Yellow Section: Camelina, Canola, Carrot, Chickpea, Cover Crops, Dry Bean, Dry Pea, Faba Bean, Flax, Hemp, Potato, Sunflower, Pumpkin, and Turf.

PRE-plant treatments in SU Canola. Dr. Howatt and Mettler. Pre-plant treatments were soil applied and Helix Vibrance canola was seeded, near Fargo, immediately following application on May 14 2019 with 71.8°F, 47% relative humidity, clear sky, 2 mph wind velocity at 220°, and dry soil at 58°. Three leaf application was applied to 3 leaf canola, 2 inch common lambsquarters and common ragweed, and 1 to 2 leaf yellow foxtail on June 13 with 67°F, 34% relative humidity, 5% cloud cover, 9.1 mph wind velocity at 180°, and dry soil 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	Growth Stage	5/21 Canola	5/28 Canola	6/11 Canola	6/19 Canola	6/25 Canola
	oz ai/A		%	%	%	%	%
Untreated Check	0		0	0	0	0	0
Trib-C+Quin-F+Glyt-4.5+MSO/ Thif&Trib-D+Cleth+Amigo	0.11+1.44+6.4+0.5%/ 0.22+0.65+0.5%	PRE/ 3L	0	0	0	0	0
Trib-C+Glyt-4.5/ Thif+Clethodim+Amigo	0.11+6.4/ 0.22+0.65+0.5%	PRE/ 3L	0	0	0	0	0
Trib-C+Glyt-4.5/ Thif&Trib-D+Cleth+Amigo	0.11+6.4/ 0.22+0.65+0.5%	PRE/ 3L	0	0	0	0	0
Thif&Trib-D+Immx+Merge	0.22+0.3+0.5	3L	0	0	0	0	0
Immx+Merge	0.3+0.5%	3L	0	0	0	0	0
Immx&Imazapyr	0.4	3L	0	0	0	0	0
Thif&Trib-D+Cleth+Amigo	0.22+0.65+0.5%	3L	0	0	0	0	0
CV			0.0	0.0	0.0	0.0	0.0
LSD			.	.	.	.	

Canola date of flowering was consistent across all treatments and was observed on July 1.

Treatment	Rate	Growth Stage	6/11 Vema	6/11 Rrpw	6/11 Corw	6/25 Vema	6/25 Rrpw	6/25 Colq	6/25 Wibw
	oz ai/A		%	%	%	%	%	%	%
Untreated Check	0		0	0	0	0	0	0	0
Trib-C+Quin-F+Glyt-4.5+MSO/ Thif&Trib-D+Cleth+Amigo	0.11+1.44+6.4+0.5%/ 0.22+0.65+0.5%	PRE/ 3L	80	90	67	94	96	95	90
Trib-C+Glyt-4.5/ Thif+Clethodim+Amigo	0.11+6.4/ 0.22+0.65+0.5%	PRE/ 3L	35	60	0	91	93	93	80
Trib-C+Glyt-4.5/ Thif&Trib-D+Cleth+Amigo	0.11+6.4/ 0.22+0.65+0.5%	PRE/ 3L	50	62	0	92	94	93	80
Thif&Trib-D+Immx+Merge	0.22+0.3+0.5	3L	-	-	-	89	93	92	85
Immx+Merge	0.3+0.5%	3L	-	-	-	82	88	84	80
Immx&Imazapyr	0.4	3L	-	-	-	89	92	85	85
Thif&Trib-D+Cleth+Amigo	0.22+0.65+0.5%	3L	-	-	-	90	94	91	95
CV			42.16	6.66	40.12	3.65	4.01	4.42	-
LSD			12.79	2.60	4.98	4.21	4.81	5.16	-

Canola response to SU timing. Helix Vibrance canola was seeded near Fargo on May 14, 2019. Treatments were applied as follows:

Treatment	Cotyledon	2 leaf	4 leaf	6 leaf
Date	May, 29	June 10	June 17	June 24
Crop stage	cotyledon	2 leaf	4 leaf	6 leaf
Air temperature°F	61.6	63	60	78
Relative humidity %	52.5	51	77	44
Sky condition % cloud	0	5	100	60
Wind velocity mph	3	6	7 to 8	4
Wind direction °	315	315	315	225
Soil moisture	Dry surface	Moist surface	Dry surface	Moist surface
Soil temperature°F	59	62	60	72
Venice mallow stage	-	1 leaf	1 to 2 leaf	2 to 3 leaf
Common ragweed stage	-	1 leaf	2 leaf	4 leaf

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 4 replicates.

Treatment	Rate	Growth Stage	6/5 Canola	6/12 Canola	6/12 Stand	6/19 Canola	6/24 Canola	7/1 Canola	Flowering	7/8 Canola	7/16 Canola
Handweeded Check	0		0	0	9	0	0	0	July 1	0	0
Thif&Trib-D+Cleth+COC	0.225+1.5+1%	Coty	0	0	9	0	0	0	July 1	0	0
Thif&Trib-D+Cleth+COC	0.45+3+1%	Coty	0	0	9	0	0	0	July 1	0	0
Thif&Trib-D+Cleth+COC	0.9+6+1%	Coty	0	0	9	0	0	0	July 1	0	0
Thif&Trib-D+Cleth+COC	0.225+1.5+1%	2L	0	0	9	0	0	0	July 1	0	0
Thif&Trib-D+Cleth+COC	0.45+3+1%	2L	0	0	9	0	0	0	July 1	0	0
Thif&Trib-D+Cleth+COC	0.9+6+1%	2L	0	0	8	1	1	0	July 1	3	0
Thif&Trib-D+Cleth+COC	0.225+1.5+1%	4L	0	0	9	6	9	0	July 1	7	0
Thif&Trib-D+Cleth+COC	0.45+3+1%	4L	0	0	9	6	9	0	July 1	6	0
Thif&Trib-D+Cleth+COC	0.9+6+1%	4L	0	0	9	4	8	0	July 1	9	0
Thif&Trib-D+Cleth+COC	0.225+1.5+1%	6L	0	0	8	0	4	0	July 1	2	0
Thif&Trib-D+Cleth+COC	0.45+3+1%	6L	0	0	8	0	5	2	July 1	11	0
Thif&Trib-D+Cleth+COC	0.9+6+1%	6L	0	0	8	0	8	6	July 1	23.8	21
CV			0.0	0.0	11.98	91.85	28.33	96.64	0.0	34.12	42.42
LSD			.	.	1.52	1.70	1.41	0.93	.	2.38	0.99

Control of volunteer Canola. Dr. Howatt and Mettler. Helix Vibrance canola was seeded near Fargo on May 14, 2019. Treatments were applied to 6 leaf to early flowering canola on June 24 with 78°F, 44% relative humidity, 60% cloud-cover, 4 mph wind velocity at 225°, and moist soil 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	Jul-8-2019 Canola	Jul-22-2019 Canola
	oz ai/A	%	%
Rimsulfuron+NIS	0.25+0.25%	40	20
Halosulfuron+NIS	0.38+0.25%	3	0
Imazamox+NIS+UAN	0.5+0.25%+24	0	0
Pyroxsulam+BB	0.21+1%	1	0
Flucarbazone+BB	0.35+1%	1	0
Thiencarbazone+BB	0.07+1	2	0
NUP-17063	6	75	93
2,4-D ester	6	79	98
Haux&Florasulam+NIS	0.15+0.25%	34	18
Brox&MCPA	8	79	88
Carfentrazone+NIS	0.128+0.25%	28	21
Brox&Pyst	3.4	92	97
Saflufenacil+MSO	0.36+20	99	99
Metribuzin+MSO	3+20	75	68
Bentazon+MSO	8+20	86	85
Fomesafen+MSO	2.8+20	99	99
Topramezone+MSO	0.175+20	87	96
CV		7.65	9.43
LSD		5.61	6.94

Canola tolerance to sulfentrazone. (Minot). The objective of the study was to evaluate canola tolerance to sulfentrazone (Spartan) applied preemergence, at cracking, at the 1-leaf stage, and the 2-3 leaf stage. We have observed that sometimes a plant will tolerate Spartan more once it has emerged. The current Spartan label indicates a 24-month rotation interval for planting canola after a Spartan application. The objective was to determine if canola has sufficient tolerance to Spartan applied PRE or early POST. Even if there is not enough tolerance PRE or early POST, could there be enough tolerance that the rotation interval could be reduced from 24 months to 12 months or less?

Canola was planted May 8, 2019. PRE, Cracking, 1-leaf, and 2-3 leaf treatments were applied May 9, 16, 23, and 28, respectively. We received 0.11, 0.59, and 0.34 inches of rain on May 11, May 24, and Jun 14, respectively. The canola struggled early under these dry conditions. Up to 18% visual injury was observed about 1 month after planting. Canola tended to recover over time, especially with late June and early July rains. Yields for treatments applied PRE, Cracking, and 1-leaf tended to be about 100-300 lb/A lower that the untreated check.

Table. Canola Tolerance to Sulfentrazone. (1915)

			Injury			Density	Height		Yield	Test wt.
Treatment	Rate	Timing	12-Jun	5-Jul	25-Jul	4-Jun	27-Jun	26-Jul	19-Aug	19-Aug
			---------%---------			---m---	----cm----		bu/A	lb/bu
Untreated			0	0	0	10.8	71.6	98.8	2088	50.8
Spartan	2 oz	PRE	8	6	3	10.0	67.2	95.3	1994	51.2
Spartan	4 oz	PRE	18	14	7	7.9	64.5	95.9	1899	50.6
Spartan	2 oz	Cracking	17	13	3	6.8	67.1	94.4	1754	50.7
Spartan	4 oz	Cracking	12	8	6	6.7	68.5	95.1	1843	51.0
Spartan	2 oz	1-leaf	13	10	3	8.4	63.9	100.2	1830	50.8
Spartan	4 oz	1-leaf	18	17	8	9.1	70.1	97.4	1838	50.9
Spartan	2 oz	2-3 leaf	6	5	3	9.5	74.0	99.9	2124	51.3
Spartan	4 oz	2-3 leaf	14	11	7	10.1	72.7	97.2	2025	51.1
Glyphosate[a]	11 oz	2-3 leaf	0	0	0	10.4	74.5	96.7	1975	51.1
LSD			4.1	4.9	5.0	2.6	NS	NS	NS	NS

[a] *Applied with AMS (2.5 gal/100 gal)*

Broadleaf weed control in Flax. Dr. Howatt and Mettler. ND gold flax was seeded May 31, 2019. Treatments were applied to 2 to 4 inch flax and 4 to 6 inch redroot pigweed on June 26 with 80°F, 43% relative humidity, 10 % cloud-cover, 2 to 5 mph wind velocity at 135°, and dry soil surface at 82°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan 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-11-2019 Flax	Jul-31-2019 Flax	Jul-31-2019 Weeds
	oz ai/A	%	%	%
Quiz+PO	1+20	0	0	0
Brox+Quiz+PO	4+1+20	4	20	42
Brox&MCPA+Quiz+PO	8+1+20	9	7	77
MCPA ester+Quiz+PO	4+1+20	2	10	74
Clpy&MCPA+Quiz+PO	9.75+1+20	3	2	92
Dicamba+Quiz+PO	1+1+20	17	70	57
Haux+Quiz+PO	0.075+1+20	81	99	84
Haux&Florasulam+Quiz+PO	0.15+1+20	85	99	60
Thif-sg+Quiz+PO	0.05+1+20	0	0	91
Mest+Quiz+PO	1.5+1+20	0	37	75
CV		7.43	23.38	12.11
LSD		2.18	11.72	11.48

Volunteer Flax control for wheat. Dr. Howatt and Mettler. ND gold flax was seeded on May 31, 2019. Treatments were applied to 2 to 4 inch flax and 4 to 6 inch redroot pigweed on June 26 with 80°F, 43% relative humidity, 10% cloud-cover, 2.5 mph wind velocity at 135°, and dry soil surface at 82°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	7/11 Flax	7/31 Flax
	oz ai/A	%	%
Fenx+Brox&Pyrasulfotole	1+3.4	17	26
Fenx+CoAct+Brox&Bcpy+PO	1+0.91+3+1%	19	12
Fenx+Haux+NIS	1+0.075+0.25%	80	99
Fenx+Haux&Florasulam+NIS	1+0.15+0.25%	81	99
Fenx+Flox&Haux+NIS	1+1.8+0.25%	93	99
Fenx+Flox	1+1	81	99
Fenx+Flox	1+1.5	72	96
Fenx+Carfentrazone+2,4-D ester	1+0.128+4	95	91
Fenx+MCPA&Flox&Clopyralid	1+8	84	87
Pyroxsulam+BB	0.21+1%	82	95
Flucarbazone+BB	0.35+1%	64	82
Thiencarbazone+BB	0.07+1%	71	80
Fenx+NUP-17063	1+8	75	49
CV		4.69	14.83
LSD		4.74	16.61

Volunteer flax control for row crops. Dr. Howatt and Mettler. ND gold flax was seeded May 31, 2019. Treatments were applied to 2 to 4 inch flax and 4 to 6 inch redroot pigweed on June 26 with 80°F, 48% relative humidity, 10% cloud-cover, 2.5 mph wind velocity at 135°, and dry soil surface at 87°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	7/11 Flax	7/31 Flax
	oz ai/A	%	%
Fenx+Dicamba	1+4	89	97
Fenx+MCPB	1+12	17	22
Fenx+Immx+MSO+UAN	1+0.5+20+16	14	6
Fenx+Tribenuron-sg+NIS	1+0.25+0.25%	66	80
Fenx+Atrazine+MSO	1+4+20	22	12
Fenx+Metribuzin+MSO	1+4+20	87	94
Fenx+Bentazon+MSO	1+8+20	0	10
Fenx+Glufosinate+AMS	1+9+32	99	99
Fenx+Acifluorfen+MSO	1+4+20	99	99
Fenx+Fomesafen+MSO	1+2.8+20	99	99
Fenx+Fluthiacet+NIS	1+0.09+0.25%	99	99
Fenx+Lactofen+MSO	1+2.5+20	99	99
Fenx+Topramezone+MSO	1+0.176+20	5	7
CV		3.98	11.03
LSD P=.05		3.49	10.04

Flax tolerance to soil-applied herbicides. (Minot). The objective of the study was to evaluate flax tolerance to soil-applied herbicides. These herbicides were selected because they may have activity on two problem weeds in flax, pigweed and green foxtail. Generally, redroot pigweed is not adequately controlled with the postemergence herbicides labeled in flax (Bronate or generic equivalent and Curtail M). Some green foxtail populations in the state are resistant to Group 1 herbicides such as Assure II and Select. Other herbicides are needed that can help control these weeds.

The herbicide treatments were applied preemergence (PRE) on May 14. 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). Very little crop injury was observed with any treatment. The unanswered question is: Was there very little flax injury because the herbicides are safe to the crop or because the herbicides were not activated due to dry conditions? This study should be repeated to provide more confidence of crop safety under more normal rainfall conditions.

Table. Flax Tolerance to Soil-Applied Herbicides. (1931)

			Injury			Height		Yield	Test wt.	Oil
Treatment	Rate	Timing	26-Jun	12-Jul	7-Aug	27-Jun	26-Jul	16-Sep	16-Sep	16-Sep
			--------%--------			-----cm-----		bu/A	lb/bu	---%---
Untreated			0	0	0	23.0	53.1	18.4	40.1	42.1
Zidua	3 oz	PRE	7	0	0	23.3	49.8	15.9	40.0	42.8
Spartan + Zidua	4 oz + 1.5 oz	PRE	6	0	0	24.9	50.1	16.2	39.0	41.9
Warrant	1.5 qt	PRE	2	0	0	22.5	54.4	20.5	43.0	43.3
Dual II Magnum	1.5 pt	PRE	6	0	0	21.9	50.6	18.0	40.7	42.3
Spartan Elite + Dual II Magnum	22.8 oz + 5.2 oz	PRE	8	0	0	21.7	53.9	20.6	42.4	42.5
Fierce	3 oz	PRE	7	1	1	22.9	56.2	21.0	42.1	41.7
Prowl H2O	3 pt	PRE	6	1	1	23.5	51.3	19.4	42.8	42.7
Valor	2 oz	PRE	12	2	1	23.2	55.1	19.9	41.4	43.7
Outlook	18 oz	PRE	8	0	0	22.0	53.7	18.2	40.6	43.0
LSD			5.5	NS	NS	NS	NS	NS	2.0	1.17

Flax tolerance to POST-applied herbicides. (Minot). The objective of the study was to evaluate flax tolerance to postemergence (POST) herbicides. These herbicides were selected because they may have activity on redroot pigweed and/or green foxtail. Generally, redroot pigweed is not adequately controlled with the postemergence herbicides labeled in flax (Bronate or generic equivalent and Curtail M). Some green foxtail populations in the state are resistant to Group 1 herbicides such as Assure II and Select. Other herbicides are needed that can help control these weeds.

The herbicide treatments were applied postemergence on June 18. 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). The herbicide treatments caused low to moderate crop injury. Raptor caused up to 42% injury when applied alone, but about 20% injury when tank mixed with Basagran. Bison (bromoxynil + MCPA), the commercial standard, caused up to 24% injury and reduced crop height early in the season. Armezon, Basagran, and Laudis caused similar or less injury than Bison. Laudis was not applied with an adjuvant. There was no difference in yield, test weight, or oil content between treatments. This study should be repeated to provide more confidence of crop safety under more normal rainfall conditions.

Table. Flax Tolerance to POST-Applied Herbicides. (1954)

			Injury			Height		Yield	Test wt	Oil content
Treatment	Rate	Timing	26-Jun	12-Jul	7-Aug	27-Jun	26-Jul	16-Sep	16-Sep	16-Sep
			--------%--------			-----cm-----		bu/A	lb/bu	%
Untreated			0	0	0	26.6	58.3	19.5	38.7	42.0
Armezon[a]	0.5 oz	POST	15	11	5	25.6	56.3	20.1	40.0	41.7
Armezon[a]	0.75 oz	POST	19	12	8	25.7	57.3	19.9	38.6	41.6
Bison	1 pt	POST	24	21	11	16.7	58.7	17.5	41.5	41.4
Basagran[a]	1 pt	POST	10	2	2	24.7	58.7	21.3	40.1	41.9
Raptor[b]	4 oz	POST	42	36	26	20.5	56.4	20.9	42.9	41.2
Basagran + Raptor[c]	1 pt + 4 oz	POST	20	17	15	20.6	54.1	17.7	40.7	41.5
Laudis	3 oz	POST	21	7	5	32.3	59.6	18.2	40.1	41.9
LSD			3.7	5.4	4.6	NS	NS	NS	NS	NS

[a] *COC applied at 1% v/v*

[b] *Applied with NIS + 28% (0.25% + 2.5 gal/100 gal)*

[c] *Applied with MSO*

Faba bean tolerance to herbicides. (Minot). The objective of the study was to evaluate faba bean tolerance to herbicides applied preemergence (PRE) and postemergence (POST). Faba bean was planted May 7. PRE and POST treatments were applied May 9 and June 12, respectively. The crop was about 2-5 inches tall at the POST application. The soil was a loam with 5.1 pH and 2.5% organic matter.

Treatments containing Metribuzin (Metribuzin and Authority MTZ) caused some plants to turn black and die. However, yield was not significantly reduced. A lighter soil with higher pH and lower organic matter could see more injury from Metribuzin. Spartan applied at higher rates (8 and 12 fl oz) caused slight initial injury, but yielded similar to other treatments. Other soil-applied herbicide treatments caused only minor or no visible crop injury. Raptor applied alone POST caused significant crop stunting after application. The crop recovered somewhat over time, but still yielded slightly lower than other treatments. Raptor tank mixed with Basagran caused significantly less crop injury compared to Raptor applied alone.

Table. Faba Bean Tolerance to Herbicides. (1918)

			Injury			Density	Height		Yield	Test wt.
Treatment	Rate	Timing	5-Jun	5-Jul	25-Jul	4-Jun	27-Jun	26-Jul	6-Sep	6-Sep
			--------%--------			m of row	-----cm-----		lb/A	lb/bu
Untreated			0	0	0	7.4	30.8	74.9	1043	61.9
Sharpen	2 oz	PRE	0	0	0	6.5	32.3	82.9	2238	65.7
Spartan	4 oz	PRE	1	0	0	6.3	32.5	83.6	2083	66.2
Spartan + Sharpen	4 oz + 1 oz	PRE	3	1	0	7.0	33.2	82.8	2093	66.1
Authority MTZ	12 oz	PRE	19	12	11	6.5	31.8	80.3	1912	66.4
BroadAxe	25 oz	PRE	6	2	0	6.2	31.7	78.0	1913	65.8
Metribuzin	0.5 lb	PRE	35	16	14	5.6	32.0	90.0	2325	66.6
Prowl H2O	3 pt	PRE	0	0	0	6.4	34.4	85.8	2253	66.4
Valor	2 oz	PRE	0	0	0	6.5	35.3	83.0	2230	66.0
Fierce	3 oz	PRE	0	0	0	6.4	35.2	81.6	2146	66.1
Prowl H2O / Basagran[a]	2 pt / 1.6 pt	PRE / POST	0	3	4	6.9	34.1	86.2	1911	66.1
Prowl H2O / Raptor[b]	2 pt / 4 oz	PRE / POST	0	57	40	6.6	22.7	72.6	1810	65.8
Prowl H2O / Basagran + Raptor[c]	2 pt / 0.8 pt + 4 oz	PRE / POST	0	7	7	5.4	33.8	77.8	2087	66.0
Dual II Magnum	1.67 pt	POST	0	8	3	6.4	32.0	78.5	1893	66.1
Prowl H2O + Handweeded	1.5 pt	PRE	0	0	0	6.2	31.7	87.7	2371	66.1
Spartan	8 oz	PRE	12	0	0	5.1	31.5	79.8	1975	67.5
Spartan	12 oz	PRE	14	0	0	5.5	33.3	77.6	2039	66.3
LSD			4.1	5.5	4.7	NS	4.0	NS	526	1.6

[a] *Applied with COC (1.5 pt)*

[b] *Applied with 28% + MSO (2.5 gal/100 gal + 1.5 pt)*

[c] *Applied with MSO (1%)*

Rotation intervals for Faba bean. (Minot). The objective of the study was to evaluate faba bean tolerance to wheat herbicides applied the previous year. Wheat was planted May 17, 2018 and postemergence herbicides were applied June 19, 2018. Faba bean was planted May 7, 2019. The soil was a loam with pH 7.0 and 3.2% organic matter. Individual plots were 10 by 30 feet with four replications.

Significant early chlorosis and some stunting was observed in the Everest treatment. Less chlorosis and stunting was observed from Ally. WideMatch caused some growth regulator-type symptoms (e.g., stem and leaf curling) in some areas. Huskie symptoms (bleaching) were observed in some areas, but tended to be minor. Generally, for most treatments, the herbicide symptoms disappeared over time. Slight stunting could be seen with Everest later in the season as well as stem and leaf curling in random areas with WideMatch. Despite the observed crop injury, crop yield was not affected by any of the herbicide treatments.

Table. Rotation Intervals for Faba Bean. (1821)

		Injury			Height	Yield	Test wt.
Treatment	Rate	13-Jun	12-Jul	26-Jul	26-Jul	6-Sep	6-Sep
		----------%----------			cm	lb/A	lb/bu
Untreated		0	0	0	78.1	1760	65.8
Everest 3.0	2 oz	23	21	17	78.7	2032	66.4
Ally XP	0.1 oz	12	9	6	78.3	1876	66.5
Widematch	1 pt	18	20	18	77.9	1783	66.1
Huskie	11 oz	12	11	4	80.5	2038	65.8
Talinor	13.7 oz	1	0	0	81.4	2009	66.3
Quelex	0.75 oz	0	0	0	82.1	1850	66.5
LSD		14.8	15.3	13.3	NS	NS	0.53

Rainfall in 2018 and 2019.

2018	Rain (in)	Departure from normal (in)
June	4.93	1.44
July	1.44	-1.11
August	1.12	-0.88
September	1.08	-0.36
October	1.10	-0.31
2019		
April	0.93	-0.33
May	0.74	-1.83
June	3.14	-0.35
July	1.76	-0.79
August	2.84	0.84

Burndown weed control with Gramoxone + Metribuzin tank mixes. (Minot). The objective of the study was to evaluate Gramoxone alone or with Metribuzin (Tricor) and 2,4-D in a burndown for kochia control. All treatments were applied May 28 when weeds were 2- to 3-inches tall.

The 3-way mix of Gramoxone + Tricor + 2,4-D provided significantly better control of kochia, Russian thistle, and common lambsquarters compared to Gramoxone alone or Gramoxone + Tricor. 2,4-D significantly increased control of Russian thistle and lambsquarters. 2,4-D only slightly improved kochia control.

Dry conditions likely limited the soil residual effectiveness of Tricor (metribuzin). Essentially no rain fell until 17 days after the herbicide application when we received 0.34 inches of rain. Late rains in June likely helped increase the soil activity of Tricor. The July kochia evaluation tended to show better kochia control as Tricor rate increased. Had a significant rainfall event occurred soon after application, we would expect better residual kochia control with Tricor.

Table. Burndown Weed Control with Gramoxone + Metribuzin Tank Mixes. (1903)

		Weed Control					
		Kochia		Ruth[b]		Colq[b]	
Treatment[a]	Rate	6-Jun	6-Jul	6-Jun	6-Jul	6-Jun	6-Jul
		----------%----------					
Untreated		0	0	0	0	0	0
Gramoxone	3 pt	98	67	100	63	77	30
Gramoxone + Tricor	3 pt + 1 oz	95	61	100	65	88	48
Gramoxone + Tricor	3 pt + 2 oz	98	65	100	63	99	53
Gramoxone + Tricor	3 pt + 3 oz	98	65	100	61	99	52
Gramoxone + Tricor	3 pt + 4 oz	99	68	100	63	99	57
Gramoxone + 2,4-D ester	3 pt	99	71	100	98	100	98
Gramoxone + Tricor + 2,4-D ester	3 pt + 1 oz + 2.1 pt	99	71	100	98	100	97
Gramoxone + Tricor + 2,4-D ester	3 pt + 2 oz + 2.1 pt	98	76	100	98	100	98
Gramoxone + Tricor + 2,4-D ester	3 pt + 3 oz + 2.1 pt	99	82	100	97	100	97
Gramoxone + Tricor + 2,4-D ester	3 pt + 4 oz + 2.1 pt	99	82	100	97	100	98
LSD		2.4	8.1	0.3	12.5	7.8	4.7

[a] *All treatments applied postemergence with NIS (0.25%) to 2- to 3-inch weeds*

[b] *Ruth=Russian Thistle; Colq=Common lambsquarters*

Weed control with fall-applied Fierce. (Minot). The objective of the study was to evaluate three rates of Fierce (Zidua + Valor) compared to Spartan applied in the fall. These treatments were also compared to fall-applied Fierce followed by spring-applied Spartan Charge. All treatments were tank mixed with Glyphosate. Fall and spring treatments were applied Oct 18, 2018 and May 14, 2019, respectively. Kochia was about 0.50-inch tall and about 3 plants/ft^2 at the spring application. However, more plants emerged after the spring application. No crop was planted. Individual treatments were replicated three times.

The low and high rates of fall-applied Fierce generally provided good kochia control through June. Kochia control was lower with the middle rate (4.5 oz), likely due to higher weed pressure in two of the three replications. Fierce followed by Spartan Charge provided excellent kochia control through early July (the last evaluation date). This study shows that fall applied Fierce (or Valor) can help control early spring-emerging kochia. However, the fall applications likely will not provide season-long weed control. A spring-applied herbicide likely will be needed for season-long weed control.

Title. Weed control with fall-applied Fierce. (1906)

			Weed Control							
			Kochia				Shep[c]		Dandelion	
Treatment[a]	Rate	Timing	14-May	23-May	5-Jun	3-Jul	14-May	5-Jun	14-May	5-Jun
			----------%----------							
Untreated			0	0	0	0	0	0	0	0
Glyphosate	32 oz	Fall	0	0	0	0	78	60	90	85
Fierce + Glyphosate	3.75 oz + 32 oz	Fall	96	91	85	78	98	90	85	73
Fierce + Glyphosate	4.5 oz + 32 oz	Fall	79	78	71	56	98	96	93	82
Fierce + Glyphosate	6 oz + 32 oz	Fall	97	97	92	82	100	100	88	82
Spartan + Glyphosate	4 oz + 32 oz	Fall	83	78	74	64	90	87	90	82
Fierce + Gly / Spartan Charge + Gly[b]	4.5 oz + 32 oz / 5 oz + 32 oz	Fall / Spring	93	100	99	96	96	100	92	88
LSD			16.0	16.4	16.6	23.2	10.1	13.5	9.0	10.8

[a] *Glyphosate (Roundup Powermax) applied with AMS 2.5 gal/100 gal*

[b] *Applied with MSO (1%)*

[c] *Shep = Shepherdspurse*

Residual weed control in sunflower. Dr. Howatt and Mettler. Falcon-Nuseed sunflower was seeded near Fargo on June 11, 2019. Preemergence treatments were applied to 2 inch common mallow and buckwheat, and 3 inch common lambsquarters on June 13 with 54°F, 47% relative humidity, 15% cloud-cover, 7 mph wind velocity at 135°, and dry soil surface a 58°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	6/19 Coma	6/19 Vema	6/19 Wibw	6/19 Colq/pgwd	6/29 Coma	6/29 Vema	6/29 Wibw	6/29 Colq/pgwd
	oz ai/A	%	%	%	%	%	%	%	%
Untreated	0	0	0	0	0	0	0	0	0
Para&s-Meto+NIS	26.7+0.25%	84	87	69	90	77	85	76	88
Para&s-Meto+NIS	33.4+0.25%	90	93	82	94	90	94	80	92
Paraquat-3+NIS	6.3+0.25%	70	81	61	85	69	80	62	66
Para&s-Meto+Suen+NIS	26.7+3+0.25%	92	96	92	96	95	96	96	97
Para&s-Meto+Pyroxasulfone&Suen+NIS	26.7+6+0.25%	95	96	94	96	95	96	95	97
Suen+Paraquat-3+NIS	3+6.3+0.25%	87	91	88	94	89	92	93	93
Pyroxasulfone&Suen+Paraquat-3+NIS	6+6.3+0.25%	93	96	91	96	93	94	90	97
CV		4.14	3.43	3.68	2.91	4.15	4.4	4.51	4.64
LSD P=.05		4.66	4.05	3.91	3.48	4.64	5.17	4.92	5.39

Sunflower response to dichlorprop-p. Dr. Howatt and Mettler. Falcon-Nuseed sunflower was seeded near Fargo on June 11, 2019. Treatments were applied as follows:

Treatments	14 DBS	7 DBS	3 DBS	2 leaf	8 leaf
Date	May 29	June 5	June 10	July 3	July 30
Crop stage	14 DBS	7 DBS	1 DBS	2 to 4 leaf	10 to 14 leaf
Temperature °F	61	67	63	70	71
Relative humidity %	35	65	51	68	38
Sky conditions % cloud-cover	0	0	5	95	0
Wind velocity mph	03.2	6	6	3	1.5
Wind direction °	315	5	315	135	90
Soil moisture on surface	Dry	Dry	Moist	Moist	Dry
Soil Temperature °F	61	72	62	72	60
Common mallow	Cotyledon	Coty to 1.5 inch		-	
Wild buckwheat	2 inch	2 inch	3 leaf	-	
Wild mustard	-	Cotyledon	2 leaf	-	
Yellow foxtail	-	1 inch	-	-	12 inch
Redroot pigweed	-	-	3 to 4 leaf	-	
Venice mallow	-	-	-	-	-

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	Growth Stage	7/20 Sunflower	7/31 Sunflower	8/19 2nd run	8/19 Sunfl 2nd	8/22 2nd run	8/30 2nd run	9/6 2nd run
	oz ai/A		%	%	%	#/20 ft	%	%	%
2,4-D ester	8	2L	91	99	0	62	0	0	0
NUP-17063	8	2L	83	99	0	62	0	0	0
NUP-17063	8	8L	9	60	0	65	0	0	0
NUP-17063+Trib-V+MSO	8+0.25+1%	2L	81	99	0	61	0	0	0
NUP-17063	8	14 DBS	5	0	0	67	0	0	0
NUP-17063	8	7 DBS	6	0	0	65	0	0	0
NUP-17063	8	3 DBS	11	0	0	58	0	0	0
2,4-D ester	8	3 DBS	5	0	0	51	0	0	0
Untreated Check	0		5	0	0	56	0	0	0
Trib-sg+MSO	0.25+1%	2L	5	0	0	62	0	0	0
Trib-v+MSO	0.25+1%	2L	5	0	0	55	0	0	0
Trib-sg+MSO/Trib-sg+MSO	0.25+1%/0.25+1%	2L/8L	6	0	0	61	0	0	0
Trib-V+MSO/Trib-V+MSO	0.25+1%/0.25+1%	2L/8L	5	0	0	61	0	0	0
CV			9.28	0.0	0.0	11.14	0.0	0.0	0.0
LSD P=.05			3.24	.	.	9.87	.	.	.

The second run information was just treatments of dichlorprop at various timings within 14 days of seeding until just after seeding.

Pinto bean response to low dose rates of dicamba and glyphosate, Carrington, 2018.
(Greg Endres, Mike Ostlie, Kelly Bjerke and Sean Nichols)

The multi-year field study continued (from 2015) at the NDSU Carrington Research Extension Center to examine the response of pinto bean to low dose (drift) rates of dicamba and glyphosate. Experimental design was a randomized complete block with three replications. The experiment was conducted on a dryland, conventionally-tilled Heimdal-Emrick loam soil. 'ND Palomino' was planted on May 29 in 22-inch rows at a rate to achieve ≥70,000 plants/A. Herbicide treatments were applied with a CO_2-hand-boom plot sprayer delivering 9 gal/A at 35 psi through 8001 flat fan nozzles on July 9 with 74 F, 73% RH and 4 mph wind to bud to early bloom (V8-R1) plants. XtendiMax (dicamba) application rates were targeted at 0.0193, 0.193 and 1.93 fl oz/A; Roundup PowerMax (glyphosate) rates were targeted at 0.025, 0.25 and 2.5 fl oz/A; plus herbicide combinations paired at low, medium and high rates. All treatments included Activator 90 (NIS) at 0.25% v/v. Plants from three herbicide-treated rows at 12 ft length of treatment numbers 1, and 5-6 were hand-pulled and placed in windrows on August 30 and seed harvested with a plot combine on August 31 (Table). Plants from treatments 2 and 8 were hand-pulled and placed in windrows on September 14 and seed harvested on September 25. Plants from treatments 3-4, 7, and 9-10 were killed by frost (28 F) on September 28. Plants from treatments 3, 7, and 9 were hand-pulled and placed in windrows on October 2 and seed harvested on October 18. Plants from treatments 4 and 10 were too heavily damaged by herbicide to produce seed, thus were not harvested. Sub-samples were taken from harvested seed and greenhouse planted December 10 to measure seed germination, and seedling vigor and dry weight.

Plant injury, based on visual evaluation of biomass reduction and chlorosis/necrosis, increased with increasing herbicide rates (Table). Compared to the untreated check, canopy cover decreased with increasing herbicide rates. The high rate of dicamba, glyphosate, and dicamba plus glyphosate had 29-35% canopy reduction compared to the untreated check. Plant maturity was similar among the untreated check and the low and medium rates of glyphosate, but was delayed 16-35 days with all other herbicide treatments. Seed yield with the low rate of dicamba (trt 2), and the low and medium rates of glyphosate (trts 5 and 6) were statistically similar to the untreated check. Yield reduction with the medium rate of dicamba, high rate of glyphosate, and low and medium rates of dicamba plus glyphosate ranged from 7 to 50 percent compared to yield with the untreated check. The high rates of dicamba, and dicamba plus glyphosate resulted in no seed yield. Greenhouse planted seed indicated similar germination (90-97%), seedling vigor (5), and seedling dry weight (23.6-27.1 g/plant) with low rate of dicamba, glyphosate, and combination; and medium glyphosate rate as untreated check.

Table.

Treatment		Plant						Seed			Seedling[1]	
		Biomass reduction (%)		Chlorosis/ necrosis (0-9)[2]		Canopy closure (%)	PM[3]	Yield	count	Germ	Vigor	Dry weight
No.	Description[4]	7/20	7/30	7/20	7/30	7/30	Jday	lb/A	no./lb	%	0-5	g/plt
1	untreated check	0	0	0	0	93	237	1579	1500	90	5	23.6
2	XtendiMax L	27	27	2	3	82	253	1205	1447	94	5	26.4
3	XtendiMax M	34	38	4	4	71	272	348	1562	40	2	12.9
4	XtendiMax H	47	52	6	6	66	272	0	x	x	x	x
5	RU PM L	7	7	0	1	89	237	1183	1549	95	5	25.9
6	RU PM M	11	12	1	1	91	237	1451	1505	97	5	27.1
7	RU PM H	38	38	5	4	67	272	117	1478	39	2	10.8
8	XtendiMax + RU PM L	28	29	3	3	81	253	785	1553	95	5	26.3
9	XtendiMax + RU PM M	38	40	4	4	72	272	371	1357	45	3	13.3
10	XtendiMax + RU PM H	55	65	7	7	60	272	0	x	x	x	x
mean		28	31	1	3	77	258	880	1494	63	4	21.0
C.V. (%)		20.7	17.4	13.2	15.5	5.4	0.2	29.7	10.1	7.7	15.1	12.9
LSD (0.05)		10	9	1	1	7	1	458	NS	15	1	4.7

[1]Greenhouse-grown seedling measurements taken December 26. Vigor: 0=very poor, 5=excellent. Average plant weight (grams).

[2]0=none, 9=all tissue affected.

[3]PM=Physiological maturity. 28 degrees occurred on Jday 271 to terminate growth of treatments 3-4, 7 and 9-10.

[4]XtendiMax rates (fl oz/A): L=0.0193; M=0.193; H=1.93. Roundup PowerMax rates (fl oz/A): L=0.025; M=0.25; H=2.5.

Fall-planted cover crop tolerance to soybean herbicides, Carrington, 2019. Greg Endres and Mike Ostlie. The trial was conducted at the NDSU Carrington Research Extension Center with support from the North Dakota Soybean Council to evaluate the tolerance of six fall-planted, cool-season cover crops on ground previously treated with seven soybean herbicides that have soil residual. Experimental design was a randomized complete block with split-plot arrangement (whole plot = cover crop and subplot = herbicide) and three replicates. The field trial was established on an irrigated, conventionally-tilled, Heimdal-Emrick loam soil with 2.9% organic matter and 7.9 pH (0- to 6-inch depth). 'AG03X7' dicamba-tolerant soybean was planted at 165,000 seeds/A on May 20 in 22-inch rows. A hand-held boom sprayer was used delivering 17 gpa at 35 psi through TeeJet XR FF80015 nozzles to the center 6.7 ft of 10- by 30-ft strips. PRE herbicides [metribuzin (Sencor), sulfentrazone (Spartan), flumioxazin (Valor), pyroxasulfone (Zidua), and imazethapyr (Pursuit)] were applied at standard rates on May 21 with 59 F, 92% RH, and 5 MPH wind on dry soil; a total of 1.0 inch of rain followed during May 22-24. POST herbicides [dicamba (Engenia) and fomesafen (Flexstar)] were applied on June 18 with 53 F, 93% RH, and 5 mph wind to first- to second trifoliate (V1-2) stage soybean; a total of 0.9 inch of rain followed during June 20-21. Rainfall totaled 19.9 inches during May 21 to October 9, and supplemented with a total of 3 inches of irrigation water (overhead pivot) during June 8 to July 10. Soybean at the seed formation (R5-6) stages were terminated by mowing on August 20. Cover crops were planted August 30 into the soybean stubble with a no-till drill in 7.5-inch rows: 'Explorer' barley, 'ND Dylan' winter rye, 'Flex' field pea, 'ND Gold' flax, 'Jackhammer' radish, and 'Purple Top' turnip. Barley, rye, radish and turnip at 2- to 4-leaf stages; field pea at 5- to 6-node stages; and 1- to 3-inch tall flax were visually evaluated on September 20 [21 days after planting (DAP)] for biomass and stand reduction. A second evaluation occurred on October 9 (40 DAP) of barley at 4- to 6-inch height; rye, flax, radish and turnip at 2- to 4-inch height; and field pea at 2- to 8-inch height.

Field pea was tolerant of all herbicides (Table). All herbicides caused injury to select cover crops. Plant injury exceeding 10%: barley = Valor; rye = Zidua; flax = Sencor; radish = Sencor, Spartan, Zidua and Flexstar; and turnip = Sencor and Zidua.

Table.

Herbicide			Cover crop injury[1]											
			20-Sep						9-Oct					
Treatment	Rate	Application timing[2]	Barley	Winter rye	Field pea	Flax	Radish	Turnip	Barley	Winter rye	Field pea	Flax	Radish	Turnip
	fl oz product/A		%											
Sencor 75 DF	0.33 lb	PRE	0	0	0	0	13	20	0	0	0	15	25	22
Spartan 4F	10	PRE	0	0	0	0	22	0	0	0	0	0	22	0
Valor SX	3 oz	PRE	10	0	0	0	0	0	20	0	0	0	0	0
Zidua SC	4	PRE	0	12	0	0	20	0	0	0	0	3	22	12
Pursuit	3	PRE	0	0	0	0	0	0	0	0	0	8	0	0
Engenia + CA Ridion	12.8 + 2% v/v	POST	0	0	0	0	0	0	0	0	0	10	0	0
Flexstar + MSO	12 + 24	POST	3	7	0	0	0	7	0	0	0	0	12	8
C.V. (%)			412						274					
LSD (0.10)			NS						NS					

[1]Biomass and/or stand reduction.

[2]PRE=May 21; POST=June 18.