Yellow Section: Canola, Dry Bean, Dry Pea, Flax, Onion, Potato, and Sunflower

ALS Canola crop safety. Howatt, Roach, Harrington. Three varieties of canola were planted near Fargo, June 12. Treatments were applied to 2 to 4 leaf (3 to 5 inch) canola, 1 to 2 inch Venice mallow, 2 to 4 inch wild mustard, 2 to 6 inch foxtail, and 1 to 3 inch redroot pigweed on July 1 with 77°F, 70% relative humidity, hazy sky (smoke), 3 to 5 mph wind at 180°, and dry soil 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. Water source had pH of 9.26 and 880 mg/L total dissolved solids. The experiment was a randomized complete block design with four replicates. Broadleaf weeds were removed by hand from plots that only received clethodim.

			7/14/15							7/29/15			10/01/15
Seed	Treatment	Rate	Stunt	Chlor	Bolt	Vema	Rrpw	Wimu	Yeft	Injury	Flower	Weeds	Yield
		oz ai/A	%	%	%	%	%	%	%	%	%	%	lb/A
SU 1	Clethodim+Agral 90	1.3+0.2%	0	0	2	0	0	0	99	0	40	99	2192
SU 1	Clet+Thif&Trib-ve[a]+Agral 90	1.3+0.21+0.2%	0	2	2	95	98	98	93	0	40	99	2055
SU 1	Clet+Thif&Trib-ve+Agral 90	1.3+0.42+0.2%	0	3	3	94	98	98	88	0	40	99	1878
SU 2	Clethodim+Agral 90	1.3+0.2%	0	0	37	0	0	0	99	0	80	99	2020
SU 2	Clet+Thif&Trib-ve+Agral 90	1.3+0.21+0.2%	0	0	33	95	98	97	87	0	80	99	1957
SU 2	Clet+Thif&Trib-ve+Agral 90	1.3+0.42+0.2%	12	13	30	93	98	98	91	0	80	99	1753
IMI	Clethodim+MSO	1.3+1%	0	2	7	0	0	0	95	0	60	99	2203
IMI	Imazamox+MSO	0.5+1%	35	23	0	85	96	96	95	0	60	99	2346
IMI	Immx+MSO	1+1%	37	23	0	86	97	98	98	2	53	99	1982
CV			48	68	23	2	2	2	2	536	7	0	13
LSD P=.05			8	8	5	2	2	2	3	2	7	-	465

[a]Thif&Trib-ve was Volta Extra from Rotam North America, Inc., 4900 Koger Blvd., Suite 140, Greensboro, NC, 27407.

Canola seed was resistant to either sulfonylurea (SU) or imidazolinone (IMI) herbicides and treated with appropriate herbicide for the technology. Both SU canola were more resistant to the herbicide program than the IMI canola, which expressed substantial stunting and chlorosis 2 weeks after treatment. The three seed samples had different bolting dates, but within seed there was only slight delay of bolting for SU 2 and IMI plants. At 4 weeks after treatment noted injury could only be observed with IMI canola treated with twice the labeled rate of imazamox. Injury also resulted in slightly less flowering than with less imazamox. Injury was evaluated each week in September. While development differences and plant architecture were noted among seed lines, herbicide treatment did not affect plant condition or appearance. Yield within seed group was not different with ALS herbicide than without; however, yield tended to be less when ALS-inhibitor was included, especially with twice the labeled rate.

Venice mallow control 2 weeks after treatment was better with thifensulfuron and tribenuron than with imazamox, although rate of herbicide did not affect control. Pigweed and mustard control were 96 to 98% across broadleaf herbicide treatments. Yellow foxtail control with clethodim was antagonized by thifensulfuron and tribenuron, but competition from canola eliminated this and other surviving weeds by 4 weeks after treatment. The canola canopy inhibited further establishment of weeds in the plots throughout the remainder of the season.

Group 1-resistant wild oat control with Liberty in LL canola. (Minot). In 2015, the objective of the study was to evaluate Group 1-resistant wild oat control with Liberty and Select in Liberty Link canola. 'L140P' canola was planted April 30. Postemergence herbicide treatments were applied at the 4-leaf canola stage.

The herbicide treatments caused slight, but temporary crop injury. All treatments provided excellent wild oat control. The crop was very competitive and essentially shaded out the low wild oat population (~1 plant per square foot). It should be noted that in previous years, Liberty alone or Select Max at 6 oz (one-half rate) has not provided good control when applied to larger, more dense wild oat populations. For larger, dense wild oat, a Liberty + Select tank mix would be recommended. Even though this wild oat population is known to be Group 1 resistant, it is not resistant to all Group 1 herbicides. It has not shown resistance to Axial or Select.

Table. Wild oat control in Liberty Link canola in 2015. (1530)

			Canola injury			Wild oat control	
Treatment	Rate	Timing	Jun-19	Jul-3	Jul-25	Jul-3	Jul-25
			----------%----------			-------%-------	
Untreated			0	0	0	0	0
Liberty + AMS	22 oz + 4.4 gal/100 gal	4-leaf	9	3	0	99	99
Select Max + NIS	6 oz + 0.25%	4-leaf	4	0	0	87	99
Liberty + Select Max + AMS	22 oz + 6 oz + 4.4 gal/100 gal	4-leaf	12	2	0	99	99
Select Max + NIS	12 oz + 0.25%	4-leaf	6	0	0	99	99
LSD (0.05)			2.5	5.1	NS	5.7	0

POST herbicide control following Eptam. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Mayville, ND to evaluate glyphosate resistant common ragweed control using Eptam applied and incorporated followed by POST herbicides. PPI was applied and incorporated on May 26, 2015 at 10:00 AM with 87 F air, 70 F soil at a four inch depth, 23% RH, 30% cloud cover, 1-3 mph E wind, and adequate soil moisture. POST treatments were applied on June 30, 2015 at 2:00 PM with 85 F air, 71 F soil at a four inch depth, 43% RH, 100% cloud cover, 2-4 mph SE wind, and adequate soil moisture. Weeds present at the time of POST application in treatments 1, 5, 8, 9, and 13 were corw 0-4" at 2-4/ft2 and rrpw 0-5" at 1-2/ft2. Weeds present in treatments 3, 4, 7, 11, and 12 were corw 3-5" at 3-5/ft2, rrpw 4-6" at 2-4/ft2, colq 4-6" at 2-3/ft2, and yeft 3-4 lf at 4-5/ft2. Weeds present in treatments 2, 6, and 10 were corw 2-4" at 5-7/ft2, rrpw 3-5" at 5-7/ft2, colq 4-6" at 4-6/ft2, and yeft 3-4 lf at 10-12/ft2. Soil characteristics were: 76.6% sand, 14% silt, 9.4% clay, Sandy Loam, 4.9% OM, and 7.8 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa through 11002 TT nozzles for PPI and 8.5 gpa through 11001 TT nozzles for the POST applications at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

The addition of Eptam used as a PPI herbicide increased the efficacy of POST herbicide application. Additionally, as the rate of Eptam increases, there was an increase in efficacy of POST herbicides.

Table. POST herbicide control following Eptam (Zollinger, Wirth, Adams).

		14 DA POST			28 DA POST		
Treatment	Rate	Rrpw	Colq	Corw	Rrpw	Colq	Corw
	(Product/A)	-----% control-----			-----% control-----		
(PPI) Eptam	3.5pt	45	55	25	43	53	25
(POST) Basagran+MSO[1]	2pt+1.5pt	30	25	0	30	25	0
(PPI) Eptam	1pt						
(POST) Basagran+MSO	2pt+1.5pt	45	47	28	45	48	28
(PPI) Eptam	2pt						
(POST) Basagran+MSO	2pt+1.5pt	73	90	75	73	90	73
(PPI) Eptam	3pt						
(POST) Basagran+MSO	2pt+1.5pt	82	99	93	82	99	93
(POST) Permit+MSO	0.67floz+1.5pt	37	43	45	42	50	58
(PPI) Eptam	1pt						
(POST) Permit+MSO	0.67floz+1.5pt	55	45	58	69	73	63
(PPI) Eptam	2pt						
(POST) Permit+MSO	0.67floz+1.5pt	83	95	88	83	95	92
(PPI) Eptam	3pt						
(POST) Permit+MSO	0.67floz+1.5pt	95	95	96	95	92	96
(POST) Reflex+MSO	0.75pt+1.5pt	72	52	55	72	52	55
(PPI) Eptam	1pt						
(POST) Reflex+MSO	0.75pt+1.5pt	90	93	82	90	93	82
(PPI) Eptam	2pt						
(POST) Reflex+MSO	0.75pt+1.5pt	95	96	95	95	96	95
(PPI) Eptam	3pt						
(POST) Reflex+MSO	0.75pt+1.5pt	99	96	97	99	96	97
LSD (0.05)		6	8	6	5	4	6

[1]MSO= Methylated Seed Oil (Adjuvant)

PRE application of generic sulfentrazone compared to Spartan in dry bean. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Prosper, ND to evaluate weed control and navy bean injury to PRE sulfentrazone applications. Navy bean was planted on June 1, 2015. PRE treatments were applied on June 4, 2015 at 8:30 AM with 64 F air, 55 F soil at a four inch depth, 51% RH, 0% cloud cover, 7-9 mph N wind, and adequate soil moisture. Soil characteristics were: 25.2% sand, 43.9% silt, 30.9% clay, Clay Loam, 4.4% OM, and 7.5 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa through 11002 TT at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Table. PRE application of generic sulfentrazone compared to Spartan in dry bean (Zollinger, Wirth, Adams).

		28 DAA								42 DAA								
Treatment	Rate	Navy	Wimu	Rrpw	Colq	Hans	Wibw	Corw	Cocb	Navy	Wimu	Rrpw	Colq	Hans	Wibw	Vema	Corw	Cocb
	(Product/A)	-% inj-	----------% control----------							-% inj-	----------% control----------							
HAI Sulfentrazone	4floz	17	32	99	99	78	25	23	20	17	25	99	99	99	43	27	23	43
Spartan	4floz	32	32	99	99	80	25	23	20	18	25	99	99	99	52	25	27	47
HAI Sulfentrazone	6floz	52	38	99	99	99	42	28	33	32	42	99	99	99	62	27	48	57
Spartan	6floz	53	40	99	99	99	48	38	38	35	48	99	99	99	68	30	57	58
HAI Sulfentrazone	8floz	57	48	99	99	99	48	47	57	53	48	99	99	99	78	42	53	63
Spartan	8floz	58	52	99	99	99	67	48	58	58	67	99	99	99	82	55	58	68
HAI Sulfentrazone	16floz	72	75	99	99	99	93	93	92	85	93	99	99	99	95	82	93	92
Spartan	16floz	77	78	99	99	99	96	96	83	87	96	99	99	99	98	85	98	88
Blanket	6floz	28	23	73	78	78	22	22	22	18	22	73	78	78	32	23	32	22
LSD (0.05)		4	6	3	2	3	7	7	5	5	7	3	2	2	6	5	7	6

PRE and Pre Plant Incorporated with POST herbicide programs in dry bean. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Prosper, ND to evaluate weed control and navy bean injury to PPI, PRE, and POST herbicides. Navy bean was planted on June 1, 2015. PPI treatments were applied on June 1, 2015 at 2:00 PM with 69 F air, 56 F soil at a four inch depth, 57% RH, 100% cloud cover, 8-10 mph SE wind, and adequate soil moisture. PRE treatments were applied on June 4, 2015 at 8:30 AM with 64 F air, 55 F soil at a four inch depth, 51% RH, 0% cloud cover, 7-9 mph N wind, and adequate soil moisture. POST treatments were applied on July 1, 2015 at 12:30 PM with 79 F air, 75 F soil at a four inch depth, 55% RH, 100% cloud cover, 5-7 mph SSW wind, and moist soil moisture. Weeds present at the time of POST application were corw 2-4" at 1/yd2, cocb 4-8" at 1-3/yd2, yeft 3 lf at 2-3/ft2, rrpw 1-4" at 6-7/ft2, and colq 3-5" at 1/yd2. Soil characteristics were: 25.2% sand, 43.9% silt, 30.9% clay, Clay Loam, 4.9% OM, and 8.0 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa through 11002 TT nozzles for PPI and PRE applications and 8.5 gpa through 11001 TT nozzles for POST applications at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Table. PRE and Pre Plant Incorporated with POST herbicide programs in dry bean (Zollinger, Wirth, Adams).

		14 DA PRE	Prior to POST							14, 28, & 42 DA POST						
Treatment	Rate	Navy	Navy	Yeft	Rrpw	Colq	Hans	Corw	Cocb	Navy	Yeft	Rrpw	Colq	Hans	Corw	Cocb
	(Product/A)	-% inj-	-% inj-	----------% control----------						-% inj-	----------% control----------					
PRE																
(PRE) Prowl H2O	2pt	0	0	70	70	70	40	0	0	0	70	42	38	40	0	0
(PRE) Satellite	2pt	0	0	70	70	70	40	0	0	0	70	70	70	40	0	0
(PRE) Prowl H2O	3pt	0	0	90	85	85	50	20	20	0	90	85	85	77	48	43
(PRE) Satellite	3pt	0	0	90	85	85	52	20	20	0	90	85	85	80	57	42
PPI/POST																
(PPI) Eptam+Sonalan	4.5pt+2pt															
(POST) Basagran+Raptor +MSO[1]	1pt+2floz +1%v/v	0	0	99	99	99	99	50	20	0	99	99	99	99	99	99
(PPI) Eptam+Sonalan	4.5pt+2pt															
(POST) Vida+MSO	0.5floz+1%v/v	0	0	99	99	99	99	50	20	43	99	99	99	99	78	62
(PPI) Eptam+Sonalan	4.5pt+2pt															
(POST) Permit+MSO	0.67oz+1%v/v	0	0	99	99	99	99	50	20	0	99	99	99	99	99	99
(PPI) Eptam+Sonalan	4.5pt+2pt															
(POST) Permit+Vida +MSO	0.67oz+0.5floz +1%v/v	0	0	99	99	99	99	50	20	43	99	99	99	99	99	99
(PPI) Eptam+Sonalan	4.5pt+2pt															
(POST) Basagran+Raptor +Vida+MSO	1pt+2floz +0.5floz+1%v/v	0	0	99	99	99	99	50	20	32	99	99	99	99	99	99
(PPI) Eptam+Sonalan	4.5pt+2pt															
(POST) Basagran+Raptor	1pt+2floz															
+Permit+Vida +MSO	+0.67oz+0.5floz +1%v/v	0	0	99	99	99	99	50	20	18	99	99	99	99	99	99
(PPI) Eptam+Sonalan	4.5pt+2pt															
(POST) Basagran+Raptor +Permit+MSO	0.5pt+1floz +0.5oz+1%v/v	0	0	99	99	99	99	51	20	0	99	99	99	99	99	99
(PPI) Eptam+Sonalan	4.5pt+2pt															
(POST) Basagran+Raptor +Permit+MSO	1pt+2floz +0.67oz+1%v/v	0	0	99	99	99	99	50	20	0	99	99	99	99	99	99
LSD (0.05)		0	0	0	0	0	1	1	0	4	0	1	1	1	5	3

[1]MSO=Methylated Seed Oil

Weed control programs in Navy bean. Zollinger, Richard K., Devin A. Wirth, Jason W. Adams. An experiment was conducted near Prosper, ND to evaluate weed control and navy bean injury to PRE and POST herbicides. Navy bean was planted on June 2, 2015. PRE treatments were applied on June 4, 2015 at 8:30 AM with 64 F air, 55 F soil at a four inch depth, 51% RH, 0% cloud cover, 7-9 mph N wind, and adequate soil moisture. POST treatments were applied on July 1, 2015 at 12:30 PM with 79 F air, 75 F soil at a four inch depth, 55% RH, 100% cloud cover, 5-7 mph SSW wind, and moist soil moisture. Weeds present at the time of POST application were corw 4-6" at 1-2/yd2, cocb 6-8" at 1-2/yd2, yeft 4 lf at 3-8/ft2, and rrpw 3-6" at 4-6/ft2. Soil characteristics were: 25.2% sand, 43.9% silt, 30.9% clay, Clay Loam, 4.9% OM, and 8.0 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa through 11002 TT nozzles for PRE and 8.5 gpa through 11001 TT nozzles for the POST applications at 40 psi. The experiment had a randomized complete block design with three replicates per treatment.

Table. Weed control programs in Navy bean (Zollinger, Wirth, Adams).

		Prior to POST							7 & 14 DA POST						
Treatment	Rate	Navy	Yeft	Rrpw	Colq	Hans	Corw	Cocb	Navy	Yeft	Rrpw	Colq	Hans	Corw	Cocb
	(Product/A)	-% inj-	----------% control----------						-% inj-	----------% control----------					
PRE															
(PRE) Outlook	16floz	0	93	77	78	75	7	7	0	93	77	78	77	20	20
(PRE) Spartan Elite	26floz	0	99	99	99	99	20	20	0	99	99	99	99	47	20
PRE/POST															
(PRE) Outlook	16floz														
(POST) Marvel+NIS[1]	6floz+0.25%v/v	0	92	75	76	75	7	7	25	95	99	99	99	77	48
(PRE) Spartan Elite	26floz														
(POST) Marvel+NIS	5floz+0.25%v/v	0	99	99	99	99	20	20	22	99	99	99	99	90	77
(PRE) Spartan Elite	26floz														
(POST) Basagran 5L+NIS	1.2pt+0.25%v/v	0	99	99	99	99	20	20	0	99	99	99	99	72	92
POST															
(POST) Marvel+NIS	6floz+0.25%v/v	0	0	0	0	0	0	0	32	0	88	73	78	88	63
(POST) Basagran 5L+NIS	1.2pt+0.25%v/v	0	0	0	0	0	0	0	0	0	53	68	90	43	62
(POST) Reflex+PO	1pt+1pt	0	0	0	0	0	0	0	12	8	97	75	95	92	92
LSD (0.05)		0	2	3	3	4	8	8	9	8	6	5	3	7	7

[1]NIS=Nonionic Surfactant; PO=Petroleum Oil

Faba bean tolerance to preemergence and postemergence herbicides. (Minot). The objective of this study was to evaluate faba bean tolerance to preemergence and postemergence herbicides. 'Tabasco' faba bean was planted April 29 at 4.5 bu/A into 7.5-inch rows. Preemergence herbicide treatments were applied on May 4. Postemergence treatments were applied June 4 to 3- to 4-inch faba bean. For the PRE herbicides, BroadAxe (Spartan + Dual) caused slight crop injury, but no injury was observed with Spartan, which indicates that the Dual component of BroadAxe may have caused the crop injury. Valor caused slight crop injury (≤10%), while Fierce (Valor + Zidua) caused slightly more crop injury (13-18%). For the POST herbicides, Raptor applied alone caused severe crop injury; however, Raptor applied with Basagran or Basagran applied alone caused slight crop injury. Flexstar caused severe crop injury. These products are not currently labeled in the U.S.

Table. Faba bean tolerance to preemergence and postemergence herbicides. (1518)

			Faba bean								
			Density	Injury					Lodging	Yield	Test wt.
Treatment	Rate	Timing	Jun-1	May-29	Jun-11	Jun-20	Jul-3	Aug-6	Aug-6	Sep-10	Sep-10
			m of row	----------%----------					--%--	bu/a	lb/bu
Untreated			5.3	0	0	0	0	0	30	52	65.1
Sharpen	2 oz	PRE	4.6	0	0	5	5	0	13	57	64.7
Spartan	4 oz	PRE	4.4	0	0	0	0	0	43	57	64.6
Spartan + Sharpen	4 oz + 1 oz	PRE	4.2	0	0	4	4	3	28	49	64.4
Authority MTZ	12 oz	PRE	4.1	0	0	0	1	0	17	56	64.6
BroadAxe	25 oz	PRE	4.6	0	13	12	13	4	15	58	65.2
Metribuzin	0.5 lb	PRE	4.6	0	5	4	7	2	20	55	64.6
Prowl H2O	3 pt	PRE	3.9	0	0	0	0	0	15	54	64.2
Valor	2 oz	PRE	4.5	0	8	7	9	2	10	54	65.0
Fierce	3 oz	PRE	5.1	0	16	17	18	13	23	52	63.9
Prowl H2O / Basagran[a]	2 pt / 2 pt	PRE / POST	4.8	0	11	13	14	3	17	53	64.6
Prowl H2O / Raptor[b]	2 pt / 4 oz	PRE / POST	4.7	0	35	53	48	38	7	44	64.8
Prowl H2O / Basagran + Raptor[c]	2 pt / 1 pt + 4 oz	PRE / POST	4.3	0	13	14	13	9	20	57	64.7
Prowl H2O / Flexstar[d]	2 pt / 0.75 pt	PRE / POST	4.7	0	77	67	60	43	7	42	64.9
Prowl H20	1.5 pt	PRE	4.1	0	0	0	0	0	18	50	64.1
LSD (0.05)			NS	NS	3.2	4.8	6.6	4.7	18.0	9.8	NS
CV			14.4	0.0	16.5	21.9	30.9	36.5	56.9	11.1	0.78

[a] *Applied with COC (1%)*
[b] *Applied with 28% N + MSO (2.5 gal/100 + 1%)*
[c] *Applied with MSO (1%)*
[d] *Applied with AMS (2.5 gal/100 gal)*

Preemergence weed control in field pea

Caleb Dalley, HREC, Hettinger, ND, 2015

A field trial was conducted to compare herbicide burndown treatments combined with soil active preemergence herbicides. "Blue Moon" field pea were seeded at a rate of 200 lb/A on May4, 2015 using a John Deere 1590 no-till drill. Herbicide treatments were applied on May 8, 2015 from 2:40 to 3:15 PM using a backpack CO_2 spray system at a volume of 10 gal/A. Glyphosate (Roundup PowerMAX) was tank-mixes with all treatments to act as a burndown. At time of application, wild buckwheat was at the 2-3 leaf stage. No other weeds were present at significant densities at time of application. Rainfall (0.31 inches) occurred on May 9 which allowed for activation of soil active herbicides. Weed control and crop injury were rated on June 9 (5 weeks after herbicide application). Injury was noted following application of Broadaxe (sulfentrazone plus s-metolachlor) and Sharpen plus Dual II Magnum. All treatments effectively controlled green foxtail. Treatments including Sharpen controlled wild buckwheat 85 to 100%. Other treatments failed to adequately control wild buckwheat. Pea yield following herbicide treatments was equal to or better than the hand-weeded control and in most cases greater than the untreated control. The highest yield occurred with combination of pendimethalin plus saflufencil (0.0223 lb ai/A or 1 oz/A) plus Spartan Charge (carfentrazone plus sulfentrazone).

Treatment		Rate	Pea	Green foxtail	Wild buckwheat	Test wt	Yield
			Jun 9			Aug-8	
		-lb ai/A-	Injury (%)	control %		lbs/A	bu/A
1	Untreated Control		0 d	0 b	0 f	1755 d	29.2 d
2	Glyphosate	0.77	0 d	91 a	88 abc	2518 abc	42.0 abc
	AMS	0.7					
	Saflufencil	0.0445					
	Pendimethalin	1.43					
	MSO	1%					
3	Glyphosate	0.77	9 b	99 a	91 ab	2569 abc	42.8 abc
	AMS	0.7					
	Saflufencil	0.0445					
	s-Metolachlor	1.91					
	MSO	1%					
4	Glyphosate	0.77	16 a	94 a	70 d	2470 abc	41.2 abc
	AMS	0.7					
	BroadAxe*	1.75					
5	Glyphosate	0.84	1 d	96 a	75 cd	2136 cd	35.6 cd
	AMS	0.7					
	Metribuzin	0.375					
	s-Metolachlor	1.91					
6	Glyphosate	0.77	1 d	100 a	93 ab	2745 a	45.8 a
	AMS	0.7					
	Pendimethalin	1.43					
	Saflufencil	0.0223					
	Spartan Charge*	0.205					
	MSO	1%					
7	Glyphosate	0.77	6 bc	99 a	100 a	2455 abc	40.9 abc
	AMS	0.7					
	Pendimethalin	1.43					
	Saflufencil	0.0445					
	Spartan Charge	0.205					
	MSO	1%					
8	Glyphosate	0.77	0 d	96 a	54 e	2659 ab	44.3 ab
	AMS	0.7					
	Pyroxasulfone	0.08					
9	Glyphosate	0.84	1 d	96 a	46 e	2122 cd	35.4 cd
	AMS	0.7					
	Pyroxasulfone	0.16					
10	Glyphosate	0.77	3 cd	93 a	85 bcd	2404 abc	40.1 abc
	AMS	0.7					
	Pyroxasulfone	0.08					
	Saflufencil	0.0445					
	MSO	1%					
11	Hand weeded	0.77	0 d	100 a	100 a	2215 bcd	36.9 bcd
	Glyphosate	0.77					
	AMS	0.7					
	Pendimethalin	1.43					

LSD P=.10	3.2	9.0	15.1	489	8.2
Standard Deviation	2.7	6.3	10.5	407.47	6.79
CV	79.97	7.13	14.38	17.2	17.2
Treatment F	13.774	87.393	32.688	1.983	1.983
Treatment Prob(F)	0.0001	0.0001	0.0001	0.0720	0.0720

*Broadaxe: sulfentrazone, 7.55%, s-metolachlor, 24.2%; Spartan Charge: carfentrazone, 3.53%, sulfentrazone, 31.77%

Dry pea tolerance to preemergence herbicides. (Minot). The objective of the study was to evaluate dry pea tolerance to labeled or experimental herbicides applied preemergence. Our goal was to find products with different modes of action that can safely be used in dry pea and control Group 1 resistant green foxtail. Zidua, Fierce, and Outlook have activity on green foxtail, but are not currently labeled for use in dry pea.

All treatments except Prowl caused slight to moderate crop injury at the two June ratings. No injury was observed at the July rating.

Table. Dry pea tolerance to preemergence herbicides. (1517)

			Dry pea			
			Density	Injury		
Treatment	Rate	Timing	Jun-1	Jun-3	Jun-20	Jul-23
			m of row	----------%----------		
Untreated			13.3	0	0	0
Zidua	3 oz	PRE	12.1	21	18	0
BroadAxe	20 oz	PRE	12.0	18	10	0
Dual II Magnum	1.67 pt	PRE	13.0	15	10	0
Outlook	14 oz	PRE	12.7	14	12	0
Prowl	3 pt	PRE	13.6	0	0	0
Fierce	3 oz	PRE	12.9	22	20	0
LSD (0.05)			NS	3.0	5.0	NS

*July 23 rating is based on one rep due to herbicide drift on reps 2 & 3.

Simulated glyphosate and dicamba drift on dry pea. (Minot). The objective of the study was to determine the impact of low rates (simulated drift) glyphosate and dicamba on dry pea. The study was conducted in 2014 and 2015. The dicamba rates were adjusted slightly in 2015 since no effect was observed at 0.005 and 0.05 oz in 2014. Two untreated treatments were included each year. Spartan + Prowl were applied PRE and Basagran + Select applied POST to control weeds.

In 2014, glyphosate and dicamba treatments were applied just prior to flowering on July 2 when dry peas were 16-19 inches tall. The first replication of the study was severely impacted by disease and therefore the data in Table 1 below is an average of two replications. Glyphosate and dicamba applied at the two lower rates did not cause visible crop injury and did not affect dry pea yield or test weight. Glyphosate and dicamba applied individually at the high rate caused some visible crop injury, but did not affect yield or test weight. However, glyphosate + dicamba applied as a tank mix at the high rate caused significant crop injury and reduced yield and test weight.

In 2015, glyphosate and dicamba treatments were applied just prior to flowering on June 23. No visible injury was observed with the glyphosate treatments and there was no effect on yield (Table 2). Slight visible injury was observed at 0.275 and 0.5 oz dicamba. There was a very slight yield reduction with 0.275 oz dicamba, but a more significant yield reduction at 0.5 oz. Very little injury was observed and no yield reduction with the low rate of glyphosate + dicamba combined. However, there was a significant yield reduction with the tank mix at the two higher rates. Thus, there appears to be a greater effect on dry pea when glyphosate and dicamba are tank mixed compared to either product applied alone.

Table 1. Simulated glyposate and dicamba drift on dry pea in 2014. (1409)

		Dry pea				
		Injury		Height	Yield	Test wt.
Treatment[a]	Rate/A	Jul-11	Aug-08	Jul-18	Aug-19	Aug-19
		--------%--------		cm	lb/A	lb/bu
Untreated		0	0	76	3777	66.5
Glyphosate	0.01 oz	0	0	82	4201	66.3
Glyphosate	0.1 oz	0	0	78	3618	65.7
Glyphosate	1 oz	5	10	76	4054	65.9
Dicamba	0.005 oz	0	0	78	3673	65.9
Dicamba	0.05 oz	0	0	78	3982	66.0
Dicamba	0.5 oz	25	12	75	3814	65.2
Glyphosate + Dicamba	0.01 oz + 0.005 oz	0	0	76	3918	66.4
Glyphosate + Dicamba	0.1 oz + 0.05 oz	0	0	74	3907	65.7
Glyphosate + Dicamba	1 oz + 0.5 oz	40	50	71	651	58.4
Untreated		0	0	77	4441	66.2
LSD (0.05)		3.3	3.8	7.9	970.9	1.1
CV		30.6	33.8	6.1	12.0	0.7

[a]*All treatments applied Pre-flower July 2*

Table 2. Simulated glyphosate and dicamba drift on dry pea in 2015. (1509)

		Dry pea					
		Injury		Height		Yield	Test wt
Treatment	Rate	Jul-3	Jul-13	Jul-06	Jul-13	Aug-10	Aug-10
		-------%-------		------cm------		lb/a	lb/bu
Untreated		0	0	95	108	4067	63.8
Glyphosate	0.1 oz	0	0	91	108	4132	64.1
Glyphosate	0.55 oz	0	0	93	109	4077	63.7
Glyphosate	1 oz	0	0	92	108	4030	63.8
Dicamba	0.05 oz	1	0	96	113	4101	63.7
Dicamba	0.275 oz	4	4	91	107	3947	63.8
Dicamba	0.5 oz	8	6	92	109	3677	64.1
Glyphosate + Dicamba	0.1 oz + 0.05 oz	1	1	93	105	4516	64.2
Glyphosate + Dicamba	0.55 oz + 0.275 oz	14	7	96	109	3298	64.3
Glyphosate + Dicamba	1 oz + 0.5 oz	21	11	85	102	2851	64.3
Untreated		0	0	97	108	4583	63.7
LSD (0.05)		2.1	1.2	NS	NS	553	NS
CV		33.6	31.9	6.5	5.4	9.7	0.6

[a]*All treatments applied Pre-flower Jun 23*

Preemergence options for weed control in Clearfield Lentils

Caleb Dalley, HREC, Hettinger, ND, 2015

A field trial was conducted to compare preemergence herbicide applications for weed control and crop tolerance in Clearfield Lentils. Lentils were seeded using a John Deere 1590 no-till drill on May 4, 2015. Herbicides treatments were applied on May 8 with lentil emergence occurring on May 15. Weeds present during application were primarily wild buckwheat, prickly lettuce, and annual mustards. Beyond (imazamox) was applied to all plots on June 8th, prior to flowering, which occurred on June 30th.

	Treatment	Rate	Lentil			Green foxtail	Wild buckwheat	Prickly lettuce	Lentil yield	
			May 22	May 29	Jun 9		Jun 9		Aug 7	
		-lb/A-	Injury (%)			Control (%)			-lb/bu-	-bu/A-
1	Glyphosate	0.77	0 b	0 c	2 de	96 a	84 bcd	100 a	64 a	37.3 ab
	AMS	0.7								
	BAS 820ABH	0.081								
2	Glyphosate	0.77	0 b	0 c	0 e	95 a	78 cd	98 ab	64 a	37.3 ab
	AMS	0.7								
	Pyroxasulfone	0.081								
3	Glyphosate	0.77	0 b	0 c	7 c	98 a	83 bcd	100 a	64 a	35.7 bc
	AMS	0.7								
	Pyroxasulfone	0.16								
4	Glyphosate	0.77	0 b	0 c	0 e	93 a	92 ab	100 a	64 a	38.4 a
	AMS	0.7								
	Saflufencil	0.0167								
	Imazethapyr	0.0313								
	MSO	1.04								
5	Glyphosate	0.77	0 b	0 c	45 a	95 a	85 bcd	100 a	64 a	33.8 cde
	AMS	0.7								
	Saflufencil	0.0167								
	Metribuzin	0.33								
	MSO	1.04								
6	Glyphosate	0.77	0 b	0 c	36 a	93 a	95 a	100 a	64 a	35.2 bcd
	AMS	0.7								
	Saflufencil	0.0167								
	Pursuit	0.0156								
	Sencor	0.33								
	MSO	1.04								
7	Glyphosate	0.77	0 b	0 c	0 e	93 a	85 bcd	93 ab	64 a	36.2 abc
	AMS	0.7								
	Pendimethalin	0.95								
8	Glyphosate	0.77	39 a	27 a	19 b	50 b	77 d	83 bc	64 a	32.6 de
	AMS	0.7								
	Sulfentrazone	0.079								
	MSO	1.04								
9	Glyphosate	0.77	34 a	15 b	6 cd	95 a	87 abc	69 c	64 a	34.3 cde
	AMS	0.7								
	BAS96110H	0.79								
	MSO	1.04								
10	Untreated Check		0 b	0 c	0 e	0 c	0 e	0 d	63 a	32.0 e
LSD P=.05			5.0	7.3	9.2	26.8	9.5	16.4	NS	2.67
Standard Deviation			3.5	5.0	6.3	18.4	6.5	11.3	0.5	1.84
CV			47.85	109.1	53.63	22.87	8.54	13.4	0.84	5.22
Treatment F			78.1	16.6	27.1	11.8	70.6	30.9	1.074	5.258
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.4125	0.0004

At 14 days after treatment (DAT), two treatments resulted in visual injury to lentils, both of which contained Spartan. At 35 DAT injury, in the form of chlorosis/necrosis, became apparent in treatments containing Sencor, which may be attributed to the high rainfall that occurred in May. Slight stunting occurred with the higher rate of pyroxasulfone. All treatments, except Spartan, were effective in controlling green foxtail. Wild buckwheat was controlled with Sharpen plus Pursuit with and without Sencor. All other treatments suppressed wild buckwheat. Prickly lettuce was controlled by all treatments except Spartan and the experimental treatment BAS96110H. Lentil yield was lowest in the untreated control

due to weed interference, whereas the highest yield occurred when Sharpen plus Pursuit, BAS 820ABH (0.081 lb ai.A), Pyroxasulfone (0.081 lb ai/A), and Prowl H2O (0.95 lb ai/A). The higher rate of Pyroxasulfone (0.16 lb ai/A) and the Sharpen plus Pursuit plus Sencor treatments had lower yields than Sharpen plus Pursuit but yields were greater than the untreated control. Treatments with yields similar to the untreated control included saflufencil plus metribuzin, sulfentrazone alone, and BAS96110H.

Lentil tolerance to preemergence herbicides. (Minot). The objective of the study was to evaluate lentil tolerance to labeled or experimental herbicides applied preemergence. Our goal was to find products with different modes of action that can safely be used in lentil and control Group 1 resistant green foxtail. Zidua and BroadAxe have activity on green foxtail, but are not currently labeled for use in lentil.

'Maxim' lentil was planted May 20 followed by the application of the PRE herbicides on May 21.

Most treatments caused slight to moderate crop injury, but by July 23 lentil injury was ≤10%. BroadAxe caused severe injury but lentil also recovered to about 18% on July 23. Some plot yields may have been significantly affected by pigweed pressure.

Table. Lentil tolerance to preemergence herbicides. (1516)

			Lentil						
			Height		Injury			Yield	Test wt
Treatment	Rate	Timing	Jun-24	Jul-6	Jun-11	Jun-24	Jul-23	Aug-26	Aug-26
			------cm ------		----------%----------			lb/a	lb/bu
Untreated			12.9	27.5	0	0	0	1144	59.9
Zidua	3 oz	PRE	11.7	28.9	16	21	9	1598	61.5
BroadAxe	20 fl oz	PRE	10.6	25.4	62	62	18	1384	61.0
Dual II Magnum	1.67 pt	PRE	12.4	25.4	15	17	10	1559	61.7
Outlook	14 fl oz	PRE	12.4	27.0	10	16	5	1471	61.2
Prowl	3 pt	PRE	13.3	25.8	14	15	1	1357	60.7
Metribuzin	0.33 lb	PRE	12.9	26.9	7	14	0	1372	61.3
LSD (0.05)			NS	NS	3.6	4.0	12.4	NS	1.1
CV			8.4	13.2	11.5	10.9	110.9	14.7	0.8

Wild buckwheat control in lentil. (Minot). The objective of this study was to determine the effect of wild buckwheat size on level of control achieved. 'Maxim' lentil was planted May 20 followed by the application of preemergence herbicides on May 21. Raptor was applied postemergence when wild buckwheat was in the cotyledon- to 2-leaf stage on June 5 and when wild buckwheat was 3- to 5-leaf on June 11, which provided 94% control at the July 23 evaluation.

All treatments caused slight to moderate crop injury, but by July injury subsided to ≤10%. The most effect treatment for wild buckwheat control was with Prowl+Sharpen (PRE) followed by Beyond (POST). Wild buckwheat control with Beyond applied alone POST was affected significantly by wild buckwheat size at application time. Beyond applied at the cotyledon- to 2-leaf stage provided 89% control compared to Beyond applied six days later at the 3- to 5-leaf stage, which provided only 63% control at the July 23 evaluation.

Table. Wild buckwheat control in Clearfield lentil. (1519)

			Lentil			Weed Control[d]								
			Injury			Wibw			Rrpw			Colq		
Treatment[a]	Rate	Timing	Jun-11	Jun-23	Jul-23	Jun-11	Jun-23	Jul-23	Jun-11	Jun-23	Jul-23	Jun-11	Jun-23	Jul-23
			----------%----------			----------%----------								
Untreated			0	0	0	0	0	0	0	0	0	0	0	0
Prowl + Sharpen[b]	2 pt + 0.75 oz	PRE	11	16	7	75	58	48	89	69	48	98	98	91
Prowl + Pursuit	2 pt + 2 oz	PRE	10	17	10	73	72	73	98	86	85	98	98	97
Prowl + Metribuzin	3 pt + 0.33 lb	PRE	17	22	7	68	56	48	97	78	56	98	98	98
Beyond[c]	4 oz	Cot-2lf	6	16	4	90	95	89	99	99	98	99	99	95
Beyond[c]	4 oz	3 lf +	0	14	6	0	75	63	0	96	99	0	95	98
Prowl+Sharpen[b] / Beyond[c]	2 pt+0.75 oz / 4 oz	PRE / Cot-2lf	16	20	9	96	97	94	99	99	99	99	99	99
LSD (0.05)			2.7	5.2	NS	3.5	6.9	4.8	3.3	6.5	12	0.5	0.0	5.6

[a] *Prowl = Prowl H2O*

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

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

[d] *Wibw=Wild buckwheat; Rrpw=Redroot pigweed; Colq=Common lambsquarters*

Safflower Tolerance to PRE Herbicides

Caleb Dalley, HREC, Hettinger, ND, 2015

A field trial was conducted to evaluate tolerance to PRE herbicide application. Safflower was planted on May 4th at a rate of 25 lb/A using a John Deere 1590 no-till drill. Preemergence treatments were applied using a hand-held spray boom at 10 gal/A on May 5th. Glyphosate plus AMS was applied across all treatments on May 5th to control weeds that had emerged prior to planting, consisting primarily of wild buckwheat and wild mustards. Safflower emerged on May 19th. On May 22nd, 17 days after PRE application and 3 days after safflower emergence, safflower was rated for injury (loss of stand) due to herbicide treatments. The only treatments causing significant injury to safflower were ones that contained saflufencil (Sharpen) with both rates causing severe injury. This injury carried over to later rating dates and stand counts showed a reduction in stand of 41 and 80% for saflufencil applied at 0.022 and 0.044 lbs ai/A. At the 5 WAT rating, safflower treated with pyroxasulfone (Zidua) were slightly stunted (7 to 11%) compared to control treatments, but there was no significant reduction in safflower population due to treatments. Weed populations in this trial were very low and the glyphosate burndown treatment was effective in controlling weeds present at planting. Due to low weed populations, no weed control ratings were taken in this trial. Plots were harvested on September 8th using a plot combine with a 5 foot header. Yield was reduced only in safflower treated with saflufencil, compare to the weed free control. Saflufencil reduced safflower yield 13 to 33% compared to the weed free control. Pyroxasulfone treatments did not reduce safflower yield at either rate applied. There were no reductions in safflower yield due to pendimethalin, sulfentrazone, and dimethenamid treatments. Further, yield was not reduced in the untreated control due to low weed populations that were not competitive with safflower. Further studies evaluating PRE herbicides for weed control in safflower is needed, especially with combinations that would provide broadleaf weed control.

Treatment		Rate	Safflower			Safflower	Test wt	Yield
			May 22	May 29	Jun 8	Jun 15	Sep 8	Sep 8
		-lb ai/A-		injury (%)		stand (no./m^2)	lbs/bu	lb/A
1	Pendimethalin	0.95	0 c	0 d	0 e	79 a	44 b-e	2396 ab
2	BAS 96110H	1.04	0 c	5 c	2 de	79 a	44 bc	2227 ab
	MSO	1.04						
3	Sulfentrazone	0.104	0 c	0 d	0 e	79 a	43 cde	2226 ab
	MSO	1.04						
4	Saflufencil	0.0223	34 b	33 b	34 b	50 b	44 b	2117 b
	MSO	1.04						
5	Saflufencil	0.0445	55 a	83 a	89 a	17 c	46 a	1643 c
	MSO	1.04						
6	Pyroxasulfone	0.106	0 c	0 d	7 cd	90 a	44 b-e	2484 a
7	Pyroxasulfone	0.213	0 c	0 d	11 c	73 a	43 de	2388 ab
8	Dimethenamid	0.47	0 c	0 d	1 e	80 a	44 bcd	2459 a
9	Untreated		0 c	0 d	0 e	80 a	44 b-e	2220 ab
10	Weed Free		0 c	0 d	0 e	84 a	43 e	2430 a
LSD P=.05			7.1	4.4	5.2	17.4	0.9	289.51
Standard Deviation			4.9	3.0	3.6	12.0	0.6	199.54
CV			55.15	25.1	25.24	16.97	1.4	8.83
Treatment F			62.635	315.796	246.400	12.920	6.090	6.228
Treatment Prob(F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Wild Oat Control and Safflower Tolerance to Pyroxasulfone

Caleb Dalley, HREC, Hettinger, ND, 2015

A field trial was conducted to evaluate PRE application of pyroxasulfone alone and in tank-mixes for weed control and safflower tolerance. Safflower was planted on May 4th at 25 lb/A using a John Deere 1590 no-till drill. A broadcast application of glyphosate (Roundup PowerMAX) plus AMS was applied to the entire study to control weeds emerged at time of planting. Preemergence treatments were applied on May 6th using a hand-held spray boom at a spray volume of 10 gallons per acre. Rainfall (0.36 inches) fell on the same day after PRE treatments were applied. Safflower emerged on May 19th. Visual evaluations at 16 and 23 days after application (3 and 10 days after emergence) showed no injury in the way of stand losses, stunting, or discoloration (chlorosis/necrosis) for any of the treatments applied. At 33 days after emergence, visual injury, in the form of stunted growth was observed for some of the treatments containing pyroxasulfone. However, injury was minor and usually less than a 10% reduction in growth. Stand counts taken at 37 days after application verified visual evaluations in regard to stand losses in that there were no significant differences in safflower stand due to herbicide treatment, although numerically the highest rate of pyroxasulfone (120 g ai/A) had the lowest stand counts. Evaluation of wild oat control showed that the higher rates of pyroxasulfone were needed to achieve satisfactory control of this weed. However, weed populations in this trial were very light and were not competitive with safflower. Yield data from safflower harvested on September 8th showed no differences in yield due to herbicide treatment which were all equivalent to the untreated control. This trial showed that while higher rates of pyroxasulfone may result in minor injury, in the form of stunting, that the injury is short lasting and did not reduce safflower yield. Further research on the safety and efficacy of pyroxasulfone in safflower need to be conducted, especially ones dealing with tank-mixes that would provide adequate control of broadleaf weeds, such as wild buckwheat.

Treatment		Rate	Safflower		Wild oat	Safflower	Test wt	Yield
			May 22	Jun 8	Jul 21	Jun 15	Sep 8	Sep 8
		-lb ai/A-	——injury (%) ——		control (%)	stand (no./m^2)	lbs/bu	bu/A
1	Pyroxasulfone	0.066	0 a	0 e	33 d	76 a	44 a	2255 a
2	Pyroxasulfone	0.132	0 a	4 bcd	60 c	72 a	44 a	2248 a
3	Pyroxasulfone	0.198	0 a	6 bc	97 a	70 a	44 a	2439 a
4	Pyroxasulfone	0.264	0 a	10 a	98 a	58 a	44 a	2336 a
5	Pendimethalin	1.425	0 a	0 e	0 e	74 a	44 a	2108 a
6	s-Metolachlor	1.595	0 a	1 de	0 e	81 a	44 a	2204 a
7	Pyroxasulfone	0.099	0 a	3 cde	68 c	69 a	45 a	2449 a
	Pendimethalin	1.425						
8	Pyroxasulfone	0.198	0 a	8 ab	97 a	72 a	44 a	2384 a
	Pendimethalin	1.425						
9	Pyroxasulfone	0.099	0 a	6 bc	95 a	60 a	44 a	2342 a
	s-Metolachlor	1.595						
10	Pyroxasulfone	0.198	0 a	11 a	79 b	67 a	44 a	2258 a
	s-Metolachlor	1.595						
11	Pyroxasulfone	0.198	0 a	5 bc	100 a	67 a	44 a	2371 a
	s-Metolachlor	0.797						
12	Pyroxasulfone	0.198	0 a	5 bc	95 a	59 a	44 a	2427 a
	Pendimethalin	0.714						
13	Untreated		0 a	0 e	0 e	69 a	45 a	2247 a
LSD P=.05			NS	3.7	9.5	NS	NS	NS
Standard Deviation			0.0	2.6	5.6	10.9	0.5	202.28
CV			0.0	58.95	8.9	15.81	1.05	8.75
Treatment F			0.000	7.939	158.219	1.579	2.026	1.028
Treatment Prob(F)			1.0000	0.0001	0.0001	0.1421	0.0529	0.4466

Sulfentrazone formulation comparison. Howatt, Roach, and Harrington. Microgen 8N3e58CDM sunflowers were planted on June 12, near Fargo. Preemergence treatments were applied June 12 with 75°F, 41% relative humidity, clear sky, 5 to 8 mph wind at 225°, and dry soil at 67°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. Sunflower were destroyed at early anthesis to prevent seed set. The experiment was a randomized complete block design with four replicates. Primary species in control plots were Venice mallow, common lambsquarters, and amaranth sp.

Treatment[a]	Rate	6/19	6/26	6/30	7/10	7/10	7/10	7/10	7/10	7/10	7/10	7/24	7/24	8/11	8/11
			Sufl	Sufl	Sufl	Wibw	Vema	Wimu	Colq	Yeft	Amar	Sufl	Weeds	Sufl	New weeds
	oz ai/A		%	no./10 ft	%	%	%	%	%	%	%	%		stage	%
Suen-H	1.5		3	8	0	99	82	84	99	90	99	0		5.1	100
Suen-H	3		15	9	0	99	93	96	99	97	99	0		4.6	100
Suen-H	4		19	8	5	99	95	99	99	97	99	3		4.3	100
Suen-H	8		55	8	33	99	99	99	99	99	99	11		4.3	25
Suen-S	1.5		2	9	0	99	87	84	99	92	99	0		5.1	100
Suen-S	3		8	9	1	98	88	90	99	93	99	0		5.1	100
Suen-S	4		11	8	3	99	95	97	99	96	99	3		4.6	100
Suen-S	8	No emergence	50	9	33	99	98	99	99	99	99	14	No new emergence	4.0	50
Suen-B	3		10	7	3	99	90	91	99	93	99	3		5.1	100
Check			0	6	0	0	0	0	0	0	0	0		4.9	100
CV			32	22	64	1	5	4	0	3	0	70		9	0
LSD 0.05			8	2	7	1	5	5	.	4	.	3		0.6	.

[a]Sulfentrazone trade names were Sulfentrazone 4F, Helm Agrochemical (-H); Spartan 4F, FMC Corporation (-S); and Blanket 4F, Tenkoz (-B). Weed species abbreviations: Wibw, wild buckwheat; Vema, Venice mallow; Wimu, wild mustard; Colq, common lambsquarters; Yeft, yellow foxtail; and Amar, mixed redroot pigweed and tame amaranth.

Emerged plants of sunflower or weed species were not present June 19. By June 26, Sunflower had emerged but weeds were still not present. Sunflower exhibited greater injury with higher sulfentrazone rate regardless of product supplier. Typical rate for this soil texture was 3 to 4 oz ai/A. Organic matter was rather high at about 5.5% which may require the higher rate for adequate weed control; however, pH was 7.5 which would indicate use of the lower rate according to the Spartan label to minimize risk of crop injury. Sunflower expressed injury as loss of green color, shortened leaf veins, and constricted leaf margins. Percent injury on June 26 was a combined value for incidence and intensity of these symptoms throughout the plot. Injury was not present on every plant even at 8 oz/A sulfentrazone.

Sulfentrazone injury did not reduce sunflower population and injury was rather consistent among products at a specific sulfentrazone rate. Injury with 4 and 8 oz/A sulfentrazone or Blanket at 3 oz ai/A diminished through the season but was evident on plants July 24, primarily on the first six leaves. Sunflower ray petals were extended (stage 5.0) in check plots on August 11. Sunflower treated with 4 or 8 oz/A sulfentrazone had heads extended from the leaves but with ray petals folded inward (stage 4.0). The duration to advance from stage 4 to initial anthesis (stage 5.1) can be as short as 2 days. So there was a slight delay in development with 4 oz/A sulfentrazone or more, but the effect likely had little implication for production. Head size did not appear affected by the injury or delay.

Populations of wild buckwheat, common labsquarters, and amaranth sp. were easily controlled by sulfentrazone at all rates. The Helm formulation of sulfentrazone gave slightly better control of Venice mallow at 1.5 and 3 oz/A than other formulations. The Helm formulation also gave slightly better control of wild mustard and yellow foxtail at 3 oz/A than the other formulation. These were instances of discernment with other rate by weed combinations occurring similar across formulations for weed control.

New weed emergence was not observed July 24. Weeds with earlier establishment continued to grow without apparent suppression from sulfentrazone presence. Therefore, relative weed control ratings remained similar through the season even though biomass accumulation in the check plots increased dramatically and possibly influenced the tendency for sunflower in the check plots to be delayed compared to plots with weed control but no crop injury due to sulfentrazone. A new flush of weeds was observed August 11. The emergence in all plots except those treated with 8 oz/A sulfentrazone was similar to check plots. Emergence was 25 to 50% of the check when sulfentrazone was applied at 8 oz/A.