of the treatments applied POST caused more than 15% crop injury. In previous years, Armezon applied at the 4-leaf stage has caused severe crop injury. The study should be repeated to verify the results under different environmental conditions.

Treatment	Rate	Timing	Injury			Height	Yield	Test wt.
			22-Jun	8-Jul	24-Jul	23-Jul	16-Aug	16-Aug
			-----%-----			cm	bu/A	lb/bu
Untreated			0	0	0	88	55	35.3
Zidua	3 oz	PRE	87	83	82	72	18	34.4
Warrant	1.5 qt	PRE	15	15	13	82	51	35.2
Dual II Magnum	1.67 pt	PRE	16	12	7	86	58	36.3
Prowl	3 pt	PRE	9	4	1	91	62	35.8
Outlook	18 oz	PRE	70	57	52	76	45	35.7
Zidua	3 oz	1-leaf Oat	10	10	19	82	53	35.2
Warrant	1.5 qt	1-leaf Oat	6	6	5	84	57	34.9
Dual II Magnum	1.67 pt	1-leaf Oat	15	14	13	75	55	36.2
Prowl	3 pt	1-leaf Oat	10	7	4	81	60	35.2
Outlook	18 oz	1-leaf Oat	14	12	9	74	59	36.3
Armezon + COC	1 oz + 1 %	1-leaf Oat	7	8	4	83	57	35.5
Armezon + COC	1 oz + 1 %	4-leaf Oat	14	12	11	82	58	34.9
LSD			11.8	12.5	13.2	NS	16.1	NS

Spring wheat and durum desiccation options – Carrington, ND

Mike Ostlie and Kirk Howatt

In 2018 and 2019 a study was conducted with spring wheat and durum to compare potential desiccation products. Each year, Divide durum and Glen spring wheat were planted. The products and rates remained the same both years. The application was made to the studies a few days either than advisable in order to better differentiate treatments. Applications were made with TT8002 nozzles using 20 GPA.

In 2018, there was a lot of variability between reps due to the very dry late-season conditions. Glyphosate, glufosinate, Reglone, and brine all increased the rate of head desiccation of wheat and durum compared to the check (Table 1). There were some trends for creating drier grain among the treatments, however, the only differences were that Valor somehow increased grain moisture in wheat and glyphosate decreased grain moisture in the durum. Under more uniform field conditions, more differences would likely have been realized. Glufosinate reduced seed germination in spring wheat, but there were no differences among treatments in durum.

In 2019 the trial site was much more uniform and there were more differences between treatments. In most cases glufosinate out-performed the check and many other treatments in the rate of dry down (Table 2). Glyphosate and Reglone similarly to glufosinate most of the time as well. Brine did not perform as well in 2019 compared to 2018 in either crop, but Valor performed better in wheat in 2019. Likely due to a rain delay, there were no harvest moisture differences in spring wheat treatments. In durum, no treatment was better than the check. The application of glufosinate to spring wheat and Reglone to durum did cause some negative effects. Test weight, yield, and kernel weight were lower after applying Valor to durum (as well as protein in wheat). Yield and protein were lower in spring wheat after applying glufosinate.

Wheat								
Treatment	Head	Stem	Head	Stem	Moisture	Test Weight	Yield	Germ
	0 DAT	0 DAT	7 DAT	7 DAT	%	lb/bu	bu/a	%
check	68.8	60.0	92.5	92.3	20.1	56.1	58.5	68.8
Glyphosate + NIS + AMS	70.0	60.0	99.0	99.0	16.9	56.7	58.2	63.3
Glufosinate + AMS	62.5	51.3	99.0	98.0	17.0	55.5	56.3	44.3
Reglone + NIS	66.3	56.3	97.0	96.8	18.7	55.9	63.2	52.0
Valor + MSO	63.8	55.0	88.8	90.0	25.9	56.1	63.6	63.5
Brine	68.8	57.5	96.0	98.0	19.4	56.0	58.6	66.8
LSD (0.05)	6.5	NS	2.4	6.3	4.1	2.5	7.1	21.0

Treatment	Head	Stem	Head	Stem	Moisture	Test Weight	Yield	Germ
	0 DAT	0 DAT	7 DAT	7 DAT	%	lb/bu	bu/a	%
check	56.3	57.5	81.3	88.8	31.5	62.8	66.0	60.0
Glyphosate + NIS + AMS	71.3	71.3	99.0	99.0	21.1	61.4	59.5	70.0
Glufosinate + AMS	66.3	70.0	96.0	98.0	23.1	61.5	59.8	68.0
Reglone + NIS	67.5	68.8	94.8	98.0	24.8	60.9	62.7	77.5
Valor + MSO	70.0	68.8	85.0	87.5	24.0	61.9	64.1	66.0
Brine	70.0	72.5	94.8	97.0	22.2	59.5	59.5	63.3
LSD (0.05)	14.2	13.5	8.3	7.9	10.3	3.0	8.1	NS

Wheat Herbicide																	
	Stem	Head	Whole	Stem	Head	Whole	Stem	Head	Whole	Stem	Head	Whole	Moisture	Test Weight	Yield	Protein	KWT
	0 DAT	0 DAT	0 DAT	3 DAT	3 DAT	3 DAT	7 DAT	7 DAT	7 DAT	10 DAT	10 DAT	10 DAT	%	lb/bu	bu/a	%	g/1000
check	78.8	80.0	80.0	86.3	92.5	90.0	91.3	97.0	93.8	97.0	99.0	97.0	16.2	57.3	62.0	14.65	33.36
Glyphosate + AMS+ NIS	77.5	81.3	78.8	88.8	92.5	91.3	95.0	98.0	95.0	99.0	99.0	99.0	15.8	57.4	58.9	14.30	31.96
Glufosinate + AMS	73.8	78.8	76.3	91.3	95.0	93.8	95.0	99.0	95.0	99.0	99.0	99.0	16.4	57.4	55.7	13.95	33.88
Reglone + NIS	76.3	80.0	77.5	88.8	95.0	92.5	95.0	98.0	95.0	99.0	99.0	99.0	16.3	57.4	57.9	14.25	33.04
Valor + MSO	78.8	80.0	80.0	86.3	93.8	88.8	95.0	99.0	95.0	99.0	99.0	99.0	16.8	57.2	58.5	14.00	33.08
Brine + MSO	71.3	76.3	72.5	86.3	92.5	88.8	92.5	98.0	95.0	98.0	99.0	98.0	16.8	57.5	58.0	14.30	33.96
LSD (0.05)	NS	NS	7.1	NS	2.5	4.9	3.5	1.9	NS	2.0	.	2.0	NS	NS	4.7	0.48	1.88

	Stem	Head	Whole	Stem	Head	Whole	Stem	Head	Whole	Stem	Head	Whole	Moisture	Test Weight	Yield	Protein	KWT
	0 DAT	0 DAT	0 DAT	3 DAT	3 DAT	3 DAT	7 DAT	7 DAT	7 DAT	10 DAT	10 DAT	10 DAT	%	lb/bu	bu/a	%	g/1000
check	76.3	82.5	77.5	82.5	88.8	85.0	87.5	96.0	92.3	97.0	99.0	98.0	16.0	55.3	48.8	15.53	35.84
Glyphosate + AMS+ NIS	72.5	80.0	76.3	82.5	87.5	85.0	92.5	98.0	93.8	99.0	99.0	99.0	15.6	55.3	48.3	14.60	34.32
Glufosinate + AMS	71.3	80.0	75.0	90.0	94.8	92.5	91.3	98.0	93.8	99.0	99.0	99.0	15.6	55.2	46.5	14.20	34.88
Reglone + NIS	76.3	81.3	78.8	87.5	92.5	90.0	91.3	97.0	92.5	98.0	99.0	98.0	16.4	54.2	43.8	15.13	32.60
Valor + MSO	70.0	75.0	72.5	76.3	87.5	80.0	85.0	95.8	90.0	97.0	99.0	97.0	17.5	54.9	49.0	15.30	36.20
Brine + MSO	75.0	80.0	76.3	82.5	87.5	86.3	87.5	95.8	91.3	97.0	99.0	97.0	17.1	55.2	47.8	14.93	35.68
LSD (0.05)	4.8	4.2	4.5	6.4	5.6	5.6	6.8	NS	NS	NS	.	NS	1.0	0.9	4.3	1.18	2.44

Grass and broadleaf weed control in spring wheat, Carrington, 2019.

Greg Endres and Mike Ostlie.

The field experiment was conducted at the NDSU Carrington Research Extension Center in cooperation with Bayer CropScience to examine weed efficacy and crop tolerance with Luxxur and broadleaf herbicide tank mixtures. Experimental design was a randomized complete block with three replicates. 'Glenn' HRS wheat was seeded on May 14 in conventionally tilled soil grown to corn in 2018. Herbicide treatments were applied with a CO₂-hand-boom plot sprayer delivering 10 gal/A at 35 psi through 80015 flat fan nozzles to the center 6.7 ft of 10- by 25-ft plots. Treatments were applied on June 10 with 71 F, 31% RH and 6 mph wind to 3.5- to 4.5-leaf wheat, 2- to 4-leaf yellow and green foxtail, and 0.5- to 1-inch tall common lambsquarters.

Minor wheat plant response (foliage chlorosis/necrosis or biomass reduction) was noted seven days after treatment (DAT) and was absent 25 DAT (July 5). Foxtail control visually evaluated 25 DAT ranged from 70-79% with all herbicide treatments. Evaluation at 52 DAT (Aug 1) indicated foxtail control at 79-81% with Luxxur A plus B and tank mixtures with Starane Ultra, MCPA ester, or WideMatch; and Huskie Complete. Common lambsquarters control 25 and 52 DAT was excellent, ranging from 92-99% with all herbicide treatments.

Table.									
			Weed control ¹						Wheat plant chlorosis
Herbicide			21-Jun		5-Jul		1-Aug		17-Jun
No.	Treatment	Rate	fota	colq	fota	colq	fota	colq	0-9 ²
		fl oz product/A	%						
1	Untreated check	x	0	0	0	0	0	0	0
2	Luxxur B + Luxxur A	6.85 + 0.21 oz wt	72	75	70	92	73	98	0
3	Luxxur B + Luxxur A + Starane Ultra	6.85 + 0.21 oz wt + 4.8	71	75	73	94	79	95	1
4	Luxxur B + Luxxur A + Sword	6.85 + 0.21 oz wt + 6.15	74	80	77	97	80	97	1
5	Luxxur B + Luxxur A + WideMatch	6.85 + 0.21 oz wt + 16	73	78	79	97	81	99	2
6	Luxxur B + Luxxur A + Bromac	6.85 + 0.21 oz wt +16	68	92	73	98	69	99	2
7	Luxxur B + Luxxur A + Supremacy	6.85 + 0.21 oz wt + 4.5 oz wt	70	75	77	99	74	99	1
8	Luxxur B + Luxxur A + Olympus + Starane Ultra	6.85 + 0.21 oz wt + 0.2 oz wt + 4.8	72	75	78	96	76	98	2
9	Huskie Complete	27.4	72	90	77	96	81	99	3
C.V. (%)			6.6	9.0	8.4	3.1	13.8	2.6	66.2
LSD (0.05)			6	9	8	4	13	3	1
¹ fota=yellow and green foxtail; colq=common lambsquarters.									
² 0=green; 9=yellow.									

Evaluation of various herbicides for pre-harvest wheat desiccation. (Minot). The objective of the study was to evaluate alternatives to Glyphosate to be used as a pre-harvest desiccant in wheat. Herbicide treatments were applied pre-harvest (August 8) when the wheat was still mostly green (soft dough stage) to better evaluate the herbicides as desiccants. Normally, a desiccant is applied at the hard dough stage when the plant is no longer green.

On the day of application, the wheat had recently begun to “turn color”. One week after treatment, Liberty and Reglone provided the fastest desiccation (99 and 93%), which was slightly faster than Glyphosate (81%). Sharpen and Drexel Defol were not effective as wheat desiccants. Two weeks after treatment, Glyphosate, Liberty, and Reglone had provided nearly complete visual wheat desiccation.

In this study, Liberty and Reglone provided wheat desiccation equal to glyphosate. To re-emphasize, we intentionally applied the desiccants early to give a better opportunity to evaluate visual desiccation. It would be difficult to evaluate desiccation if the wheat had already turned color before applying the desiccants. Thus, due to the early application (soft dough), which is never recommended in commercial fields, wheat yield and test weight tended to be lower in the Glyphosate, Liberty, and Reglone treatments. Had the desiccants been applied at the normal hard dough stage, we would expect no impact on yield or test weight. As of 2019, Liberty and Reglone are not currently labeled for use as wheat desiccants.

Table. Evaluation of Various Herbicides for Pre-Harvest Wheat Desiccation. (1927)							
Treatment	Rate	Wheat					Weed Control
		Desiccation			Yield	Test Wt.	Green Foxtail
		8-Aug	15-Aug	22-Aug	29-Aug	29-Aug	22-Aug
		-----%-----			bu/A	lb/bu	-----%-----
Untreated		15	59	83	35	63.8	0
Glyphosate + AMS	22 oz + 2.5 gal	16	81	99	29	64.2	94
Liberty + AMS	32 oz + 8.825 gal	15	99	100	23	61.7	83
Reglone + NIS	24 oz + 0.25 %	14	93	100	24	62.0	93
Sharpen + MSO + AMS	1 oz + 1 % + 2.5 gal	14	59	85	38	64.2	48
Drexel Defol + MSO	4.8 qt + 1 %	15	68	88	33	63.8	50
LSD		NS	3.6	2.1	5.3	0.74	7.9

Wheat response to herbicide-fungicide combinations. Dr. Howatt and Mettler. ND Vitro hard red spring wheat was seeded near Fargo on May 14, 2019. Treatments (2L) were applied to 3.5 to 4 leaf wheat, 1 to 2 leaf yellow foxtail, 3 inch common lambsquarters, 4 to 6 leaf wild mustard, and 2 to 4 leaf lance leaf sage on June 17 with 60°F, 69% relative humidity, 100% cloud-cover, 8 mph wind velocity at 315°, and moist soil surface at 60°F. Treatments (3L) were applied to 4 to 5 leaf wheat, 1 to 2 leaf yellow foxtail, 3 inch common lambsquarters, 4 to 6 leaf wild mustard and 2 to 4 leaf lance leaf sage on June 21 with 65°F, 84% relative humidity, 100% cloud-cover, 7.7 mph wind velocity at 90°F, and moist soil surface at 62°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to 17 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate		6/21 Wht	6/29 Wht	7/8 Wht	8/22 Yield
	oz ai/A		%	%	%	bu/A
Fenx&Brox&Pyst+2,4-D ester	5.4+4	2L	5	0	0	40
Fenx&Brox&Pyst+2,4-D ester/COCH	5.4+4/4.4	2L/3L	5	0	0	39
Fenx&Brox&Pyst+2,4-D ester/COCH	5.4+4/7.9	2L/3L	5	0	0	39
Fenx&Brox&Pyst+2,4-D ester+COCH	5.4+4+4.4	3L	5	0	0	40
Fenx&Brox&Pyst+2,4-D ester+COCH	5.4+4+7.9	3L	5	0	0	40
Fenx&Brox&Pyst+2,4-D ester/Pyrac	5.4+4/2	2L/3L	5	0	0	42
Fenx&Brox&Pyst+2,4-D ester+Pyrac	5.4+4+2	3L	5	0	0	37
CV			0.0	0.0	0.0	6.54
LSD P=.05			.	.	.	3.8

Layby herbicide treatments in wheat. Dr, Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo on May 14 2019. Treatments were applied to 1.5 to 2 leaf wheat, 2 inch Venice mallow, 3 inch wild buckwheat and wild mustard, and 1 to 2 leaf yellow foxtail on June 13 with 59°F, 42% relative humidity, 15% cloud-cover, 7.5 mph wind velocity at 135° and dry soil surface at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was August 22.

Treatment	Rate	6/19 Wht	6/29 Wht	7/11 Wht	7/22 Wht	8/22 Yield
	oz ai/A	%	%	%	%	bu/A
Pxdn+Brox&MCPA	0.86+8	4	0	0	0	37
Pxdn+Brox&MCPA+Pend-h	0.86+8+22	8	0	0	0	40
Pxdn+Brox&MCPA+Pxsf-SC	0.86+8+2	4	0	0	0	36
Pxdn+Brox&MCPA+Mets&Thif&Flox	0.86+8+1.35	2	0	0	0	37
Pxdn+Brox&MCPA+Aceto-W	0.86+8+24	4	0	0	0	38
Pxdn+Brox&MCPA+Dime	0.86+8+18	13	0	0	0	39
Pxdn+Brox&MCPA+Meto	0.86+8+24	9	0	0	0	40
CV		21.75	0.0	0.0	0.0	6.36
LSD P=.05		2.07	.	.	.	3.6

Layby herbicide treatments in wheat. Dr, Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo on May 14, 2019. Treatments were applied to 1.5 to 2 leaf wheat, 2 inch common lambsquarters and common ragweed, 4 inch wild mustard, and 1 to 2 leaf yellow foxtail on June 13 with 62°F, 35% relative humidity, 0% cloud-cover, 8 mph wind velocity at 135°, and dry soil surface at 60°F. Treatments were 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. Harvest for yield was on August 22.

Treatment	Rate	6/19 Wht	6/29 Wht	7/11 Wht	7/22 Wht	8/22 Yield
	oz ai/A	%	%	%	%	bu/A
Pxdn+Brox&MCPA	0.86+8	4	0	0	0	44
Pxdn+Brox&MCPA+Pend	0.86+8+22	10	0	0	0	41
Pxdn+Brox&MCPA+Pyroxasulfone-SC	0.86+8+2	5	0	0	0	43
Pxdn+Brox&MCPA+Mets&Thif&Flox	0.86+8+1.35	1	0	0	0	43
Pxdn+Brox&MCPA+Acetochlor-W	0.86+8+24	4	0	0	0	43
Pxdn+Brox&MCPA+Dime	0.86+8+18	7	0	0	0	44
Pxdn+Brox&MCPA+Meto	0.86+8+24	11	0	0	0	45
CV		0.0	40.74	0.0	0.0	6.58
LSD P=.05		.	3.76	.	.	4.2

Chemical desiccation of wheat and weeds, Fargo1. Dr. Howatt and Mettler. Grenora and Tioga hard red spring wheat was mixed and seeded near Fargo on May 21, 2019. Treatments were applied to early hard dough wheat, mature yellow foxtail, common lambsquarters, and redroot pigweed on August 8 with 67°, 57% relative humidity, 0% cloud-cover, 3 mph wind velocity at 350°, dry soil surface at 65°F. Treatments 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	8/22	8/22	8/22	8/26	8/26	8/26	8/30	8/30	8/30
		Durum	Gr	Bl	Durum	Gr	Bl	Durum	Gr	Bl
	oz ai/A	%	%	%	%	%	%	%	%	%
Untreated Check	0	96	0	0	96	11	0	99	16	7
Glyphosate-4.5+AMS	12+24	97	20	15	98	86	42	99	98	87
Glufosinate+AMS	9.4+48	97	45	45	99	92	89	99	97	94
Diquat+NIS	6+0.25%	96	60	57	99	94	85	99	95	90
Saflufenacil+MSO+AMS	0.36+1%+24	96	25	25	97	73.8	59	99	61	67
Sodium Chlorate+MSO	96+1%	97	60	37	98	82.5	50	99	93	72
CV		0.84	22.94	30.83	0.83	4.23	7.4	0.0	10.86	8.07
LSD P=.05		1.23	12.10	13.94	1.23	4.67	6.05	.	12.56	8.48

Chemical desiccation of wheat and weeds, Fargo2. Vitpro hard red spring wheat was seeded near Fargo on May 14, 2019. Treatments were applied to pre-harvest wheat, flowering common lambsquarters and Venice mallow on August 19 with 74°F, 21% relative humidity, 0% cloud-cover, 7.8 mph wind velocity at 225°, and dry soil surface at 69°F. Treatments 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. Yield for harvest was August 22.

Treatment	Rate	8/12 Hrsw	8/12 Gr	8/12 Bl	8/16 Hrsw	8/16 Gr	8/16 Bl	8/19 Hrsw	8/19 Gr	8/19 Bl	8/22 Hrsw	8/22 Gr	8/22 Bl	8/22 Lodging	8/22 Yield
	oz ai/A	%	%	%	%	%	%	%	%	%	%	%	%	%	bu/A
Untreated Check	0	72	0	0	86	0	0	90	0	0	94	7	0	0	29
Glyphosate-4.5+AMS	12+24	77	12	0	96	91	82	97	95	90	99	99	98	27	27
Glufosinate+AMS	9.4+48	86	79	82	98	97	95	98	97	97	99	99	99	0	31
Diquat+NIS	6+0.25%	87	87	85	98	97	94	97	96	96	99	97	96	0	31
Saflufenacil+MSO+AMS	0.36+1%+24	79	64	59	91	76	74	92	81	87	96	86	87	0	31
Sodium Chlorate+MSO	96+1%	79	79	55	95	92	79	93	91	81	96	93	79	0	30
CV		3.34	8.5	12.46	1.4	3.97	6.05	1.49	3.39	2.34	0.99	3.05	2.22	44.54	13.01
LSD P=.05		4.03	6.84	8.80	1.98	4.53	6.45	2.13	3.94	2.65	1.46	3.69	2.56	3.08	5.9

Control of volunteer Corn. Dr. Howatt and Mettler. DKC40-77RIB corn was seeded near Fargo to simulate an infestation of volunteer corn on May 17. Treatments were applied to V5 corn and 6 to 8 inch redroot pigweed on July 16 with 74°F, 79% relative humidity, 100% cloud-cover, 1 mph wind velocity at 220°, and moist soil surface at 74°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Jul-31-2019	Aug-14-2019
		Vcorn	Vcorn
	oz ai/A	%	%
Quiz+PO	0.67+24	76.3	87.5
Fenx	0.66	85.0	93.8
Clodinfop NG	0.8	22.5	23.8
Pxdn	0.86	83.8	90.0
Pxdn&Fenx	1.28	0.0	0.0
Halauxifen&Flas+BB	0.15+1%	57.5	80.0
Flucarbazone-3+BB	0.32+1%	27.5	45.0
Pyroxsulam+BB	0.21+1%	71.3	81.3
Imazamox+BB	0.5+1%		
CV		6.0	6.04
LSD P=.05		4.99	5.82

Woolly cup grass response to POST herbicides, Hankinson loc. Dr. Howatt and Mettler. Soybean was seeded near Hankinson, North Dakota. Treatments were applied to cotyledon soybean, 2 inch common lambsquarters, and 2 to 3 leaf woolly cup grass on June 19 with 71°F, 67% relative humidity 50% cloud-cover, 4 mph wind velocity at 135°, and dry soil surface at 69°F. A second flush of weeds occurred after the first evaluation. Treatments were repeated on V4 to R1 soybean and 4 leaf woolly cup grass on July 22 with 76°F, 37% relative humidity, 10% cloud cover, 2.7 mph wind velocity at 320°, and dry soil surface at 75°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Jul-16-2019 Wocu	Aug-1-2019 Wocu	Aug-14-2019 Wocu
	oz ai/A	%	%	%
FicZ-3+BB	0.42+1%	55	72	70
Pxlm+BB	0.21+1%	30	61	56
Thcz+BB	0.072+1	10	51	42
Brox&Pyst+UAN	3.4+32	5	15	5
Immx+NIS+UAN	0.5+0.25%+32	75	77	75
Fenx	1.32	15	69	89
Clfp NG	0.8	32	76	91
Pxdn	0.86	30	82	96
Pxdn&Fenx	1.28	37	85	98
Cleth+PO	1.5+24	30	82	97
Quiz+PO	1+24	34	80	88
Flzp+PO	2+24	36	77	89
CV		89.73	17.63	9.49
LSD P=.05		41.96	17.55	10.22

Broadleaf weed control in wheat. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo on May 15, 2019. Treatments were applied to 5 leaf wheat, 6 inch wild buckwheat, 2 to 4 inch redroot pigweed, 1 to 4 inch common lambsquarters, and 4 to 7 leaf wild mustard on June 13 with 68°F, 68% relative humidity, 60% cloud-cover, 5 to 6 mph wind velocity at 0°, and dry soil surface at 66°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/25 Wht	7/2 Wht	7/2 Wibw	7/2 Pgwd	7/2 Colq
	oz ai/A	%	%	%	%	%
Pxdn	0.86	0	0	0	0	0
Pxdn+Clpy&Flox	0.86+3	1	0	87	70	81
Pxdn+2,4-D&Dica&Flox	0.86+9.5	12	4	93	86	89
Pxdn+Clpy&Flox&MCPA	0.86+8	7	2	88	81	89
Pxdn+NUP-15009	0.86+8	5	0	90	82	88
Pxdn+Haux&Flas+NIS	0.86+0.15+0.25%	0	0	91	81	85
Pxdn+Carf+2,4-D ester	0.86+0.128+4	10	2	92	94	95
Pxdn+Thif-sg+Trib-sg+MCPA ester+NIS	0.86+0.24+0.06+4+0.25%	0	0	92	89	93
Pxdn+Thif-sg+Trib-sg+2,4-D ester+NIS	0.86+0.15+0.15+4+0.25%	1	0	92	89	92
Pxdn+Brox&MCPA	0.86+8	8	1	91	81	90
Pxdn+Brox&Pyst	0.86+3.4	5	0	93	87	90
Pxdn+CoAct+Brox&Bcpy+PO	0.86+0.91+3+1%	5	0	96	94	95
Pxdn+Brox&Flox&Pyst	0.86+10	4	0	97	96	98
Pxdn+Thif&Flox	0.86+1.4	0	0	91	86	86
CV		34.43	190.67	3.18	4.78	3.73
LSD P=.05		2.07	1.85	3.88	5.46	4.47

Kochia control with NUP-17063. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 15, 2019. Treatments were applied to 5 leaf wheat, 4 leaf wild buckwheat, 3 leaf redroot pigweed, and 2 to 4 inch common lambsquarters on June 18 with 68°F, 57% relative humidity, 60% cloud-cover, 5 to 6 mph wind velocity at 0°, and dry soil surface at 66°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/25 Wheat	7/2 Wibw	7/2 Pgwd	7/2 Colq
	oz ai/A	%	%	%	%
Untreated Check	0	0	0	0	0
NUP-17063+COC	4+1%	0	82	69	80
NUP-17063+COC	6+1%	0	85	77	82
NUP-17063+COC	8+1%	0	86	81	85
NUP-17063+COC	16+1%	1	92	85	86
Dica-C+COC	4+1%	3	89	86	87
Fluroxypyr-C+COC	2+1%	0	82	75	71
2,4-D-WLV4+COC	6.3+1%	0	88	87	90
NUP-17063+Dica-C+2,4-D-WLV4+COC	8+4+4+1%	8	95	92	92
NUP-17063+Dica-C+COC	8+4+1%	7	94	92	91
NUP-17063+Dica-C+COC	8+8+1%	10	94	94	95
NUP-17063+Dica-C+2,4-D-WLV4+COC	6+4+4+1%	8	90	92	94
NUP-17063+Dica-C+2,4-D-WLV4+COC	6+4+6.3+1%	12	95	94	94
NUP-17063+2,4-D-WLV4+Floxr-C+COC	8+6.3+2+1%	1	92	90	93
NUP-17063+Dica-C+2,4-D-WLV4+COC	4+2+2+1%	6	92	90	91
CV		35.52	2.8	3.89	3.05
LSD P=.05		1.91	3.35	4.46	3.57

Weed control in Fallow. Dr. Howatt and Mettler. Tradition rye was seeded near Rogers North Dakota on May 14, 2019. Treatments were applied to 6 leaf rye and 3 to 12 inch kochia on June 24 with 66°F, 78% relative humidity, 3 mph wind velocity at 345°, and moist soil surface at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Jul-2-2019 Kocz	Jul-15-2019 Kocz	Sep-29-2019 Kocz
	oz ai/A	%	%	%
Untreated Check	0	0	0	0
NUP-17063+COC	4+1%	60	81	79
NUP-17063+COC	6+1%	74	88	86
NUP-17063+COC	8+1%	76	90	85
NUP-17063+COC	16+1%	75	88	90
Dica-C+COC	4+1%	76	94	97
Fluroxypyr-C+COC	2+1%	66	81	83
2,4-D-WLV4+COC	6.3+1%	35	25	5
NUP-17063+Dica-C+2,4-D-WLV4+COC	8+4+4+1%	74	94	95
NUP-17063+Dica-C+COC	8+4+1%	74	96	97
NUP-17063+Dica-C+COC	8+8+1%	77	98	98
NUP-17063+Dica-C+2,4-D-WLV4+COC	6+4+4+1%	76	95	96
NUP-17063+Dica-C+2,4-D-WLV4+COC	6+4+6.3+1%	72	96	97
NUP-17063+2,4-D-WLV4+Floxr-C+COC	8+6.3+2+1%	75	89	90
NUP-17063+Dica-C+2,4-D-WLV4+COC	4+2+2+1%	81	95	97
CV		5.36	3.7	4.7
LSD P=.05		5.06	4.26	5.34

NUP-17063 control of large kochia. Barley was seeded near Rogers, North Dakota on May 14, 2019. Treatments were applied to 6 leaf barley and 3 to 12 inch kochia on June 24 with 66°F, 78% relative humidity, 95% cloud-cover, 3 mph wind velocity at 345°, and moist soil surface at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Jul-2-2019	Jul-15-2019	Jul-15-2019	Jul-29-2019
		Kocz	Bar	Kocz	Kocz
	oz ai/A	%	%	%	%
Untreated Check	0	0	0	0	0
NUP-17063+NIS	6+0.5%	66	0	80	81
NUP-17063+NIS	8+0.5%	76	0	89	92
NUP-17063+NIS	16+0.5%	70	0	94	95
Brox&Pyst+NIS	2.8+0.5%	72	0	89	88
Brox&Pyst+NIS	3.9+0.5%	80	0	84	90
NUP-17063+Brox&Pyst+NIS	6+2.8+0.5%	80	0	98	98
NUP-17063+Brox&Pyst+NIS	8+3.9+0.5%	79	0	96	99
NUP-17063+Brox-M+MCPA-RX+NIS	8+4+4.2+0.5%	77	0	96	97
NUP-17063+Brox-M+MCPA-RX+NIS	6+4+4.2+0.5%	80	0	96	97
Brox&Fluroxypyr&2,4-D+NIS	12+0.5%	81	0	84	91
Fluroxypyr-C+Dica-C+NIS	2+1+0.5%	72	22	93	93
CV		4.18	44.44	4.96	3.53
LSD P=.05		4.18	1.20	5.95	4.33

Kochia control in wheat with PGR's. Dr. Howatt and Mettler. Barley was seeded May 14, 2019 near Fargo. Treatments were applied to 3 to 4 leaf barley and 3 to 4 inch kochia on June 17 with 58°F, 76% relative humidity, 100% cloud-cover, 7.3 mph wind velocity at 280°, and moist soil surface at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/24	6/24	7/2	7/2	7/15	7/15
		Ba	Kocz	Bar	Kocz	Bar	Kocz
	oz ai/A	%	%	%	%	%	%
Untreated Check	0	0	0	0	0	0	0
NUP-17063	4	0	47	0	72	0	92
NUP-17063	6	0	43	0	78	0	92
NUP-17063	8	0	43	0	80	0	90
Brox-M	4	0	65	0	95	0	99
Brox-M	6	0	68	0	94	0	98
MCPA-RX	4.2	0	23	0	0	0	13
Flox-C	2	12	57	12	78	0	96
NUP-17063+Brox-M+MCPA-RX	8+4+4.2	0	65	0	95	0	98
NUP-17063+Brox-M+MCPA-RX	8+4+2.1	0	63	0	87	0	89
NUP-17063+Brox-M+MCPA-RX	6+4+4.2	0	67	0	93	0	91
NUP-17063+Brox-M	8+4	0	50	0	83	0	95
NUP-17063+Brox-M	6+6	0	50	0	82	0	92
NUP-17063+Brox-M	8+6	0	53	0	83	0	86
NUP-17063+Brox-M+Flox-C	8+4+2	8	75	12	92	0	99
NUP-17063+Brox-M+Flox-C	6+4+2	8	75	12	93	0	98
NUP-17063+Brox-M+Flox-C	8+4+1.4	11	75	12	93	0	98
Brox&Flox&2,4-D	12	9	72	7	92	0	99
Flox-C+Dica-C	2+1	15	57	15	87	7	98
CV		41.96	9.46	50.84	3.76	58.08	5.44
LSD P=.05		2.28	8.64	3.06	4.84	0.44	7.70

Weed control in wheat with PGRs. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo on May 13, 2019. Treatments were applied to 3 leaf wheat, 3 inch common lambsquarters, 2 inch common ragweed, and 1 inch redroot pigweed on June 18 with 62°F, 76% relative humidity, 80% cloud-cover, 2 mph wind velocity at 360°, and dry soil surface at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was August 22.

Treatment	Rate	6/24 Wht	7/2 Pgwd	7/2 Colq	7/2 Corw	7/22 Pgwd	7/22 Colq	7/22 Corw	8/22 Yield
	oz ai/A	%	%	%	%	%	%	%	bu/A
Untreated Check	0	0	0	0	0	0	0	0	48
NUP-17063	4	0	86	79	85	97	98	94	45
NUP-17063	6	0	87	85	88	98	99	97	44
NUP-17063	8	0	86	82	86	99	99	96	46
Brox-M	4	0	92	88	93	96	97	98	46
Brox-M	6	0	90	91	95	97	99	98	44
MCPA-RX	4.2	0	94	88	93	98	99	98	48
Flox-C	2	0	85	80	89	99	97	99	44
NUP-17063+Brox-M+MCPA-RX	8+4+4.2	0	94	92	96	99	99	98	45
NUP-17063+Brox-M+MCPA-RX	8+4+2.1	0	95	95	96	98	99	99	44
NUP-17063+Brox-M+MCPA-RX	6+4+4.2	0	95	96	95	99	99	99	45
NUP-17063+Brox-M	8+4	0	93	91	93	98	99	97	46
NUP-17063+Brox-M	6+6	0	95	94	95	99	99	98	44
NUP-17063+Brox-M	8+6	0	94	90	93	99	99	99	44
NUP-17063+Brox-M+Flox-C	8+4+2	0	96	96	97	98	99	99	43
NUP-17063+Brox-M+Flox-C	6+4+2	0	90	87	91	99	99	99	44
NUP-17063+Brox-M+Flox-C	8+4+1.4	0	96	96	96	99	99	99	44
Brox&Flox&2,4-D	12	0	95	94	97	99	99	99	45
Flox-C+Dica-C	2+1	0	92	87	94	99	99	99	42
CV		0.0	2.33	3.24	2.47	1.45	1.32	1.42	7.13
LSD P=.05		.	2.88	3.91	3.08	1.92	1.74	1.88	4.5

Broadleaf weed control with Halauxifen. Dr. Howatt and Mettler. Barley was seeded near Fargo, North Dakota on May 14, 2019. Treatments were applied to 3 to 4 leaf stage barley and 3 to 4 inch kochia on June 17 with 58°F, 76% relative humidity, 100% cloud-cover, 7.6 mph wind velocity at 280°, and moist soil surface at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/24 Bar	6/24 Kocz	7/2 Bar	7/2 Kocz	7/15 Bar	7/15 Kocz	7/29 Kocz
	oz ai/A	%	%	%	%	%	%	%
Pxdn	0.86	0	0	0	0	0	0	0
Pxdn+Flox&Haux+NIS	0.86+1.8+0.25%	0	53	0	85	0	91	89
Pxdn+Flox&Haux+2,4-D ester	0.86+1.8+5.5	0	53	0	78	0	87	82
Pxdn+Clpy&Flox+NIS	0.86+3+0.25%	0	53	0	75	0	87	84
Pxdn+Clpy&Flox+Haux&Flas+NIS	0.86+3+0.15+0.25%	0	53	0	80	0	93	95
Pxlm&Flox+NIS+AMS-L	2.1+0.25%+20	22	65	53	83	37	92	93
Pxdn+Clpy+Flox&Haux+NIS	0.86+1.5+1.8+0.25%	0	50	0	85	0	94	96
Pxdn+Clpy+Flox&Haux+2,4-D ester	0.86+1.5+1.8+5.5	0	57	0	73	0	96	97
Brox&Pyrst&Thcz+AMS-L	3.5+20	22	78	25	95	20	96	94
Pxdn+Haux&Flas+Carf	0.86+0.15+0.128	0	87	0	93	0	99	99
Pxdn+Brox&Flox&2,4-D	0.86+12	4	77	0	89	0	98	99
CV		40.67	7.25	30.92	4.13	42.74	3.35	2.65
LSD P=.05		3.00	7.03	3.75	5.36	3.75	4.84	3.81

Broadleaf weed control with Halauxifen. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 15, 2019. Treatments were applied to 5 leaf wheat, 3 leaf wild buckwheat, and 2 to 4 inch redroot pigweed and common lambsquarters on June 18 with 75°F, 51% relative humidity, 75% cloud-cover, 7.5 mph wind velocity at 0°, and dry soil surface at 65°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Jul-2-2019	Jul-2-2019	Jul-2-2019	Jul-2-2019
		Wht	Wibw	Pgwd	Colq
	oz ai/A	%	%	%	%
Pxdn	0.86	0	0	0	0
Pxdn+Flox&Haux+NIS	0.86+1.8+0.25%	0	90	85	89
Pxdn+Flox&Haux+2,4-D ester	0.86+1.8+5.5	0	90	85	89
Pxdn+Clpy&Flox+NIS	0.86+3+0.25%	0	87	72	86
Pxdn+Clpy&Flox+Haux&Flas+NIS	0.86+3+0.15+0.25%	0	93	87	89
Pxlm&Flox+NIS+AMS-L	2.1+0.25%+20	0	93	89	91
Pxdn+Clpy+Flox&Haux+NIS	0.86+1.5+1.8+0.25%	0	90	84	89
Pxdn+Clpy+Flox&Haux+2,4-D ester	0.86+1.5+1.8+5.5	0	93	91	93
Brox&Pyrst&Thcz+AMS-L	3.5+20	0	92	87	93
Pxdn+Haux&Flas+Carf	0.86+0.15+0.128	0	96	94	94
Pxdn+Brox&Flox&2,4-D	0.86+12	0	94	91	95
CV		0.0	2.55	4.38	3.77
LSD P=.05		.	3.08	4.99	4.49

Weed control with new Pyrasulfotole formulation. Dr. Howatt and Mettler. Barley was seeded near Fargo on May 14, 2019. Treatments were applied to 3 to 4 leaf barley and 3 to 40 inch kochia on June 17 with 58°F, 76% relative humidity, 100% cloud cover, 8.5 mph wind velocity at 280°, and moist soil surface at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/24	6/24	7/2	7/2	7/15	7/15	7/24
		Bar	Kocz	Bar	Kocz	Bar	Kocz	Kocz
	oz ai/A	%	%	%	%	%	%	%
Untreated Check	0	0	0	0	0	0	0	0
Brox&Flox&Pyst	4.6	2	78	0	95	0	99	99
Brox&Flox&Pyst	5.36	3	75	0	92	0	98	99
Clopyralid&Flox+MCPA ester	3+4	3	50	0	68	0	89	84
Brox&Bcpy+CoAct+COC	3+0.91+1%	0	65	0	82	0	99	99
Brox&MCPA	8	0	77	0	95	0	99	99
Thcz+Trib-sg+Brox&Flox&Pyst	0.072+0.11+4.6	23	82	17	95	0	98	99
Pinoxaden&Fenx-AB+Brox&Flox&Pyst	1.3+4.6	0	82	0	93	0	98	99
CV		44.95	8.02	48.99	4.06	0.0	1.83	1.5
LSD P=.05		3.15	8.93	1.79	5.51	.	2.73	2.23

Weed control with new Pyrasulfotole formulation. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo on May 15, 2019. Treatments were applied to 5 leaf wheat, 2 leaf wild mustard, 3 inch redroot pigweed, 1 to 3 inch common lambsquarters, and 3 to 4 leaf wild buckwheat on June 18 with 78°F, 38% relative humidity, 75% cloud-cover, 8 mph wind velocity at 0°, and dry soil surface at 63°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The Experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/25 Wheat	7/2 Wht	7/2 Wimu	7/2 Wibw	7/2 Pgwd	7/2 Colq
	oz ai/A	%	%	%	%	%	%
Untreated Check	0	0	0	0	0	0	0
Brox&Flox&Pyst	4.6	0	0	97	93	90	94
Brox&Flox&Pyst	5.36	0	0	98	96	92	96
Clopyralid&Flox+MCPA ester	3+4	0	0	94	90	81	86
Brox&Bcpy+CoAct+COC	3+0.91+1%	0	0	97	92	90	95
Brox&MCPA	8	0	0	95	91	83	94
Thcz+Trib-sg+Brox&Flox&Pyst	0.072+0.11+4.6	3	0	98	96	94	97
Pinoxaden&Fenx-AB+Brox&Flox&Pyst	1.3+4.6	8	0	99	96	92	96
CV		54.24	0.0	2.36	3.6	5.63	3.27
LSD P=.05		1.07	.	2.94	4.34	6.44	3.96

Broadleaf weed control in wheat. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments were applied to 3 leaf wheat, 3 inch common lambsquarters, and 2 inch common ragweed on June 18 with 62°F, 75% relative humidity, 2 mph wind velocity at 300°, and dry soil surface at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	7/2 Colq	7/2 Corw	7/2 Wht	7/22 Colq	7/22 Corw	8/22 Yield
	oz ai/A	%	%	%	%	%	bu/A
Pxdn	0.86	0	0	2	0	0	46
Pxdn+Clpy&Flox	0.86+3	80	81	0	99	99	43
Pxdn+2,4-D&Dica&Flox	0.86+9.5	91	95	4	99	99	42
Pxdn+Clpy&Flox&MCPA	0.86+8	90	94	0	99	99	47
Pxdn+NUP-17063	0.86+8	82	85	3	99	94	48
Pxdn+Haux&Flas+NIS	0.86+0.15+0.25%	89	92	0	99	99	48
Pxdn+Carf+2,4-D ester	0.86+0.128+4	92	85	2	99	99	48
Pxdn+Thif-sg+Trib-sg+MCPA ester+NIS	0.86+0.24+0.06+4+0.25%	93	84	1	99	94	50
Pxdn+Thif-sg+Trib-sg+2,4-D ester+NIS	0.86+0.15+0.15+4+0.25%	92	82	1	99	83	46
Pxdn+Brox&MCPA	0.86+8	95	96	0	99	99	48
Pxdn+Brox&Pyst	0.86+3.4	95	93	0	99	99	48
Pxdn+CoAct+Brox&Bcpy+PO	0.86+0.91+3+1%	94	95	0	99	99	50
Pxdn+Brox&Flox&Pyst	0.86+10	95	97	0	99	99	47
Pxdn+Thif&Flox	0.86+1.4	84	89	0	99	99	48
CV		2.58	3.13	119.15	0.0	1.48	6.2
LSD P=.05		3.09	3.74	1.67	.	1.91	4.2

Soybean control with wheat herbicides. Dr. Howatt and Mettler. ND17009GT Soybeans were seeded near Fargo, North Dakota on June 3, 2019. Treatments were applied to 2 trifoliolate beans on July 3 with 76°F, 69% relative humidity, 90% cloud-cover, 2 mph wind velocity at 100°, and moist soil surface at 72°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Jul-31-2019 Volunteer soybean
	oz ai/A	%
NUP-17063	6	15
2,4-D ester	6	98
2,4-D ester	8	99
Dicamba-C	1	80
Fluroxypyr	1.5	98
Clopyralid	1.5	99
Trib-sg+BB	0.2+1%	83
Flcz-3+BB	0.32+1%	53
Pxlm+BB	0.21+1%	99
Thcz+BB	0.072+1%	75
Brox	3	22
Brox&Pyst	3.4	90
CoAct+Brox&Bcpy+PO	0.91+3+1%	94
CV		5.14
LSD P=.05		6.69

Antagonism of Pinoxaden&Fenoxaprop. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments (2L) were applied to 4 leaf wheat, 2 to 4 leaf yellow foxtail, 1 to 3 leaf green foxtail, and 4 leaf wild oat on June 13 with 66°F, 39% relative humidity, 5% cloud-cover, 7 to 9 mph wind velocity at 165°, and dry soil surface at 59°F. Treatments (3-4L) were applied to 4 leaf wheat, 2 to 4 leaf yellow foxtail, 1 to 3 leaf green foxtail, 4 leaf wild oat, 4 to 6 leaf wild mustard and 2 to 5 leaf wild buckwheat on June 17 with 58°F, 78% relative humidity, 100% cloud-cover, 6 mph wind velocity at 270°m and moist soil surface at 60°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was August 21.

Treatment	Rate	Growth Stage	7/16 Wheat	7/16 Wioa	7/16 Fota	8/21 Yield
	oz ai/A		%	%	%	bu/A
Flox&MCPA&Brox+Thif-sg	8+0.15	2L	0	0	0	29
Flox&MCPA&Brox+Thif-sg/Pxdn&Fenx	8+0.15/1.2	2L/ 3-4L	0	98	97	46
Pxdn&Fenx+2,4-D-UE	1.2+6	3-4L	5	98	90	47
Pxdn&Fenx+2,4-D-R	1.2+6	3-4L	2	99	92	48
Pxdn&Fenx+Salvo	1.2+6	3-4L	0	99	95	46
Pxdn&Fenx+2,4-D-BC	1.2+6	3-4L	4	99	94	49
Pxdn&Fenx+Flox&2,4-D-TC	1.2+10	3-4L	8	99	93	42
Pxdn&Fenx+Brox&2,4-D-DU	1.2+15.6	3-4L	0	99	97	48
Pxdn&Fenx+Flox&2,4-D-CS	1.2+9.8	3-4L	0	99	97	48
Pxdn&Fenx+Brox&Flox&2,4-D	1.2+12	3-4L	0	99	97	49
Pxdn&Fenx+Brox&2,4-D-DB	1.2+11.3	3-4L	0	99	95	50
Pxdn&Fenx+NUP-17063	1.2+6	3-4L	0	99	95	47
CV			99.6	0.68	2.08	11.63
LSD P=.05			2.26	0.90	2.67	7.6

Foxtail control with NUP17063 tank-mixes. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments were applied to 4 leaf wheat, 2 to 4 leaf yellow foxtail, 1 to 3 leaf green foxtail, and 3 to 4 leaf wild oat on June 13 with 66°F, 34% relative humidity, 0% cloud-cover, 7 to 9 mph wind velocity at 165°, and dry soil surface at 58°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment Name	Rate	6/29 Wheat	6/29 Fxtl	7/11 Wioa	7/11 Fxtl	7/22 Wioa	7/22 Fxtl
Untreated Check	0	0	0	0	0	0	0
NUP-17063+Fenx	8+0.8	0	81	94	94	93	93
NUP-17063+Brox-M+Fenx	8+4+0.8	0	77	79	83	83	87
NUP-17063+Brox-M+MCPA-RM+Fenx	8+4+4+0.8	0	79	76	79	79	83
Brox-M+Fenx	6+0.8	0	74	80	80	71	82
MCPA-RM+Fenx	4+0.8	0	83	93	93	89	87
NUP-17063+xdn	8+0.86	0	82	94	89	93	91
NUP-17063+Brox-M+Pxdn	8+4+0.86	0	85	95	88	96	86
NUP-17063+Brox-M+MCPA-RM+Pxdn	8+4+4+0.86	0	84	96	89	96	91
Brox-M+Pxdn	6+0.86	0	84	92	86	97	91
MCPA-RM+Pxdn	4+0.86	0	88	94	89	97	91
NUP-17063+Flcz-3+BB	8+0.43+1%	0	69	90	84	94	86
NUP-17063+Brox-M+Flcz-3+BB	8+4+0.43+1%	0	72	89	80	90	82
NUP-17063+Brox-M+MCPA-RM+Flcz-3+BB	8+4+4+0.43+1%	0	67	89	82	87	80
Brox-M+Flcz-3+BB	6+0.43+1%	0	61	90	82	91	84
MCPA-RM+Flcz-3+BB	4+0.43+1%	0	71	91	85	94	86
Fenx	0.8	0	86	92	90	95	90
Pxdn	0.86	0	89	96	93	98	93
Flcz-3+BB	0.43+1%	0	70	92	87	93	85
CV		0.0	5.21	4.32	4.49	4.76	3.73
LSD P=.05		.	5.46	5.23	5.20	5.82	4.36

Foxtail control with Thiencarbazon tank-mixes. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments were applied to 4 leaf wheat, 2 to 4 leaf yellow foxtail and 1 to 3 leaf green foxtail on June 13 with 66°F, 40% relative humidity, 5% cloud-cover, 6 to 8 mph wind at 180°, and dry soil surface at 59°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was August 21.

Treatment	Rate	6/19 Wht	6/29 Wht	6/29 Fxtl	7/31 Fxtl	8/21 Yield
	oz ai/A	%	%	%	%	bu/A
Untreated Check	0	0.2	0	1	1	32
Thcz+Trib-sg	0.072+0.11	2.3	0	76	90	45
Thcz+Trib-sg+Flox-U	0.072+0.11+1.68	0.8	0	76	93	48
Thcz+Trib-sg+MCPA ester	0.072+0.11+4	2.3	0	74	95	60
Thcz+Trib-sg+Cipy&Flox	0.072+0.11+3	2.3	0	75	94	49
Thcz+Trib-sg+Brox&MCPA	0.072+0.11+8	3.0	0	71	91	49
Thcz+Trib-sg+Flox&Thif&Trib*	0.072+0.11+1.4	1.5	0	72	92	46
Thcz+Trib-sg+Prcz+Flox-U	0.072+0.11+0.14+1.68	2.3	0	77	90	42
Brox&Pyst&Thcz	3	2.3	0	69	90	42
Fenx&Brox&Pyst	5.4	1.5	0	86	98	43
CV		19.84	77.02	0.0	4.92	3.43
LSD P=.05		13.1	2.07	.	4.97	4.26

*Supremacy did not mix well in this treatment

NUF-17063 antagonism of foxtail control. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments were applied to 4 leaf wheat, 2 to 4 leaf yellow foxtail, 1 to 3 leaf green foxtail, and 4 leaf wild oat on June 13 with 66°F, 41% relative humidity, 5% cloud-cover, 7 to 8 mph wind velocity at 180°, and dry soil surface at 59°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/29	6/29	7/11	7/11
		Wht	Fxtl	Wioa	Fxtl
	oz ai/A	%	%	%	%
Untreated Check	0	0	0	0	0
2,4-D ester+Fenx	8+0.8	0	80	82	87
2,4-D ester+Fenx	16+0.8	0	75	76	82
2,4-D ester+Fenx+Thif-sg+Trib-sg	16+0.8+0.32+0.08	0	67	66	71
2,4-D ester+Pxdn	16+0.86	0	88	94	93
2,4-D ester+Pxdn+Thif-sg+Trib-sg	16+0.86+0.32+0.08	0	86	90	90
NUP-17063+Fenx	8+0.8	0	89	94	92
NUP-17063+Fenx	16+0.8	0	87	89	91
NUP-17063+Fenx+Thif-sg+Trib-sg	16+0.8+0.32+0.08	0	86	91	89
NUP-17063+Pxdn	16+0.86	0	91	94	90
NUP-17063+Pxdn+Thif-sg+Trib-sg	16+0.86+0.32+0.08	0	88	93	87
Fenx	0.8	0	87	92	93
Pxdn	0.86	0	90	97	93
CV		0.0	3.5	4.19	4.31
LSD P=.05		.	3.91	4.90	5.04

Pyroxasulfuron use in wheat. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 14, 2019. Preemergence treatments were applied May 15 with 69°F, 31% relative humidity, 10% cloud-cover, 6.5 mph wind velocity at 170°, and dry soil surface at 50°F. Post treatments were applied to 1.5 leaf wheat, 2 inch common lambsquarters and common ragweed, and 2 to 4 leaf Venice mallow on June 13 with 61.5°F, 35% relative humidity, 0% cloud-cover, 8 mph wind velocity at 135°, and dry soil surface at 60°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide are the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was August 22.

Treatment	Rate	Growth Stage	6/5 Wht	6/12 Wht	6/12 Colq	6/12 Vema	6/19 Wht	6/25 Wht	6/25 Vema	6/25 Colq
	oz ai/A		%	%	%	%	%	%	%	%
Untreated Check	0		0	0	0	0	0	0	0	0
Pxsf&Carf	1.5	PRE	0	0	76	74	0	0	95	76
Pxsf&Carf	1.75	PRE	0	0	75	85	0	0	91	86
Pxsf&Carf	2.25	PRE	0	0	81	92	0	0	94	80
Pxsf&Carf/Flcz-3+BB	1.75/0.33+1%	PRE/1.5L	0	0	80	86	3	0	94	87
Pxsf&Carf	1.75	1.5L	0	0	0	0	3	0	90	89
Pxsf&Carf+Flcz-3+BB	1.75+0.33+1%	1.5L	0	0	0	0	3	0	89	92
Pxsf&Carf+Flcz-3+Thif-sg+Trib-sg+BB	1.75+0.33+0.1+0.1+1%	1.5L	0	0	0	0	5	0	95	95
Flcz-3+BB	0.33+1%	1.5L	0	0	0	0	2	0	86	66
Thif-sg+Trib-sg+BB	0.1+0.1+1%	1.5L	0	0	0	0	2	0	88	85
Flcz-3+Thif+Trib-sg+BB	0.33+0.1+0.1+1%	1.5L	0	0	0	0	3	0	93	87
Pxdn+Clpy&Flox&MCPA	0.86+8	1.5L	0	0	0	0	8	0	91	87
CV			0.0	0.0	8.9	7.42	30.39	0.0	3.35	3.64
LSD P=.05			.	.	3.33	3.00	1.13	.	4.05	4.07

Treatment	Rate	Growth Stage	6/25 Corw	7/1 Vema	7/1 Colq	7/1 Corw	7/22 Vema	7/22 Colq	7/22 Corw	8/22 Yield
	oz ai/A		%	%	%	%	%	%	%	bu/A
Untreated Check	0		0	0	0	0	0	0	0	42
Pxsf&Carf	1.5	PRE	85	88	76	85	97	87	89	43
Pxsf&Carf	1.75	PRE	80	94	82	71	98	95	95	40
Pxsf&Carf	2.25	PRE	84	95	82	94	99	89	96	42
Pxsf&Carf/Flcz-3+BB	1.75/0.33+1%	PRE/1.5L	90	96	94	85	99	96	97	41
Pxsf&Carf	1.75	1.5L	90	90	95	74	99	99	99	44
Pxsf&Carf+Flcz-3+BB	1.75+0.33+1%	1.5L	92	94	96	97	99	99	99	43
Pxsf&Carf+Flcz-3+Thif-sg+Trib-sg+BB	1.75+0.33+0.1+0.1+1%	1.5L	92	95	94	89	99	99	99	43
Flcz-3+BB	0.33+1%	1.5L	74	84	71	70	97	91	93	40
Thif-sg+Trib-sg+BB	0.1+0.1+1%	1.5L	86	96	93	91	98	98	95	43
Flcz-3+Thif+Trib-sg+BB	0.33+0.1+0.1+1%	1.5L	93	95	96	95	99	98	97	44
Pxdn+Clpy&Flox&MCPA	0.86+8	1.5L	92	96	95	95	99	99	99	42
CV			5.33	2.67	2.96	5.78	0.69	2.79	1.82	7.98
LSD P=.05			6.12	3.28	3.46	6.56	0.90	3.52	2.31	4.8

Adjuvant comparison for Pxdn tank-mix. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 14, 2019. Treatments were applied to 5 leaf wheat and 3 leaf yellow foxtail on June 24 with 81°F, 52% relative humidity, 50% cloud-cover, 1 to 2 mph wind velocity at 280°, moist soil surface at 68°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest for Yield was August 22.

Treatment	Rate	7/1 Wht	7/1 Yeft	7/11 Yeft	7/22 Yeft	8/22 Yield
	oz ai/A	%	%	%	%	bu/A
Untreated Check	0	0	0	0	0	31
Brox&Flox&MCPA-E	8.6	0	0	10	0	29
Pxdn-T+Adigor	0.86+9.6	0	84	92	95	37
Pxdn-T+Brox&Flox&MCPA-E	0.86+8.6	0	75	97	98	39
Pxdn-T+Brox&Flox&MCPA-E+Adigor	0.86+8.6+9.6	0	76	90	95	38
Pxdn-T+Brox&Flox&MCPA-E+Destiny HC	0.86+8.6+6.8	0	79	97	97	39
Pxdn-T+Brox&Flox&MCPA-E+Destiny HC	0.86+8.6+9.6	0	75	98	98	37
Pxdn-T+Brox&Flox&MCPA+DestinyHC+Interlock	0.86+8.6+6.8+3.4	0	77	99	99	39
Pxdn-T+Brox&Flox&MCPA-E+AG18307	0.86+8.6+6.8	0	89	97	97	38
CV		11.05	0.0	4.48	6.14	2.04
LSD P=.05		5.9	.	4.03	6.78	2.25

Adjuvant comparison for Clodinafop tank-mix. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 14, 2019. Treatments were applied to 6 leaf wheat and 4 leaf yellow foxtail on June 24 with 81°F, 52% relative humidity, 50% cloud-cover, 2 to 3 mph wind velocity at 225°, and moist soil surface at 68°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was August 22.

Treatment	Rate	7/1 Wht	7/1 Yeft	7/11 Yeft	7/22 Yeft	8/22 Yield
	oz ai/A	%	%	%	%	bu/A
Untreated Check	0	0	0	0	0	32
Brox&Flox&MCPA-E	8.6	0	0	5	26	32
Clfp-S+AG19088	0.8+0.25%	0	72	93	94	28
Clfp-S+Brox&Flox&MCPA-E	0.8+8.6	0	82	96	96	33
Clfp-S+Brox&Flox&MCPA-E+ AG19088	0.8+8.6+0.25%	0	80	96	96	31
Clfp-S+Brox&Flox&MCPA-E+Destiny HC	0.8+8.6+6.8	0	76	97	94	26
Clfp-S+Brox&Flox&MCPA-E+Destiny HC	0.8+8.6+11	0	85	96	95	27
Clfp-S+Brox&Flox&MCPA-E+Destiny HC+Interlock	0.8+8.6+6.8+3.4	0	77	96	96	25
Clfp-S+Brox&Flox&MCPA-E+AG18037	0.8+8.6+6.8	0	76	92	91	26
CV		0.0	5.35	5.73	3.17	34.01
LSD P=.05		.	4.78	6.24	3.54	14.3

Wild oat control in wheat. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments were applied to 3 leaf wheat and wild oat and 1 to 2 leaf yellow foxtail on June 11 with 71°F, 44% relative humidity, 40% cloud cover, 3 mph wind velocity at 270°, and dry soil surface at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was August 19.

Treatment		6/19	6/19	6/19	6/25	6/25	6/25	7/11	7/11	7/11	8/19
		Wht	Wioa	Fxtl	Wht	Wioa	Fxtl	Wht	Wioa	Fxtl	Yield
	oz ai/A	%	%	%	%	%	%	%	%	%	bu/A
Brox&MCPA	8	0	0	0	0	0	0	0	0	0	10
Ficz-3+Brox&MCPA+BB	0.35+8+1%	3	50	45	0	83	80	0	93	79	16
Prcz+Brox&MCPA+BB	0.42+8+1%	7	40	32	2	72	40	0	64	37	13
Pxlm+Brox&MCPA+BB	0.21+8+1%	7	40	35	1	75	70	0	77	75	19
Pxlm&Clpy&Flox+BB	3.2+1%	6	42	40	0	72	71	0	84	76	20
Pxlm&Flox+Thif-sg+BB	2.1+0.2+1%	6	42	40	1	75	72	0	85	74	18
Thcz+Brox&MCPA+BB	0.072+8+1%	6	42	32	0	71	72	0	76	70	25
Brox&Pyst&Thcz+UAN	3+16	5	42	40	1	75	71	0	82	80	21
Fenx+Brox&MCPA	1.32+8	0	60	65	0	88	89	0	91	92	26
Fenx&Brox&Pyst	5.4	1	60	56	0	91	89	0	96	95	28
Clfp NG+Brox&MCPA	0.8+8	0	55	55	0	86	77	0	95	86	24
Pxdn+Brox&MCPA	0.86+8	1	62	62	0	89	87	0	96	88	23
Pxdn&Fenx-AB+Brox&MCPA	1.28+8	5	67	71	2	91	90	0	98	92	22
CV		41.52	39.08	13.49	13.95	343.85	3.74	4.48	0.0	5.34	5.09
LSD P=.05		12.2	2.11	9.00	8.85	2.94	4.00	4.50	.	6.11	5.30

Antagonism of Pinoxaden&Fenoxaprop. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments (2L) were applied to 2 leaf wheat, 3 leaf volunteer oat, and 1 to 2 leaf yellow foxtail on June 11 with 71°F, 44% relative humidity, 40% cloud-cover, 4 mph wind velocity at 270°, and dry soil surface at 62°F, Treatments (3-4L) were applied to 4 leaf wheat, 3 leaf volunteer oat, and 1 to 2 leaf yellow foxtail on June 17 with 58°F, 79% relative humidity, 100% cloud-cover, 6 mph wind velocity at 270°, and moist soil surface at 60°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest was August 19.

Treatment	Rate	Growth Stage	6/19 Wht	6/19 Wioa	6/19 Fxtl	6/25 Wht	6/25 Wioa	6/25 Fxtl	7/2 Wht
	oz ai/A		%	%	%	%	%	%	%
Flox&MCPA&Brox+Thif-sg	8+0.15	2L	0	0	0	0	0	0	0
Flox&MCPA&Brox+Thif-sg/Pxdn&Fenx	8+0.15/1.2	2L/ 3-4L	4	71	70	0	88	88	0
Pxdn&Fenx+2,4-D-UE	1.2+6	3-4L	8	72	70	4	88	87	0
Pxdn&Fenx+2,4-D-R	1.2+6	3-4L	11	74	72	7	88	85	0
Pxdn&Fenx+Salvo	1.2+6	3-4L	4	70	71	0	89	86	0
Pxdn&Fenx+2,4-D-BC	1.2+6	3-4L	9	71	70	4	86	84	0
Pxdn&Fenx+Flox&2,4-D-TC	1.2+10	3-4L	15	72	72	6	89	88	0
Pxdn&Fenx+Brox&2,4-D-DU	1.2+15.6	3-4L	4	71	72	0	86	85	0
Pxdn&Fenx+Flox&2,4-D-CS	1.2+9.8	3-4L	6	71	71	0	88	87	0
Pxdn&Fenx+Brox&Flox&2,4-D	1.2+12	3-4L	4	70	72	0	86	86	0
Pxdn&Fenx+Brox&2,4-D-DB	1.2+11.3	3-4L	6	74	70	0	86	85	0
Pxdn&Fenx+NUP-17063	1.2+6	3-4L	3	71	71	0	92	89	0
CV			24.22	3.16	4.81	43.0	2.77	3.14	0.0
LSD P=.05			2.25	2.99	4.52	1.11	3.22	3.58	.
Treatment	Rate	Growth Stage	7/2 Wioa	7/2 Fxtl	7/16 Wht	7/16 Wioa	7/16 Fxtl	8/19 Yield	
	oz ai/A		%	%	%	%	%	bu/A	
Flox&MCPA&Brox+Thif-sg	8+0.15	2L	0	0	0	0	0	18	
Flox&MCPA&Brox+Thif-sg/Pxdn&Fenx	8+0.15/1.2	2L/ 3-4L	98	96	0	99	98	42	
Pxdn&Fenx+2,4-D-UE	1.2+6	3-4L	96	92	4	99	90	38	
Pxdn&Fenx+2,4-D-R	1.2+6	3-4L	95	93	4	99	88	31	
Pxdn&Fenx+Salvo	1.2+6	3-4L	94	91	0	99	90	38	
Pxdn&Fenx+2,4-D-BC	1.2+6	3-4L	96	93	0	99	92	40	
Pxdn&Fenx+Flox&2,4-D-TC	1.2+10	3-4L	96	93	8	99	91	39	
Pxdn&Fenx+Brox&2,4-D-DU	1.2+15.6	3-4L	94	90	0	99	92	42	
Pxdn&Fenx+Flox&2,4-D-CS	1.2+9.8	3-4L	95	92	0	99	90	37	
Pxdn&Fenx+Brox&Flox&2,4-D	1.2+12	3-4L	95	92	0	99	92	38	
Pxdn&Fenx+Brox&2,4-D-DB	1.2+11.3	3-4L	95	92	0	98	89	35	
Pxdn&Fenx+NUP-17063	1.2+6	3-4L	96	95	0	99	91	35	
CV			1.62	2.98	83.52	0.37	3.88	24.13	
LSD P=.05			2.04	3.65	1.68	0.48	4.67	12.5	

Wild Oat control with NUP17063 tank-mixes. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments were applied to 3 to 4 leaf wheat and wild oat and 1 to 2 leaf yellow foxtail on June 11 with 75°F, 44% relative humidity, 40% cloud-cover, 6.5 mph wind velocity at 270°, and dry soil surface at 62°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/25	6/25	6/25	7/11	7/11	7/22	7/22
		Wht	Wioa	Fxtl	Wioa	Fxtl	Wioa	Fxtl
	oz ai/A	%	%	%	%	%	%	%
Untreated Check	0	0	0	0	0	0	0	0
NUP-17063+Fenx	8+1.3	0	85	87	91	89	95	91
NUP-17063+Brox-M+Fenx	8+4+1.3	0	84	81	91	90	89	85
NUP-17063+Brox-M+MCPA-RM*+Fenx	8+4+4+1.3	0	79	79	85	87	81	84
Brox-M+Fenx	6+1.3	0	82	83	93	92	83	81
MCPA-RM+Fenx	4+1.3	0	84	83	92	88	89	85
NUP-17063+Pxdn	8+0.86	0	88	87	97	93	98	91
NUP-17063+Brox-M+Pxdn	8+4+0.86	0	85	80	93	85	97	86
NUP-17063+Brox-M+MCPA-RM+Pxdn	8+4+4+0.86	0	84	83	95	89	95	87
Brox-M+Pxdn	6+0.86	0	85	82	94	85	96	85
MCPA-RM+Pxdn	4+0.86	0	87	87	96	91	97	87
NUP-17063+Flcz-3+BB	8+0.32+1%	0	76	71	89	84	77	82
NUP-17063+Brox-M+Flcz-3+BB	8+4+0.32+1%	0	71	72	89	77	74	79
NUP-17063+Brox-M+MCPA-RM+Flcz-3+BB	8+4+4+0.32+1%	0	75	74	87	79	85	80
Brox-M+Flcz-3+BB	6+0.32+1%	0	74	75	91	81	84	79
MCPA-RM+Flcz-3+BB	4+0.32+1%	0	75	74	89	80	84	80
Fenx	1.3	0	87	90	96	92	96	91
Pxdn	0.86	0	86	81	97	89	98	88
Flcz-3+BB	0.32+1%	0	74	72	88	77	84	81
CV		0.0	3.34	4.76	5.31	4.57	5.82	3.1
LSD P=.05		.	3.65	5.13	6.56	5.28	6.97	3.52

*MCPA-RM is Rhonox

Wild Oat control with Thiencazone tank-mixes. Dr. Howatt and Mettler. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments were applied to 3 leaf wheat, 3 leaf wild oat and 1 to 2 leaf yellow foxtail on June 11 with 79°F, 36% relative humidity, 25% cloud-cover, 5.5 mph wind velocity and 270°, and dry soil surface at 66°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates. Harvest for yield was August 21.

Treatment	Rate	6/19	6/19	6/19	6/25	6/25	6/25	7/31	8/21
		Wht	Wioa	Fxtl	Wht	Wioa	Fxtl	Wioa	Yield
	oz ai/A	%	%	%	%	%	%	%	bu/A
Untreated Check	0	0	0	0	0	0	0	0	14
Thiencazone+Trib-sg	0.072+0.11	6	30	30	0	72	74	84	18
Thiencazone+Trib-sg+Flox-U	0.072+0.11+1.68	6	37	35	0	71	70	72	12
Thiencazone+Trib-sg+MCPA ester	0.072+0.11+4	6	32	32	0	71	72	79	15
Thiencazone+Trib-sg+Clopyralid&Flox	0.072+0.11+3	6	35	35	0	76	75	84	18
Thiencazone+Trib-sg+Brox&MCPA	0.072+0.11+8	6	37	37	0	74	71	79	17
Thiencazone+Trib-sg+Flox&Thif&Trib	0.072+0.11+1.4	4	30	32	0	74	72	76	17
Thiencazone+Trib-sg+Prcz+Flox-U	0.072+0.11+0.14+1.68	4	32	40	0	77	79	81	17
Brox&Pyst&Thiencazone	3	4	35	32	0	75	72	76	18
Fenx&Brox&Pyst	5.4	1	50	50	0	85	87	91	18
CV		45.63	13.18	12.84	0.0	4.72	4.38	4.74	33.48
LSD P=.05		2.93	6.12	6.05	.	4.63	4.27	4.97	8.0

NUP-17063 antagonism of wild oat control. ND Vitpro hard red spring wheat was seeded near Fargo, North Dakota on May 13, 2019. Treatments were applied to 3 leaf wheat, 2 leaf wild oat, and 1 to 2 leaf yellow foxtail on June 11 with 76°F, 31% relative humidity, 25% cloud-cover, 7.2 mph wind velocity at 270°, and dry soil surface at 70°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	6/25	6/25	6/25	7/11	7/11
		Wht	Wioa	Fxtl	Wioa	Fxtl
	oz ai/A	%	%	%	%	%
Untreated Check	0	0	0	0	0	0
2,4-D ester+Fenx	8+1.32	0	81	82	85	79
2,4-D ester+Fenx	16+1.32	0	78	78	76	74
2,4-D ester+Fenx+Thif-sg+Trib-sg	16+1.32+0.32+0.08	0	79	81	67	66
2,4-D ester+Pxdn	16+0.86	0	85	82	90	87
2,4-D ester+Pxdn+Thif-sg+Trib-sg	16+0.86+0.32+0.08	0	86	82	87	82
NUP-17063+Fenx	8+1.32	0	87	86	92	87
NUP-17063+Fenx	16+1.32	0	85	88	90	89
NUP-17063+Fenx+Thif-sg+Trib-sg	16+1.32+0.32+0.08	0	84	82	89	85
NUP-17063+Pxdn	16+0.86	0	88	87	98	91
NUP-17063+Pxdn+Thif-sg+Trib-sg	16+0.86+0.32+0.08	0	87	85	96	89
Fenx	1.32	0	85	86	96	95
Pxdn	0.86	0	89	89	98	93
CV		0.0	2.71	3.54	3.46	3.52
LSD P=.05		.	3.03	3.95	4.07	3.95

Adjuvant comparison for pinoxaden. The experiment was established in a non-cropped field near Fargo, North Dakota. Treatments were applied to 2 to 4 leaf wild oat on June 6 with 89°F, 26% relative humidity, 5 mph wind velocity at 315°, dry soil surface at 76°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Jun-13-2019 Wioa	Jun-19-2019 Wioa	Jul-2-2019 Wioa
	oz ai/A	%	%	%
Untreated Check	0	0	0	0
Pinoxaden-T	0.86	40	61	76
Pinoxaden-T+Adigor	0.86+9.6	40	77	87
Pinoxaden-T+Destiny HC	0.86+6.8	40	75	88
Pinoxaden-T+Destiny HC	0.86+9.6	40	71	84
Pinoxaden-T+Destiny HC+Interlock	0.86+6.8+3.4	40	74	85
Pinoxaden-T+AG18307	0.86+6.8	40	74	84
CV		0.0	3.46	3.69
LSD P=.05		.	3.17	3.94

Adjuvant comparison for Clodinafop. An experiment was established in a non-cropped area near Fargo, North Dakota. The treatments were applied to 2 to 4 leaf wild oat on June 6 with 89°F, 26% relative humidity, 0% cloud-cover, 5 mph wind velocity at 315°, and dry soil surface at 76°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 TT nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Jun-13-2019 Wioa	Jun-19-2019 Wioa	Jul-2-2019 Wioa
	oz ai/A	%	%	%
Untreated Check	0	0	0	0
Clodinafop-S	0.8	30	40	74
Clodinafop-S+AG19088	0.8+0.25%	30	55	74
Clodinafop-S+Destiny HC	0.8+6.8	30	52	79
Clodinafop-S+Destiny HC	0.8+11	30	50	69
Clodinafop-S+Destiny HC+Interlock	0.8+6.8+3.4	30	52	71
Clodinafop-S+AG18307	0.8+6.8	30	55	71
CV		0.0	11.83	7.22
LSD P=.05		.	7.66	6.70