Cabbage Weed Control - Oakes. Richard Greenland. Cabbage production has tremendous potential in North Dakota. A few farmers are growing cabbage but have difficulty controlling weeds because few herbicides are available for weed control in cabbage production. In these experiments I looked at several new herbicide and herbicide combinations for use in direct seeded and transplanted cabbage production. This study was on a Hecla sandy loam, pH of 6.3, and 2.6% organic matter. 'Fresco' cabbage was direct seeded on April 26 with a Monosem precision vacuum planter which also planted a row of barley cover crop (0.45 bu/acre in 18-inch rows) between and parallel to the cabbage rows. Cabbage seeds were planted about ½ to ¾ inches deep and spaced 7 inches apart in 18-inch rows. Plants were later thinned to 15 inches apart (about 26,000 plants/acre). 'Bronco' cabbage was transplanted 15 inches apart in 18-inch rows on May 13. No cover crop was planted with the transplanted cabbage. Plots were 17 ft long by 8 ft wide. The experiment was subsurface drip irrigated. Fertilizer and fungicides were applied as needed.

Treatments were applied with a CO_2 backpack sprayer using AI 110-04 flat fan nozzles, 45 gpa, and 57 psi. Treatment application data is given in Table 1. Using a tractor mounted sprayer (AI 110-04 flat fan nozzles, 36 gpa, and 55 psi), Treflan (1 pt/acre) was applied to the direct seeded study on April 23, and Fusilade + NIS (12 oz/acre + 1 pt/25 gal) was applied to the direct seeded study on May 29, and to the both studies on June 7. The Fusilade was to kill the barley cover crop and any grass weeds. Weed ratings were taken on June 3, June 13 or 17, and July 2. Cabbage was harvested on Aug. 28 and 29.

Summary.
Direct seeded cabbage. Dacthal gave good control of pigweed, fair control of lambsquarters and very poor control of nightshade, resulting in no harvestable yield. Applied as a post treatment after Dacthal, Stinger gave better nightshade control than Tough, but neither gave acceptable control. Authority gave good control of pigweed, fair control of lambsquarters, and poor control of hairy nightshade. Valor severely injured cabbage and controlled weeds when applied at the two-leaf stage of cabbage. Injury and weed control were both lower when applied at the four-leaf stage. None of the treatments had yields as high as the handweeded check.
Transplanted cabbage. Cabbage injury was much less with the transplanted cabbage than when cabbage was direct seeded. Valor applied PRE severely injured cabbage and didn't control weeds very well. Valor injured cabbage less and controlled weeds better when applied POST2 or POST3. Prowl gave better pigweed control when applied PPI vs. PRE. Goal gave better nightshade but poorer pigweed control than Prowl PPI. Authority controlled pigweed and nightshade better when applied POST3, and controlled lambsquarters better when applied PRE or POST2. Treflan PPI improved weed control. All treatments except the Treflan + Authority + Valor treatment resulted in cabbage yields lower than the handweeded check.

Table 1. Treatment application data at the Oakes Irrigation Research Site.

Application timing	Date	Time	Barley height	Cabbage height	Cabbage growth stage	Weed height	Weed growth stage
Direct seeded study							
PRE	April 29	9:30 am	0	0	0	0	0
POST1	May 10	10:30 am	1"	¼"	cot.	0	0
POST2	May 29	9:15 am	7"	2.5"	2.5 lf	½ to 2"	2 to 4 lf
POST3	June 7	3:20 pm	4"(dying)	4.5"	4 lf	½ to 3"	cot. to 6 lf
Transplanted study							
PPI	May 2	11:50 am	—	0	0	0	0
PRE	May 10	11:10 am	—	0	0	0	0
POST1	May 14	10:30 am	—	4.5"	3.5 leaf	0	0
POST2	May 20	10:15 am	—	5"	3 leaf	¼"	cot.
POST3	May 28	10:10 am	—	3"	3 leaf	½ to 1"	cot. to 2 lf
POST4	June 4	10:00 am	—	5"	5 leaf	½ to 2"	cot. to 4 lf

Table 2. Cabbage injury, barley cover crop injury, and redroot pigweed ratings for the direct seeded cabbage weed control study at the Oakes Irrigation Research Site.

Herbicides	Rates	Application timing	Cabbage injury			Barley injury	Redroot pigweed ratings		
			6/3	6/17	7/2	6/3	6/3	6/17	7/2
			0 to 10[1]						
Dacthal	8 lbs	PRE	0.3	0.0	0.0	0.0	9.3	9.3	8.0
Dacthal	8 lbs	POST1	0.3	0.0	0.0	0.0	10.0	9.8	8.8
Authority	2 oz	POST2	2.0	0.8	0.0	1.8	10.0	10.0	9.3
Valor	2 oz	POST2	7.0	6.3	5.8	6.3	10.0	10.0	10.0
Authority	2 oz	POST2	7.3	7.0	7.3	6.3	10.0	10.0	10.0
Valor	2 oz	POST2							
Authority	2 oz	POST3	0.0	5.0	4.5	0.0	9.8	10.0	9.3
Valor	2 oz	POST3							
Dacthal	8 lbs	POST1	0.5	0.0	0.0	0.0	9.3	9.8	9.3
Tough	12 oz	POST3							
Dacthal	8 lbs	POST1	0.5	0.3	0.8	0.0	9.3	9.0	6.8
Stinger	1/3 pt	POST3							
Handweeded check			0.0	0.0	0.8	0.0	10.0	10.0	10.0
LSD(0.05)			0.8	0.9	1.0	0.5	—	0.7	1.1
Probability			<.0001	<.0001	<.0001	<.0001	0.11	0.04	<.0001
C.V. (%)			29	29	32	23	5	5	8

[1]Ratings: 0 is no effect (no weed control or no crop injury); 10 is complete weed or crop kill.

Table 3. Lambsquarters and hairy nightshade ratings and yields for the direct seeded cabbage weed control study at the Oakes Irrigation Research Site.

Herbicides	Rates	Application timing	Lambsquarters rating			Hairy nightshade ratings			Cabbage yield
			6/3	6/17	7/2	6/3	6/17	7/2	
			0 to 10[1]						tons/acre
Dacthal	8 lbs	PRE	9.0	8.0	7.5	5.0	3.3	0.5	0.0
Dacthal	8 lbs	POST1	9.3	7.5	7.0	5.3	3.5	1.0	0.0
Authority	2 oz	POST2	9.8	8.3	7.0	8.8	7.0	4.5	3.8
Valor	2 oz	POST2	10.0	8.3	6.5	10.0	10.0	10.0	5.8
Authority	2 oz	POST2	10.0	9.3	9.0	10.0	10.0	10.0	21.4
Valor	2 oz	POST2							
Authority	2 oz	POST3	8.3	8.8	8.3	4.3	7.8	6.8	13.0
Valor	2 oz	POST3							
Dacthal	8 lbs	POST1	9.0	8.3	7.0	5.8	5.3	2.0	0.0
Tough	12 oz	POST3							
Dacthal	8 lbs	POST1	8.8	8.0	6.8	5.8	6.8	6.5	16.6
Stinger	1/3 pt	POST3							
Handweeded check			7.3	10.0	10.0	4.8	10.0	10.0	45.0
LSD(0.05)			1.4	1.2	1.2	1.3	1.3	1.0	6.9
Probability			0.009	0.011	<.0001	<.0001	<.0001	<.0001	<.0001
C.V. (%)			11	10	10	13	13	12	40

[1]Ratings: 0 is no effect (no weed control or no crop injury); 10 is complete weed or crop kill.

Table 4. Cabbage injury, barley cover crop injury, and redroot pigweed ratings for the transplanted cabbage weed control study at the Oakes Irrigation Research Site.

Herbicides	Rates	Application timing	Cabbage injury			Redroot pigweed ratings		
			6/3	6/13	7/2	6/3	6/13	7/2
			0 to 10[1]					
Prowl	1.5 pt	PPI	0.8	0.3	0.5	8.5	8.5	7.8
Prowl	1.5 pt	PRE	1.3	0.8	2.5	5.3	5.3	3.5
Goal 2XL	2 pt	PRE	2.5	2.0	0.5	7.8	7.3	5.3
Treflan	1pt	PPI	0.0	0.5	1.0	9.8	10.0	9.8
Goal 2XL	2 pt	PRE						
Valor	2 oz	PRE	4.8	4.3	2.5	7.3	7.3	3.8
Valor	2 oz	POST2	0.8	0.8	0.8	9.3	9.8	7.8
Valor	2 oz	POST3	1.0	0.8	1.0	10.0	10.0	8.8
Authority	2 oz	PRE	0.8	0.8	0.3	9.0	9.0	6.0
Authority	2 oz	POST2	1.0	0.8	1.0	9.5	9.0	6.5
Authority	2 oz	POST3	2.0	1.0	1.3	10.0	10.0	9.5
Authority	2 oz	PRE	5.0	5.0	3.5	8.8	8.3	5.8
Valor	2 oz	PRE						
Authority	2 oz	POST2	1.5	1.3	1.3	10.0	9.5	8.8
Valor	2 oz	POST2						
Authority	2 oz	POST3	2.3	2.0	0.5	10.0	10.0	10.0
Valor	2 oz	POST3						
Treflan	1 pt	PPI	1.0	0.5	0.3	9.3	9.3	8.3
Dacthal	8 lbs	POST1						
Treflan	1 pt	PPI	1.0	0.3	0.3	9.3	9.8	8.3
Dual II Magnum	1 pt	POST1						
Treflan	1 pt	PPI	0.3	1.3	0.5	9.8	10.0	8.8
Outlook	1 pt	POST1						
Treflan	1 pt	PPI	1.5	1.0	1.3	10.0	10.0	10.0
Valor	2 oz	POST3						
Treflan	1 pt	PPI	1.5	0.8	1.5	10.0	10.0	10.0
Authority	2 oz	POST3						
Treflan	1 pt	PPI	3.0	2.3	1.5	10.0	10.0	10.0
Authority	2 oz	POST3						
Valor	2 oz	POST3						
Treflan	1 pt	PPI	0.5	1.0	0.8	9.8	9.8	8.3
Dacthal	8 lbs	POST1						
Stinger	⅓ pt	POST4						
Handweed check			0.0	0.5	0.0	9.5	10.0	10.0
LSD(0.05)			1.5	1.1	1.3	1.2	1.0	1.2
Probability			<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
C.V. (%)			69	57	85	9	8	11

[1]Ratings: 0 is no effect (no weed control or no crop injury); 10 is complete weed or crop kill.

Table 5. Lambsquarters and hairy nightshade ratings and yields for the transplanted cabbage weed control study at the Oakes Irrigation Research Site.

Herbicides	Rates	Application timing	Lambsquarters rating			Hairy nightshade ratings			Cabbage yield
			6/3	6/13	7/2	6/3	6/13	7/2	
			0 to 10[1]						tons/acre
Prowl	1.5 pt	PPI	9.8	8.8	7.8	6.8	4.0	2.5	0.0
Prowl	1.5 pt	PRE	9.0	8.3	7.0	6.3	3.5	3.8	0.0
Goal 2XL	2 pt	PRE	8.8	7.3	5.3	9.3	7.8	7.5	1.6
Treflan	1pt	PPI	10.0	9.8	8.8	8.3	6.5	6.0	14.6
Goal 2XL	2 pt	PRE							
Valor	2 oz	PRE	9.5	8.5	6.8	8.8	7.8	6.8	0.0
Valor	2 oz	POST2	8.8	7.8	6.8	9.8	9.0	9.5	18.9
Valor	2 oz	POST3	9.8	9.0	8.0	9.8	8.5	6.5	17.0
Authority	2 oz	PRE	10.0	9.8	9.0	8.5	7.5	6.0	11.6
Authority	2 oz	POST2	10.0	9.5	8.0	8.3	7.5	5.5	5.7
Authority	2 oz	POST3	8.5	6.8	4.5	10.0	9.0	10.0	12.2
Authority	2 oz	PRE	9.5	9.5	8.5	9.0	8.5	6.8	4.3
Valor	2 oz	PRE							
Authority	2 oz	POST2	10.0	9.8	9.0	10.0	9.8	9.8	29.3
Valor	2 oz	POST2							
Authority	2 oz	POST3	9.5	8.8	7.5	10.0	10.0	10.0	27.8
Valor	2 oz	POST3							
Treflan	1 pt	PPI	9.8	9.3	8.8	7.0	5.3	3.8	0.8
Dacthal	8 lbs	POST1							
Treflan	1 pt	PPI	9.3	8.5	7.3	7.0	5.3	3.5	0.0
Dual II Magnum	1 pt	POST1							
Treflan	1 pt	PPI	9.5	9.0	7.8	6.8	5.5	3.5	1.9
Outlook	1 pt	POST1							
Treflan	1 pt	PPI	9.3	8.3	7.0	10.0	9.8	9.8	26.7
Valor	2 oz	POST3							
Treflan	1 pt	PPI	10.0	9.8	8.8	9.8	8.5	7.3	23.8
Authority	2 oz	POST3							
Treflan	1 pt	PPI	10.0	10.0	9.3	10.0	10.0	10.0	37.0
Authority	2 oz	POST3							
Valor	2 oz	POST3							
Treflan	1 pt	PPI	9.5	9.5	8.5	7.0	7.5	8.8	28.4
Dacthal	8 lbs	POST1							
Stinger	⅓ pt	POST4							
Handweed check			9.8	10.0	10.0	9.8	10.0	10.0	40.7
LSD(0.05)			0.8	1.3	1.7	0.9	1.3	1.2	8.9
Probability			0.0025	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
C.V. (%)			6	11	15	7	12	12	44

[1]Ratings: 0 is no effect (no weed control or no crop injury); 10 is complete weed or crop kill.

Preplant thifensulfuron&tribenuron in canola. Howatt, Kirk A., Ronald F. Roach, and Janet D. Harrington. The experiment was established to determine canola response to preplant thifensulfuron&tribenuron. Preplant (PP) treatments were applied on May 14 with 47 F, 59% relative humidity, 0% cloudcover, 4 to 8 mph wind and soil temperature of 54 F. Pre-emergene (PRE) treatments were applied on May 24 with 58 F, 59% relative humidity, 80% cloudcover, 5 to 9 mph southeast wind and soil temperature of 51 F. " Rider" canola was planted May 22. Treatments were applied with a backpack type plot sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. A 4 by 20 ft dried swath was combined from each plot on August 2. The experiment was a randomized complete block design with four replicates.

Treatment[a]	Rate	Application timing	Jun-18 Canola injury	Jun-25 Canola injury	Jul-22 Canola Maturity[b]	Aug-02 Yield
	(oz/A)	(DBP)	(%)	(%)	(days)	(lb/A)
Thif&trib+NIS	0.15&0.07+0.25%	PP	45	58	4	650
Thif&trib+NIS	0.25&0.13+0.25%	PP	55	74	6	670
Thif&trib+NIS	0.5&0.25+0.25%	PP	92	89	13	530
Thif&trib+NIS	0.15&0.07+0.25%	PRE	50	58	4	640
Thif&trib+NIS	0.25&0.13+0.25%	PRE	76	78	8	670
Thifensulfuron+NIS	0.75+0.25%	PRE	94	85	10	380
Untreated	0		0	0	0	1230
C.V.			16	12	28	31
LSD 5%			14	11	3	260

[a]NIS, non-ionic surfactant was Activator 90 from Loveland Industries, Greeley, CO.
[b]Canola maturity expressed as estimated maturity lag compared to untreated.

Early season canola population in herbicide treated plots was not different from untreated control (data not shown), but plants were severely stunted and chlorotic. Canola responded similarly to thifensulfuron & tribenuron whether applied at planting or 7 days prior to planting. Thifensulfuron & tribenuron at 0.15 & 0.07 oz/A reduced yield to 53% of untreated and delayed flower and pod maturity by an estimated 4 days. Accidental substitution of thifensulfuron for thifensulfuron & tribenuron at 0 DBP did not result in greater crop safety.

Canola crop response to Select. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate crop response in canola. Interstate Payco 'Hyola 357RR' canola was planted on May 20, 2002. EPOST treatments were applied June 18 at 5:15 pm with 80 F air, 81 F soil surface, 63% relative humidity, 85% clouds, 8 to 15 mph S wind, dry soil surface, damp subsoil, good crop vigor, and no dew present to V6 canola. POST treatments were applied June 21 at 10:30 am with 69 F air, 71 F soil surface, 63% relative humidity, 100% clouds, 4 to 5 mph SW wind, dry soil surface, damp subsoil, good crop vigor, and no dew present to V7 to V8 (just prior bolting) canola. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a hooded bicycle-wheel-type sprayer for EPOST treatments and a non-hooded for POST treatments all delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

The addition of Stinger during EPOST applications delayed flower initiation but was not noticeable at later ratings. Select applied at the POST application resulted in maturity delays that continued to increase through the growing season. Two strong wind storms (gust of 60 mph) just prior to harvesting. Considerable pod shatter resulted. Plots were not swathed, and it would not have made much difference to the yield because the swaths would have been blown away. Yields not of any use. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Canola Crop Response (Zollinger and Ries).

		June 26	July 15	August 5
Treatment	Rate	Flower Initiation Delay[1]	Full Bloom Delay[2]	Dry Down[3]
	(product/A)	days	days	days
EPOST				
Select+PO	5fl oz+1% v/v	0	0	0
Select+PO	6fl oz+1% v/v	0	0	0
Select+PO+AMS	5fl oz+1% v/v+2lb	0	0	0
Select+PO+AMS	6fl oz+1% v/v+2lb	0	0	0
Select+Stinger+PO	6fl oz+0.33pt+1% v/v	2	0	0
Assure II+PO	8fl oz+1qt	0	0	0
POST				
Select+PO	5fl oz+1% v/v	1	2	3
Select+PO	6fl oz+1% v/v	1	3	5
Assure II+PO	8fl oz+1qt	0	0	0
Untreated		0	0	0
LSD (0.05)		1	0	1

[1]Flower Initiation Delay = the number of additional days taken to begin flower initiation after application of treatments when compared to untreated.
[2]Full Bloom Delay = the number of additional days to reach full bloom when compared to untreated.
[3]Dry Down = the number of additional days taken to reach level of plant moisture where harvesting could begin when compared to the untreated.

Liberty Link Canola. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate weed control in Liberty Link Canola. Aventis 'Invigor 2373' canola was planted on May 20, 2002. EPOST treatments were applied June 18 at 5:30 pm with 80 F air, 81 F soil surface, 63% relative humidity, 85% clouds, 8 to 15 mph S wind, dry soil surface, damp subsoil, good crop vigor, and no dew present to V4 canola. Weed species present were: 1 to 6 inch (1 to 10/yd^2) volunteer wheat; 1 to 3 inch (1 to 5/yd^2) yellow foxtail; and 6 to 8 inch (1 to 10/yd^2) wild oat. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a hooded bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

All treatments controlled volunteer wheat, yellow foxtail, and wild oat. No antagonism was observed by tankmixing Liberty with Select. Two strong wind storms (gust of 60 mph) just prior to harvesting resulting in considerable pod shatter. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Liberty Link Canola (Zollinger and Ries).

Treatment[1]	Rate	Yield Canola
	(product/A)	lb/A
Select+PO	5fl oz+1% v/v	727.5
Liberty+AMS	34fl oz+3lb	862.7
Select+Liberty+AMS	5fl oz+34fl oz+3lb	876.7
Select+Liberty+AMS	4fl oz+34fl oz+3lb	854.3
Select+Liberty+AMS	2fl oz+34fl oz+3lb	861.9
Untreated		906.7
LSD (0.05)		236.9

[1]AMS = ammonium sulfate.

Liberty for Weed Control in Canola. (Terry D. Gregoire, 2002) Devils Lake. The canola was planted May 17th and a good stand was established. Treatments were applied at 10:30 a.m. on June 19th with a CO2 pressured back pack sprayer using 8001 nozzles at 40 psi delivering 8.5 gpa. The temperature at application time was 72° F with 77% RH and calm wind. The canola was 4-5 leaf. Weed pressure was very light. Broadleaf weeds were 2-4 leaf and wild oat was 3 ½ leaf. Treatments were evaluated June 29th. A harvest time observation indicated good weed control with all treatments. Treatments were arranged in a RCBD and replicated four times.

Trt No.	Treatment Name	Rate Rate Unit	June 27 % control Broadleaf	June 27 % control Grasses
1	untreated	0	0	0
2	Liberty	2.1 pt/a	97	100
2	Ams	3.0 lb/a		
3	Liberty	1.75 pt/a	96	99
3	AMS	1.5 lb/a		
3	Assure II	.25 pt/a		
4	Liberty	1.75 pt/a	95	99
4	AMS	1.5 lb/a		
4	Select	0.125 pt/a		
5	Liberty	1.75 pt/a	96	99
5	AMS	1.5 lb/a		
5	Poast	0.375		
LSD (P=.05)			7.2	2.9
Standard Deviation			4.7	1.9
CV			6.1	2.4

Summary
The June evaluation indicated no difference in weed control among herbicide treatments.

Weed control and crop response in glyphosate-resistant canola. (Hendrickson and Valenti) The study was conducted at the NDSU Carrington Research Extension Center on a loam soil with a 6.7 pH and 3.3% organic matter. Glyphosate-resistant canola 'DKL223' was seeded May 3, 2002 into 7-inch rows at 5 lb/A. Individual plots were 10 ft by 25 ft and arranged in a randomized complete block design with three replications. Herbic ide treatments were applied with a CO_2 pressurized hand-held plot sprayer at 10 gal/A and 26 psi through XR80015 flat fan nozzles. EPOST herbicides were applied on May 31 with 75° F, 24% RH, 0% cloud cover, 7 mph wind, and 64° F soil temperature to 2- to 3-leaf canola, emerging redroot pigweed, 1- to 2-inch commo n lambsquarters, and 2-leaf green and yellow foxtail. MPOST herbicides were applied on June 7 with 56° F, 49% RH, 100% cloud cover, 9 mph wind, and 64° F soil temperature to 2.5- to 4-leaf canola, 0.5-inch redroot pigweed, 2- to 4- inch common lambsquarters, and 3-leaf green and yellow foxtail. LPOST herbic ides were applied on June 17 with 69° F, 66% RH, 0% cloud cover, 9 mph wind, and 66° F soil te mperature to 4-leaf to bolting canola, 2- to 4-inch redroot pi gweed, 3- to 6-inch common lambsquarters, and 5-leaf green and yellow foxtail. The canola was harvested on August 5.

Roundup Ultramax was applied EPOST at 0.56 lb ae/A but was dele ted from analysis due to a misapplication. The EPOST and MPOST applications provided 85 to 100% weed control when evaluated 6/11 and 6/20 (Table). The LPOST application was required to control later emerging wee ds. None of the treatments caused visible crop injury (data not shown). Canola seed yield was similar among treatments, likely due to low weed densities and low seed yield. Oil content was greater in the treated plots when compared to the untreated check.

Table. Weed control and crop response in glyphosate-resistant canola.

			Weed control												Canola	
			Redroot pigweed				Common lambsquarters				Green and Yellow foxtail				Oil	Seed
Treatment[a]	Rate[b]	Timing	6/11	6/20	7/1	7/17	6/11	6/20	7/1	7/17	6/11	6/20	7/1	7/17	content	yield
	lb/A		%												%	lb/A
Roundup Ultramax	0.375	EPOST	100	100	72	70	100	98	82	98	100	85	30	65	39	895
Roundup Ultramax	0.375	MPOST	-	99	72	75	-	98	72	77	-	94	38	70	38	1002
Roundup Ultramax	0.56	MPOST	-	98	85	82	-	97	88	90	-	98	78	78	41	1160
Glyphomax Plus+ Stinger	0.375+ 0.089	MPOST	-	100	87	92	-	99	93	98	-	100	45	70	40	1280
Roundup Ultramax	0.375	LPOST	-	-	100	98	-	-	98	100	-	-	88	83	42	1194
Roundup Ultramax	0.56	LPOST	-	-	100	98	-	-	100	100	-	-	94	88	43	1267
Roundup Ultramax / Roundup Ultramax	0.375 / 0.375	EPOST / LPOST	100	100	100	99	100	100	100	100	100	85	90	93	42	1030
Untreated check	0	-		0	0	0		0	0	0		0	0	0	29	937
LSD (P=.05)			0	2	17	19	0	5	17	11	0	6	46	25	7	NS

[a]All treatments included ammonium sulfate at 16.7 lb/100 gal.

[b]Roundup Ultramax and Glyphomax Plus=lb ae/A, Stinger=lb ai/A.

Wild buckwheat control in Roundup Ready canola. Jenks, Willoughby, and Markle. Hyola 357 Roundup Ready canola was seeded May 2 into 6-inch rows at 700,000 pls/A. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied to 1-2 leaf canola on May 28, 3-4 leaf canola on June 4, or 4-6 leaf canola on June 14. The primary weeds were wild buckwheat (Wibw), redroot pigweed (Rrpw), and yellow foxtail (Yeft).

		Wibw		Rrpw		Yeft		Aug 5	
Treatment[a]	Rate	Jun 15	Jul 5	Jun 15	Jul 5	Jun 15	Jul 5	Yield	Test wt
		% control						lb/A	lb/bu
1-2 lf									
Roundup Ultra Max	0.375 lb ae	70	85	90	90	75	85	1733	51.1
Roundup Ultra Max	0.56 lb ae	72	91	80	94	75	86	1665	51.3
3-4 lf									
Roundup Ultra Max	0.375 lb ae	77	97	97	97	99	93	1985	50.7
Roundup Ultra Max	0.56 lb ae	86	98	99	95	100	95	1544	51.0
Glyphomax Plus + Stinger	0.375 lb ae + 0.089 lb ai	93	99	97	97	98	92	1844	51.0
5-6 lf									
Roundup Ultra Max	0.375 lb ae		93		95		95	1839	50.6
Roundup Ultra Max	0.56 lb ae		97		95		95	1851	50.6
1-2 lf / 5-6 lf									
Roundup Ultra Max / Roundup Ultra Max	0.375 lb ae / 0.375 lb ae	69	97	88	97	72	97	1958	50.5
Untreated		0	0	0	0	0	0	1157	51.5
LSD (0.05)		9	8	12	6	11	10	396	NS
CV		8	5	9	4	8	7	13	1.3

[a]*All treatments were applied with AMS at 2% w/w.*

We evaluated wild buckwheat control with Roundup Ultra Max at different rates and timings. Roundup Ultra Max provided 85-98% control of wild buckwheat at the July evaluation. The lower control with the 1-2 leaf application was partially due to later germinating weeds. Glyphomax Plus + Stinger provided 99% wild buckwheat control. All treatments applied at 3-4 leaf or 5-6 leaf canola provided excellent pigweed and yellow foxtail control. The 3-4 leaf and 5-6 leaf treatments generally yielded more than treatments applied at the 1-2 leaf canola stage.

Volunteer RUR wheat control in RUR canola-Carrington. Oltmans and Zollinger. An experiment was conducted near Carrington, ND to evaluate volunteer Roundup Ready wheat control from POST applied herbicides. 'RideR' canola was planted May 14, 2002. 'Oxen' Roundup Ready wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 14, 2002. EPOST treatments were applied May 30, 2002 at 11:30 to 11:45 am with 81 F air, 68 F soil at a 2 to 4 inch soil depth, 28% relative humidity, 5% clouds, 5 to 18 mph WNW wind, moist soil surface, dry subsoil, good crop vigor, and no dew present to cotyledon canola. Weed species present were: 1 to 6 inch, (10-25 plants/ft^2) foxtail; and 1 to 2 inch volunteer wheat. MPOST treatments were applied June 12, 2002 at 8:15 to 8:45 am with 55 F air, 53 F soil at a 2 to 4 inch depth, 82% relative humidity, 100% clouds, 4 to 11 mph WNW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 3 to 4 leaf canola. Weed species present were: 1 to 8 inch, (20-40 plants/ft^2) foxtail; and 3 to 5 inch volunteer wheat. POST treatments were applied June 19, 2002 at 4:00 to 4:15 pm with 82 F air, 67 F soil at a 2 to 4 inch depth, 28% relative humidity, 35% clouds, 2 to 4 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 5 to 6 leaf canola. Weed species present were: 1 to 2 inch, (5-10 plants/ft^2) foxtail; and 3 to 5 inch volunteer wheat. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer equipped with a wind shield. The experiment had a randomized complete block design with four replicates per treatment.

Treatment	Rate[b]	Growth Stage	14 DAT		28 DAT	
			Fxtl[c]	Vwht	Fxtl	Vwht
	(product/Acre)	(leaf)	% control			
RUM+AMS+Assure II	13floz+8floz	3-4	99	85	90	98
RUM+AMS+Assure II	13floz+6floz	3-4	99	93	92	99
RUM+AMS+Assure II	13floz+4floz	3-4	99	49	92	94
RUM+AMS+Select	13floz+6floz	3-4	99	84	93	95
RUM+AMS+Select	13floz+4floz	3-4	99	43	95	67
RUM+AMS+Assure II/ RUM+AMS+Assure II	13floz+3floz/ 13floz+3floz	cot-2/ 5-6	99	99	93	99
RUM+AMS+Assure II/ RUM+AMS+Assure II	13floz+2floz/ 13floz+2floz	cot-2/ 5-6	99	99	93	96
RUM+AMS+Assure II/ RUM+AMS	13floz+6floz/ 13floz	cot-2/ 5-6	99	99	94	99
Stinger+Assure II+Herbimax	0.33pt+8floz+1%v/v	3-4	95	96	78	99
Untreated			0	0	0	0
LSD (0.05)			2	9	6	5

[a]RUM = Roundup UltraMax
[b]AMS = ammonium sulfate at 8.5lb/100gal
[c]Fxtl = Grft and Yeft; Vwht = volunteer wheat

At 14 days after treatment (DAT), all treatments had 95% foxtail control or greater. Volunteer wheat control ranged from 43 to 99%. All treatments had 93% volunteer wheat control or greater, except Roundup UltraMax applied with Select at 4 or 6 floz/A or Assure II at 4 or 8 floz/A. At 28 DAA, all treatments had 90% foxtail control or greater, except Stinger plus Assure II plus Herbimax, with 78% control. Volunteer wheat control ranged from 67 to 99%. All treatments had 94% volunteer wheat control or greater, except Roundup UltrMAX applied with Select at 4 floz/A. Split-applied and single applications of Roundup UltraMAX with labeled- and reduced-rates of Assure II or labeled-rates of Select were the most effective treatments, providing 90% foxtail and 94% volunteer wheat control or greater.

Volunteer RUR wheat control in RUR canola-Prosper. Oltmans and Zollinger. An experiment was conducted near Prosper, ND to evaluate volunteer Roundup Ready wheat control from POST applied herbicides. 'RideR' canola was planted May 17, 2002. 'Oxen' Roundup Ready wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 17, 2002. EPOST treatments were applied June 4, 2002 at 10:00 to 10:15 am with 68 F air, 56 F soil at a 2 to 4 inch soil depth, 40% relative humidity, 5% clouds, 4 to 6 mph E wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to cotyledon to 2 leaf canola. Weed species present were: 1 to 6 inch, (10-20 plants/ft^2) foxtail; and 1 to 2 inch volunteer wheat. MPOST treatments were applied June 17, 2002 at 10:15 to 10:45 am with 76 F air, 63 F soil at a 2 to 4 inch depth, 57% relative humidity, 20% clouds, 4 to 8 mph E wind, dry soil surface, moist subsoil, fair crop vigor, and no dew present to 4 leaf canola. Weed species present were: 1 to 4 inch, (20-30 plants/ft^2) foxtail; and 5 inch volunteer wheat. POST treatments were applied June 20, 2002 at 12:30 to 12:45 pm with 75 F air, 64F soil at a 2 to 4 inch depth, 52% relative humidity, 35% clouds, 4 to 7 mph N wind, dry soil surface, moist subsoil, fair crop vigor, and no dew present to 6 leaf canola. Weed species present were: 1 to 4 inch, (20-30 plants/ft^2) foxtail; and 6 inch volunteer wheat. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer. The experiment had a randomized complete block design with four replicates per treatment.

Treatment	Rate[b]	Growth Stage	14 DAT		28 DAT	
			Fxtl[c]	Vwht	Fxtl	Vwht
	(product/Acre)	(leaf)	% control			
RUM+AMS+Assure II	13floz+8floz	3-4	99	98	93	99
RUM+AMS+Assure II	13floz+6floz	3-4	99	98	96	99
RUM+AMS+Assure II	13floz+4floz	3-4	99	97	93	99
RUM+AMS+Select	13floz+6floz	3-4	99	71	95	92
RUM+AMS+Select	13floz+4floz	3-4	94	70	95	89
RUM+AMS+Assure II/ RUM+AMS+Assure II	13floz+3floz/ 13floz+3floz	cot-2/ 5-6	99	99	94	99
RUM+AMS+Assure II/ RUM+AMS+Assure II	13floz+2floz/ 13floz+2floz	cot-2/ 5-6	99	99	94	99
RUM+AMS+Assure II/ RUM+AMS	13floz+6floz/ 13floz	cot-2/ 5-6	99	99	96	98
Stinger+Assure II+Herbimax	0.33pt+8floz+1%v/v	3-4	98	98	91	99
Untreated			0	0	0	0
LSD (0.05)			4	5	5	4

[a]RUM = Roundup UltraMax.
[b]AMS = ammonium sulfate at 8.5lb/100gal
[c]Fxtl = Grft and Yeft; Vwht = volunteer wheat

At 14 days after treatment (DAT), all treatments had 97% volunteer wheat control or greater, except Roundup UltraMax applied with Select at 4 or 6 floz/A. Foxtail control ranged from 94 to 99%. At 28 DAT, all treatments had 91% foxtail control or greater. Volunteer wheat control ranged from 89 to 99%. All treatments had 98% volunteer wheat control or greater, except Roundup UltraMax applied with Select at 4 or 6 floz/A. Select applied at 4 or 6 floz/A provided 89% and 92% volunteer wheat control, respectively.

Herbicide Screening for Volunteer Crop Control. (Terry Gregoire, 2002) Plaza Durum, Clearfield Pioneer 46A76 Canola, Minot RR Canola, LL Invigor 2663 Canola, Rehab 94 Flax and Traill Soybean were seeded June 4 in RCB design with 3 replications. Treatments were applied July 3 between 10:00 a.m. and noon using a CO2 pressurized tractor mounted boom delivering 8.5 gpa using 80015 nozzles. It was calm and sunny with a RH of 40% and a temperature of 70°F during application. Crop and weed growth stages at application were: flax 4" tall, soybean 1-2 trifoliate, canola 5-6 leaf, durum 4 leaf, common mallow 4-5 leaf, wild buckwheat 4-5 leaf and kochia emerging to 1" tall. Evaluation for visual fresh weight reduction was July 15th. Only two replications were used to evaluate kochia and wild buckwheat.

Visual estimation of Percent Fresh Weight Reduction 7-15

Treatment	Product	Trail Sobe	Rehab 94 Flax	Plaza Durum	Roundup Ready Canola	Clearfield Canola	Liberty Link Canola	Coma	Wibu	Kocz
	oz/A					%				
Untreated	0	0	0	0	0	0	0	0	0	0
2,4-D	16	72	40	0	83	92	85	35	40	30
Bronate Advanced	12.8	52	7	0	88	96	92	78	100	98
Clarity+Oil	3+0.25G	65	3	0	15	18	20	0	50	68
Harmony GT	0.033	22	3	0	52	3	80	65	98	0
Harmony GT	0.055	0	0	0	50	8	45	20	25	0
Canvas	0.3	83	3	0	87	15	100	35	93	0
Cobra	6	0	99	0	83	85	85	87	0	100
Basagran+Oil	32+0.25G	0	15	0	100	100	100	50	50	100
Flexstar+AMS	6+2 %	5	100	0	100	100	100	98	65	93
Callisto+ Oil+ Uan	2+1%+2.5%	77	63	70	100	98	97	92	0	88
Callisto+ Oil+ Uan+ Harmony GT	2+1%+2.5%+ 0.055	88	58	68	98	100	100	93	95	100
Sencor	4	13	25	0	0	52	35	48	22	50

Canola Herbicide Systems, Langdon. (Lukach) Eight canola varieties were seeded on May 23 at 5 lb/a. Flea beetles and white mold damage to the trial was minor. Fertility was adequate for a 2500 lb/a canola yield goal. The 2 leaf canola treatments were applied June 17, 4 leaf on June 24 and 6 leaf on June 28. Weeds and canola were still emerging on June 17. Weed(number/yd2) were; Wioa(5-25), Kocz(5-25), Wibu(8), Vwht(1), Rrpw(18), Yeft(3), Bygr(4), Colq(1). Treatments were applied with a tractor mounted CO2 sprayer with DG80015 tips, 40 psi delivering 10 gal/a solution. Plots size was 10 by 30 feet with 4 by 24 feet harvested. The experiment was a randomized complete block design with three replicates. The plots were swath on August 27 and combined on Sept 20.

Herbicide	Treatment &	Crop		Canola	August	Aug 9 Control							
Variety	Leaf Stage	Injury	Yield	Height	Maturity	Kocz	Wibw	Rrpw	Wioa	Yeft	Bygr	Vwht	Colq
	lb ai/acre	%	lb/a	cm	date	----------	----------	----------	%----------	----------	----------	----------	----------
Roundup	No Control	0	162	90	21	0	0	0	0	0	0	0	0
Ready	Glyp 0.375 2 Leaf	0	832	106	21	60	43	23	70	23	17	100	75
DKL223	Glyp 0.375 4 Leaf	0	1468	100	23	87	90	83	100	78	78	100	100
	Glyp 0.375 2&6 L	0	1549	94	21	98	97	98	100	98	98	100	100
Roundup	No Control	0	105	92	26	0	0	0	0	0	0	0	0
Ready	Glyp 0.375 2 Leaf	0	1188	100	23	62	47	30	72	40	40	100	40
DKL34-55	Glyp 0.375 4 Leaf	0	1453	94	23	78	88	70	100	77	87	100	65
	Glyp 0.375 2&6 L	0	1529	102	24	97	95	89	100	100	87	100	95
Roundup	No Control	0	264	84	21	0	0	0	0	0	0	0	0
Ready	Glyp 0.375 2 Leaf	0	1026	93	23	63	60	27	50	27	30	100	40
Hyola 357	Glyp 0.375 4 Leaf	0	1504	92	26	92	97	75	100	83	75	100	63
	Glyp 0.375 2&6 L	0	1737	94	23	97	95	100	100	97	97	100	100
Roundup	No Control	0	90	104	23	0	0	0	0	0	0	0	0
Ready	Glyp 0.375 2 Leaf	0	777	112	24	53	40	37	70	23	23	100	10
Peak	Glyp 0.375 4 Leaf	0	1206	108	28	83	88	58	100	57	70	100	65
	Glyp 0.375 2&6 L	0	1919	99	23	95	97	98	100	93	92	100	100
Roundup	No Control	0	111	104	25	0	0	0	0	0	0	0	0
Ready	Glyp 0.375 2 Leaf	0	891	107	26	63	47	30	73	33	30	100	35
45H21	Glyp 0.375 4 Leaf	0	1086	94	28	93	90	65	100	67	65	100	85
	Glyp 0.375 2&6 L	0	1501	110	28	98	92	100	100	96	93	100	98
Roundup	No Control	0	276	98	23	0	0	0	0	0	0	0	0
Ready	Glyp 0.375 2 Leaf	0	1276	111	25	78	57	67	87	23	23	100	60
CL2061	Glyp 0.375 4 Leaf	0	1701	111	25	87	95	85	100	88	90	100	90
	Glyp 0.375 2&6 L	0	1932	110	26	98	97	100	100	100	98	100	100
Liberty	No Control	0	314	103	23	0	0	0	0	0	0	0	0
Invigor 2663	Gluf 0.443 4 leaf	0	1730	104	24	87	87	93	80	67	80	95	98
Clearfield	No Control	0	23	97	27	0	0	0	0	0	0	0	0
46A76	Imaz 0.031 4 leaf	0	3	96	27	0	50	93	100	83	80	100	100
C.V. %			26	7	10	20	18	33	16	38	31	2	28
LSD 5%			427	12	4	18	16	28	17	30	24	3	31
# of reps			3	3	3	3	3	3	3	3	3	2	2

Glyp 0.375 = Roundup Ultramax, 13 oz/a + AMS 1.7 lb/a in 10 gal/a spray solution
Gluf 0.443 = Liberty, 34 oz/a + AMS 3 lb/a in 10 gal/a spray solution
Imaz 0.031 = Raptor, 4 oz/a, + Activator 90, 0.25% v/v, + UAN, 1 qt/a, in 10 gal/a spray solution

Kochia and Wild Buckwheat control were associated with higher yields. The kochia was ALS resistant so control other weeds with Raptor allowed the kochia to grow 145 cm tall in the Clearfield plots. The many weeds emerged after the two leaf application stage reduced canola yield

Sprayer Contamination Simulation on Roundup Ready Canola, Langdon. (Lukach) The Roundup Ready canola 'Minot' was planted May 22 at 5 lb/a. Fertility was adequate for a 2500 lb/a yield goal. Very little flea beetle damage occurred. Treatments were applied on June 21 to 4.5-5 leaf canola with scattered cotyledon stage canola in the canopy. Conditions were 76°F, 47%RH, with a 10 mph wind from the southeast. The sky was sunny and the foliage dry. Rain the next morning, 0.74 inch, provided good growing conditions for recovery from injury. Three leaf common mallow was present at 2-5 plants per ft^2. Treatments were applied with a bicycle sprayer with DG80015 tips at 35 psi delivering 10 gal/a spray solution. Plot size was 10 by 30 feet with 4 by 24 feet harvested. The treatments were swath on August 23 and combined on September 5.

		13-Jul			13-Jul 22-Aug							
Treatment	Rate	Chlorosis	Inury	Coma Control	Inury	Inury	Yield	Lodge	Height	Maturity August	Maturity Delay	White Mold
	lb ai/A	%	%	%	%	%	lb/a	0-9	cm	date	days	%
RU+none	--	0	1	81	0	0	2185	1	111	17	0	0
RU+ Express	0.0002	28	35	83	33	30	1184	4	99	25	7	0
RU+ Express	0.00002	6	4	79	3	1	2190	2	112	20	1	0
RU+ Pursuit	0.0003	10	5	81	4	3	1712	2	114	19	0	0
RU+ Pursuit	0.00003	4	3	78	1	1	2054	2	112	19	0	0
RU+ 2,4-De	0.025	15	53	83	40	58	994	6	90	25	6	5
RU+ 2,4-De	0.0025	2	3	76	2	2	2038	2	114	19	0	1
RU+ Clarity	0.0125	0	4	80	2	0	2150	2	113	20	1	0
RU+ Clarity	0.00125	0	1	83	1	1	2327	2	114	19	0	0
C.V. %		40	47	9	18	17	10	18	4	5	47	189
LSD 5%		4	8	NS	3	3	272	1	7	1	1	2
# OF REPS		4	4	4	4	4	4	4	4	4	4	4

RU+ = Roundup Ultramax 0.375 lb/a + AMS 1.7 lb/a
2,4-De = Agsco MXL

Stands were not reduced by these rates of tank contaminants. Chlorosis of canola was gone and growth resumed on all treatments by July 4. Much of the new growth on the 2,4-D plots was from branches while the other contaminants did not cause death of the terminal bud. Express treated plants had the most initial chlorosis but had normal appearance at harvest except for late maturity and thinner, shorter stems. Pursuit gave some chlorosis and curling of the new leaves but the plants grew out of it quickly. The Clarity treatments had 30-50% of the plants with a bend in the stem at the height of the plant when the herbicide was applied but were otherwise normal in appearance. The 0.025 lb/a rate of 2,4-D caused kinking and cracking of the stem at the soil line resulting in callus tissue formation. White mold developed on the callus tissue of 5% of the plants while other treatments had no white mold. The 0.0025 rate of 2,4-D had some chlorosis and bending of the stems at the soil line but very few stems that were cracked or formed callus tissue. All treatments gave 95% or better common mallow control at harvest.

Weed control in conventional-till chickpea. Jenks, Willoughby, and Markle. B-90 chickpea was seeded May 13 into 7.5-inch rows at 130 lb/A. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preplant incorporated (PPI) or preemergence (PRE) on May 13, postemergence (POST) on June 14, and POST II on June 20. The primary weeds were wild buckwheat (Wibw), prostrate and redroot pigweed (Pigweed), and yellow foxtail (Yeft).

			Wibw		Pigweed		Yeft		Chickpea Injury		Chickpea Stand	Chickpea Yield
Treatment[a]	Rate	Timing	Jun 15	Jul 10	Jun 15	Jul 10	Jun 15	Jul 10	Jun 15	Jul 10	Jun 28	Sep 3
			% control						—% —		pl/m[d]	lb/A
Spartan[a]	2.67 oz	PRE	70	47	63	28	60	78	3	0	7.9	1773
Spartan[a]	4 oz	PRE	83	68	75	56	70	81	4	0	7.2	2080
Spartan[a]	5.33 oz	PRE	87	81	81	65	75	89	4	1	6.6	2235
Balance + Spartan[a]	1.5 oz + 4 oz	PRE	83	72	74	61	68	94	3	1	6.6	2014
Balance + Sonalan[a]	1.5 oz + 2 pt	PPI	89	82	97	98	97	100	5	1	7.5	2354
Spartan + Sencor[a]	4 oz + 0.5 lb	PRE	81	85	77	54	78	88	6	25	6.3	1832
Spartan + Sonalan[a]	4 oz + 2 pt	PPI	90	80	99	85	98	100	8	3	7.0	2456
Sonalan + Sencor[a]	2 pt + 0.5 lb	PPI	93	80	100	96	99	100	15	24	5.5	2201
Sonalan[a]	2 pt	PPI	90	83	100	95	98	100	5	1	6.6	2423
Sonalan / Tough[a]	2 pt / 1.5 pt	PPI/POST	90	92	99	100	98	98	4	3	6.1	2313
Spartan / Tough[a]	4 oz/1.5 pt	PRE/POST	83	94	80	98	73	85	4	1	6.7	2270
Spartan + Sonalan/ Sencor[a]	5.33 oz+2 pt/ 0.25 lb	PPI/ POST	90	92	95	98	97	98	6	20	6.6	2517
Spartan + Sonalan/ Sencor[b]	5.33 oz+2 pt/ 0.25 lb	PPI/ POST	92	93	95	100	99	100	6	24	6.1	2388
Spartan/ Sencor[b]	4 oz/ 0.25 lb	PPI/ POSTII	78	84	73	94	71	91	3	31	5.5	2175
Handweeded check[c]			100	100	100	100	100	100	4	0	6.1	2341
LSD (0.05)			7	12	7	10	7	7	3	10	NS	309
CV			5	9	5	7	5	5	35	67	16.2	8

[a] *Select at 5 fl oz/A with COC at 1% v/v was applied June 14.*
[b] *Select at 5 fl oz/A with COC at 1% v/v was applied June 20.*
[c] *Spartan + Treflan followed by Tough + Select + COC were applied to aid handweeding.*
[d] *pl/m = plants per meter of row*

We evaluated weed control and chickpea tolerance to several herbicides. Spartan was granted a specific exemption (Section 18) for use in chickpea in 2001 and 2002. All treatments caused very low crop injury with the exception of tank mixes that included Sencor. Sencor soil-applied at 0.5 lb/A or applied postemergence at 0.25 lb/A caused moderate crop injury at the early July rating. Spartan caused minimal injury at any rate. There was no significant difference in crop stand between treatments on June 28; however, treatments that included Sencor tended to have lower stands.

Treatments with Sonalan provided good to excellent wild buckwheat control. Spartan provided poor to good wild buckwheat control with control increasing as the rate increased. Soil conditions were very dry until June 9 when we received 1.20 inches of rain. Up to that point, Spartan at any rate was not controlling the wild buckwheat; however, the moisture appeared to activate the Spartan, which eventually killed many of the already emerged wild buckwheat plants.

Treatments that included Sonalan or Tough provided good to excellent pigweed control. Spartan provided only poor to fair pigweed control. Sonalan provided excellent yellow foxtail control, while Select generally provided good yellow foxtail control.

Weed control in chickpea at Williston. Jenks, Willoughby, and Markle. B-90 chickpeas were seeded May 20 into 8-inch rows at 140 lb/A. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preemergence (PRE) on May 24 and postemergence (POST) on June 20. The primary weeds were redroot pigweed (Rrpw), green foxtail (Grft), and Russian thistle (Ruth).

			Chickpea		Rrpw		Grft		Ruth		Yield	Test wt
Treatment[a]	Rate	Timing	Jun 20	Jul 10	Jun 20	Jul 10	Jun 20	Jul 10	Jun 20	Jul 10	Sep 3	Sep 3
			% injury		% control						lb/A	lb/bu
Spartan / Select	2.67 oz / 5 fl oz	PRE / POST	1	0	92	100	74	100	97	100	1663	61.9
Spartan / Select	4 oz / 5 fl oz	PRE / POST	3	2	95	100	89	99	100	100	1902	62.0
Spartan / Select	5.33 oz / 5 fl oz	PRE / POST	4	4	96	100	91	100	100	100	1795	62.2
Balance + Spartan / Select	1.5 oz + 4 oz / 5 fl oz	PRE / POST	4	3	99	100	94	100	100	100	1751	62.4
Spartan + Sencor / Select	4 oz + 0.5 lb / 5 fl oz	PRE / POST	35	53	97	100	94	99	100	98	1405	60.9
Spartan / Tough + Select	4 oz + 1.5 pt/ 5 fl oz + 2 pt	PRE / POST	2	3	96	100	89	100	100	99	1724	62.0
Spartan / Sencor + Select	4 oz / 0.167lb+5 fl oz	PRE / POST	2	15	97	100	88	100	100	100	1803	62.3
Tough + Select	1.5 pt + 5 fl oz	POST	0	2	0	98	0	94	0	99	1692	62.4
Untreated			0	0	0	0	0	0	0	0	1082	61.3
LSD (0.05)			4	12	5	2	5	2	3	2	352	0.7
CV			36	73	4	2	4	1	2	1	12	0.7

[a]*Select treatments were applied with COC at 1% v/v.*

We evaluated weed control and chickpea tolerance to several herbicides at Williston. Spartan was granted a specific exemption (Section 18) for use in chickpea in 2001 and 2002. Spartan caused minimal chickpea injury at any rate. Sencor tank mixed with Spartan caused 53% crop injury. Sencor tank mixed with Select caused 15% crop injury. Crop injury from Sencor at 0.50 lb/A + Spartan resulted in a yield reduction compared to other treatments. All herbicide treatments provided excellent control of redroot pigweed, Russian thistle, and green foxtail.

Valor on dry bean. Richard K. Zollinger and Jerry L. Ries. An experiment was conducted near Hatton, ND, to evaluate the tolerance of four dry bean varieties to flumioxazin applied PPI. Treatments were applied June 4, 2002, at 2:00 pm and incorporated with a rototiller to a depth of 2 inches. Weather conditions at the time of PPI applications were 79 F air, 68 F subsoil at a depth of 4 inches, 18% relative humidity, 50% clouds, 3 to 5 mph E wind, dry soil surface, and moist subsoil. One row per plot was planted to 'T-39' black bean, 'UI259' red bean, 'Montcalm' dark red kidney bean, and 'UI537' pink bean following treatment incorporation. Treatments were applied to the entire 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles. The experiment was in a randomized complete block design with three replicates. The dry bean types were evaluated for visible injury from 0 for no visible injury to 100 for plant death.

The study was targeted for a weed-free environment. No weeds emerged in the treated area for the duration of the study. Weather conditions in the spring were dry, but up to six inches of rain fell on July 10. After the July rain event, there was no water standing in the plots a full day afterwards due to the sandy soil at this location. Dry bean injury from PPI Valor treatments has been consistently observed in NDSU research. This study evaluated the potential to safen other dry bean types by incorporating Valor. Valor at 2 and 4 oz/A caused significant visible injury and stand loss to the four dry bean types. Injury did not decrease over time but the three indeterminate dry bean varieties did produce high yield at harvest. Dark red kidney is a bush-type bean that is determinate. Black, red, and pink are vining-type beans that are indeterminate. The dark red kidney bean being determinate may explain the lower yields in both the treated and untreated plots. Dry conditions and some water damage throughout the study probably delayed the dark red kidney variety enough so that when the single flowering event was complete, the plants were not large or developed enough to produce a large yield. The dark red kidney bean may also be more susceptible to water damage. The other three varieties are indeterminate (multiple flowering) and were able to continue to produce seed through the remainder of the growing season, resulting in greater yields. The three indeterminate bean types also may be more tolerant to excess water. High yields of the three indeterminate bean types may indicate minimal impact of the high rainfall event. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Flumioxazin on dry bean.

Valor	June 18				July 2				July 2				Yield			
rate	Black	Red	DRK[1]	Pink	Black	Red	DRK[1]	Pink	Black	Red	DRK[1]	Pink	Black	Red	DRK[1]	Pink
(product/A)	------% injury ------				------ % injury ------				----- % stand loss -----				------- cwt/A -------			
2 oz	23	12	3	14	35	20	20	23	38	18	20	37	21.7	27.1	11.3	24.9
4 oz	33	7	4	22	57	57	18	35	58	38	17	55	16.9	24.3	12.7	20.8
0	0	0	0	0	0	0	0	0	0	0	0	0	26.0	27.2	10.4	24.8
LSD (0.05)	15	5	4	11	17	16	6	8	19	24	9	16	4.5	5.4	3.6	4.8

[1]DRK = Dark Red Kidney.

Nightshade control in dry edible bean. Richard K. Zollinger and Jerry L. Ries. An experiment was conducted near Hatton, ND, to evaluate treatments applied PPI to control eastern black nightshade in dry edible bean. May 16, 2002, PPI applications were made and incorporated with a rototiller operating to a depth of 2 inches at 1:00 pm with 48 F air, 48 F soil at a depth of 4 inches, 32% relative humidity, 0% clouds, 7 mph N wind, dry soil surface, and moist subsoil. Ensign '372' navy bean was planted on May 29. Treatments were applied to the entire 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 11002 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

On May 30 (14 DAT), no weeds or dry bean plants had emergence. On June 4 dry bean plants were just emerging, but no eastern black nightshade had emerged. Injury on June 13 (28 DAT) was stunting and poor emergence. An interesting observation was made on June 13, there was better germination of dry bean and weeds in the rototilled area of the plots than the rest of the field where just cultivation was used to prepare the field for planting. Weeds were spotty in the study area causing some variability in ratings. Environmental conditions were extremely dry until rain occurred on June 9. Slight stunting and no crop canopy was observed on June 27 (42 DAT) and July 9 (56 DAT). Yields were not taken due to four to six inches of rainfall on July 10, causing death and stunting to much of the study. All rates and combination of Valor and Outlook applied alone provided near complete control of eastern black nightshade. Tank-mixes with Valor at 2 oz/A or higher caused significant injury. (Dept. of Plant Sciences, North Dakota State University, Fargo)

Table. Nightshade control in dry edible beans (Zollinger and Ries).

		June 13			June 27			July 7	
Treatment	Rate	Navy	Ebns	Colq	Navy	Ebns	Colq	Ebns	Colq
	(product/A)	% injury	-% control -		% injury	-% control -		-% control -	
Prowl	3.6pt	1	48	45	0	23	23	13	10
Prowl H2O	3.16pt	0	93	78	1	25	38	15	23
Outlook	21fl oz	4	99	98	2	94	50	94	59
Valor	1.5oz	0	99	89	5	98	58	98	55
Valor	2oz	0	89	47	2	99	42	98	33
Valor	3oz	2	99	58	3	98	58	98	57
Valor	4oz	1	99	85	6	99	81	99	80
Prowl+Valor	3.6pt+1.5oz	0	99	99	3	99	82	99	57
Prowl+Valor	3.6pt+3oz	0	99	95	23	99	90	99	68
Outlook+Valor	21fl oz+1.5oz	6	99	96	6	99	87	99	83
Outlook+Valor	21fl oz+2oz	10	99	90	17	99	72	99	70
Outlook+Valor	21fl oz+3oz	12	99	94	16	99	86	99	68
LSD (0.05)		4	13	19	11	10	25	7	39

Rezult tank-mixes in dry edible bean. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Hatton, ND, to evaluate dry edible bean response from herbicides applied PPI and POST. On June 4, 2002, PPI treatments were applied and incorporated with a rototiller operating to a 2 inch depth at 2:00 pm with 79 F air, 68 F soil at a depth of 4 inches, 18% relative humidity, 50% clouds, 3 to 5 mph E wind, dry soil surface, and moist subsoil. The planting of 'Maverick' pinto bean followed the incorporation of treatments. POST treatments were applied July 15 at 9:30 am with 77 F air, 80 F soil surface, 71% relative humidity, 0% clouds, 5 to 8 mph SW wind, wet soil surface, wet subsoil, excellent crop vigor, and no dew present to V4 to V6 dry edible bean. Weed species present were: 6 to 18 inch (1/yd^2) blossoming wild mustard. Treatments were applied to the entire 10 by 40 foot plots with a bicylce-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PPI treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

The experiment was established in a near weed free environment. The few wild mustard plants that emerged were completely controlled by all herbicide treatments. On July 10, four to six inches of rain fell. Only a few plots in the far end of the third replication had water damage. The PPI treatments were rated prior to application of POST treatments on July 15, injury was stunting and stand loss. Pursuit Plus at 30 fl oz/A caused increased injury, but recovered in later evaluations. Injury ratings taken on July 29 (14 DAT) and August 5 (21 DAT) were based on foliar injury from POST treatments. POST treatment injury was slight puckering/krinkling of newest trifoliate. No burn/speckling was observed. Injury from POST herbicides, as observed on August 5 (21 DAT) was to older leaves. The top, newer leaf had no visual injury. Injury that did not decrease over time had some new leaf puckering and crinkling. All treatments were safe to Pinto type dry bean. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Nightshade control in dry edible beans (Zollinger and Ries).

		July 15	July 29	August 5		Pinto
Treatment[1]	Rate	Pinto	Pinto	Pinto	Pinto	Yield
	(product/A)	% injury	% injury	% injury	% stand loss	cwt/A
PPI/POST						
Prowl/Raptor+Rezult+PO+28-0-0	3.5pt/2fl oz+1.6pt+1.6pt	4	0	0	3	17.2
Prowl/Pursuit+Rezult+PO+28-0-0	3.5pt/0.72oz+1.6pt+1.6pt	4	0	0	4	17.2
Pursuit Plus+Prowl/Rezult+PO	20fl oz+2.25pt/1.6pt+1.6pt	6	1	1	3	13.3
Pursuit Plus+Prowl/Rezult+PO	30fl oz+1.6pt/1.6pt+1.6pt	25	0	0	4	14.1
Outlook/Raptor+Rezult+PO+28-0-0	16fl oz/2fl oz+1.6pt+1.6pt	6	0	0	0	17.7
POST						
Rezult+PO	1.6pt+1.6pt	-	1	2	0	21.7
Raptor+NIS	4fl oz+0.25% v/v	-	1	1	0	17.1
Pursuit+NIS	0.72oz+0.25% v/v	-	0	0	0	20.1
Raptor+Rezult+PO+28-0-0	2fl oz+1.6pt+1.6pt	-	0	0	0	1939
Pursuit+Rezult+PO+28-0-0	0.72oz+1.6pt+1.6pt	-	0	0	0	20.3
Raptor+Dual Magnum+NIS	2fl oz+1.67pt	-	3	3	0	18.0
Reflex+Outlook+NIS	0.5pt+12fl oz	-	4	2	0	18.2
Untreated		0	0	0	0	19.2
LSD (0.05)		5	1	3	4	4.8

[1]PO = Herbimax at 1% v/v; 28-0-0 = urea ammonium nitrate at 1qt/A; NIS = nonionic surfactant = 0.25% v/v.

Weed Control in Dry Bean. (Hendrickson and Frie) The study was conducted near Heaton, ND. 'Maverick' pinto bean was seeded June 5, 2002 into 30-inch rows. Individual plots were 10 ft by 25 ft and arranged in a randomized complete block design with three replications. Herbicide treatments were applied with a CO_2 pressurized hand-held plot sprayer. PPI treatments were incorporated twice with a culti-harrow set at a 3-inch depth. PPI treatments were applied June 5 with 47° F, 90% RH, 20% cloud cover, 0 mph wind, and 54° F soil temperature. PRE treatments were applied June 6 with 62° F, 56% RH, 10% cloud cover, 10 mph wind, and 58° F soil temperature. POST treatments were applied July 3 with 68° F, 54% RH, 15% cloud cover, 0 mph wind, and 70° F soil temperature to V3 dry beans, 7- to 10-inch green and yellow foxtail, emerging to 4-inch eastern black nightshade, 6- to 8-inch wild mustard, and emerging field bindweed. The dry beans were harvested August 17.

The study area had a high population of green and yellow foxtail and low populations of eastern black nightshade, wild mustard and field bindweed. Control of green and yellow foxtail was inconsistent with a POST only timing (Table). This was likely due to the size of the plants at application, the high population, and secondary foxtail flushes. All PPI or PRE followed by POST herbicide timings provided 80 to 100% weed control. None of the treatments caused visible crop injury (data not shown). Due to the high foxtail population dry bean seed yield was zero in the untreated check. The PPI or PRE followed by POST timings increased seed yields 38% when compared to POST only timings.

Table. Weed control and crop response in dry bean.

			Weed control										Dry bean
			Fxtl				Wimu			Ebns		Fibw	Seed yield
Treatment[a]	Rate	Timing	7/3	7/18	8/8	8/29	7/3	7/18	8/8	7/18	8/29	8/29	9/17
	product/A		---------- % ----------										lb/A
Rezult+COC	3.2pt+1%v/v	POST	-	78	83	95	-	82	93	78	60	50	1883
Raptor+NIS	4fl oz+0.25%v/v	POST	-	63	57	70	-	100	100	94	77	70	2116
Pursuit+NIS	2fl oz+0.25%v/v	POST	-	37	63	43	-	100	100	69	83	40	1682
Raptor+Rezult+ COC+28%	2fl oz+3.2pt+ 1%v/v+1qt	POST	-	77	75	77	-	100	97	97	100	100	2511
Pursuit+Rezult+ COC+28%	2fl oz+3.2pt+ 1%v/v+1qt	POST	-	53	53	43	-	98	93	95	93	100	2120
Prowl / Raptor+Rezult+ COC+28%	3.5pt / 2fl oz+3.2pt+ 1%v/v+1qt	PPI / POST	93	95	98	99	96	100	99	100	100	100	2731
Prowl H2O / Raptor+Rezult+ COC+28%	3pt / 2fl oz+3.2pt+ 1%v/v+1qt	PPI / POST	90	94	99	98	92	100	93	100	98	100	3016
Prowl H2O / Raptor+Rezult+ COC+28%	3pt / 2fl oz+3.2pt+ 1%v/v+1qt	PRE POST	90	93	95	99	87	100	97	100	95	100	3152
Prowl / Pursuit+Rezult+ COC+28%	3.5pt / 2fl oz+3.2pt+ 1%v/v+1qt	PPI / POST	80	82	85	88	85	100	100	100	88	97	2269
Pursuit Plus+Prowl / Rezult+COC	20fl oz+2.25pt / 3.2pt+1%v/v	PPI / POST	94	99	100	100	99	100	100	99	100	100	2851
Pursuit Plus+Prowl / Rezult+COC	30fl oz+1.6pt / 3.2pt+1%v/v	PPI / POST	95	99	100	97	98	100	100	99	97	93	3129
Outlook / Raptor Rezult+COC+28%	16fl oz / 2fl oz+ 3.2pt+1%v/v+1qt	PPI / POST	96	98	100	98	98	100	100	100	100	100	2739
Prowl / Rezult Reflex+COC	1.6pt+3.2pt+ 0.75pt+1%v/v	PPI / POST	85	100	98	96	87	100	100	100	93	90	2845
Spartan / Rezult+COC	4oz+3.2fl oz+1%v/v	PRE / POST	92	95	99	98	93	96	82	98	93	100	2922
Untreated check	-		0	0	0	0	0	0	0	0	0	0	0
LSD (P=.05)			11	16	20	14	5	9	14	19	28	31	571

[a]COC=crop oil concentrate=Herbimax; NIS=nonionic surfactant=Activator 90; 28%=urea ammonium nitrate.

Herbicides and cultivation in dry beans, Fargo, ND. Kegode and Ciernia. A combination of broadcast and banded herbicides with and without row crop cultivation was used to control broadleaf weeds in navy bean. Sulfentrazone was applied both broadcast and banded preemergence while bentazon plus methylated seed oil (Scoil) was applied broadcast and banded as early (Epost) and late (Lpost) postemergence treatments. All broadcast treatments were applied with a 2 wheel bicycle sprayer equipped with 4 XR 8002 nozzles and delivering 17 gpa at 38 psi and all banded treatments used the same sprayer equipped with 2 TwinJet 60-4002E banding nozzles also delivering 17 gpa in a 10 in. band over each of the center 2 rows of the plot. Navy beans were planted in 30 in. rows on June 17. Preemergence treatments were applied on June 18 with air temperature 73 F, RH 55%, wind 7 mph SE, sky cloudy and soil surface dry. Epost treatments were applied July 16 with air temperature 78 F, RH 55%, wind S at 5 mph, sunny sky and dry leaf surfaces. Dry beans were 6 in. tall and 3 trifoliolates, redroot pigweed was 1-6 in. tall and 4-10 leaf and common cocklebur was 3-8 in. tall. Lpost treatments were applied July 23 to 6-8 in. dry beans with 4-5 trifoliolates and air temperature 65 F, RH 60%, wind NW at 1 mph, sky mostly cloudy and plant leaf surfaces dry. Redroot pigweed was 3-25 in tall with the larger plants flowering and common cocklebur was 12 in. tall. On July 19 the center 2 rows of the first seven treatments were cultivated and the entire experiment was sprayed with 16 fl. oz. clethodim + 1 qt. Scoil to control grasses. Evaluations for phytotoxicity and efficacy were made Aug. 2 and 23 and the plots were harvested Oct. 23. Plots measured 10 by 25 ft. and the experiment was a randomized complete block design with 4 reps.

					Aug 2		Aug 23			
Treatment	Rate	Timing	Method	Cultivation	Injury	RRPW	Injury	RRPW	COCB	Yield
	oz ai/A				%	% control	%	% control		lb/A
Sulfentrazone	4	Pre	Broad	Yes	20	98	8	97	70	412
Sulfentrazone	4	Pre	Band	Yes	0	65	1	69	50	752
Bentazon	16	Epost	Broad	Yes	0	70	1	61	55	686
Bentazon	16	Epost	Band	Yes	0	44	0	25	68	785
Bentazon	16	Lpost	Broad	Yes	0	58	1	58	90	711
Bentazon	16	Lpost	Band	Yes	0	57	0	61	50	593
Cultivation only	0 -		-	Yes	0	27	0	11	43	512
Sulfentrazone	4	Pre	Broad	No	26	99	23	97	68	132
Sulfentrazone	4	Pre	Band	No	3	44	2	45	40	599
Bentazon	16	Epost	Broad	No	0	33	0	24	10	699
Bentazon	16	Epost	Band	No	0	26	0	15	33	933
Bentazon	16	Lpost	Broad	No	0	29	0	5	5	546
Bentazon	16	Lpost	Band	No	0	8	0	3	28	439
Untreated	0 -		-	No	0	0	8	0	0	521
Hand Weed	0 -		-	-	0	99	1	99	99	511
C.V. %					136	35	224	52	40	63
LSD 5%					6	25	9	33	40	NS
# OF REPS					4	4	4	4	2	4

Preemergence-applied sulfentrazone treatments provided the best redroot pigweed control but caused significant injury to dry bean, especially when broadcast-applied, which resulted in lower yields. Control with bentazon was generally poor though higher yields were obtained when bentazon was applied Epost as a banded treatment and with no interrow cultivation. Control of common cocklebur was generally poor amongst all treatments except when bentazon was broadcast-applied Lpost plus interrow cultivation.

Glyphosate timing of application. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Fargo, ND, to evaluate weed control from timing of glyphosate formulations applied to non-cropland. POST treatments were applied at one week intervals. Week 1 treatments were applied June 7, 2002 at 9:30 am with 62 F air, 61 F soil surface, 54% relative humidity, 100% clouds, 5 mph N wind, damp soil surface, and moist subsoil. Weed species present were: emerging to 1 inch (10 to 50/ft^2) yellow foxtail; cotyledon to 1 inch (5 to 25/ft^2) wild buckwheat; rosette to bloom (<1/yd^2) dandelion; emerging to 1 inch (1 to 5/yd^2) common lambsquarters. Week 2 treatments were applied June 14, 2002 at 3:15 pm with 76 F air, 80 F soil surface, 38% relative humidity, 100% clouds, 2 mph NW wind, moist soil surface, and moist subsoil. Weed species present were: 1 to 2 inch (10 to 50/ft^2) yellow foxtail; 1 to 3 inch (5 to 15/ft^2) wild buckwheat; rosette to bloom (<1/yd^2) dandelion; and 1 to 3 inch (1 to 5/yd^2) common lambsquarters. Week 3 treatments were applied June 21, 2002 at 11:30 am with 69 F air, 73 F soil surface, 66% relative humidity, 100% clouds, 5 mph NW wind, dry soil surface, and damp subsoil. Weed species present were: 2 to 4 inch (10 to 50/ft^2) yellow foxtail; 3 inch to vining (5 to 15/ft^2) wild buckwheat; rosette to bloom (<1/yd^2) dandelion; and 1 to 4 inch (1 to 5/yd^2) common lambsquarters. Week 4 treatments were applied June 28, 2002 at 9:30 am with 79 F air, 82 F soil surface, 58% relative humidity, 10% clouds, 5 mph S wind, dry soil surface, and damp subsoil. Weed species present were: 4 to 12 inch (10 to 50/ft^2) yellow foxtail; vining (5 to 15/ft^2) wild buckwheat; blossom (<1/yd^2) dandelion; and 6 to 12 inch (1 to 5/yd^2) common lambsquarters. Week 5 treatments were applied July 5, 2002 at 12:00 pm with 81 F air, 89 F soil surface, 59% relative humidity, 25% clouds, 4 mph NW wind, dry soil surface, and moist subsoil. Weed species present were: 10 to 16 inch (10 to 50/ft^2) yellow foxtail; extensive vining (5 to 15/ft^2) wild buckwheat; blossom (<1/yd^2) dandelion; and 12 to 18 inch (1 to 5/yd^2) common lambsquarters. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles for all treatments. The experiment had a randomized complete block design with three replicates per treatment.

Evaluations were made prior to the next herbicide application. ETK 2350 is a premix of Engame + 2,4-D acid. It was thought that ETK 2350 should not antagonize grass control from glyphosate that occurs when 2,4-D amine is added to glyphosate-isopropyl amine salt. Also, 2,4-D acid should not volatilize like a 2,4-D ester so possibly the 2,4-D acid should have the activity of a 2,4-D ester (Salvo), especially in dry weather but does not volatilize. Generally had very heavy weed pressure, some lighter pressure in areas could explain better control in later applications. Some university reports from the plains states have shown faster, and higher weed control from Engame under adverse (hot, dry) environmental conditions. This data indicates that, in general, under normal growing conditions, glyphosate and Engame give similar weed control when comparing the same amount of active ingredient of glyphosate. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Glyphosate timing of application (Zollinger and Ries).

Treatment[1]	Rate	7 DAT				14 DAT			
		Yeft	Colq	Wibw	Dali	Yeft	Colq	Wibw	Dali
	(product/A)	----------% control ----------				----------% control ----------			
Week 1									
RUM+AMS	0.81pt+8.5lb/100gal	99	99	70	50	99	99	95	70
RUM+AMS	1.62pt+8.5lb/100gal	99	99	70	40	99	99	99	90
Engame+Liberate	2.44pt+0.25% v/v	99	99	75	30	99	99	85	35
Engame+Liberate	4.9pt+0.25% v/v	99	99	90	75	99	99	97	90
ETK 2350+Liberate	2pt+0.25% v/v	99	85	70	60	99	99	80	60
RUM+2,4-D Amine+AMS	0.81pt+0.75pt+8.5lb/100gal	99	90	80	70	99	99	97	70
Week 2									
RUM+AMS	0.81pt+8.5lb/100gal	99	90	30	20	99	99	45	30
RUM+AMS	1.62pt+8.5lb/100gal	99	95	75	15	99	99	90	25
Engame+Liberate	2.44pt+0.25% v/v	99	95	50	40	99	99	55	65
Engame+Liberate	4.9pt+0.25% v/v	99	99	75	70	99	99	80	85
ETK 2350+Liberate	2pt+0.25% v/v	99	75	50	40	99	99	70	50
RUM+2,4-D Amine+AMS	0.81pt+0.75pt+8.5lb/100gal	99	90	80	40	99	99	95	45
Week 3									
RUM+AMS	0.81pt+8.5lb/100gal	95	90	75	45	99	99	85	50
RUM+AMS	1.62pt+8.5lb/100gal	99	95	75	25	99	99	95	75
Engame+Liberate	2.44pt+0.25% v/v	95	95	65	50	99	99	80	65
Engame+Liberate	4.9pt+0.25% v/v	99	99	90	70	99	99	97	85
ETK 2350+Liberate	2pt+0.25% v/v	95	60	30	50	99	90	65	60
RUM+2,4-D Amine+AMS	0.81pt+0.75pt+8.5lb/100gal	85	65	60	50	99	95	85	60
Week 4									
RUM+AMS	0.81pt+8.5lb/100gal	80	50	40	40	97	80	50	40
RUM+AMS	1.62pt+8.5lb/100gal	90	70	40	30	99	85	90	50
Engame+Liberate	2.44pt+0.25% v/v	75	70	60	30	90	85	50	40
Engame+Liberate	4.9pt+0.25% v/v	80	65	40	30	95	85	70	60
ETK 2350+Liberate	2pt+0.25% v/v	70	60	65	35	90	75	50	40
RUM+2,4-D Amine+AMS	0.81pt+0.75pt+8.5lb/100gal	87	60	45	40	95	80	65	50

[1]RUM = Roundup UltraMax; AMS = ammonium sulfate; Liberate = surfactant; ETK 2350 = Engame+ 2,4-D acid.

Table. cont. Glyphosate timing of application (Zollinger and Ries).

Treatment[1]	Rate	7 DAT				14 DAT			
		Yeft	Colq	Wibw	Dali	Yeft	Colq	Wibw	Dali
	(product/A)	----------% control ----------				----------% control ----------			
Week 5									
RUM+AMS	0.81pt+8.5lb/100gal	75	45	30	40	95	65	35	45
RUM+AMS	1.62pt+8.5lb/100gal	80	40	25	30	97	75	25	30
Engame+Liberate	2.44pt+0.25% v/v	65	40	35	25	95	70	35	25
Engame+Liberate	4.9pt+0.25% v/v	65	50	30	25	92	60	30	25
ETK 2350+Liberate	2pt+0.25% v/v	60	45	30	30	85	55	30	30
RUM+2,4-D Amine+AMS	0.81pt+0.75pt+8.5lb/100gal	70	45	35	30	80	65	35	30
LSD (0.05)									

[1]RUM = Roundup UltraMax; AMS = ammonium sulfate; Liberate = surfactant; ETK 2350 = Engame+ 2,4-D acid.

Comparison of 2,4-D formulations. (Howatt, Roach, and Davidson-Harrington) Treatments were post applied to 4- to 6-inch wild buckwheat, 6-inch bolting prickley lettuce, and 6-inch Canada thistle on fallow ground June 13 with 58 F, 100% cloudcover, and 7.5 mph northwest wind. Treatments were broadcast with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan nozzle to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design.

Table. Comparison of 2,4-D formulations.

			Jun 29			Jul 15		
Treatment[a]	Rate	Spray	Wibu	Prle	Cath	Wibu	Prle	Cath
	oz ai/A	pH	%					
2,4-D-ester+Liberate	4+0.25%	5.8	20	78	73	15	92	86
2,4-D-ester+Liberate	8+0.25%	5.8	35	61	64	20	70	70
2,4-D-ester+Liberate	12+0.25%	5.4	35	90	81	18	95	95
2,4-D-amine+Liberate	4+0.25%	7.0	23	74	53	18	89	65
2,4-D-amine+Liberate	8+0.25%	7.6	23	80	72	20	93	81
2,4-D-amine+Liberate	12+0.25%	8.0	40	89	79	25	91	90
PCC 1133+Liberate	4+0.25%	2.6	20	80	70	23	94	81
PCC 1133+Liberate	8+0.25%	2.2	45	85	86	18	92	88
PCC 1133+Liberate	12+0.25%	2.2	51	90	85	28	94	92
PCC 1133+AMADS+Liberate	4+1%+0.25%	1.6	30	84	78	15	92	83
PCC 1133+AMADS+Liberate	8+1%+0.25%	1.6	53	90	87	23	95	92
PCC 1133+AMADS+Liberate	12+1%+0.25%	1.6	33	90	81	18	95	91
Untreated	0		0	0	0	0	0	0
CV			67	17	21	54	16	17
LSD (P=0.05)			30	18	21	14	19	19

[a] 2,4-D-ester was Salvo, 2,4-D-amine was Saber, and PCC 1133 was formulated 2,4-D acid from UAP.

Spray solution pH was measured because at near neutral pH 2,4-D acid would dissociate and form salt associations. This could negate any benefit of the acid molecule. AMADS reduced solution pH to 1.6, while PCC 1133 reduced pH to 2.6 or 2.2 depending on chemical rate. Application rate of 2,4-D had more effect on weed control than formulation type, although 2,4-D-amine tended to provide lower weed control than ester or acid formulations, especially at 4 oz/A. Wild buckwheat was not adequately controlled by any formulation or rate. 2,4-D at 12 oz/A provided at least 90% control of prickley lettuce and Canada thistle.

Quizalofop formulations for control of volunteer spring wheat. (Howatt, Roach, and Davidson-Harrington) Wheat was seeded May 14 at Argusville, ND. Treatments were applied to 3- to 6-leaf wheat on June 18 with 71 F, 60% relative humidity, 100% cloudcover, 6 mph southwest wind, and soil temperature of 64 F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Table. Quizalofop formulations for control of Roundup Ready spring wheat.

Treatment[a]	Rate	Jun 29 Vowh	Jul 18 Vowh
	oz ai/A	%	
Glyphosate	9	99	99
Quizalofop+MON 59112	0.45+0.22	84	99
Quizalofop+MON 59112	0.54+0.22	85	99
Quizalofop+MON 59112	0.66+0.22	84	99
MON 24710+MON 59112	0.45+0.22	85	99
MON 24710+MON 59112	0.54+0.22	89	99
MON 24710+MON 59112	0.66+0.22	88	99
MON 24711+MON 59112	0.45+0.22	89	99
MON 24711+MON 59112	0.54+0.22	82	99
MON 24711+MON 59112	0.66+0.22	87	99
Quizalofop+MON 59112+PO	0.45+0.22+1%	87	99
Quizalofop+MON 59112+PO	0.54+0.22+1%	87	99
Quizalofop+MON 59112+PO	0.66+0.22+1%	87	99
MON 24710+MON 59112+PO	0.45+0.22+1%	86	99
MON 24710+MON 59112+PO	0.54+0.22+1%	87	99
MON 24710+MON 59112+PO	0.66+0.22+1%	87	99
MON 24711+MON 59112+PO	0.45+0.22+1%	84	99
MON 24711+MON 59112+PO	0.54+0.22+1%	89	99
MON 24711+MON 59112+PO	0.66+0.22+1%	86	99
Clethodim	2	81	99
Untreated	0	0	0
CV		5	0
LSD (0.05)		6	0

[a] MON 24710, MON 24711, and MON 59112 were proprietary products from Monsanto.

Glyphosate gave the quickest burndown of 3- to 6-leaf wheat, providing 99% control on June 29. Quizalofop provided consistent control of volunteer wheat, 84 to 89%, across quizalofop formulations and adjuvants. Clethodim gave the least control of the herbicide treatments at 81% on June 29. On July 18, all herbicides provided complete control of volunteer wheat.

Quizalofop Formulations for Control of Volunteer Spring Wheat on Fallow, Langdon. (Lukach) 'Alsen' hard red spring wheat was seeded on May 20 at 10 lb/a to simulate volunteer wheat on fallow. The previous crop was also 'Alsen'. The land had been chiseled twice in the fall and cultivated twice in the spring so residue levels were low. Bronate Advanced was applied 12 oz/a on June 13 to control broadleaf weeds. Treatments were applied on June 20 with 73°F, 33% RH, and 10 mph west wind. The sky was sunny and the foliage dry. The wheat was 5 leaf and the green foxtail and barnyard grass 1-4.5 leaf. The wheat, foxtail and barnyard grass densities were 2, 5 and 3 per ft^2, respectively. Wild oat was at 1-1.5 per yd^2. Treatments were applied with a CO2 bicycle sprayer with DG80015 tips, 35 psi, delivering 10 gpa solution. Plot size was 10 by 25 feet. The experiment was a randomized complete block design with four replicates.

		8-Jul		2-Aug			
Treatment	Rate	Vwht	Grft & Bygr	Vwht	Wioa	Grft	Bygr
	fl oz/a	%	%	%	%	%	%
Roundup Ultramax + AMS	20+1.7#	95	92	100	100	56	56
ASSURE II +Mon59112	4+2.8	78	80	100	96	58	60
ASSURE II +Mon59112	5+2.8	83	83	100	98	53	63
ASSURE II +Mon59112	6+2.8	83	88	100	98	75	65
Mon 24710 +Mon59112	2.86+2.8	80	75	100	98	53	55
Mon 24710 +Mon59112	3.5+2.8	83	83	100	99	70	65
Mon 24710 +Mon59112	4.2+2.8	80	83	100	96	60	60
Mon 24711 +Mon59112	2.15+2.8	75	70	100	99	50	60
Mon 24711 +Mon59112	2.6+2.8	80	90	100	98	75	63
Mon 24711 +Mon59112	3.1+2.8	80	89	100	100	48	53
ASSURE II +Mon59112+COC	4+2.8+12.8	90	80	100	99	70	73
ASSURE II +Mon59112+COC	5+2.8+12.8	90	85	100	100	48	63
ASSURE II +Mon59112+COC	6+2.8+12.8	90	90	100	100	73	58
Mon 24710 +Mon59112+COC	2.86+2.8+12.8	90	80	100	99	65	65
Mon 24710 +Mon59112+COC	3.5+2.8+12.8	88	78	100	95	65	60
Mon 24710 +Mon59112+COC	4.2+2.8+12.8	88	80	100	98	73	68
Mon 24711 +Mon59112+COC	2.15+2.8+12.8	88	78	100	98	78	63
Mon 24711 +Mon59112+COC	2.6+2.8+12.8	90	91	100	96	55	55
Mon 24711 +Mon59112+COC	3.1+2.8+12.8	90	91	100	99	70	58
C.V. %		4	8	0	3	26	33
LSD 5%		5	10	NS	NS	NS	NS
# OF REPS		4	4	4	4	4	4

COC = Prime Oil

The green foxtail and barnyard grass ratings on Aug 2 reflect emergence of weeds after herbicide application. The wheat and maybe the wild oat had only one emergence date, before the herbicide application. COC hastened burn down of hrsw before the July 8 rating. Higher chemical rates allowed faster burn down of the green foxtail and barnyard grass with or without COC. The quizalofop formulations were about equal for control of grassy weeds.

Weed control in CRP. Jenks, Willoughby, and Markle. The objective of this study was to evaluate weed control in CRP with different herbicide rates compared to clipping. Individual plots were 10 x 50 ft with four replications. Redeem, 2,4-D ester, and Tordon + 2,4-D were applied in June 2001. Two treatments were clipped in August 2001 with a rotary mower with the intention of following the clipping with a fall application of Redeem or Tordon + 2,4-D. However, dry conditions prevented weed regrowth, thus no herbicide treatments were applied following the August clipping. Canada thistle density was determined by averaging densities in three square-meter quadrats in each plot prior to herbicide application in June 2001.

In these small plot trials, all herbicide treatments reduced weed densities in 2002 compared to 2001 densities. 2,4-D ester reduced weed densities similar to Redeem and Tordon + 2,4-D at Sawyer (Table 1) and Minot (Table 2). Clipping also reduced Canada thistle densities, but not perennial sowthistle densities.

These results are in contrast to what we observed in larger scale plots in the same fields as the small plot trials. Herbicide treatments in the larger scale plots were 4-6 acres each. In the larger scale plots, we generally observed excellent (>95%) Canada thistle control with Tordon + 2,4-D (1 pt + 1 qt), good (80%) Canada thistle control with Redeem (2.5 pt) or Curtail (4 pt), but poor (<50%) Canada thistle control with 2,4-D ester (1 qt).

Table 1. Weed control in CRP - Sawyer

			Canada thistle		Perennial Sowthistle	
Treatment	Rate	Timing	July 2, 2001	June 17, 2002	July 2, 2001	June 17, 2002
			plants / m^2			
Redeem + NIS	1 pt + 0.25% v/v	June	15	7	10	7
Redeem + NIS	2.5 pt + 0.25% v/v	June	26	5	9	0
2,4-D ester	1 qt	June	25	4	10	2
Tordon + 2,4-D	0.5 pt + 1 qt	June	17	5	15	1
Tordon + 2,4-D	1 pt + 1 qt	June	16	4	9	5
Clipping		August	23	9	17	24
Clipping		August	26	11	13	17
LSD (0.05)			NS	NS	NS	15
CV			42	94	92	127

Table 2. Weed control in CRP - Minot

			Canada thistle		Perennial Sowth.		Absinth wormwd	
Treatment	Rate	Timing	Jul 2 2001	Jun 17 2002	Jul 02 2001	Jun 17 2002	Jul 2 2001	Jun 17 2002
			plants / m^2					
Redeem + NIS	1 pt + 0.25% v/v	June	8	2	11	0	5	2
Redeem + NIS	2.5 pt + 0.25% v/v	June	10	1	10	0	3	0
2,4-D ester	1 qt	June	15	4	16	0	3	1
Tordon + 2,4-D	0.5 pt + 1 qt	June	13	0	18	0	1	0
Tordon + 2,4-D	1 pt + 1 qt	June	14	0	16	0	8	0
Clipping		August	9	3	11	3	3	2
Clipping		August	4	3	10	2	6	6
LSD (0.05)			NS	2	NS	NS	NS	NS
CV			59	79	51	328	116	186

Preplant thifensulfuron&tribenuron in flax. (Howatt, Roach, and Davidson-Harrington) 'Rayhab 94' flax was seeded May 21 at Fargo. Preplant (PP) treatments were applied May 14 with 70 F, 19% relative humidity, 10 mph wind, and soil temperature at 52 F. Pre-emergence (PRE) treatments were applied May 22 with 58 F, 59% relative humidity, and 12 mph wind. All treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Table. Preplant thifensulfuron&tribenuron in flax.

			Jun 6	Jun 18		Jun 25	Jul 22
Treatment	Rate	Timing	Flax stand	Flax chlor	Flax std vig	Flax	Flax
	oz ai/A		pl/m	%			
Thifensulfuron&trib+NIS	0.15&0.07+0.25%	PP	38	1	0	0	0
Thif&tribenuron+NIS	0.25&0.13+0.25%	PP	36	2	4	2	0
Thif&trib+NIS	0.5&0.25+0.25%	PP	42	5	29	14	0
Thif&trib+NIS	0.15&0.07+0.25%	PRE	55	5	4	1	0
Thif&trib+NIS	0.25&0.13+0.25%	PRE	54	4	4	2	0
Thif+NIS	0.75+0.25%	PRE	47	5	5	5	0
Untreated	0		59	5	1	0	0
CV			43	74	63	58	0
LSD (P=0.05)			30	4	6	3	0

Flax stands in herbicide treated plots were not different from the untreated, although plant population tended to be less when thifensulfuron&tribenuron was applied 7 days before planting (PP). This may indicate movement of the herbicide into the germination zone of flax, however emerging flax plants did not show greater vegetative injury compared to the treatments applied after planting (PRE). Flax chlorosis and vigor on June 18 were not different from the untreated except for thifensulfuron&tribenuron at 0.5&0.25 oz/A PP. Excessive water resulted in minor chlorosis in all plots. On July 22, no herbicide injury was observed. Post-planting weed emergence caused significant yield reduction. These weeds were not controlled early to avoid confounding herbicide responses. Yields were not different for treatments and ranged from 5 to 8 bu/A.

Flax tolerance to preplant and preemergence glyphosate. Jenks, Willoughby, and Markle. Cathay flax was seeded June 5 into 7.5-inch rows at 50 lb/A. Individual plots were 10 x 30 ft and replicated four times. Treatments were applied 7 days prior to planting (DPP) on May 29, 1 DPP on June 4, and 2 days after planting (DAP) on June 7.

			Flax injury			Height	Sep 16	
Treatment[a]	Rate	Timing[b]	Jun 26	Jul 9	Aug 9	Sep 9	Yield	Test Wt
			———	%	———	in.	bu/A	lb/bu
No-Till								
Roundup Ultra Max	13 fl oz	7 DPP	0	0	0	21.4	17	53.1
Roundup Ultra Max	13 fl oz	1 DPP	0	0	0	21.0	15	53.2
Roundup Ultra Max	13 fl oz	2 DAP	0	0	0	21.0	15	53.3
RT Master	16 fl oz	7 DPP	0	0	0	21.0	15	53.2
RT Master	16 fl oz	1 DPP	0	0	0	21.0	15	53.2
Untreated			0	0	0	21.0	12	53.2
Conventional-Till								
Roundup Ultra Max	13 fl oz	7 DPP	0	0	0	22.3	13	53.0
Roundup Ultra Max	13 fl oz	1 DPP	0	0	0	21.5	13	52.9
Roundup Ultra Max	13 fl oz	2 DAP	0	0	0	22.0	14	52.8
RT Master	16 fl oz	7 DPP	0	0	0	21.0	13	53.0
RT Master	16 fl oz	1 DPP	0	0	0	21.6	12	52.7
Untreated			0	0	0	21.7	14	53.0
LSD (0.05)			NS	NS	NS	NS	NS	NS
CV			0	0	0	2.8	17	0.6

[a]*All treatments were applied with 1% w/w AMS.*
[b]*DPP=Days prior to planting; DAP=Days after planting.*

We evaluated flax tolerance to different formulations of glyphosate applied 7 days preplant, 1 day preplant, and 2 days after planting. The study was conducted in both a conventionally-tilled field as well as direct seeded (no-till).

We did not see any flax injury regardless of tillage system, herbicide formulation, or application timing. Flax heights were similar among treatments one week prior to harvest. The only trend was that the no-till treatments tended to yield a little higher than the conventionally-tilled treatments.

Flax tolerance to Bronate plus grass herbicides. Jenks, Willoughby, and Markle. Cathay flax was seeded May 17 into 7.5-inch rows at 50 lb/A. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied postemergence on June 20. The primary weeds were green and yellow foxtail.

		Foxtail		Flax						
		Control		Injury			Height	Sep 10		
Treatment	Rate	Jul 8	Aug 19	Jun 24	Jul 8	Aug 19	Jul 16	Yield	Test Wt	Oil
		—% —		—————% —————			in	bu/A	lb/bu	%
Untreated		0	0	0	0	0	22.0	8	52.3	41.3
Bronate[a]	11.4 fl oz	0	0	12	15	13	21.5	5	51.5	42.2
Bronate[a] + COC	11.4 fl oz + 1% v/v	0	0	14	16	14	21.8	6	51.5	41.0
Bronate[a] + Select	11.4 fl oz + 5 fl oz	95	96	12	12	10	20.7	7	52.5	42.4
Bronate[a] + Select + COC	11.4 fl oz + 5 fl oz + 1% v/v	92	95	9	9	4	21.5	6	52.3	42.5
Bronate[a] + Poast	11.4 fl oz + 16 fl oz	82	85	11	11	9	21.3	5	52.3	42.2
Bronate[a] + Poast + COC	11.4 fl oz + 16 fl oz + 1% v/v	87	88	11	12	8	20.7	6	52.4	42.5
Bronate[a] + Assure II	11.4 fl oz + 8 fl oz	63	65	12	13	8	21.3	6	52.3	41.8
Bronate[a] + Assure II + COC	11.4 fl oz + 8 fl oz + 1% v/v	82	79	10	13	11	20.8	6	52.3	41.7
LSD (0.05)		9	9	3	3	6	NS	NS	NS	NS
CV		9	9	15	16	37	3.5	26	0.6	1.8

[a]*Bronate=Bronate Advanced 5 EC.*

We evaluated flax tolerance to Bronate or Bronate + grass herbicide + oil combinations. Both Bronate with and without crop oil concentrate (COC) caused slight flax injury. Bronate plus either Select, Poast, or Assure II caused similar or less injury than Bronate alone. Adding COC to any tank mix did not significantly increase crop injury. Flax heights were similar across treatments in August. Foxtail control was better with Select than Poast or Assure II. Yields were very low and variable due to very dry conditions. Assure II is not registered for use in flax.

Weed control in flax. Jenks, Willoughby, and Markle. Cathay flax was seeded May 15 into 7.5-inch rows at 50 lb/A. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preemergence (PRE) on May 17 and postemergence (POST) on June 20. The entire plot was treated with Assure II one day prior to the POST broadleaf herbicide application.

Treatment	Rate	Timing	Flax injury			Sep 16		
			Jun 24	Jul 19	Aug 19	Yield	Test Wt	Oil
			——%——			bu/A	lb/bu	%
Untreated			0	0	0	6	51.5	42.6
Bronate Advanced	11.4 pt	POST	9	13	11	8	52.0	43.3
Bronate Advanced + Harmony GT + NIS	11.4 fl oz + 0.25 oz + 0.25% v/v	POST	15	35	21	6	51.7	42.6
Harmony GT + Clarity + NIS	0.25 oz + 2 fl oz + 0.25% v/v	POST	19	50	45	4		42.2
Spartan	2.67 oz	PRE	3	0	0	8	52.0	42.9
Spartan	5.33 oz	PRE	5	1	2	7	52.1	42.9
Spartan	10.67 oz	PRE	12	2	3	7	52.1	43.2
Spartan / Bronate Advanced	2.67 oz / 11.4 fl oz	PRE/ POST	11	8	9	7	52.0	42.8
Aim + NIS	0.33 oz + 0.25% v/v	POST	55	42	37	5	51.6	42.7
Aim + Harmony GT + NIS	0.33 oz + 0.25 oz + 0.25% v/v	POST	60	55	43	4		42.4
Aim + MCPA ester + NIS	0.33 oz + 0.5 pt + 0.25% v/v	POST	72	67	60	4		43.0
LSD (0.05)			5	16	18	2	0.3	0.6
CV			13	37	51	17	0.3	0.8

We evaluated flax tolerance to several registered and non-registered herbicides. Harmony GT, Clarity, and Aim are not registered for use in flax. Spartan was granted a specific exemption (Section 18) for the 2002 growing season. Tank mixes containing Harmony GT, Clarity, or Aim caused moderate to severe flax injury. Bronate Advanced caused slight flax injury. Low or high rates of Spartan caused minimal flax injury. Dry conditions led to low and variable flax yields. Weed pressure was low in this study.

Flax response to clethodim tank-mixes. (Howatt, Roach, and Davidson-Harrington) 'Rayhab 94' flax was seeded May 6 at locations near Fargo and Casselton, ND. At Fargo, treatments were applied to 7-inch flax, 3- to 5-leaf yellow foxtail, and 3-inch redroot pigweed on June 18 with 71 F, 69% relative humidity, 100% cloudcover, and 13 mph southeast wind. At Casselton, treatments were applied to blooming flax and 5- to 6-leaf yellow foxtail on July 3 with 86 F, 16% relative humidity, 0% cloudcover, and 3.5 mph north-northwest wind. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles at Fargo and 11001 flat fan nozzles at Casselton to a 7 ft wide area the length of 10 by 30 ft plots. The experiments were randomized complete block design with four replicates.

Table 1. Flax response to clethodim tank-mixes (Fargo).

		Jun 28			Jul 23		Sep 12
							Flax
Treatment[a]	Rate	Flax	Yeft	Rrpw	Yeft	Rrpw	yield
Name	oz ai/A			%			bu/A
Clethodim+PO	1+1%	0	90	0	98	0	9
Clethodim+PO	1.5+1%	0	93	0	98	0	10
Clethodim+PO	2+1%	0	93	0	98	0	9
Clethodim+clopyralid&MCPA+PO	1+8.3+1%	0	88	76	95	76	15
Clethodim+clopyralid&MCPA+PO	1.5+8.3+1%	0	94	79	96	75	14
Clethodim+bromoxynil&MCPA+PO	1+7.1+1%	0	91	73	96	42	12
Clethodim+bromoxynil&MCPA+PO	1.5+7.1+1%	0	89	71	96	47	12
Untreated	0	0	0	0	0	0	6
C.V.		0	3	19	2	23	16
LSD (P=0.05)		0	4	10	2	10	3

[a] Bromoxynil&MCPA was the 5 EC formulation.

Table 2. Flax response to clethodim tank-mixes (Casselton).

		Jun 28	
Treatment[a]	Rate	Flax	Yeft
	oz ai/A	%	
Clethodim+PO	1+1%	0	88
Clethodim+PO	1.5+1%	0	91
Clethodim+PO	2+1%	0	93
Clethodim+clopyralidy&MCPA+PO	1+8.3+1%	0	93
Clethodim+clopyralidy&MCPA +PO	1.5+8.3+1%	0	93
Clethodim+bromoxynil&MCPA+PO	1+7.1+1%	0	93
Clethodim+bromoxynil&MCPA+PO	1.5+7.1+1%	0	93
Untreated	0	0	0
CV		0	4
LSD (P=0.05)		0	5

[a] Bromoxynil&MCPA was the 5 EC formulation.

Clethodim and clethodim tank-mixes did not cause visible injury to flax. Yellow foxtail control on June 28 was at least 88% and clethodim activity was not antagonized by broadleaf herbicides included in the study. Clopyralid&MCPA provided 75% redroot pigweed control on July 23, while bromoxynil&MCPA only gave 42 to 47% control (Table 1). The Casselton experiment was terminated early because of water damage. The study at Fargo was also affected by water resulting in lower than usual yield.

Flax response to quizalofop. (Howatt, Roach, and Davidson-Harrington) 'Rayhab 94' flax was seeded May 6 at Fargo. Treatments were applied to 4- to 6-inch flax and 3- to 4-leaf yellow foxtail on June 13 with 72 F and 10 mph southwest wind. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Table. Flax response to quizalofop.

		Jun 21		Jul 23	Sep 12
Treatment	Rate	Flax	Yeft	Yeft	Yield
	oz ai/A	% inj	%	%	bu/A
Quizalofop+PO	1+1%	0	90	88	9
Quizalofop+PO	2+1%	0	93	88	11
Quizalofop+PO	4+1%	0	94	89	10
Clethodim+PO	1.5+1%	0	97	96	9
Untreated	0	0	0	0	6
CV		0	3	3	44
LSD (P=.05)		0	3	3	6

No flax injury was observed from herbicide treatments. Clethodim at 1.5 oz/A provided better yellow foxtail control than quizalofop at 1 to 4 oz/A on both evaluation dates. On July 23, foxtail control with quizalofop had declined slightly compared to the June 21 rating while foxtail control with clethodim remained consistent. Yield was lower than normal because of very wet growing conditions. It is not known whether this affected the performance of quizalofop.

Quizalofop for control of volunteer spring wheat in flax, Langdon. (Lukach) The experiment was seeded on May 20 with 'Alsen' hard red spring wheat seeded first to simulate volunteer and 'Rahab 94' flax over-seeded at a right angle to the Alsen. Fertility was adequate for a 35 bu/A flax yield goal. Treatments were applied to 5 inch tall flax on June 21 with 71°F, 31% RH, and 12 mph southeast wind. The sky was sunny and the foliage dry. The volunteer wheat was 5 leaf and the green foxtail and barnyard grass 1-4.5 leaf. The wheat population was 2 per ft^2 and foxtail 5 per yd^2. The barnyard grass was mostly in two reps at 12 per yd^2. Bronate Advanced, 12 oz/a, was applied June 13 and 27 for broadleaf weed control with only temporary curling or upper stem for injury. Treatments were applied with a tractor sprayer delivering 5 or 10 gpa by adjusting speed from 3 to 6 mph. XR8001VS tips at 40 psi were used. Plots size was 22 by 30 feet. The experiment was a randomized complete block design with four replicates. Harvest was on September 16.

			Control						
Treatment	Rate	Spray Volume	11-Jul Wht	11-Jul Grft&Bygr	17-Aug Wht	17-Aug Grft	17-Aug Bygr	Yield	Test Weight
	lb/a	gal/a	%	%	%	%	%	bu/a	lb/bu
Assure II + Mon 59112	0.028 +0.4375%v/v	5	85	89	95	95	97	19.1	53.5
Assure II + Mon 59112	0.034 +0.4375%v/v	5	91	93	99	98	100	20.6	53.8
Assure II + Mon 59112	0.028 +0.219%v/v	10	89	94	98	97	99	20.9	53.7
Assure II + Mon 59112	0.034 +0.219%v/v	10	93	94	99	98	98	22.5	53.8
Untreated	--	--	0	0	0	0	0	13.7	52.3
C.V. %			6	5	1	4	3	15.4	1.5
LSD 5%			7	6	2	4	6	4.6	NS
# OF REPS			4	4	4	4	2	4	4

Grassy weed control was good with both rates and spray volumes. Both weed control and yield were slightly increased by the higher Assure II rate and increased spray volume because the competition from volunteer wheat was heavy.

Kochia Control in Flax. (Terry D. Gregoire, 2002) Raheb 94 Flax was sprayed at 10:45 a.m. June 19th for broadleaf weeds near Webster, North Dakota. The temperature during application was 74°, relative humidity near 78% and clear skies. The soil was wet and leaves damp. 0.23 inches rain fell 3 hours after application followed by an additional rainfall of 2.0" two days later. The flax was 3-4" tall. Treatments were applied with a CO_2 pressurized back pack sprayer using 8.5 gpa at 40 psi and 8001 nozzles. Treatments were arranged in RCBD and replicated 4 times. Wild mustard, redroot pigweed and other broadleaf weeds were in the 2-4 leaf stage wild oat was 3-4 leaf. The whole plot was sprayed again July 5th with Poast at 1 pint plus 1 pt crop oil on 6 leaf green foxtail and volunteer wheat. The Dicamba formulation used was marketed as 4.0 lb a.i/a Clarity. Spartan was sprayed at the same time as other treatments.

Treatment	Product	Injury inch height reduction	Injury inch height reduction	Injury Height	Wild	Wild	Redroot	
	oz/A			Inches	Oat	Mustard	Pigweed	Yield
					----------Percent Control ----------			bu/A
		6/29/02	7/15/02	8/14/02				
untreated	0	0	0	24	0	0	0	18.7
Clarity	2 oz/a	1.0	0.3	27	0	83	93	23.2
Clarity+ POIL	2 +0.25G	3	0.8	22	0	48	68	
Clarity+MCPA	2 +8	4	1	21	0	90	100	18.2
Clarity	3 oz/a	0.3	0	23	0	78	93	22.1
Clarity+ POIL	3 +0.25G	4	2	20	0	69	93	
Clarity+ Curtail M	2 +24	4	2	21	0	100	100	20.4
Curtail M	24 oz/a	1	0	21	0	100	100	20.7
Bronate Advanced	12.8 oz/a	0.8	0.3	22	0	100	100	22.6
Spartan	4 oz/a	0.3	0.5	22	25	78	100	
Harmony GT	0.165 oz/a	2	0.5	22	0	100	100	26.2
Harmony GT+ Clarity	0.165+2	3	2	21	0	100	100	22.4
Clarity+ Select+ POIL	2+5+0.25G	4	0.5	22	100	41	63	
Select+ POIL	5 +0.25G	0	0	24	100	0	0	
LDS (P=.05)		1.45	0.78	1.52	19.10	25.30	20.09	8.7
Standard Deviation		1.02	0.54	0.90	13.36	17.71	11.97	5.0
CV		52.7	78.15	4.08	83.15	25.17	15.07	23.2

* 3 replications used for yield

Summary

Clarity when applied alone or at 2 to 3 oz of product did not significantly reduce flax height compared to the untreated at any evaluation date. Generally the addition of oil or other broadleaf products increased flax injury. The additional oil generally reduced broadleaf control and significantly increased flax injury. Wild oat control with Select was not reduced by Clarity. Flax treated with Clarity was noticeably greener August 14th than the untreated indicating maturity was delayed by about 4-7 days as compared to the untreated or other broadleaf treatments. Yields were not statistically different among harvested treatments.

Broad spectrum weed control in flax. (Howatt, Roach, and Davidson-Harrington) 'Rayhab 94' flax was seeded May 6 at Fargo. Preemergence (PRE) treatments were applied May 14 with 47 F, 59% relative humidity, 0% cloudcover, 4 to 8 mph southeast wind, and soil temperature of 54 F. Post treatments were applied to 7-inch flax, 3- to 4-inch redroot pigweed, 2-inch common lambsquarters, 1- to 3-leaf wild buckwheat, and 3- to 5-leaf yellow foxtail on June 13 with 72 F and 10 mph southwest wind. Treatments were applied with a backpack type sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

			Jun 29					Sep 12
Treatment	Rate	Timing	Flax	Rrpw	Colq	Wibu	Yeft	Yield
	oz ai/A				%			bu/A
Sulfentrazone	2	PRE	1	30	40	22	35	9
Sulfentrazone	3	PRE	1	74	87	66	50	14
Sulfentrazone	4	PRE	0	91	96	86	80	14
Sulfentrazone	6	PRE	1	92	97	91	85	17
Suen/seth+brox&MCPA+PO	3/4.5+7.2+0.25G	PRE/POST	1	89	95	93	94	18
Suen/seth+brox&MCPA+thif+PO	3/4.5+6+0.11+0.25G	PRE/POST	15	96	97	96	94	21
Suen/clet+brox&MCPA+thif+PO	3/1+6+0.11+0.25G	PRE/POST	19	96	97	96	93	21
Suen/seth+clpy&MCPA+dica+PO	3/4.5+9.4+1.5+0.25G	PRE/POST	8	94	97	95	96	19
Suen/clet+clpy&MCPA+dica+PO	3/1+9.4+1.5+0.25G	PRE/POST	14	95	97	93	95	18
Suen/seth+PO	3+4.5+0.25G	PRE/POST	1	85	94	86	95	17
Suen/clet+PO	3/1+0.25	PRE/POST	1	91	94	88	94	12
Clet+brox&MCPA+thif+PO	1+6+0.11+0.25G	POST	11	92	93	94	92	18
Clet+clpy&MCPA+dica+PO	1+9.4+1.5+0.25G	POST	3	89	95	88	95	17
Untreated	0		0	0	0	0	0	6
CV			82	5	4	5	7	26
LSD (P=.05)			6	6	4	6	8	6

Flax injury occurred when thifensulfuron or dicamba was included in the POST herbicide application. Injury was accentuated by wet soil conditions, which also reduced flaxseed yield potential. Injury tended to be more intense when clethodim was included for grass weed control compared to sethoxydim. Choice of POST grass control product did not affect broadleaf weed control. Sulfentrazone did not cause injury at any rate including 6oz/A, twice the labeled rate for this soil. Sulfentrazone at 4 oz/A, the higher labeled rate for this soil, delayed weed emergence by about 3 weeks. Increasing sulfentrazone rate to 6 oz/A did not improve weed control compared to 4 oz/A. PRE/POST or POST treatments were generally more effective in controlling weeds and resulting in greater yield than PRE treatments alone. PRE/POST treatments that included thifensulfuron tended to result in the greatest yield even though these treatments caused the most early season flax injury.

Flax response to application timing of postemergence herbicides. Blaine G. Schatz and Gregory J. Endres. (Carrington Research Extension Center, North Dakota State University, Carrington, ND 58421) The trial was conducted to evaluate flax response to three application timings of selected POST herbicides. The experimental design was a randomized complete block design with a split-plot arrangement (main plots=herbicide application timing and subplots=herbicide treatments) and three replicates. The trial was conducted on a conventional-tilled, loam soil with 7.6 pH and 3.0% organic matter at Carrington, ND in 2002. 'Cathay' flax was seeded on May 3 at the rate of 42 lb/A. Herbicide treatments were applied to the center 6.7 ft of 10- by 25-ft plots with a CO_2 pressurized hand-held plot sprayer delivering 17 gal/A at 30 psi through 8002 flat fan nozzles for the PRE treatment and 35 psi through 80015 flat fan nozzles for POST treatments. PRE sulfentrazone was applied on May 10 with 60 F, 24% RH, 70% clear sky and dry soil surface. No significant rain was received during May following sulfentrazone application. Early POST (POST A) treatments were applied on June 7 with 57 F, 69% RH, 0% clear sky, and 5 mph wind to 2-inch tall flax. Mid POST (POST B) treatments were applied on June 19 with 67 F, 84% RH, 10% clear sky, and 5 mph wind to 5- to 7-inch tall flax and emerging to 6-inch tall weeds. Late POST (POST C) treatments were applied on June 27 with 78 F, 59% RH, 50% clear sky, and 5 mph wind to 10- to 14-inch tall (initial flowering stage) flax and 4- to 10-inch tall weeds. Density of weed species was low, ranging from 0 to 3 plants/ft^2. The trial was harvested on September 3 with a plot combine.

Grass and broadleaf weed control ranged from 80 to 99% with bromoxynil&MCPA or clopyralid&MCPA and clethodim tank mixtures, or the three-way tank mixture (Table 1). Weed control generally was not affected by timing of herbicide application. Averaged across herbicide treatments, flax growth reduction was higher with the first two herbicide application times compared to the late application (Table 2). However, first flower dates were delayed and seed yield was reduced as application timing was delayed. Physiological maturity was not affected by application timing (data not shown). Seed yield with POSTA application timing was 17% greater than POSTC yield. Herbicide treatments that included clopyralid&MCPA generally had significant flax growth reduction ranging from 3 to 47% (Table 3). Flax injury did not occur with sulfentrazone (data not shown). This was probably due to the extended delay of rainfall following application of sulfentrazone. While seed yield was improved with herbicides, application timing of the seven herbicide treatments did not impact seed yield or test weight (Table 4).

Table 1. Weed control in flax as impacted by three application timings of herbicides.

		Weed control[a]					
		Grass			Broadleaf		
Herbicide		Herbicide aplication timing[b]					
Treatment[c]	Rate	POSTA	POSTB	POSTC	POSTA	POSTB	POSTC
	lb/A	%					
Sulfentrazone/Bromoxynil&MCPA+ clethodim+COC	0.19/0.23&0.23+ 0.08+2pt	95	95	92	99	98	98
Bromoxynil&MCPA	0.23&0.23	0	0	0	93	86	87
Clopyralid&MCPA	0.07&0.39	0	0	0	87	91	85
Bromoxynil&MCPA+clopyralid&MCPA	0.23&0.23+0.07&0.39	0	0	0	97	95	95
Bromoxynil&MCPA+clethodim+COC	0.23&0.23+0.08+2pt	96	95	89	95	87	90
Clopyralid&MCPA+clethodim+COC	0.07&0.39+0.08+2pt	98	92	90	80	90	90
Bromoxynil&MCPA+clopyralid&MCPA + clethodim+COC	0.23&0.23+0.07&0.39+ 0.08+2pt	99	92	91	97	93	85
Untreated check	x	0	0	0	0	0	0
Interaction of Timing x Herbicide: LSD (0.05)		NS			6		

[a]Grass=yellow and green foxtail; Broadleaf=Common lambsquarters, redroot and prostrate pigweed, common purslane, and wild buckwheat. Visual evaluation one month after herbicide application.

[b]POSTA=June 7; POSTB=June 19; POSTC=June 27.

[c]Bromoxynil&MCPA=Bronate Advanced; COC=Destiny, a methylated seed oil from Agriliance, St. Paul, MN.

Table 2. Flax response to herbicide treatments across three application timings.

	Flax			
Herbicide application timings[a]	Injury[b]	First flower[c]	Seed yield	Test weight
	%	days	bu/A	lb/bu
POSTA	18	56	21.0	54.4
POSTB	19	58	19.2	54.3
POSTC	6	63	17.4	54.3
LSD (0.05)	8	1	1.6	NS

[a]POSTA=June 7; POSTB=June 19; POSTC=June 27.

[b]Injury=% growth reduction by visual evaluation 7 days after herbicide application.

[c]Days from seeding date.

Table 3. Flax injury and days to first flower as impacted by three application timings of herbicides.

		Flax					
		Injury[a]			Days to first flower[b]		
Herbicide		Herbicide application timing[c]					
Treatment[d]	Rate	POSTA	POSTB	POSTC	POSTA	POSTB	POSTC
	lb/A						
Sulfentrazone/Bromoxynil&MCPA+ clethodim+COC	0.19/0.23&0.23+ 0.08+2pt	10	3	0	55	56	59
Bromoxynil&MCPA	0.23&0.23	3	10	3	55	58	65
Clopyralid&MCPA	0.07&0.39	8	13	3	56	58	65
Bromoxynil&MCPA+clopyralid&MCPA	0.23&0.23+0.07&0.39	42	33	15	57	59	66
Bromoxynil&MCPA+clethodim+COC	0.23&0.23+0.08+2pt	8	12	2	56	57	60
Clopyralid&MCPA+clethodim+COC	0.07&0.39+0.08+2pt	25	38	12	56	59	66
Bromoxynil&MCPA+clopyralid+MCPA+ clethodim+COC	0.23&0.23+0.07&0.39+ 0.08+2pt	47	43	12	57	60	66
Untreated check	x	0	0	0	55	55	55
Interaction of Timing x Herbicide: LSD (0.05)		9			2		

[a]Injury=% growth reduction by visual evaluation 7 days after herbicide application.

[b]Days from seeding date.

[c]POSTA=June 7; POSTB=June 19; POSTC=June 27.

[d]Bromoxynil&MCPA=Bronate Advanced; COC=Destiny, a methylated seed oil from Agriliance, St. Paul, MN.

Table 4. Flax seed yield and test weight as impacted by three herbicide application timings of herbicides.

Herbicide		Seed yield			Test weight		
		bu/acre			lb/bu		
		Herbicide application timing[a]					
Treatment[b]	Rate	POSTA	POSTB	POSTC	POSTA	POSTB	POSTC
	lb/A						
Sulfentrazone/Bromoxynil&MCPA+ clethodim+COC	0.19/0.23&0.23+ 0.08+2pt	22.3	21.0	20.4	54.8	54.5	54.6
Bromoxynil&MCPA	0.23&0.23	18.9	19.6	17.3	53.8	54.1	54.1
Clopyralid&MCPA	0.07&0.39	21.3	18.9	19.6	54.6	54.2	54.1
Bromoxynil&MCPA+clopyralid&MCPA	0.23&0.23+0.07&0.39	20.6	21.7	17.2	54.2	53.8	54.1
Bromoxynil&MCPA+clethodim+COC	0.23&0.23+0.08+2pt	24.6	20.8	19.3	54.1	54.4	54.3
Clopyralid&MCPA+clethodim+COC	0.07&0.39+0.08+2pt	23.4	20.6	16.2	54.7	54.7	54.1
Bromoxynil&MCPA+clopyralid+MCPA+ clethodim+COC	0.23&0.23+0.07&0.39+ 0.08+2pt	24.0	18.8	17.5	54.7	54.5	54.6
Untreated check	x	12.9	12.4	12.0	54.6	53.9	54.6
Interaction of Timing x Herbicide: LSD (0.05)		NS					

[a]POSTA=June 7; POSTB=June 19; POSTC=June 27.

[b]Bromoxynil&MCPA=Bronate Advanced; COC=Destiny, a methylated seed oil from Agriliance, St. Paul, MN.

Herbicide Screening for Weed Control in Flax and Tame Buckwheat. (Terry D. Gregoire) Flax and buckwheat were planted July 26th at Langdon to establish plants for a fall herbicide application to screen for injury potential. Treatments were applied August 22nd between 10:30 a.m. and 11:00 a.m. it was sunny, 72°F, with a Relative Humidity of 60%. The buckwheat was 6-8 leaf and flax was 1-2" tall. Treatments were applied with a CO_2 pressurized back pack sprayer using 8.5 GPA at 40 psi and 8001 nozzles. Treatments were visually evaluated for fresh weight reduction August 28th. Treatments were replicated 3 times in RCBD.

Treatments		Oz Product Per Acre	Percent Fresh Weight Reduction Flax	Buckwheat
1	Callisto oil uan	3 oz/a 1% v/v 2.5% v/v	26	70
2	Callisto oil uan	2 0z/a % v/v 2.5% v/v	20	68
3	Callisto oil uan	1.5 oz/a 1% v/v 2.5% v/v	18	62
4	Stinger	5.3 oz/a	0	0
5	Stinger	4 oz/a	0	0
6	Untreated		0	0

Summary Callisto severely injured tame buckwheat at all rates treated. Flax growing points were chlorotic in Callisto treatments but most plants appeared capable of recovery. Plants smaller than ½" were killed. Stinger did not injure flax or buckwheat.

Weed Control in Flax, Langdon. (Lukach, Gregoire). Pre-plant incorporated and seeding of Rahab 94 flax was on May 24. The pre-emergence, non-incorporated treatments were applied on May 29. Rain delayed post treatments until June 24. Select, 5 oz/a + PO 1qt/a was applied to all treatments except the one shot treatments on June 29.

		June 24					Jun 29	July 24						
Treatment and Rate oz/a **		Flax Injury	Stand Redu	Wioa	Wimu	Wibw	Flax Injury	Kocz	Rrpw	Wibw	Wimu	Vol Cano	Height	Flax Yield
		----------%----------											cm	bu/a
Spartan 4 / BronateAd 12.8	PPI/P	4.5	0.0	0	13	25	7.5	98	88	85	98	91	52	9.4
Spartan 8	PPI	15.0	10.0	0	50	90	--	79	80	91	23	0	55	7.8
Spartan 4	PPI	3.3	0.0	0	15	23	--	90	91	66	18	0	52	5.1
Treflan 16+Spartan 4	PPI	20.0	15.0	63	18	53	--	88	91	88	8	0	61	4.2
Treflan 16+Spartan 2.7	PPI	10.0	6.3	66	5	48	--	41	85	66	0	0	60	4.1
Spartan 5.3	PPI	8.8	2.5	0	25	50	--	94	89	81	16	0	52	3.5
Treflan 16	PPI	3.8	5.0	68	0	40	--	66	85	81	0	0	54	2.8
Spartan 2.7	PPI	0.0	0.0	0	0	0	--	76	39	10	19	0	53	2.2
Treflan 32	PPI	25.0	30.0	90	0	35	--	56	70	53	0	0	62	1.9
Spartan 4 / BronateAd 12.8	PE/P	1.3	0.0	0	9	15	6.3	96	83	79	100	93	53	10.4
Spartan 2.7	PE	0.0	0.0	0	0	0	--	84	78	58	19	0	57	7.1
Spartan 8	PE	10.0	0.0	0	33	30	--	96	93	84	56	0	56	6.9
Spartan 4	PE	0.5	0.0	0	0	10	--	86	86	45	53	0	53	6.2
Spartan 5.3	PE	3.8	0.0	0	13	23	--	94	90	44	53	0	52	4.5
Clarity 2+CurtailM 24	Post	--	--	--	--	--	52.5	100	86	91	100	100	49	12.4
BronateAd 12.8+NIS.25%	Post	--	--	--	--	--	12.5	80	47	60	92	78	51	11.3
BronateAdvanced 12.8	Post	--	--	--	--	--	5.3	79	43	88	100	95	52	10.4
CurtailM 24+Buctril 16	Post	--	--	--	--	--	38.8	79	65	93	100	100	49	9.4
BronateAdvanced 22.6	Post	--	--	--	--	--	47.5	78	68	86	100	100	50	8.3
CurtailM 24+NIS.25%	Post	--	--	--	--	--	47.5	41	53	80	100	100	50	8.2
CurtailM 16+Clarity 2+NIS .25%	Post	--	--	--	--	--	35	93	70	76	100	99	48	8.1
CurtailM 24	Post	--	--	--	--	--	45	41	46	65	100	100	51	7.2
Clarity 2	Post	--	--	--	--	--	8.5	95	85	45	49	0	47	5.8
CurtailM 16	Post	--	--	--	--	--	28.8	18	46	60	100	100	53	5.0
MCPAester 8 +NIS.25%	Post	--	--	--	--	--	20	26	33	0	100	100	51	3.0
Clarity 2+NIS.25%	Post	--	--	--	--	--	25	93	86	48	40	3	49	2.5
BronateAd 12.8+Select 5+PO 32	1shot	--	--	--	--	--	18.8	76	39	88	100	84	54	12.6
CurtailM 16+Clarity 2+Select 5+NIS	1shot	--	--	--	--	--	40	97	62	70	100	100	50	11.2
CurtailM 24+Select 5+PO 32	1shot	--	--	--	--	--	52.5	16	58	80	100	100	48	8.4
Clarity 3+Select 5+NIS .25%	1shot	--	--	--	--	--	30	94	75	44	42	14	51	1.6
Clarity 2+Select 5+NIS .25%	1shot	--	--	--	--	--	15	89	55	25	31	3	50	1.6
Select 5+PO 32	1shot	--	--	--	--	--	0	0	0	0	0	0	53	1.2
Check	--	0.0	0.0	0	0	0	0	0	0	0	0	0	53	0.4
C.V. %		61.0	79.4	18	73	43	29.4	29	26	30	19	10	10	36.1
LSD 5%		6.1	5.2	5	12	18	11.2	29	24	26	15	6	7	3.7
# OF REPS		4	4	4	4	4	4	4	4	4	4	4	4	3

No rain, except one 0.14 inch shower, occurred between planting and June 8. 6.37 inches of rain were received between June 8 and June 24. Lack of early rain caused few weeds to emerge except wild oats while good flax stands were established before the pre-emergence treatments of Spartan were activated. All treatments received Select 5oz/a +PO 32oz/a on June 29 except the One Shot treatments which received a Select tank mix on June 24. The wild oats were thick and already 5 leaf on the June 24 and the 5 day delay in Select application likely affected yield. Control of both kochia and volunteer canola was needed for a treatment to have increased yield. The HarmonyGT was inadvertently left out of some spray solutions which would have provided improved canola control but increased risk of flax injury.

Weed control in onion sets at Absaraka, ND. Harlene Hatterman-Valenti and Paul Mayland. A late-planted experiment was conducted on the NDSU Research Station near Absaraka, ND to evaluate weed control and onion set safety from various herbicide regimes. The field was in potatoes in 2001. The field was rototilled early spring and then again prior to planting onion sets with a transplanter on July 2, 2002. Preemergence herbicides were applied on July 11 (timing A); 20 gpa of 28% liquid N applied July 12 across all treatments (timing B); and postemergence herbicides were applied on July 22, 2002 (timing C). The average wind speeds were 3, 6 and 8 mph; RH of 68, 66 and 57%; air temperatures of 71, 77, and 69°F; and soil temperatures of 70, 77 and 76°F, respectively. All preemergence treatments were applied using a 3-nozzle backpack CO_2 sprayer with 11002 flat fan nozzles spaced at 19 inches, pressure set at 30 psi, and 20 gpa output. The postemergence treatments were applied with the same unit using 11005 nozzles at 45 gpa. The trial was arranged as a RCBD with 4 replications. Individual plots consisted of three rows and a length of 20 feet. The control was hand weeded on July 22 and August 20, 2002. Due to the late planting of the trial, Cheal (common lambsquarter) and Porol (common purslane) were the only consistent weeds in the trial.

Summary:

Treatments with Callisto showed severe onion injury. Most leaves were completely white by the initial evaluation period and eventually killed many of the plants. The only other treatment causing more than 10% injury was Balance Pro followed by Buctril + Goal. Acceptable season-long common lambsquarters control (and crop safety) was achieved by treatments that included preemergence applications of Authority, Dual Magnum II, Nortron, or Surpass. Acceptable season-long common purslane control (and crop safety) was achieved by all treatments except Python followed by Buctril + Goal, Surpass followed by Stinger + Buctril, and Basagran.

Table 1. Late planted onion set tolerance and weed control.

Treatment	Rate (ai/A)	Applic. Timing	August 01, 2002			August 22, 2002		
			Phyto	Cheal	Porol	Phyto	Cheal	Porol
					%			
Untreated + Handweed		C	0	100	100	0	100	100
Prowl +	0.62 lb	A						
Buctril + Goal	0.375+0.125 lb	C	2	89	94	2	74	93
Nortron +	2 lb	A						
Buctril + Goal	0.375+0.125 lb	C	8	97	98	4	96	100
Buctril + Prowl +	0.25+0.412 lb	A						
Buctril + Goal	0.375+0.125 lb	C	1	86	93	1	70	91
Dual Magnum +	0.95 lb	A						
Buctril + Goal	0.375 + 0.125 lb	C	4	98	95	3	94	90
Outlook +	0.75 lb	A						
Buctril + Goal	0.375+0.125 lb	C	1	94	94	2	78	90
Authority +	2.24 oz	A						
Buctril + Goal	0.375+0.125 lb	C	2	98	96	5	100	94
Callisto +	1.5 oz	C						
COC + UAN28%	1%+2.5% v/v	C	71	98	30	94	100	20
Outlook +	0.75 lb	A						
Callisto +	1.5 oz	C						
COC + UAN 28%	1% + 2.5% v/v	C	71	98	22	92	100	21
Valor +	0.045 oz	A						
Callisto +	1.5 oz	C						
COC + UAN 28%	1% + 2.5% v/v	C	71	98	22	90	100	15
Valor +	0.045 oz	A						
Buctril + Goal	0.375+0.125 lb	C	1	87	98	2	68	92
Authority +	2.24 oz	A						
Callisto +	1.5 oz	C						
COC + UAN28%	1%+2.5% v/v	C	74	98	18	90	100	12
Buctril + Goal +	0.375+0.125 lb	A						
Buctril + Goal	0.375+0.125 lb	C	1	71	89	1	74	90
Surpass +	1.75 lb	A						
Buctril + Goal	0.375+0.125 lb	C	1	82	95	1	86	91
Surpass +	1.75 lb	A						
Stinger + Buctril	3 oz + 0.375 lb	C	1	94	89	3	99	72
Python +	0.88 oz	A						
Buctril + Goal	0.375+0.125 lb	C	1	98	20	0	75	22
Balance Pro +	1.0 oz	A						
Buctril + Goal	0.375+0.125 lb	C	14	98	98	16	100	98
Basagran	0.75 lb	C	0	42	29	0	30	35
LSD .05				4	4	7	8	16

Onion Weed Control - Oakes. Richard Greenland, Harlene Hatterman-Valenti, Paul Hendrickson. Weed control is difficult in onions because onions do not compete well with weeds and few herbicides are available for onion production. In this experiment we looked at several new herbicide and herbicide combinations for use in onions, along with some new application timings for labeled herbicides. This study was on a Hecla sandy loam, pH of 6.6, and 2.0% organic matter. Teton onions and a barley living mulch were direct seeded into a fine seedbed on April 25. Onions were planted in paired rows (3 inches apart), with the paired rows on 18-inch centers. A row of barley was planted between onion rows. Seeding rate was 174,000 seeds/acre for onions and 0.45 bu/acre for the barley. Plots were 17 ft long by 8 ft wide. The experiment was subsurface drip irrigated. Fertilizer and fungicides were applied as needed.

Treatments were applied with a CO_2 backpack sprayer using AI 110-04 flat fan nozzles, 45 gpa, and 57 psi (except treatment POST2 which was applied using 8002 flat fan nozzles, 15 to 25 gpa, and 36 psi). Treatment application data is given in Table 1. On May 29, Fusilade + NIS (12 oz/acre + 1 pt/25 gal) was applied to the entire study with a tractor mounted sprayer using AI 110-04 flat fan nozzles, 36 gpa, and 55 psi pressure. This was to kill the barley cover crop which was about 7 inches tall and vigorously growing. Weed ratings were taken on May 31, June 18, July 5, and Sept. 11. Onions were pulled by hand on Sept. 18 and 19, and bagged on Oct 7 and 8.

Summary. Valor injured onion when applied PRE. Nortron injured onion and severely injured the barley cover crop. Valor and Nortron controlled weeds early, but lost control later in the season. Onion yield for these treatments was close to zero because of onion injury and weed competition, except for when Buctril + Goal was added to the Nortron treatment. Buctril + Goal gave good control of pigweed and excellent control of lambsquarters and hairy nightshade. The half rate of Buctril + Goal did not injure onions less and was a little weak on pigweed and nightshade. Spraying 28% N increased redroot pigweed control slightly vs. broadcasting urea. Authority gave good weed control early, but lost control of hairy nightshade later in the season, which eliminated any onion yields. When Buctril + Goal was applied at POST4 and POST6, applying Dual, Outlook, Prowl, or Authority at POST5 did not improve late season weed control.

Table 1. Treatment application data at the Oakes Irrigation Research Site.

Application timing	Date	Time	Barley height	Onion height	Onion growth stage	Weed height	Weed growth stage
PRE1	April 26	10:30 am	0	0	0	0	0
PRE2	May 10	10:15 am	1"	0	0	<¼"	cot.
PRE3	May 13	9:45 am	2"	0	0	¼"	cot.
POST1	May 24	9:00 am	4.5"	1"	loop to flag lf	½ to 1"	cot. to 2 lf
POST2	May 31	10:15 am	7.5"	3"	1 true leaf	1 to 2"	2 to 4 lf
POST3	June 5	10:00 am	7" (dying)	4.5"	1.3 true leaf	1 to 3"	2 to 5 lf
POST4	June 7	2:30 pm	6" (dying)	5"	1.8 true leaf	1 to 5"	2 to 8 lf
POST5	June 11	4:00 pm	3" (dead)	6"	2.5 true leaf	2"	mostly dead
POST6	June 25	3:15 pm	---	8"	5 true leaf	1 to 6"	4 to 12 lf

Table 2. Onion injury, barley cover crop injury, and redroot pigweed ratings at the Oakes Irrigation Research Site.

Herbicides	Rates	Application timing	Onion injury			Barley injury	Redroot pigweed ratings			
			5/31	6/18	7/5	5/31	5/31	6/18	7/5	9/11
			0 to 10[1]							
Prowl	1.5 pt	POST1 & 5	0.0 a[2]	0.0 a	1.0 abc	0.0 a	9.3 a-d	9.8 ab	9.5 ab	8.3 a-d
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Dacthal	8 lbs	PRE2	0.0 a	0.5 a	1.0 abc	0.0 a	8.8 b-e	9.5 abc	9.0 abc	7.0 de
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl	1.5 pt	POST5								
Valor	1.5 oz	PRE1	2.3 cd	0.3 a	3.8 e	0.0 a	8.5 cde	6.3 d	5.0 e	4.3 fg
Valor	3.0 oz	PRE1	2.8 d	0.3 a	1.8 cd	0.0 a	10.0 a	8.8 c	7.0 d	6.8 de
Prowl	1.5 pt	PRE1	0.3 ab	0.0 a	0.8 abc	0.0 a	8.5 cde	6.8 d	4.5 e	3.5 g
Valor	1.5 oz	POST4								
Nortron	3 pts	PRE1	4.0 e	1.3 b	5.3 f	7.0 b	9.5 abc	9.0 bc	8.0 cd	7.3 cde
Nortron	6 pts	PRE1	4.3 e	1.8 b	3.0 e	9.0 d	9.8 ab	9.0 bc	8.8 bc	9.0 abc
Nortron	3 pts	PRE1	2.3 cd	1.3 b	1.5 bc	7.5 c	10.0 a	10.0 a	10.0 a	9.0 abc
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl	1.5 pts	POST1 & 5	0.3 ab	0.0 a	0.5 ab	0.0 a	9.3 a-d	9.5 abc	8.8 bc	6.0 ef
Buctril + Goal	¾ + ¼ pt	POST3 & 6								
Prowl	1.5 pts	POST1 & 5	0.8 ab	0.0 a	0.5 ab	0.0 a	9.4 abc	9.8 ab	9.3 ab	7.5 cde
Buctril + Goal	¾ + ¼ pt	POST4 & 6								
Prowl	1.5 pt	POST1	1.3 bc	0.3 a	0.8 abc	0.0 a	9.3 a-d	10.0 a	10.0 a	8.0 bcd
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Buctril	1 pt	PRE3	0.3 ab	0.0 a	1.0 abc	0.0 a	8.7 b-e	9.8 ab	9.5 ab	6.6 de
Prowl	1.5 pt	POST1 & 5								
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl[3]	1.5 pt	POST1 & 5	0.0 a	0.3 a	0.8 abc	0.0 a	8.3 de	9.5 abc	9.5 ab	7.5 cde
Urea	130 lbs	POST2								
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl[3]	1.5 pt	POST1 & 5	0.3 ab	0.3 a	0.3 a	0.0 a	9.0 a-e	9.5 abc	9.8 ab	8.0 bcd
28% N + urea	15 gal + 33 lbs	POST2								
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl[3]	1.5 pt	POST1 & 5	0.0 a	0.0 a	0.5 ab	0.0 a	9.5 abc	9.5 abc	9.5 ab	7.5 cde
28% N	25 gal	POST2								
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl	1.5 pt	POST1	0.3 ab	0.3 a	0.8 abc	0.0 a	9.3 a-d	10.0 a	10.0 a	8.0 bcd
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Dual II Magnum	1 pt	POST5								
Prowl	1.5 pt	POST1	0.0 a	0.0 a	1.3 abc	0.0 a	8.8 b-e	10.0 a	10.0 a	9.0 abc
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Outlook	1 pt	POST5								
Prowl	1.5 pt	POST1	0.5 ab	0.3 a	2.8 de	0.0 a	9.0 a-e	10.0 a	10.0 a	9.5 ab
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Authority	3 oz	POST5								
Prowl	1.5 pt	POST1	0.8 ab	0.5 a	3.3 e	0.0 a	9.3 a-d	10.0 a	9.8 ab	8.3 a-d
Authority	3 oz	POST5								
Prowl	1.5 pt	PRE1	0.7 ab	0.0 a	0.3 ab	0.0 a	8.1 e	8.8 bc	9.1 abc	6.3 def
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl	1.5 pt	POST5								
Handweed			0.0 a	0.0 a	0.5 ab	0.0 a	8.3 de	10.0 a	10.0 a	10.0 a
Probability			<.0001	<.0001	<.0001	<.0001	0.006	<.0001	<.0001	<.0001
C.V. (%)			89	145	58	19	8	7	9	18

[1]Ratings: 0 is no effect (no weed control or no crop injury); 10 is complete weed or crop kill.
[2]Values in the same column followed by the same letter are not significantly different at the 0.05 level.
[3]Except for these treatments, all treatments received 20 gal of 28% N applied POST2.

Table 3. Common lambsquarters and hairy nightshade weed ratings in onion study at the Oakes Irrigation Research Site.

Herbicides	Rates	Application timing	Common lambsquarters ratings				Hairy nightshade ratings			
			5/31	6/18	7/5	9/11	5/31	6/18	7/5	9/11
			0 to 10[1]							
Prowl	1.5 pt	POST1 & 5	9.3 a-d[2]	10.0 a	10.0 a	10.0 a	8.5 bcd	10.0 a	10.0 a	9.0 ab
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Dacthal	8 lbs	PRE2	9.5 abc	10.0 a	10.0 a	10.0 a	6.0 f	10.0 a	10.0 a	7.8 bc
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl	1.5 pt	POST5								
Valor	1.5 oz	PRE1	10.0 a	9.0 c	8.5 b	6.3 cd	9.3 ab	7.8 de	5.8 b	1.3 ef
Valor	3.0 oz	PRE1	9.8 ab	9.0 c	8.0 b	6.3 cd	10.0 a	9.0 bc	9.3 a	5.0 d
Prowl	1.5 pt	PRE1	9.6 abc	9.3 bc	8.0 b	7.0 bc	8.5 bcd	8.5 cd	6.8 b	1.8 e
Valor	1.5 oz	POST4								
Nortron	3 pts	PRE1	7.8 e	6.3 d	6.3 c	4.5 d	9.8 a	6.3 f	3.8 c	0.3 ef
Nortron	6 pts	PRE1	9.5 abc	8.5 c	8.8 b	8.8 ab	9.4 ab	7.0 ef	4.3 c	0.0 f
Nortron	3 pts	PRE1	9.3 a-d	10.0 a	10.0 a	10.0 a	9.0 abc	10.0 a	10.0 a	9.3 ab
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl	1.5 pts	POST1 & 5	9.0 bcd	9.8 ab	9.8 a	10.0 a	8.0 cd	9.8 ab	10.0 a	8.5 abc
Buctril + Goal	¾ + ¼ pt	POST3 & 6								
Prowl	1.5 pts	POST1 & 5	8.8 cd	9.3 bc	10.0 a	9.8 a	8.3 bcd	9.8 ab	9.8 a	7.0 c
Buctril + Goal	¾ + ¼ pt	POST4 & 6								
Prowl	1.5 pt	POST1	9.3 a-d	10.0 a	10.0 a	9.8 a	8.3 bcd	10.0 a	10.0 a	10.0 a
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Buctril	1 pt	PRE3	10.0 a	10.0 a	10.0 a	9.6 a	8.5 bcd	10.0 a	10.0 a	9.5 a
Prowl	1.5 pt	POST1 & 5								
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl[3]	1.5 pt	POST1 & 5	9.1 a-d	10.0 a	10.0 a	10.0 a	8.4 bcd	10.0 a	10.0 a	9.5 a
Urea	130 lbs	POST2								
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl[3]	1.5 pt	POST1 & 5	9.3 a-d	10.0 a	10.0 a	10.0 a	8.3 bcd	10.0 a	10.0 a	9.8 a
28% N + urea	15 gal + 33 lbs	POST2								
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl[3]	1.5 pt	POST1 & 5	8.8 cd	10.0 a	10.0 a	10.0 a	8.0 cd	10.0 a	10.0 a	10.0 a
28% N	25 gal	POST2								
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl	1.5 pt	POST1	9.3 a-d	9.8 ab	10.0 a	10.0 a	7.5 de	10.0 a	10.0 a	10.0 a
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Dual II Magnum	1 pt	POST5								
Prowl	1.5 pt	POST1	9.3 a-d	10.0 a	10.0 a	10.0 a	8.0 cd	10.0 a	10.0 a	9.5 a
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Outlook	1 pt	POST5								
Prowl	1.5 pt	POST1	9.5 abc	10.0 a	10.0 a	10.0 a	7.5 de	10.0 a	10.0 a	10.0 a
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Authority	3 oz	POST5								
Prowl	1.5 pt	POST1	9.5 abc	9.3 bc	9.8 a	9.8 a	8.0 cd	9.3 abc	6.0 b	0.0 f
Authority	3 oz	POST5								
Prowl	1.5 pt	PRE1	9.8 ab	9.9 ab	9.9 a	9.9 a	7.4 de	9.7 ab	10.0 a	8.3 abc
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6								
Prowl	1.5 pt	POST5								
Handweed			8.5 de	10.0 a	10.0 a	10.0 a	6.5 ef	10.0 a	10.0 a	10.0 a
Probability			0.006	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
C.V. (%)			7	6	6	14	10	6	10	18

[1]Ratings: 0 is no effect (no weed control or no crop injury); 10 is complete weed or crop kill.
[2]Values in the same column followed by the same letter are not significantly different at the 0.05 level.
[3]Except for these treatments, all treatments received 20 gal of 28% N applied POST2.

Table 4. Onion yields and total number of bulbs in weed control study at the Oakes Irrigation Research Site.

Herbicides	Rates	Application timing	Onion yields (by onion diameter) >3.5"	3 to 3.5"	2.25 to 3"	<2.25"	total US #1	total yield	Total bulbs
			cwt/acre						1000s/A
Prowl	1.5 pt	POST1 & 5	25 b-e[1]	108 abc	76 de	11 ab	209 abc	269 abc	63 ab
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Dacthal	8 lbs	PRE2	16 b-f	72 c	85 cde	12 ab	174 c	231 c	58 b
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Prowl	1.5 pt	POST5							
Valor	1.5 oz	PRE1	0 f	0 d	0 f	0 c	0 d	0 d	0 c
Valor	3.0 oz	PRE1	0 f	0 d	12 f	12 ab	12 d	28 d	17 c
Prowl	1.5 pt	PRE1	0 f	0 d	0 f	0 c	0 d	0 d	0 c
Valor	1.5 oz	POST4							
Nortron	3 pts	PRE1	0 f	0 d	0 f	0 c	0 d	0 d	0 c
Nortron	6 pts	PRE1	0 f	0 d	0 f	0 c	0 d	0 d	0 c
Nortron	3 pts	PRE1	36 abc	129 ab	59 e	7 bc	224 abc	273 abc	61 ab
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Prowl	1.5 pts	POST1 & 5	16 b-f	104 abc	92 b-e	13 ab	212 abc	268 abc	68 ab
Buctril + Goal	¾ + ¼ pt	POST3 & 6							
Prowl	1.5 pts	POST1 & 5	13 c-f	80 c	97 a-e	13 ab	190 bc	246 bc	65 ab
Buctril + Goal	¾ + ¼ pt	POST4 & 6							
Prowl	1.5 pt	POST1	45 a	129 ab	91 b-e	7 bc	265 a	320 a	69 ab
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Buctril	1 pt	PRE3	18 b-f	72 c	86 cde	16 ab	176 c	226 c	60 b
Prowl	1.5 pt	POST1 & 5							
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Prowl[2]	1.5 pt	POST1 & 5	15 b-f	92 bc	119 abc	17 ab	226 abc	275 abc	75 ab
Urea	130 lbs	POST2							
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Prowl[2]	1.5 pt	POST1 & 5	10 ef	103 abc	127 ab	11 ab	240 ab	290 abc	75 ab
28% N + urea	15 gal + 33 lbs	POST2							
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Prowl[2]	1.5 pt	POST1 & 5	17 b-f	104 abc	106 a-d	18 a	226 abc	279 abc	73 ab
28% N	25 gal	POST2							
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Prowl	1.5 pt	POST1	23 b-e	132 a	86 cde	10 abc	242 ab	288 abc	68 ab
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Dual II Magnum	1 pt	POST5							
Prowl	1.5 pt	POST1	14 def	134 a	83 cde	10 abc	231 abc	276 abc	64 ab
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Outlook	1 pt	POST5							
Prowl	1.5 pt	POST1	34 a-d	102 abc	74 de	10 abc	210 abc	285 abc	65 ab
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Authority	3 oz	POST5							
Prowl	1.5 pt	POST1	0 f	0 d	0 f	0 c	0 d	0 d	0 c
Authority	3 oz	POST5							
Prowl	1.5 pt	PRE1	14 b-f	101 abc	133 a	16 ab	248 ab	306 ab	82 a
Buctril + Goal	1.5 + 0.5 pt	POST4 & 6							
Prowl	1.5 pt	POST5							
Handweed			36 ab	107 abc	101 a-e	13 ab	244 ab	294 abc	71 ab
Probability			0.0001	<.0001	<.0001	0.0013	<.0001	<.0001	<.0001
C.V. (%)			95	36	40	76	28	24	27

[1]Values in the same column followed by the same letter are not significantly different at the 0.05 level.
[2]Except for these treatments, all treatments received 20 gal of 28% N applied POST2.

Weed control with soil- and POST-applied herbicides in field pea. Endres, Gregory J., Robert A. Henson, and Blaine G. Schatz. Weed control and field pea response to selected soil- and POST-applied herbicides were evaluated in a randomized complete block with three replicates. The experiment was conducted on a Heimdahl loam soil with 6.8 pH and 3.4% organic matter at Carrington, ND in 2002. The trial area was cultivated on April 30 with a Melroe culti-harrow. Herbicide treatments were applied at 18 gal/A and 30 to 35 psi through 80015 flat fan nozzles to 5 by 25 ft plots with a CO_2 pressurized hand-held plot sprayer. PPI treatments were applied on May 2 with 38 F, 44% RH, 7 mph wind, and clear sky and immediately incorporated twice using a Melroe culti-harrow set at a 2-inch depth. On May 3, inoculated 'Toledo' field pea was planted in 7-inch rows at pure live seed rates of 300,000 seeds/A. Guard plots were planted between treated plots. PRE treatments were applied on a dry soil surface on May 3 with 73 F, 26% RH, 11 mph wind, and 40% clear sky. A total of 1.12 inches of rainfall occurred during the 5-day period following application of PRE treatments. Early POST (EPOST) treatments were applied on May 30 with 72 F, 36% RH, 16 mph wind, and clear sky to 2-inch tall field pea, 1- to 3-leaf green and yellow foxtail, 0.5- to 1-inch tall common lambsquarters, 0.5-inch tall redroot and prostrate pigweed, and 0.5- to 1-inch tall wild buckwheat. POST treatments were applied on June 7 with 69 F, 37% RH, 8 mph wind, and 30% clear sky to 5- to 6-inch tall field pea, 3- to 4-leaf yellow and green foxtail, 1- to 2-inch tall common lambsquarters, 0.5- to 1-inch tall redroot and prostrate pigweed, and 1- to 3-inch tall wild buckwheat. Late POST (LPOST) treatments were applied on June 17 with 73 F, 58% RH, 10 mph wind, and 90% clear sky to 7- to 9-inch tall field pea, 4- to 5-leaf and tillering yellow and green foxtail, 3- to 6-inch tall common lambsquarters, 1- to 3-inch tall redroot and prostrate pigweed, and 2- to 8-inch tall wild buckwheat. Average plant density in untreated plots: field pea = 11/ft^2, yellow and green foxtail = 4/ft^2, common lambsquarters = 1/ft^2, redroot and prostrate pigweed = 7/ft^2, and wild buckwheat = 2/ft^2. Paraquat was preharvest applied at 0.5 lb/A across the trial on August 10. Field pea was hand harvested due to heavy growth of wild buckwheat on August 16, dried, and threshed with a plot combine.

Good to excellent foxtail control (82 to 99%) was achieved with all treatments (Table 1). Imazethapyr&pendimethalin generally provided excellent control of all weeds in the trial including wild buckwheat and pea seed yield was 42.0 to 47.4 bu/A (Table 2). Broadleaf weed control with PRE imazethapyr was greater compared to sulfentrazone treatments. The addition of 28%N to imazamox + bentazon at 0.188 lb/A + NIS did not increase weed control or pea injury. Imazamox + bentazon at 0.188 lb/A + Quad7 provided 95 to 99% control of common lambsquarters while imazamox + bentazon at 0.188 lb/A + NIS or NIS + 28%N provided 68 to 90% control. Imazethapyr + bentazon + sethoxydim + Quad7 provided good control of wild buckwheat (84 to 88%) and low pea injury (7%). Plots treated with Bentazon + sethoxydim + MSO generally yielded less due to poor late-season wild buckwheat control than plots treated with Imazamox + bentazon + NIS or Quad7. Similar weed control generally was achieved with imazamox + bentazon at 0.188 or 0.5 lb/A. LPOST application of imazamox + bentazon at 0.188 lb/A + NIS + 28%N gave weed control and pea yield similar to earlier application. (Carrington Research Extension Center, North Dakota Agric. Exp. Stn., North Dakota State Univ.)

Table 1. Weed control in field pea (Endres, Henson, and Schatz).

Treatment[a]	Rate	4 wk after treatment				8 wk after treatment			
		Foxtail spp.[b]	Common lambs-quarters	Pigweed spp.[b]	Wild buck-wheat	Foxtail spp.	Common lambs-quarters	Pigweed spp.	Wild buck-wheat
	(lb/A)	(% control)							
Untreated	---	0	0	0	0	0	0	0	0
PPI									
Imazethapyr& pendimethalin	0.031& 0.5	93	99	97	90	94	99	96	85
Imep&pend +pend	0.031&0.5 +0.9	96	99	99	97	95	99	97	93
PRE									
Imep	0.031	91	96	89	75	88	90	90	75
Sulfentrazone/ sethoxydim+MSO	0.125/ 0.2+2pt	99	70	68	27	96	72	65	34
Suen/seth +MSO(POST)	0.25/0.2 +2pt	99	81	71	66	97	66	60	66
Suen+metribuzin/ seth+MSO (POST)	0.187+0.25/ 0.2+2pt	99	67	65	58	99	62	55	47
EPOST									
Imazamox +bentazon +NIS+28%N	0.031 +0.188 +0.25%+2pt	95	91	95	82	89	76	93	78
POST									
Bent+seth+MSO	1+0.2+2pt	91	92	84	65	87	87	79	49
Imep+NIS	0.031+0.25%	93	75	81	75	84	70	83	77
Immx+bent +NIS	0.031+0.188+ 0.25%	94	82	92	74	88	68	92	71
Immx+bent +NIS+ 28%N	0.031+0.188+ 0.25%+2pt	95	90	97	76	90	76	95	74
Immx+bent +NIS+ 28%N	0.031+0.5 +0.25%+2pt	96	99	96	81	86	96	95	79
Immx+bent +seth+Quad7	0.016+1 +0.2+1%	91	99	96	79	82	95	90	71
Imep+bent +seth+Quad7	0.031+1 +0.2+1%	95	99	90	88	88	98	86	84
Immx+bent +Quad7	0.031+0.188+ 1%	98	99	97	75	90	95	93	73
Immx+bent +Quad7	0.031+0.5 +1%	97	95	97	75	91	92	94	74
LPOST									
Immx+bent +NIS+28%N	0.031+0.188+ 0.25%+2pt	87	85	92	72	90	81	91	71
LSD (0.05)		5	14	8	16	7	16	12	22

[a]MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN; NIS=Preferenc e, a nonionic surfactant from Agriliance, St. Paul, MN; Quad7=a surfactant blend from AGSCO, Grand Forks, ND.

[b]Foxtail spp.=Yellow and green; Pigweed spp.=Redroot and prostrate.

Table 2. Field pea response to herbicide treatments (Endres, Henson, and Schatz).

Treatment[a]	Rate	Crop injury Wk after treatment 2	4	Seed yield
	(lb/A)	(%)		(bu/A)
Untreated		0	0	17.5
Imazethapyr&pendimethalin	0.031&0.5	0	0	42.0
Imep&pend+pend	0.031&0.5+0.9	0	0	47.4
PRE				
Imep	0.031	0	0	44.9
Sulfentrazone/sethoxydim+MSO (POST)	0.125/0.2+2pt	0	0	32.1
Suen/seth+MSO (POST)	0.25/0.2+2pt	0	0	33.7
Suen+metribuzin/ seth+MSO (POST)	0.187+0.25/0.2+2pt	0	0	36.4
EPOST				
Imazamox+bentazon+NIS+28%N	0.031+0.188+0.25%+2pt	0	0	37.2
POST				
Bent+seth+MSO	1+0.2+2pt	0	0	24.2
Imep+NIS	0.031+0.25%	0	0	34.3
Immx+bent+NIS	0.031+0.188+0.25%	0	0	39.5
Immx+bent+NIS+28%N	0.031+0.188+0.25%+2pt	0	0	41.1
Immx+bent+NIS+28%N	0.031+0.5+ 0.25%+2pt	0	0	39.2
Immx+bent+seth+Quad7	0.016+1+0.2+1%	0	0	38.1
Imep+bent+seth+Quad7	0.031+1+0.2+1%	7	7	32.2
Immx+bent+Quad7	0.031+0.188+1%	0	0	41.8
Immx+bent+Quad7	0.031+0.5+1%	0	0	41.9
LPOST				
Immx+bent+NIS+28%N	0.031+0.188+0.25%+2pt	0	0	31.8
LSD (0.05)		3	3	11.7

[a]MSO=Destiny, a methylated seed oil from Agriliance, St. Paul; NIS=Preference, a nonionic surfactant from Agriliance, St. Paul, MN; Quad7=a surfactant blend from AGSCO, Grand Forks, ND.

Weed control in dry pea at Williston. Jenks, Willoughby, and Markle. Scuba dry pea was seeded May 17 into 9.5-inch rows at 140 lb/A. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preemergence (PRE) on May 24 and postemergence (POST) on June 20. The primary weeds were redroot pigweed (Rrpw), green foxtail (Grft), Russian thistle (Ruth), and common lambsquarters (Colq).

Table 1. Weed control in dry pea at Williston.

			Dry pea		Rrpw		Grft		Ruth		Colq		Yield	Test wt
Treatment	Rate	Timing	Jun 20	Jul 10	Jun 20	Jul 10	Jun 20	Jul 10	Jun 20	Jul 10	Jun 20	Jul 10	Aug 8	Aug 8
			% injury		—————% control—————								lb/A	lb/bu
Raptor + Basagran + COC	4 oz + 1 pt + 1% v/v	POST	0	7	0	88	0	77	0	93	0	98	1279	61.2
Spartan/ Select	2.67 oz/ 5 fl oz	PRE/ POST	14	7	98	94	89	99	100	100	100	100	1394	61.0
Spartan/ Select	4 oz/ 5 fl oz	PRE/ POST	18	17	98	97	96	100	100	98	100	100	1379	61.2
Spartan/ Select	5.33 oz/ 5 fl oz	PRE/ POST	29	8	100	100	97	100	100	100	100	100	1174	61.3
Basagran + Poast	2 pt + 1 pt	POST	0	7	0	78	0	95	0	98	0	98	1151	61.2
Spartan/ Basagran + Poast	2.67 oz/ 1 pt + 1 pt	PRE/ POST	9	6	96	96	95	99	100	100	100	100	1190	61.1
Spartan + Sencor/ Select	4 oz + 0.5 lb/ 5 fl oz	PRE/ POST	52	53	98	100	99	100	100	100	100	100	831	61.4
Basagran + Poast + Raptor	1 pt + 0.5 pt + 2 fl oz	POST	0	7	0	79	0	75	0	93	0	95	1342	61.1
Untreated			0	0	0	0	0	0	0	0	0	0	1127	60.7
LSD (0.05)			16	15	4	10	3	2	--	8	--	6	317	NS
CV			69	68	4	7	3	2	0	5	0	4	15	0.79

[a]*All Select treatments were applied with 1% v/v COC, and Poast treatments were applied with 2 pt/A COC.*

We evaluated weed control and dry pea tolerance to several herbicides. Spartan was granted a specific exemption (Section 18) for use in dry pea in 2001 and 2002. Dry pea injury from Spartan was erratic and varied even within our 10 x 30 ft plots. The injury appeared to be positively correlated with soil pH. As soil pH increased, crop injury also increased (see Table 2 below). Dry pea injury was much higher where Sencor was tank mixed with Spartan.

All treatments containing Spartan followed by Select provided excellent control of redroot pigweed, lambsquarters, Russian thistle, and green foxtail. Raptor/Basagran/Poast tank mixes provided excellent control of Russian thistle and lambsquarters, but provided only fair to good control of redroot pigweed and green foxtail. Dry conditions led to low and variable dry pea yields.

Table 2. Herbicide injury in dry pea at Williston.

Herbicide	Rate	Injury	pH	OM	Plot #
	oz/A	— % —		— % —	
Spartan	2.67	5	6.4	1.9	205
Spartan	2.67	10	6.6	1.7	301
Spartan	2.67	22	6.8	1.8	306

Weed control in conventional-till dry pea. Jenks, Willoughby, and Markle. Majoret peas were seeded May 13 into 7.5-inch rows at 140 lb/A. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preplant incorporated (PPI) or preemergence (PRE) on May 13 and postemergence (POST) on June 14. The primary weeds were wild buckwheat (Wibw), prostrate and redroot pigweed (Pigweed), and yellow foxtail (Yeft).

			Wibw		Pigweed		Yeft		Dry pea Injury		Stand	Yield
Treatment[a]	Rate	Timing	Jun 12	Jul 8	Jun 12	Jul 8	Jun 12	Jul 8	Jun 12	Jul 8	Jun 13	Aug 6
			——% control ——						—% —		pl/m[b]	lb/A
Prowl/ Raptor	3 pt/ 4 oz	PPI/ POST	87	87	92	97	93	95	9	7	7.5	2410
Raptor + Basagran + 28% N	4 oz + 0.5 pt + 1 qt	POST		80		90		80	0	3	7.9	2181
Spartan/ Select	2.67 oz/ 5 fl oz	PRE/ POST	43	48	53	52	28	90	2	1	7.8	1888
Spartan/ Select	4 oz/ 5 fl oz	PRE/ POST	58	64	57	59	48	93	5	2	7.7	2158
Spartan/ Select	5.33 oz/ 5 fl oz	PRE/ POST	68	73	77	73	62	95	4	3	7.1	2409
Sonalan + Sencor/ Select	2 pt + 0.5 lb/ 5 fl oz	PPI/ POST	91	80	95	86	97	100	9	12	7.5	2137
Spartan/ Basagran + Poast	2.67 oz/ 1 pt + 1 pt	PRE/ POST	45	77	50	78	30	78	2	2	7.5	2346
Basagran + Poast	2 pt + 1 pt	POST		78		57		66	0	4	7.4	1490
Sonalan + Spartan/ Select	2 pt + 4 oz/ 5 fl oz	PPI/ POST	93	82	98	89	98	99	8	1	7.6	2662
Handweeded check									7	2	7.6	2407
Treflan/ Select	2 pt/ 5 fl oz	PPI/ POST										
Untreated			0	0	0	0	0	0	0	0	7.0	1202
LSD (0.05)			8	9	11	9	11	8	4	4	NS	448
CV			7	8	10	8	11	6	49	67	9.9	12

[a] *Raptor was applied with NIS at 0.25% v/v, and Select and Poast were applied with COC at 1% v/v and 2 pt, respectively.*

[b] *pl/m = plants per meter of row*

We evaluated weed control and dry pea tolerance to several herbicides. Spartan was granted a specific exemption (Section 18) for use in dry pea in 2001 and 2002. Prowl and Sonalan alone or tank mixed with Sencor caused slight crop injury early in the season. Sonalan + Sencor caused more injury that other treatments at the July rating. Spartan caused minimal injury at any rate. There was no difference in crop stand between treatments on June 13.

Prowl and Sonalan tank mixes provided good early season control of wild buckwheat. Spartan provided poor to fair wild buckwheat control. Soil conditions were very dry until June 9 when we received 1.20 inches of rain. Up to that point Spartan at any rate was not controlling the wild buckwheat; however, the moisture appeared to activate the Spartan, which eventually killed many of the already emerged wild buckwheat plants. Basagran or Raptor + Basagran provided fair wild buckwheat control.

Prowl, Sonalan, and Raptor + Basagran provided good pigweed control. Spartan provided only poor to fair pigweed control. Select provided better yellow foxtail control than Raptor or Poast.

Cultivation and herbicides in Potato, Prosper, ND Kegode and Ciernia. This experiment compared preemergence treatments with and without cultivation for broadleaf weed control. The timing of the cultivations was determined by the prediction model *Weedcast* which was used to simulate emergence of eastern black nightshade. Red Lasoda potato was planted at the Prosper research farm May 23 in 36 in. rows. Half the treatments received a preemergence application of 0.375 oz ai rimsulfuron plus 4 oz ai metribuzin. These treatments were applied May 29 using a 4 nozzle bicycle wheel sprayer equipped with XR8002 tips and delivering 17 gpa at 38 psi. At application air temperature was 84 F, RH 28%, wind W at 1 mph, sky sunny and soil surface dry. Plots were cultivated at 0% Ebns emergence (planting), 15% Ebns emergence (June 19), 30% Ebns emergence (June 27), and 60% Ebns emergence (July 16). Each timing matched a cultivation treatment with a cultivation plus herbicide treatment. Weed control evaluations for redroot pigweed (Rrpw) were made July 30 and August 16. Plots were harvested for graded yield Sept. 16. Maintenance insecticides and fungicides were applied as needed. Grasses were controlled with an application of clethodim plus methylated seed oil (Scoil). Plots were 4 rows wide by 25 ft. long and the experiment was a randomized complete block design with 4 reps.

		Rrpw Control		Yield	
Treatment[a]	Predicted Ebns emergence	July 30	Aug 16	Total	Marketable
	%	---------%---------		-------cwt/A -------	
Cultivation	0	6	38	113	84
Cultivation	15	73	45	119	94
Cultivation	30	67	80	104	80
Cultivation	60	31	48	82	60
Cultivation + herbicide	0	58	60	138	101
Cultivation + herbicide	15	51	40	95	74
Cultivation + herbicide	30	91	97	140	107
Cultivation + herbicide	60	58	76	130	101
C.V. %		51	54	43	46
LSD 1%		41	NS	NS	NS
LSD 5%		NS	NS	NS	NS

[a] Cultivation = two passes with potato hiller; Herbicide = 0.375 oz ai rimsulfuron plus 4 oz ai metribuzin

Though the target weed originally was eastern black nightshade, the study was heavily infested by redroot pigweed that crowded out the nightshade. Due to high variability, there were no significant differences in cultivation time or herbicide on redroot pigweed control or marketable yield. Nonetheless, higher redroot pigweed control was obtained when cultivation treatments (with/without herbicide) were applied when predicted eastern black nightshade emergence was 30%.

Potato cultivar response to Valor, Tappen, ND. Kegode, Ciernia, Hatterman-Valenti, Mayland. This experiment was designed to evaluate the response of three commercial potato varieties to Valor. Russet Nortokah, Yukon Gold, and Ranger Russet were planted May 17 at the irrigated potato research site near Tappen, ND. Plots were hilled June 11 and all treatments were applied June 14 to the center two rows of treated plots using a shielded 4 nozzle bicycle wheel sprayer equipped with XR8002 tips and delivering 17 gpa at 38 psi. At application air temperature was 80 F, RH 35%, wind NW 10 mph, sky sunny and soil surface dry. Phytotoxicity ratings were made July 5 and July 25. The center two rows of each plot were harvested for graded yield Oct 1. Maintenance insecticides and fungicides were applied as needed. Plots were four rows wide by 25 ft. long and the experiment was a randomized complete block design with 3 reps.

Treatment	Rate	July 5 Injury	July 25 Injury	Total yield	Market yield
	oz ai/A	%	%	cwt/A	cwt/A
Russet Nortokah					
Untreated	0	5	0	252	233
Valor	1	13	8	324	312
Valor	2	9	8	380	368
Spartan	4	27	20	278	269
Yukon Gold					
Untreated	0	0	0	188	182
Valor	1	19	12	284	277
Valor	2	35	15	330	323
Spartan	4	34	18	313	306
Ranger Russet					
Untreated	0	0	0	349	327
Valor	1	3	2	371	344
Valor	2	6	8	376	351
Spartan	4	11	6	355	321
LSD 5%		NA	NA	NA	NA

Yukon Gold was the most sensitive potato cultivar to applications of Valor whereas Ranger Russet was the more tolerant cultivar. For comparison, Spartan was applied to each potato cultivar at the high labeled use rate and resulted in relatively high levels of injury on Russet Narkotah and Yukon Gold cultivars, whereas Ranger Russet was more tolerant.

Weed control in potatoes, Tappen, ND. Kegode and Ciernia. This experiment was conducted at the irrigated potato research farm near Tappen, ND. Russet Burbank potato was planted in 36 in. rows May 22 and hilled June 11. All treatments were applied June 14 to the center two rows using a shielded 4 nozzle bicycle wheel sprayer equipped with XR8002 tips and delivered 17 gpa at 38 psi. At application air temperature was 80 F, RH 35%, wind NW 10 mph, sky sunny and soil surface dry. Weed control evaluations were made July 5 and July 24. The center two rows of each plot were harvested for total yield Oct 1. Maintenance insecticides and fungicides were applied as needed. Plots were four rows wide by 25 ft. long and the experiment was a randomized complete block design with 3 reps.

		July 5			July 24			
Treatment	Rate	Injury	Fota	Wibu	Injury	Wibu	Fota	Yield
	oz ai/A	%	% control		%	% control		cwt/A
Dimethenamid-P	10.5	1	96	20	1	8	97	312
Dimethenamid-P	17.75	3	97	33	1	15	99	297
Dimethenamid-P+ metribuzin	10.5+12	1	97	94	0	65	97	324
Flumioxazin	1	2	95	91	1	53	84	309
Flumioxazin	1.5	5	95	96	3	85	93	257
Flumioxazin + metolachlor	1+22.9	18	95	96	5	32	95	339
Sulfentrazone	3	14	62	94	6	97	72	373
Sulfentrazone	4	30	94	96	11	97	82	385
Sulfentrazone + metolachlor	3+22.9	15	100	100	8	97	93	397
Metolachlor + metribuzin	22.9+12	3	100	99	1	90	98	362
Untreated	0	0	0	0	0	0	0	324
C.V. %		43	8	7	90	22	7	19
LSD 5%		6	12	10	5	21	10	NS
# OF REPS		3	3	3	3	3	3	3

Potato injury was relatively high when sulfentrazone was applied (6 to 11%) and lower with flumioxazin applications (1 to 5%). Dimethenamid-P provided excellent foxtail control but performed poorly on wild buckwheat. Flumioxazin at 1 oz/A provided poor and good control of wild buckwheat and foxtail, respectively. Increasing flumioxazin rate to 1.5 oz/A improved control of both species. Sulfentrazone provided excellent wild buckwheat control but only fair to good control of foxtail. Sulfentrazone plus metolachlor provided excellent control of both weeds.

Nightshade Control in Potato, Hazelton, ND. Kegode and Ciernia. This experiment was conducted in an irrigated field of Russet Burbank potatoes near Hazelton, ND. The field was planted April 24 and hilled May 28. Treatments were applied May 28 to the center two rows of treated plots using a 4 nozzle bicycle wheel sprayer equipped with XR8002 tips and delivering 17 gpa at 38 psi. At application, air temperature was 86 F, RH 20%, wind SW 2 mph, sky partly sunny and soil surface was dry. Weed control evaluations were made June 14 and June 28. The nightshade species (Nish) were a mixture of black and eastern black. Maintenance pesticides were applied by the cooperator and the experiment was not harvested. Plots measured 4 rows wide by 25 ft. long and the experiment was a randomized complete block design with 4 reps.

		June 14						June 28					
Treatment	Rate	Injury	Nish	Kocz	Fota	Colq	Cocb	Injury	Nish	Kocz	Fota	Colq	Cocb
	oz ai/A	%	----------% control----------					%	----------% control----------				
Dimethenamid-P	10.5	2	89	66	95	54	27	0	92	44	94	66	17
Dimethenamid-P	13.5	5	97	69	99	56	35	2	79	63	98	70	38
Dimethenamid-P	15.75	7	94	69	99	67	23	0	90	79	98	69	13
Dimethenamid-P + pendamethalin	13.5+13.2	24	97	81	98	93	40	2	95	94	99	96	63
Dimethenamid-P + metribuzin	13.5+12	2	100	100	100	100	98	1	100	100	100	100	100
Flumioxazin	0.5	2	98	99	91	97	97	2	96	95	63	90	90
Flumioxazin	1	5	89	44	86	88	94	7	82	60	71	61	37
Flumioxazin	1.5	10	99	88	94	75	80	11	97	98	70	99	73
Sulfentrazone	2	1	50	60	43	24	48	1	82	87	83	92	87
Sulfentrazone	3	0	58	41	67	67	18	1	80	91	85	85	70
Sulfentrazone	4	2	94	98	98	95	77	0	100	100	99	100	99
Metolachlor + metribuzin	23+12	4	96	99	99	99	72	0	100	99	100	99	100
Untreated	0	0	0	0	0	0	0	0	0	0	0	0	0
C.V. %		98	18	35	14	35	37	138	14	24	22	22	37
LSD 5%		7	21	36	16	41	34	4	19	26	25	25	38
# OF REPS		4	4	4	4	3	3	4	3	4	4	4	3

At the June 28 evaluation date, flumioxazin cause the most injury to potatoes especially when application rate was increased from 0.5 to 1.5 oz/A. Most of the other treatments caused some early injury to potato which was barely detectable at the June 28 rating. Control of nightshade with dimethenamid-P varied among the rates used and was good to excellent. The tank mix consisting of dimethenamid-P with either pendamethalin or metribuzin resulted in excellent nightshade control. Nightshade control with flumioxazin was good to excellent, whereas sulfentrazone provided excellent control with 4 oz/A, but only good control with 2 and 3 oz/A. Sulfentrazone at 4 oz/A and the dimethenamid-P plus metribuzin tank mix provided excellent control of all weeds.

Nightshade control in potato, Oakes, ND. Kegode and Ciernia. This experiment was established in an irrigated field of Russet Burbank potato near Oakes, ND. The field was hilled May 22 and all treatments were applied preemergence May 24 using a 2 wheel bicycle plot sprayer equipped with 4 XR8002 nozzles and delivering 17 gpa at 38 psi. Each plot was 4 rows wide and 25 ft. long and the center 2 rows were treated. At spray time air temperature was 62 F, RH 15%, wind SE 5-10 mph, sky sunny and soil surface dry. Weed control ratings were made June 14 and 28 and 3 reps were harvested for total yield on Sept. 11. The predominant nightshade species (Nish) present was hairy nightshade. Plots measured 4 rows by 25 ft. long and the experiment was a randomized complete block design with 4 reps.

		June 14			June 28			
Treatment	Rate	Injury	Nish	Colq	Injury	Nish	Colq	Yield
	oz ai/A	%	---% control---		%	---% control---		cwt/A
Dimethenamid-P	10.5	1	53	35	0	68	14	238
Dimethenamid-P	13.5	3	64	31	0	43	16	269
Dimethenamid-P	15.75	3	88	56	0	50	35	281
Dimethenamid-P + pendamethalin	13.5+13.2	4	93	38	1	91	76	271
Dimethenamid-P + metribuzin	13.5+12	1	92	56	0	94	92	319
Flumioxazin	0.5	4	51	60	3	91	78	278
Flumioxazin	1	3	92	59	5	95	85	293
Flumioxazin	1.5	3	94	78	6	91	83	305
Sulfentrazone	2	1	85	55	1	86	88	267
Sulfentrazone	3	1	64	43	2	65	69	266
Sulfentrazone	4	1	89	68	1	96	94	302
Metolachlor + metribuzin	23+12	2	28	23	1	74	90	274
Untreated	0	0	0	0	0	0	0	221
C.V. %		140	18	51	127	23	25	30
LSD 5%		NS	17	34	3	24	22	NS
# OF REPS		4	4	4	4	4	4	3

Minor injury to potatoes occurred with flumioxazin and sulfentrazone applications that did not appear to affect potato yields. Dimethenamid-P alone provided poor to no control of nightshade and common lambsquarters on June 28 irrespective of rate applied. However, when dimethenamid was applied with pendamethalin or metribuzin control of nightshade was excellent while that of common lambsquarters was fair to excellent. All rates of flumioxazin and the high rate of sulfentrazone provided excellent control of nightshade. Flumioxazin generally provided good control of common lambsquarters, whereas control with sulfentrazone was good at the 2 and 3 oz/A rates and excellent at the 4 oz/A rate.

Weed control in irrigated potato with rimsulfuron combinations. Hatterman-Valenti, Harlene M. and Paul G. Mayland. Several new herbicides are potential candidates for registration on potatoes. A study was conducted at the Northern Plains Potato Growers Irrigation Research site to evaluate pre and post tank-mixed or sequential applications of rimsulfuron and new product offerings for crop safety and weed control in potatoes. The study was conducted on sandy loam soil with 1.8% organic matter and 7.6 pH that for the past several years had been cropped for hay (alfalfa/brome mixture). Plots were 4 rows by 30 ft arranged in a randomized complete block design with three replications. 'Russet Burbank' potatoes were planted on 36 inch rows and 12 inch spacing on May 21, 2002. Treatments were applied to the middle 2 rows. Crop injury and weed control were evaluated 31 and 52 DAT (days after treatment). Water was not limiting as irrigation was schedule every 3-4 days once potatoes had emerged following hilling. Potatoes were machine harvested October 2 and graded October 15. Application, environmental, crop, and weed data are listed below:

Date:	6/14/02	7/15/02
Treatement:	PRE	POST
Sprayer:		
gpa:	8.5	20
psi:	35	35
nozzle:	11001	11002
Temperature:		
Air (F):	73	94
Soil (4 inch):	69	91
Rel. Hum. (%):	32	30
Wind (mph):	6	19
Soil Moisture:	dry	moist
Cloud Cover (%):	5	0
Potato:		
Height (inch):	1	14
Spiny amaranth		
Height (inch):	-	4-6
Leaf number:	-	4-8
Wild buckwheat		
Height (inch):	-	4-6
Leaf number:	-	4-8
Green foxtail		
Height (inch):	-	1-4
Leaf number:	-	3-7

Flumioxazin alone or in combination with rimsulfuron caused some early potato injury (Table 1). Weed infestation levels were considered light to moderate. All treatments with preemergence herbicides except sulfentrazone alone or with rimsulfuron (post), flumioxazin with rimsulfuron (post), and dimethenamid-P alone provided acceptable early season control of green foxtail, spiny amaranth, and wild buckwheat. Flumioxazin and sulfentrazone weakness was with green foxtail while dimethenamid showed some weakness on wild buckwheat. Postemergence applications of rimsulfuron alone or with EPTC just prior to irrigation did not provide adequate control of the three species evaluated. Potato yield and grade varied and did not show a trend associated with early injury or lack of weed control (Table 2). Lowest marketable yield occurred with the untreated and the flumioxazin followed by rimsulfuron (post) treatment (Plant Sciences Dept., North Dakota State University).

Table 1. Weed control in irrigated potato with rimsulfuron combinations.

Treatment	Application method	Rate (oz/A)	Crop Injury 7/15	Crop Injury 8/5	AMASP control 7/15	AMASP control 8/5	POLCO control 7/15	POLCO control 8/5	SETVI control 7/15	SETVI control 8/5
			%							
Rimsulfuron Dimethenamid-p	PRE PRE	0.375 10.6	2	2	98	97	94	97	95	90
Rimsulfuron Flumioxazin	PRE PRE	0.375 1.5	7	3	98	100	97	95	97	93
Rimsulfuron Sulfentrazone	PRE PRE	0.375 1.5	2	0	98	100	96	100	96	87
Rimsulfuron Metribuzin	PRE PRE	0.375 8.0	0	0	98	98	97	90	95	94
Rimsulfuron	PRE	0.375	0	1	98	100	94	90	96	92
Dimethenamid-p Rimsulfuron MSO	PRE POST POST	10.6 0.375 1 % v/v	3	4	97	93	85	77	93	82
Flumioxazin Rimsulfuron MSO	PRE POST POST	1.5 0.375 1 % v/v	8	3	98	90	98	100	78	87
Sulfentrazone Rimsulfuron MSO	PRE POST POST	1.5 0.375 1 % v/v	3	1	95	88	95	77	37	73
Dimethenamid-p	PRE	10.6	0	3	95	83	73	80	88	83
Flumioxazin	PRE	1.5	9	1	98	100	98	100	87	77
Sulfentrazone	PRE	1.5	0	1	98	93	96	100	10	13
Rimsulfuron MSO	POST POST	0.37 1 % v/v	0	0	-	58	-	51	-	50
Rimsulfuron EPTC AMS MSO	 POST POST	0.375 14.0 17 lb/100 gal 1 % v/v	-	2	-	53	-	55	-	47
Untreated			0	0	0	0	0	0	0	0
LSD 0.05			4	3	3	14	8	14	11	17

Table 2. Potato grade and yield following rimsulfuron combinations.

Treatment	Application method	Rate (oz/A)	Yield <4 oz	Yield 4-10 oz	Yield 10-16 oz	Yield US #1	Hollow heart	Specific gravity
			cwt/A				(%)	
Rimsulfuron Dimethenamid-p	PRE PRE	0.375 10.6	24	231	95	326	33	1.0849
Rimsulfuron Flumioxazin	PRE PRE	0.375 1.5	27	232	86	318	40	1.0848
Rimsulfuron Sulfentrazone	PRE PRE	0.375 1.5	21	222	98	322	25	1.0827
Rimsulfuron Metribuzin	PRE PRE	0.375 8.0	26	249	87	349	35	1.0841
Rimsulfuron	PRE	0.375	27	221	83	303	38	1.0829
Dimethenamid-p Rimsulfuron MSO	PRE POST POST	10.6 0.375 1 % v/v	32	248	88	336	33	1.0837
Flumioxazin Rimsulfuron MSO	PRE POST POST	1.5 0.375 1 % v/v	17	195	60	255	15	1.0836
Sulfentrazone Rimsulfuron MSO	PRE POST POST	1.5 0.375 1 % v/v	21	201	72	274	43	1.0822
Dimethenamid-p	PRE	10.6	24	227	65	295	23	1.0808
Flumioxazin	PRE	1.5	27	228	64	291	38	1.0845
Sulfentrazone	PRE	1.5	30	248	81	331	25	1.0843
Rimsulfuron MSO	POST POST	0.37 1 % v/v	31	258	77	340	29	1.0825
Rimsulfuron EPTC AMS MSO	POST POST POST POST	0.375 14.0 17 lb/100 gal 1 % v/v	28	274	73	347	23	1.0829
Untreated			32	225	32	257	33	1.0812
LSD 0.05			11	67	41	64	18	0.0065

Aim Applied as a Desiccant on Russet Burbank at Tappen, ND. Harlene Hatterman-Valenti and Paul Mayland. An experiment was conducted on an irrigated site near Tappen, ND to evaluate potato desiccation and skin set from Aim (carfentrazone) alone and in combination with other desiccants. The field was alfalfa and perennial grass prior to being disked and double roto-tilled prior to planting on May 21, 2002. Fertilizer, irrigation, insecticides and fungicides were applied as needed. The first treatment applications were made September 18 at 10:00 A.M. with an average wind speed of 8 mph from the South, 87% RH, 63°F and 100% cloud cover. The second application was made September 25, 2002 at 12:00 with an average wind speed of 3 mph from the NW, 50% RH, 51°F and 10% cloud cover. All treatments were applied to the center 2 rows of the 4-row 25-foot long plots using a backpack CO_2 sprayer with 11002 flat fan nozzles, 30 psi and 30 gpa.

Summary: All treatments except Rely and Aim + Liberate provide quick leaf desiccation (1 week after application) and all treatments except Aim + Liberate provided greater than 85% leaf necrosis by 2 weeks after initial application. The greatest stem desiccation occurred with two applications of Reglone + Liberate. However, statistically all treatments except Aim + Liberate, Rely, and the untreated provided similar stem desiccation 2 weeks after initial application. Skin set averaged across 24 tubers exhibited no differences.

Table 1. Desiccation 1 and 2 weeks after initial desiccant application and skin set at harvest.

Treatmen	Rate Product/A	Applic Timing	1 WAA*		2 WAA		Skin Set
			Leaf	Stem	Leaf	Stem	(PSI)
			%				
Aim + Liberate	3.2 oz + 1% v/v	A + B	53	37	83	43	49
Aim + Desicate II + Liberate	3.2 oz + 32 oz + 1% v/v	A + B	85	53	95	58	50
Aim + Reglone + Liberate	3.2 oz + 16 oz + 1% v/v	A + B	82	52	91	53	50
Desicate II + AMS	64 oz + 5 lb	A	73	40	88	57	49
Reglone + Liberate	24 oz + 1% v/v	A + B	88	57	97	63	49
Rely	48 oz	A	62	40	87	50	49
Untreated			17	8	40	33	49
LSD 0.05			14	15	14	11	3

* WAA = week after application.

Potato variety desiccation at Prosper, ND. Harlene Hatterman-Valenti and Paul Mayland. An experiment was conducted on a dryland site at Prosper, ND to evaluate potato variety desiccation and skin set comparing different treatments of Rely to Reglone. The field was field cultivated prior to planting. Yukon Gold, Chieftain, Red Pontiac, Red Norland, Dakota Rose, and LaSoda were planted May 24, 2002. Fertilizer, insecticides and fungicides were applied as needed. Potatoes were hilled on June 5. The first desiccation application was August 27 at 13:30 with an average wind speed of 9 mph, 71% RH, 79°F and a clear sky. The treatments were sprayed using a CO2 backpack sprayer with a 6.33-foot boom, 11002 flat fan nozzles, 30 psi and 20 gpa. Herbicide applications were made across two rows of each variety. Second applications were made September 3 using the same spray unit. Environmental conditions during spraying consisted of 4 mph windspeed, 47% RH, 74°F and 10% cloud cover. The experiment was a randomized complete block design with three replicates.

Summary

Yukon Gold, Red Norland, and Dakota Rose were beginning to senesce when the first desiccation application was made and by 17 DAA (days after application) all treatments provided excellent leaf and stem desiccation. All treatments except Rely + AMS and Reglone + Preference provided excellent leaf and stem desiccation with the Chieftain cultivar 28 DAA. Rely + AMS followed by Reglone + Preference provided the greatest leaf and stem desiccation with the Red Pontiac cultivar 28 DAA. The leaf and stem necrosis was significantly greater than any other treatment except Rely followed by Reglone + Preference (stem only). Rely followed by Reglone + Preference provided the greatest leaf and stem desiccation with the Red LaSoda cultivar 28 DAA. This treatment provided greater leaf desiccation than all other treatments except Rely + AMS followed by Reglone + Preference, but did not differ from other treatments for stem necrosis. The skin set varied among cultivars and treatments but was generally a little higher when desiccated than untreated. Little benefit was observed with the addition of AMS or Aim to Rely.

Table 1. Desiccation 7, 17 and 28 days after initial desiccant application and skin set at harvest.

Treatment	Rate Product/A	Applic timing	7 DAA leaf	7 DAA stem	17 DAA leaf	17 DAA stem	28 DAA leaf	28 DAA stem	Skin set (psi)
Yukon Gold						%			
Untreated	---	-	18	0	73	45	99	77	53
Rely + AMS	3 pt + 3 lb	A	90	43	97	92	100	97	61
Rely	3 pt	A	94	53	100	97	100	97	59
Rely + AMS	3 pt + 3 lb	A	93	60	100	95	100	98	62
Reglone + Pref.	1 pt + 0.25%	B							
Rely	3 pt	A	94	53	100	98	100	100	44
Reglone + Pref.	1 pt + 0.25%	B							
Rely + AMS + Aim	3 pt+3 lb+0.55 fl oz	A	95	53	98	98	100	100	54
Reglone + Pref.	1 pt + 0.25%	A	92	57	100	95	100	96	57
Reglone + Pref. +	1 pt + 0.25%	A	83	37	100	98	100	98	60
Reglone + Pref.	1 pt + 0.25%	B							
LSD 0.05			9	8	6	9	1	6	8
Chieftain									
Untreated	---	-	5	0	22	7	42	18	42
Rely + AMS	3 pt + 3 lb	A	57	25	83	67	83	68	49
Rely	3 pt	A	73	33	95	87	99	97	50
Rely + AMS	3 pt + 3 lb	A	68	28	92	85	98	90	52
Reglone + Pref.	1 pt + 0.25%	B							
Rely	3 pt	A	65	32	97	88	96	90	55
Reglone + Pref.	1 pt + 0.25%	B							
Rely + AMS + Aim	3 pt+3 lb+0.55 fl oz	A	65	27	98	90	98	93	51
Reglone + Pref.	1 pt + 0.25%	A	70	37	93	87	85	73	50
Reglone + Pref. +	1 pt + 0.25%	A	53	27	88	72	95	85	52
Reglone + Pref.	1 pt + 0.25%	B							
LSD 0.05			9	8	6	10	9	14	8

Table continued on next page.

Treatment	Rate Pdt/A	Applic timing	7 DAA leaf	7 DAA stem	17 DAA leaf	17 DAA stem	28 DAA leaf	28 DAA stem	skin set (psi)
Red Pontiac					%				
Untreated	---	-	4	0	27	5	38	17	49
Rely + AMS	3 pt + 3 lb	A	52	23	63	47	75	50	51
Rely	3 pt	A	67	28	75	55	75	53	50
Rely + AMS	3 pt + 3 lb	A	43	20	80	55	96	77	53
Reglone + Pref.	1 pt + 0.25%	B							
Rely	3 pt	A	53	23	80	67	85	67	48
Reglone + Pref.	1 pt + 0.25%	B							
Rely + AMS + Aim	3 pt+3 lb+0.55 fl oz	A	45	23	70	50	85	63	50
Reglone + Pref.	1 pt + 0.25%	A	68	37	82	67	73	57	53
Reglone + Pref. +	1 pt + 0.25%	A	48	22	77	53	77	57	54
Reglone + Pref.	1 pt + 0.25%	B							
LSD 0.05			10	7	8	10	9	12	NS
Red Norland									
Untreated	---	-	15	0	68	27	100	77	60
Rely + AMS	3 pt + 3 lb	A	95	57	98	95	100	98	52
Rely	3 pt	A	97	63	100	100	100	98	55
Rely + AMS	3 pt + 3 lb	A	91	63	100	97	100	100	53
Reglone + Pref.	1 pt + 0.25%	B							
Rely	3 pt	A	95	58	100	97	100	99	52
Reglone + Pref.	1 pt + 0.25%	B							
Rely + AMS + Aim	3 pt+3 lb+0.55 fl oz	A	95	63	100	97	100	99	47
Reglone + Pref.	1 pt + 0.25%	A	93	60	100	100	100	100	59
Reglone + Pref. +	1 pt + 0.25%	A	88	47	100	85	100	98	59
Reglone + Pref.	1 pt + 0.25%	B							
LSD 0.05			5	9	2	9	0	4	12
Dakota Rose									
Untreated	---	-	8	0	47	23	90	68	47
Rely + AMS	3 pt + 3 lb	A	70	37	97	90	100	97	42
Rely	3 pt	A	65	33	97	93	100	98	47
Rely + AMS	3 pt + 3 lb	A	75	33	97	95	100	100	48
Reglone + Pref.	1 pt + 0.25%	B							
Rely	3 pt	A	68	38	100	97	100	100	48
Reglone + Pref.	1 pt + 0.25%	B							
Rely + AMS + Aim	3 pt+3 lb+0.55 fl oz	A	75	38	99	90	100	100	45
Reglone + Pref.	1 pt + 0.25%	A	82	43	98	97	100	100	47
Reglone + Pref. +	1 pt + 0.25%	A	47	30	100	95	100	87	46
Reglone + Pref.	1 pt + 0.25%	B							
LSD 0.05			9	8	8	7	3	15	NS
LaSoda									
Untreated	---	-	6	0	23	10	53	33	48
Rely + AMS	3 pt + 3 lb	A	53	30	75	60	88	77	56
Rely	3 pt	A	57	30	80	63	87	73	45
Rely + AMS	3 pt + 3 lb	A	57	27	90	80	90	80	52
Reglone + Pref.	1 pt + 0.25%	B							
Rely	3 pt	A	53	27	93	80	95	78	49
Reglone + Pref.	1 pt + 0.25%	B							
Rely + AMS + Aim	3 pt+3 lb+0.55 fl oz	A	52	32	78	75	83	78	49
Reglone + Pref.	1 pt + 0.25%	A	60	35	87	77	87	77	47
Reglone + Pref. +	1 pt + 0.25%	A	40	23	85	67	83	70	54
Reglone + Pref.	1 pt + 0.25%	B							
LSD 0.05			7	7	8	11	7	5	11

Spartan on safflower, Williston 2002. 'Montola 2003' safflower was planted on fallowed land in 7-inch rows at 30 lbs/A on May 31. The preplant incorporated (PPI) treatments were applied on may 31 with 75 F, 41% RH, 95% clear sky and 7 to 10 mph Southwest wind and dry topsoil at 64 F. Treatments were incorporated first with a triple-K having roller baskets working parallel to the treatment application. The second incorporation was perpendicular to the treatment application with a multi-weeder and all plots were worked in this manner. The pre-emergence (PE) treatments were applied June 5 with 79 F, 33% RH, 80% clear sky and 5 to 8 mph South wind with damp soil surface and a 4 inch temperature of 67 F. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 20 (for the PPI treatments) and 10 gpa (for the PE treatments) at 40 psi through 8002 and 8001 flat fan nozzles, respectively, to a 6.67 ft wide area the length of 10 by 25 ft plots. First rain received after PPI application was 1.00 inches on June 2 and 0.45 on June 8 after PE applications. The experiment was a randomized complete block design with four replications. Visual stand reduction ratings were taken on June 29 and again on July 5. Weed control ratings were on August 16. Weed density were: green foxtail - 20 to 40 /ft^2, common purslain - 1 to 5 ft^2, and Russian thistle - 1 to 5 plants per yd^2 in reps 3 and 4. Safflower was machine harvested on September 23.

				6/29	7/05	8/16			9/23		
Treatment	Formulation	Timing	Rate	Safl	Safl	Grft	Ruth	Copu	Weight	Yield	Oil
			oz ai/A	% st. red		% control			lbs/bu	lbs/A	%
Treflan,	4EC	PPI	16.0	10	8	97	70	99	40.9	1191	34.6
Sonalan	3EC	PPI	16.0	15	0	99	88	98	41.4	1251	34.9
Sonalan	3EC	PPI	12.0	6	4	98	90	96	41.4	1248	35.0
Spartan	75 WGF	PPI	2.0	59	59	66	99	64	38.7	487	34.2
Spartan	75 WGF	PE	2.0	9	5	81	99	86	40.5	1020	35.0
Spartan	75 WGF	PE	2.5	36	38	86	95	88	40.6	905	34.7
Spartan	75 WGF	PE	3.0	26	35	86	95	94	40.2	986	34.7
Spartan	75 WGF	PE	4.0	55	54	93	99	96	39.8	788	34.5
Spartan	75 WGF	PE	6.0	64	74	94	95	97	38.1	764	33.9
Untreated			0	0	0	0	0	0	35.1	125	25.5
Exp Mean				28	28	80	83	82	39.7	882	33.7
C.V.%				66	64	11	8	9	4.6	16	16.0
LSD 5%				27	26	12	14	11	NS	205	NS

Summary: Spartan applied PPI and the higher rates applied PE caused stand reductions that exceed 50%. Yield reductions for these treatments exceeded 36% for the PE treatments (compared to the Sonalan treatments) and about 60% for the PPI treatment. As Spartan rates increased, green foxtail (the predominant weed) control tended to increase. Russian thistle and common purslain control was adequate at all PE rates of Spartan.

Grassy weed control in safflower, Williston 2002. (Neil Riveland) 'Finch' Safflower was planted no till on recrop land (cropped to wheat in 2001) in 7 inch rows at 30 lbs/A on may 14. The treatments were applied on June 24 to 5 to 7-leaf safflower and green foxtail 2 to 6 leaf and volunteer barley flag leaf to heading with 82 F, 40% RH, 95% clear sky and 5 to 10 mph west wind and dry topsoil at 70 F and dry plant surfaces. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 8.6 gpa at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. First rain received after application was 0.04 inches on July 5. The experiment was a randomized complete block design with four replications. Plots were evaluated for crop injury on June 27 and July 13 and for weed control on July 13. Green foxtail density ranged from 25 to 50 plants/ft^2. Volunteer wheat density was light and rated in two reps with an average density of 2 plants/yd^2. Safflower was machine harvested on September 16.

Treatment[a]	Formulation	Product Rate	Grft	Vowh	Test weight	Yield	Oil
		oz/A					
Poast+PO	1.5 EC	8	79	77	38.3	632	33
Assure II+PO	0.88 EC	8	94	92	37.7	672	33
Select+PO	2 EC	8	89	85	37.9	638	32
Select+PO	2 EC	12	96	90	38.6	795	33
Poast+PO	1.5 EC	16	84	75	38.0	673	33
Select+PO	2 EC	6	87	80	37.8	728	33
Select+PO	2 EC	4	79	77	38.2	705	33
Assure II+PO	0.88 EC	7	88	92	37.7	633	33
Poast+MSO	1.5 EC	8	75	72	38.5	691	33
Untreated		0	0	38	38.3	447	33
C.V.%			7.8	11.5	1.1	7.4	1.5
LSD 5%			8.7	19.2	NS	70.5	NS
# of Reps			4	2	2	4	4

Summary: No crop injury was noted for any treatment at any time. All treatmens resulted in yield increases when compared to the untreated check. Poast treatments tended to give the lowest control of both green foxtail and volunteer wheat.

Safflower response to clethodim. (Howatt, Roach, and Davidson-Harrington) Safflower was seeded May 20 at Fargo. Treatments were applied to 6-inch safflower, 6-leaf volunteer wheat, and 6-leaf yellow foxtail on June 20 with 61 F, 49% relative humidity, 15% cloudcover, 8 mph northwest wind, and soil temperature of 63 F. Treatments were hand broadcast with a backpack sprayer delivering 8.5 gpa at 40 psi through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Table. Safflower response to clethodim.

		Jun 28			Jul 5		
Treatment	Rate	Safflower	Vowt	Yeft	Safflower	Vowt	Yeft
	oz ai/A	%					
Clethodim+PO	1.5+1%	0	82	91	0	95	99
Clethodim+PO	2+1%	0	87	94	0	97	99
Sethoxydim+PO	3+1%	0	87	96	0	94	99
Untreated	0	0	0	0	0	0	0
CV		0	3	2	0	1	0
LSD (0.05)		0	6	5	0	2	1
# of reps		2	2	2	2	2	2

Two reps were lost to flood damage. No injury was observed for any herbicide treatment. On June 28, treatments provided 82 to 87% volunteer wheat control and 91 to 96% yellow foxtail control. Control increased for all treatments on July 5 resulting in at least 94% control of grasses.

Early pre-plant Spartan on sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Valley City, ND, to evaluate soil treatments applied 30 days prior to planting sunflower. On May 2, 2002 treatments were applied at 12:00 pm with 37 F air, 35 F subsoil at a depth of 4 inches, 33% relative humidity, 0% clouds, 3 to 4 mph N wind, dry soil surface, and wet subsoil. Pioneer '63M80' sunflower was planted on May 29. Treatments were applied to the center 6.67 feet with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 11002 flat fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Target weed was wild buckwheat, but had no emergence. On May 30 (28 DAT), no weeds had emerged. At June 13 (14 DAP - days after planting), sunflowers were beginning to emerging to cotyledon stage. Foxtail was beginning to emerge. Very dry spring conditions contributed to slow weed germination and development. No crop injury was observed at June 13 or June 27 (28 DAP). Spartan at rates above 3 oz/A controlled broadleaf weeds. Dry weather contributed to Prowl inactivation and causing higher Spartan rates to control sensitive weeds like redroot pigweed and common lambsquarters. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Early pre-plant Spartan on sunflower (Zollinger and Ries).

		June 27			
Treatment[1]	Rate	Fxtl	Wimu	Rrpw	Colq
	(product/A)	---------- % control ----------			
RUM+AMS	1.6pt	0	0	0	0
Valor+RUM+AMS	2oz+1.6pt	37	90	50	50
V-10080+PO+AMS	2pt	30	90	40	40
Spartan+Prowl+RUM+AMS	2oz+2.9pt+1.6pt	50	99	53	90
Spartan+Prowl+RUM+AMS	2.5oz+2.9pt+1.6pt	60	99	63	95
Spartan+Prowl+RUM+AMS	3oz+2.9pt+1.6pt	65	99	82	99
Spartan+Prowl+RUM+AMS	3.5oz+2.9pt+1.6pt	72	99	99	99
Spartan+Prowl+RUM+AMS	4oz+2.9pt+1.6pt	92	99	99	99
LSD (0.05)		7	0	5	0

[1]RUM = Roundup UltraMax; AMS = ammonium sulfate at 2lb/A; PO = petroleum oil concentrate = Herbimax at 1pt/A; V-10080 = proprietary herbicide from Valent.

Express resistant cultivated sunflower. An experiment was conducted near Prosper, ND, to evaluate weed control in Express resistant sunflower. Pioneer '02RL0004' sunflower was planted on June 4, 2002. PRE treatments were applied on June 6 at 10:30 am were 79 F air, 62 F soil to a depth of 4 inches, 33% relative humidity, 75% clouds, 12 mph S wind, dry soil surface, and damp subsoil. POST treatments were applied June 26 at 9:30 am with 78 F air, 80 F soil surface, 62% relative humidity, 0% clouds, 5 mph NW wind, dry soil surface, moist subsoil, excellent crop vigor, and dew present to V3 to V4 sunflower. Weed species present were: 2 to 10 inch (20 to 75/ft^2) yellow foxtail; 1 to 4 inch (1 to 5/ft^2) redroot pigweed; 1 to 5 inch (1 to 2/yd^2) common lambsquarters; 1 to 4 inch (1 to 5/yd^2) wild mustard. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments, and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

Yellow foxtail was emerging at the time of planting which resulted in a early crop competition resulting in some sunflower stunting. POST treatments were applied on June 27, which was later than scheduled because up to six inches of rainfall on June 23. The advanced stage of the yellow foxtail and delay in application resulted in poor yellow foxtail control. It appears that Express antagonizes Assure II by controlling yellow foxtail when Assure II was applied alone compared to when applied with Express. On June 27, PRE treatments were rated and no crop injury was observed from Express. Prowl + Spartan applied PRE and Spartan applied PRE + Select or Assure II applied POST controlled yellow foxtail. On July 3 (7 DAT) there was no sunflower injury on any Express treatment. On July 10 (14 DAT) and July 24 (28 DAT), all treatments controlled wild mustard, redroot pigweed, and common lambsquarters. MSO type adjuvant enhanced yellow foxtail control from Express and partially overcame tank-mix antagonism more than other adjuvants used. Other ALS herbicides used instead of Express, namely Harmony GT, Harmony Extra, and Option, severely injured Express resistant sunflower. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Express resistant cultivated sunflower (Zollinger and Ries).

Treatment[1]	Rate	June 27				July 11		July 25	
		Yeft	Wimu	Rrpw	Hans	Snfl	Yeft	Snfl	Yeft
	(product/A)	----------% control ----------				% injury	% control	% injury	% control
PRE									
Prowl+Spartan	3pt+4oz	89	89	99	99	0	96	0	92
PRE/POST									
Spartan/Select+PO+AMS	4oz/6fl oz	72	78	99	99	0	98	0	99
Spartan/Assure II+PO+AMS	4oz/9fl oz	53	73	98	99	0	99	0	99
POST									
Express+Select+PO+AMS	0.33oz+6fl oz					0	70	0	67
Express+Assure II+NIS	0.167oz+9fl oz					0	50	0	40
Express+Assure II+NIS	0.25oz+9fl oz					0	50	0	30
Express+Assure II+NIS	0.33oz+9fl oz					0	50	0	30
Express+Assure II+NIS	0.67oz+9fl oz					0	50	0	50
Express+Assure II+	0.33oz+9fl oz+								
Liberate	1pt/100gal					0	30	0	30
Basic Blend	1% v/v					0	50	0	50
PO	1.5pt					0	50	0	40
L-132	0.75pt					0	60	0	72
MSO	1.5pt					0	60	0	85
Base	1% v/v					0	50	0	48
Z-64	1% v/v					0	50	0	73
Harmony GT+Assure II+NIS	0.3oz+9fl oz					28	50	30	30
Harmony GT+Assure II+NIS	0.6oz+9fl oz					52	50	70	30
Harmony Extra+Assure II+NIS	0.3oz+9fl oz					32	50	33	30
Harmony Extra+Assure II+NIS	0.6oz+9fl oz					50	50	50	30
Option+MSO+28-0-0	1.5oz					57	50	60	72
LSD (0.05)		15	11	2	1	3	1	1	3

[1]PO = petroleum oil concentrate = Herbimax at 1qt/A; AMS = ammonium sulfate at 2.5lb/A; NIS = nonionic surfactant = Activator 90 at 0.5% v/v; Liberate = surfactant; Basic Blend = Quad 7; L-132 = MSO = methylated seed oil = Scoil at 1.5pt/A; Base = MSO basic blend; Z-64 = 28-0-0 = urea ammonium nitrate at 1.5qt/A.

Weed control and crop response in tribenuron-tolerant sunflower. Paul Hendrickson and Richard Zollinger. (Carrington Research Extension Center, North Dakota State University, Carrington, ND 58421 and Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). The study was conducted at the NDSU Carrington Research Extension Center on a loam soil with a 6.2 pH and 3.9% organic matter. Tribenuron-tolerant sunflower '02RL0009' and a conventional hybrid '63M80' were seeded May 23, 2002 into 30-inch rows at 22,000 seeds/A. Guard plots were present between treated plots. Individual plots were 5 ft by 30 ft and arranged in a randomized complete block design with three replications. Herbicide treatments were applied with a CO_2 pressurized hand-held plot sprayer. PRE treatments were applied at 20 gal/A and 20 psi through XR8003 flat fan nozzles. POST treatments were applied at 10 gal/A and 20 psi through XR80015 flat fan nozzles. Pendimethalin and sulfentrazone were applied PRE on May 27 with 66° F, 33% RH, 0% cloud cover, 0 mph wind, and 54° F soil temperature. The soil was dry to a depth of 2.5 inches with no significant rain for 12 days after application. All other herbicides were applied on June 29 with 76° F, 77% RH, 5% cloud cover, 6 mph wind, and 78° F soil temperature to 4- to 6-leaf sunflower, 1- to 6-leaf green and yellow foxtail, 2- to 8-inch marshelder, and emerging kochia. The sunflowers were harvested on October 21.

Broadleaf weed control was generally good to excellent (76 to 100%) with tribenuron (Table). Green and yellow foxtail control from quizalofop-P decreased as the tribenuron rate increased from 0.25 to 0.5 oz ai/A. Pendimethalin and sulfentrazone did not injure the crop when evaluated on 6/29 (data not shown). Tribenuron was relatively safe when applied to the tribenuron-tolerant sunflower with yields of 1700-1900 lb/A. Thifensulfuron, thifensulfuron + tribenuron, and foramsulfuron injured the crop and reduced yields when compared to the tribenuron treatments. Tribenuron applied at 0.125 oz ai/A seriously injured the conventional hybrid, causing a 90% reduction in height and zero seed yield.

Table. Weed control and crop response in tribenuron-tolerant sunflower.

		Weed control[2]							Sunflower			
		Setaria spp.			Marshelder			Kochia	Crop injury	Height reduct.	Seed yield	Test weight
Treatment[1]	Rate	6/29	7/12	9/4	6/29	7/12	9/4	9/4	7/12	9/4	--- 10/21 ---	
	oz ai/A	---------- % ----------									lb/A	lb/bu
Express-tolerant hybrid												
Pendimethalin+sulfentrazone	19.8+3	53	0	0	87	80	88	96	0	0	1685	29.1
Sulfentrazone / clethodim +PO+AMS	3 / 1.5 +1qt+2.5lb	77	94	100	88	90	98	100	0	0	1564	29.3
Sulfentrazone / quizalofop-P +PO+AMS	3 / 0.99 +1qt+2.5lb	80	98	100	94	93	98	100	0	0	1722	29.8
Tribenuron+clethodim +PO+AMS	0.25+1.5 +1qt+2.5lb	-	93	100	-	100	100	99	2	0	1811	29.9
Tribenuron+quizalofop-P +NIS	0.125+0.99 +0.5%v/v	-	85	100	-	100	76	98	0	0	1906	29.7
Tribenuron+quizalofop-P +NIS	0.187+0.99 +0.5%v/v	-	83	100	-	100	100	98	0	0	1750	29.5
Tribenuron+quizalofop-P +NIS	0.25+0.99 +0.5%v/v	-	75	98	-	100	99	95	3	0	1907	29.7
Tribenuron+quizalofop-P +NIS	0.5+0.99 +0.5%v/v	-	37	7	-	100	99	93	15	0	1705	29.1
Thifensulfuron+quizalofop-P +NIS	0.225+0.99 +0.5%v/v	-	90	100	-	100	91	27	50	33	663	27.6
Thifensulfuron+quizalofop-P +NIS	0.45+0.99 +0.5%v/v	-	92	100	-	100	98	42	63	57	448	26.7
Thifensulfuron+tribenuron+ quizalofop-P+NIS	0.15+.075+ 0.99+0.5%v/v	-	85	100	-	100	98	83	37	13	1206	28.7
Thifensulfuron+tribenuron+ quizalofop-P+NIS	0.3+0.15+ 0.99+0.5%v/v	-	75	86	-	100	97	88	20	23	1249	28.1
Foramsulfuron + MSO+28%	1.05+ 1.5pt+1.5qt	-	96	97	-	100	100	17	75	67	0	0.0
Untreated check	0	0	0	0	0	0	0	0	0	0	1147	29.3
Conventional hybrid												
Tribenuron+quizalofop-P +NIS	0.125+0.99 +0.5%v/v	-	92	100	-	98	17	17	83	90	0	0.0
LSD (0.05)		6	12	11	11	3	20	18	8	7	327	1.0

[1]PO=petroleum oil concentrate (Peptoil), AMS=ammoniom sulfate, NIS=non-ionic surfactant (Preference), and MSO=methylated seed oil (MES100)

[2]Setaria spp. is a mix of green and yellow foxtail

Beyond application timing on Clearfield sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate the response of imidazolinone-resistant sunflower to imazamox applied at the V3 to V4 (early postemergence, EPOST), V5 to V7 (postemergence, POST), and V8 to V10 (late postemergence, LPOST) sunflower. On May 28, 2002, ethalfluralin at 1.1 lb/A was applied and incorporated for weed-free conditions. On June 4 each plot was planted consisting of four rows, two rows of USDA 'cmsHA425/RHA426' planted on the left side of each plot, and two rows of Mycogen 'X81359' planted on the right side of each plot. EPOST treatments were applied to V3 to V4 sunflower on June 27 at 10:00 am with 79 F air, 84 F soil surface, 64% relative humidity, 0% clouds, 5 mph NW wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present. POST treatments were applied to V5 to V7 sunflower on July 2 at 7:30 am with 70 F air, 72 F soil surface, 64% relative humidity, 75% clouds, 5 mph W wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present. LPOST treatments were applied to V8 to V10 sunflower on July 9 at 9:45 am with 73 F air, 78 F soil surface, 63% relative humidity, 50% clouds, 2 mph N wind, moist soil surface, wet subsoil, excellent crop vigor, and no dew present. Treatments were applied to the center two rows of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment.

The study was handweeded to avoid any confounding and competition by weeds. For all visible injury ratings, slight injury was stunting but the higher injury ratings included yellowing. Both sunflower lines were tolerant when Raptor was applied at 4 and 8 fl oz/A to V3 to V4 and V5 to V7 sunflower. Unacceptable injury increased when Raptor was applied at 8 and 12 fl oz/A to V8 to V10 sunflower. Injury did not entirely disappear through time. Sunflower from the V3 to V10 stage exhibited excellent safety to Raptor at 4 fl oz/A. The USDA sunflower line exhibited more resistance to Raptor than the Mycogen line. (Dept. of Plant Science, North Dakota State University, Fargo).

Table. Beyond application timing on Clearfield sunflower (Zollinger and Ries).

Treatment[1]	Rate	July 3		July 11		July 16		July 23		July 30		August 13		Yield	
		Line A[2]	Line B[3]	Line A[2]	Line B[3]	Line A[2]	Line B[3]	Line A[2]	Line B[3]	Line A[2]	Line B[3]	Line A[2]	Line B[3]	Line A[2]	Line B[3]
	(product/A)	--% injury --		--% injury --		--% injury --		--% injury --		--% injury --		--% injury --		----lb/A ----	
V3 to V4 (EPOST)															
Beyond+NIS+28-0-0	4fl oz	0	0	0	0	0	5	0	0	0	0	0	0	1208	1561
Beyond+NIS+28-0-0	8fl oz	0	10	0	10	0	5	0	0	0	0	0	0	1470	1575
Beyond+NIS+28-0-0	12fl oz	0	20	0	15	0	10	0	10	0	0	0	0	13368	1362
Beyond+MSO+28-0-0	12fl oz	0	0	0	0	0	0	0	0	0	0	0	0	13445	1595
V5 to V7 (POST)															
Beyond+NIS+28-0-0	4fl oz	0	0	0	0	0	0	0	0	0	0	0	0	1088	1703
Beyond+NIS+28-0-0	8fl oz	0	5	0	0	0	0	0	0	0	0	0	0	1381	1576
Beyond+NIS+28-0-0	12fl z	0	30	0	20	0	15	0	15	5	0	0	0	1381	1181
Beyond+MSO+28-0-0	12fl oz	0	10	0	5	0	0	0	0	0	0	0	0	1504	1474
V8 to V10) (LPOST)															
Beyond+NIS+28-0-0	4fl oz					0	5	0	0	0	0	0	0	1410	1383
Beyond+NIS+28-0-0	8fl oz					10	20	10	10	5	5	0	5	1390	1479
Beyond+NIS+28-0-0	12fl oz					20	35	15	25	7	15	5	10	14175	1481
Beyond+MSO+28-0-0	12fl oz					25	45	25	35	10	15	5	15	12927	12326
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	1341	1571
LSD (0.05)		NS	4	NS	4	4	5	4	5	3	3	NS	4	258	369

[1]NIS = nonionic surfactant = Activator 90 at 0.25% v/v; 28-0-0 = ammonium sulfate at 2.5% v/v; MSO = methylated seed oil = Scoil at 1.25% v/v.
[2]Line A = USDA 'cmsHA425xRH426'.
[3]Line B = Mycogen'X81359'.

Clearfield sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Valley City, ND, to evaluate crop response and weed control in sunflower to herbicides applied PRE and POST. PRE treatments were applied on May 31, 2002, at 11:30 am with 87 F air, 62 F subsoil to a depth of 4 inches, 62% relative humidity, 0% clouds, 3 to 5 mph S wind, dry soil surface, and damp subsoil. Mycogen 'X81359' sunflower was planted on May 29. POST treatments were applied June 28 at 11:30 am with 84 F air, 87 F soil surface, 51% relative humidity, 0% clouds, 5 to 12 mph S wind, dry soil surface, damp subsoil, excellent crop vigor, and no dew present to V4 to V6 sunflower. Weeds present were: 2 to 6 inch (15 to 100/ft^2) green and yellow foxtail (40:60 ratio); 6 to 10 inch (1 to 5/ft^2) wild oat; 6 to 10 inch (10 to 20/ft^2) volunteer barley; and 1 to 6 inch (2 to 20/yd^2) marshelder. Treatments were applied to the center 6.67 feet of the 10 by 30 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles with an attached windscreen for POST treatments. The experiment had a randomized complete block design with four replicates per treatment.

On June 28, PRE treatments were evaluated prior to POST application. Prowl averaged 40 to 60% green and yellow foxtail control and 20 to 30% volunteer barley control (data not shown). Dry spring conditions may have contributed to nonperformance of Prowl. No crop injury was observed with any treatment. Raptor with NIS or MSO applied alone or with Arsenal controlled foxtail species, wild oat, and marshelder. Using any other ALS type herbicide, whether SU safened (Option) or unsafened (Express, Harmony GT, Accent, or Ally), or TPS herbicide (FirstRate) either killed or seriously injured Clearfield sunflower. Clearfield sunflowers are tolerant only to imidazolinone type herbicides (Raptor, Pursuit, Arsenal).

Table. Clearfield sunflower (Zollinger and Ries).

Treatment[1]	Rate	July 10				July 26			
		Snfl	Fxtl	Wioa	Mael	Snfl	Fxtl	Wioa	Mael
	(product/A)	% injury	------% control ------			% injury	------% control ------		
PRE									
Prowl	2.42pt	0	10	0	20	0	13	0	28
Prowl+Spartan	2.42pt+2.67oz	0	0	0	48	0	28	5	46
PRE/POST									
Prowl/Beyond+ NIS+28-0-0	2.42pt/4fl oz+ 0.25% v/v+1% v/v	0	86	83	99	0	91	91	99
Prowl/Beyond+Arsenal+ NIS+28-0-0	2.42pt/4fl oz+0.896fl oz+ 0.25% v/v+1% v/v	0	95	91	99	0	98	97	99
Prowl/Beyond+Arsenal+ NIS+28-0-0	2.42pt/2.82fl oz+0.64fl oz+ 0.25% v/v+1% v/v	0	85	78	99	0	94	92	98
Prowl+Spartan/Beyond+ NIS+28-0-0	2.42pt+2.67oz/4fl oz+ 0.25% v/v+1% v/v	0	95	91	99	0	95	94	99
Prowl+Spartan/Beyond+ Arsenal+NIS+28-0-0	2.42pt+2.67oz/2.82fl oz+ 0.64fl oz+0.25% v/v+1% v/v	0	95	93	99	0	97	97	99
POST									
Beyond+NIS+28-0-0	4fl oz+0.25% v/v+1% v/v	0	78	81	99	0	85	88	99
Beyond+MSO+28-0-0	4fl oz+0.25% v/v+1% v/v	0	85	84	99	0	95	95	99
Beyond+Arsenal+ NIS+28-0-0	4fl oz+0.896fl oz+ 0.25% v/v+1% v/v	0	95	91	99	0	97	96	99
Beyond+Arsenal+ NIS+28-0-0	2.82fl oz+0.64fl oz+ 0.25% v/v+1% v/v	0	71	71	89	0	86	85	98
Express+NIS	0.533oz+0.25% v/v	49	20	10	99	48	18	10	99
Express+NIS	0.3oz+0.25% v/v	33	0	0	99	31	0	0	99
Harmony GT+NIS	0.3oz+ 0.25% v/v	90	30	20	99	99	0	2	99
Harmony Extra+NIS	0.3oz+0.25% v/v	83	30	20	99	99	0	13	99
Accent+PO+28-0-0	0.67oz+1.5pt+1.5qt	68	53	58	99	65	76	92	99
Option+MSO+28-0-0	1.5oz+1.5pt+1.5qt	70	58	68	99	68	73	86	99
FirstRate+NIS	0.3oz+0.25% v/v	90	0	0	99	99	0	0	99
Ally+NIS	0.1oz+0.25% v/v	90	25	20	99	97	16	15	77
Untreated		0	0	0	0	0	0	0	0
LSD (0.05)		3	7	4	6	6	10	10	15

[1]NIS = nonionic surfactant = Activator 90; 28-0-0 = urea ammonium nitrate; MSO = methylated seed oil = Scoil; PO = petroleum oil concentrate = Herbimax.

Weed control in imidazolinone-resistant sunflower. Endres, Gregory J. and Richard K. Zollinger. Weed control and crop response to selected herbicide treatments in imidazolinone-resistant (Clearfield™) sunflower were investigated. The trial had a randomized complete block design with three replicates. The experiment was conducted on a loam soil with 6.2 pH and 3.9% organic matter at Carrington, ND in 2002. Mycogen experimental line '6101 10180' was planted on May 22 in 30-inch rows. Herbicide treatments were applied to 10 by 30 ft plots with a CO_2 pressurized hand-held plot sprayer. PRE treatments were applied on a dry soil surface at 17 gal/A and 30 psi through 8002 flat fan nozzles on May 23 with 44 F, 53% RH, 65% clear sky, and 11 mph wind. Rainfall did not occur until 16 d following application of PRE treatments (1.15 inches). POST treatments were applied at 11.5 gal/A and 30 psi through 8001 flat fan nozzles on June 29 with 81 F, 61% RH, 80% clear sky, and 6 mph wind to V10-stage sunflower, 1- to 10-inch tall green and yellow foxtail (8 plants/ft^2), and 1- to 2-inch tall marshelder (1 plant/ft^2). The trial was hand-thinned to a population of about 20,000 sunflower/A on June 14.

Weed control was poor with PRE treatments due to the extended delay in rainfall after herbicide application (Table). Foxtail and marshelder control generally was good to excellent with imazamox four and eight weeks after herbicide application. Use of MSO as an adjuvant or addition of imazapyr did not improve weed control compared to imazamox+NIS+28%N. Sunflower tolerance to imazamox and imazamox+imazapyr was excellent. Sunflower tolerance to tribenuron and nicosulfuron was excellent while response was high with thifensulfuron, thifensulfuron&tribenuron, foramsulfuron, and chloransulam. (Carrington Research Extension Center, North Dakota Agric. Exp. Stn., North Dakota State Univ.)

Table. Weed control and crop response with imidazolinone-resistant sunflower (Endres and Zollinger).

		2 wk after trt		4 wk after trt		8 wk after trt		Sunflower response	
Treatment[a]	Rate	Fxtl	Mael	Fxtl	Mael	Fxtl	Mael	2 wk after trt	4 wk after trt
	(lb/A)	% control						% growth reduction	
Untreated	x	0	0	0	0	0	0	0	0
PRE									
Pendimethalin+sulfentrazone	1.24+0.164	x	x	25	36	20	13	x	0
Pendimethalin H_20+suen	1.24+0.164	x	x	44	40	23	0	x	0
PRE/POST									
Pend/Imazamox+NIS+28%N	1.0/0.031+0.25%+1%	73	87	83	86	92	82	0	0
Pend/Immx+imazapyr+NIS+28%N	1.0/0.031+0.014+0.25%+1%	75	83	90	88	94	83	0	0
Pend/Immx+impr+NIS+28%N	1.0/0.022+0.010+0.25%+1%	72	87	81	85	90	86	0	0
Pend+suen/Immx+NIS+ 28%N	1.0+0.125/0.031+0.25%+1%	76	84	87	88	96	89	0	0
Pend+suen/Immx+impr+NIS+ 28%N	1.0+0.125/0.022+0.010+0.25% +1%	73	89	91	83	94	81	0	0
POST									
Immx+NIS+28%N	0.031+0.25%+1%	70	90	76	92	90	92	0	0
Immx+MSO+28%N	0.031+1%+1%	70	87	80	92	93	96	1	0
Immx+impr+NIS+28%N	0.031+0.014+0.25%+1%	72	85	90	92	98	91	0	0
Immx+impr+NIS+28%N	0.031+0.010+0.25%+1%	71	88	77	88	84	84	0	0
Tribenuron+NIS	0.014+0.25%	0	56	0	38	0	68	0	0
Thifensulfuron+NIS	0.014+0.25%	0	95	0	95	0	98	90	90
Thif&trib+NIS	0.014+0.25%	0	93	0	96	0	98	89	77
Nicosulfuron+NIS	0.031+0.25%	57	66	57	45	65	37	0	0
Foramsulfuron+MSO+28%N	0.033+1.6%+3.3%	75	90	73	93	80	94	70	38
Chloransulam+NIS	0.016+0.25%	0	88	0	95	0	98	71	47
LSD (0.05)		8	8	24	22	18	13	4	6

[a]NIS=Preference, a nonionic surfactant from agriliance, St. Paul, MN; MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN.

Sugarbeets following sulfentrazone, Prosper, ND. Kegode and Ciernia. Several sulfentrazone and sulfentrazone tank mix applications were made to potato research plots at the Prosper research station in 2001. In 2002 this site was planted May 17 with Hilleshog Horizon RR sugarbeet and plots were evaluated for stand reduction and stunting. Tillage consisted of a tandem disking in the fall of 2001 and the field was cultivated prior to planting in the spring of 2002. All plots were sprayed June 19 and July 16 with 1.6 pt/A glyphosate (Roundup UltraMax) plus 0.5 lb/A AMS to control weeds. Two 10 ft. sections of row per plot were harvested by hand Sept. 17 and tare samples analyzed for sugar content by Crystal Sugar. Plots were 12 ft. wide by 20 ft. long and the experiment was a randomized complete block design with 4 reps.

		June 24	July 30		Aug 16					
Treatment in 2001	Rate	Stand	Stunt	Stand	Stunt	Plts/ 20ft	Sucrose	Root yield	Impurity index	Extractable sucrose
	oz ai/A	%	%	%	%		%	ton/A		lb/A
Sulfentrazone	4	24	25	30	31	19	9.3	16.1	1833	2208
Sulfentrazone	8	1	25	14	64	7	9.0	6.2	1852	824
Sulfentrazone + Metolachlor	4 + 22.8	67	7	86	1	30	9.8	21.2	1737	3094
Sulfentrazone + Rimsulfuron	4 + 0.375	15	26	34	24	16	9.0	15.5	1858	2067
Sulfentrazone + Metribuzin	4 + 8	28	24	46	21	20	9.3	19.2	1862	2596
Untreated	4	100	3	99	0	37	9.7	22.9	1726	3301
C.V. %		35	71	29	58	36	8.1	25.8	11	32
LSD 1%		21	NS	23	21	12	NS	6.5	NS	1119
LSD 5%		28	NS	31	29	16	NS	9.1	NS	1548

Sulfentrazone at 4 and 8 oz/A applied to potatoes in 2001 reduced overall sugarbeet stands that led to reductions in yield and extractable sucrose. Sulfentrazone plus rimsulfuron and sulfentrazone plus metribuzin had similar losses in stands, yield and extractable sucrose as sulfentrazone applied at 4 oz/A. Sulfentrazone plus metolachlor had similar yield and extractable sucrose as the control (untreated).