Weed Control in Glyphosate-resistant Alfalfa. Kirk Howatt, Dwain Meyer, Ronald Roach, Robert Nudell, and Janet Harrington. 'DK-34RR17' alfalfa was seeded. Treatments 1 through 11 were seeded to alfalfa with tame oat as a cover crop. Treatments 12 through 16 were seeded only with alfalfa. The study was located in Fargo, ND, on research area having silty clay soil texture, 6.8 % organic matter, and pH of 7.2. Parts of treatments were applied four times as follows:

Date	5/23/06	5/30/06	6/2/06	6/13/06
Temperature (air, °F)	73	85	81	67
Temperature (soil, °F)	69	Not reported	64	61
Humidity (%)	58	11	20	56
Sky (% cloud cover)	100	20	0	25
Wind & direction (mph @ deg)	4 gusting to 15 @ 180	4 @ 270	3 @270	6 @ 20
Alfalfa	1 to 2-trifoliolate	3-trifoliolate	4 d after 3-trif.	3 w after 1 trif., 4 to 8-inch tall
Wimu	2 to 4-leaf	3 to 5-leaf		injured plants, flowering
Wibw	1 to 3-leaf	2 to 5-leaf		1 to 3-leaf
Dali	1 inch tall and flowering	flowering		injured plants, flowering
Cath	2 to 4-inch	4 to 6-inch tall		4- to 6 inch
Wioa (wild and tame oats)	3 to 4-leaf	3 to 5-leaf		essentially none present

All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT 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 replications.

		Treatment	Alfalfa				6/13					6/27				
Treatment	Rate	stage	6/1	6/6	6/13	6/27	Wioa	Wibw	Cath	Wimu	Dali	Wioa	Wibw	Cath	Wimu	Dali
	oz ai/A		% injury				% control									
Untreated		NA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glyphosate-WM+AMS	12+22	1 trf	0	0	0	0	99	79	84	76	40	99	79	70	67	66
Glyt-WM+AMS/Glyt-WM+AMS	12+22/12+22	1 trf/3 w	0	0	0	0	98	79	85	65	55	99	93	94	99	89
Glyt-WM+AMS/Glyt-WM+AMS	24+22+24+22	1 trf/3 w	0	0	0	0	99	84	81	81	55	99	90	94	99	89
Glyphosate-WM+AMS	12+22	3 trf	0	0	0	0	99	89	89	96	67	99	94	89	97	84
Glyphosate-WM+AMS	24+22	3 trf	0	0	0	0	99	95	92	97	90	99	98	91	99	97
Imazamox+MSO+UAN	0.5+0.19G+0.25G	3 trf	0	0	0	0	71	52	66	77	22	98	79	70	93	75
Cleth-SM+Brox+2,4-B+NIS+AMS	1.5+4+8+0.25%+40	3 trf	0	0	0	0	97	95	81	76	42	99	81	81	74	65
Cleth-SM+NIS+AMS/Brox+2,4-DB	1.5+0.25%+40/4+8	3 trf/4 d	0	0	0	0	86	84	76	89	25	74	81	77	80	62
Glyt-WM+Immx+NIS+AMS	12+0.5+0.25%+22	3 trf	0	0	0	0	99	93	94	97	86	99	96	96	99	96
Glyt-WM+Cleth-M+Brox+2,4-+NIS+AMS	12+1.5+4+8+0.25%+40	3 trf	0	0	0	0	99	96	86	98	76	99	91	91	99	90
Untreated	0	NA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glyt-WM+AMS/Glyt-WM+AMS	12+22/12+22	1 trf/3 w	0	0	0	0	95	76	82	71	52	99	93	94	99	86
Glyt-WM+AMS/Glypt-WM+AMS	24+22/24+22	1 trf/3 w	0	0	0	0	99	74	85	94	52	99	92	96	98	86
Imazamox+MSO+UAN	0.5+0.19G+0.25G	3 trf	0	0	0	0	69	55	70	80	25	96	71	71	92	75
Bromoxynil+2,4-DB	4+8	3 trf	0	0	0	0	10	91	87	84	27	0	75	81	87	62
LSD (P=0.05)			0	0	0	0	4	6	6	7	9	18	4	4	4	6
CV			0	0	0	0	3	6	6	6	14	16	4	4	3	6

Alfalfa was not visibly injured by any of the treatments, including a two-fold application rate applied twice. Weed control was not improved for treatments that were applied at the first trifoliolate stage compared to the third trifoliolate stage. However, alfalfa was more vigorous in plots that received treatment at the first trifoliolate because the severe competition by weeds was removed.

Broadleaf weed control in transplanted cabbage. Harlene Hatterman-Valenti and Collin Auwarter.

A study was conducted at the NDSU Agriculture Experiment Station in Fargo, ND to evaluate herbicides applied sequentially for crop safety and weed control in transplanted cabbage. The study was conducted on a silty-clay soil with 6.8% organic matter and 7.2 pH. A small grain was grown during 2005. Plots were 2 rows (2 ft row spacing) by 10 ft arranged in a randomized complete block design with four replicates. Seedlings were transplanted at 1.5 ft centers on May 22. Initial herbicide treatments consisted of herbicides applied just prior to transplanting or immediately following transplanting using a CO_2-pressurized sprayer Crop injury and weed control were evaluated 3 and 7weeks after initial treatments. Water was not limiting as irrigation was scheduled as needed. Select was applied with MSO on June 28 for post-emergence grass control. Cabbages were harvested beginning August 14, and 28. Application, environmental, crop, and weed data are listed below:

Date:		5/22/06	5/22/06	7/1/06
Treatment:		PRETRA	PROSTTRA	POSPOS
Sprayer:	gpa:	20	20	20
	psi:	40	40	40
	nozzle:	11001	11001	11001
Air temperature (F):		72	72	75
Rel. hum. (%):		33	33	40
Wind (mph):		8	8	4
Soil moisture:		adequate	adequate	adequate
Cloud cover (%):		50	50	10
Cabbage:	Height (inch):	0	6	14

Weed control evaluations indicated that common purslane, Venice mallow, and redroot pigweed control 3 WAT was greater than 85% when Outlook, GoalTender (water-based formulation), or Spartan were applied prior to transplanting. However, by 7 WAT, broadleaf weed control had dropped below an acceptable measure (85%) for all treatments except GoalTender (water-based formulation) applied pre-transplant followed by Goal (EC formation) applied post-emergence. The post-emergence application of oxyfluorfen caused visible injury to some of the cabbage leaves, but plants outgrew injury and had the greatest total yield from the two harvests. This was almost twice the yield from the untreated and approximately 25% more than the Outlook treatment, which was the second highest yielding treatment. GoalTender (water-based formulation) applied post-emergence caused less cabbage injury compared to the EC formulation, but because the initial application was at a lower rate, broadleaf weed pressure was much greater and many of the broadleaf weeds were beyond a controllable size at the time of the post-emergence application.

Table 1. Effect of herbicides and herbicide combinations on cabbage injury, broadleaf weed control, and total yield.

			Injury	Vema	Rrpw	Copu	Rrpw	Colq	Vema	Copu	Total Yield
Treatment	Rate	Timing	6/15/2006				7/15/2006				8/28/2006
	lb ai/a		%								lb/A
Untreated			0	0	0	0	0	0	0	0	23081
Chateau	0.06		4	71	83	88	58	69	64	89	25803
Chateau	0.03		3	78	88	89	83	65	65	71	29040
Chateau	0.03										
Spartan	0.31		5	88	90	100	65	80	56	79	21296
GoalTender	0.5		1	93	94	99	86	90	81	96	40142
Goal	0.13										
GoalTender	0.25		3	65	76	86	80	73	75	96	28435
GoalTender	0.25										
Aim	0.007		5	70	71	79	93	88	58	71	29131
Aim	0.015										
Outlook	0.98		0	90	95	98	68	58	55	70	32398
Prowl H2O	0.71		0	54	61	69	63	81	55	75	27316
Dacthal	10.5		1	66	68	64	60	74	46	78	31853
LSD (P=.05)			7	27	32	30	30	29	25	31	18788

* PRETRA = herbicide applied prior to transplanting, POSTTR = herbicide applied immediately after transplanting, POSPOS = herbicide applied post-emergence to the crop.

Pre- and post-emergence herbicide combinations for broadleaf weed control in transplanted cabbage. Harlene Hatterman-Valenti and Collin Auwarter. A study was conducted at the NDSU Agriculture Experiment Station in Fargo, ND to evaluate herbicides applied sequentially for crop safety and weed control in transplanted cabbage. The study was conducted on a silty-clay soil with 6.8% organic matter and 7.2 pH. A small grain was grown during 2005. Plots were 2 rows (2 ft row spacing) by 10 ft arranged in a randomized complete block design with four replicates. Seedlings were transplanted at 1.5 ft centers on May 22. Initial herbicide treatments consisted of herbicides applied just prior to transplanting or immediately following transplanting using a CO_2-pressurized sprayer Crop injury and weed control were evaluated 3 and 7weeks after initial treatments. Water was not limiting as irrigation was scheduled as needed. Select was applied with MSO on June 28 for post-emergence grass control. Cabbages were harvested beginning August 14, 28, and September 11. Application, environmental, crop, and weed data are listed below:

Date:		5/22/06	5/22/06		7/1/03
Treatment:		PRETRA	PROSTTRA		POSPOS
Sprayer:	gpa:	20	20		20
	psi:	40	40		40
	nozzle:	11001	11001		11001
Air temperature (F):	72	72		75	
Rel. hum. (%):		33	33		40
Wind (mph):		8	8		4
Soil moisture:		adequate	adequate		adequate
Cloud cover (%):		50 50		10	
Cabbage:	Height (inch):	0	6		14

Weed control evaluations indicated that common purslane, Venice mallow, and redroot pigweed control 3 WAT was greater than 85% when GoalTender (water-based formulation), or Spartan were applied prior to transplanting. However, by 7 WAT, broadleaf weed control had dropped below an acceptable measure (85%) for all treatments. The post-emergence application of GoalTender caused visible injury to some of the cabbage leaves, but plants outgrew injury. The greatest total yield from the three harvests was when GoalTender was applied pretransplant and again postemergence. This was 65% greater than the untreated and approximately 10% more than the Prowl H2O followed by GoalTender treatment, which was the second highest yielding treatment. Oxyfluorfen (water-based formulation) applied post-emergence caused minor cabbage injury.

Table 1. Effect of herbicide combinations on cabbage injury, broadleaf weed control, and total yield.

Treatment	Rate	Timing*	Injury	Vema 6/15/2006	Rrpw 6/15/2006	Copu 6/15/2006	Rrpw 7/15/2006	Colq 7/15/2006	Vema 7/15/2006	Copu 7/15/2006	Total Yield 9/14/2006
	lb ai/a		%	%	%	%	%	%	%	%	lb/A
Untreated			0	0	0	0	35	31	30	30	27376
Chateau	0.06	PRETRA	0	74	79	85	80	76	65	80	36179
Chateau	0.05	POSPOS									
Chateau	0.03	POSTTR	0	53	56	65	53	64	58	78	25077
Chateau	0.05	POSPOS									
Spartan	0.3	PRETRA	0	89	90	91	88	89	78	73	30401
Spartan	0.13	POSPOS									
GoalTender	0.5	PRETRA	1	90	87	91	79	68	86	80	45194
GoalTender	0.38	POSPOS									
GoalTender	0.25	POSTTR	3	76	71	85	54	71	74	83	29131
GoalTender	0.38	POSPOS									
Aim	0.007	POSTTR	0	63	50	50	53	75	58	66	36542
Aim	0.02	POSPOS									
Outlook	0.98	POSTTR	0	66	94	100	88	85	51	78	39265
GoalTender	0.25	POSPOS									
Prowl H2O	0.7	POSTTR	0	84	80	83	76	83	81	73	41594
GoalTender	0.25	POSPOS									
Dacthal	10.5	POSTTR	0	73	54	80	71	71	70	90	28375
GoalTender	0.25	POSPOS									
LSD (P=.05)			3	28	26	24	23	29	36	26	16100

* PRETRA = herbicide applied prior to transplanting, POSTTR = herbicide applied immediately after transplanting, POSPOS = herbicide applied post-emergence to the crop/

Dry Bean tolerance to halosulfuron. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Thompson and Hatton, ND, to evaluate dry bean type tolerance to halosulfuron. 'Ensign' navy bean, 'Maverick' pinto bean, 'T-39' black bean, and 'Montcalm' kidney bean were planted perpendicular to the plot length on May 23 and June 1, 2006 at Thompson and Hatton, respectively. At Thompson, PRE treatments were applied on May 26 at 8:00 am with 54 F air, 56 F soil at a four inch depth, 75% relative humidity, 0% cloud cover, 2 to 4 mph SE wind, moist soil surface and subsoil. Soil characteristics were 16.1% sand, 56.9% silt, 27% clay, silt loam texture, 5.3% OM and 7.7 pH. POST treatments were applied on June 14 at 12:00 pm with 79 F air, 88 F soil surface, 38% relative humidity, 30% cloud cover, 9 to 14 mph S wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to V2 to V3 (1 to 2 inch) navy bean; V2 to V3 (1 to 2 inch) pinto bean; V2 to V3 (1 to 2 inch) black bean; and V2 to V3 (1 to 2 inch) kidney bean.

At Hatton, PRE treatments were applied June 1 at 1:05 pm with 79 F air, 68 F soil at a four inch depth, 22% relative humidity, 30% cloud cover, 5 to 7 mph SW wind, dry soil surface, and moist subsoil. Soil characteristics were 62.5% sand, 25.4% silt, 12.1% clay, sandy loam texture, 3.5% OM, and 7.5 pH. POST treatments were applied June 21 at 9:40 am with 65 F air, 71 F soil surface, 66% relative humidity, 60% cloud cover, 8 to 12 mph S wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to V2 (2 to 5 inch) navy bean; V2 (2 to 5 inch) pinto bean; V2 (2 to 5 inch) black bean; and V2 (2 to 5 inch) kidney bean.

Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a bicycle-type plot sprayer delivering 17 gpa at 40 psi through 8002 TeeJet flat-fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 TeeJet flat-fan nozzles for POST treatments. The experiment had a strip block design with three replicates per treatment.

Hatton:
On June 14, pinto, navy, kidney, and black beans were in the unifoliate stage and showed good emergence. No injury was observed with any treatment. This rating is approximately 14 days after planting. There was no stunting, chlorosis, burning, deformed leaves or injury symptoms. No weeds were emerging except volunteer wheat in the treated plot area which was a light infestation. There was little to no rain after PRE applications. On June 29, (7 DAT after the Permit POST treatments), there was no visible injury. On July 14, there was no visible injury. Pinto beans were 8 to 10 inches tall and flowering, navy beans were 6 to 8 inches tall and flowering, kidney beans were 10 to 12 inches tall and flowering, and black beans were 6 to 9 inches tall and flowering. On August 9, there was no visible injury in any treatment. All bean types were green without any indication of beginning senescence and no indication of stress from any herbicide treatment as exhibited in delay in physiological maturity.

Thompson:
On June 7, pinto, navy, kidney, and black beans were all in the unifoliate stage and showed good emergence. No injury was observed with any treatment. This rating is approximately 14 days after application. There was no stunting, chlorosis, burning, deformed leaves or injury symptoms. Very little rain occurred after application. Redroot pigweed was emerged which Permit has some activity. This may indicate that the herbicide applied PRE was not activated by rain. Almost all weeds were in the wheel tracks from seeding. On June 15, no visible injury and beans were in the 1 to 2 trifoliate. Redroot pigweed was emerging to 2 inches tall. On July 14, there was no visible injury. Pinto beans were 14 to 18 inches tall and flowering, navy beans were 10 to 12 inches tall and flowering, kidney beans were 12 to 14 inches tall and flowering, and black beans were 14 to 18 inches tall and flowering. On August 9, no injury was observed in any treatment. Beans were green without any indication of beginning senescence and no indication of stress from any herbicide treatment as exhibited in delay in physiological maturity. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table 1. Dry Bean tolerance to halosulfuron, Thompson (Zollinger and Ries).

Treatment[1]	Rate	12 and 20 DAT - PRE				30 and 56 DAT - POST				Yield			
		pinto	navy	kidney	black	pinto	navy	kidney	black	pinto	navy	kidney	black
		% injury				% injury				cwt/A			
PRE													
Permit	0.67oz	0	0	0	0	0	0	0	0	27.3	29.7	29.0	27.3
PRE/POST													
Permit/Permit+ NIS	0.67oz/0.67oz+ 0.25% v/v	0	0	0	0	0	0	0	0	28.7	30.4	31.4	30.7
POST													
Permit+NIS	0.67oz+0.25% v/v					0	0	0	0	28.4	30.1	29.7	29.4
Untreated		0	0	0	0	0	0	0	0	30.1	30.4	31.4	29.4
LSD (0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS			

[1]NIS = nonionic surfactant = R-11.

Table 2. Dry Bean tolerance to halosulfuron, Hatton (Zollinger and Ries).

Treatment[1]	Rate	12 and 20 DAT - PRE				30 and 56 DAT - POST				Yield			
		pinto	navy	kidney	black	pinto	navy	kidney	black	pinto	navy	kidney	black
		% injury				% injury				cwt/A			
PRE													
Permit	0.67oz	0	0	0	0	0	0	0	0	25.8	26.7	26.5	26.6
PRE/POST													
Permit/Permit+ NIS	0.67oz/0.67oz+ 0.25% v/v	0	0	0	0	0	0	0	0	23.5	25.6	25.9	26.8
POST													
Permit+NIS	0.67oz+0.25% v/v					0	0	0	0	27.8	28.6	26.7	26.1
Untreated		0	0	0	0	0	0	0	0	26.7	27.2	26.1	27.6
LSD (0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS			

[1]NIS = nonionic surfactant = R-11.

<u>Dry bean tolerance to KIH-485.</u> Zollinger, Richard K. and Jerry L. Ries. Two experiments were conducted near Hatton and Thompson, ND, to evaluate dry bean type response to soil-applied KIH-485. 'Ensign' navy dry bean, 'Maverick' pinto dry bean, 'T-39' black dry bean, and 'Montcalm' kidney dry bean were planted perpendicular to each plot length on June 1, 2006 at Hatton and May 23 in Thompson. At Hatton, PRE treatments were applied on June 1 at 1:15 with 80 F air, 68 F soil at a four inch depth, 23% relative humidity, 30% cloud cover, 6 to 10 mph SW wind, dry soil surface, moist subsoil, and no dew present. Soil characteristics were 63.9% sand, 23.4% silt, 12.7% clay, sandy loam texture, 3.6% OM, and pH 7.6.

At Thompson, PRE treatments were applied on May 26 at 7:30 am with 54 F air, 56 F soil at a four inch depth, 75% relative humidity, 0% cloud cover, 2 to 4 mph S wind, moist soil surface and subsoil. Soil characteristics were 16.1% sand, 56.9% silt, 27% clay, silt loam texture, 5.3% OM, and pH 7.7.

Treatments at both locations were applied to the center 6.7 feet of the 10 by 40 foot plots with a bicycle-type plot sprayer delivering 17 gpa at 40 psi through 11002 TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replicates per treatment.

Hatton:
On June 14, pinto, navy, kidney, and black beans were in the unifoliate stage and showed good emergence. No injury was observed with any treatment. This rating is approximately 14 days after planting. There was no stunting, chlorosis, burning, deformed leaves or injury symptoms. No weeds were emerging except volunteer wheat in the treated plot area which was a light infestation. There was little to no rain after PRE applications. On June 29, there was no visible injury. On July 14, there was no visible injury. Pinto beans were 8 to 10 inches tall and flowering, navy beans were 6 to 8 inches tall and flowering, kidney beans were 10 to 12 inches tall and flowering, and black beans were 6 to 9 inches tall and flowering. On August 9, there was no visible injury in any treatment. All bean types were green without any indication of beginning senescence and no indication of stress from any herbicide treatment as exhibited in delay in physiological maturity.

Thompson:
On June 7, pinto, navy, kidney, and black beans were all in the unifoliate stage and showed good emergence. No injury was observed with any treatment. This rating is approximately 14 days after application. There was no stunting, chlorosis, burning, deformed leaves or injury symptoms. Very little rain occurred after application. Redroot pigweed was emerged which KIH-485 has activity. This may indicate that the KIH-485 applied was not activated by the lack of rain. Almost all weeds were in the wheel tracks from planting. On June 15, no visible injury and beans were in the 1st to 2nd trifoliate. Redroot pigweed was emerging to 2 inches tall. On July 14, there was no visible injury. Pinto beans were 14 to 18 inches tall and flowering, navy beans were 10 to 12 inches tall and flowering, kidney beans were 12 to 14 inches tall and flowering, and black beans were 14 to 18 inches tall and flowering. On August 9, no injury was observed in any treatment. Beans were green without any indication of beginning senescence and no indication of stress from any herbicide treatment as exhibited in delay in physiological maturity. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Dry bean tolerance to KIH-485, Hatton (Zollinger and Ries).

Treatment	Rate	13, 28, 43, and 69 DAT				Yield			
		Pinto	Navy	Kidney	Black	Pinto	Navy	Kidney	Black
	(product/A)	------------ % control ------------				-------------- cwt/A --------------			
KIH-485	2.1oz	0	0	0	0	23.7	24.5	24.9	25.1
KIH-485	2.8oz	0	0	0	0	27.5	25.5	22.7	25.4
KIH-485	4.2oz	0	0	0	0	23.9	21.8	19.4	22.1
Untreated		0	0	0	0	26.3	25.2	23.5	23.1
LSD (0.05)		NS	NS	NS	NS	NS			

Table. Dry bean tolerance to KIH-485, Thompson (Zollinger and Ries).

Treatment	Rate	12, 20, 49, and 75 DAT				Yield			
		Pinto	Navy	Kidney	Black	Pinto	Navy	Kidney	Black
	(product/A)	------------ % control ------------				-------------- cwt/A --------------			
KIH-485	2.8oz	0	0	0	0	27.3	26.2	27.3	27.3
KIH-485	3.5oz	0	0	0	0	29.0	24.5	28.6	29.0
KIH-485	5.24oz	0	0	0	0	29.7	26.9	29.0	28.0
Untreated		0	0	0	0	26.2	26.3	30.1	29.7
LSD (0.05)		NS	NS	NS	NS	NS			

Dry bean herbicide programs. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate crop response and weed efficacy in dry beans. PPI treatments were applied on May 23, 2006 at 10:15 am with 60 F air, 61 F soil at a four inch depth, 96% relative humidity, 100% cloud cover, 8 to 11 mph N wind, dry soil surface, and moist subsoil and double incorporated with a field cultivator at a depth of 2 to 2.5 inches. Soil characteristics were 29.7% sand, 44.7% silt, 25.6% clay, loam texture, 3.9% OM, and pH 5.4. 'Maverick' pinto dry bean was planted on May 23. POST treatments were applied on June 20 at 10:15 am with 66 F air, 68 F soil surface, 92% relative humidity, 100% cloud cover, 2 to 4 mph S wind, moist soil surface, moist subsoil, excellent crop vigor, and dew present to V3 to V4 pinto bean. Weed species present in PPI treatments were: 1 to 7 inch (10 to 25/yd^2) yellow foxtail; 2 to 5 inch (5 to 10/yd^2) common ragweed;1 to 5 inch (1 to 5/yd^2) redroot pigweed; and 1 to 5 inch (1 to 5/yd^2) common lambsquarters. Weed species present in POST only treatments were: 6 to 10 inch (30 to 50/ft^2) yellow foxtail; 4 to 8 inch (5 to 20/yd^2) common ragweed; 3 to 8 inch (5 to 15/yd^2) redroot pigweed; and 3 to 6 inch (1 to 5/yd^2) common lambsquarters. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet flat-fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 11001 Turbo TeeJet flat-fan nozzles for POST treatments. The experiment had randomized complete block design with three replicates per treatment.

The study was conducted to evaluate common ragweed control with various herbicide combinations. The common ragweed pressure was very high. On June 21, the injury was localized speckles or necrotic patches. There was no stunting or chlorosis. By July 18, the dry beans had recovered and all new growth were void of the burn symptoms. On June 21, Prowl H_2O gave 70 to 80% foxtail control but poor broadleaf weed control. Reflex applied alone gave near complete ragweed control. Adding other broadleaf herbicides to Reflex reduced common ragweed control. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Dry bean herbicide programs (Zollinger and Ries).

		June 21	July 5					July 18				
Treatment[1]	Rate	Pinto	Pinto	Yeft	Rrpw	Colq	Corw	Pinto	Yeft	Rrpw	Colq	Corw
	(product/A)	% injury	% injury	------------ % control ------------				% injury	------------ % control ------------			
PPI/POST												
Prowl H_2O/Rezult+PO+28% N	3pt/1.6pt+1.6pt+1% v/v+1qt	20	14	97	47	58	69	0	99	91	99	69
Pursuit Plus/Reflex+PO+28% N	1.25pt/4fl oz+1% v/v+1qt	18	8	43	99	85	71	0	50	99	87	65
POST												
Rezult+PO+28% N	1.6pt+1.6pt1% v/v+1qt	18	13	78	57	47	40	0	83	62	50	40
Reflex+R-11	12fl oz+0.25% v/v	13	3	0	99	43	98	0	0	99	73	98
Raptor+Reflex+R-11	4fl oz+8fl oz+0.25% v/v	12	12	63	99	57	59	0	63	99	57	69
Rezult+Raptor+Reflex+ PO+28%N	1.6pt+1.6pt+2fl oz+4fl oz+ 1% v/v+1qt	28	8	70	99	55	63	0	70	99	58	63
Rezult+Reflex+ PO+28%N	1.6pt+1.6pt+4fl oz+1% v/v+1qt	28	18	74	99	47	90	0	82	99	50	84
Untreated		0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		5	5	8	2	9	4	NS	10	2	11	5

[1]Rezult = Rezult Copack; PO = petroleum oil concentrate = Herbimax; 28% N = 28-0-0; R-11 = nonionic surfactant.

Navy bean desiccation. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Hatton, ND, to evaluate dry bean desiccation from Aim and Valor with adjuvants. 'Ensign' navy bean was planted on June 1, 2006. The study site was maintained weed free through the growing season from two applications of Rezult Copack at 1.6pt/A and hand-weeding. Desiccation treatments were applied on August 23 at 10:00 am with 70 F air, 76 F soil surface, 77% relative humidity, 25% clouds, 3 to 5 mph E wind, moist soil surface and subsoil, and no dew present to naturally senescent dry bean. Dry bean senescence at application was quantified in the following manner: 50% green pods, 50% yellow pods, 0% leather pods, 5 to 10% top leaf drop, and 50 to 60% bottom leaf drop. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 00 gpa at 40 psi through 11002 Turbo TeeJet flat-fan nozzles. The experiment had a randomized complete block design with three replicates per treatment.

Generally, Gramoxone Inteon increased desiccation quicker than other treatments. Over 0.75 inches of rain occurred following application. From 0 to 7 DAT the weather was sunny, warm, and breezy with 55F lows and 80F highs. At 10 DAT, there was less differences between treatments. Desiccation from Gramoxone and glyphosate was better than previous years. At 10 to14 DAT, 0.2 inches of rain occurred with sunny and highs were in the 70F which may explain the increased desiccation. Valor + Dyne-Amic desiccated vines quickly, it was not until 10 DAT for Gramoxone to equal Valor + Dyne-Amic vine control of 73%. Valor increased control over Aim over time and all treatments desiccated dry bean greater than the untreated. Dyne-Amic and Superb HC with Valor and Aim and Gramoxone had 94% or better leather pods at 14 DAT. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Navy bean desiccation (Zollinger and Ries).

Treatment[1]	Rate	5 DAT					7 DAT				
		leaf[2]	vine[3]	green[4]	yellow[5]	leather[6]	leaf	vine	green	yellow	leather
	(product/A)	---------------% control ---------------					---------------% control ---------------				
Aim+Z-64	2oz+2pt	68	20	22	70	8	73	25	17	62	22
Aim+Renegade	2oz+2pt	66	10	27	68	5	73	20	18	53	28
Aim+Scoil	2oz+2pt	71	30	17	63	20	77	25	12	57	32
Aim+Trophy Gold	2oz+0.5pt	68	12	17	77	7	73	17	17	65	18
Valor+Trophy Gold	1.5oz+0.5pt	75	28	17	72	12	82	40	8	55	38
Aim+Dyne-Amic	2oz+2pt	72	13	20	68	12	77	25	17	43	40
Valor+Dyne-Amic	1.5oz+2pt	81	47	8	73	18	86	67	5	27	68
Aim+Superb HC	2oz+0.5% v/v	72	28	23	63	13	79	30	12	52	37
Valor+Superb HC	1.5oz+0.5% v/v	78	28	13	70	17	85	45	8	44	48
Aim+Base	2oz+2pt	65	13	15	67	17	73	18	7	58	35
Valor+Base	1.5oz+2pt	73	27	13	73	13	81	30	12	50	38
Aim+AG 05006	2oz+0.5% v/v	67	18	22	67	12	74	28	10	58	32
Valor+AG 05006	1.5oz+0.5% v/v	78	23	16	71	12	84	40	8	53	38
Aim+AG 06038	2oz+0.5% v/v	69	14	25	68	7	71	28	8	52	40
Valor+AG 06038	1.5oz+0.5% v/v	79	22	10	78	12	87	45	7	43	50
Aim+AG 06011	2oz+6oz	67	10	19	76	5	73	18	17	57	27
Valor+AG 06011	1.5oz+6oz	72	18	18	73	5	78	27	12	50	37
Aim+AG 02013+AG 06470	2oz+4oz+1% v/v	68	22	18	73	8	74	37	12	50	32
Valor+AG 02013+AG 06470	1.5oz+4oz+1% v/v	70	18	22	77	5	75	23	20	53	27
Aim+N-Tense	2oz+1% v/v	70	18	17	77	7	78	25	10	50	40
Valor+N-Tense	1.5oz+1% v/v	68	16	30	63	7	78	20	20	52	27
Gramoxone Inteon+R-11	1.5pt+0.5% v/v	86	33	10	72	18	93	53	7	42	52
Roundup Original Max+AMS	22fl oz+17lb/100gal	66	5	42	58	0	78	18	20	57	23
Untreated		43	0	52	48	0	53	5	38	55	7
LSD (0.05)		4	6	7	6	5	5	7	6	10	10

[1]Z-64,Renegade and Base = MSO basic pH blend; Scoil = methylated seed oil; Trophy Gold = oil based surfactant; Dyne-Amic = MSO + organosilicone surfactant; Superb HC = high surfactant oil concentrate; AG = proprietary adjuvants from Agriliance; N-Tense = water conditioning agents + surfactants; R-11 = nonionic surfactant; AMS = ammonium sulfate.

[2]Leaf = % dry leaf and leaf drop.

[3]Vine = % vine desiccation.

[4]Green = % green colored pods.

[5]Yellow = % yellow colored pods.

[6]Leather = % brown/dry pods.

Table cont. Navy bean desiccation (Zollinger and Ries).

Treatment[1]	Rate	10 DAT leaf[2]	10 DAT vine[3]	10 DAT green[4]	10 DAT yellow[5]	10 DAT leather[6]	14 DAT leaf	14 DAT vine	14 DAT green	14 DAT yellow	14 DAT leather
	(product/A)	---------------% control				---------------	---------------% control				---------------
Aim+Z-64	2oz+2pt	78	32	13	60	27	81	58	13	33	53
Aim+Renegade	2oz+2pt	79	30	13	53	33	86	67	5	28	67
Aim+Scoil	2oz+2pt	78	30	12	52	37	86	63	5	28	67
Aim+Trophy Gold	2oz+0.5pt	76	22	10	57	32	85	32	7	17	77
Valor+Trophy Gold	1.5oz+0.5pt	91	43	7	35	58	95	73	3	15	83
Aim+Dyne-Amic	2oz+2pt	81	43	8	27	65	90	68	4	2	94
Valor+Dyne-Amic	1.5oz+2pt	92	73	3	24	72	96	91	1	3	96
Aim+Superb HC	2oz+0.5% v/v	81	42	8	30	62	92	73	2	1	97
Valor+Superb HC	1.5oz+0.5% v/v	88	68	5	22	73	94	82	1	2	97
Aim+Base	2oz+2pt	77	23	7	47	47	86	53	5	22	73
Valor+Base	1.5oz+2pt	85	37	10	32	62	92	72	7	10	83
Aim+AG 05006	2oz+0.5% v/v	79	32	8	43	48	86	58	2	18	77
Valor+AG 05006	1.5oz+0.5% v/v	86	45	7	47	47	92	74	3	20	77
Aim+AG 06038	2oz+0.5% v/v	77	32	7	35	58	88	67	4	13	83
Valor+AG 06038	1.5oz+0.5% v/v	92	55	5	32	65	97	77	1	9	90
Aim+AG 06011	2oz+6oz	76	28	17	48	33	81	50	7	25	68
Valor+AG 06011	1.5oz+6oz	81	32	8	50	42	91	62	3	18	78
Aim+AG 02013+AG 06470	2oz+4oz+1% v/v	57	40	10	50	40	85	53	8	25	67
Valor+AG 02013+AG 06470	1.5oz+4oz+1% v/v	79	33	15	42	43	91	68	5	13	83
Aim+N-Tense	2oz+1% v/v	83	43	5	33	58	89	58	3	11	86
Valor+N-Tense	1.5oz+1% v/v	81	32	17	47	33	89	62	10	22	68
Gramoxone Inteon+R-11	1.5pt+0.5% v/v	96	73	3	23	73	99	97	0	4	99
Roundup Original Max+AMS	22fl oz+17lb/100gal	84	35	17	42	42	89	68	8	15	77
Untreated		58	9	23	58	18	68	27	18	23	58
LSD (0.05)		13	5	5	7	7	3	5	4	6	5

[1]Z-64,Renegade and Base = MSO basic pH blend; Scoil = methylated seed oil; Trophy Gold = oil based surfactant; Dyne-Amic = MSO + organosilicone surfactant; Superb HC = high surfacatant oil concentrate; AG = proprietary adjuvants from Agriliance; N-Tense = water conditioning agents + surfactants; R-11 = nonionic surfactant; AMS = ammonium sulfate.

[2]Leaf = % dry leaf and leaf drop.

[3]Vine = % vine desiccation.

[4]Green = % green colored pods.

[5]Yellow = % yellow colored pods.

[6]Leather = % brown/dry pods.

2006 Evaluation of No-Till Field Pea Herbicide Programs at Hettinger

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Pre-plant treatments (PP) were applied on April 15. 'DS Admiral' yellow field pea was seeded on April 23. Post-emergence (POST) treatments were applied to 6 node peas (3"), tillering volunteer hrsw, 2" tall Russian thistle (ruth) and to 2" tall kochia (kocz) on May 25 with 52°F, 87% RH clear sky and 4 mph NW wind. HRSW, Russian thistle and kochia populations were 1, 4 and 0.3 plants / ft^2, respectively. Treatments were applied with a tractor mounted CO^2 propelled plot sprayer delivering 10 gpa at 30 psi to 5 foot wide by 20 foot long plots. The experiment was a randomized complete block design with four replications. Plots were evaluated for days to bloom, for crop injury on June 7 and June 20, and for weed control on June 7, June 20 and on July 14. The trial was harvested on July 14.

Summary

Pre-plant treatments did not appear to cause problems with seed germination or seedling emergence. Although crop injury (chlorosis) was observed on June 7, it was statistically not significant and diminished quickly. All herbicide treatments provided excellent season long weed control resulting in significantly higher seed yields than the untreated check. Test weight was not significantly different than the untreated check. Although not statistically significant, 1000 seed weights tended to be heavier for all herbicide treatments than for the untreated check.

2006 Evaluation of No-Till Field Pea Herbicide Programs at Hettinger

Treatment	Application Timing	Product Rate	Days to Bloom	---------- June 7 ---------- inj.	hrsw	ruth	kocz	--------- June 20 --------- inj	hrsw	ruth	kocz
	*	oz/ac	days	----------------------- % control -----------------------							
1 Glyphosate+Prowl H2O /	PP /	24 + 48 /									
Rezult + Raptor + COC + 28-0-0	POST	51 + 2 + 1% + 32	56	16	100	100	100	0	98	97	99
2 Glyphosate + Spartan /	PP /	24 + 4 /									
Rezult + Raptor + COC + 28-0-0	POST	51 + 2 + 1% + 32	56	6	95	100	100	0	99	97	99
3 Glyphosate + Prowl H2O /	PP /	24 + 48 /									
Rezult + Raptor + COC + 28-0-0	POST	10 + 4 + 1% + 32	56	11	98	100	100	0	98	96	99
4 Glyphosate /	PP /	24 /									
Rezult + Raptor + COC + 28-0-0	POST	51 + 2 + 1% + 32	56	9	100	100	100	1	98	97	97
5 Untreated		0	55	0	0	0	0	0	0	0	0
C.V. %			1.1	113	4.7	0	0	343	1.9	5.1	2.6
LSD .05			NS	NS	6	1	1	NS	2	6	3

Treatment	Application Timing	Product Rate	------- July 14 ------- hrsw	ruth	kocz	Test Weight	1000 Seed wt.	Seed Yield
	*	oz/ac	------ % control ------			lbs/bu	grams	bu/A
1 Glyphosate+Prowl H2O /	PP /	24 + 48 /						
Rezult + Raptor + COC + 28-0-0	POST	51 + 2 + 1% + 32	99	94	99	60.9	217	26.3
2 Glyphosate + Spartan /	PP /	24 + 4 /						
Rezult + Raptor + COC + 28-0-0	POST	51 + 2 + 1% + 32	99	99	99	62.1	204	29.7
3 Glyphosate + Prowl H2O /	PP /	24 + 48 /						
Rezult + Raptor + COC + 28-0-0	POST	10 + 4 + 1% + 32	99	99	97	61.8	212	29.9
4 Glyphosate /	PP /	24 /						
Rezult + Raptor + COC + 28-0-0	POST	51 + 2 + 1% + 32	99	96	98	61.6	216	26.4
5 Untreated		0	0	0	0	61.0	186	21.2
C.V. %			0	3.4	2.9	1.9	7.6	7.9
LSD .05			1	4	3	NS	NS	3.3

* Application Timing: PP (pre-plant) = April 15, POST (post emergence) = May 25

Field pea and lentil response to test compound 101. Kirk Howatt, Ronald Roach, and Janet Harrington. Field pea and lentil were seeded in adjacent strips on May 18 near Fargo, North Dakota. Treatments were applied to 4-node pea and 3-inch lentil on June 14 with 74°F, 44% RH, 30% cloud cover, wind velocity of 13 mph at 105°, and dry soil with 63°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT 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.

		6/27		7/10	
Treatment	Rate	Lentil	Field pea	Lentil	Field pea
	oz ai/A	%			
T101	3	0	0	0	0
T101	6	2	0	5	0
T101	12	6	1	6	0
2,4-DB	6	6	2	4	0
2,4-DB	12	8	2	0	0
MCPB	6	55	5	20	0
MCPB	12	79	9	55	0
T101+Cornbelt Premier 90	3+0.5%	2	1	4	0
T101+Cornbelt Premier 90	6+0.5%	7	2	4	0
2,4-DB+Cornbelt Premier 90	6+0.5%	17	11	6	0
T101+Trophy Gold	6+0.25%	10	4	4	0
T101+N-Tense	6+0.5%	12	6	5	0
T101+Premium AMS	6+13.6	7	4	2	0
Untreated	0%	0	0	0	0
LSD (P=.05)		8	5	10	0
CV		36	95	84	0

Test compound 101 caused injury similar to 2,4-DB on lentil and field pea, which were slightly less than injury with MCPB on field pea. MCPB caused 50 to 80% injury to lentil on June 27, and substantial injury persisted beyond July 10. Test compound 101 caused less injury than 2,4-DB when applied with Cornbelt Premier 90, but Trophy Gold and N-Tense resulted in increased injury compared with Cornbelt Premier 90.

Legume desiccation with carfentrazone. Kirk Howatt, Ronald Roach, and Janet Harrington. Lentil and field pea were seeded May 18 near Fargo, North Dakota. Treatments were applied to the biologically mature crop on August 3 with 86°F, 42% RH, clear sky, wind velocity of 5 mph at 45°, and dry soil at 75°F. Treatment following the (/) was applied August 5 with 70°F, 66% RH, clear sky, wind velocity of 11 mph at 180°, and dry soil at 70°F. Weeds present at both applications were pigweed, Venice Mallow, green foxtail, and curly dock in the flowering to seed set stage. Treatments were applied with a backpack sprayer delivering 17 gpa (treatments 1 through 6) or 8.5 gpa (treatments 7 through 12) at 35 psi through 11002 or 11001 TT 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.

		Field pea		Lentil			8/7		8/11		8/17	
Treatment	Rate	8/7	8/11	8/7	8/11	8/17	Rrpw	Wibw	Rrpw	Wibw	Rrpw	Wibw
	oz ai/A	% desiccation					% control					
Carf+Z64	0.5+0.25G	90	90	10	17	25	25	10	32	5	47	2
Carf+Renegade	0.5+0.25G	90	94	17	42	27	30	10	50	7	37	5
Carf+Trophy Gold	0.5+0.25G	91	99	22	62	31	42	20	57	22	50	17
Carf+Dyne-Amic	0.5+0.25G	90	95	22	32	37	40	10	57	32	57	15
Carf+MSO	0.5+0.25G	94	92	22	42	42	27	12	55	37	67	30
Carf+Renegade/carf+Renegade	0.25+0.25G/0.25+0.25G	90	92	20	60	48	29	12	74	38	64	22
Carf+Z64	0.5+0.25G	97	98	27	17	50	35	20	32	22	52	15
Carf+Renegade	0.5+0.25G	93	97	27	30	52	55	22	74	25	66	30
Carf+MSO	0.5+0.25G	92	98	32	52	55	42	15	79	49	71	17
Glyt-WM	12	92	96	17	57	81	10	2	84	37	96	66
Glyt-WM+carf+NIS	12+0.5+0.25%	97	98	37	82	92	74	25	91	45	97	62
Pyraflufen+Renegade	0.5+0.25G	94	93	30	45	60	70	35	86	82	85	65
Untreated	0	91	94	5	17	22	0	0	0	0	0	0
LSD (P=0.05)		7	5	13	10	12	15	15	12	27	12	24
CV		6	3	39	16	17	28	71	14	60	14	61

Dry weather in July and August hastened the senescence of field pea. Even so, several treatments tended to improve desiccation compared to the untreated. At 17 gpa, Trophy Gold caused the most desiccation on Aug 11. At this date, application in 8.5 gpa tended to result in more desiccation than treatments in 17 gpa. Lentil did not respond well to desiccation with carfentrazone. Carfentrazone was more effective on lentil when applied in 8.5 gpa comared with 17 gpa according to the Aug 17 evaluation. Pigweed was more susceptible than wild buckwheat to carfentrazone, although control did not exceed 80%. Carfentrazone tended to improve initial desiccation and control with glyphosate, but terminal ratings did not differ between the two treatments.

Preemergence herbicides in flax. Kirk Howatt, Ronald Roach, and Janet Harrington. 'Omega' flax was seeded May 17 at Fargo, North Dakota. Preemergence treatments were applied May 18 with 75°F, 19% RH, 5 mph wind at 180°, and damp soil at 58°F. The post treatment was applied to 6-inch flax, 6-leaf wild buckwheat, and flowering wild mustard. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT 11001 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.

		Flax			
Treatment	Rate	6/8	6/15	6/26	7/10
	oz ai/A	% injury			
Sulfentrazone	3	10	5	0	0
Sulfentrazone	4	25	14	4	0
Mesotrione	1.5	0	0	0	0
Mesotrione	3	1	0	0	0
Tembotrione	2	0	0	0	0
Tembotrione	4	1	1	0	0
Tembotrione+MSO+UAN (POST)	2+1%+2.5%	0	29	16	10
KIH-485	1	0	0	0	0
KIH-485	1.5	0	0	0	0
KIH-485	2	0	0	0	0
Untreated	0	0	0	0	0
LSD (P=.05)		2	4	2	1
CV		57	67	95	119

Sulfentrazone caused discoloration of flax meristem and slow emergence. Plants recovered and flowering was not adversely affected. Mesotrione, tembotrione PRE, and KIH-485 did not cause visible injury to flax. PRE treatments with mesitione, tembotrione, or KIH-485 also did not provide noticeable weed control. Sulfentrazone was the only herbicide to have any visible effect on weeds. It is believed that the dry growing season was not a good test of the efficacy of these herbicides, nor of the tolerance of flax to these products. The study will be conducted again next season.

Flax response to thifensulfuron rate, Fargo. Kirk Howatt, Ronald Roach, and Janet Harrington. 'Omega' flax was seeded May 18 near Fargo, North Dakota. Treatments 1 through 5 were applied to 3-inch flax and 3- to 5-leaf redroot pigweed on June 8 with 59°F, 44% RH, clear sky, 6 mph wind at 45°, and dry soil at 60°F. Treatments 6-10 were applied to 6-inch flax and 5-leaf redroot pigweed on June 19 with 61°F, 56% RH, clear sky, 3 mph wind at 270°, and dry soil at 64°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT 11001 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.

Treatment	Rate	Flax			6/21 Flax	7/6 Flax	7/25 Flax	Pgwd
	oz ai/A	Plts/m	hght cm	bolls/30 plts	%	%	%	pl/m^2
Bromoxynil&MCPA5+Thifensulfuron-sg	6+0.22	36	48	265	32	8	3	8
Bromoxynil&MCPA5+Thifensulfuron-sg	6+0.11	38	52	259	29	5	0	6
Bromoxynil&MCPA5+Thifensulfuron-sg	6+0.06	37	51	262	20	4	0	13
Bromoxynil&MCPA5+Thifensulfuron-sg	6+0.03	38	51	240	21	2	0	4
Bromoxynil&MCPA5	6	41	50	269	9	1	0	7
Bromoxynil&MCPA5+Thifensulfuron-sg	6+0.22	42	41	236	17	20	11	6
Bromoxynil&MCPA5+Thifensulfuron-sg	6+0.11	45	41	240	12	17	10	7
Bromoxynil&MCPA5+Thifensulfuron-sg	6+0.06	40	40	253	11	14	8	10
Bromoxynil&MCPA5+Thifensulfuron-sg	6+0.03	44	42	241	11	11	6	5
Bromoxynil&MCPA5	6	39	48	274	6	4	4	13
Untreated	0	38	51	254	0	0	0	27
LSD (P=.05)		8	5	45	4	3	2	8
CV		15	7	12	18	23	33	58

Stunting was a major component of the injury rating, especially during the evaluations in July. Thifensulfuron application resulted in lower flax height at the end of the season by 8 to 10 cm. The flowering period seemed to be affected also, but there was no difference in the number of bolls produced among the treatments. Flowering was delayed slightly by thifensulfuron, but flax in thifensulfuron plots flowered for a longer period of time as well. Dry conditions also kept the flax shorter than typical for this area, which allowed late emergence of pigweed and prevented separation of herbicide treatments by means of late-season pigweed population.

Flax response to thifensulfuron rate, Prosper. Kirk Howatt, Ronald Roach, and Janet Harrington. 'Omega' flax was seeded May 17 near Prosper, North Dakota. Treatments 1 through 5 were applied to 3- to 4-inch flax and 2- to 6-leaf redroot pigweed on June 8 with 58°F, 55% RH, clear sky, 5 to 6 mph wind at 0°, and dry soil at 62°F. Treatments 6 through 10 were applied to 6-inch flax and 4- to 6-inch redroot pigweed on June 13 with 68°F, 42% RH, 35% cloud cover, 5 mph wind at 315°, and dry soil at 62°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT 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.

Treatment	Rate		Flax		6/20 Flax	7/6 Flax	7/25 Flax	Pigweed
	oz ai/A	plts/m	cm	bolls/30 pl	%	%	%	pl/m^2
Brox&MCPA5+Thif-sg	6+0.22	42	61	314	42	6	0	2
Brox&MCPA5+Thif-sg	6+0.11	41	65	278	35	4	0	0
Brox&MCPA5+Thif-sg	6+0.06	40	62	308	30	2	0	0
Brox&MCPA5+Thif-sg	6+0.03	43	68	301	25	4	0	1
Brox&MCPA5	6	42	60	328	16	1	0	1
Brox&MCPA5+Thif-sg	6+0.22	36	58	265	32	4	0	0
Brox&MCPA5+Thif-sg	6+0.11	42	62	305	25	6	0	1
Brox&MCPA5+Thif-sg	6+0.06	39	60	311	22	5	0	0
Brox&MCPA5+Thif-sg	6+0.03	39	59	344	16	1	0	0
Brox&MCPA5	6	39	61	305	10	0	0	1
Untreated	0	27	65	250	0	0	0	4
LSD (P=.05)		8	7	69	6	3	0	3
CV		15	7	16	19	75	0	192

Initial injury was chlorosis of the apical meristem region. This injury dissipated by the July 6 evaluation but some stunting remained apparent. Mature flax height varied but height of flax treated with thifensulfuron did not differ from control plants. Flax stand was lower for the untreated control than herbicide treatments. This was likely due to weed competition. The number of bolls produced also tended to be less without the benefit of herbicides.

Flax response to thifensulfuron timing, Fargo. Kirk Howatt, Ronald Roach, and Janet Harrington. 'Omega' flax was seeded May 17 near Fargo, North Dakota. Treatments 1 and 2 were applied to 2-inch flax and1-inch pigweed on June 5 with 75°F, 54% RH, 98% cloud clover, and 7 mph wind at 135°. Treatments 3 and 4 were applied to 4-inch flax and 4- to 8-leaf pigweed on June 12 with 65°F, 33% RH, 5% cloud cover, 5 mph at 225°, and dry soil at 60°F. Treatments 5 and 6 were applied to 6-inch flax and 5- to 9-leaf pigweed on June 19 with 63°F, 56% RH, clear sky, 3 mph wind at 270°, and dry soil at 64°F. Treatments 7 and 8 were applied to 8-inch flax and 6- to 10-leaf pigweed on June 22 with 66°F, 46% RH, 100% cloud cover, 5 mph at 45°, and dry soil at 72°F. Treatments 9 and 10 were applied to 10-inch flax and 6- to 12-leaf pigweed on June 26 with 68°F, 59% RH, 2% cloud cover, 1 mph wind at 290°, and dry soil at 64°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT 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.

Treatment	Rate		Flax		6/19 Flax	7/6 Flax	7/25 Flax	Pigweed
	oz ai/A	plts/m	bolls /30 pts	ht (cm)	%	%	%	pl/m^2
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.22+1+1%	36	277	48	53	12	5	6
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	34	299	51	27	5	1	4
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.22+1+1%	35	289	45	40	10	5	4
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	36	242	42	29	5	3	2
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.22+1+1%	32	247	48	10	20	12	6
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	35	294	45	10	12	8	4
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.22+1+1%	35	240	44	0	17	10	4
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	37	264	49	0	12	7	4
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.22+1+1%	33	228	44	0	20	8	4
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	33	250	43	0	16	7	7
LSD (P=.05)		8	46	11	5	3	2	5
CV		16	12	17	19	19	25	76

Flax treated with thifensulfuron exhibited substantial chlorosis and stunting. Initial injury was more severe at earlier flax growth stage applications, especially with thifensulfuron at 0.22 oz/A, 53% injury. The greater injury ratings at earlier growth stages reflected the relative amount of plant affected. For example, 2 inches of chlorotic tissue at the top of a 4-inch plant is more obvious than 2 inches of chlorosis at the top of an 8-inch plant. Plants treated at earlier stages tended to have more bolls, and herbicide did not affect flax population or height at maturity.

Flax response to thifensulfuron timing, Prosper. Kirk Howatt, Ronald Roach, and Janet Harrington. 'Omega' flax was seeded May 17 near Prosper, North Dakota. Treatments 1 and 2 were applied to 3-inch flax and1-inch pigweed on June 5 with 68°F, 49% RH, 97% cloud cover, 9 mph wind at 225°, and dry soil at 68°F. Treatments 2 and 3 were applied to 4-inch flax and 2- to 4-leaf pigweed on June 8 with 60°F, 46% RH, 10% cloud cover, 7 mph wind at 45°, and dry soil at 63°F. Treatments 5 and 6 were applied to 6-inch flax and 4- to 6-inch pigweed on June 13 with 68°F, 42% RH, 35 % cloud cover, 5 mph wind at 315°F, and dry soil at 62°F. Treatments 7 and 8 were applied to 8-inch flax and 6- to 8-inch pigweed on June 19 with 64°F, 43% RH, clear sky, 2 mph wind at 270°, and dry soil at 62°F. Treatments 9 and 10 were applied to 10- to 12-inch flax and redroot pigweed on June 23 with 69°F, 59% RH, 10% cloud cover, 1 mph wind at 270°, and dry soil at 72°F. All treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT 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.

					6/20	7/6	7/25	
Treatment	Rate		Flax		Flax	Flax	Flax	Pigweed
	oz ai/A	plts/m	ht (cm)	bolls/30 pl	%	%	%	pl/m^2
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.22+1+1%	26	62	256	55	13	0	2
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	27	60	269	42	6	0	1
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.22+1+1%	22	62	264	47	8	0	0
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	35	71	252	32	2	0	1
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.22+1+1%	30	58	297	35	5	0	0
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	28	60	305	22	0	0	0
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.22+1+1%	21	56	253	13	11	0	0
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	25	56	318	15	8	0	0
Brox&MCPA5+Thif-g+Clethodim+PO	6+0.22+1+1%	26	53	246	0	19	0	0
Brox&MCPA5+Thif-sg+Cleth+PO	6+0.06+1+1%	25	52	251	0	14	0	0
LSD (P=.05)		13	7	58	6	4	0	2
CV		34	8	14	15	35	0	403

Thifensulfuron caused substantial chlorosis and stunting of flax, especially with application to younger flax because of relative plant sizes at application. Three-inch tall flax treated with thifensulfuron at 0.22 oz/A still exhibited 13% injury on July 6 while flax treated at 4- and 6-inch growth stages displayed 8% injury or less. Flax plants per meter of row and number of bolls produced did not differ among treatments, but mature flax height was greater with application to flax less than 8 inches tall than when applied to 10-inch flax. This indicates than flax recovered from the substantial injury observed early in the season.

2006 Juncea Tolerance to Sonalan Herbicide at Hettinger, ND

Eric Eriksmoen

Sonalan treatments were applied on April 17 to no-till oat stubble. Granular treatments 2, 3, 6 and 7 were broadcast with a "Gandy" type box spreader and liquid treatments 4, 5, 8 and 9 were applied with a tractor mounted CO_2 propelled plot sprayer delivering 10 gpa at 30 psi to 5 foot wide by 20 foot long plots. Treatments 6 through 9 were lightly incorporated with a harrow following herbicide applications. "Y04J013C" juncea was seeded on April 23. Treatment 10 was maintained as a weed free check by hand weeding throughout the growing season. The experiment was a randomized complete block design with four replications. Plots were evaluated for crop stand on May 30, for days to bloom, for crop injury on May 26 and June 20, and for Russian thistle control on June 20. The trial was harvested on July 27.

	Treatment	Product Rate	Tillage	Crop Stand	Days to Bloom	5/26 inj.	-- 6/20 -- inj.	ruth	Seed Yield
		oz/Ac		#/ft^2	Days	--------	%	--------	lbs/A
1	Untreated	0	No-till	12.7	52	0	0	0	526
2	Sonalan 10G	120	No-till	9.6	52	0	0	38	563
3	Sonalan 10G	160	No-till	12.0	52	0	0	0	649
4	Sonalan HFP	32	No-till	8.3	52	0	0	0	524
5	Sonalan HFP	40	No-till	9.3	52	0	0	15	525
6	Sonalan 10G	120	Harrow	8.7	52	2	0	10	570
7	Sonalan 10G	160	Harrow	10.3	52	1	0	22	576
8	Sonalan HFP	32	Harrow	8.0	52	2	0	25	522
9	Sonalan HFP	40	Harrow	9.4	52	2	0	12	538
10	Hand weeded	0	No-till	11.4	52	0	0	100	738
Trial Mean				10.0	52	0.9	0	22	573
C.V. %				49.4	0.9	328	0	92	21.1
LSD .05				NS	NS	NS	NS	30	NS

NS = no statistical difference between treatments.

Summary

A total of 3.9 inches of rainfall was received throughout the growing season. Seedling establishment and days to bloom were not affected by herbicide treatments. Crop injury was very minor and was only observed on the harrowed treatments (trts. 6 – 9). Russian thistle control was inconsistent and very poor across herbicide treatments. This may be partially due to a lack of rainfall following application. All treatments that were harrowed had activity on Russian thistle. Hot and dry growing conditions caused relatively low seed yields and were not statistically different between treatments.

Juncea tolerance to spring-applied Sonalan. Jenks, Willoughby, and Mazurek. Juncea was seeded May 12, 2006 at approximately 600,000 seeds/A into 7.5 inch rows in standing stubble. Herbicide treatments were applied preplant on May 6 with granular herbicide spread prior to liquid mixtures. One-half of the treatments were incorporated with a heavy harrow immediately following application, while the other one-half were not mechanically incorporated. No weeds were present at application. Individual plots were 15 x 30 ft and replicated three times.

The objective of the study was to evaluate juncea tolerance to spring-applied Sonalan compared to Pendimax (pendimethalin). No rainfall was received following the May 6 herbicide applications until May 24 when 0.22 inches of precipitation was recorded. Other small rainfall events occurred over the next two weeks, but were not likely enough to fully activate the herbicides. No definitive crop injury was observed throughout the study. There were no differences in plant density, crop yield, or test weight in any of the herbicide treatments.

Table. Juncea tolerance to spring-applied Sonalan.

		Juncea					
Treatment[a]	Rate	Jun 6	Jun 16	Jul 12	Aug 1	Yield	Test wt.
		pl/ft^2	---------------	% injury	--------------	lb/A	lb/bu
Not Incorporated							
Untreated		10.4	0	0	0	1779	53.0
Sonalan	7.5 lb	12.4	0	0	0	1755	53.2
Sonalan	10 lb	11.4	0	0	0	1616	53.0
Sonalan	2 pt	12.1	0	0	0	1795	53.3
Sonalan	2.5 pt	10.7	0	0	0	1832	53.5
Pendimax	3 pt	14.2	0	0	0	1545	53.1
Incorporated (Harrow)							
Sonalan	7.5 lb	11.4	0	0	0	1644	53.7
Sonalan	10 lb	10.7	0	0	0	1450	53.4
Sonalan	2 pt	14.1	0	0	0	1706	53.2
Sonalan	2.5 pt	13.2	0	0	0	1703	53.4
Pendimax	3 pt	12.9	0	0	0	1899	53.3
Untreated		11.4	0	0	0	1829	52.9
LSD (0.05)		NS	NS	NS	NS	NS	NS
CV		20.4	0	0	0	15	0.6

[a] Treatments were applied 6 days prior to planting.

Weed control methods during Juneberry establishment. Deborah Willard and Harlene Hatterman-Valenti.

A study was conducted in a field near Prosper, North Dakota to determine the effect of various mulches and herbicide applications on weed suppression and juneberry growth. The soil was a loam, almost neutral in reaction and non-saline. The juneberry cultivar, Parkhill was tested in this experiment. The plants were produced from stratified seed in the spring of 2004. They were planted to the field near Prosper on June 2, 2005. The experiment was arranged as a randomized complete-block design. There were eight weed control treatments and four replicates. Each single row plot measured 1.0 m wide and 6.7 m long and contained 10 plants. Plant spacing was 0.6 m with 1.2 m between treatments. Each replicate was 53.7 m long and contained 80 juneberry shrubs with 4.3 m between replicates. Each treatment was applied to a 1.0 m wide section of each row, extending 0.5 m on either side of the juneberry row. Treatments consisted of: 1) winter rye cover crop, 2) hairy vetch, 3) flax (*Linum usitatissimum*) mulch 4) straw mulch, 5) woven landscape fabric, 6) flumioxazin 7) glyphosate plus oryzalin, and 8) untreated control. Winter rye seed was sown at 342 kg/ha on September 12, 2005. On May 15 2006 it was sprayed with clethodim at 0.14 kg ai/ha using a pump sprayer and then mowed to a height of 8 cm on June 15. On May 15, hairy vetch seed was sown at 61.2 kg/ha and supplementary wheat straw was applied to again reach the initial depth of 7 cm. The flax mulch and landscape fabric laid down the previous year were undisturbed. Herbicide treatments were applied using a CO_2–pressurized backpack sprayer with a 1-m spray boom. Glyphosate plus oryzalin and flumioxazin were applied to their respective experimental units on May 15 and July 14. Glyphosate was applied at 0.84 kg ae/ha, oryzalin at 2.24 kg ai/ha and flumioxazin at 0.07 kg ai/ha. Juneberry plants were covered to prevent spray contact. Weeds were removed from all experimental units except the chemical treatments on May 15 and July 14, and from all experimental units on June 15 and August 15. During weed removal in June, July and August, the broadleaf and grass weeds were counted. In addition, the time required to remove the weeds and fresh weights were recorded. On September 2, height, width, stem number per plant, and total length of main and secondary branches were measured for the middle six juneberries from each experimental unit.

Herbicide application dates and environmental conditions for Prosper, 2006.

Application Date:	5/15/2006	7/14/2006
Air Temp., (F):	59	84
Wind Velocity, (MPH):	12.2	4.2
Soil Temp., (F):	54	84
Operating Pressure:	30 psi	30 psi
Nozzle Type:	Flat Fan	Flat Fan
Nozzle Size:	8002	8002
Spray Volume, GPA:	20	20

Results: Woven landscape fabric provided the greatest weed control in the juneberry, keeping the area weed-free throughout the study. Hairy vetch provided poor early season weed control, and good late season weed control. However, by the end of the growing season, the hairy vetch completely covered the juneberries. Reduced plant height, width and length of main and secondary branches in the hairy vetch treatment was attributed to excessive competition by the cover crop. The greatest juneberry growth occurred in the untreated, followed by the herbicide treatments.

Table 8. Weed counts, time required for hand weeding, and weed biomass Prosper, ND during 2006.

Treatment	Grasses	Broadleaves	Hand Weed	Weed weight
June	----number/6.0m^2----		------minutes-----	------Kg-----
Straw	7 b^z	116 cd	10 bcd	1 c
Landscape Fabric	0 b	0 d	0 d	0 c
Hairy Vetch	29 a	1138 a	45 a	4 b
Flax Mulch	1 b	29 d	6 cd	1 c
Winter Rye	2 b	81 d	17 bc	1 c
Glyphosate +oryzalin	2 b	13 d	4 d	1 c
Flumioxazin	7 b	376 b	19 b	10 a
Untreated	7 b	304 bc	20 b	3 b
$LSD_{0.05}$	14	198	12	2
July	-----number/6.0m^2----		----minutes----	-------Kg------
Straw	4	117 bc	13 bc	3 b
Landscape Fabric	0	0 d	0 d	0 c
Hairy Vetch	4	138 b	24 a	5 a
Flax Mulch	3	53 cd	9 cd	2 bc
Winter Rye	4	139 b	18 abc	2 bc
Glyphosate +oryzalin	1	107 bc	-	-
Flumioxazin	2	78 bc	-	-
Untreated	4	210 a	21 ab	5 a
$LSD_{0.05}$	NS	68	10	2
August	-----number/6.0m^2----		----minutes----	-------Kg------
Straw	1 bc	89 cd	21 b	3 cd
Landscape Fabric	0 c	0 d	0 c	0 e
Hairy Vetc	1 bc	72 cd	25 b	4 cd
Flax Mulch	1 bc	68 cd	14 b	2 de
Winter Rye	5 a	640 a	47 a	8 b
Glyphosate +oryzalin	1 bc	67 cd	16 b	2 de
Flumioxazin	5 a	151 c	40 a	11 a
Untreated	3 ab	314 b	27 b	5 c
$LSD_{0.05}$	3	121	13	2

[Z]Mean separation within columns by Fisher's protected LSD, $P \leq 0.05$.
NS = Nonsignificant.

Table 9. Juneberry plant measurements taken the fall of 2006 at Prosper, ND

Treatment	Height	Width	Stem Number	Length of Main and Secondary Branches
	---cm---	---cm---		-----------cm---------
Straw	40^z	45 bc	5 cd	297 cd
Landscape Fabric	44 cd	45 bc	4 cd	415 bc
Hairy Vetch	40 d	40 c	4 cd	172 d
Flax Mulch	39 d	43 bc	3 d	252 d
Winter Rye	47 bcd	51 ab	5 bcd	488 b
Glyphosate +oryzalin	52 abc	62 a	5 bc	956 a
Linuron/Flumioxazin	53 ab	59 a	6 ab	961 a
Untreated	59 a	63 a	7 a	1058 a
$LSD_{0.05}$	9	12	2	131

[Z]Mean separation within columns by Fisher's protected LSD, $P \leq 0.05$.

Effect of spring and fall applied herbicides on weed control in established Juneberries. Harlene Hatterman-Valenti and Collin Auwarter.

This trial is being conducted at the NDSU Horticulture Research Arboretum near Absaraka, ND to determine th effect of fall versus spring applied herbicides to juneberries. The soil is a Spottswood sandy loam with 2.0% O.M. and 7.2 pH. The fall treatments were applied on November 2, 2005 and the spring treatments on April 17, 2006. Plots were 1 row by 10 ft arranged in a randomized complete block design with 4 replicates. The plants a 8 ft apart between rows and 3 ft apart within rows. The treatments were applied using a CO_2 backpack sprayer equipped with 8002 flat fan nozzles with an output of 20 GPA and a pressure of 40 psi.

Application Date:	11/2/05	4/17/06
Time of Day:	10:00 AM	12:00 PM
Air Temp. (F):	45	58
Rel. Hum. (%):	48	53
Wind (mph):	7	8
Cloud Cover (%):	25	50

Perennial weed control on October 30, 2006.

		-------Fall Applied (363 DAA)------			-----Spring Applied (168 DAA)------		
Treatment	Rate	Qugr	Pest	Dali	Qugr	Pest	Deli
	lb ai/A	-----	-----	-----% Control	-----	-----	-----
Untreated		0c	0c	0c	0b	0c	0d
Spartan	0.375	75b	83ab	75ab	98a	68b	79abc
Spartan	0.5	78ab	76ab	79ab	73a	91a	71c
Chateau	0.47	86ab	85a	65b	85a	91a	86a
Chateau	0.75	75b	79ab	76ab	81a	88a	86a
Calisto	0.23	100a	68b	68ab	88a	93a	76abc
Calisto	0.46	85ab	75ab	74ab	73a	98a	76abc
Princep	2.5	86ab	89a	70ab	84a	86a	83ab
Casoron	6	98ab	83ab	81a	85a	84a	85ab
Matrix	0.125	84ab	85a	80a	88a	88a	75c

Overall there was better control during the spring application for perennial sowthistle and dandelion. Rates of th Spartan, Chateau, and Calisto had little effect on the overall control of weeds. Earlier data taken in the year (no shown) had good perennial weed control using Casoron and Matrix regardless of when these herbicides were applied (>90%).

2006 Lentil Tolerance to linuron, diuron and KIH-485 at Hettinger

Eric Eriksmoen

'CDC Richlea' lentil was seeded on April 23 into no-till barley stubble. All herbicide treatments were applied pre-emergence on April 29. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 10 gpa at 30 psi through PK-01E80 nozzles to 5 foot wide by 28 foot long plots. The trial was sprayed with 16 ounces/A of glyphosate on April 29 and with 16 ounces/A of Poast herbicide for grassy weed control on June 6. These broadcast applications resulted in relatively low weed populations. The trial was a randomized complete block design with four replications. Soil analysis indicated a pH of 6.3 and organic matter of 3.5%. Plots were evaluated for crop stand (stand) on May 26, for crop injury (inj) on May 26 and June 20, for plant height (ht) on June 7 and July 10, for Russian thistle (ruth) and kochia (kocz) control on June 20, July 3 and July 29, and for days from planting to 10% bloom (bloom). The trial was harvested on August 2.

Summary

Plant stands and plant height were not significantly affected by herbicide treatments. Although crop injury was observed, it was generally minor and not significant. Significant differences were detected for days to bloom but these differences did not follow a trend. Prowl alone (trt 1) provided very effective season long control of kochia and marginal control of Russian thistle. Linuron alone (trt 11) provided relatively poor season long control of both kochia and Russian thistle. The combination of Prowl and linuron (trts 2 – 4) appears to provide some synergistic control of Russian thistle. This control does not appear to be rate dependant. Diuron alone (trt 12) provided good season long control of Russian thistle and very good season long control of kochia. Weed control tended to increase with increasing rates of diuron (trts 5 – 7). The combination of Prowl with diuron did not enhance weed control over levels provided by each herbicide alone. KIH-485 alone (trt 13) provided excellent season long control of both kochia and Russian thistle. Russian thistle control tended to be rate dependant with KIH-485 (trts 8 - 10). The combination of Prowl and KIH-485 did not provide significantly enhanced season long weed control over either herbicide alone. Linuron and KIH-485 do not appear to affect 1000 seed weights or test weights but there does appears to be an inverse relationship between rates of diuron and 1000 seed weights and test weights. None of the herbicide treatments appear to be detrimental to seed yields.

2006 Lentil tolerance to linuron, diuron and KIH-485 at Hettinger

Treatment		Product Rate	Plant Stand	5/26 Inj.	6/7 Ht	Days to Bloom	6/20 Inj.	6/20 ruth	7/3 kocz	7/3 ruth	7/10 Ht	7/29 ruth	7/29 kocz	1000 Seed wt	Test Wt.	Yield
		oz/Ac	# / ft^2	%	cm	days	--------- % Control ---------				cm	% Control		grams	lbs/bu	lbs/ac
1	Prowl	42	16	2.5	14	54	0	94	96	91	29	81	92	32.2	58.3	933
2	Prowl + Linuron	42 + 8	15	0.5	14	54	0	88	94	90	31	88	90	35.6	58.4	1008
3	Prowl + Linuron	42 + 16	12	4.0	15	54	0	94	96	92	32	91	94	31.5	58.1	1083
4	Prowl + Linuron	42 + 32	18	0.2	14	55	2.5	86	90	86	31	86	85	36.6	59.1	952
5	Prowl + Diuron	42 + 24	20	1.2	14	54	0	88	86	88	32	81	72	34.1	58.2	896
6	Prowl + Diuron	42 + 32	15	5.2	13	56	12.5	97	94	89	31	86	91	32.3	57.7	859
7	Prowl + Diuron	42 + 40	16	0	14	55	2.5	91	94	90	30	90	90	30.6	56.1	849
8	Prowl + KIH-485	42 + 0.42	14	2.5	14	56	0	96	96	95	32	88	90	34.2	58.2	747
9	Prowl + KIH-485	42 + 0.63	22	2.8	14	55	2.5	94	90	91	30	90	84	29.2	56.4	756
10	Prowl + KIH-485	42 + 0.85	20	0.2	14	54	1.2	94	96	94	29	91	90	32.4	57.8	877
11	Linuron	16	16	4.0	14	55	2.5	76	86	85	31	75	59	31.8	55.9	747
12	Diuron	40	19	1.2	15	55	5.0	88	90	90	29	86	91	30.9	57.7	831
13	KIH-485	0.42	17	0.2	16	54	2.5	98	95	94	30	90	91	34.6	58.4	1111
14	Weed Free		15	0	14	55	0	99	99	100	29	100	99	36.3	59.7	1176
15	Untreated		19	0	14	54	0	0	0	0	30	0	0	34.8	56.1	747
C. V. %			27.7	205	10.6	1.6	230	8.2	7.4	6.1	6.6	9.4	12.6	7.1	1.7	16.2
LSD .05			NS	NS	NS	1	NS	10	9	7	NS	11	15	3.4	1.4	209

NS = No significant differences between treatments.

2006 Lentil Tolerance to 2,4-DB at Hettinger

Eric Eriksmoen

'CDC Richlea' lentil was seeded on April 23 into no-till barley stubble. A pre-emergence burndown with 16 ounces/A glyphosate was applied on April 29. Treatments were applied on May 31 to 8 node (3 ½" tall) lentil, to 3 inch tall kochia (kocz) and to 2 inch tall Russian thistle (ruth) with 62° F, 65% RH, clear sky and 6 mph west wind. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 10 gpa at 30 psi through PK-01E80 nozzles to 5 foot wide by 28 foot long plots. Kochia and Russian thistle populations were 1.25 and 2.25 plants per square foot, respectively. The trial was sprayed with 16 ounces/A of Poast herbicide for grassy weed control on June 6. The trial was a randomized complete block design with four replications. Soil analysis indicated a pH of 6.3 and organic matter of 3.5%. Plots were evaluated for crop stand (stand) on May 26, for crop injury (inj) on June 7 and June 29, for plant height (ht) on June 29, for kochia and Russian thistle control on July 3, and for days from planting to 10% bloom (bloom). The trial was harvested on August 2.

Treatment		Product Rate	Plant Stand	6/7 Inj.	6/29 Inj.	Days to Bloom	6/29 Ht	7/3 kocz	7/3 ruth	1000 kwt	Seed Yield
		oz/Ac	# / ft^2	%	%	days	cm	% Control		grams	lbs/ac
1	Weed Free		18	0	0	55	28	100	100	40.0	644
2	2,4-DB	11	22	1.2	0	55	30	45	48	40.1	401
3	2,4-DB	22	19	2.5	2.5	56	28	72	78	40.6	364
4	2,4-DB + Assure II*	11 + 8	22	12.5	5.0	56	28	58	52	39.6	308
5	2,4-DB + Assure II*	22 + 8	22	13.8	6.2	55	26	82	81	38.2	355
6	Untreated		17	0	0	56	27	0	0	40.8	327
C. V. %			14.2	135	138	0.9	6.6	16.1	16.4	4.0	26.8
LSD .05			NS	10	5	NS	NS	14	15	NS	161

*Crop Oil Concentrate at 1% v/v was added to this treatment.
NS = No significant differences between treatments.

Summary

Plant height, days to bloom and 1000 seed weights were not significantly affected by herbicide treatments. Crop injury caused by 2,4-DB treatments alone (trts 2 and 3) were very minor and not significantly different than the untreated check. The combination of 2,4-DB and Assure II + COC caused significantly higher crop injury than the untreated check. Control of both kochia and Russian thistle tended to increase with increasing rates of 2,4-DB, however, neither rate provided adequate control of either weed. Seed yields of all of the herbicide treatments were not significantly different than the untreated check.

Lentil tolerance to preemergence herbicides. Jenks, Willoughby, and Mazurek. 'Pennell' lentil was seeded on May 8 at 12 plants/ft² into 7.5 inch rows in a no-till system. Herbicide treatments were applied preemergence (PRE) on May 11. Individual plots were 10 x 30 ft and replicated three times. Prowl H2O was applied PRE to all treatments including the handweeded to help control weeds. Atrazine and Express are not labeled for use in lentil.

None of the herbicide treatments reduced crop density at the June 7 evaluation. Only atrazine at the 0.5 and 0.75 lb ai caused more than 10% crop injury. There was no significant difference in yield between treatments; however, there was high variability between replications (CV=20).

Table. Lentil tolerance to preemergence herbicides.

			Lentil					
Treatment[a]	Rate	Timing	Jun 7	Jun 10	Jul 8	Aug 3	Yield	Test wt.
			pl/ft²	-------------% injury----------			lb/A	lb/bu
Atrazine	0.25 lb ai	PRE	10.4	0	7	7	1679	56.7
Atrazine	0.50 lb ai	PRE	11.5	0	11	12	1743	56.7
Atrazine	0.75 lb ai	PRE	10.7	0	13	15	1830	57.0
Sencor	0.25 lb	PRE	11.9	0	3	3	2079	56.7
Express	0.167 oz	PRE	12.2	3	5	7	2015	56.6
Handweeded			10.9	0	5	5	1792	56.8
Prowl H2O			12.3	0	0	0	1979	55.8
LSD (0.05)			NS	2	4	4	NS	NS
CV			6.9	250	33	28	20	0.8

[a] Prowl H2O was applied PRE to all treatments.

No-till lentil tolerance to 2,4-DB. Jenks, Willoughby, and Mazurek. 'Pennell' lentil was seeded on May 8 at 12 plants/ft² into 7.5 inch rows in a no-till system. Glyphosate + Prowl H2O was applied preemergence (PRE) on May 11 to help control weeds and allow us to see the effect of 2,4-DB on lentil growth and yield. 2,4-DB alone at two rates or tank mixed with Assure II was applied postemergence (POST) on June 6 with lentil at 4-5 inches tall. Individual plots were 10 x 30 ft and replicated three times.

2,4-DB generally caused more crop injury when tank mixed with Assure II compared to 2,4-DB applied alone. Tank mixing 2,4-DB with Assure II resulted slightly lower lentil yield, especially at the higher 2,4-DB rate. 2,4-DB is not currently labeled for use in lentil, but could be labeled in 2-3 years.

Table. No-till lentil tolerance to 2,4-DB.

			Lentil						
Treatment[a]	Rate	Timing	Jun 3	Jun 15	Jul 3	Aug 3	Height Jul 3	Yield	Test wt.
			pl/ft²	--------% injury--------			in.	lb/A	lb/bu
Handweeded[b]		POST	12.8	3	2	0	11.7	2071	56.4
2,4-DB / Assure II	0.7 pt / 8 fl oz	POST / + 5 days	11.4	5	6	5	11.8	1850	56.2
2,4-DB / Assure II	1.4 pt / 8 fl oz	POST / + 5 days	11.4	14	10	10	11.4	2061	56.3
2,4-DB + Assure II	0.7 pt + 8 fl oz	POST	11.6	17	11	12	11.9	1709	56.0
2,4-DB + Assure II	1.4 pt + 8 fl oz	POST	12.0	23	19	18	11.6	1496	55.7
Prowl H2O / Assure II	2.6 pt / 8 fl oz	PRE/POST	12.2	0	0	0	11.9	2014	56.2
LSD (0.05)			NS	2	7	5	NS	332	NS
CV			6.4	10	49	38	5.6	10	1

[a] Glyphosate + Prowl H2O + AMS applied PRE to all plots. COC (1%) was applied with all Assure II treatments.
[b] Prowl and Assure II were applied to aid handweeding.

Weed control using herbicides applied as micro-rates in onion, Absaraka. Loken, James R., Harlene Hatterman-Valenti, Collin Auwarter. An experiment was conducted at the North Dakota State Research Arboretum near Absaraka, ND, to compare early-season weed control of bromoxynil, oxyflourfen (water based formulation), metribuzin, and aciflourfen applied at micro-rates to a standard preemergence treatment of DCPA in onion (*Allium cepa* L.). The soil was a Spottswood sandy loam with 2.0% O.M. and 7.2 pH, and potato as the previous crop. Onion variety 'Teton' pelleted seed was planted at 220,000 seeds/A using a Stanhay four row double-line planter on May 17. Plots were 6 ft wide by 20 ft long and arranged in a randomized complete block design with four replicates. The standard preemergence treatment of DCPA was applied the day after planting (May 18). At time of weed cotyledon stage (June 1) herbicides were applied as micro-rates at 1/16, 1/8, and 1/4 of their lowest labeled rates every 7 days, with 2 or 3 total applications. Herbicide micro-rates were applied with a CO_2 pressurized backpack sprayer. A standard application of bromoxynil and oxyfluorfen was applied on June 30 (3-leaf stage) to control broadleaf weeds. Another standard application of bromoxynil and oxyfluorfen was made on July 21 (5-6-leaf stage) as a final late-season broadleaf weed control measure. Standard applications were applied using a tractor mounted sprayer. Best management practices were used for fertility, disease, insect, and grass weed control. Treatments were evaluated for overall control of redroot pigweed (*Amaranthus retroflexus* L.) and common lambsquarters (*Chenopodium album* L.) seven days after each micro-rate treatment using weed counts and approximately two weeks after the first standard application using a visual evaluation. On October 16, 10 ft of the middle two rows of each plot were harvested for grade and yield analysis. After harvest, onions were allowed to cure and then were graded. Split and diseased bulbs were graded as culls regardless of diameter. Samples were taken to check for % double-centered bulbs.

Herbicide application dates, timings, and environmental conditions for Oakes, 2006.

Application Date:	5-18	6-1	6-8	6-15	6-30	7-21
Onion Stage:	PRE	PRE	E	1-1½ lf	3 lf	5-6 lf
Air Temp., (F):	51	61	59	68	72	67
Wind Velocity, (MPH):	7	4	10	10	6	7
Soil Temp., (F):	56	59	68	69	72	73
Operating Pressure:	40 psi	40 psi	40 psi	40 psi	40 psi	40 psi
Nozzle Type:	Flat Fan	Flat Fan	Flat Fan	Flat Fan	Flat Fan	Flat Fan
Nozzle Size:	8002	8002	8002	8002	8002	8002
Spray Volume, GPA:	20	20	20	20	20	20

Results: Micro-rate herbicide applications did not appear to injure onion during establishment. Plant counts generally reinforced visual weed control ratings. Visual ratings indicated that excellent common lambsquarters and redroot pigweed control occurred early on with 2 or 3 applications of bromoxynil at 0.063 lb ai/A. However, the greatest total yield occurred with 3 applications of oxyfluorfen at 0.013 lb ai/A. This treatment provided good early-season common lambsquarters and redroot pigweed control but towards the end of the season common lambsquarters control declined considerably. Bromoxynil injury to onion was not obvious but the plants did not appear to grow while they slowly metabolized the herbicide. Greatest large-diameter onion yield occurred with the DCPA pre-emergence treatment.

Effect of herbicide, rate, and number of applications on weed control, onion yield, and grade at Absaraka.

Herbicide	Micro-rate (lb ai/A)	# of App.	Population lq		[4]Population rrpw		[5]% Weed Control colq	% Weed Control rrpw	[3]Yield (cwt/A)		
			[1]1WAT1	2WAT3	1WAT1	2WAT3	[2]9WAP	9WAP	2.25-3 in	3 in or >	Total
Bromoxynil	0.016	2	3	7	4	6	19	38	43	18	61
Bromoxynil	0.031	2	4	5	4	6	56	70	18	17	35
Bromoxynil	0.063	2	6	3	3	3	95	94	33	17	51
Bromoxynil	0.016	3	8	7	4	4	29	54	45	3	48
Bromoxynil	0.031	3	3	7	3	1	65	98	40	53	93
Bromoxynil	0.063	3	7	0	7	2	98	100	46	63	109
Oxyfluorfen	0.003	2	10	8	9	2	13	28	24	0	24
Oxyfluorfen	0.006	2	7	3	7	6	31	25	29	0	29
Oxyfluorfen	0.013	2	13	5	4	3	40	63	51	6	60
Oxyfluorfen	0.003	3	6	6	4	5	51	31	1	0	1
Oxyfluorfen	0.006	3	8	6	5	2	56	58	19	8	27
Oxyfluorfen	0.013	3	6	5	4	3	49	96	67	65	132
Metribuzin	0.005	2	7	5	3	3	40	41	5	0	5
Metribuzin	0.009	2	8	6	4	5	21	6	4	0	4
Metribuzin	0.019	2	5	3	5	4	48	46	1	0	1
Metribuzin	0.005	3	3	7	4	6	25	13	16	0	16
Metribuzin	0.009	3	7	4	3	4	25	31	5	0	5
Metribuzin	0.019	3	3	2	3	3	46	56	26	0	26
Acifluorfen	0.016	2	8	7	3	3	40	29	3	0	3
Acifluorfen	0.031	2	4	4	3	2	28	46	17	0	17
Acifluorfen	0.063	2	3	3	7	1	56	69	57	32	89
Acifluorfen	0.016	3	3	5	3	3	38	44	7	4	11
Acifluorfen	0.031	3	5	5	3	1	53	66	46	0	46
Acifluorfen	0.063	3	5	3	2	0	60	89	30	0	30
DCPA - PRE	8	—	4	1	2	3	86		49	79	127
Hand-Weeded Check		—	0	0	0	0	0	100	100	71	28
LSD (0.05)			5	5	4	3	38	32	44	63	87

[1] 1WAT1 denotes one week after first treatment, [2] 9WAP denotes nine weeks after planting, [3]Cull yield not shown,
[4] Average populations taken from a 1 ft2 area, [5] colq and rrpw denote common lambsquarters and redroot pigweed respectively

Weed control using herbicides applied as micro-rates in onion, Oakes. Loken, James R., Harlene Hatterman-Valenti, Collin Auwarter, and Walt Albus. An experiment was conducted at the Oakes Irrigation Research Site near Oakes, ND, to compare early-season weed control of bromoxynil, oxyflourfen (water based formulation), metribuzin, and aciflourfen applied at micro-rates to a standard preemergence treatment of DCPA in onion (*Allium cepa* L.). The soil was a Madock sandy loam with 2.2% organic matter and 7.4 pH. Onion variety 'Teton' pelleted seed was planted at 220,000 seeds/A using a Monosem four row double-line planter on May 4. Plots were 6 ft wide by 17 ft long and arranged in a randomized complete block design with four replicates. The standard preemergence treatment of DCPA was applied one week after planting (May 11). At time of weed cotyledon stage (May 15) herbicides were applied as micro-rates at 1/16, 1/8, and 1/4 of their lowest labeled rates every 7 days, with 2 or 3 total applications. Herbicide micro-rates were applied with a CO_2 pressurized backpack sprayer. A standard application of bromoxynil, oxyfluorfen, and dimethenamid-P was applied on June 20 (3-leaf stage) to control broadleaf weeds. Another standard application of bromoxynil and oxyfluorfen was made on July 10 (5-6-leaf stage) as a final late-season broadleaf weed control measure. Standard applications were applied using a tractor mounted sprayer. Best management practices were used for fertility, disease, insect, and grass weed control. 50 lb/A of 28% nitrogen was applied on April 18. Liquid nitrogen (30 lb/A at 28%) was applied via streambar on June 7, June 21, and July 11. Treatments were evaluated for overall control of redroot pigweed (*Amaranthus retroflexus* L.) and common lambsquarters (*Chenopodium album* L.) seven days after each micro-rate treatment using weed counts and approximately two weeks after the first standard application using a visual evaluation. On October 4, 10 ft of the middle two rows of each plot were harvested for grade and yield analysis. After harvest, onions were allowed to cure and then were graded. Split and diseased bulbs were graded as culls regardless of diameter. Samples were taken to check for % double-centered bulbs.

Herbicide application dates, timings, and environmental conditions for Oakes, 2006.

Application Date:	5-11	5-15	5-22	5-29	6-20	7-10
Onion Stage:	PRE	PRE	E	1-1½ lf	3 lf	5-6 lf
Air Temp., (F):	57	60	70	70	73	73
Wind Velocity, (MPH):	7	10	6	8	1	0
Soil Temp., (F):	50	55	60	79	82	81
Operating Pressure:	40 psi	40 psi	40 psi	40 psi	40 psi	40 psi
Nozzle Type:	Flat Fan	Flat Fan	Flat Fan	Flat Fan	Flat Fan	Flat Fan
Nozzle Size:	8002	8002	8002	8002	8002	8002
Spray Volume, GPA:	20	20	20	20	20	20

Results: Micro-rate herbicide applications did not appear to injure onion during establishment. Plant counts reinforced visual weed control ratings. Visual ratings indicated that excellent common lambsquarters and redroot pigweed control occurred early on with 3 applications of bromoxynil at 0.063 lb ai/A and 3 applications of oxyfluorfen at 0.013 lb ai/A. The greatest total and large diameter onion yields were also associated with the oxyfluorfen treatment. Early-season common lambsquarters control was necessary to achieve high yields with the micro-rate treatments.

Effect of herbicide, rate, and number of applications on weed control, onion yield, and grade at Oakes.

Herbicide	Micro-rate (lb ai/A)	# of App.	Population lq		[4]Population rrpw		[5]% Weed Control colq	% Weed Control rrpw	[3]Yield (cwt/A)		
			[1]1WAT1	2WAT3	1WAT1	2WAT3	[2]9WAP	9WAP	2.25-3 in	3 in or >	Total
Bromoxynil	0.016	2	44	31	3	3	15	21	5	0	5
Bromoxynil	0.031	2	28	30	1	5	24	43	32	0	32
Bromoxynil	0.063	2	22	4	2	4	69	61	167	110	278
Bromoxynil	0.016	3	37	36	4	3	9	35	26	2	28
Bromoxynil	0.031	3	58	10	2	1	81	83	132	114	246
Bromoxynil	0.063	3	10	1	4	3	99	95	161	114	275
Oxyfluorfen	0.003	2	11	22	1	2	13	26	44	4	48
Oxyfluorfen	0.006	2	4	26	1	1	28	63	114	34	148
Oxyfluorfen	0.013	2	4	10	0	1	73	71	154	190	343
Oxyfluorfen	0.003	3	7	18	1	2	14	30	66	49	115
Oxyfluorfen	0.006	3	3	7	0	2	85	79	195	219	414
Oxyfluorfen	0.013	3	1	3	0	0	99	100	108	350	458
Metribuzin	0.005	2	25	24	1	1	3	21	0	0	0
Metribuzin	0.009	2	33	24	5	6	6	31	0	0	0
Metribuzin	0.019	2	23	11	1	1	0	21	6	0	6
Metribuzin	0.005	3	18	31	9	16	6	25	0	0	0
Metribuzin	0.009	3	22	27	1	1	3	19	2	0	2
Metribuzin	0.019	3	10	6	1	2	28	44	54	0	54
Acifluorfen	0.016	2	17	21	0	2	0	3	0	0	0
Acifluorfen	0.031	2	18	27	4	2	6	3	28	2	30
Acifluorfen	0.063	2	16	19	2	1	20	8	85	46	132
Acifluorfen	0.016	3	34	35	3	7	3	3	0	0	0
Acifluorfen	0.031	3	16	14	3	2	10	3	30	2	32
Acifluorfen	0.063	3	19	24	2	1	28	31	97	27	124
DCPA - PRE	8	—	25	25	2	3	85	87	199	248	447
Hand-Weeded Check		—	0	0	0	0	0	100	100	173	286
LSD (0.05)			28	18	4	5	22	36	60	110	141

[1] 1WAT1 denotes one week after first treatment, [2] 9WAP denotes nine weeks after planting, 3Cull yield not shown,
[4] Average populations taken from a 1 ft2 area, [5] colq and rrpw denote common lambsquarters and redroot pigweed respectively.

Weed control using herbicides applied as micro-rates in onion, Tappen. Loken, James R., Harlene Hatterman-Valenti, Collin Auwarter. An experiment was conducted at the North Dakota Potato Growers Association Research Site near Tappen, ND, to compare early-season weed control of bromoxynil, oxyfluorfen (water based formulation), metribuzin, and acifluorfen applied at micro-rates to a standard preemergence treatment of DCPA in onion (*Allium cepa* L.). The soil was a loamy sand soil with 1.8% organic matter and 7.6 pH. Onion variety 'Teton' pelleted seed was planted at 220,000 seeds/A using a Monosem four row double-line planter on May 12. Plots were 6 ft wide by 20 ft long and arranged in a randomized complete block design with four replicates. The standard preemergence treatment of DCPA was applied the day planting. At time of weed cotyledon stage (May 31) herbicides were applied as micro-rates at 1/16, 1/8, and 1/4 of their lowest labeled rates every 7 days, with 2 or 3 total applications. Herbicide micro-rates were applied with a CO_2 pressurized backpack sprayer. A standard application of bromoxynil and oxyfluorfen was applied on July 6 (3-leaf stage) to control broadleaf weeds. Another standard application of bromoxynil and oxyfluorfen was made on July 27 (5-6-leaf stage) as a final late-season broadleaf weed control measure. Standard applications were applied using a tractor mounted sprayer. Best management practices were used for fertility, disease, insect, and grass weed control. Treatments were evaluated for overall control of redroot pigweed (*Amaranthus retroflexus* L.) and common lambsquarters (*Chenopodium album* L.) seven days after each micro-rate treatment using weed counts and approximately two weeks after the first standard application using a visual evaluation. On October 19, 10 ft of the middle two rows of each plot were harvested for grade and yield analysis. After harvest, onions were allowed to cure and then were graded. Split and diseased bulbs were graded as culls regardless of diameter. Samples were taken to check for % double-centered bulbs.

Herbicide application dates, timings, and environmental conditions for Oakes, 2006.

Application Date:	5-12	5-31	6-7	6-16	7-6	7-27
Onion Stage:	PRE	PRE	E	1-1½ lf	3 lf	5-6 lf
Air Temp., (F):	60	61	66	63	72	71
Wind Velocity, (MPH):	15	4	10	5	15	4
Soil Temp., (F):	65	65	68	66	72	72
Operating Pressure:	40 psi	40 psi	40 psi	40 psi	40 psi	40 psi
Nozzle Type:	Flat Fan	Flat Fan	Flat Fan	Flat Fan	Flat Fan	Flat Fan
Nozzle Size:	8002	8002	8002	8002	8002	8002
Spray Volume, GPA:	20	20	20	20	20	20

Results: Micro-rate herbicide applications did not injure onion during establishment. Plant counts reinforced visual weed control ratings. Visual ratings indicated that excellent common lambsquarters and redroot pigweed control occurred early on with 2 or 3 applications of bromoxynil at 0.063 lb ai/A and 3 applications of bromoxynil at 0.031 lb ai/A. The greatest yields were also associated with the two bromoxynil treatments that provided the best early-season broadleaf weed control.

Effect of herbicide, rate, and number of applications on weed control, onion yield, and grade at Tappen

Herbicide	Micro-rate (lb ai/A)	# of App.	Population lq		[4]Population rrpw		[5]% Weed Control colq	% Weed Control rrpw	[3]Yield (cwt/A)		
			[1]1WAT1	2WAT3	1WAT1	2WAT3	[2]9WAP	9WAP	2.25-3 in	3 in or >	Total
Bromoxynil	0.016	2	9	7	9	5	40	40	30	23	53
Bromoxynil	0.031	2	8	6	19	8	63	63	11	0	11
Bromoxynil	0.063	2	2	3	6	6	100	100	171	122	294
Bromoxynil	0.016	3	5	3	8	10	74	80	52	7	59
Bromoxynil	0.031	3	4	4	8	9	90	90	78	9	87
Bromoxynil	0.063	3	1	1	4	4	98	98	157	72	229
Oxyfluorfen	0.003	2	3	6	13	6	50	50	2	0	2
Oxyfluorfen	0.006	2	8	4	12	11	66	66	43	2	45
Oxyfluorfen	0.013	2	8	5	11	9	59	59	65	12	77
Oxyfluorfen	0.003	3	6	3	1	11	64	66	51	8	59
Oxyfluorfen	0.006	3	21	12	7	5	76	80	78	6	84
Oxyfluorfen	0.013	3	6	4	8	4	84	84	154	44	199
Metribuzin	0.005	2	7	8	15	8	50	50	17	0	20
Metribuzin	0.009	2	2	5	19	8	56	56	16	0	16
Metribuzin	0.019	2	3	3	22	10	50	50	32	4	36
Metribuzin	0.005	3	4	5	23	7	56	56	33	2	35
Metribuzin	0.009	3	4	6	18	10	69	99	31	0	31
Metribuzin	0.019	3	8	4	15	16	73	73	34	0	34
Acifluorfen	0.016	2	20	14	12	7	45	45	10	0	10
Acifluorfen	0.031	2	9	6	15	9	56	56	20	0	20
Acifluorfen	0.063	2	4	5	6	7	71	71	89	21	110
Acifluorfen	0.016	3	3	6	16	10	65	65	24	4	28
Acifluorfen	0.031	3	8	7	8	9	78	78	85	13	97
Acifluorfen	0.063	3	6	6	5	10	86	86	112	21	133
DCPA - PRE	8	—	2	5	5	4	71	71	126	29	155
Hand-Weeded Check		—	0	0	0	0	100	100	130	27	157
LSD (0.05)			12	6	13	7	19	20	89	55	125

[1] 1WAT1 denotes one week after first treatment, [2] 9WAP denotes nine weeks after planting, 3Cull yield not shown,
[4] Average populations taken from a 1 ft2 area, [5] colq and rrpw denote common lambsquarters and redroot pigweed respectively.

Late-season simulated glyphosate drift to seed potato. Harlene Hatterman-Valenti and Collin Auwarter.

A field trial was initiated during 2005 at the NDSU Agriculture Experiment Station research site near Prosper, ND to evaluate the effect of simulated drift to daughter tubers used for seed the following year. The trial was conducted on clay loam soil with 2.6 O.M. and 6.7 pH. Simulated drift rates of glyphosate were applied to Russet Burbank and Red Lasoda potato plants in 2005 during the early senescence stage at rates one-third, one-sixth, one-twelfth, one-twenty-fourth, and one-forty-eight the use rate for spring wheat desiccation. Following harvest, samples from each plot were placed into cold storage until the following April. The samples then were cut into 2 oz pieces with at least two eyes to each piece and stored at 65° F with approximately 90% RH until planted. The 2006 plots were 2 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces were planted on 36 inch rows and 12 inch spacing on June 2, 2006. Extension recommendations were used for cultural practices. Plots were desiccated on September 26, and harvested on October 9. Tubers were graded into the various categories shortly after harvest.

Application, environmental, crop, and weed data are listed below:

Date:		9/2/05
Treatment:		POST
Sprayer:	gpa:	30
	psi:	40
	nozzle:	8002
Temperature:	Air (F):	66
	Soil (4 inch):	62
Rel. hum. (%):		56
Wind (mph):		6
Soil moisture:		adequate
Cloud cover (%):		15
Potato:	Height (inch):	28

All glyphosate rates (Russet Burbank) and all rates except 0.0313 and 0.0156 lb ae/A (Red Lasoda) showed signs from the effect of glyphosate applied the previous season compared to the untreated (Tables 1 and 2). Plant populations were reduced in several instances, which reflected in lower tuber yields. Russet Burbank showed a greater reduction in total yield at the all rates compared to the Red Lasoda versus the untreated. Tuber size distribution varied for both cultivars, however glyphosate applied at 0.25 lb ae/A constantly reduced tuber size.

Table 1. Yield and grade after glyphosate spray drift to Russet Burbank seed potatoes the previous year.

Treatment	Rate	<4oz	4-6oz	6-10oz	10-12oz	12-14oz	>14oz	Total	>4oz
		CWT/A							%
Untreated		40b	59a	94a	31a	27a	42a	293a	86a
Glyphosate	0.25 lb ae/A	6d	3e	5d	2d	1b	2c	18f	24d
AMS	4 lb/100 gal								
Glyphosate	0.125 lb ae/A	26c	15d	18d	11bcd	5b	10bc	84e	49c
AMS	2 lb/100 gal								
Glyphosate	0.0625 lb ae/A	43b	28c	38c	8cd	6b	14bc	137d	65bc
AMS	1 lb/100 gal								
Glyphosate	0.0313 lb ae/A	65a	47b	57b	12bc	7b	15b	203c	68b
AMS	0.5 lb/100 gal								
Glyphosate	0.0156 lb ae/A	66a	60a	78a	17b	10b	18b	248b	73ab
AMS	0.25 lb/100 gal								

Table 2. Yield and grade after glyphosate spray drift on Red Lasoda seed potatoes the previous year.

Treatment	Rate	<4oz	4-6oz	6-10oz	10-12oz	12-14oz	>14oz	Total	>4oz
		CWT/A							%
Untreated		29bc	39a	121a	53a	47a	53a	344a	92a
Glyphosate	0.25 lb ae/A	21d	20b	23c	10b	5c	17b	95d	74d
AMS	4 lb/100 gal								
Glyphosate	0.125 lb ae/A	41a	54a	76b	36a	25b	46a	278c	85c
AMS	2 lb/100 gal								
Glyphosate	0.0625 lb ae/A	35ab	49a	89b	42a	26b	39a	280bc	87bc
AMS	1 lb/100 gal								
Glyphosate	0.0313 lb ae/A	28c	45a	123a	49a	36ab	42a	322ab	91ab
AMS	0.5 lb/100 gal								
Glyphosate	0.0156 lb ae/A	28cd	54a	112a	47a	43a	55a	339a	92a
AMS	0.25 lb/100 gal								

Simulated Glyphosate Drift in Potatoes at Different Growth Stages. Harlene M. Hatterman-Valenti, Collin P. Auwarter. A study was conducted at the NDSU Agriculture Experiment Station research site near Prosper, ND to evaluate glyphosate drift on potatoes at different growth stages. The trial was conducted on clay loam soil with 2.6% O.M. and 6.7 pH. The objective of this study was to compare the injury from glyphosate applied to Red Lasoda potatoes at the tuber set stage (TS) and early bulking stage (EB) to the late tuber/early senescence stage (LB). Glyphosate was applied at rates one-third, one-sixth, one-twelfth, and one-twenty-forth the standard use rate (0.25, 0.125, 0.0625, and 0.0313 lb ae/A) on July 18 and August 14 and at the 0.25 lb ae/A rate on September 11 with a CO_2 pressurized sprayer equipped with 8002EX flat fan nozzles with a spray volume of 30 GPA and a pressure of 40 psi. The amount of AMS added to the spray solution was also reduced accordingly. Field design was a randomized complete block, factorial arrangement, with four replications. Potatoes were planted on June 2 using a Harrison double-row planter with 12 inch spacing between seed pieces and 36 inches between rows. Extension recommendations were used for cultural practices. Vines were desiccated 2 weeks prior to harvest with diquat (0.5 lb ai/A), and flailed one day prior to harvest. Harvesting was done with a single-row Hasia harvester on October 9.

Application, environmental, and crop data are listed below:

Date:		7/18/06	8/14/06	9/11/06
Treatment:		POST	POST	POST
Sprayer:	GPA:	30	30	30
	PSI:	40	40	40
	Nozzle:	8002	8002	8002
Temperature:	Air (F):	77	66	56
	Soil (4 inch):	76	67	62
Rel. hum. (%)		50	66	85
Wind (mph)		6	6	4
Soil moisture:		Adequate	Adequate	Adequate
Cloud cover:		20	50	90

Potatoes treated with 0.25 lb/A glyphosate at the EB stage produced significantly more tubers than other treatments. However, this was primarily due to the greater number of cull tubers (≤ 4 oz). Potatoes treated with 0.25 lb/A glyphosate at the EB stage produced 40% more cull tubers than potatoes treated with 0.125 lb/A glyphosate at the EB stage and 2.5 times more cull tubers than the untreated check. Potatoes treated with glyphosate earlier during the growing season (TS or EB) had lower yields compared to those treated with the same rate at the later growth stage (LB). Plants treated with ≤ 0.0625 lb/A glyphosate at the TS or EB growth stages or with 0.25 lb/A glyphosate at the LB stage had total yields similar to the untreated check. Plants treated with 0.25 lb/A at TS or EB growth stage, and plants treated with 0.125 lb/A glyphosate at the EB stage consistently yielded higher for cull tubers and tubers graded at the 4 to 6 oz size, whereas they consistently yielded less for grades 6 to 12 oz, 10 to 12 oz, and > 12 oz sizes. Daughter tuber samples were saved to determine effect on sprout inhibition this spring.

Table 1. Yield and grade after glyphosate spray drift to potatoes.

Treatment	Stage	Rate	<4 oz	4-6 oz	6-10 oz	10-12 oz	12-14 oz	>14 oz	Total
		lb ae/A	CWT/A						
Glyt+AMS	TS	0.25+4 lb/100 G	58	56	95	29	16	23	277
Glyt+AMS	TS	0.125+2 lb/100G	27	36	103	45	58	90	359
Glyt+AMS	TS	0.0625+1 lb/100 G	30	40	107	52	50	113	392
Glyt+AMS	TS	0.0313+0.5 lb/100G	22	35	96	56	44	155	409
Glyt+AMS	EB	0.25 +4 lb/100 G	108	54	62	30	23	22	300
Glyt+AMS	EB	0.125+2 lb/100 G	81	55	89	24	16	39	303
Glyt+AMS	EB	0.0625 +1 lb/100 gal	38	42	108	56	38	94	376
Glyt+AMS	EB	0.0313 +0.5 lb/100 gal	31	38	104	50	48	102	373
Glyt+AMS	LB	0.25 +4 lb/100 gal	42	42	128	57	50	62	381
Untreated			33	35	107	59	54	101	389

Table 2. Total count of tubers in 25 row-feet.

Treatment	Stage	Rate	<4 oz	4-6 oz	6-10 oz	10-12 oz	12-14 oz	>14 oz	Total
		lb ae/A	Counts/25 row-feet						
Glyt+AMS	TS	0.25 +4 lb/100 gal	69	31	34	7	3	4	149
Glyt+AMS	TS	0.125+2 lb/100 gal	31	20	36	11	12	14	124
Glyt+AMS	TS	0.0625+1 lb/100 gal	35	22	37	13	11	17	135
Glyt+AMS	TS	0.0313+0.5 lb/100 gal	26	19	33	14	9	23	125
Glyt+AMS	EB	0.25+4 lb/100 gal	137	31	22	8	5	4	206
Glyt+AMS	EB	0.125+2 lb/100 gal	97	31	32	6	3	6	175
Glyt+AMS	EB	0.0625+1 lb/100 gal	45	23	37	14	8	14	142
Glyt+AMS	EB	0.0313+0.5 lb/100 gal	38	21	36	12	10	16	134
Glyt+AMS	LB	0.25+4 lb/100 gal	50	23	44	14	11	10	152
Untreated			39	19	37	15	12	15	137

<u>Carfentrazone-ethyl (Aim) as a desiccant on dryland potatoes</u>. Harlene Hatterman-Valenti and Collin Auwarter.

A study was conducted at the NDSU Agriculture Experiment Station research site near Prosper, ND to compare desiccation with carfentrazone when applied with different adjuvants. The trial was conducted on clay loam soil with 2.6% O.M. and 6.7 pH. Red Lasoda seed pieces were planted on June 2, 2006. Plots were 4 rows by 25 ft arranged in a randomized complete block design with 4 replicates. The potato seed pieces were planted in 36 inch rows at 12 inch spacing between plants. Extension recommendations were used for cultural practices. The desiccant treatments were applied using a CO_2 backpack sprayer equipped with 8002 flat fan nozzles with an output on 20 GPA and a pressure of 40 psi.

Application Date:	9/21/06
Time of Day:	10:00 AM
Air Temp. (F):	56
Rel. Hum. (%:)	62
Wind (mph):	7
% Cloud Cover:	50

<u>Potato desiccation with carfentrazone-ethyl in response with different adjuvants.</u>

Rating date:			-----9/25/06-----		-----10/2/06-----		-----10/5/06-----	
			stem	leaves	stem	leaves	stem	leaves
DAA:			4	4	11	11	14	14
	Rate	Rate unit						
1 Carfentrazone	3.2	oz/A	11b	18ab	29ab	31a	33a	36a
Z 64	1	qt/A						
2 Carfentrazone	3.2	oz/A	9b	14b	23b	26a	29a	31a
Trophy Gold	1	qt/A						
3 Carfentrazone	3.2	oz/A	11b	14b	24b	29a	29a	36a
Dynemic	1	qt/A						
4 Carfentrazone	3.2	oz/A	19a	23a	33a	36a	35a	40a
MSO	1	qt/A						
5 Untreated			0c	0c	0c	0b	0b	0b

The treatments were applied when the plants were beginning to senescence. At 4 days after application (DAA) the carfentrazone applied with MSO showed adequate stem and leaf desiccation. The other treatments soon followed, but showing little desiccation by trials end (<40%). Cold temperatures (22°F) 18 DAA resulted in ending the trial as plants showed signs of frost damage.

Weed control in irrigated potato. Harlene Hatterman-Valenti and Collin Auwarter.

A study was conducted at the Northern Plains Potato Grower's Association Irrigation Research site near Tappen, ND to evaluate new and reintroduced products applied either separately, tank-mixed, or sequentially for crop safety and weed control in Russet Burbank potato. The study was conducted on loamy sand soil with 1.5% O.M. and 7.2 pH. Onions were grown during 2005. Plots were 4 rows by 25 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on April 30, 2006. Treatments were applied 3 days after hilling to the middle 2 rows. Crop injury and weed control were evaluated 2, 5, and 14 weeks after treatment. Water was not limiting as irrigation was scheduled every 3 to 4 d once potato had emerged following hilling. Potatoes were machine harvested September 28 and graded a few weeks later. Application, environmental, crop, and weed data are listed below:

Date:		5/26/06	6/16/06
Treatment:		PRE	POST
Sprayer:	GPA:	20	20
	PSI:	40	40
	Nozzle:	11001	11001
Air temperature (F):		57	70
Rel. humidity (%):		89	87
Wind (mph):		8	3
Soil moisture:		adequate	adequate
Cloud cover (%):		50	25
Potato:	Height (inch):	0	12

There was minor injury in some of the treatments 2 WAT (Table 1), Chateau alone or tank-mixed with V-10142 showing the highest visual injury (6-10%). Most plants outgrew injury 5 WAT, however there were a few treatments still showing small signs of injury. Both POST treatments, second application of V10142 and Permit plus Sencor, had minor signs of injury 2 WAT (1-4%). Weed control was at least 90% for common lambsquarters 2WAT for all treatments except Stalwart and Matrix. Common lambsquarters control 5 and 14 WAT was similar with Matrix, however Stalwart alone continued a decline in control ending with 40% control by trials end. Tuber grades for the various treatments are provided in Table 2. All treatments yielded greater than 400 cwt/A except the untreated and Dual Magnum. Two of the three highest yielding treatments were V10142 either at 4.85 oz ai/A or 8.0 oz ai/A with 485 and 493 cwt/A respectively. All treatments had between 74-83% of their tubers being >4 oz except for the untreated check with 63%. The trial indicated that irrigated potato growers have several management options for season-long weed control.

Table 1. Potato injury and weed control 2, 5, and 14 weeks after treatment.

			Appl Code	Pota	Cheal	Amare	Saskr	Setss	Polco	Pota	Amare	Cheal	Polco	Setss	Cheal	Amare	Setss	Saskr
		Rate		6/14/06						7/29/06					8/2906			
No.	Name	oz ai/a		% Inj	-% Control					% Inj	% Control							
1	Untreated			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	V10142	4.85	A	0	94	99	70	90	87	3	100	95	89	83	95	100	95	87
3	V10142	8	A	0	98	100	100	94	95	0	100	96	96	92	98	100	95	100
4	V10142	4.85	A	6	100	100	98	95	98	5	100	100	100	94	99	100		95
	Chateau	0.765	A															
5	V10142	8	A	10	98	85		93	95	5	99	98	95	93	99	100	100	98
	Chateau	0.765	A															
6	Chateau	0.765	A	6	99	98	90	90	70	3	100	100	85	88	100	100	90	100
7	V10142	4.85	A	0	94	100	87	90	78	1	100	96	98	86	96	100	95	98
	V10142	8	B															
8	Spartan	1.13	A	0	100	100	100	100	85	1	100	100	91	100	99	100	98	100
	Outlook	15	A															
9	Stalwart	32	A	1	86	97	50	99	55	1	95	70	70	99	40	69	100	35
10	Stalwart	32	A	0	100				93	0	100	100	85	100	99	100	100	95
	Sencor	8	A															
11	Dual Magnum	30.5	A	1	90	100	40	100	70	0	100	91	59	98	88	100	100	77
12	Dual Magnum	30.5	A	3	100				93	3	100	100	91	100	99	100	100	98
	Sencor	8	A															
13	Matrix	0.375	A	1	89	99	80	96	50	3	99	88	53	100	88	95	100	86
14	Permit	0.75	B	0						4	100	100	99	91	100	100	95	95
	Sencor	8	B															
15	Reflex	4	A	0	99	100	90			0	100	97	95	98	94	100		95
	Dual Magnum	30.5	A															
16	Reflex	4	A	0	98	100	61	96	88	0	100	96	86	94	94	100	98	93

Table 2. Effect of herbicides on potato yield and grade.

No.	Name	Rate oz ai/a	Appl Code	<4oz	4-6oz	6-10oz	10-12oz	12-14oz	>14oz	Total	>4oz
				---Cwt/A---							%
1	Untreated			120 a	112 a	81 d	11 c	4 a	4 a	331 e	63 c
2	V10142	4.85	A	94 a	123 a	188 a	46 ab	18 a	16 a	485 a	80 a
3	V10142	8	A	86 a	125 a	188 a	48 a	22 a	24 a	493 a	83 a
4	V10142	4.85	A	81 a	115 a	179 a	42 ab	26 a	32 a	475 ab	83 a
	Chateau	0.765	A								
5	V10142	8	A	87 a	113 a	171 ab	40 ab	30 a	37 a	478 ab	82 a
	Chateau	0.765	A								
6	Chateau	0.765	A	89 a	126 a	152 abc	38 ab	20 a	16 a	441 a-d	80 ab
7	V10142	4.85	A	95 a	121 a	181 a	33 ab	19 a	23 a	472 abc	80 ab
	V10142	8	B								
8	Spartan	1.13	A	95 a	126 a	182 a	43 ab	25 a	16 a	487 a	80 a
	Outlook	15	A								
9	Stalwart	32	A	106 a	128 a	133 c	27 bc	12 a	10 a	415 cd	74 b
10	Stalwart	32	A	91 a	115 a	167 abc	44 ab	26 a	24 a	467 abc	80 a
	Sencor	8	A								
11	Dual Magnum	30.5	A	87 a	114 a	136 bc	30 ab	12 a	11 a	389 de	78 ab
12	Dual Magnum	30.5	A	92 a	121 a	179 a	41 ab	19 a	19 a	470 abc	80 a
	Sencor	8	A								
13	Matrix	0.375	A	81 a	123 a	165 abc	43 ab	24 a	20 a	456 abc	82 a
14	Permit	0.75	B	95 a	105 a	162 abc	32 ab	13 a	16 a	423 bcd	77 ab
	Sencor	8	B								
15	Reflex	4	A	91 a	117 a	169 ab	36 ab	16 a	23 a	452 abc	80 a
	Dual Magnum	30.5	A								
16	Reflex	4	A	90 a	115 a	169 abc	39 ab	19 a	22 a	455 abc	80 a

Effect of hilling and application timing of Chateau on weed control and potato injury. Harlene Hatterman-Valenti and Collin Auwarter.

A study was conducted at the Northern Plains Potato Grower's Association Irrigation site near Tappen, ND to evaluate Chateau applied at different hilling timings for crop safety and weed control in Russet Burbank potato. The study was conducted on loamy sand soil with 1.5% O.M. and 7.2 pH. Onions were grown in 2005. Plots were 4 rows by 25 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on April 28, 2006. Treatments were hilled early (12 DAP), normal (25 DAP), late (40 DAP), or not at all. The Chateau treatments included an early hilling with a low and high rate, normal hilling with a low and high rate, and a no hill treatment with the high rate. Other treatments included Sencor tank-mixed with either Permit or Matrix, and hilled early or late. Crop injury and weed control were evaluated throughout the growing season. Water was not limiting as irrigation was scheduled every 3 to 4 d once potatoes had emerged. Potatoes were machine harvested September 29 and graded a few weeks later. Application, environmental, crop, and weed data are listed below:

Date:		5/11/06	5/26/06	6/16/06
Treatment:		PRE	PRE	POST
Sprayer:	GPA:	20	20	20
	PSI:	40	40	40
	Nozzle:	11001	11001	11001
Air temperature (F):		50	59	63
Rel. hum. (%):		78	89	94
Wind (mph):		7	9	4
Soil moisture:		adequate	adequate	adequate
Cloud cover (%):		50	50	25
Potato (inch):		0	0	12

Using the high rate of Chateau (2 oz/a) while hilling 25 DAP showed the greatest effect on weed control and yield. However, injury was more prevalent when using this herbicide rate (Table 1). Hilling the potatoes 25 DAP left the plants with little soil cove, which may have come into contact with the chemical. All treatments showed signs of injury early in the season, but grew out symptoms as the year progressed. Chateau applied without a hilling showed remarkably little injury, but this treatment showed poor weed control which affected yield (Table 2). The high rate of Chateau along with hilling 25 DAP had the highest yield with 402 cwt/a followed by the low rate (1 oz/a) with 361 cwt/a. Hilling 12 DAP and the using the low rate of Chateau had a yield of 343 cwt/a followed by the high rate with 339 cwt/a. These four Chateau treatments had the highest yield of the trial. Sencor (0.042 oz/a) with Matrix (1.5 oz/a) had the highest yield of the POST treatments with 318 cwt/a.

Table 1. Potato injury and weed control.

Treatment	Rate	Appl Code	6/14/2006 Pota	Cheal	Amare	Setss	Polco	6/29/2006 Pota	Soltu	Cheal	Polco	Setss	8/29/2006 Cheal	Amare	Setss
	oz/A		% inj	-------------% Control-------------				% inj	---------------% Control---------------						
Hill 25 DAP/No herbicide		C/-	0	0	0	0	0	0	0	0	0	0	0	0	0
Hill 12 DAP/Chateau	1	A/B	3	95	98	80	85	2	95	93	81	53	71	100	81
Hill 12 DAP/Chateau	2	A/B	13	99	99	93	93	5	100	98	85	90	74	97	64
Chateau 25DAP	2	D	2	74	100	80	65	7	98	80	65	83	95	100	90
Hill 25 DAP/Chateau	1	C/D	1	96	99	89	80	3	98	95	90	83	90	100	81
Hill 25 DAP/Chateau	2	C/D	14	99	100	97	100	10	100	100	96	94	99	100	85
Hill 12 DAP/Sencor/Matrix	-/10.7/1.5	A/F/F						2	99	99	96	96	99	100	100
Hill 12 DAP/Permit/Sencor/	-/1/10.7	A/F/F						8	98	10	40	35	5	100	98
Hill 40 DAP/Sencor/Matrix	-/10.7/1.5	E/F/F						1	100	83	88	100	94	100	100
Hill 40 DAP/Permit/Sencor	-/1/10.7	E/F/F						2	100	75	84	100	91	100	100

Table 2. Yield

Treatment	Rate	Appl	>4oz	4-6oz	6-10oz	10-12oz	12-14oz	>14oz	Total	>4oz
	oz/A	Code	Cwt/A							%
Hill 25 DAP/No herbicide	-/-	C/-	105	116	98	10	9	4	343	68
Hill 12 DAP/Chateau	-/1	A/B	84	95	114	24	10	13	339	74
Hill 12 DAP/Chateau/	-/2	A/B	78	60	28	3	1	0	169	53
Chateau 25DAP	2	D	114	119	97	16	8	8	361	68
Hill 25 DAP/Chateau	-/1	C/D	87	109	148	30	11	18	402	78
Hill 25 DAP/Chateau	-/2	C/D	105	102	86	18	4	4	318	67
Hill 12 DAP/Sencor/Matrix	-/10.7/1.5	A/F/F	139	96	67	5	1	4	311	55
Hill 12 DAP/Permit/Sencor	-/1/10.7	A/F/F	113	101	78	11	3	8	313	64
Hill 40 DAP/Sencor/Matrix	-/10.7/1.5	E/F/F	128	77	57	8	2	2	273	53
Hill 40 DAP/Permit/Sencor	-/1/10.7	E/F/F	105	101	93	12	2	2	316	67

Broadleaf weed control in transplanted pumpkin. Harlene Hatterman-Valenti and Collin Auwarter. A study was conducted at the NDSU Agriculture Experiment Station in Fargo, ND to evaluate herbicides applied pre-emergence for crop safety and weed control in transplanted 'Golden Delicious' pumpkin used for the confectionary market. The study was conducted on a silty-clay soil with 6.8% organic matter and 7.2 pH. A small grain was grown during 2005. Plots were 1 row (10 ft) by 10 ft arranged in a randomized complete block design with four replicates. Seedlings were transplanted at 3 ft centers on June 3. Herbicides were applied the day prior to transplanting using a CO_2-pressurized sprayer. Crop injury and weed control were evaluated 2 and 6 weeks after treatments. Water was not limiting as irrigation was scheduled as needed. Select was applied with MSO on June 28 for post-emergence grass control. Pumpkins were harvested beginning September 22. Two randomly selected pumpkins from each plot had the seeds removed, counted, dried and weighed. Application, environmental, crop, and weed data are listed below:

Date:		6/2/2006
Treatment:		PRETTRA
Sprayer:	gpa:	20
	psi:	40
	nozzle:	11001
Air temperature (F):		75
Rel. hum. (%):		57
Wind (mph):		5
Soil moisture:		adequate
Cloud cover (%):		20

Weed control evaluations indicated that common lambsquarters, common purslane, Venice mallow, and redroot pigweed control 2 WAT was greater than 85% only when Outlook was applied prior to transplanting. However, by 6 WAT, broadleaf weed control had dropped below an acceptable measure (85%) for all treatments. The greatest fruit yield occurred when Define plus Spartan were applied, with approximately a 65% yield increase compared to the untreated. The greatest seed yield occurred when Chateau was applied, with approximately a 70% yield increase compared to the untreated.

Table 1. Effect of herbicide combinations on pumpkin injury, broadleaf weed control, and total yield.

		Injury	Vema	Rrpw	Copu	Colq	Yeft	Copu	Rrpw	Colq	Vema	Fruit	Seed
Treatment	Rate	6/20/2006						7/14/2006				9/22/2006	
	lb ai/a	%										lb/A	
Sonalan	1.12	8	64	89	76	93	71	71	74	87	35	9572	91
Permit	0.024												
Outlook	1.3	1	81	95	96	78	90	93	86	93	35	11249	105
Permit	0.024												
Define	0.8	0	48	95	89	85	58	90	85	98	38	9736	105
Permit	0.024												
Outlook	1.32	3	80	86	93	68	78	98	58	75	40	10444	109
Chateau	0.025												
Define	0.8	3	63	68	70	68	51	88	40	75	43	9964	92
Chateau	0.025												
Chateau	0.025	0	43	55	94	80	35	73	49	78	45	10574	171
Outlook	1.3	1	90	93	99	96	84	93	74	90	51	9540	106
Spartan	0.2												
Define	0.8	0	70	93	90	99	79	100	73	88	48	12578	114
Spartan	0.2												
Spartan	0.2	0	58	61	88	93	61	73	56	85	50	9768	100
Untreated		0	0	0	0	0	0	66	36	80	28	7678	101
LSD (P=.05)		7	30	30	26	36	33	28	33	26	30	5590	72

Broadleaf weed control in seeded pumpkin. Harlene Hatterman-Valenti and Collin Auwarter.

A study was conducted at the NDSU Agriculture Experiment Station in Fargo, ND to evaluate herbicides applied pre-emergence for crop safety and weed control in seeded 'Golden Delicious' pumpkin used for the confectionary market. The study was conducted on a silty-clay soil with 6.8% organic matter and 7.2 pH. A small grain was grown during 2005. Plots were 1 row (10 ft) by 10 ft arranged in a randomized complete block design with four replicates. Three seeds were transplanted at 3 ft centers on June 3. Herbicides were applied immediately following planting using a CO_2-pressurized sprayer. Crop injury and weed control were evaluated 2 and 6 weeks after treatments. Water was not limiting as irrigation was scheduled as needed. Select was applied with MSO on June 28 for post-emergence grass control. Pumpkins were harvested beginning September 22. Two randomly selected pumpkins from each plot had the seeds removed, counted, dried and weighed. Application, environmental, crop, and weed data are listed below:

Date:		6/2/2006
Treatment:		PRE
Sprayer:	gpa:	20
	psi:	40
	nozzle:	11001
Air temperature (F):		75
Rel. hum. (%):		57
Wind (mph):		5
Soil moisture:		adequate
Cloud cover (%):		20

Weed control evaluations indicated that common lambsquarters, common purslane, Venice mallow, and redroot pigweed control 2 WAT was best when Outlook + Permit or Define + Spartan were applied following seeding. However, by 6 WAT, Venice mallow control had dropped considerably for all treatments so much that most plots appeared overrun by this weed. The greatest fruit yield occurred when Outlook + Chateau were applied, with approximately a 4-fold yield increase compared to the untreated. The greatest seed yield occurred when Define + Spartan were applied, with approximately a 1.5-fold yield increase compared to the untreated.

Table 1. Effect of herbicide combinations on pumpkin injury, broadleaf weed control, and total yield.

Treatment	Rate	Injury	Vema	Rrpw	Copu	Colq	Yeft		Rrpw	Colq	Vema	Copu	Fruit	Seed
		6/20/2006							7/14/2006				9/22/2006	
	lb ai/a	%											lb/A	
Sonalan	1.12	3	50	100	100	100	73		98	100	43	100	7547	47
Permit	0.02													
Outlook	1.3	1	82	98	100	98	91		95	93	64	98	6861	49
Permit	0.02													
Define	0.8	0	59	100	99	96	84		95	91	25	100	7609	43
Permit	0.02													
Outlook	1.32	4	60	83	100	97	81		70	83	28	98	9090	36
Chateau	0.03													
Define	0.8	2	59	95	96	95	72		61	88	43	100	2439	35
Chateau	0.03													
Chateau	0.03	3	38	93	99	94	28		59	93	30	100	7057	18
Outlook	1.3	2	66	99	75	100	75		91	100	65	100	9834	60
Spartan	0.2													
Define	0.8	1	83	95	100	100	89		70	93	43	100	6970	68
Spartan	0.2													
Spartan	0.2	2	65	99	96	100	41		91	100	50	100	3202	25
Untreated		3	0	0	0	0	0		56	94	38	80	1808	26
LSD (P=.05)		7	4	33	17	23	6	8	28	35	14	29	8385	18

2006 Evaluation of Safflower Tolerance to Spartan Herbicide in No-till and Minimum Tillage Systems at Hettinger

Eric Eriksmoen

Pre-plant treatment (trt 1) was applied on April 14. Finch safflower was seeded on April 23 into no-till oat stubble (no-till) and into oat stubble which had been spring tilled with a light cultivator (minimum tillage). Pre-emergence treatments (trts 2 – 6) were applied on April 27. Treatments were applied with a tractor mounted CO_2 propelled plot sprayer delivering 10 gpa at 30 psi through PK-01E80 nozzles to 5 by 28 foot plots. Crop emergence was on May 9 in the minimum till system and on May 11 in the no-till system. Plots were sprayed with 16 ounces/A of Poast herbicide for grassy weed control on June 6 and were sprayed with 8 ounces/A of Headline fungicide to prevent diseases on June 15 (diseases were not observed). Each tillage system was a randomized complete block design with four replications and was analyzed separately. Soil analysis indicated a soil pH of 6.3 and soil organic matter of 3.5%. Plots were evaluated for crop stand on May 25, for crop injury on May 26, June 20 and July 19, for plant height on June 7 and July 19, for crop biomass on July 19, and for date of 10% bloom. The trial was harvested on August 29.

Summary

Plant stands were not significantly affected by herbicide treatments in the no-till system but tended to reduce stands in the minimum till system. Crop injury was inconsistent and tended to be very minor when observed. There was no obvious trend for plant heights although differences were observed. Date of bloom was not affected by herbicide rates. Plant biomass was not significantly affected by herbicide treatments in the no-till system. Significant differences in plant biomass were observed in the minimum till system but these differences did not relate to herbicide rates or to plant stand. Significant differences between treatments for test weight were observed but no trends were detected. Percent oil content was not significantly different between treatments in the no-till system. Percent oil content was significantly higher than the untreated check for all pre-emergence treatments in the minimum till system and did not differ significantly from the weed free check. Seed yields of all herbicide treatments were significantly higher than the untreated check in the no-till system but were not significantly different than the weed free check. Seed yields of all the herbicide treatments in the minimum till system were not significantly different than the untreated check.

In summary, enhanced safflower seed yields may be achieved with pre-emergence applications of moderate rates of Spartan Herbicide to control kochia in a no-till system. Injury levels tend to be more volatile in a minimum tillage system and with pre-plant applications. The weed control benefits of Spartan Herbicide in a no-till system and the subsequent seed yield enhancement of this practice appear to outweigh the potential of significant and detrimental crop losses.

Evaluation of Safflower Tolerance to Spartan Herbicide in a No-till System at Hettinger

Treatment		Product Rate	App. Timing	Plant Stand	5/26 Inj.	6/7 Ht.	6/20 Inj.	Date of Bloom	7/19 Biomass	7/19 Ht.	7/19 Inj.	Test Weight	Oil Content	Seed Yield
		oz/Ac	*	# / ft^2	%	cm	%	July	oz / 5 plants	cm	%	lbs/bu	%**	lbs/ac
1	Spartan***	3.0	PP	3.6	0	11	0	14	10	57	0	44.5	42.4	1180
2	Spartan	1.5	PE	4.4	1	9	0	15	14	65	0	45.0	42.4	1340
3	Spartan	2.25	PE	4.4	4	10	0	14	11	61	0	45.9	41.6	1253
4	Spartan	3.0	PE	4.7	0	9	0	15	14	62	0	46.2	42.6	1233
5	Spartan	3.75	PE	6.0	2	9	0	14	12	64	0	45.4	42.7	1200
6	Spartan	4.5	PE	4.1	1	10	0	14	12	62	0	45.8	42.4	1220
7	Untreated			5.3	0	10	0	14	10	61	0	42.1	41.7	853
8	Weed Free			4.5	0	10	0	15	15	60	0	46.3	42.6	1240
C. V. %				31.6	257	18.5	0	8.5	21.7	5.0	0	1.5	1.6	11.8
LSD .05				NS	NS	NS	NS	NS	NS	5	NS	0.5	NS	207

Evaluation of Safflower Tolerance to Spartan Herbicide in a Minimum Tillage System at Hettinger

Treatment		Product Rate	App. Timing	Plant Stand	5/26 Inj.	6/7 Ht.	6/20 Inj.	Date of Bloom	7/19 Biomass	7/19 Ht.	7/19 Inj.	Test Weight	Oil Content	Seed Yield
		oz/Ac	*	# / ft^2	%	cm	%	July	oz / 5 plants	cm	%	lbs/bu	%**	lbs/ac
1	Spartan***	3.0	PP	4.6	1	13	0	12	8	56	0	42.9	41.6	1184
2	Spartan	1.5	PE	6.1	0	12	0	12	13	55	0	43.8	42.4	1213
3	Spartan	2.25	PE	4.6	0	13	0	13	9	60	0	44.7	42.4	1207
4	Spartan	3.0	PE	4.7	1	12	0	13	18	59	0	44.9	42.3	1533
5	Spartan	3.75	PE	5.0	0	13	0	12	11	55	0	44.4	42.0	1247
6	Spartan	4.5	PE	4.3	1	13	0	12	12	60	0	45.2	42.3	1320
7	Untreated			7.3	0	13	0	13	10	59	0	42.8	41.2	1353
8	Weed Free			7.6	0	13	0	13	15	58	0	45.3	42.4	1500
C. V. %				20.7	276	10.3	0	4.6	22.9	4.7	0	44.2	1.1	11.5
LSD .05				2	NS	NS	NS	NS	4	NS	NS	1.3	0.7	224

* Application Timing: PP = pre-plant, PE = pre-emergence. ** Oil Content is based on 8% moisture. *** Spartan 3F

SPARTAN ON SAFFLOWER - TILLED RECROP

Spartan on safflower sown into tilled recrop. Williston 2006. 'Finch' safflower was planted on May 15 into tilled soil previously cropped to durum wheat (in 2005) using a planter having 7 inch row spacing, seeding at 30 lbs/a. The preplant treatment was applied on May 12 to a dry soil surface with 66 F temperature, 50% clear sky, wind SE at 5-8 mph And RH 24%. PE treatments were applied on May 16 to a dry soil surface with 65 degree F temperature, 43% RH, wind south at 3-6 mph, and clear sky. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 10 gals/a at 40 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 0.12 inches on May 21 and 0.38 inches on May 24. Poast was applied on June 4 at 24 oz/a with a COC to control all grassy weeds. The experiment was a randomized complete block design with four replications. Plots were evaluated for crop injury on June 17 and July 18. Russian thistle (Ruth) density was low at 1-2/yd2 and was rated on September 6. Safflower was machine harvested on September 6.

Table 1: Effect of Spartan on weed control and safflower stand density, crop injury, flower date, plant height, and biomass weights.

Treatment	Product Rate		Stand Density	Crop Injury 6/17	Crop Injury 7/18	Flower Date	Plant Height 6/22	Plant Height 7/17	OD Wgt Biomass 10 plts	Ruth Control
	oz/a		plts/ft^2	%		fr 6-1	cms		grams	%
Spartan	3.0	PP	6.7	15	8	48	10.7	54.5	80.5	84
Spartan	1.5	PE	6.7	12	15	48	13.5	50.7	67.7	80
Spartan	2.25	PE	6.9	12	9	47	15.1	54.0	75.5	96
Spartan	3.0	PE	6.8	21	9	48	11.6	56.7	77.5	99
Spartan	3.75	PE	6.7	24	12	48	11.7	52.3	105.5	99
Spartan	4.5	PE	6.0	38	16	49	12.5	55.5	105.7	96
Weedy Check			6.7	0	0	48	15.4	55.6	72.7	0
Weedfree Check			6.7	0	0	47	16.7	55.6	103.5	76
KIH-485	2.4	PE	6.4	2	2	48	18.2	58.8	95.5	82
EXP MEAN			6.6	14	8	48	13.9	54.8	87.1	79
C.V. %			10.1	44	117	1	29.2	7.6	34.0	13
LSD 5%			NS	9	NS	1	NS	NS	NS	15

Table 2: Effect of Spartan on safflower test weight, yield and seed oil content.

Treatment	Product Rate		Test Weight	Yield	Seed Oil
	oz/a		lbs/bu	lbs/a	%OD
Spartan	3.0	PP	43.0	829	36.7
Spartan	1.5	PE	43.2	759	37.3
Spartan	2.25	PE	43.5	904	37.4
Spartan	3.0	PE	43.2	910	37.1
Spartan	3.75	PE	44.0	912	37.4
Spartan	4.5	PE	43.4	843	37.1
Weedy Check			43.5	859	37.2
Weedfree Check			43.1	916	37.2
KIH-485	2.4	PE	43.5	925	37.1
EXP MEAN			43.4	873	37.2
C.V. %			1.3	14	1.3
LSD 5%			NS	NS	NS

SPARTAN ON SAFFLOWER - NOTILL RECROP

Spartan on no-till safflower. 'Finch' safflower was sown no-till into standing durum stubble from 2005 using a planter having 7 inch row spacing and seeding at 30 lbs/a on May 15. The pre-plant treatment were applied on May 12 to a dry soil surface with 66 F temperature, 50% clear sky, wind SE at 5-8 mph And RH 24%. PE treatments were applied on May 16 to a dry soil surface with 65 degree F temperature, 43% RH, wind south at 2-5 mph, and clear sky. We used a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor to apply the treatments, delivering 10 gals/a at 40 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 0.12 inches on May 21and 0.38 inches on May 24. Poast was applied on June 4 at 24 oz/a with a COC to control all grassy weeds. The experiment was a randomized complete block design with four replications. Plots were evaluated for crop injury on June 17 and July 18. Russian thistle (Ruth) density was low at 1-2/yd2 and was rated on September 6. Safflower was machine harvested on September 6.

Table 1: Effect of Spartan on weed control and safflower stand density, crop injury, flower date, plant height, and biomass weights.

Treatment	Product Rate		Stand Density plts/ft^2	Crop Injury 6/17	Crop Injury 7/18	Flower Date	Plant Height 6/22	Plant Height 7/17	OD Wgt Biomass 10 plts	Ruth Control
	oz/a			%	%	fr 6-1		cms	grams	%
Spartan	3.0	PP	4.9	6	2	47	18.2	63.7	115.6	90
Spartan	1.5	PE	4.7	1	1	47	20.2	61.5	116.9	86
Spartan	2.25	PE	3.9	5	1	48	15.0	63.7	137.2	97
Spartan	3.0	PE	4.6	6	1	47	19.5	61.8	109.4	98
Spartan	3.75	PE	4.6	8	2	47	18.5	62.4	122.7	96
Spartan	4.5	PE	4.6	6	0	47	24.1	63.3	118.4	99
Weedy Check			5.1	0	0	47	22.2	63.9	92.8	0
Weedfree Check			4.5	0	0	47	20.9	64.6	108.2	85
KIH-485	2.4	PE	4.6	0	1	47	21.3	59.9	95.8	86
EXP MEAN			4.6	4	1	47	20.0	62.7	113.0	82
C.V. %			15.0	125	251	1	20.8	4.2	21.0	9
LSD 5%			NS	NS	NS	NS	NS	NS	NS	10

Table 2: Effect of Spartan on safflower test weight, yield and seed oil content.

Treatment	Product Rate		Test Weight	Yield	Seed Oil
	oz/a		lbs/bu	lbs/a	%OD
Spartan	3.0	PP	44.8	1018	37.6
Spartan	1.5	PE	45.0	1011	37.7
Spartan	2.25	PE	45.4	1008	37.9
Spartan	3.0	PE	44.7	1037	37.8
Spartan	3.75	PE	45.1	1001	37.5
Spartan	4.5	PE	44.8	963	37.2
Weedy Check			45.3	938	37.7
Weedfree Check			45.0	1024	37.7
KIH-485	2.4	PE	45.3	982	37.8
EXP MEAN			45.0	998	37.6
C.V. %			1.2	8	1.1
LSD 5%			NS	NS	NS

Weed control systems in Clearfield sunflower. Jenks, Willoughby, and Mazurek. Clearfield sunflower was seeded on May 23 at 20,000 seeds/A into 30-inch rows. Herbicide treatments were applied on May 16, seven days prior to planting (DPP), preemergence (PRE) on May 25, and postemergence on June 19 with the sunflower at the 4- to 6-leaf stage. On May 16 and 25, no weeds were present. On June 19, redroot pigweed (Rrpw) was 0.25-4 inches tall with 10-50 plants/ft², while kochia (Kocz) was 2-4 inches tall with 0-5 plants/ft². Individual plots were 10 x 30 ft and replicated three times.

None of the treatments caused visible crop injury. All treatments provided greater than 90% redroot pigweed control at the August evaluation. None of the treatments provided excellent kochia control. Only Prowl H2O + Spartan followed by Beyond provided greater than 80% kochia control. Beyond alone and Prowl H2O followed by Beyond provided poor kochia control. Dry conditions in 2006 likely inhibited complete herbicide activation.

Table. Weed control systems in Clearfield sunflower.

			Sunflower			Rrpw			Kocz			Sunflower	
Treatment	Rate	Timing	Jun 21	Jul 13	Aug 16	Jun 21	Jul 13	Aug 16	Jun 21	Jul 13	Aug 16	Yield	Test wt.
			--% injury--			--------% control--------						lb/A	lb/bu
Prowl H2O / Beyond[a]	3 pt / 4 fl oz	7DPP / 4-6 lf	0	0	0	78	96	97	82	65	57	1902	32.7
Spartan / Beyond[a]	3 fl oz + 4 fl oz	PRE / 4-6 lf	0	0	0	75	97	97	88	74	71	2119	32.7
Prowl H2O + Spartan / Beyond[a]	1.5 pt + 1.5 fl oz + 4 fl oz	7DPP / 4-6 lf	0	0	0	89	99	99	94	85	83	2100	33.0
Beyond[a]	4 fl oz	4-6 lf	0	0	0	0	87	91	0	42	27	1549	32.9
Beyond[b]	4 fl oz	4-6 lf	0	0	0	0	87	91	0	53	35	1956	33.0
Untreated			0	0	0	0	0	0	0	0	0	785	33.4
LSD (0.05)			NS	NS	NS	5	2	3	13	23	24	632	1.2
CV			0	0	0	6	1	2	16	24	29	20	2.0

[a]Beyond applied with NIS (0.25%) and 28% N (2.5%)
[b]Beyond applied with COC (1%) and 28% N (2.5%)

Weed management in Clearfield sunflower, Carrington, 2006. Gregory J. Endres. The trial had a randomized complete block design with three replicates. The trial was conducted under conventional-till with lupin as the previous crop on a loam soil with 6.8 pH and 3.1% organic matter at the NDSU Carrington Research Extension Center. Herbicide treatments were applied to 10 by 30 ft plots with a CO_2 pressurized hand-held plot sprayer at 12 gal/A and 30 psi through 80015 flat fan nozzles. Preplant (PP) treatments were applied on May 24 on a dry soil surface with 63 F, 95% RH, 100% cloudy sky, and 7 mph wind. Rainfall totaled 0.6 inches during May 24 to 31. Mycogen NuSun '8N429CL', treated with Maxim + Apron XL LS, was planted in 30-inch rows on May 31 and hand-thinned to 20,000 plants/A on July 7. POST treatments were applied on June 29 with 62 F, 79% RH, clear sky, and 8 mph wind to V6- to V8-stage sunflower, 0.5- to 6-inch tall common lambsquarters and 0.5- to 3-inch tall redroot and prostrate pigweed. The trial was hand harvested and seed threshed with a plot combine on October 16.

Adequate rainfall occurred for timely activation of soil-applied herbicides. The preplant herbicides provided 73 to 78% control of common lambsquarters and pigweed species when visually evaluated on June 29 (Table 1). Common lambsquarters control ranged from 64 to 82% with POST Beyond applied alone or following soil-applied herbicides while pigweed control was excellent. Crop injury from herbicides was not detected in the trial (data not shown). Sunflower development from planting to first flower and physiological maturity was similar among treatments (Table 2). Seed yield was highest with soil-applied herbicides followed by Beyond. Yield was reduced with POST treatments due to delay in controlling weeds in combination with drought stress.

Table 1. Weed control in Clearfield sunflower.

Herbicide[1]			29-Jun		21-Jul		7-Aug	
Treatment	Rate	Timing	colq[2]	piwe[3]	colq	piwe	colq	piwe
	product/A		% control					
Prowl H_2O/Beyond + NIS + UAN	48 fl oz/4 fl oz	PP/POST	73	78	77	96	74	96
Spartan F/Beyond + NIS + UAN	3 fl oz/4 fl oz	PP/POST	78	78	80	95	82	98
Prowl H_2O + Spartan F/	24 + 1.5 fl oz/							
Beyond + NIS + UAN	4 fl oz	PP/POST	76	76	77	97	79	98
Beyond + NIS + UAN	4 fl oz	POST	x	x	69	91	64	92
Beyond + MSO + UAN	4 fl oz	POST	x	x	71	91	70	96
Untreated check	x	x	0	0	0	0	0	0
mean			57	58	62	78	62	80
C.V. (%)			4.7	2.6	3.2	4.9	4.9	6.7
LSD (0.05)			5	3	4	7	5	10

[1]Treatments: NIS=Preference at 0.25% v/v, a nonionic surfactant from Agriliance; MSO=Destiny at 1% v/v, a methylated seed oil from Agriliance; UAN at 2.5% v/v. Timing: PP=Preplant on May 24 and POST=Postemergence on June 29.
[2]colq=common lambsquarters.
[3]piwe=prostrate and redroot pigweed.

Table 2. Clearfield sunflower response to herbicides.

Herbicide[1]			Sunflower		
Treatment	Rate	Timing	First flower	Physiological maturity	Seed yield
	product/A		Jday	Jday	lb/A
Prowl H_2O/Beyond + NIS + UAN	48 fl oz/4 fl oz	PP/POST	216	258	1233
Spartan F/Beyond + NIS + UAN	3 fl oz/4 fl oz	PP/POST	217	258	1102
Prowl H_2O + Spartan F/ Beyond + NIS + UAN	24 + 1.5 fl oz/ 4 fl oz	PP/POST	217	258	1269
Beyond + NIS + UAN	4 fl oz	POST	219	258	401
Beyond + MSO + UAN	4 fl oz	POST	220	258	494
Untreated check	x	x	219	258	91
mean			218	258	765
C.V. (%)			0.6	0.2	37.4
LSD (0.05)			3	NS	521

[1]Treatments: NIS=Preference at 0.25% v/v, a nonionic surfactant from Agriliance; MSO=Destiny at 1% v/v, a methylated seed oil from Agriliance; UAN at 2.5% v/v. Timing: PP=Preplant on May 24 and POST=Postemergence on June 29.

Weed management in Express-resistant sunflower, Carrington, 2006. Gregory J. Endres. The trial had a randomized complete block design with three replicates. The trial was conducted under conventional-till with lupin as the previous crop on a loam soil with 6.8 pH and 3.1% organic matter at the NDSU Carrington Research Extension Center. Herbicide treatments were applied to 10 by 30 ft plots with a CO_2 pressurized hand-held plot sprayer at 12 gal/A and 30 psi through 80015 flat fan nozzles. PP treatments were applied on May 24 on a dry soil surface with 63 F, 95% RH, 100% cloudy sky, and 7 mph wind. Rainfall totaled 0.6 inches during May 24 to 31. Pioneer 'XF3312' was planted in 30-inch rows on May 31 and hand-thinned to 20,000 plants/A on July 7. POST treatments were applied on June 29 with 62 F, 79% RH, clear sky, and 8 mph wind to V8-stage sunflower, 0.5- to 3-inch tall common lambsquarters, 2- to 4-inch tall hairy nightshade, and seedling- to bud-stage (1- to 30-inch tall) dandelion. The trial was hand harvested and seed threshed with a plot combine on October 16.

Adequate rainfall occurred for timely activation of soil-applied herbicides. Common lambsquarters control was excellent among all treatments (Table 1). Hairy nightshade and pigweed control was excellent with Spartan followed by Express (August 14). Canada thistle growth was suppressed with all Express treatments. Crop response to POST treatments included slight and variable yellowing (data not shown) and height reduction (Table 2). Sunflower development from planting to first flower and physiological maturity (data not shown) was similar among treatments. Seed yield was similar among treatments, likely due to minimal crop injury and low weed density.

Table 1. Weed control in Express-resistant sunflower.

Herbicide[1]			21-Jul			14-Aug		
Treatment	Rate	Timing	colq[2]	hans[3]	cath[4]	colq	hans	piwe[5]
	product/A		% control					
Prowl/Express SG + MSO	32 fl oz/0.25 oz	PP/POST	99	72	61	99	81	89
Prowl/Express SG + MSO	32 fl oz/0.5 oz	PP/POST	99	78	63	98	81	86
Spartan /Express SG + MSO	4.5 fl oz/0.25 oz	PP/POST	99	86	65	99	96	99
Spartan/Express SG + MSO	4.5 fl oz/0.5 oz	PP/POST	98	82	57	99	92	99
Express SG + MSO	0.25 oz	POST	99	73	67	93	81	62
Express SG + MSO	0.5 oz	POST	97	76	65	94	87	80
Express WG + Quad7	0.167 oz	POST	99	73	65	92	73	63
Express WG + Quad7	0.333 oz	POST	96	75	68	92	86	75
Untreated check	x	x	0	0	0	0	0	0
C.V. (%)			1.5	8.4	9.7	3.5	10.2	16.5
LSD (0.05)			2	10	10	5	13	21

[1]Treatments: All treatments included Assure II at 8 fl oz/A. MSO=Destiny at 24 fl oz/A, a methylated seed oil from Agriliance. Quad7=1% v/v, a basic blend adjuvant from Agsco. Timing: PP=Preplant on May 24 and POST=Postemergence on June 29.
[2]colq=common lambsquarters.
[3]hans=hairy nightshade.
[4]cath=Canada thistle.
[5]piwe=prostrate and redroot pigweed.

Table 2. Express-resistant sunflower response to herbicides.

Herbicide[1]			Crop height reduction (July 21)	First flower	Seed yield
Treatment	Rate	Timing			
	product/A		inches	Jday	lb/A
Prowl/Express SG + MSO	32 fl oz/0.25 oz	PP/POST	0	214	1662
Prowl/Express SG + MSO	32 fl oz/0.5 oz	PP/POST	0	214	1697
Spartan /Express SG + MSO	4.5 fl oz/0.25 oz	PP/POST	3	214	1735
Spartan/Express SG + MSO	4.5 fl oz/0.5 oz	PP/POST	0	215	1662
Express SG + MSO	0.25 oz	POST	0	214	1384
Express SG + MSO	0.5 oz	POST	4	214	1839
Express WG + Quad7	0.167 oz	POST	3	214	1248
Express WG + Quad7	0.333 oz	POST	6	214	1542
Untreated check	x	x	0	215	838
C.V. (%)			154.1	0.4	24.2
LSD (0.05)			NS	NS	NS

[1]Treatments: All treatments included Assure II at 8 fl oz/A. MSO=Destiny at 24 fl oz/A, a methylated seed oil from Agriliance. Quad7=1% v/v, a basic blend adjuvant from Agsco. Timing: PP=Preplant on May 24 and POST=Postemergence on June 29.

KIH-485 in sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate crop response of Express-Resistant sunflower. Pioneer 'XF3312' sunflower was planted on May 23, 2006. PRE treatments were applied on May 25 at 5:50 pm with 66 F air, 61 F soil at a four inch depth, 96% relative humidity, 100% cloud cover, 8 to 10 mph N wind, dry soil surface, and moist subsoil. Soil characteristics were 29.7% sand, 44.7% silt, 25.6% clay, loam texture, 3.9% OM, and pH 5.4. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replicates per treatment.

This study was conducted to observe sunflower response to KIH-485. The rate sequence of KIH-485 is 0.8X, 1X, 1.2X, and 1.4X of the anticipated rate for the soil type of the study. No injury in the form of stunting, burning, speckling, or chlorosis was seen at any of the evaluations. Very little rain occurred after PRE application and both herbicides may not have been fully activated. KIH-485 has provided complete control of yellow foxtail, redroot pigweed, common lambsquarters, hairy nightshade in studies conducted in previous years when 0.75 to 1.5 inches of rain occurred shortly after application. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. KIH-485 in sunflower (Zollinger and Ries).

		9 DAT	21 DAT	21 DAT					35 DAT
Treatment	Rate	Snfl	Snfl	Yeft	Rrpw	Colq	Hans	Corw	Snfl
	(product/A)	% injury	% injury	% control					% injury
KIH-485	2.8oz	0	0	75	70	77	80	42	0
KIH-485	3.5oz	0	0	78	91	92	88	62	0
KIH-485	4.2oz	0	0	88	96	96	91	78	0
KIH-485	5oz	0	0	86	96	97	94	83	0
KIH-485+Spartan	2.8oz+3fl oz	0	0	83	97	97	76	64	0
KIH-485+Spartan	2.8oz+4fl oz	0	0	84	98	98	96	73	0
KIH-485+Spartan	3.5oz+3fl oz	0	0	87	97	97	95	77	0
KIH-485+Spartan	3.5oz+4fl oz	0	0	86	99	99	96	83	0
LSD (0.05)		NS	NS	9	4	8	7	6	NS

Weed control in Clearfield sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Valley City, ND, to evaluate weed efficacy and crop response. Croplan '521CF' sunflower was planted on June 2, 2006. PRE treatments were applied on June 7 at 10:00 am with 71 F air, 64 F soil at a four inch depth, 51% relative humidity, 0% cloud cover, 5 to 9 mph N wind, dry soil surface, and moist subsoil. Soil characteristics were 35% sand, 47.3% silt, 17.7% clay, loam texture, 6.0% OM, pH 7.0. POST treatments were applied on June 20 at 1:10 pm with 76 F air, 87 F soil surface, 52% relative humidity, 0% cloud cover, 7 to 12 mph S wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to V4 sunflower. Weed species present at time of application with PRE treatments were: 1 to 2 inch (1 to 3/yd^2) yellow foxtail, and 0.5 to 1 inch (1 to 2/yd^2) prostrate pigweed. Weed species present at time of application with POST only treatments were: 1 to 4 inch (1 to 5/yd^2) yellow foxtail; 1 to 2 inch (0 to 2/yd^2) marshelder; .5 to 1 inch (0 to 3/yd^2) easternblack nightshade; and 1 to 2 inch (1 to 3/yd^2) prostrate pigweed. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a bicycle-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet flat-fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 11001 Turbo TeeJet flat-fan nozzles for POST treatments. The experiment had randomized complete block design with three replicates per treatment.

All treatments gave season-long control of green and yellow foxtail, prostrate pigweed, and E. Black nightshade. At 14 DAT, sunflower injury from KIH-485 + Spartan was stunting; and injury from Beyond on Clearfield sunflower (POST) was stunting and chlorosis. On August 9 (42 DAT), the sunflower in all treatments were tall (5 to 7 ft) and headed, the sunflowers previously injured by some treatments recovered with little stunting, and there was no difference in weed control from the last rating. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Weed control in Clearfield sunflower (Zollinger and Ries).

Treatment[1]	Rate	7 DAT		14 DAT		42 DAT	
		Sunflower	Mael	Sunflower	Mael	Sunflower	Mael
	(product/A)	% injury	% control	% injury	% control	% injury	% control
PRE							
KIH-485	2.8oz	0	81	0	83	0	83
KIH-485	3.5oz	0	91	0	91	0	91
KIH-485	4.2oz	0	92	0	92	0	92
KIH-485	7oz	0	93	0	93	0	93
KIH-485+Spartan	2.8oz+3fl oz	11	93	8	94	0	94
KIH-485+Spartan	3.5oz+3fl oz	8	93	3	93	0	93
KIH-485+Spartan	2.8oz+4fl oz	22	91	18	91	0	91
KIH-485+Spartan	3.5oz+4fl oz	12	94	9	94	0	94
PRE/POST							
Prowl H_2O/Beyond+NIS+28% N	3pt/4fl oz+0.25% v/v+2.5% v/v	25	99	22	99	0	99
Spartan/Beyond+NIS+28% N	3fl oz/4fl oz+0.25% v/v+2.5% v/v	22	95	25	99	0	99
Prowl H_2O+Spartan/Beyond+NIS+28% N	1.5pt+1.5fl oz/4fl oz+0.25% v/v+2.5% v/v	26	99	28	99	0	99
POST							
Beyond+NIS+28% N	4fl oz+0.25% v/v+2.5% v/v	17	99	15	99	0	99
Beyond+PO+28% N	4fl oz+1% v/v+2.5% v/v	19	99	18	99	0	99
LSD (0.05)		6	4	10	4	0	4

[1]NIS = nonionic surfactant = R-11; 28% N = 28-0-0; PO = petroleum oil concentrate = Herbimax.

Weed programs in Express-Resistant sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate weed control programs in Express-Resistant sunflower. Pioneer 'XF3312' sunflower was planted on May 23, 2006. PRE treatments were applied on May 25 at 6:00 pm with 66 F air, 61 F soil at a four inch depth, 96% relative humidity, 100 % cloud cover, 8 to 10 mph N wind, dry soil surface, and moist subsoil. Soil characteristics were 29.7% sand, 44.7% silt, 25.6% clay, loam texture, 3.9% OM, and pH 5.4. POST treatments were applied on June 13 at 9:20 pm with 67 F air, 56 F soil surface, 85% relative humidity, 10 % cloud cover, 1 to 4 mph NE wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to V4 sunflower. Weed species present were: 1 to 4 inch (15 to 75/ft^2) yellow foxtail; 1 to 2 inch (5 to 15/yd^2) redroot pigweed; 1 to 3 inch (5 to 15/yd^2) wild mustard; 1 to 2 inch (1 to 3/yd^2) hairy nightshade; 1 to 2 inch (1 to 3/yd^2) common lambsquarters; 1 to 2 inch (1/yd^2) common ragweed; and 1 to 3 inch (1 to 2/yd^2) common cocklebur. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 Turbo TeeJet flat-fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 11001 Turbo TeeJet flat-fan nozzles for POST treatments. The experiment had randomized complete block design with three replicates per treatment.

The study was conducted in an area with high weed pressure. Generally, sunflower tolerance was good from Express at 0.25 oz/A but up to 23% sunflower injury was seen from Express at 0.5 oz/A. Sunflower injury from the higher rate (0.5 oz/A) of Express has decreased slightly by 28 DAT. By 42 DAT, injury from most treatments was less than 10%. Cold nighttime temperatures occurred before and after POST application which may have reduced the sunflower plants capacity to metabolize Express. Sunflower injury from Express at 0.25 oz/A was less than 5% except for one treatment when Express was applied with quizalafop at the highest rate 12 fl oz/A. The emulsifiers in the quizalafop formulation may have increased the activity of Express in addition to Quad 7. Conversely, all treatments of Express at 0.5 oz/A showed high sunflower injury except for one treatment when Express was applied with Select Max + at 9 fl oz/A + NIS. Interestingly, weed control was initially lower, but later was equal to most treatments. The NIS in this treatment did not enhance activity as much as the Quad 7 resulting in lower sunflower response and lower weed control.

Yellow foxtail control was antagonized more when Express was applied with quizalofop than clethodim. Express applied at 0.5 oz/A antagonized quizalofop more than when applied at 0.25 oz/A. Yellow foxtail control was antagonized from one clethodim treatment; when Express at 0.5 oz/A was applied with Select Max at 9 fl oz/A + NIS. Again, the NIS did not enhance the activity of quizalofop as did Quad 7.

Express usually gives excellent redroot pigweed, and common lambquarters control. Control at 14 and 28 DAT was less than usual, perhaps because of the high weed pressure and dry conditions after application. This data corresponds to the Express label of hairy nightshade suppression. Common ragweed control was more than expected. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Weed programs in Express-Resistant sunflower (Zollinger and Ries).

Treatment[1]	Rate	14 DAT Sunflower	14 DAT Yeft	14 DAT Rrpw	14 DAT Colq	14 DAT Hans	14 DAT Corw	28 DAT Sunflower	28 DAT Yeft	28 DAT Rrpw	28 DAT Colq	28 DAT Hans	28 DAT Corw
	(product/A)	% injury	% control					% injury	% control				
PRE/POST													
Prowl H_2O/Express SG+Quizalafop+PO	2pt/0.25oz+8fl oz+1.5pt	0	99	99	99	60	66	0	99	99	99	90	37
Prowl H_2O/Express SG+Quizalafop+PO	2pt/0.5oz+8fl oz+1.5pt	20	99	96	93	60	77	13	99	98	96	97	70
Spartan/Express SG+Quizalafop+PO	4.5fl oz/0.25oz+8fl oz+1.5pt	0	99	99	99	99	89	0	99	93	99	99	70
Spartan/Express SG+Quizalafop+PO	4.5fl oz/0.5oz+8fl oz+1.5pt	23	99	96	96	96	93	17	99	93	96	98	70
POST													
Express SG+Quizalafop+PO	0.25oz+8fl oz+1.5pt	5	83	85	85	85	80	3	83	90	95	95	70
Express SG+Quizalafop+PO	0.5oz+8fl oz+1.5pt	17	72	83	83	83	78	13	90	93	95	95	70
Express SG+Quizalafop+Quad 7	0.25oz+8fl oz+1% v/v	3	83	80	80	80	73	2	80	93	93	95	70
Express SG+Quizalafop+Quad 7	0.5oz+8fl oz+1% v/v	17	77	83	83	83	78	15	89	83	90	95	71
Express SG+Quizalafop+Quad 7	0.25oz+12fl oz+1% v/v	20	72	80	80	80	78	20	94	90	88	95	70
Express SG+Quizalafop+Quad 7	0.5oz+12fl oz+1% v/v	22	81	80	80	80	75	17	89	88	90	96	70
Express SG+Select+PO	0.25oz+6fl oz+1.5pt	10	92	80	78	78	78	5	96	73	88	80	70
Express SG+Select+PO	0.5oz+6fl oz+1.5pt	20	93	80	80	80	78	15	95	89	92	95	70
Express SG+Select+Quad 7	0.25oz+6fl oz+1% v/v	2	91	80	80	80	80	2	90	75	90	80	63
Express SG+Select+Quad 7	0.5oz+6fl oz+1% v/v	17	93	82	83	82	82	13	94	94	87	93	70
Express SG+Select Max+NIS	0.25oz+9fl oz+0.25% v/v	0	95	87	87	87	83	0	91	73	82	92	63
Express SG+Select Max+NIS	0.5oz+9fl oz+0.25% v/v	3	68	70	70	70	70	3	83	87	88	95	70
Express SG+Select Max+Quad 7	0.25oz+9fl oz+1% v/v	0	94	70	70	70	70	0	92	84	92	95	70
Express SG+Select Max+Quad 7	0.55oz+9fl oz+1% v/v	18	93	80	80	80	80	10	93	97	96	96	80
LSD (0.05)		7	4	5	5	5	4	1	3	4	5	2	4

[1]PO = petroleum oil concentrate = Herbimax; Quad 7 = basic pH blend; NIS = nonionic surfactant = R-11.

Table cont. Weed programs in Express-Resistant sunflower (Zollinger and Ries).

Treatment[1]	Rate	42 DAT					
		Sunflower	Yeft	Rrpw	Colq	Hans	Corw
	(product/A)	-% injury -	% control				
PRE/POST							
Prowl H_2O/Express SG+Quizalafop+PO	2pt/0.25oz+8fl oz+1.5pt	0	99	99	99	96	47
Prowl H_2O/Express SG+Quizalafop+PO	2pt/0.5oz+8fl oz+1.5pt	5	99	98	96	97	76
Spartan/Express SG+Quizalafop+PO	4.5fl oz/0.25oz+8fl oz+1.5pt	0	99	95	99	99	87
Spartan/Express SG+Quizalafop+PO	4.5fl oz/0.5oz+8fl oz+1.5pt	15	99	93	96	98	93
POST							
Express SG+Quizalafop+PO	0.25oz+8fl oz+1.5pt	5	93	90	95	95	87
Express SG+Quizalafop+PO	0.5oz+8fl oz+1.5pt	12	93	93	95	95	83
Express SG+Quizalafop+Quad 7	0.25oz+8fl oz+1% v/v	0	80	94	95	95	83
Express SG+Quizalafop+Quad 7	0.5oz+8fl oz+1% v/v	5	89	93	90	95	81
Express SG+Quizalafop+Quad 7	0.25oz+12fl oz+1% v/v	20	96	95	94	95	89
Express SG+Quizalafop+Quad 7	0.5oz+12fl oz+1% v/v	10	89	93	93	96	89
Express SG+Select+PO	0.25oz+6fl oz+1.5pt	2	98	87	88	87	82
Express SG+Select+PO	0.5oz+6fl oz+1.5pt	5	95	89	92	95	82
Express SG+Select+Quad 7	0.25oz+6fl oz+1% v/v	2	90	78	90	94	68
Express SG+Select+Quad 7	0.5oz+6fl oz+1% v/v	3	95	94	93	93	83
Express SG+Select Max+NIS	0.25oz+9fl oz+0.25% v/v	0	91	87	93	93	80
Express SG+Select Max+NIS	0.5oz+9fl oz+0.25% v/v	0	90	90	93	95	85
Express SG+Select Max+Quad 7	0.25oz+9fl oz+1% v/v	0	92	93	93	95	83
Express SG+Select Max+Quad 7	0.55oz+9fl oz+1% v/v	0	94	97	96	97	93
LSD (0.05)		4	3	3	5	3	5

[1]PO = petroleum oil concentrate = Herbimax; Quad 7 = basic pH blend; NIS = nonionic surfactant = R-11.

Assert plus grass herbicides in sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Valley City, ND, to evaluate weed control and crop response to treatments applied POST. Croplan '521CF' sunflower was planted on June 2, 2006. POST treatments were applied on June 23 at 12:00 pm with 78 F air, 87 F soil surface, 34% relative humidity, 50% cloud cover, 1 to 5 mph NW wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to V4 to V6 sunflower. Weed species present were: 2 to 8 inch (5 to 50/yd^2) green foxtail; and 2 to 8 inch (5 to 50/yd^2) yellow foxtail; and 2 to 8 inch (1 to 10/yd^2) volunteer corn. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 8.5 gpa at 40 psi through 11001 Turbo TeeJet flat-fan nozzles. The experiment had randomized complete block design with three replicates per treatment.

On June 26, June 30 (7 DAT POST), July 7, and Aug 9, there was no sunflower injury in any treatment and grasses were controlled in all treatments except Assert alone. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Assert plus grass herbicides in sunflower (Zollinger and Ries).

		14 DAT		28 DAT		47DAT	
Treatment[1]	Rate	Fxtl[2]	V corn[3]	Fxtl	V corn	Fxtl	V corn
	(product/A)	-% control -		-% control -		-% control -	
Select+Assert+NIS+AMS	6fl oz+0.8pt+0.25% v/v+2.5lb	90	99	95	99	95	99
Select+Assert+PO	6fl oz+0.8pt+1qt	90	99	95	99	95	99
Select Max+Assert	9fl oz+0.8pt	90	99	95	99	95	99
Select Max+Assert+NIS	9fl oz+0.8pt+0.25% v/v	90	99	95	99	95	99
Assure II+Assert+NIS	8fl oz+0.8pt+0.25% v/v	90	99	96	99	96	99
Assure II+Assert+PO	8fl oz+0.8pt+1qt	90	99	95	99	95	99
Targa+Assert+NIS	8fl oz+0.8pt+0.25% v/v	90	99	95	99	95	99
Targa+Assert+PO	8fl oz+0.8pt+1qt	90	99	95	99	95	99
Assert+NIS	0.8pt+0.25% v/v	0	0	0	0	0	0
Assert+PO	0.8pt+1qt	0	0	0	0	0	0
LSD (0.05)		1	1	1	1	1	1

[1]NIS = nonionic surfactant = R-11; AMS = ammonium sulfate; PO = petroleum oil concentrate = Herbimax.
[2]Fxtl = yellow and green foxtail.
[3]V corn = volunteer corn.

Specialty oilseed response to preemergence herbicides. Kirk Howatt, Ronald Roach and Janet Harrington. Strips of fenugreek, coriander, quinoa, borage, and camelina were seeded in adjacent strips on May 31 near Fargo, North Dakota. Preemergence treatments were applied June 1 with 77°F, 52% RH, 50% cloud cover, wind velocity of mph at 225°, and moist soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT 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.

Treatment	Rate	6/14 All crops	6/21 fenugreek	6/21 coriander	6/21 quinoa	6/21 borage	6/21 camelina
	oz ai/A	% injury					
KIH-485	0.7+5	0	0	0	0	0	0
KIH-485	1	0	0	0	0	0	0
KIH-485	1.2+5	0	0	0	0	0	0
KIH-485	1.5	0	0	0	0	0	0
KIH-485	2	0	0	0	0	0	0
Tembotrione	1.5	0	0	0	0	0	0
Tembotrione	3	0	0	0	0	0	0
Tembotrione+MSO+UAN	1.5+1%+2.5%	0	0	0	0	0	0
Flucarbazone	0.28	0	0	0	0	0	0
Mesotrione	2	0	22	15	22	27	84
Dimethenamid-p	12	0	0	0	0	0	0
Metolachlor	16	0	0	0	0	0	0
Sulfentrazone	3	0	4	30	76	7	67
Untreated	0	0	0	0	0	0	0
LSD (P=.05)		0	6	4	4	7	8
CV		0	219	81	40	189	49

Several of the products did not cause injury to the crops investigated. However, weed control in these plots was not apparent either. Lack of moisture may have prevented adequate availability of several herbicides. This experiment should be repeated before pursuing these combinations in greater detail. Mesotrione caused substantial injury to all crops even with the limited moisture availability. Sulfentrazone also caused injury, but fenugreek and borage tolerated sulfentrazone better than other crops. With increased soil moisture these crops may show more injury than acceptable.

Oilseed response to Clethodim. Kirk Howatt, Ronald Roach, and Janet Harrington. Strips of fenugreek, coriander, quinoa, borage, and camolina were seeded in adjacent strips on May 31 near Fargo, North Dakota. Early post treatments were applied to cotyledon-stage crops and 2-leaf yellow foxtail on June 13 with 71°F, 44% RH, 65% cloud cover, wind velocity of 1 mph at 315°, and dry soil at 65°F. Late post treatments were applied to 3- to 4-inch tall crops and 3-leaf yellow foxtail on June 28 with 67°F, 51% RH, clear sky, wind velocity of 8 mph at 90°, and dry soil at 60°F. Flowering treatments were applied to bolted crops that were displaying initial flower development and mature yellow foxtail on July 7 with 70°F, 58% RH, 20% cloud cover, wind velocity of 19 mph at 135°, and dry soil at 68°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT 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.

			All varietyes		
Treatment	Rate	Timing	6/27	7/10	7/17
	oz ai/A			% injury	
Clethodim-SM+NIS	1.5+0.25%	EPOST	0	0	0
Clethodim-SM+NIS	4+0.25%	EPOST	0	0	0
Clethodim-SM+NIS	1.5+0.25%	LPOST	0	0	0
Clethodim-SM+NIS	4+0.25%	LPOST	0	0	0
Clethodim-SM+NIS	1.5+0.25%	flowering	0	0	0
Clethodim-SM+NIS	4+0.25%	flowering	0	0	0
Untreated	0		0	0	0
LSD (P=.05)			0	0	0
CV			0	0	0

None of the crops exhibited visible injury with application of clethodim at any growth stage. This is reasonable since clethodim controls grasses and all of the crops listed were broadleaf plants. However, clethodim has damaged canola when applied during bolting and flower development, causing deformed and sterile flowers. Such injury was not observed with the Select Max formulation of clethodim on these crops. In addition, clethodim provided complete control of yellow foxtail at each application rate and timing, with foxtail death taking longer to occur for mature plants compared with seedings.

Kentucky bluegrass response to propoxycarbazone rate, Fargo location 1. Kirk Howatt, Ronald Roach, and Janet Harrington. The experiment was established on a lawn area of Kentucky bluegrass. Treatments 1 through 5 were applied on May 26 with 63°F, 54% RH, clear sky, wind velocity of 8 mph at 45°, and wet soil with 61°F. Treatments 6 through 10 were applied on June 30 with 82°F, 49% RH, 50% cloud cover, wind velocity of 3 to 5 mph at 270°, and dry soil at 63°F. A backpack sprayer delivering 8.5 gpa at 40 and 35 psi, respectively, through 11001 TT nozzles was used for application of treatments 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.

		Bluegrass			
Treatment	Rate	6/12	6/28	7/17	8/3
	oz ai/A	% injury			
Propoxycarbazone+Basic Blend	0.25+1%	0	0	0	0
Propoxycarbazone+Basic Blend	0.5+1%	0	0	0	0
Propoxycarbazone+Basic Blend	1+1%	0	0	0	0
Propoxycarbazone+Basic Blend	2+1%	0	0	0	0
Propoxycarbazone+Basic Blend	4+1%	0	2	0	0
Propoxycarbazone+Basic Blend	0.25+1%	0	0	0	0
Propoxycarbazone+Basic Blend	0.5+1%	0	0	0	2
Propoxycarbazone+Basic Blend	1+1%	0	0	0	4
Propoxycarbazone+Basic Blend	2+1%	0	0	0	3
Propoxycarbazone+Basic Blend	4+1%	0	0	0	7
Untreated		0	0	0	0
LSD (P=.05)		0	1	0	2
CV		0	406	0	98

Kentucky bluegrass was very tolerant of propoxycarbazone applied at rates up to 4 oz/A in May. Propoxycarbazone applied at the end of June caused injury that was not discernible until early in August, and the injury was less than 10% observed as discoloration and stunting. The dry weather conditions demonstrate considerable tolerance for areas of low precipitation.

Kentucky bluegrass response to propoxycarbazone rate, Fargo location 2. Kirk Howatt, Ronald Roach, and Janet Harrington. The experiment was established on a lawn area of Kentucky bluegrass. Treatments 1 through 5 were applied on May 26 with 59°F, 60% RH, 25% cloud cover, wind velocity of 0 to 6 mph at 270°, and damp soil at 60°F. Treatments 6 through 10 were applied on June 30 with 89°F, 36% RH, 50% cloud cover, wind velocity of 1 to 3 mph at 170°, and dry soil at 77°F. A backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT nozzles was used for application to a 7-ft wide area the length of 10 by 30 ft plots. The experiment was a randomized, complete block design with three replicates.

		Bluegrass			
Rating Date	Rate	6/12	6/28	7/17	8/3
	oz ai/A	% injury			
Propoxycarbazone+Basic Blend	0.25+1%	0	0	0	0
Propoxycarbazone+Basic Blend	0.5+1%	0	0	0	0
Propoxycarbazone+Basic Blend	1+1%	0	2	0	0
Propoxycarbazone+Basic Blend	2+1%	0	0	0	0
Propoxycarbazone+Basic Blend	4+1%	0	6	0	0
Propoxycarbazone+Basic Blend	0.25+1%	0	0	0	0
Propoxycarbazone+Basic Blend	0.5+1%	0	0	0	0
Propoxycarbazone+Basic Blend	1+1%	0	0	0	0
Propoxycarbazone+Basic Blend	2+1%	0	0	0	0
Propoxycarbazone+Basic Blend	4+1%	0	0	0	0
Untreated		0	0	0	0
LSD (P=.05)		0	2	0	0
CV		0	149	0	0

Kentucky bluegrass was very tolerant of propoxycarbazone applied at rates up to 4 oz/A in May or the end of June. The plants at this location demonstrated symptoms typical of nitrogen deficiency prior to herbicide application, which may have masked the injury observed at location 1. However, this indicated that even under nutrient and moisture stress, Kentucky bluegrass was very tolerant of propoxycarbazone.

Application volume with propoxycarbazone in Kentucky bluegrass, Fargo location 1. Kirk Howatt, Ronald Roach, and Janet Harrington. The experiment was established in a lawn area of Kentucky bluegrass. Treatments were applied May 26 with 61°F, 55% RH, clear sky, wind velocity of 8 mph at 45°, and wet soil at 61°F. A backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT nozzle tips (treatments 1 through 3), 40 gpa at 55 psi through 8004 vs nozzle tips (treatments 3 through 5), and 80 gpa at 60 psi through 8008 vs nozzle tips (treatments 7 through 9) was used for treatment application 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.

Rating Date			Bluegrass			
Treatment	Rate	Volume	6/12	6/28	7/17	8/3
	oz ai/A	gpa	% injury			
Propoxycarbazone+Basic Blend	0.25+1%	8.5	0	0	0	0
Propoxycarbazone+Basic Blend	0.5+1%	8.5	0	0	0	0
Propoxycarbazone+Basic Blend	1+1%	8.5	0	0	0	0
Propoxycarbazone+Basic Blend	0.25+1%	40	0	0	0	0
Propoxycarbazone+Basic Blend	0.5+1%	40	0	0	0	0
Propoxycarbazone+Basic Blend	1+1%	40	0	0	0	0
Propoxycarbazone+Basic Blend	0.25+1%	80	0	0	0	0
Propoxycarbazone+Basic Blend	0.5+1%	80	0	0	0	0
Propoxycarbazone+Basic Blend	1+1%	80	0	0	0	0
Untreated	0		0	0	0	0
LSD (P=.05)			0	0	0	0
CV			0	0	0	0

Application spray volume up to 80 gpa did not contribute to Kentucky bluegrass injury. This is important because many turf applications of pesticides are included in greater spray volume than typical agronomic applications.

Application volume with propoxycarbazone in bluegrass, Fargo location 2. Kirk Howatt, Ronald Roach, and Janet Harrington. The experiment was established in a lawn area of Kentucky bluegrass. Treatments were applied to Kentucky bluegrass, quackgrass, and smooth brome that was 5 to 6 inches tall on May 26 with 60°F, 61% RH, clear sky, wind velocity of 4 mph at 45°, and wet soil at 54°F. A backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT nozzle tips (treatments 1 through 3), 40 gpa at 55 psi through 8004 vs nozzle tips (treatments 3 through 5), and 80 gpa at 55 psi through 8008 vs nozzle tips (treatments 7 through 9) was used for treatment application 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.

			Bluegrass				Quackgrass			Smooth brome
Treatment[a]	Rate	Volume	6/12	6/28	7/17	8/3	6/12	6/28	7/17	7/17
	oz ai/A	gpa	% injury				% control			
Propoxycarbazone	0.25	8.5	0	0	0	0	85	80	81	50
Propoxycarbazone	0.5	8.5	0	0	0	0	85	82	81	52
Propoxycarbazone	1	8.5	0	0	0	0	85	86	84	66
Propoxycarbazone	0.25	40	0	0	0	0	85	77	76	55
Propoxycarbazone	0.5	40	0	0	0	0	85	82	81	55
Propoxycarbazone	1	40	0	0	0	0	85	87	84	57
Propoxycarbazone	0.25	80	0	0	0	0	79	75	75	57
Propoxycarbazone	0.5	80	0	0	0	0	85	82	79	57
Propoxycarbazone	1	80	0	0	0	0	85	84	81	65
Untreated	0		0	0	0	0	0	0	0	0
LSD (P=.05)			0	0	0	0	1	3	4	9
CV			0	0	0	0	1	3	4	14

[a] Propoxycarbazone was applied with a basic blend adjuvant at 1% vol/vol.

Application volumes up to 80 gpa did not result in propoxycarbazone injury to Kentucky bluegrass. Growth and seed head development of quackgrass and smooth brome was eliminated with all treatments of propoxycarbazone. In addition quackgrass plants showed decline in health even though quackgrass was not completely removed from the plant community. Propoxycarbazone control of quackgrass tended to be better in application volume of 8.5 and 40 compared with 80 gpa, but the greatest difference within propoxycarbazone rate was 6% on July 17. Quackgrass control tended to increase with increasing herbicide rate with a maximum difference of 6% between 0.25 and 1 oz/A at 80 gpa. Propoxycarbazone caused a static effect on smooth brome. Plants did not develop new leaves or seed heads following treatments of propoxycarbazone, and plants appeared to have a red or brown hue to the typical green color.

Bluegrass response to propoxycarbazone tank-mixes, Fargo location 1. Kirk Howatt, Ronald Roach, and Janet Harrington. The experiment was established on a lawn area of Kentucky bluegrass. Treatments were applied to 3-inch Kentucky bluegrass May 26 with 61°F, 55% RH, clear sky, wind velocity of 8 mph at 45°, and wet soil at 61°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT 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.

		Bluegrass			
Treatment	Rate	6/12	6/28	7/17	8/3
	oz ai/A	% injury			
Propoxycarbazone+Basic Blend	0.5+1%	0	0	0	0
Propoxycarbazone+2,4-D ester+Basic Blend	0.5+8+1%	0	0	0	0
Propoxycarbazone +2,4-D amine+Basic Blend	0.5+8+1%	0	0	0	0
Propoxycarbazone +2,4-D amine+Carf+Basic Blend	0.5+8+0.25+1%	0	0	0	0
Propoxycarbazone +2,4-D ester+MCPA+Dica+Basic Blend	0.5+4+4+1+1%	0	0	0	0
Propoxycarbazone +Clpy&Triclopyr+MCPP+Basic Blend	0.5+12+4+1%	0	0	0	0
Untreated		0	0	0	0
LSD (P=.05)		0	0	0	0
CV		0	0	0	0

The inclusion of herbicides for control of broadleaf weeds did not result in propoxycarbazone injury to Kentucky bluegrass. This is important because all treatments for weed control in turf are expected to include components to improve broadleaf weed control. This demonstrated safety is important for use specifications.

Bluegrass response to propoxycarbazone tank-mixes, Fargo location 2. Kirk Howatt, Ronald Roach, and Janet Harrington. The experiment was established on an area of Kentucky bluegrass. Treatments were applied to 3-inch Kentucky bluegrass May 26 with 59°F, 60% RH, 25% cloud cover, wind velocity less than 1 mph at 270°, and damp soil at 60°F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through 11001 TT nozzles to a 7-ft wide area the length of 10 by 30 ft plots. The experiment was a randomized, complete block design with three replicates.

Treatment	Rate	Bluegrass 6/12	6/28	7/17	8/3
	oz ai/A	% injury			
Propoxycarbazone+Basic Blend	0.5+1%	0	0	0	0
Propoxycarbazone+2,4-D ester+Basic Blend	0.5+8+1%	0	0	0	0
Propoxycarbazone+2,4-D amine+Basic Blend	0.5+8+1%	0	0	0	0
Prcz+2,4-D amine+Carf+Basic Blend	0.5+8+0.25+1%	0	0	0	0
Prcz+2,4-D ester+MCPA+Dica+Basic Blend	0.5+4+4+1+1%	0	0	0	0
Prcz+Clpy&Triclopyr+MCPP+Basic Blend	0.5+12+4+1%	0	0	0	0
Untreated	0	0	0	0	0
LSD (P=.05)		0	0	0	0
CV		0	0	0	0

The inclusion of herbicides for control of broadleaf weeds did not result in propoxycarbazone injury to Kentucky bluegrass. This is important because all treatments for weed control in turf are expected to include components to improve broadleaf weed control. This demonstrated safety is important for use specifications.

Yellow toadflax control with various herbicides and application timings. Jenks, Willoughby, and Mazurek. Herbicide treatments were applied to vegetative-stage yellow toadflax (12-18 inches tall) on July 6, 2005, late flowering toadflax on August 30, 2005 and in late fall on October 17, 2005. Individual plots were 10 x 30 ft and replicated three times. Yellow toadflax control and grass injury were rated June 27, 2006. The study was conducted just west of Burlington, ND in rangeland.

The objective of the study was to evaluate long-term yellow toadflax (Yetf) control with herbicides applied at the vegetative stage, flowering stage, and in the fall. Herbicides applied in the vegetative stage in July 2005 provided very poor yellow toadflax control. Of the herbicides applied in the late flowering stage in late August 2005, only treatments containing Tordon (2 pt/A) provided some control of yellow toadflax (45-49%). Tordon applied at 4 pt/A at the late flowering stage provided significantly better control (84%). In the fall application, again only Tordon at 2 pt/A provided any significant level of control (62-71%). Treatments containing Plateau or Ally + WeedMaster essentially showed no activity on yellow toadflax. Only Plateau applied in the fall showed significant injury to established perennial grasses.

Table. Yellow toadflax control with various herbicides and application timings.

Treatment	Rate	Timing	Grass Jun 27 2006	Yeft Jun 27 2006
			% injury	% control
Tordon + 2,4-D amine	2 pt + 1 qt	VEG	0	15
Plateau + MSO + 28% N	8 oz + 1 qt + 1 qt	VEG	0	0
Tordon + Plateau + 2,4-D amine + MSO	2 pt + 4 oz + 1 qt + 1 qt	VEG	0	17
Ally + Weedmaster + COC	0.5 oz + 2 pt + 1%	VEG	0	0
Tordon + 2,4-D amine	2 pt + 1 qt	FLWR	0	49
Plateau + MSO + 28% N	8 oz + 1 qt + 1 qt	FLWR	4	0
Tordon + Plateau + 2,4-D amine + MSO	2 pt + 4 oz + 1 qt + 1 qt	FLWR	0	45
Ally + Weedmaster + COC	0.5 oz + 2 pt + 1%	FLWR	0	0
Tordon	4 pt	FLWR	3	84
Tordon + 2,4-D amine	2 pt + 1 qt	FALL	0	62
Plateau + MSO + 28% N	8 oz + 1 qt + 1 qt	FALL	23	0
Tordon + Plateau + 2,4-D amine + MSO	2 pt + 4 oz + 1 qt + 1 qt	FALL	3	71
Ally + Weedmaster + COC	0.5 oz + 2 pt + 1%	FALL	0	0
Untreated Check			0	0
LSD (0.05)			3	15
CV			86	36