Herbicide-Tolerant and Conventional Canola Production Systems Comparison. Johnson, B., R. Zollinger, B. Hanson, B. Jenks, N. Riveland, E. Eriksmoen, and R. Henson. Evaluation of conventional and herbicide-tolerant (HT) canola performance was performed in a systems comparison study conducted at Prosper, Minot, Langdon, Williston, Carrington, and Hettinger, ND during the 2001 growing season. The study was abandoned at Hettinger midway through the growing season due to severe damage form a hailstorm. Cultivar type and corresponding herbicide compliment (Table 1) identified 16 canola production systems. Open-pollinated (OP), synthetic (SYN), and hybrid cultivars were selected from commercial conventional and HT cultivars. Herbicide compliment for conventional cultivars was PPI trifluralin alone and with post application of quizalofop and where necessary ethametsulfuron. Herbicide-tolerant cultivars were Roundup, Liberty, or Clearfield types. Replicated studies were solid seeded at 5 lb/A live seed in mid-May. Data collected included seed yield, seed weight, seed oil concentration, flowering date, weed species and intensity, plant lodging, and plant height. This report will focus on seed yield and crop value, and production costs associated with seed for planting and herbicides for weed control.

System costs reflect a nearly four-fold range from lowest, system 1, to highest system14 (Table 1). Contributing to system cost were seed and herbicide components. Hybrid seed cost was two to nearly three times greater than cost for OP cultivars with SYN seed cost intermediate. Conventional systems 2 and 4 herbicide costs were similar to the Clearfield systems 15 and 16, and single application Roundup systems 5, 7, 9, and 11. Herbicide costs were lowest for systems 1 and 3 where PPI trifluralin alone provided weed control and highest for the Liberty systems 13 and 14.

At Prosper conventional hybrid systems 3 and 4, and HT hybrid system 11 produced yields in the highest group (Table 2). These systems also ranked 1, 2, and 3 in net returns. The Liberty hybrid system 14 also produced yield in the high group but high seed/herbicide costs lowered system net return to the 11th ranking among the 16 systems. Roundup system 9 produced 220 lb/A less yield than hybrid Liberty system 14 but net return was just $4/A less for this system. These results indicate higher cost systems need to produce greater yield to produce net returns comparable or greater to lower yielding less costly systems.

At Minot the 10 systems comprising the high yield group included conventional hybrid, Roundup OP and hybrid, and hybrid Liberty systems. Net returns for single application Roundup systems 5, 7, and 11 ranked 2, 3, and 4, respectively, and differed by only $2. Similarly HT hybrid system 12 and conventional hybrid system 3 also differed by only $2/A in net return. At this site Roundup OP cultivars LG3295 (system 5) and Minot (system 7) were competitive with hybrids in yield production and net return. Conventional, Clearfield, and Liberty OP systems were in the low yield and net return group.

Yield ranking at the Langdon site showed conventional hybrid system 3 producing 23% greater yield than the third yield ranking of HT system 10. Yield from conventional hybrid system 4 was similar to system 3 and system 10. Systems 3 and 4 produced net returns of $271 and $186, respectively, and are considerably greater than the $159 net return from system 10. This illustrates the importance of yield in determining net return. Yield was greater with two than one application of glyphosate for SYN SW Rider systems. Net return ranking for these systems was 4th and 9th for system 10 ($159) and system 9 ($137), respectively, indicating the greater yield from system 10 more than offset the additional cost for the second glyphosate application. Hybrid 357 (systems 11 and 12) and OP Minot (systems 7 and 8) produced similar yield in one and two glyphosate application systems. Low yield and high seed/herbicide costs ranked OP Liberty system 13 the lowest for net return at $114/A.

System yield performance was the poorest at the Williston site due to delayed emergence caused by dry conditions that prevailed for three weeks after seeding. The four highest yielding systems were hybrid systems 3, 5, 11, and 12. Systems 3 and 5 were conventional hybrid Hyola 401, and systems 11 and 12 were HT Hyola 357. These systems showed the four highest net returns. Although yield was high for system 12 high seed and herbicide costs lowered net return to $66/A for this system. Systems 3, 4, and 11 net returns ranged from $76 to $80/A. Low yield and high seed/herbicide costs resulted in the Liberty systems ranking 12th and 13th for net return. Low yield for these systems may be cultivar related but there was only 85% (data not shown) control of green foxtail and Russian thistle indicating weed competition may also have reduced yield.

System yields showed conventional, Roundup, Liberty, and Clearfield systems in the high yield group at Carrington. Hybrid systems 4 and 11 produced the greatest yield and highest net returns, $191 and $194, respectively, among the 16 systems. Two application glyphosate systems generally produced lower net return than one-application systems except for cultivar SW Rider where similar net returns were observed. The newer Liberty (Invigor 2373) and Clearfield (46A76) cultivars exhibited improved yield performance over the older cultivars Phoenix and 45A71. The low seed/herbicide cost of system 1 and relatively good yield performance of this system produced a net return ranking of 5 ($183/A) among the 16 systems.

The frequency of treatments should be noted when making conclusions regarding yield and net return. In this study 8 treatments were Roundup, 2 Liberty, 2 Clearfield, and 4 Conventional. Hybrids have been reported to yield 10 to 15% more than OP cultivars. There were hybrid treatments associated with the conventional, Roundup, and Liberty systems but not the Clearfield systems. Hybrids produced the greatest yield at Prosper, Langdon, and Williston. At Minot and Carrington conventional and HT OP cultivars and hybrids produced high yields. Net returns generally followed yield with the exception of high cost seed/herbicide systems that required greater yield to compensate for greater input costs. When these systems produced average or low yields their net returns were substantially reduced. Conversely when low cost seed/herbicide systems produced above average yield net returns for these systems increased. Cultivar site adaptation and weed competition should be considered with seed/herbicide costs when selecting the best canola production system for an area.

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Table 1. Seed and herbicide costs associated with conventional and herbicide-tolerant canola production systems.

System	Cultivar †	Type ‡	Seed Cost/A §	Herbicide	Rate (ai/A)	Adjuvant	Herbicide Cost/A ¶	Total Cost/A
1	Hudson	OP	$ 7.45	Trifluralin	1.0 lb.		$ 6.25	$13.70
2	Hudson	OP	$ 7.45	Trifluralin Quizalofop	1.0 lb. 1.0 oz.		$16.15	$23.60
3	Hyola 401	HYB	$15.65	Trifluralin	1.0 lb.		$ 6.25	$21.90
4	Hyola 401	HYB	$15.65	Trifluralin Quizalofop	1.0 lb. 1.0 oz.		$16.15	$31.80
5	LG3295	OP	$10.00	Glyphosate	0.375 lb	AMS 13 lb / 100 gal	$15.75	$25.75
6	LG3295	OP	$10.00	Glyphosate Glyphosate	0.375 lb 0.375 lb	AMS 13 lb / 100 gal	$20.90	$30.90
7	Minot	OP	$11.10	Glyphosate	0.375 lb	AMS 13 lb / 100 gal	$15.75	$26.85
8	Minot	OP	$11.10	Glyphosate Glyphosate	0.375 lb 0.375 lb	AMS 13 lb / 100 gal	$20.90	$32.00
9	SW Rider	SYN	$14.20	Glyphosate	0.375 lb	AMS 13 lb / 100 gal	$15.75	$29.95
10	SW Rider	SYN	$14.20	Glyphosate Glyphosate	0.375 lb 0.375 lb	AMS 13 lb / 100 gal	$20.90	$35.10
11	Hyola 357	HYB	$20.35	Glyphosate	0.375 lb	AMS 13 lb / 100 gal	$15.75	$36.10
12	Hyola 357	HYB	$20.35	Glyphosate Glyphosate	0.375 lb 0.375 lb	AMS 13 lb / 100 gal	$20.90	$41.25
13	Phoenix	OB	$ 7.20	Glufosinate	0.44 lb	AMS 3 lb / A	$27.48	$34.68
14	Invigor 2373	HYB	$19.95	Glufosinate	0.44 lb	AMS 3 lb / A	$27.48	$47.43
15	45A71	OP	$11.00	Imazamox	0.5 oz	UAN 3pt / A	$16.28	$27.28
16	45A76	OP	$13.00	Imazamox	0.5 oz	UAN 3pt / A	$16.28	$29.28

† Hudson and Hyola 401 are conventional canola cultivars.
LG3295, Minot, SW Rider, and Hyola 357 are Roundup-resistant cultivars.
Phoenix and Invigor 2373 are Liberty-resistant cultivars.
45A71 and 46A76 are Clearfield-resistant cultivars.

‡ OP = Open-Pollinated; SYN = Synthetic; HYB = Hybrid

§ Seed cost is based on average retail prices for 2000 at a 5 lb/acre seeding rate. Seed was treated with fungicide but not insecticide.

¶ Herbicide cost is based on average retail prices for 2001. Roundup Ready systems include a $15/A technology fee that includes 1 pt of glyphosate/A.

Table 2. Convention and herbicide-tolerant canola production system comparisions for yield and net return from four North Dakota Research Extension Centers for the 2001 growing season.

System	Cultivar	Type	Herbicide	Prosper		Minot		Langdon		Williston		Carrinton	
				Yield	NR †	Yield	NR	Yield	NR	Yield	NR	Yield	NR
				lb/A	$/A	lb/A	$/A	lb/A	$/A	lb/A	$/A	lb/A	$/A
1	Hudson	OP	Trifluralin	1770	154	1890	165	1770	154	790	61	2080	183
2	Hudson	OP	Trifluralin Quizalofop	1840	150	1720	139	1740	141	910	62	2290	184‡
3	Hyola 401	HYB	Trifluralin	2220	188	2150	182	2520	217	1040	76	2190	185
4	Hyola 401	HYB	Trifluralin Quizalofop	2070	164	2230	179	2310	186	1150	77	2450	191‡
5	LG3295	OP	Glyphosate	1700	135	2260	188	¶		¶		1970	161
6	LG3295	OP	Glyphosate Glyphosate	1460	109	2160	174	¶		¶		1670	127
7	Minot	OP	Glyphosate	1960	159	2260	187	1630	127	770	46	2030	165
8	Minot	OP	Glyphosate Glyphosate	1700	129	¶		1720	131	810	45	1920	150
9	SW Rider	SYN	Glyphosate	1650	126	2390	196	1760	137	780	44	2050	164
10	SW Rider	SYN	Glyphosate Glyphosate	1570	114	2240	177	2050	159	780	39	2120	166
11	Hyola 357	HYB	Glyphosate	2060	159	2350	187	2030	156	1230	80	2430	194
12	Hyola 357	HYB	Glyphosate Glyphosate	1950	144	2390	185	2010	149	1130	66	2130	161
13	Phoenix	OB	Glufosinate	1830	138	1840	139	1570	114	750	36	2040	158
14	Invigor 2373	HYB	Glufosinate	1870	130	2160	158	1810	124	800	29	2330	174
15	45A71	OP	Imazamox	1660	130	940	62	¶		¶		1810	144
16	45A76	OP	Imazamox	1740	136	1790	141	2030	163	820	49	2210	180
LSD (0.05)				220		290		320		120		440	
C.V.%				8.0		9.9		14.0		9.4		14.7	

† NR = net return = $/A = (Yield @ $9.47/cwt) – (Total Cost from Table 1)
‡ Ethametsulfuron also applied (0.23 ai/A + NIS 0.25% v/v) at $9.20/A.
¶ System was not evaluated.

Glyphosate application strategies in glyphosate-resistant canola. Gregory J. Endres, Robert A. Henson, and Stephen A. Valenti. (Carrington Research Extension Center, North Dakota State University, Carrington, ND 58421 and Monsanto, Fargo, ND 58104) Weed control and canola response to selected glyphosate treatments were evaluated in a randomized complete block design with three replicates. The experiment was conducted on a loam soil with 7.2 pH and 2.9% organic matter at Carrington, ND in 2001. 'Hyola 357RR' canola was seeded on May 3 in 7-inch rows at the rate of 15 pure live seeds/ft^2 in a conventional tillage system. Guard plots were present between treated plots. Herbicide treatments were applied to 5 by 25 ft plots with a CO_2 pressurized hand-held plot sprayer at 14 gal/A and 30 psi through 8001 flat fan nozzles. Early postemergence (POST1) treatments were applied on May 25 with 63 F, 51% RH, 95% clear sky, and light wind to 2-leaf canola, 1- to 2-leaf yellow foxtail, 0.5-inch tall redroot and prostrate pigweed, 0.5-inch tall common lambsquarters, and 1-inch tall wild buckwheat. Mid postemergence (POST2) treatments were applied on June 1 with 49 F, 85% RH, 10% clear sky, and light wind to 4-leaf canola, 3- to 4-leaf yellow foxtail, 0.5- to 1-inch tall redroot and prostrate pigweed, 0.5- to 4-inch tall common lambsquarters, and 2-inch tall wild buckwheat. Late postemergence (POST3) treatments were applied on June 7 with 52 F, 100% RH, clear sky, and 7 mph wind to 5- to 6-leaf canola, 3- to 5-leaf yellow foxtail, 0.5- to 2-inch tall redroot and prostrate pigweed, 3- to 4-inch tall common lambsquarters, and 3-inch tall wild buckwheat. Average canola density was 6 plants/ft^2, yellow foxtail density was 3 plants/ft^2, pigweed density was 3 plants/ft^2, common lambsquarters density was 2 plants/ft^2, and wild buckwheat density was 1 plant/ft^2. The trial was swathed on August 7 and harvested on August 14 with a plot combine.

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

Herbicide			Weed control								Canola
			30 days after treatment				8/2				seed
Treatment[a]	Rate	Timing[b]	SETLU	AMASS[c]	CHEAL	POLCO	SETLU	AMASS	CHEAL	POLCO	yield
	lb/A[d]		%								lb/A
Glyphosate	0.38	POST2	94	98	94	91	80	98	87	78	2048
Glyphosate	0.56	POST2	95	99	97	91	79	95	87	70	2103
Glyphosate	1.12	POST2	95	98	98	91	85	95	93	79	1961
Glyphosate+clopyralid	0.38+0.089	POST2	96	98	98	99	90	98	88	91	2234
Clopyralid+ quizalofop+MSO	0.094+ 0.07+1% v/v	POST3	93	76	58	75	79	69	70	79	1763
Glyphosate	0.38	POST3	87	80	86	84	92	73	79	67	2302
Glyphosate	0.56	POST3	96	86	98	86	94	78	91	70	2230
Glyphosate	1.12	POST3	91	90	99	79	85	83	99	60	2194
Glyphosate/glyphosate	0.38/0.38	POST1/3	93	98	99	94	87	94	99	82	2122
untreated			0	0	0	0	0	0	0	0	2293
LSD (0.05)			7	11	14	22	15	9	14	20	NS

[a]Glyphosate=Roundup UltraMax except fourth glyphosate treatment=Glyphomax Plus. Glyphosate treatments include AMS at 2% w/w. MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN.
[b]POST1=May 25; POST2=June 1; POST3=June 7.
[c]AMASS=Redroot and prostrate pigweed.
[d]Glyphosate rates=acid equivalent.

Glyphosate at 0.38 lb/A generally provided similar yellow foxtail, pigweed, common lambsquarters, and wild buckwheat control as glyphosate at 0.56 or 1.12 lb/A (Table). Glyphosate at 0.38 lb/A applied at the 4-leaf stage of canola provided 91 to 99% control of all weed species when evaluated 30 days after treatment application. Glyphosate at 0.38 lb/A applied at the 4-leaf stage or sequential application generally provided greater control of pigweed compared to all glyphosate rates applied at the 5- to 6-leaf stage of canola. Glyphosate+clopyralid provided 88 to 98% control of all weed species at crop maturity (late evaluation date). Wild buckwheat control was 60 to 82% with all glyphosate treatments at crop maturity. Very low crop chlorosis ($\leq$ 4%) was observed 3 days after treatment application and no growth reduction was observed on August 2 (data not shown). Canola seed yield was similar among treatments, likely due to low weed densities.

Timing of weed control in Roundup Ready canola. Jenks, Willoughby, and Markle. Limagrain 3455 was seeded May 3 into 6-inch rows at 700,000 pls/A in a conventional tillage system. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preplant incorporated (PPI) on May 2, or postemergence on May 25 (0-2 lf), June 2 (3-4 lf), or June 8 (5-6 lf). PPI treatments were applied with XR80015 flat fan nozzles at 20 gpa and 30 psi. POST treatments were applied with XR8001 flat fan nozzles at 10 gpa and 40 psi. The primary weeds were green foxtail (Grft) and wild oat (Wioa).

			Jun 26			Aug 13	
Treatment[a]	Rate	Timing	Injury	Grft	Wioa	Yield	Test wt.
			— % —	— % control —		lb/A	lb/bu
Treflan	1.5 pt	PPI	0			2075	51.3
Treflan / Assure II	1.5 pt / 8 fl oz	PPI / 3-4 lf	0	99	100	2277	51.3
Sonalan	2 pt	PPI	0			2279	51.3
Sonalan / Assure II	2 pt / 8 fl oz	PPI / 3-4 lf	0	99	100	2341	51.3
Treflan / Roundup	1.5 pt / 1 pt	PPI / 3-4 lf	0	99	99	2211	51.5
Sonalan / Roundup	2 pt / 1 pt	PPI / 3-4 lf	0	99	99	2227	51.6
Roundup	1 pt	0-2 lf	0	94	94	2383	51.4
Roundup	1 pt	3-4 lf	0	95	96	2351	51.4
Roundup	1 pt	5-6 lf	0	98	98	2174	51.3
Roundup / Roundup	0.5 pt / 0.5 pt	0-2 lf / 5-6 lf	0	98	98	2268	51.4
Roundup / Roundup	1 pt / 1 pt	0-2 lf / 5-6 lf	0	99	99	2299	51.5
Weedy check			0	0	0	1993	51.0
LSD			--	1	1	NS	NS
CV			0	1	1	6	0.4

[a]*All Roundup treatments were applied with 1% AMS; all Assure II treatments applied with 1% COC*

The study area had a very low population of wild oat and a moderate population of green foxtail. All Roundup treatments provided good to excellent control of green foxtail and wild oat at any rate or timing. Treflan and Sonalan were not rated due to inconsistent incorporation. None of the treatments caused visible crop injury. The treatments increased canola yield 200-400 lb/A over the untreated check. The canola crop was very competitive with the weeds, thus allowing even the reduced herbicide rates to be effective. The labeled use rate of Roundup 1-1.5 pt/A for a single application. Higher weed densities and non-ideal spraying conditions may result in unacceptable weed control from reduced herbicide rates.

Timing of weed control in Liberty Link canola. Jenks, Willoughby, and Markle. Invigor 2663 canola was seeded May 4 into 6-inch rows at 600,000 pls/A in a conventional tillage system. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preplant incorporated (PPI) on May 2, or postemergence on May 25 (0-2 lf), June 2 (3-4 lf), or June 8 (5-6 lf). PPI treatments were applied with XR80015 flat fan nozzles at 20 gpa and 30 psi. POST treatments were applied with XR8001 flat fan nozzles at 10 gpa and 40 psi. The primary weeds were green foxtail (Grft), wild buckwheat (Wibw), common lambsquarters (Colq), and kochia (Kocz).

				Jun 23				Aug 13	
Treatment[a]	Rate	Timing	Injury	Grft	Wibw	Colq	Kocz	Yield	Test wt.
			%	——— % control ———				lb/A	lb/bu
Treflan	1.5 pt	PPI	0					2089	51.8
Treflan / Assure II	1.5 pt / 8 fl oz	PPI / 3-4 lf	0	98				1942	52.1
Sonalan	2 pt	PPI	0					1984	51.8
Sonalan / Assure II	2 pt / 8 fl oz	PPI / 3-4 lf	0	97				1768	51.6
Treflan / Liberty	1.5 pt / 20 fl oz	PPI / 3-4 lf	0	96	97	100	100	2341	52.1
Sonalan / Liberty	2 pt / 20 fl oz	PPI / 3-4 lf	0	97	98	100	98	2187	52.2
Liberty	27 fl oz	0-2 lf	0	82	89	93	90	2100	51.7
Liberty	27 fl oz	3-4 lf	0	87	95	100	100	2181	52.0
Liberty	27 fl oz	5-6 lf	0	95	95	97	96	2182	51.9
Liberty	34 fl oz	0-2 lf	0	84	93	100	100	2260	51.6
Liberty	34 fl oz	3-4 lf	0	88	95	100	100	2218	51.6
Liberty	34 fl oz	5-6 lf	0	94	94	100	100	2229	52.0
Liberty / Liberty	17 fl oz / 17 fl oz	0-2 lf / 5-6 lf	0	97	100	100	100	2368	51.6
Liberty / Liberty	10 fl oz / 10 fl oz	0-2 lf / 5-6 lf	0	91	90	87	93	2402	51.7
Liberty + Assure II	20 fl oz + 5 fl oz	3-4 lf	0	92	86	93	97	2157	52.0
Weedy check			0	0	0	0	0	1860	52.3
LSD			--	7	6	9	5	NS	NS
CV			0	5	4	6	3	11	1.0

[a] *All Liberty treatments applied with 3 lb/A AMS; all Assure II treatments applied with 1% COC*

The study area had a low population of kochia, common lambsquarters, and wild buckwheat; and a moderate population of green foxtail. All Liberty treatments provided good to excellent control of green foxtail, wild buckwheat, common lambsquarters, and kochia at any rate or timing. Treflan and Sonalan were not rated due to inconsistent incorporation. None of the treatments caused visible crop injury. The treatments increased canola yield 250-550 lb/A over the untreated check. The canola crop was very competitive with the weeds, thus allowing even the reduced herbicide rates to be effective. The labeled use rate of Liberty is 28-34 fl oz/A. Higher weed densities and non-ideal spraying conditions may result in unacceptable weed control from reduced herbicide rates.

Timing of weed control in Clearfield Canola. Jenks, Willoughby, and Markle. Clearfield canola (46A76) was seeded May 4 into 6-inch rows at 700,000 pls/A in a conventional tillage system. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preplant incorporated (PPI) on May 2, or postemergence on May 25 (0-2 lf), June 2 (3-4 lf), or June 8 (5-6 lf). PPI treatments were applied with XR80015 flat fan nozzles at 20 gpa and 30 psi. POST treatments were applied with XR8001 flat fan nozzles at 10 gpa and 40 psi. The primary weeds were green foxtail (Grft) and wild oat (Wioa).

			Jun 26			Aug 14	
Treatment[a]	Rate	Timing	Injury	Grft	Wioa	Yield	Test wt.
			— % —	— % control —		lb/A	lb/bu
Treflan	1.5 pt	PPI	0			2429	50.5
Treflan / Assure II	1.5 pt / 8 fl oz	PPI / 3-4 lf	0	98	97	2173	50.5
Sonalan	2 pt	PPI	0			2281	50.6
Sonalan / Assure II	2 pt / 8 fl oz	PPI / 3-4 lf	0	98	98	2474	50.9
Treflan / Raptor	1.5 pt / 2 fl oz	PPI / 3-4 lf	0	96	93	2339	50.9
Sonalan / Raptor	2 pt / 2 fl oz	PPI / 3-4 lf	0	97	96	2373	50.9
Raptor	2 fl oz	0-2 lf	0	92	90	2425	50.8
Raptor	2 fl oz	3-4 lf	0	92	90	2428	50.7
Raptor	2 fl oz	5-6 lf	0	89	85	2340	50.4
Raptor	4 fl oz	0-2 lf	0	95	94	2366	50.7
Raptor	4 fl oz	3-4 lf	0	95	95	2247	50.8
Raptor	4 fl oz	5-6 lf	0	94	92	2149	50.6
Raptor / Raptor	2 fl oz / 2 fl oz	0-2 lf / 5-6 lf	0	98	98	2392	51.1
Raptor / Raptor	1 fl oz / 1 fl oz	0-2 lf / 5-6 lf	0	96	96	2472	51.0
Weedy check			0	0	0	1856	50.1
LSD			--	4	5	318	NS
CV			0	2	3	8	1.0

[a]*All Raptor treatments were applied with 0.25% NIS and 1 qt 28% UAN.*

The study area had a very low population of wild oat and a moderate population of green foxtail. All postemergence treatments provided good to excellent control of green foxtail and wild oat at any rate or timing. Treflan and Sonalan were not rated due to inconsistent incorporation. None of the treatments caused visible crop injury. The treatments increased canola yield 200-600 lb/A over the untreated check. The canola crop was very competitive with the weeds, thus allowing even the reduced herbicide rates to be effective. The labeled use rate of Raptor is 4 fl oz/A. Higher weed densities and non-ideal spraying conditions may result in unacceptable weed control from reduced herbicide rates.

Weed control with SUs in Clearfield Canola. Jenks, Willoughby, and Markle. Clearfield canola (46A76) was seeded May 4 into 6-inch rows at 700,000 pls/A in a conventional tillage system. Individual plots were 10 x 30 ft and replicated three times. Postemergence (POST) treatments were applied June 2 at the 3 to 4-leaf canola stage with XR8001 flat fan nozzles at 10 gpa and 40 psi. The primary weeds were green foxtail (Grft) and wild oat (Wioa).

		Wioa	Grft		Clearfield Canola			
Treatment	Rate	Jun 26	Jun 26	Aug 13	Jun 26	Aug 13	Yield	Test wt.
		% control			% injury		lb/A	lb/bu
Harmony GT + Assure II + COC	0.4 oz + 10 fl oz + 1 pt	97	97	82	70	35	1237	51.8
Harmony Extra + Assure II + COC	0.4 oz + 10 fl oz + 1 pt	94	99	82	75	42	1319	51.9
Muster + Assure II + COC	0.4 oz + 10 fl oz + 1 pt	96	98	98	0	0	1985	51.2
Raptor + NIS	4 fl oz + 0.25 %	93	97	95	0	0	2034	51.3
Untreated		0	0	0	0	0	1886	50.5
LSD		5	4	5	1	5	221	0.8
CV		4	3	3	1	17	7	1

Assure II and Raptor provided excellent wild oat control and good green foxtail control. Muster and Raptor caused no visible crop injury. Harmony GT and Harmony Extra severely stunted the crop and reduced yields by 600-800 lb/A compared to the Muster and Raptor treatments. This is in contrast to 1999 where we saw little or no injury from Harmony GT applied to the Clearfield Canola variety '45A71'. Note that the variety used in 2001 was '46A76'.

Select in Canola. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate canola response to herbicides applied POST and LPOST. Hyola '401' canola was planted May 30, 2001. POST treatments were applied June 26 at 12:30 pm with 80 F air, 93 F soil surface, 46 % relative humidity, 10% clouds, 5 mph NE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V-4 canola. Weed species present were: 1-3 inch (1-3/yd^2) foxtail; 3-5 inch tillering (1-2/yd^2) volunteer wheat. LPOST treatments were applied July 3 at 7:00 pm with 79 F air, 101 F soil surface, 54% relative humidity, 10% clouds, 7 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to bud/prebolt canola. Treatments were applied to the center 6.67 feet of the 10 by 20 foot plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles. The experiment had a randomized complete block design with four replicates per treatment. All treatments were visually evaluated. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Select in Canola (Zollinger and Ries).

		July 10	July 17		July 31			Canola
Treatment[1]	Rate	Stunting	Stunting	Delay bolting	Pod abortion[2]	Heat blast[3]	Pod twist[4]	Yield
	(fl oz/A)	--% --	--% --	--days --	--% --	--% --	– % --	--lb/A –
POST								
Select+PO	4	0	0	0	0	0	0	1314
Select+PO	6	0	0	0	0	0	0	1374
LPOST								
Select+PO	4	0	0	0	10	0	0	966
Select+PO	6	0	0	0	25	7	0	895
Assure II+PO	8	10	10	4	60	50	50	756
Untreated		0	0	0	0	0	0	1500

[1]PO = petroleum oil concentrate = Herbimax at 1% v/v.
[2]Pod abortion = lack of fertilization.
[2]Heat blast = development of nearly full-sized pods but with lack of seed formation.
[3]Pod twist = unusual twisting/curving of pods.

Select label does not allow more than 5 fl oz/A and restricts application to prior to bolting. Canola was planted late due to rains. Late planting, high rate and late application may partially explain observed injury and yield loss of Select and Assure II applied LPOST. Substantial injury and yield loss from Assure II was unexpected. Long periods of high heat and humidity were present at time of applications, possibly increasing pod abortion and heat blast. Assure II label allows application until 30 days or more prior to harvest. No distinct explanation can be given.

Volunteer RUR wheat control in RUR canola-Prosper. Oltmans and Zollinger. An experiment was conducted near Prosper, ND to evaluate volunteer Roundup Ready wheat control from POST applied herbicides. 'RideR' canola was planted May 18, 2001. 'Oxen' Roundup Ready wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 29, 2001. EPOST treatments were applied June 8, 2001 at 5:45 to 6:00 pm with 83 F air, 70 F soil at a 2 to 4 inch soil depth, 30% relative humidity, 45% clouds, 5 to 8 mph SW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to cotyledon to 2 leaf canola. Weed species present were: 1 to 3 inch, (20-30 plants/ft^2) foxtail; 1 to 2 inch, (20-30 plants/ft^2) redroot pigweed; 1 to 4 inch, (5-10 plants/ft^2) common lambsquarters; and 3 to 5 inch volunteer wheat. MPOST treatments were applied June 18, 2001 at 9:00 to 9:30 am with 66 F air, 62 F soil at a 2 to 4 inch soil depth, 75% relative humidity, 100% clouds, 4 to 6 mph NE wind, moist soil surface, moist subsoil, good crop vigor, and dew present to 3 to 4 leaf canola. Weed species present were: 1 to 4 inch, (20-30 plants/ft^2) foxtail; 2 to 4 inch, (20-30 plants/ft^2) redroot pigweed; 2 to 4 inch, (5-10 plants/ft^2) common lambsquarters; and 4 to 6 inch volunteer wheat. POST treatments were applied June 20, 2001 at 12:45 to 1:00 pm with 69 F air, 66 F soil at a 2 to 4 inch soil depth, 52% relative humidity, 100% clouds, 2 to 4 mph SW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 5 to 6 leaf canola. Weed species present were: 1 to 2 inch, (10-15 plants/ft^2) foxtail; 1 to 2 inch, (1-5 plants/ft^2) common lambsquarters; and 5 to 6 inch volunteer wheat. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer equipped with a wind shield. The experiment had a randomized complete block design with four replicates per treatment.

Treatment[a]	Rate[b]	Growth Stage	14 DAA				28 DAA			
			Fxtl[c]	Vwht	Rrpw	Colq	Fxtl	Vwht	Rrpw	Colq
	(product/Acre)	(leaf)	% control							
RUM+AMS+Assure II	13floz+8floz	3-4	99	83	99	99	98	98	99	99
RUM+AMS+Assure II	13floz+6floz	3-4	99	86	99	99	96	97	99	99
RUM+AMS+Assure II	13floz+4floz	3-4	99	75	99	99	94	93	96	94
RUM+AMS+Select	13floz+6floz	3-4	97	71	97	97	94	90	97	95
RUM+AMS+Select	13floz+4floz	3-4	98	64	98	98	93	70	98	96
RUM+AMS+Assure II/ RUM+AMS+Assure II	13floz+3floz/ 13floz+3floz	cot-2/ 5-6	99	97	99	99	97	97	99	99
RUM+AMS+Assure II/ RUM+AMS+Assure II	13floz+2floz/ 13floz+2floz	cot-2/ 5-6	99	98	99	99	95	99	99	99
RUM+AMS+Assure II/ RUM+AMS	13floz+6floz/ 13floz	cot-2/ 5-6	99	99	99	99	96	99	99	99
Stinger+Assure II+PO	0.33pt+8floz+1%v/v	3-4	45	91	48	45	58	98	66	63
Untreated			0	0	0	0	0	0	0	0
LSD (0.05)			5	8	5	5	5	6	5	4

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

At 14 days after application (DAA), all treatments had greater than 97% foxtail, redroot pigweed, and common lambsquarters control, except Stinger+Assure II+PO. Volunteer wheat control ranged from 64 to 99%. Roundup UltraMax split-applied provided the greatest volunteer wheat control. At 28 DAA, all treatments had greater than 93% foxtail, redroot pigweed, and common lambsquarters control, except Stinger+Assure II+PO. Volunteer wheat control ranged from 70 to 99%. All treatments had greater than 90% volunteer wheat control, except Roundup UltraMax+4floz Select. Split-applied and single applications of Roundup UltraMax with Assure II were the most effective treatments, having greater than 93% weed control.

Volunteer RUR wheat control in RUR canola-Carrington. Oltmans and Zollinger. An experiment was conducted near Carrington, ND to evaluate volunteer Roundup Ready wheat control from POST applied herbicides. 'RideR' canola was planted May 30, 2001. 'Oxen' Roundup Ready wheat was planted at 55 lb/Acre, in 4 rows across each replicate May 30, 2001. EPOST treatments were applied June 22, 2001 at 12:00 to 12:15 pm with 76 F air, 65 F soil at a 2 to 4 inch soil depth, 41% relative humidity, 30% clouds, 4 to 8 mph S wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to cotyledon to 2 leaf canola. Weed species present were: 1 to 6 inch, (5-10 plants/ft^2) foxtail; 1 to 6 inch, (1-5 plants/ft^2) redroot pigweed; 1 to 6 inch, (1-5 plants/ft^2) common lambsquarters; 1 to 6 inch, (1-5 plants/m^2) wild buckwheat; 2 to 12 inch, (1-5 plants/m^2) wild mustard; and 4 to 6 inch volunteer wheat. MPOST treatments were applied June 29, 2001 at 11:15 to 11:45 am with 72 F air, 64 F soil at a 2 to 4 inch depth, 77% relative humidity, 100% clouds, 2 to 4 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 3 to 4 leaf canola. Weed species present were: 1 to 8 inch, (15-30 plants/ft^2) foxtail; 1 to 8 inch, (5-10 plants/ft^2) redroot pigweed; 1 to 9 inch, (5-10 plants/ft^2) common lambsquarters; 1 to 7 inch, (5-10 plants/m^2) wild buckwheat; 2 to 14 inch, (5-10 plants/m^2) wild mustard; and 6 to 8 inch volunteer wheat. POST treatments were applied July 2, 2001 at 3:15 to 3:30 pm with 84 F air, 66 F soil at a 2 to 4 inch depth, 41% relative humidity, 4% clouds, 4 to 8 mph S wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to 5 to 6 leaf canola. Weed species present were: 1 to 2 inch, (5-10 plants/ft^2) foxtail; 1 to 3 inch, (1-5 plants/m^2) wild buckwheat; and 8 to 10 inch volunteer wheat. Treatments were applied to the center 6.67 feet of the 10 by 40 ft plots. Treatments were applied delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles using a bicycle-wheel-type plot sprayer equipped with a wind shield. The experiment had a randomized complete block design with four replicates per treatment.

At 14 days after application (DAA), all treatments had greater than 95% foxtail, wild mustard, redroot pigweed, common lambsquarters, and wild buckwheat control, except Stinger+Assure II+PO. Volunteer wheat control ranged from 49 to 96%. Split-applied treatments had greater than 96% volunteer wheat control, the remaining had less than 55% control. At 28 DAA, all treatments had 99% foxtail, wild mustard, redroot pigweed, common lambsquarters, and wild buckwheat control, except Stinger+Assure II+PO. Volunteer wheat control ranged from 78 to 99%. All treatments had greater than 98% volunteer wheat control, except Roundup UltraMax+Select treatments. Split-applied and single applications of Roundup UltraMax with Assure II were the most effective treatments, having greater than 98% weed control.

Treatment[a]	Rate[b] (product/Acre)	Growth Stage (leaf)	14 DAA						28 DAA					
			Fxtl[c]	Wimu	Vwht	Rrpw	Colq	Wibw	Fxtl	Wimu	Vwht	Rrpw	Colq	Wibw
			% control											
RUM+AMS+Assure II	13floz+8floz	3-4	99	98	53	99	99	99	99	99	99	99	99	98
RUM+AMS+Assure II	13floz+6floz	3-4	99	99	53	99	99	99	99	99	99	99	99	99
RUM+AMS+Assure II	13floz+4floz	3-4	99	99	54	99	99	99	99	99	99	99	99	99
RUM+AMS+Select	13floz+6floz	3-4	99	99	54	99	99	99	99	99	87	99	99	99
RUM+AMS+Select	13floz+4floz	3-4	99	99	49	99	99	99	99	99	78	99	99	99
RUM+AMS+Assure II/ RUM+AMS+Assure II	13floz+3floz/ 13floz+3floz	cot-2/ 5-6	98	98	96	99	98	95	99	99	99	99	99	99
RUM+AMS+Assure II/ RUM+AMS+Assure II	13floz+2floz/ 13floz+2floz	cot-2/ 5-6	98	99	96	99	98	95	99	99	99	99	99	99
RUM+AMS+Assure II/ RUM+AMS	13floz+6floz/ 13floz	cot-2/ 5-6	97	97	96	99	98	97	99	99	98	99	99	99
Stinger+Assure II+PO	0.33pt+8floz+1%v/v	3-4	85	53	55	60	60	53	69	70	99	59	58	56
Untreated			0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)			2	3	3	1	1	3	5	2	3	1	2	4

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

Weed control in chickpea, Prosper. (Kegode, Ciernia, and Fronning). Several herbicides and application timings were investigated for weed control in chickpea. Chickpeas were seeded with a conventional grain drill into plots 11 ft. wide by 30 ft. long. All treatments were applied with a 4-nozzle bicycle wheel plot sprayer delivering 17 gpa at 40 psi through XR8002 tips. PPI treatments were applied May 25 with the sprayer shielded and air temperature 70 F, RH 30%, wind N at 14 mph, cloudy sky, and the soil surface was dry. Treatments were incorporated twice with a field cultivator. PRE treatments were applied May 29 with air temperature 69 F, RH 42%, wind SE at 7 mph, sky overcast, and soil surface was dry. EPOST treatments were applied June 22 with air temperature 70 F, RH 50%, wind SW at 3 mph, sky clear, and the leaf surfaces were dry. At that time chickpeas were 4 inches tall, redroot pigweed 1-3 inch and 4-6 leaf, and common lambsquarters 1-2 inch and 4-6 leaf. MPOST treatments were applied June 26 with air temperature 77 F, RH 47%, wind NE at 5 mph, clear sky, and dry plant surfaces. The crop was 6 inches tall, redroot pigweed 1-3 inch and 2-6 leaf, common lambsquarters 1-3 inch and 2-6 leaf, foxtail 6 inch and 5-6 leaf, and kochia 0.5-1.5 inch. LPOST treatments were applied July 9 to 16 inch chickpea, 16 inch kochia, 7-14 inch redroot pigweed, 4-8 inch common lambsquarters, 14-20 inch wild mustard, and 12 inch foxtail. At application air temperature was 83 F, RH 61%, wind N at 6 mph, sky sunny, and plant leaf surfaces dry. Weed control evaluations were made visually. The experiment was a randomized complete block design with 4 reps and was not harvested.

			July 10				July 25			
Treatment	Timing	Rate	Stand	Fxtl	Rrpw	Colq	Fxtl	Rrpw	Colq	Kocz
		oz ai/A	%	% control						
Ethalfluralin	PPI	12	84	94	98	96	81	91	98	97
Sulfentrazone	PRE	4	86	67	96	99	43	91	98	97
Isoxoflutole	PRE	1.5	82	71	97	99	87	96	100	95
Dimethenamid	PRE	24	89	98	59	60	99	40	10	50
Metribuzin	PRE	6	81	94	69	79	75	65	74	83
Ethalfluralin/Pyridate	PRE/MPOST	12/15	84	97	99	99	96	99	100	100
Pyridate	EPOST	15	75	79	99	99	20	99	100	99
Pyridate	MPOST	15	71	61	98	99	6	99	99	99
Pyridate	LPOST	15	68	50	59	86	34	86	99	100
Pyridate/Pyridate	EPOST /LPOST	15/15	73	80	99	99	36	100	100	98
Trifluralin	PPI	12	90	93	97	98	90	95	97	96
Untreated		0	56							
LSD (0.05)			NS	NS	19	19	32	18	22	NS

Chickpea stands were poor mainly as a result of excessive rainfall and partial flooding of plots. Actual kochia emergence was low at the July 10 evaluation and therefore was not evaluated on this date. Control of kochia with dimethenamid and metribuzin was lower, though not significant, then with other treatments. Isoxoflutole (PRE) and trifluralin (PPI) each provided excellent control of all grass and broadleaf weeds. Sulfentrazone (PRE) and ethalfluralin (PPI) provided excellent control of broadleaf weeds but were weaker on grass control. Ethalfluralin (PPI) fb pyridate (MPOST) provided excellent grass and broadleaf weed control. All pyridate treatments provided excellent broadleaf weed control but were weak on grass control.

Weed control in chickpea, Fargo. (Kegode, Ciernia, and Fronning). Several herbicides and application timings were investigated for weed control in chickpea. Chickpeas were seeded May 30 with a conventional grain drill into plots 11 ft. wide by 30 ft. long. All treatments were applied with a 4-nozzle bicycle wheel plot sprayer delivering 17 gpa at 40 psi through XR8002 tips. PPI treatments were applied May 30 with air temperature 69 F, RH 40%, wind SE at 6 mph, sky mostly cloudy, and the soil surface dry. Treatments were incorporated twice with a field cultivator. PRE treatments were also applied May 30 with air temperature 71 F, RH 32%, wind SE at 2 mph, sky overcast, and soil surface moist. EPOST treatments were applied June 26 with air temperature 77 F, RH 53%, wind N at 7 mph, sky clear, and the soil surface dry. At that time chickpeas were 6 inches tall and biennial wormwood was cotyledon to 0.5 inch. MPOST and LPOST treatments were applied July 9 with air temperature 78 F, RH 60%, wind NW at 7 mph, clear sky, and dry soil surface. At application chickpeas were 14 inches tall, biww 0.5 to 4 inch, redroot pigweed 4-10 leaf and 2-7 inch., and wild mustard 12 inch and flowering . Weed control evaluations were made visually and a 4 by 27 foot swath of each plot was harvested for yield on Oct. 19. The experiment was a randomized complete block design with 4 reps.

				July 10				July 25				
Treatment	Timing	Rate	Stand	Wimu	Rrpw	Kocz	Biww	Wimu	Rrpw	Kocz	Biww	Yield
		oz ai/A	%	% control								lb/A
Ethalfluralin	PPI	12	56	55	99	99	47	49	91	95	25	1488
Sulfentrazone	PRE	4	51	99	99	99	100	93	100	100	92	1775
Isoxoflutole	PRE	1.5	58	99	99	99	100	100	99	100	99	1684
Dimethenamid	PRE	24	49	99	99	99	98	78	86	100	98	1639
Metribuzin	PRE	6	31	99	99	99	99	99	98	100	100	1458
Ethalfluralin/	PRE/	12/										
Pyridate	MPOST	15	64	99	99	100	98	99	96	100	98	1600
Pyridate	EPOST	15	69	84	72	99	100	73	70	99	100	1520
Pyridate	MPOST	15	69	98	99	99	100	81	96	97	89	1288
Pyridate	LPOST	15	58	19	28	87	28	71	85	96	89	1434
Pyridate/	EPOST /											
Pyridate	LPOST	15/15	69	99	99	99	100	98	98	100	98	1688
Trifluralin	PPI	12	69	30	99	98	-	29	85	95	-	1464
Untreated		0	61	-	-	-	-	-	-	-	-	901
LSD (0.05)			NS	18	20	NS	27	29	15	3	27	247

Chickpea stands were poor mainly as a result of excessive rainfall and partial flooding of plots. Consequently, chickpea yields were relatively low and highly variable. Control of kochia was excellent with all treatments at both evaluations. Preemergence metribuzin, isoxoflutole and sulfentrazone provided excellent control of all weeds present. Ethalfluralin (PRE) fb pyridate (MPOST) and the split-applied pyridate treatments provided excellent postemergence control of all weeds present.

PPI weed control in dry edible bean. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate weed control in dry edible bean using herbicides applied PPI and POST. PPI treatments were applied and incorporated with a rototiller operating at a 2 inch depth on June 26, 2001 at 9:00 am, followed by planting two rows of 'Navigator' navy and 'Winchester pinto' in each plot. Weather conditions at PPI incorporations were 78 F air, 77 F soil at a depth of 4 inches, 47% relative humidity, 10% clouds, 5 mph NE wind, dry soil surface, and moist subsoil. POST treatments were applied July 12, 2001 at 10:00 am with 75 F air, 79 F soil surface, 50% relative humidity, 0% clouds, 5 mph NE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V-2 to V-3 dry bean. Weed species present were: 2 to 6 inch (1-5/yd^2) foxtail; 1 to 4 inch (1-2/yd^2) redroot pigweed; 1 to 4 inch (1-2/yd^2) common lambsquarters; and 1 to 3 inch (1-3/yd^2) common ragweed. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PPI treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. PPI weed control in dry edible bean (Zollinger and Ries).

		July 10			July 26			August 9			September 6		
Treament [1]	Rate	Fxtl	Rrpw	Colq	Fxtl	Rrpw	Colq	Fxtl	Rrpw	Colq	Fxtl	Rrpw	Colq
	(product/A)	% control						% control					
PPI													
Valor	2oz	84	89	91	82	80	87	83	99	96	83	99	99
Valor	3oz	86	99	99	86	88	83	89	95	89	89	99	89
Valor+Treflan	2oz+1.5pt	91	99	98	98	99	86	99	99	89	99	99	93
Valor+Treflan	3oz+1.5pt	96	99	99	97	98	98	99	99	99	99	99	99
Valor+Dual II Magnum	2oz+1.5pt	98	99	99	98	99	85	99	99	89	99	99	83
Valor+Dual II Magnum	3oz+1.5pt	94	99	96	96	99	99	99	99	99	99	99	99
Spartan	3oz	78	99	93	93	88	75	99	93	83	99	99	83
Spartan	4oz	76	99	86	96	99	88	99	99	89	99	99	89
Spartan+Treflan	3oz+1.5pt	95	99	99	86	86	89	96	89	89	99	93	89
Spartan+Treflan	4oz+1.5pt	90	99	98	89	88	83	93	93	93	99	93	99
Prowl+Pursuit Plus	2.25pt+20fl oz	99	99	98	96	98	99	99	99	99	99	99	99
Prowl+Pursuit Plus	1.6pt+30 fl oz	99	99	99	95	99	99	99	99	99	99	99	99
PPI/POST													
Prowl/Pursuit+Rezult+Quad 7	3.5pt/0.72oz+1.6pt+1.6pt	90	99	99	98	99	99	99	99	99	99	99	99
Prowl/Raptor+Rezult+Quad 7	3.5pt/2fl oz+1.6pt+1.6pt	99	99	99	98	99	99	99	99	99	99	99	99
Prowl/Pursuit+NIS	3pt/0.72oz	98	99	98	98	99	88	99	99	93	99	99	96
Prowl/Raptor+NIS	3pt/3fl oz	91	99	99	96	99	99	99	99	99	99	99	99
Prowl/Rezult	3.5pt/1.6pt+1.6pt	93	94	93	99	99	99	99	99	99	99	99	99
LSD (0.05)		7	4	6	6	9	6	7	9	8	7	6	10

[1]Quad 7 = basic blend adjuvant applied at 1% v/v; NIS = nonionic surfactant = Activator 90 was applied at 0.25% v/v.

No crop injury occurred. All treatments controlled wild mustard. Weed pressure was light but most treatments provided good to excellent season-long grass and broadleaf weed control.

PRE weed control in dry edible bean. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate weed control in dry edible beans using herbicides applied PRE and POST. Two rows of 'Navigator' navy and 'Winchester' pinto bean were planted in each plot on June 26, 2001. PRE treatments were applied June 26 at 10:00 am with 78 F air, 77 F soil at a depth of 4 inches, 47% relative humidity, 10% clouds, 5 mph NE wind, dry soil surface, and moist subsoil. POST treatments were applied July 12 at 10:30 am with 75 F air, 79 F soil surface, 50% relative humidity, 0% clouds, 5 mph NE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V-2 to V-3 dry bean. Weed species present were: 2 to 6 inch (1-5/yd^2) foxtail; 1 to 4 inch (1-2/yd^2) redroot pigweed; 1 to 4 inch (1-2/yd^2) common lambsquarters; and 1 to 3 inch (1-3/yd^2) common ragweed. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. PRE weed control in dry edible bean (Zollinger and Ries).

		July 10		July 26		August 9		September 6		July 10				July 26	August 9	Sept 6
Treatment[1]	Rate	Navy	Pinto	Navy	Pinto	Navy	Pinto	Navy	Pinto	Fxtl	Rrpw	Colq	Corw	Corw	Corw	Corw
	(product/A)	% injury								% control				% control		
PRE																
Valor	2oz	9	7	15	15	13	13	13	13	72	96	81	86	73	60	47
Valor	3oz	18	9	30	23	28	25	27	30	83	99	91	86	80	89	77
Valor+Dual II Magnum	2oz+1.5pt	33	18	33	25	30	25	23	23	73	99	88	85	76	66	50
Valor+Dual II Magnum	3oz+1.5pt	53	27	53	40	57	43	57	40	99	99	98	89	88	66	50
Spartan	3oz	0	0	0	0	0	0	0	0	67	86	86	76	81	66	50
Spartan	4oz	0	0	0	0	0	0	0	0	77	96	93	83	83	83	57
Spartan+Outlook	3oz+18fl oz	0	0	0	0	0	0	0	0	73	89	89	78	86	83	50
Spartan+Outlook	4oz+18fl oz	0	0	0	0	0	0	0	0	84	99	99	89	88	76	57
PRE/POST																
Spartan/Select+PO	3oz/4oz+1% v/v			0	0	0	0	0	0					63	50	10
Spartan/Rezult+PO	3oz/1pt+1pt+1qt			0	0	0	0	0	0					66	60	43
POST																
Raptor+Quad 7	2 fl oz+1% v/v			0	0	0	0	0	0					60	20	0
Reflex+Select+PO	0.75pt+5fl oz+1qt			0	0	0	0	0	0					96	99	99
LSD (0.05)		5	7	13	9	7	6	7	8	13	8	13	10	15	20	15

[1]PO = petroleum oil = Herbimax; Quad 7 = basic blend adjuvant.

14 DAT ratings for PRE treatments were made July 26. No rain occurred after application and before crop and weeds emerged. 14 28, and 56 DAT ratings for POST treatments were made July 26, August 9, and September 6, respectively and all treatments controlled foxtail, redroot pigweed, and common lambsquarters. Valor caused significant dry bean injury and adding Outlook to Valor increased bean injury as compared to Valor alone. Only Reflex controlled common ragweed.

POST weed control in dry edible bean. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Hatton, ND, to evaluate weed control in dry edible bean using herbicides applied PPI and POST. On June 5, 2001, PPI applications were made and incorporated with a rototiller operating at a 2 inch depth at 1:30 pm followed by seeding of two rows of 'Navigator' navy and 'Winchester' pinto bean in each plot. Weather conditions at PPI incorporations were 61 F air, 58 F soil at a depth of 4 inches, 56% relative humidity, 100% clouds, 7 mph SE wind, dry soil surface, and moist subsoil. POST treatments were applied June 11 at 9:00 am with 65 F air, 68 F soil surface, 60% relative humidity, 100% clouds, 2 mph NE wind, dry soil surface, moist subsoil, excellent crop vigor, and no dew present to V-4 to V-6 dry bean. Weed species present were: 6 to 24 inch diameter flowering (1-5/yd^2) wild mustard; and 1 to 4 inch (1/yd^2) common lambsquarters. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles for PPI treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles for POST treatments. The experiment had a randomized complete block design with three replicates per treatment. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. POST weed control in dry edible bean (Zollinger and Ries).

		July 11		July 18		July 25		August 8		August 15		September 5		Yield	
Treatment[1]	Rate	Pinto	Navy	Pinto	Navy	Pinto	Navy	Pinto	Navy	Pinto	Navy	Pinto	Navy	Pinto	Navy
	(product/A)	% injury												----cwt/A ----	
PPI															
Prowl+Pursuit Plus	2.25pt+20fl oz	27	28	38	40	25	22	20	17	19	13	17	13	2189	2469
Prowl+Pursuit Plus	1.6pt+30fl oz	30	35	53	47	40	37	35	32	30	27	30	30	2188	2378
PPI/POST															
Prowl/Pursuit+Rezult+Quad 7	3.5pt/0.72oz+1.6pt+1.6pt	3	4	28	15	13	8	10	5	8	2	7	0	2437	3049
Prowl/Raptor+Rezult+Quad 7	3.5pt/2fl oz+1.6pt+1.6pt	4	8	22	18	7	9	3	3	2	2	0	0	2647	2726
POST															
Raptor+NIS	4fl oz			28	23	2	2	0	0	0	0	0	0	2906	2147
Raptor+Basagran[2]+NIS+28-0-0	4fl oz+1pt			22	13	0	0	0	0	0	0	0	0	2401	2680
Raptor+Basagran[2]+Quad 7	4fl oz+0.5pt			23	18	0	5	0	3	0	0	0	0	2325	2684
Raptor+Rezult+NIS+28-0-0	3fl oz+1pt+1pt			20	10	6	0	0	0	0	0	0	0	2312	2979
Raptor+Rezult+Quad 7	2fl oz+1.6pt+1.6pt			17	10	3	0	2	0	0	0	0	0	2355	2351
Raptor+Rezult+NIS+28-0-0	3fl oz+1.6pt+1.6pt			20	10	3	0	2	0	0	0	0	0	2513	2970
Raptor+Rezult+PO+28-0-0	3fl oz+1.6pt+1.6pt			17	10	0	0	0	0	0	0	0	0	2360	3027
Pursuit+NIS	0.72oz			25	13	0	0	0	0	0	0	0	0	2616	2975
Pursuit+Basagran[2]+NIS+28-0-0	3fl oz+1pt			23	12	0	0	0	0	0	0	0	0	2249	2747
Pursuit+Basagran[2]+Quad 7	0.72oz+0.5pt			20	8	0	0	0	0	0	0	0	0	2319	2925
Pursuit+Rezult+NIS+28-0-0	2fl oz+1pt+1pt			17	8	2	0	0	0	0	0	0	0	2262	2822
Pursuit+Rezult+NIS+28-0-0	3fl oz+1pt+1pt			20	13	0	0	0	0	0	0	0	0	2218	2807
Pursuit+Rezult+NIS+28-0-0	2fl oz+1.6pt+1.6pt			13	2	0	0	0	0	0	0	0	0	2638	2939
Pursuit+Rezult+Quad 7	0.72oz+1.6pt+1.6pt			20	5	0	0	0	0	0	0	0	0	2630	2997
Pursuit+Rezult+NIS+28-0-0	3fl oz+1.6pt+1.6pt			22	8	0	0	0	0	0	0	0	0	2691	3011
Pursuit+Rezult+PO+28-0-0	3fl oz+1.6pt+1.6pt			20	10	7	0	5	0	3	0	3	0	2276	2970
Rezult+28-0-0	1.6pt+1.6pt			0	3	0	0	0	0	0	0	0	0	2742	2963
Rezult+PO	1.6pt+1.6pt			0	0	0	0	0	0	0	0	0	0	2581	3205
LSD (0.05)		6	9	7	11	8	6	6	5	5	5	7	4	611	577

[1]Quad 7 = basic blend adjuvant at 1% v/v; NIS = nonionic surfactant = Activator 90 at 0.25% v/v; 28-0-0 = urea ammonium nitrate at 1 qt/A; PO = petroleum oil = Herbimax at 1%v/v.
[2]Basagran component of Rezult.

All treatments controlled foxtail, redroot pigweed, and wild mustard. PPI treatments injured dry beans which injury continued throughout the growing season.

Weed control in dry bean. Jenks, Willoughby, and Markle. Maverick pinto beans were seeded June 2 into 30-inch rows at 60 lb/A in a conventional tillage system. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preplant incorporated (PPI) or preemgergance (PRE) on June 2, or postemergence (POST) on July 9 (0-2 lf), or July 23 (POST 2). PPI and PRE treatments were applied with XR80015 flat fan nozzles at 20 gpa and 30 psi. POST treatments were applied with XR8001 flat fan nozzles at 10 gpa and 40 psi. The primary weeds were biennial wormwood (Biww) and kochia (Kocz).

Table 1. Control of biennial wormwood and kochia in dry bean.

			Biww		Kocz			
Treatment[a]	Rate	Timing	Jul 5	Aug 15	Jul 5	Aug 15	Yield	Test wt.
			% control				lb/A	lb/bu
Spartan	2.67 oz	PRE	87	70	97	96	1508	58.7
Spartan	5.33 oz	PRE	98	89	100	100	1407	57.5
Spartan	10.66 oz	PRE	100	97	100	98	1412	58.2
Broadstrike + Dual	2 pt	PPI	93	77	25	0	844	55.3
Python	1 oz	PPI	96	84	22	3	891	59.5
Sencor	0.33 lb	PRE	95	84	94	83	1420	58.0
Valor	3 oz	PRE	100	96	98	84	1367	57.6
Basagran / Basagran	1 pt / 1 pt	POST / POST 2		92		92	1907	58.0
Basagran	2 pt	POST		78		91	1638	57.3
Spartan + Sencor	5.33 oz + 0.25 lb	PRE	100	95	100	100	1589	57.8
Basagran + Raptor	1 pt + 4 fl oz	POST		73		80	1966	58.8
Treflan	1.5 pt	PPI		0		25	1078	58.7
Untreated			0	0	0	0	861	58.6
LSD			6	20	5	16	440	NS
CV			4	17	4	15	19	3

[a] *Raptor was applied with NIS at 0.25% and 28% N at 1 qt.*

Table 2. Dry bean injury from soil-applied herbicides.

			Soil pH		% Crop injury		Yield, lb/A	
Treatment[a]	Rate	Timing	Rep 1[a]	Rep 2&3	Rep 1	Rep 2&3	Rep 1	Rep 2&3
Spartan	2.67 oz	PRE	7.8	6.0	30	4	1158	1683
Spartan	5.33 oz	PRE	7.8	5.1	50	5	829	1696
Spartan	10.66 oz	PRE	7.9	5.1	70	8	689	1774
Sencor	0.33 lb	PRE	6.3	5.2	50	19	1292	1405
Valor	3 oz	PRE	7.0	6.0	35	15	1454	1403
Spartan+Sencor	5.33 oz + 0.25 lb	PRE	5.5	5.6	15	11	1387	1691

[a] *Rep = replication; each treatment is applied to three 10 by 30 ft blocks or replications.*

Spartan, Broadstrike, Python, Sencor, Valor, and Raptor are not registered for use in dry bean as of late 2001. Spartan and Raptor are likely to be labeled for use in dry bean in ND in the future. In this study, Spartan, Sencor, Valor, and Basagran provided good to excellent kochia control. With the exception of Treflan, all treatments provided fair to excellent control of biennial wormwood.

We observed more crop injury in the 1st replication (rep) compared to reps 2 and 3. We found that the soil in rep 1 was higher in soil pH, which likely contributed to the higher crop injury. Spartan and Sencor will be more active as soil pH increases, thus increasing the chance of crop injury.

Species response to glyphosate and 2,4-D acid. (Howatt, Roach, and Davidson-Harrington) An experiment was established by seeding wild buckwheat, velvetleaf, rye, nightshade, and kochia into an area infested with Canada thistle, common dandelion, lanceleaf sage, common lambsquarters, and redroot pigweed on June 8. Treatments (3 to 5 inch) were applied on July 5 with 69 F, 42% RH, 5% cloudcover, 0 to 1 mph wind, and 61 F soil temperature. Treatments (5 to 8 inch) were applied on July 20 with 78 F, 73% RH, 6 to 8 mph wind, and 75 F soil temperature. Treatments (8 to 12 inch) were applied on August 13 with 78 F, 38% RH, 5% cloudcover, and 2 to 4 mph wind. All treatments were applied with a CO_2 backpack sprayer delivering 8.5 gpa at 35 psi through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with three replicates. Canada thistle bolted prior to July 5 and was always much larger than other species.

Table 1. July 13 weed control evaluation of treatments applied to 3 to 5 inch weeds (treatments 1-8).

Treatment[a]	Rate	Cath	Nish	Vele	Dali	Llsa	Colq	Rrpw	Wibw	Rye
	oz/A					%				
Glyphosate-ipa+AMS (3-5")	6+10	43	95	78	47	96	47	97	43	94
Glyphosate-ipa+AMS (3-5")	12+10	60	98	65	63	96	57	98	67	97
Glyphosate&AMADS (3-5")	6&44	47	99	68	43	67	90	95	57	99
Glyphosate&AMADS (3-5")	12&88	73	95	92	75	92	86	98	87	99
Glyphosate-ipa+24-Dsalvo+AMS (3-5")	6+6+10	77	95	68	63	98	82	96	82	88
Glyphosate&AMADS+PCC1133 (3-5")	6&44+6	66	77	33	26	53	58	75	43	NA
AMADS+PCC1133 (3-5")	2%+0.5	67	67	75	37	78	75	83	57	0
2,4-Dsalvo (3-5")	0.5	23	63	50	33	75	63	72	67	0
Untreated	0	0	0	0	0	0	0	0	0	0
C.V. %		15	6	16	13	6	10	5	8	3
LSD 5%		13	8	17	10	8	10	7	7	3
# OF REPS		3	3	3	3	3	3	3	3	3

[a] AMADS, aminomethanamide dihydrogen tetraoxosulfate, was adjuvant system from Entek and PCC1133 was a proprietary 2,4-D formulation from Loveland.

Table 2. July 25 weed control evaluation of treatments applied to 3 to 5 or 5 to 8 inch weeds (treatments 1-16).

Treatment[a]	Rate	Cath	Nish	Vele	Dali	Llsa	Colq	Rrpw	Wibw	RYE
	oz/A					%				
Glyt-ipa+AMS (3-5")	6+10	82	99	93	77	99	90	99	87	99
Glyt-ipa+AMS (3-5")	12+10	83	99	92	87	99	88	99	96	99
Glyt&AMADS (3-5")	6&44	88	99	92	80	96	91	99	92	99
Glyt&AMADS (3-5")	12&88	88	99	92	88	99	96	99	92	99
Glyt-ipa+24-Dsalvo+AMS (3-5")	6+6+10	71	99	90	83	99	87	99	88	99
Glyt&AMADS+PCC1133 (3-5")	6&44+6	59	80	68	63	83	67	99	63	NA
AMADS+PCC1133 (3-5")	2%+0.5	65	78	70	43	78	82	99	67	0
24-Dsalvo (3-5")	0.5	61	83	67	60	93	68	99	77	0
Glyt-ipa+AMS (5-8")	6+10	37	83	37	30	65	47	92	30	82
Glyt-ipa+AMS (5-8")	12+10	49	93	78	40	82	68	99	47	92
Glyt&AMADS (5-8")	6&44	37	90	47	37	92	68	92	43	94
Glyt&AMADS (5-8")	12&88	49	96	90	57	90	78	98	77	96
Glyt-ipa+24-Dsalvo+AMS (5-8")	6+6+10	37	92	37	27	83	68	94	50	63
Glyt&AMADS+PCC1133 (5-8")	6&44+6	56	92	63	50	90	78	98	78	77
AMADS+PCC1133 (5-8")	2%+0.5	64	72	67	30	83	63	90	27	0
24-Dsalvo (5-8")	0.5	49	68	37	27	82	60	73	67	0
Untreated	0	0	0	0	0	0	0	0	0	0
C.V. %		6	5	10	14	6	8	2	10	4
LSD 5%		5	8	11	12	8	9	3	11	4
# OF REPS		3	3	3	3	3	3	3	3	3

[a] AMADS, aminomethanamide dihydrogen tetraoxosulfate, was adjuvant system from Entek and PCC1133 was a proprietary 2,4-D formulation from Loveland.

Table 3. August 17 weed control evaluation of treatments applied to 5 to 8 or 8 to 12 inch weeds (trts 9-25).

Treatment[a]	Rate	Cath	Nish	Vele	Dali	Llsa	Colq	Rrpw	Wibw	Rye
	oz/A					%				
Glyphosate-ipa+AMS (5-8")	6+10	75	90	37	53	93	33	96	77	98
Glyphosate -ipa+AMS (5-8")	12+10	80	94	27	33	93	63	99	20	96
Glyphosate &AMADS (5-8")	6&44	53	89	43	30	96	57	92	17	98
Glyphosate &AMADS (5-8")	12&88	85	90	95	84	92	92	98	82	98
Glyt-ipa+24-Dsalvo+AMS (5-8")	6+6+10	77	78	67	33	75	67	92	27	93
Glyt&AMADS+PCC1133 (5-8")	6&44+6	83	92	95	50	93	88	98	73	99
AMADS+PCC1133 (5-8")	2%+0.5	60	70	87	57	87	70	92	47	0
24-Dsalvo (5-8")	0.5	35	73	57	57	57	47	85	27	0
Glyphosate -ipa+AMS (8-12")	6+10	40	67	37	17	43	23	82	27	37
Glyphosate -ipa+AMS (8-12")	12+10	27	43	30	33	43	33	50	13	82
Glyphosate &AMADS (8-12")	6&44	30	47	37	27	37	33	50	27	78
Glyphosate &AMADS (8-12")	12&88	43	43	37	33	53	43	63	20	93
Glyt-ipa+2,4-Dsalvo+AMS (8-12")	6+6+10	63	63	57	27	50	37	80	23	77
Glyt&AMADS+PCC1133 (8-12")	6&44+6	47	83	68	33	57	37	85	20	73
AMADS+PCC1133 (8-12")	2%+0.5	60	67	72	23	72	57	83	13	0
2,4-Dsalvo (8-12")	0.5	35	43	37	27	43	23	47	23	0
Untreated	0	0	0	0	0	0	0	0	0	0
C.V. %		9	7	10	20	8	13	7	24	5
LSD 5%		8	7	9	12	9	10	9	12	5
# OF REPS		3	3	3	3	3	3	3	3	3

[a] AMADS, aminomethanamide dihydrogen tetraoxosulfate, was adjuvant system from Entek and PCC1133 was a proprietary 2,4-D formulation from Loveland.

Table 4. August 24 weed control evaluation of treatments applied to 8 to 12 inch weeds (treatments 17-25).

		8/24 (treatments 17-25)								
Treatment[a]	Rate	Cath	Nish	Vele	Dali	Llsa	Colq	Rrpw	Wibw	Rye
	oz/A					%				
Glyphosate-ipa+AMS (8-12")	6+10	58	53	67	37	67	37	72	30	83
Glyphosate -ipa+AMS (8-12")	12+10	70	72	77	33	67	60	90	40	91
Glyphosate &AMADS (8-12")	6&44	74	75	85	47	70	72	92	40	92
Glyphosate &AMADS (8-12")	12&88	77	80	90	53	78	72	90	50	91
Glyt-ipa+24-Dsalvo+AMS (8-12")	6+6+10	78	73	84	50	87	68	92	43	89
Glyt&AMADS+PCC1133 (8-12")	6&44+6	73	77	82	43	83	62	88	40	80
AMADS+PCC1133 (8-12")	2%+0.5	61	33	83	57	72	43	82	30	0
2,4-Dsalvo (8-12")	0.5	43	50	73	40	63	43	83	23	0
Untreated	0	0	0	0	0	0	0	0	0	0
C.V. %		9	14	6	17	17	18	5	23	8
LSD 5%		9	14	8	12	19	16	7	13	8
# OF REPS		3	3	3	3	3	3	3	3	3

[a] AMADS, aminomethanamide dihydrogen tetraoxosulfate, was adjuvant system from Entek and PCC1133 was a proprietary 2,4-D formulation from Loveland.

In general, younger weeds were easier to control than older weeds. Glyphosate&AMADS or AMADS+PCC1133 provided equal or greater control of larger and more tolerant weeds than glyphosate or 2,4-D.

Weed control with glyphosate tank-mixes. (Howatt, Roach, and Davidson-Harrington) Treatments were applied to headed hard red spring wheat, 5 to 6 leaf yellow foxtail, 2 to 10 inch redroot pigweed, 4 to 12 inch common lambsquarters, and 4 to 10 inch common purslane on July 5 with 82 F, 32% relative humidity, 5% cloudcover, 0 to 2 mph wind, and 67 F soil temperature. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 35 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		7/10					7/25			
Treatment[a]	Rate	Wheat	Yeft	Rrpw	Colq	Copu	Yeft	Rrpw	Colq	Copu
	(oz/A)	%								
Glyphosate-ipa+AMS	6+10	96	89	97	56	74	94	95	76	83
Glyphosate-ipa+ Carfentrazone+AMS	6+ 0.128+10	96	94	98	83	83	93	96	84	81
Glyphosate-ipa+dicamba+AMS	6+3+10	95	87	96	78	84	91	97	94	95
Glyphosate&2,4-D+AMS	6&10+10	95	87	98	86	86	86	96	93	93
Glyphosate-ipa+MCPA+AMS	6+8+10	92	87	98	77	91	88	96	96	95
Glyphosate-ipa+fluroxypyr+AMS	6+1.5+10	94	86	97	65	91	87	94	74	96
Glyt-ipa+thifensulfuron+AMS	6+0.22+10	96	90	97	83	81	92	97	89	87
Glyphosate&AMADS	6&44	97	94	99	84	84	97	97	91	92
Untreated	0	0	0	0	0	0	0	0	0	0
C.V. %		2	2	2	19	5	2	2	5	3
LSD 5%		2	3	3	19	5	3	3	6	3
# OF REPS		4	4	4	4	4	4	4	4	4

[a] AMADS, aminomethanamide dihydrogen tetraoxosulfate, was an adjuvant system in Engame premix from Entek.

MCPA slightly antagonized, 4% decrease, glyphosate activity on wheat. Carfentrazone or AMADS improved yellow foxtail control on July 10, while 2,4-D, MCPA, and fluroxypyr antagonized yellow foxtail control on July 25. No difference in redroot pigweed control was detected. Only fluroxypyr did not improve common lambsquarters control with glyphosate. Other herbicides increased lambsquarters control by as much as 20% compared to glyphosate alone on July 25. On July 25, all herbicide combinations gave better control of common purslane than glyphosate alone, with dicamba, MCPA, and fluroxypyr tank-mixes providing 95% control or better.

Fallow sulfentrazone application before winter wheat, Fargo. (Howatt, Roach, and Davidson-Harrington). An experiment was established on fallow bare ground for weed control prior to winter wheat planting. Treatments were applied on June 5 with 55 F, 70% RH, 100% cloudcover, 4 to 6 mph wind, and 57 F soil temperature. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. "Elkhorn" winter wheat was planted September 12. The experiment was a randomized complete block design with four replicates.

		7/07	
Treatment	Rate	Fota	Rrpq
	oz/A	%	
Sulfentrazone	2	60	99
Suen	2.5	64	99
Suen	3.25	56	99
Suen	4	75	99
Flumioxazin	1	75	13
Flumioxazin	1.5	70	20
Metsulfuron+NIS	0.06+0.25%	74	99
Untreated	0	0	0
C.V. %		12	5
LSD 5%		10	5
# OF REPS		4	4

The field use rate of sulfentrazone on this soil was 3 to 4 oz/A, and the prescribed use rate of flumioxazin was 1.5 oz/A. Sulfentrazone at 4 oz provided better foxtail control than other sulfentrazone rates at the July 7 evaluation. All rates of sulfentrazone controlled redroot pigweed for four weeks after application. Flumioxazin gave 70 to 75% foxtail control but redroot pigweed control was very poor, 13 to 20%. Sulfentrazone at 4 oz gave similar control of this weed spectrum as metsulfuron. On July 27, no herbicide treatment could be distinguished from the untreated check plots (data not shown). None of the treatments were able to control vegetation in summer fallow all season long. Adequate moisture was received at this location to stimulate late germination and emergence as well as degrade and dilute the chemicals in the soil profile. Winter wheat did not show symptoms of herbicide injury on October 12 or November 21 (data not shown).

Weed control in field pea, Prosper. (Kegode, Ciernia, and Fronning). The purpose of this experiment was to evaluate application timings with bentazon and imazamox for weed control in field pea. PPI treatments were applied May 25 using a shielded 4-nozzle bicycle wheel sprayer delivering 17 gpa at 40 psi through XR8002 tips. At application air temperature was 70 F, RH 30%, wind N at 14 mph, sky cloudy , and the soil surface dry. Treatments were incorporated twice with a field cultivator. "Marjoret" field pea was seeded May 29 with a conventional grain drill into plots 11 feet wide and 30 feet long. All POST treatments were applied using the same sprayer equipped with XR8001 nozzles and delivering 8.5 gpa at 40 psi. Percentage emergence was based on the *Weedcast* model, and predictions used were for kochia. EPOST treatments were applied June 26 to 6-7 inch field pea, 0.5-3 inch and 2-6 leaf redroot pigweed, 0.5-1.5 inch kochia, 0.5-3 inch and 2-6 leaf common lambsquarters, and 6 inch and 5 leaf foxtail. At application air temperature was 77 F, RH 47%, wind NE 5 mph, sky clear, and plant surfaces dry. MPOST treatments were applied July 3 to 10 inch field pea, 6-10 inch and 4-10 leaf redroot pigweed, 1-5 inch and 4-8 leaf common lambsquarters, 3-7 inch and 4-8 leaf yellow foxtail, and 1-2 inch kochia. At that time air temperature was 84 F, RH 32%, wind W 8-10 mph (sprayer was shielded), sky partly cloudy, and plant surfaces dry. LPOST treatments were applied July 9 to 14 inch and flowering field pea, 7-14 inch redroot pigweed, 4-8 inch common lambsquarters, and 12 inch foxtail. At application air temperature was 83 F, RH 61%, wind N at 6 mph, sky sunny, and plant surfaces dry. Weed control evaluations were made visually. The experiment was a randomized complete block design with 4 reps. The field was desiccated Aug. 29 and a 4 by 27 foot swath was harvested Sept. 29.

			July 10				July 25				
Treatment	Timing	Rate	Stand	Fxtl	Rrpw	Colq	Fxtl	Rrpw	Colq	Kocz	Yield
		oz ai/A	%	% control							lb/A
Metribuzin + MSO	MPOST	3+16	38	39	75	94	24	57	100	99	394
Clethodim + bentazon + MSO	MPOST	3.2+16+16	63	57	80	65	69	69	94	48	759
Imazamox + MSO	MPOST	0.5+16	38	69	81	66	98	100	99	100	912
Ethalfluralin/	PPI/	12/8+0.25+16	55	99	99	99	100	100	100	99	1651
Bentazon + imazamox + MSO	MPOST										
Bentazon + MSO/	EPOST/	8+16/	60	88	76	96	98	62	100	99	1132
Bentazon + sethoxydim + MSO	10-14 dat	8+16+1.5									
Bentazon + imazamox + MSO	EPOST	8+0.25+16	80	74	96	93	60	95	100	100	1228
Bentazon + imazamox + MSO	MPOST	8+0.25+16	74	76	98	99	80	100	99	99	1406
Bentazon + imazamox + MSO	LPOST	8+0.25+16	53	75	41	59	73	100	82	100	720
Bentazon + imazamox + MSO/	EPOST/	8+0.25+16/	68	69	85	100	78	100	100	100	1182
Bentazon + imazamox + MSO	LPOST	8+0.25+16									
Pyridate	MPOST	15	20	40	93	99	0	91	100	100	239
Trifluralin	PPI	12	70	82	96	81	67	97	76	100	1383
Untreated		0	73	-	-	-	-	-	-	-	318
LSD (0.05)			21	34	17	NS	41	26	NS	2	500

Field pea stands were poor mainly as a result of excessive rainfall and partial flooding of plots. Consequently, field pea yields were relatively low and highly variable. Actual kochia emergence was low at the July 10 evaluation and therefore was not evaluated on this date. Ethafluralin (PPI) fb bentazon plus imazamox (MPOST) provided excellent control of foxtail, redroot pigweed, common lambsquarters, and kochia. Bentazon plus imazamox split-applied was also excellent except for foxtail control.

Weed control in field pea, Fargo. (Kegode, Ciernia, and Fronning). The purpose of this experiment was to evaluate application timings with bentazon and imazamox for weed control in field pea. PPI treatments were applied May 30 using a 4-nozzle bicycle wheel sprayer delivering 17 gpa at 40 psi through XR8002 tips. At application, air temperature was 69 F, RH 40%, wind SE at 6 mph, sky mostly cloudy, and the soil surface dry. Treatments were incorporated twice with a field cultivator. "Marjoret" field pea was seeded May 30 with a conventional grain drill into plots 11 feet wide and 30 feet long. All POST treatments were applied using the same sprayer equipped with XR8001 nozzles and delivering 8.5 gpa at 40 psi. Kochia percentage emergence was based on *Weedcast,* a weed emergence and growth prediction model. EPOST treatments were applied June 26 to 6-7 inch field pea, 0.5-2 inch and 2-6 leaf redroot pigweed, 1-2 inch and 2-4 leaf common lambsquarters, 5-7 inch and 4-6 leaf foxtail, and 0.5-2 inch and 2-6 leaf wild mustard. At application, air temperature was 77 F, RH 53%, wind W at 7 mph, clear sky, and dry leaf surfaces. MPOST treatments were applied July 3 to 8 inch field pea, 1-6 inch and 5-8 leaf redroot pigweed, 2-8 inch and 4-6 leaf wild mustard, and 2-6 inch and 3-6 leaf foxtail. At application, air temperature was 80 F, RH 50%, wind W at 5 mph, sunny sky, and dry leaf surfaces. LPOST treatments were applied July 9 to 14-16 inch field pea, 6-10 inch redroot pigweed, 4-14 inch and flowering wild mustard, and 2-8 inch and 4-5 leaf foxtail. At application, air temperature was 78 F, RH 60%, wind NW at 7 mph, clear sky, and dry plant surfaces. Weed control evaluations were made visually and the experiment was a randomized complete block design with 4 reps. Some treatments sustained water damage and the experiment was not harvested.

				July 11			July 25		
Treatment	Timing	Rate	Stand	Fxtl	Rrpw	Wimu	Fxtl	Rrpw	Wimu
		oz ai/A	%	% control					
Metribuzin + MSO	MPOST	3+16	33	13	60	75	3	23	40
Clethodim + bentazon + MSO	MPOST	3.2+16+16	42	87	61	96	97	23	75
Imazamox + MSO	MPOST	0.5+16	41	71	72	85	97	95	98
Ethalfluralin/	PPI/	12/8+0.25+16							
Bentazon + imazamox + MSO	MPOST		45	81	99	99	85	94	94
Bentazon + MSO/	EPOST/	8+16/							
Bentazon + sethoxydim +MSO	10-14 dat	8+16+1.5	46	65	53	99	91	38	91
Bentazon + imazamox + MSO	EPOST	8+0.25+16	36	28	25	95	39	15	75
Bentazon + imazamox + MSO	MPOST	8+0.25+16	38	71	95	99	56	81	91
Bentazon + imazamox + MSO	LPOST	8+0.25+16	50	72	11	25	58	81	91
Bentazon + imazamox + MSO/	EPOST/	8+0.25+16/							
Bentazon + imazamox + MSO	LPOST	8+0.25+16	46	39	43	98	74	91	95
Pyridate	MPOST	15	16	19	94	93	3	67	21
Trifluralin	PPI	12	57	90	82	56	76	63	8
Untreated		0	38	-	-	-	-	-	-
LSD (0.05)			NS	26	13	10	23	24	23

Though the objective of this study was to use *Weedcast* predictions for kochia emergence as a means for determining when to apply a treatment, the population density of kochia was insufficient to rate. Field pea stands were poor mainly as a result of excessive rainfall and partial flooding of plots. The MPOST imazamox treatment provided the best control of all weeds. The split-applied bentazon plus imazamox treatment was excellent on broadleaf control but was weaker on grass control.

Weed control with soil- and POST-applied herbicides in field pea. Endres, Gregory J., Robert A. Henson, and Blaine G. Schatz. Weed control and field pea response to selected soil- and POST-applied herbicides were evaluated in a randomized complete block with four replicates. The experiment was conducted on a loam soil with 7.2 pH and 2.9% organic matter at Carrington, ND in 2001. The trial area was cultivated on May 9 with a Melroe culti-harrow. Herbicide treatments were made to 5 by 25 ft plots with a CO_2 pressurized hand-held plot sprayer. PPI treatments were applied at 17 gal/A and 30 psi through 8002 flat fan nozzles on May 9 with 79 F, 21% RH, and 14 mph wind. PPI treatments were immediately incorporated twice using a Melroe culti-harrow set at a 2-inch depth. On May 10, inoculated 'Majoret' field pea was planted in 7-inch rows at pure live seed rates of 300,000 seeds/A. Guard plots were planted between treated plots. PRE treatments were applied on a dry soil surface at 17 gal/A and 30 psi through 8002 flat fan nozzles on May 11 with 62 F, 38% RH, 70% clear sky, and 8 mph wind. Late preemergence (LPRE) treatments were applied on a wet soil surface at 18 gal/A and 30 psi through 8002 flat fan nozzles on May 17 with 52 F, 77% RH, 70% clear sky, and 18 mph wind. A total of 0.74 inches of rainfall occurred during the 10-day period following application of PRE treatments. A total of 0.61 inches of rainfall occurred during the 10-day period following application of LPRE treatments. POST treatments were applied at 10 gal/A and 30 psi through 8001 flat fan nozzles. Early postemergence (EPOST) treatments were applied on June 1 with 49 F, 92% RH, 20% clear sky, and 9 mph wind to 2- to 3-inch tall field pea, 3-leaf yellow foxtail, 1-inch tall common lambsquarters, 0.5-inch tall redroot and prostrate pigweed, and 1- to 1.5-inch tall wild buckwheat. POST treatments were applied on June 8 with 64 F, 83% RH, 90% clear sky, and 12 mph wind to 3- to 6-inch tall field pea, 3- to 5-leaf yellow foxtail, 1- to 3-inch tall common lambsquarters, 0.5- to 1-inch tall redroot and prostrate pigweed, and 1.5- to 3-inch tall wild buckwheat. Late postemergence (LPOST) treatments were applied on June 16 with 55 F, 92% RH, 10% clear sky, and 9 mph wind to 6- to 10-inch tall field pea, 4- to 5-leaf yellow foxtail, 2- to 6-inch tall common lambsquarters, 0.5- to 4-inch tall redroot and prostrate pigweed, and 2- to 6-inch tall wild buckwheat. Field pea was harvested with a plot combine on August 10.

Good to excellent (86 to 99%) weed control was achieved with all PPI and LPRE treatments (Table 1). Sulfentrazone at 0.25 lb/A improved common lambsquarters and pigweed control, and increased seed yield compared to the low rate (Table 2). Weed control and pea response generally was not impacted by application timing of imazamox. Imazethapyr and imazamox generally provided similar weed control and yield. The addition of Quad7 injured the crop (growth reduction), but four of six treatments with Quad7 were in the high-yielding group. Bentazon&sethoxydim+MSO provided poor weed control and yield. (Carrington Research Extension Center, North Dakota Agric. Exp. Stn., North Dakota State Univ., Carrington.)

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

Treatment[a]	Rate	4 wk after treatment				8 wk after treatment			
		SETLU	CHEAL	Pigweed spp.[b]	POLCO	SETLU	CHEAL	Pigweed spp.	POLCO
	(lb/A)	(% control)							
Untreated	---	0	0	0	0	0	0	0	0
PPI									
Imazethapyr &pendimethalin	0.033&0.5	93	93	97	94	88	90	99	99
Imep&pend+pend	0.049&0.75+ 0.66	98	96	98	98	88	88	91	88
Imep&pend+pend	0.033&0.5+ 0.94	97	98	99	89	94	88	96	82
Pend/imep+bent-azon&sethoxydim +Quad7(POST)	1.46/0.031+1 &0.2+1%	95	99	93	93	99	96	96	94
Pend/imep+bent& seth+Quad7 (POST)	1.46/0.016+1 &0.2+1%	95	91	92	99	94	91	96	99
PRE									
Sulfentrazone/seth +MSO (POST)	0.125/0.2+ 2pt	96	77	68	65	96	79	60	73
Suen/seth+MSO (POST)	0.25/0.2+2pt	93	99	88	72	92	99	80	85
LPRE									
Glyphosate&imep+ NIS&UAN	0.42&0.047+ 2pt	95	99	92	99	86	98	91	97
EPOST									
Imazamox+NIS	0.031+0.25%	88	81	98	85	91	86	99	83
POST									
Imep+bent+Quad7	0.031+0.5+ 1%	90	92	77	78	93	86	77	72
Immx+bent+ Quad7	0.031+0.5+ 1%	92	84	91	83	93	86	96	68
Imep+bent&seth+ Quad7	0.031+1&0.2+ 1%	93	98	96	89	88	99	97	88
Immx+bent&seth+ Quad7	0.016+1&0.2+ 1%	83	94	93	89	78	96	94	91
Imep+NIS	0.031+0.25%	90	66	90	81	97	70	99	83
Immx+NIS	0.031+0.25%	84	76	97	82	93	88	99	81
Bent&seth+MSO	1&0.2+2pt	65	40	55	35	57	47	57	48
LPOST									
Immx+NIS	0.031+0.25%	82	73	81	67	86	83	96	73
LSD (0.05)		6	15	9	21	11	16	13	18

[a]Quad7=a surfactant blend from AGSCO, Grand Forks, ND; MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN; NIS=Induce, a nonionic surfactant from Helena Chemical Co., Memphis, TN; NIS&UAN=Class APM 28, a surfactant+fertilizer from Cenex, St. Paul, MN.

[b]Pigweed spp.=Redroot and prostrate.

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

Treatment[a]	Rate	Stand reduction 2 WAT	Stand reduction 4 WAT	Seed yield
	(lb/A)	(%)	(%)	(bu/A)
Untreated		0	0	44.5
PPI				
Imazethapyr&pendimethalin	0.033&0.5	0	0	56.3
Imep&pend+pend	0.049&0.75+0.66	0	0	63.0
Imep&pend+pend	0.033&0.5+0.94	0	0	61.3
Pend/imep+bentazon&sethoxydim +Quad7(POST)	1.46/0.031+1&0.2+1%	29	19	62.8
Pend/imep+bent& seth+Quad7 (POST)	1.46/0.016+1&0.2+1%	26	18	62.5
PRE				
Sulfentrazone/seth+MSO (POST)	0.125/0.2+ 2pt	0	0	52.2
Suen/seth+MSO (POST)	0.25/0.2+2pt	0	0	60.9
LPRE				
Glyphosate&imep+NIS&UAN	0.42&0.047+2pt	0	0	64.4
EPOST				
Imazamox+NIS	0.031+0.25%	0	0	63.1
POST				
Imep+bent+Quad7	0.031+0.5+1%	12	3	61.0
Immx+bent+Quad7	0.031+0.5+1%	22	15	62.6
Imep+bent&seth+Quad7	0.031+1&0.2+1%	27	18	57.0
Immx+bent&seth+Quad7	0.016+1&0.2+1%	26	18	55.4
Imep+NIS	0.031+0.25%	3	3	56.3
Immx+NIS	0.031+0.25%	0	0	58.0
Bent&seth+MSO	1&0.2+2pt	0	0	42.7
LPOST				
Immx+NIS	0.031+0.25%	0	0	61.5
LSD (0.05)		5	4	7.1

[a]Quad7=a surfactant blend from AGSCO, Grand Forks, ND; MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN; NIS=Induce, a nonionic surfactant from Helena Chemical Co., Helena, TN; NIS&UAN=Class APM 28, a surfactant+fertilizer from Cenex, St. Paul, MN.

Weed control in flax. Jenks, Willoughby, and Markle. Cathay flax was seeded May 4 into 6-inch rows at 50 lbs/A in a conventional tillage system. Individual plots were 10 x 30 ft and replicated three times. Treatments were applied preemergence (PRE) on May 8 or 10, or postemergence (POST) on June 8. PRE treatments were applied with XR80015 flat fan nozzles at 20 gpa and 30 psi. POST treatments were applied with XR8001 flat fan nozzles at 10 gpa and 40 psi. The primary weeds were redroot pigweed (Rrpw) and kochia (Kocz).

Treatment	Rate	Timing	Rrpw	Kocz		Flax Injury		Yield	Test wt.
			Jul 10	Jul 10	Aug 15	Jul 10	Aug 15	Aug 27	
			% Control			%		bu/A	lb/bu
Spartan	2.67 oz	PRE	85	82	73	3	2	26	52.5
Spartan	5.33 oz	PRE	87	77	69	2	2	25	52.0
Spartan	10.67 oz	PRE	100	100	100	4	3	28	52.3
DPX-R6447	2 oz	PRE	70	62	32	3	3		
Amicarbazone	5 oz	PRE	7	0	0	0	0		
Amicarbazone	6 oz	PRE	13	7	0	1	0		
Amicarbazone	7 oz	PRE	10	0	0	2	0		
Harmony GT	0.25 oz	POST	98	42	7	4	4		
Bronate	1 pt	POST	91	94	96	14	8	26	52.4
Olympus	0.9 oz	POST	96	7	0	0	0		
Untreated			0	0	0	0	0		
LSD			16	18	24	4	3	NS	NS
CV			16	23	37	61	64	17	1

Spartan, DPX-R6447, amicarbazone, Harmony GT, and Olympus are not registered for use in flax. Spartan caused very little crop injury at any rate, whereas, Bronate caused some yellowing and slight stunting. Harmony GT, at 0.25 oz, caused only slight crop injury. Harmony GT, above 0.25 oz, has caused moderate to severe crop injury in previous years.

Bronate provided excellent kochia control. Spartan provided excellent control at the 2X rate (10.67 oz), but only fair control at the rates recommended for sunflower (2.67-5.33 oz). The Spartan and Bronate treatments were the only plots that we could harvest due to lack of kochia control from the other treatments.

Soil applied herbicide evaluation in flax. (Howatt, Roach, Davidson-Harrington) "Omega" flax was seeded on May 18. Treatments (Pre) were applied May 26 with 58 F, 89% RH, 50% cloudcover, 10 mph wind, and 56 F soil temperature. Treatments (Post) were applied June 20 with 65 F, 56% RH, 70% cloudcover, 2 to 5 mph wind, and 59 F soil temperature. Treatments were applied with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 30 psi through 8001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	7/07 FLAX
	oz/A	%
Ambicarbazone (PRE)	5	33
Acetachlor (PRE)	32	95
Metribuzin (PRE)	8	89
Sulfentrazone (PRE)	4	1
Azafenidin (PRE)	2	84
Ambicarbazone+NIS (POST)	5+0.25%	73
Sulfentrazone+NIS (POST)	4+0.25%	68
Azafenidin+NIS (POST)	2+0.25%	75
Bentazon+PO (POST)	12+3%	45
Clopyralid&MCPA (POST)	8.3	40
Thifensulfuron+NIS (POST)	0.22+0.125%	24
Thifensulfuron+NIS (POST)	0.18+0.125%	25
Untreated (POST)	0	13
C.V. %		28
LSD 5%		20
# OF REPS		4

Herbicide injury was mainly expressed as white or necrotic tissue with stand reduction. Thifensulfuron did not reduce stand as much as some treatments such as acetochlor, metribuzin, or azafenidin, but caused 10 to 20% stunting and chlorosis that persisted. Flax in plots treated with ambicarbazone initially appeared unaffected (data not collected), but late June rain led to waterlogged soil that injured plants 13% as well as elicited late expression of herbicide injury. Sulfentrazone was very safe to flax. None of the randomized sulfentrazone plot locations were subject to areas of greater water damage.

Pre-harvest weed and crop desiccation. (Howatt, Roach, and Davidson-Harrington) "Omega" flax was seeded May 17. Sethoxydim + bromoxynil + MCPA + methylated seed oil was applied for early season weed control to the entire study area. Treatments were applied pre-harvest when bolls were tuning from tan to brown and late flush flowers were blooming on August 20 with 81 F, 47% RH, 10% cloudcover, and 4 to 5 mph wind. Treatments were applied with an ATV sprayer delivering 8.5 gpa at 35 psi through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates. Mature redroot pigweed was present at 10 plants/m^2.

Treatment[a]	Rate	8/30		Flax	Abnormal
		Rrpw	Flax	germ	seed
	(oz/A)			%	
Glyphosate-ipa+AMS	9+10	65	86	78	5
Glyphosate&AMADS	9&66	68	88	81	4
Glyphosate-ipa+carfentrazone+AMS	9+0.128+10	71	84	81	4
Glyphosate&AMADS+carfentrazone	9&66+0.128	76	85	74	6
Carfentrazone+NIS	0.128+0.25%	33	69	80	4
Glyphosate-ipa+dicamba	9+2	60	84	81	4
Glyphosate&2,4-D	9&13	58	80	79	4
Untreated	0	0	68	78	4
C.V. %		10	5	7	36
LSD 5%		8	6	NS	NS
# OF REPS		4	4	4	4

[a] AMADS, aminomethanamide dihydrogen tetraoxosulfate, was an adjuvant system in Engame premix from Entek.

Carfentrazone alone did not control vegetation, but the addition of carfentrazone to glyphosate or glyphosate&AMADS tended to improve redroot pigweed control. All treatments containing glyphosate were effective at killing the late flush of flowers and speeding flax plant desiccation. This greatly improved the ease of combining. Even though all flax was allowed to mature and dry before harvest, glyphosate treated flax shattered easier in the combine and provided for cleaner samples. There was no difference in germination of flax seed. It is important to remember that treatments in this study were applied to mature bolls and new flowers. No bolls were in the development stage or still in seed fill. All bolls had lost almost all green color. The effect of herbicide treatment to immature bolls is not known.

Flax response to application timing of postemergence herbicides. Gregory J. Endres and Blaine G. Schatz. (Carrington Research Extension Center, North Dakota State University, Carrington, ND 58421) The trial was conducted to evaluate flax response to three application timings of selected POST herbicides. The experimental design was a randomized complete block design with a split-plot arrangement (main plots=herbicide application timing and subplots=herbicide treatments) and three replicates. The trial was conducted on a conventional-tilled, loam soil with 7.6 pH and 2.4% organic matter at Carrington, ND in 2001. 'Pembina' flax was seeded on May 11 at the rate of 42 lb/A. Herbicide treatments were applied to the center 6.7 ft of 10- by 25-ft plots with a CO_2 pressurized hand-held plot sprayer at 17 gal/A and 35 psi through 80015 flat fan nozzles. Early POST (POST A) treatments were applied on June 2 with 62 F, 64% RH, 70% clear sky, and 7 mph wind to 1.5-inch tall flax. Mid POST (POST B) treatments were applied on June 17 with 53 F, 95% RH, 30% clear sky, and 7 mph wind to 5- to 6-inch tall flax, 2- to 4-leaf yellow and green foxtail, 2- to 3-inch tall redroot and prostrate pigweed, 3- to 5-inch tall common lambsquarters, and 3- to 6-inch tall wild mustard. Late POST (POST C) treatments were applied on June 28 with 77 F, 86% RH, 10% clear sky, and 5 mph wind to 12- to 14-inch tall (initial flowering stage) flax. The trial was harvested on August 23 with a plot combine.

Full-season weed control was achieved with bromoxynil&MCPA or clopyralid&MCPA and sethoxydim tank mixtures, or the three-way tank mixture (Table 1). Averaged across herbicide treatments, flax growth reduction was higher with the first two herbicide application times but PM (physiological maturity) was delayed and seed yield was reduced with the late application (Table 2). Herbicide treatments that included clopyralid&MCPA generally had significant flax growth reduction (Table 3). All herbicide treatments and application timings extended PM four to nine days compared to the untreated check. All herbicide treatments applied early improved yield compared to the untreated check (Table 4). The mid- and late-applied herbicide treatments generally had similar yield as the untreated check and less yield compared to the early-applied treatments. The highest test weight with all herbicide application timings was with bromoxynil&MCPA or clopyralid&MCPA and sethoxydim tank mixtures, or the three-way tank mixture. Based on these data, bromoxynil&MCPA or clopyralid&MCPA and sethoxydim tank mixtures, or the three-way tank mixture applied early provided the highest yield and test weight.

Table 1. Weed control in flax with three application timings of POST herbicides.

Herbicide		POST A[a]		POST B[a]		POST C[a]	
		Weed control[b]					
		6/29		7/17		7/25	
Treatment[c]	Rate	Grass	Broadleaf	Grass	Broadleaf	Grass	Broadleaf
	lb/A	%					
Bromoxynil&MCPA	0.23&0.23	0	95	0	94	0	94
Clopyralid&MCPA	0.07&0.39	0	93	0	90	0	88
Bromoxynil&MCPA+clopyralid&MCPA	0.23&0.23+0.07&0.39	0	98	0	96	0	96
Bromoxynil&MCPA+sethoxydim+MSO	0.23&0.23+0.2+2pt	92	96	81	81	87	94
Clopyralid&MCPA+sethoxydim+MSO	0.07&0.39+0.2+2pt	92	95	94	86	91	95
Bromoxynil&MCPA+clopyralid+MCPA +sethoxydim+MSO	.23&0.23+0.07&0.39+0.2+2pt	92	97	91	96	87	96
Bentazon&sethoxydim+MSO	1&0.2+2pt	93	94	95	50	87	55
Untreated check		0	0	0	0	0	0
LSD (0.05)		4	9	4	9	4	9

[a]POST A=June 2; POST B=June 17; POST C=June 28.

[b]Grass=Yellow and green foxtail; Broadleaf=Common lambsquarters, redroot and prostrate pigweed, wild buckwheat, and wild mustard.
[c]Bromoxynil&MCPA=Bronate; Clopyralid&MCPA=Curtail M; Bentazon+sethoxydim=Rezult; MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN.

Table 2. Flax response across herbicide treatments with three application timings of POST herbicides.

	Flax			
Herbicide application timings[a]	Injury[b]	PM[c]	Seed yield	Test weight
	%	days	bu/A	lb/bu
POST A	13	88	18.7	52.9
POST B	17	88	17.1	52.6
POST C	7	91	14.2	53.1
LSD (0.05)	6	1	3	NS

[a]POST A=June 2; POST B=June 17; POST C=June 28.

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

[c]PM=Physiological maturity from seeding date.

Table 3. Flax injury and days to physiological maturity with three application timings of POST herbicides.

Herbicide		POSTA[a]		POSTB[a]		POSTC[a]	
		Flax					
Treatment[b]	Rate	Injury[c]	PM[d]	Injury	PM	Injury	PM
	lb/A	%	days	%	days	%	days
Bromoxynil&MCPA	0.23&0.23	0	88	8	88	0	90
Clopyralid&MCPA	0.07&0.39	3	89	23	88	12	91
Bromoxynil&MCPA+clopyralid&MCPA	0.23&0.23+0.07&0.39	23	90	40	90	13	93
Bromoxynil&MCPA+sethoxydim+MSO	0.23&0.23+0.2+2pt	18	88	3	88	3	92
Clopyralid&MCPA+sethoxydim+MSO	0.07&0.39+0.2+2pt	11	88	23	90	15	92
Bromoxynil&MCPA+clopyralid+MCPA	.23&0.23+0.07&0.39+0.2+2p	37	90	32	90	15	93
Bentazon&sethoxydim+MSO	1&0.2+2pt	13	88	3	88	0	88
Untreated check		0	84	0	84	0	84
LSD (0.05)		9	2	9	2	9	2

[a]POSTA=June 2; POSTB=June 17; POSTC=June 28.

[b]Bromoxynil&MCPA=Bronate; Clopyralid&MCPA=Curtail M; Bentazon+sethoxydim=Rezult; MSO=Destiny, a methylated seed oil from

[c]Injury=% growth reduction by visual evaluation 7 days after treatment.

[d]PM=Physiological maturity from seeding date.

Table 4. Flax seed yield and test weight with three application timings of POST herbicides.

Herbicide		POSTA[a]		POSTB[a]		POSTC[a]	
		Seed	Test	Seed	Test	Seed	Test
Treatment[b]	Rate	yield	weight	yield	weight	yield	weight
	lb/A	bu/A	lb/A	bu/A	lb/bu	bu/A	lb/bu
Bromoxynil&MCPA	0.23&0.23	17.3	52.6	17.8	53.0	15.9	52.6
Clopyralid&MCPA	0.07&0.39	19.9	52.9	17.9	52.9	12.5	53.2
Bromoxynil&MCPA+clopyralid&MCPA	0.23&0.23+0.07&0.39	19.0	52.9	18.8	52.8	13.4	53.1
Bromoxynil&MCPA+sethoxydim+MSO	0.23&0.23+0.2+2pt	20.4	53.9	17.6	53.5	15.2	53.9
Clopyralid&MCPA+sethoxydim+MSO	0.07&0.39+0.2+2pt	19.3	53.8	17.1	53.9	13.5	54.3
Bromoxynil&MCPA+clopyralid+MCPA +sethoxydim+MSO	.23&0.23+0.07&0.39+0.2+2p	19.9	53.7	16.6	53.9	13.7	53.9
Bentazon&sethoxydim+MSO	1&0.2+2pt	19.1	53.8	15.7	51.0	13.8	53.3
Untreated check		14.5	50.0	15.1	50.0	15.4	50.2
LSD (0.05)		2.8	0.9	2.8	0.9	2.8	0.9

[a]POSTA=June 2; POSTB=June 17; POSTC=June 28.

[b]Bromoxynil&MCPA=Bronate; Clopyralid&MCPA=Curtail M; Bentazon+sethoxydim=Rezult; MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN

Weed control in onion, Prosper, ND. Hatterman-Valenti, Greenland, Hendrickson, Larson, Ciernia, and Fronning. Onion were planted May 18 using a Stanhay precision planter. Pelleted seed (cv. Teton) were placed in paired 4-inch rows on 16-inch centers at a planting population of 200,000 seeds/A. The randomized complete bock design consisted of four double row plots, 20 feet long, with four replications. Preemergence and delayed preemergence applications were made May 18 (partly cloudy, 12.5 mph N, 63° F, 49% RH) and May 25 (mostly cloudy, 6 mph SE, 75° F, 24% RH) using a CO_2 pressurized backpack sprayer with XR8002 flat-fan nozzles delivering 17 gpa at 40 psi. Postemergence applications to l-leaf, 2-leaf, and 5-leaf onion were June 19, (sunny, 9 mph W, 73° F, 57% RH), July 5, (sunny, 4 mph N, 70° F, 33% RH) and July 24 (sunny, 3 mph SE, 7l° F, 71% RH) using a CO_2 pressurized bicycle sprayer with XR800L flat-fan nozzles delivering 8.5 gpa at 40 psi.

Variable germination and emergence made initial injury ratings difficult. However, by 7/5 stunting from weed competition and herbicide injury was obvious in the untreated plots and those receiving Axiom. Little or no injury was observed with Prowl applications PRE or to 1-leaf onion, or the Buctril delayed PRE application even though the labels restrict applications to 2-leaf or larger onion. Likewise, little onion injury was observed in Nortron or Valor treated plots. Nortron and Valor green foxtail control was reduced with time and would require a follow-up application of a registered P0 grass herbicide. Tank-mix application of Buctril + Goal (2-leaf) following the low rate of either Nortron or Valor did not improve common lambsquarter or redroot pigweed control. Dual Magnum, Prowl, Outlook, or Authority applied to 2-leaf onion did not injure onion and provided residual for late season weed control. An application of 28% UAN did not increase broadleaf control regardless of the amount applied. All treatments containing applications of Prowl, Fusiladc DX, and the tank-mix of Buctril + Goal provided excellent season-long control of the annual grasses and broadleaves present in the experiment. Further treatment separation using onion harvest data was unavailable due to widespread harvesting by unidentified individuals.

Table 1.

No	Treatment	Rate Product/A	Applic. Stage	Injury 6/14	Injury 7/5	Grft 6/14	Grft 7/5	Grft 8/2	Colq 6/14	Colq 7/5	Colq 8/2	Rrpw 6/14	Rrpw 7/5	Rrpw 8/2	Vowh 6/14	Vowh 7/5	Vowh 8/2
										%							
1	Prowl	24 oz	1-leaf	6	0	95	94	90	91	100	100	84	95	99	100	98	100
	28% UAN	20 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
	Prowl	32 oz	2-leaf														
2	Dacthal	10 lb	PRE	11	1	96	96	99	94	100	100	96	94	98	99	99	98
	28% UAN	20 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
	Prowl	32 oz	2-leaf														
3	Valor	1.5 oz	PRE	6	1	89	78	88	93	65	65	95	65	73	98	81	98
4	Valor	3 oz	PRE	9	8	86	89	81	98	90	85	99	85	85	93	95	91
5	Valor	1.5 oz	PRE	14	6	73	80	74	90	86	85	96	95	100	90	98	91
	Buctril + Goal	24 + 10 oz	2-leaf														
6	Nortron	64 oz	PRE	18	5	95	66	86	96	63	68	100	64	95	98	83	95
7	Nortron	128 oz	PRE	9	3	78	60	50	86	49	36	85	78	53	98	85	63
8	Nortron	64 oz	PRE	16	8	75	61	73	86	46	66	95	58	85	98	81	95
	Buctril + Goal	24 + 10 oz	2-leaf														
9	Axiom	20 oz	PRE	11	11	80	68	71	88	66	45	91	68	60	94	93	70
10	Axiom	40 oz	PRE	24	23	84	79	93	89	71	86	86	66	88	99	93	98
11	Axiom	20 oz	PRE	18	19	83	93	89	91	98	88	96	95	100	91	91	88
	Buctril + Goal	24 + 10 oz	2-leaf														
12	Buctril	16 oz	7-10 DAP	10	4	96	96	93	96	99	95	99	98	100	98	100	96
	Prowl	24 oz	2-leaf														
	28% UAN	20 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
	Prowl	32 oz	2-leaf														
13	Prowl	24 oz	1-leaf	9	4	95	96	93	98	100	100	83	88	95	98	98	98
	Urea	20 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
	Prowl	32 oz	2-leaf														
14	Prowl	24 oz	1-leaf	13	4	91	95	94	99	100	100	86	94	93	100	98	100
	28% UAN	15 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
	Prowl	32 oz	2-leaf														
15	Prowl	24 oz	1-leaf	13	5	96	96	91	71	95	94	75	94	89	100	100	100
	28% UAN	25 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
16	Prowl	24 oz	1-leaf	8	4	94	90	94	90	99	98	85	84	85	100	99	100
	28% UAN	20 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
	Dual Magnum	20.2 oz	2-leaf														
17	Prowl	24 oz	1-leaf	8	0	94	91	93	85	99	98	90	91	86	99	100	99
	28% UAN	20 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
	Outlook	21 oz	2-leaf														
18	Prowl	24 oz	1-leaf	6	0	96	95	93	91	98	100	79	99	98	100	98	100
	28% UAN	20 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
	Authority	4 oz	2-leaf														
19	Prowl	24 oz	1-leaf	6	0	95	84	81	96	94	98	91	74	86	100	100	100
	28% UAN	20 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2-leaf														
	Authority	4 oz	2-leaf														
20	Prowl	24 oz	PRE	6	1	96	100	99	85	98	90	91	94	100	99	98	98
	28% UAN	20 G	1-leaf														
	Fusilade DX	11.5 oz	1-leaf														
	Buctril + Goal	24 + 10 oz	2 & 5-leaf														
	Prowl	32 oz	2-leaf														
21	Untreated			16	21	0	0	0	0	0	0	0	0	0	0	0	0
	LSD 0.05			12	10	12	24	27	16	22	25	15	25	30	8	19	24

Onion Weed Control - Oakes. Richard Greenland, Harlene Hatterman-Valenti, Paul Hendrickson. Weed control is difficult in onions because onions do not compete well with weeds and few herbicides are available for onion production. In this experiment we looked at several new herbicide and herbicide combinations for use in onions, along with some new application timings for labeled herbicides. This study was on a Maddock sandy loam, pH of 7.5, and 2.0% organic matter. Teton onions and a barley living mulch were direct seeded into a fine seedbed on May 1. Onions were planted in paired rows (3 inches apart), with the paired rows on 16-inch centers. Two rows of barley were drilled between the paired rows. Seeding rate was 200,000 seeds/acre for onions and 1 bu/acre for the barley. Plots were 17 ft long by 8 ft wide. The experiment was overhead sprinkler irrigated. Fertilizer and fungicides were applied as needed.

Treatments (except POST2 and POST3) were applied with a CO_2 backpack sprayer using Al 110-04 flat fan nozzles, 45 gpa, 55 psi. The PRE1 treatment was on May 9. Some weeds and barley had emerged and were less than 1 inch tall (this application was later than desired). The PRE2 treatment was on May 11. The barley was 1 to 2 inches tall and weeds were less than 1 inch tall. The PRE3 application was on May 14. Barley was 4 inches tall, onions had sprouted but not emerged, and weeds were about 1 inch tall. The POST1 treatment was applied on May 29. The onions had all emerged and were 1 to 2 inches tall with some having 1 true leaf; barley was 9 inches tall and weeds were 1 to 4 inches tall. At POST2 (May 30), Poast + Dash (1.5 pt + 1 pt/acre) was applied with a tractor mounted sprayer with Al 110-04 flat fan nozzles, 36 gpa, 55psi. The barley was about 9 inches tall and vigorously growing. The POST3 application (20 gal of 28% N solution on all treatments) was on June 4 with a CO_2 backpack sprayer using 8002 flat fan nozzles and 65 psi. Onions had 1 true leaf. Weeds were 1 to 4 inches tall. The POST4 application was on June 12. Onions had 2 true leaves. Weeds were 2 to 8 inches tall. The POST5 application was on June 19. Onions had 3 true leaves. Most weeds were dead or dying from the Buctril + Goal treatment of June 12. The POST6 treatment was on June 29 when onions had 5 true leaves. Weeds were 1 to 6 inches tall. Some weeds that survived the POST4 treatment were regrowing. To better look at late season weed control, the plots were hand weeded on July 9. The Sept. 7 ratings show weeds that emerged after that date.

Summary. Axiom and Nortron were weak on lambsquarters and nightshades, but this may have been due, at least in part, to the late application. When combined with Buctril + Goal, both Axiom and Nortron gave good to excellent control of all weeds in the study. Valor gave good to excellent weed control. But Valor and Axiom reduced onion stand. Buctril, applied just before onions emerged gave excellent weed control. Authority had the best weed control late in the season, but it injured onions and delayed their maturity. A lower rate of Authority may reduce injury while still controlling weeds.

Table 1. Onion stand and injury, and weed ratings for June 4 and June 21.

Herbicides	Rates	Application timing	June 4 ratings						June 21 ratings					
			stand	injury	rrpw	colq	hns	ebns	stand	injury	rrpw	colq	hns	ebns
			0 to 10											
Prowl	1.5 pt	POST1	5.5	1.0	9.0	7.3	7.5	6.5	6.3	2.0	8.8	9.5	10.0	10.0
Prowl	1.5 pt	POST5												
Dacthal	8 lbs	PRE2	6.0	0.3	9.3	9.5	9.3	8.8	7.0	1.0	9.3	10.0	10.0	10.0
Prowl	1.5 pt	POST5												
Valor§	1.5 oz	PRE1	4.3	1.5	10.0	8.8	10.0	9.5	5.5	0.0	8.8	7.3	10.0	9.5
Valor§	3.0 oz	PRE1	3.8	1.3	10.0	9.3	9.5	8.8	4.5	0.5	9.5	8.8	10.0	9.8
Valor	1.5 oz	PRE1	5.5	1.0	9.8	8.5	10.0	9.8	5.8	1.5	10.0	9.8	10.0	10.0
Nortron§	1 lb	PRE1	5.8	0.3	9.8	8.0	8.8	8.8	7.0	0.3	9.5	6.5	8.3	8.0
Nortron§	2 lb	PRE1	7.3	0.0	9.8	9.0	8.8	9.0	7.3	1.0	10.0	7.0	9.0	9.0
Nortron	1 lb	PRE1	7.8	0.5	10.0	9.0	8.0	7.8	7.5	1.8	10.0	9.8	10.0	10.0
Axiom§	0.43 lb	PRE1	5.3	0.5	10.0	8.5	6.3	8.3	4.0	0.0	8.8	6.8	3.5	9.0
Axiom§	0.85 lb	PRE1	2.5	2.8	10.0	9.5	6.8	8.5	3.5	0.3	10.0	8.5	4.8	8.8
Axiom	0.43 lb	PRE1	4.3	0.0	9.5	8.5	6.8	8.3	4.5	3.0	10.0	8.3	10.0	10.0
Buctril	1 pt	PRE3	7.0	0.8	9.5	9.0	9.5	8.5	6.8	1.3	10.0	10.0	10.0	10.0
Prowl	1 pt	POST1												
Prowl	1.5 pt	POST5												
Prowl	1.5 pt	POST1	6.3	0.3	9.5	8.0	6.8	6.3	6.8	1.8	8.5	9.3	10.0	10.0
Dual II Mag	1 pt	POST5												
Prowl	1.5 pt	POST1	7.5	0.5	10.0	7.8	8.5	5.8	7.5	1.8	9.3	8.8	10.0	10.0
Outlook	1 pt	POST5												
Prowl	1.5 pt	POST1	5.5	0.0	9.0	8.0	8.0	4.5	6.8	2.3	10.0	9.3	10.0	10.0
Authority	4 oz	POST5												
Prowl	1.5 pt	POST1	6.3	0.3	8.8	8.5	7.8	6.8	7.3	2.0	7.8	9.8	10.0	10.0
Prowl	1.5 pt	PRE	7.3	0.0	8.3	10.0	9.0	8.5	7.0	1.3	8.5	10.0	10.0	10.0
Prowl	1.5 pt	POST5												
LSD (0.05)			2.4	1.2	NS	1.4	1.6	2.0	1.7	0.9	1.2	1.6	0.9	1.1
Probability			0.004	0.02	0.50	0.012	<.0001	<.0001	<.0001	<.0001	0.0004	<.0001	<.0001	0.025

All treatments were sprayed with 20 gal of undiluted 28% N solution at POST3, and Poast (1.5 pts) + surfactant at POST2 (to kill barley cover crop). Except for those marked with a "§", all treatments received Buctril + Goal (1.5 + 0.6 pts) POST4 and POST6.

PRE1 - after onions & barley were planted (May 9); PRE2 - just after barley emerged (May 11); PRE3 - just before onions emerged (May 14); POST1 - just after onions emerged (May 29); POST2 - when barley cover crop was 9 inches tall (May 30); POST3 - when onions had 1 true leaf (June 4); POST4 - when onions had two true leaves (June 12); POST5 - when onions had 3 true leaves (June 19); POST6 - when onions had 4 to 5 true leaves (June 29).

Table 2. Onion stand and injury, and weed ratings for July 4 and Sept. 7, and days to half-down.

Herbicides	Rates	Application timing	July 4 ratings						Sept. 7 ratings					Days to half-down
			stand	injury	rrpw	colq	hns	ebns	rrpw	colq	hns	ebns	copu	
			0 to 10											
Prowl Prowl	1.5 pt 1.5 pt	POST1 POST5	6.3	1.0	8.8	10.0	10.0	10.0	7.3	8.5	8.8	9.8	9.8	129
Dacthal Prowl	8 lbs 1.5 pt	PRE2 POST5	7.0	0.5	9.3	10.0	10.0	10.0	7.8	9.0	9.3	10.0	10.0	126
Valor§	1.5 oz	PRE1	6.3	0.0	8.3	6.5	9.8	8.5	6.3	8.5	8.8	9.8	7.3	128
Valor§	3.0 oz	PRE1	4.5	0.0	9.5	8.5	10.0	10.0	8.3	10.0	9.5	10.0	8.5	128
Valor	1.5 oz	PRE1	6.0	0.0	9.3	9.3	10.0	10.0	8.0	8.5	9.3	9.5	8.8	127
Nortron§	1 lb	PRE1	6.8	0.0	9.3	6.0	7.0	6.8	6.3	7.0	8.5	8.5	6.5	133
Nortron§	2 lb	PRE1	7.0	1.0	9.0	6.8	8.0	7.5	6.8	8.0	9.0	8.8	7.3	128
Nortron	1 lb	PRE1	8.0	0.8	10.0	9.8	10.0	10.0	8.3	8.3	8.8	9.0	9.3	129
Axiom§	0.43 lb	PRE1	3.8	0.8	8.5	6.8	3.0	8.8	4.0	8.0	8.5	10.0	5.5	129
Axiom§	0.85 lb	PRE1	2.5	0.3	9.0	7.8	2.5	8.5	5.0	9.0	8.5	9.0	4.5	133
Axiom	0.43 lb	PRE1	5.0	1.3	8.8	8.0	10.0	10.0	6.8	7.8	8.5	9.3	6.5	122
Buctril Prowl Prowl	1 pt 1 pt 1.5 pt	PRE3 POST1 POST5	7.0	0.5	9.8	10.0	10.0	10.0	8.0	8.8	8.5	9.8	9.5	127
Prowl Dual II Mag	1.5 pt 1 pt	POST1 POST5	7.0	1.0	9.0	9.8	10.0	10.0	7.8	9.0	8.3	9.8	9.3	126
Prowl Outlook	1.5 pt 1 pt	POST1 POST5	7.5	0.8	9.0	9.5	10.0	10.0	7.5	8.8	8.5	9.8	9.8	128
Prowl Authority	1.5 pt 4 oz	POST1 POST5	6.3	5.8	10.0	10.0	10.0	10.0	10.0	10.0	9.8	10.0	10.0	>150
Prowl	1.5 pt	POST1	7.0	0.8	6.8	10.0	10.0	10.0	7.3	7.8	8.5	9.5	8.3	129
Prowl Prowl	1.5 pt 1.5 pt	PRE POST5	7.3	1.0	8.8	10.0	10.0	10.0	7.8	9.5	8.5	9.5	9.5	125
LSD (0.05)			1.4	0.9	1.0	1.4	0.8	1.3	2.4	NS	NS	NS	1.8	5
Probability			<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.011	0.17	1.00	0.24	<.0001	<.0001

All treatments were sprayed with 20 gal of undiluted 28% N solution at POST3 and Poast (1.5 pts) + surfactant at POST2 (to kill barley cover crop). Except for those marked with a "§", all treatments received Buctril + Goal (1.5 + 0.6 pts) POST4 and POST6.

PRE1 - after onions & barley were planted (May 9); PRE2 - just after barley emerged (May 11); PRE3 - just before onions emerged (May 14); POST1 - just after onions emerged (May 29); POST2 - when barley cover crop was 9 inches tall (May 30); POST3 - when onions had 1 true leaf (June 4); POST4 - when onions had two true leaves (June 12); POST5 - when onions had 3 true leaves (June 19); POST6 - when onions had 4 to 5 true leaves (June 29).

Broadleaf weed control in onions, Carrington, 2001. (Hendrickson, Hatterman-Valenti, and Greenland) The trial was conducted at the NDSU Carrington Research Extension Center on a loam soil with a 7.9 pH and 3.1% organic matter. 'Teton' onions were seeded with a Stanhay vegetable planter on April 28, 2001 into 3-inch paired rows on 16-inch centers at 200,000 seeds/A. Onion emergence was on May 17, 2001. Individual plots were 8 x 25 ft arranged in a randomized complete block design with four replications. Herbicide treatments were applied with a $C0_2$ – hand boom sprayer delivering 20 gpa at 20 psi through XR 8003 flat fan nozzles except for bromoxynil + oxyfluorfen which were applied through XR 8005 nozzles delivering 50 gpa at 58 psi. Treatments that did not receive 28% N received 59 lb N/A applied as urea at the POST 2 timing. Application dates, environmental conditions, and onion growth stage at application are summarized in Table 1. Weeds evaluated were wild mustard, common lambsquarters, and redroot pigweed. The onions were pulled on September 26, bagged on October 4, and graded and weighed October 22-24.

Flumioxazin and flufenacet + metribuzin caused significant early season (6/1) injury and a reduction in the number of harvested bulbs and yield when compared to the standard treatment of pendimethalin at POST 1 and 4 and bromoxynil + oxyfluorfen at POST 3 and 5 (Tables 2 and 3). Moderate to acceptable injury (<25%) was observed for all other treatments (Table 2). A lack of weed control from ethofumesate resulted in a low number of harvest bulbs and yield (Tables 3 and 4). Following flumioxazin, ethofumesafe, and flufenacet + metribuzin with bromoxynil + oxyfluorfen resulted in an increase in yield and number of bulbs harvested over the respective treatment without bromoxynil + oxyfluorfen (Table 3).

Onion yield for the untreated check was 112 cwt/A with no bulbs greater than three inches in size (Table 3). Onion yield for the standard treatment, and bromoxynil applied PRE 2 followed by the standard treatment were 758 and 794 cwt/A, respectively. Flufenacet + metribuzin followed by bromoxynil + oxyfluorfen (384 cwt/A), flumioxazin followed by bromoxynil + oxyfluorfen (337 cwt/A), and bromoxynil followed by the standard treatment (315 cwt/A) provided the highest yields of 3 to 4 ½ inch onions. Although the results are not significant, flufenacet + metribuzin followed by bromoxynil + oxyfluorfen and flumioxazin followed by bromoxynil + oxyfluorfen tended to increased the percentage of onions with double centers. Prior to the POST 3 application of bromoxynil + oxyfluorfen, the soil was allowed to dry out to try and minimize crop injury from bromoxynil. This may have water stressed the plants, causing the low percentage of single centers in the trial.

Bromoxynil applied PRE 2 followed by the standard treatment, flumioxazin followed by bromoxynil + oxyfluorfen, and flufenacet + metribuzin followed by bromoxynil + oxyfluorfen provided excellent season-long weed control (table 4). For the standard treatment, replacing pendimethalin at POST 5 with metolachlor, dimethanamid, or sulfentrazone resulted in similar weed control and crop yield compared to the standard treatment (Tables 3 and 4). The addition of 28% N applied POST 2 at 20 gal/A to the standard treatment did not affect weed control or crop injury (Table 3).

In summary, flumioxazin and flufenacet + metribuzin caused unacceptable crop injury at Carrington. Ethofumesate provided poor weed control. Bromoxynil applied late PRE (PRE 2) provided excellent early season weed control with no visible crop injury. Further testing is needed to determine if bromoxynil applied PRE is a safe option for early season weed control in North Dakota onion production.

Table 1. Application data.

Application timing	Date	Temperature	Relative humidity	Wind speed	Onion growth stage
		F	%	mph	
PPI	4/28	57	57	8	
PRE 1	4/30	42	79	5	
PRE 2	5/13	50	95	5	
POST 1	5/24	50	87	6	cotyledon
POST 2	6/8	80	28	8	1.5 leaf
POST 3	6/21	69	46	4	3 to 3.5 leaf
POST 4	6/26	72	55	5	3.5 to 4 leaf
POST 5	7/5	68	57	7	4.5 to 5 leaf

Table 2. Onion Injury.

Treatment[a]	Rate	Application timing[c]	Onion 6/1	Onion 7/11	Onion 9/5
	lb ai/A[b]		% Injury		% TD[d]
DCPA / 28% N / bromoxynil + oxyfluorfen / pendimethalin	7.5 / 20 / 0.375 + 0.15 / 0.619	PRE1 / POST2 / POST3 & 5 / POST4	0	23	50
Flumioxazin	0.765	PPI	48	0	3
Flumioxazin	1.53	PPI	58	48	18
Flumioxazin / bromox + oxyf	0.765 / 0.375 + 0.15	PPI / POST3	60	0	43
Ethofumesate	1.5	PRE1	0	0	0
Ethofumesate	3	PRE1	0	0	0
Ethofumesate / bromox + oxyf	1.5 / 0.375 + 0.15	PRE1 / POST3	0	0	75
Flufenacet + metribuzin	0.5 + 0.13	PRE1	94	77	30
Flufenacet + metribuzin	1 + 0.26	PRE1	98	85	80
Flufenacet + metribuzin / bromox + oxyf	0.5 + 0.13 / 0.375 + 0.15	PRE1 / POST3	94	53	38
Bromoxynil / pendimethalin / 28% N / bromox + oxyf	0.25 / 0.619 / 20 / 0.375 + 0.15	PRE2 / POST1 & 4 / POST2 / POST3 & 5	0	20	68
Pendimethalin / bromox + oxyf	0.619 / 0.375 + 0.15	POST1 & 4 / POST3 & 5	0	20	83
Pendimethalin / 28% N / bromox + oxyf / metolachlor	0.619 / 20 / 0.375 + 0.15 / 0.595	POST1 / POST2 / POST3 & 5 / POST4	0	20	78
Pendimethalin / 28% N / bromox + oxyf / dimethenamid	0.619 / 20 / 0.375 + 0.15 / 0.469	POST1 / POST2 / POST3 & 5 / POST4	0	23	63
Pendimethalin / 28% N / bromox + oxyf / sulfentrazone	0.619 / 20 / 0.375 + 0.15 / 3	POST1 / POST2 / POST3 & 5 / POST4	0	23	55
Pendimethalin / 28% N / sulfentrazone	0.619 / 20 / 3	POST1 + POST2 / POST4	0	13	45
Pendimethalin / 28% N / bromox + oxyf	0.619 / 20 / 0.375 + 0.15	PRE1 & POST4 / POST2 / POST3 & 5	0	20	70
Untreated check			0	0	0
LSD (0.05)			12	12	27

[a]Treatments that did not receive 28% N receive 59 lb N/A applied as urea at the POST2 timing.

[b]28% N rates are gal/A.

[c]PPI=April 28, PRE1=April 30, PRE2=May 13, POST1=May 24, POST2=June 8, POST 3= June 21, POST4= June 26, POST5=July 5.

Table 3. Onion yield and grade response to herbicides.

Treatment[a]	Rate	Application timing[c]	Yield by grade and total yield							Harvested bulbs	Single centers
			<2 1/4"	2 1/4 to 3"	3 to 4"	4 to 4 1/2"	>4 1/2"	Total	Culls		
	lb ai/A[b]		cwt/acre							1000s/A	%
DCPA / 28% N / bromoxynil + oxyfluorfen / pendimethalin	7.5 / 20 / 0.375 + 0.15 / 0.619	PRE1 / POST2 / POST3 & 5 / POST4	57	395	222	0	0	674	0	186	40
Flumioxazin	0.765	PPI	43	50	9	0	0	101	0	60	63
Flumioxazin	1.53	PPI	24	54	156	5	0	239	18	57	43
Flumioxazin / bromox + oxyf	0.765 / 0.375 + 0.15	PPI / POST3	20	117	331	6	0	473	0	98	28
Ethofumesate	1.5	PRE1	70	20	0	0	0	90	2	105	60
Ethofumesate	3	PRE1	70	26	0	0	0	96	4	79	50
Ethofumesate / bromox + oxyf	1.5 / 0.375 + 0.15	PRE1 / POST3	97	413	103	0	0	613	1	192	50
Flufenacet + metribuzin	0.5 + 0.13	PRE1	44	67	57	0	0	168	9	56	58
Flufenacet + metribuzin	1 + 0.26	PRE1	8	14	44	0	0	66	6	16	60
Flufenacet + metribuzin / bromox + oxyf	0.5 + 0.13 / 0.375 + 0.15	PRE1 / POST3	6	53	371	13	0	443	5	71	25
Bromoxynil / pendimethalin / 28% N / bromox + oxyf	0.25 / 0.619 / 20 / 0.375 + 0.15	PRE2 / POST1 & 4 / POST2 / POST3 & 5	33	446	315	0	0	794	4	191	53
Pendimethalin / bromox + oxyf	0.619 / 0.375 + 0.15	POST1 & 4 / POST3 & 5	41	549	168	0	0	758	5	196	43
Pendimethalin / 28% N / bromox + oxyf / metolachlor	0.619 / 20 / 0.375 + 0.15 / 0.595	POST1 / POST2 / POST3 & 5 / POST4	50	466	235	0	0	751	0	188	48
Pendimethalin / 28% N / bromox + oxyf / dimethenamid	0.619 / 20 / 0.375 + 0.15 / 0.469	POST1 / POST2 / POST3 & 5 / POST4	67	501	162	0	0	730	2	200	45
Pendimethalin / 28% N / bromox + oxyf / sulfentrazone	0.619 / 20 / 0.375 + 0.15 / 3	POST1 / POST2 / POST3 & 5 / POST4	63	395	268	0	0	726	0	191	55
Pendimethalin / 28% N / sulfentrazone	0.619 / 20 / 3	POST1 + POST2 / POST4	87	434	86	0	0	607	1	189	55
Pendimethalin / 28% N / bromox + oxyf	0.619 / 20 / 0.375 + 0.15	PRE1 & POST4 / POST2 / POST3 & 5	85	425	118	0	0	628	0	191	40
Untreated check			64	48	0	0	0	112	0	79	65
LSD (0.05)			49	118	131	ns	ns	159	59	38	ns

[a]Treatments that did not receive 28% N receive 59 lb N/A applied as urea at the POST2 timing.

[b]28% N rates are gal/A.

[c]PPI=April 28, PRE1=April 30, PRE2=May 13, POST1=May 24, POST2=June 8, POST 3= June 21, POST4= June 26, POST5=July 5.

Table 4. Weed control.

Treatment[a]	Rate	Application timing[c]	Wild Mustard			Common lambsquarters			Redroot pigweed		
	lb ai/A[b]		6/1	7/11	9/5	6/1	7/11	9/5	6/1	7/11	9/5
			%								
DCPA / 28% N / bromoxynil + oxyfluorfen / pendimethalin	7.5 / 20 / 0.375 + 0.15 / 0.619	PRE1 / POST2 / POST3 & 5 / POST4	24	38	5	24	33	5	24	45	5
Flumioxazin	0.765	PPI	66	70	65	74	78	74	74	80	78
Flumioxazin	1.53	PPI	88	93	98	94	85	90	85	96	86
Flumioxazin / bromox + oxyf	0.765 / 0.375 + 0.15	PPI / POST3	0	0	0	48	0	0	48	0	0
Ethofumesate	1.5	PRE1	8	0	0	65	0	0	65	0	0
Ethofumesate	3	PRE1	0	35	70	50	70	83	50	74	83
Ethofumesate / bromox + oxyf	1.5 / 0.375 + 0.15	PRE1 / POST3	95	98	100	95	96	100	96	100	69
Flufenacet + metribuzin	0.5 + 0.13	PRE1	100	100	100	100	100	94	100	100	78
Flufenacet + metribuzin	1 + 0.26	PRE1	100	99	100	100	98	100	100	100	99
Flufenacet + metribuzin / bromox + oxyf	0.5 + 0.13 / 0.375 + 0.15	PRE1 / POST3	0	95	96	0	95	93	0	95	89
Bromoxynil / pendimethalin / 28% N / bromox + oxyf	0.25 / 0.619 / 20 / 0.375 + 0.15	PRE2 / POST1 & 4 / POST2 / POST3 & 5	100	100	100	100	100	100	100	100	100
Pendimethalin / bromox + oxyf	0.619 / 0.375 + 0.15	POST1 & 4 / POST3 & 5	0	100	100	0	99	96	0	100	85
Pendimethalin / 28% N / bromox + oxyf / metolachlor	0.619 / 20 / 0.375 + 0.15 / 0.595	POST1 / POST2 / POST3 & 5 / POST4	0	100	100	0	100	100	0	100	100
Pendimethalin / 28% N / bromox + oxyf / dimethenamid	0.619 / 20 / 0.375 + 0.15 / 0.469	POST1 / POST2 / POST3 & 5 / POST4	0	100	100	0	100	100	0	100	99
Pendimethalin / 28% N / bromox + oxyf / sulfentrazone	0.619 / 20 / 0.375 + 0.15 / 3	POST1 / POST2 / POST3 & 5 / POST4	0	100	100	0	100	99	0	100	93
Pendimethalin / 28% N / sulfentrazone	0.619 / 20 / 3	POST1 + POST2 / POST4	0	100	100	0	100	100	0	100	100
Pendimethalin / 28% N / bromox + oxyf	0.619 / 20 / 0.375 + 0.15	PRE1 & POST4 / POST2 / POST3 & 5	0	30	10	0	48	86	0	48	88
Untreated check			0	0	0	0	0	0	0	0	0
LSD (0.05)			20	10	21	22	10	12	22	9	22

[a]Treatments that did not receive 28% N received 59 lb N/A applied as urea at the POST 2 timing.
[b]28% N rates are gal/A.
[c]PPI=April 28, PRE 1=April 30, PRE 2=May 13, POST 1=May 24, POST 2=June 8, POST 3= June 21, POST 4= June 26, POST 5=July 5.

Dimethenamid-P for weed control in potato, Dawson. (Kegode, Ciernia and Fronning). The purpose of this experiment was to evaluate dimethenamid-P and dimethenamid-P tank mixes as preemergence herbicides in irrigated potato. "Russet Burbank" potato was planted May 19 in hilled rows 38 in. wide. Plots were 4 rows wide, 25 ft. long, and set up as a RCBD with 4 reps. Treatments were applied June 8 to the center 2 rows of the plot with a 4-nozzle bicycle wheel plot sprayer delivering 17 gpa at 40 psi through XR8002 tips. At application air temperature was 86 F, RH 30%, wind SW at 2 mph, sky sunny, and the soil surface was dry. Some potato had emerged by application causing some injury. Weed control evaluations were made visually and maintenance insecticides and fungicides were applied as needed. All plots were vine killed prior to harvest and 1 row per plot was harvested for total yield on Sept. 25.

		6/26				8/21				
Treatment	Rate	Injury	Foxtail	Wibw	Wimu	Injury	Foxtail	Wibw	Wimu	Yield
	oz ai/A	%				%				cwt/A
Dimethenamid-P	10.5	0	99	29	68	0	99	100	100	396
Metribuzin	15.6	0	98	100	100	0	100	100	100	384
Dimethenamid-P + Metribuzin	10.5 + 15.6	0	100	100	100	0	100	100	100	361
Pendimethalin	24	0	96	31	35	0	95	100	100	338
Dimethenamid-P + Pendimethalin	10.5 + 24	1	100	91	100	0	100	96	100	387
Rimsulfuron	0.37	0	97	59	91	0	100	96	100	424
Dimethenamid-P + Rimsulfuron	10.5 + 0.37	0	100	91	94	0	100	100	100	352
Sulfentrazone	3	8	98	100	97	0	100	100	100	372
Dimethenamid-P + Sulfentrazone	10.5 + 3	24	100	100	100	0	100	100	100	285
Metolachlor	22.8	0	100	34	55	0	100	93	100	352
Untreated		-	-	-	-	-	-	-	-	395
LSD 5%		5	NS	22	24	NS	NS	NS	NS	NS

The early injury symptoms due to sulfentrazone were most likely due to there being some emerged plants at application. Excellent foxtail control was achieved with all treatments. Dimethenamid-P needed to be tank mixed with a broadleaf herbicide to get adequate wild buckwheat and wild mustard control early in the season. The lush crop canopy resulting from frequent irrigation helped with weed control late in the season and thus no significant differences in yield were detected.

Dimethenamid-P for weed control in potato, Carrington. (Kegode, Ciernia, Fronning, and Hendrickson). The purpose of this experiment was to evaluate dimethenamid-P and dimethenamid-P tank mixes for crop safety in irrigated potato. "Russet Burbank" potato was planted May 2 in hilled rows 38 in. wide. Plots were 4 rows wide, 25 ft. long, and set up as a RCBD with 6 reps. Treatments were applied May 31 to the center 2 rows of the plot with a shielded 4-nozzle bicycle wheel plot sprayer delivering 17 gpa at 40 psi through XR8002 tips. At application air temperature was 73 F, RH 46%, wind NW at 11 mph, soil surface dry, and the sky cloudy with some intermittent rain. Crop injury evaluations were made visually and maintenance insecticides and fungicides were applied as needed. The field was kept weed free with hand labor during the growing season. All plots were vine killed prior to harvest and 1 row per plot was harvested for graded yield on Oct.2.

					Yield					
					Grade					
Treatment	Rate	6/21	7/9	8/21	1	2	3	4	5	Total
	oz ai/A	% injury			cwt/A					
Dimethenamid-P	10.5	0	0	0	0	2	36	55	53	145
Metribuzin	15.6	0	0	0	0	3	57	60	63	183
Dimethenamid-P + Metribuzin	10.5 + 15.6	0	0	0	0	6	46	58	50	160
Pendimethalin	24	0	0	0	0	6	54	55	60	178
Dimethenamid-P + Pendimethalin	10.5 + 24	1	0	0	0	8	60	66	68	201
Rimsulfuron	0.37	0	0	0	0	4	50	50	51	156
Dimethenamid-P + Rimsulfuron	10.5 + 0.37	0	0	0	0	6	46	48	58	157
Sulfentrazone	3	8	0	0	0	5	40	51	55	151
Dimethenamid-P + Sulfentrazone	10.5 + 3	24	0	0	0	5	42	57	54	158
Metolachlor	22.8	0	0	0	0	7	48	61	69	184
Untreated		-	-	-	0	1	41	58	62	162
LSD 5%		1	NS	NS	NS	NS	NS	NS	NS	NS

Early injury with the sulfentrazone treatment was presumably because some potatoes were emerging at time of herbicide application. All treatments, however, showed excellent crop safety by the second evaluation. No significant differences were found in potato yield, which were relatively low because the ground was too dry for harvesting at the appropriate depth. Thus, harvesting was from shallower depth and uniform for all treatments.

Sulfentrazone for weed control in potato, Dawson. (Kegode, Ciernia, and Fronning). This study investigated sulfentrazone and sulfentrazone tank mixes for weed control in irrigated potato. "Russet Burbank" potato was planted May 19 in hilled rows 38 in. wide. Plots were 4 rows wide, 25 ft. long, and set up as a RCBD with 4 reps. Treatments were applied June 8 to the center 2 rows of the plot with a 4-nozzle bicycle wheel plot sprayer delivering 17 gpa at 40 psi through XR8002 tips. At application, air temperature was 77 F, RH 49%, wind SW at 3 mph, sky sunny, and the soil surface dry. Weed control evaluations were made visually and maintenance insecticides and fungicides were applied as needed. All plots were vine killed prior to harvest and 1 row per plot was harvested for total yield Sept. 25.

		June 26				July 12				Aug 2				
Treatment	Rate	Inj	Grft	Wibw	Wimu	Inj	Grft	Wibw	Wimu	Inj	Grft	Wibw	Wimu	Yield
	oz ai/A							%						cwt
Sulfentrazone	3	0	92	100	90	0	77	99	75	0	79	100	100	257
Sulfentrazone + metolachlor	3 + 15.2	2	90	100	81	2	81	98	86	0	91	95	70	234
Sulfentrazone + rimsulfuron	3 + 0.25	0	98	100	100	0	93	100	98	0	90	99	92	258
Sulfentrazone + metribuzin	3 + 4	2	95	99	100	0	90	96	99	0	83	100	100	276
Sulfentrazone	6	5	99	100	97	5	86	96	86	0	90	99	92	242
Untreated	0	-	-	-	-	-	-	-	-	-	-	-	-	229
LSD (0.05)		3	NS	NS	NS	3	NS	NS	NS	NS	NS	NS	NS	NS

There was minimal potato injury at the first two evaluations and none by the final evaluation. Control of green foxtail was slightly lower then wild buckwheat and wild mustard. Comparison of treatments on control of all weed species did not yield significant results.

Preemergence weed control in potato, Crookston. (Kegode, Ciernia, and Fronning). The purpose of this experiment was to evaluate several preemergence herbicides for weed control in dryland potato. "Red Norland" potato was planted May 17 in hilled rows 38 in. wide. Plots were 4 rows wide, 25 ft. long, and set up as a RCBD with 4 reps. Treatments were applied June 7 to the center 2 rows of the plot with a 4-nozzle bicycle wheel plot sprayer delivering 17 gpa at 40 psi through XR8002 tips. At application, air temperature was 66 F, RH 53%, wind SW at 2 mph, sky partly cloudy, and the soil surface was damp. Weed control evaluations were made visually and maintenance insecticides and fungicides were applied as needed. The field lacked a consistent stand of broadleaf weeds. The experiment was not harvested.

		June 27			Aug 2		
Treatment	Rate	Injury	Fxtl	Wioa	Injury	Fxtl	Wioa
	oz ai/A	% control					
Sulfentrazone	3	0	70	31	0	70	59
Sulfentrazone	4	0	90	59	0	76	73
Flumioxazin	1	4	83	56	0	54	74
Flumioxazin	1.5	11	92	74	0	64	94
Dimethenamid-P	10.5	0	90	55	0	78	69
Dimethenamid-P	16	0	93	64	0	79	74
Rimsulfuron	0.357	0	69	70	0	59	86
Metolachor	30.4	0	96	86	0	90	90
Metribuzin	16	0	94	79	0	98	97
LSD 5%		2	13	30	NS	23	32

Flumioxazin caused significant crop injury by the first evaluation, and no injury by the second evaluation. Generally among treatments, foxtail control was relatively higher at the first evaluation, and was lower by the second evaluation. In contrast, wild oat control was generally higher at the second evaluation when compared to the first.

Nightshade control in potato, Gwinner. (Kegode, Ciernia, and Fronning). Several preemergence herbicides were evaluated for eastern black nightshade control in irrigated potato. "Russet Burbank" potato was planted May 3 in hilled rows 38 in. wide. Plots were 4 rows wide, 25 ft. long, and set up as a RCBD with 4 reps. Treatments were applied May 22 to the center 2 rows of the plot with a 4-nozzle bicycle wheel plot sprayer delivering 17 gpa at 40 psi through XR8002 tips. At application air temperature was 55 F, RH 30%, wind NW at 15 mph, sky cloudy, and the soil surface was dry. Some cotyledon nightshades as well as common lambsquarters seedlings were present at application. Weed control evaluations were made visually and the farmer cooperator applied maintenance pesticides. The experiment was not harvested.

		June 21			July 31		
Treatment	Rate	Injury	Ebns	Colq	Injury	Ebns	Colq
	oz ai/A			%			
Sulfentrazone	3	1	90	100	0	100	100
Sulfentrazone	4	1	95	100	0	100	100
Flumioxazin	1	22	100	100	0	100	98
Flumioxazin	1.5	38	100	100	0	100	100
Dimethenamid-P	10.5	0	89	58	0	71	78
Dimethenamid-P	16	1	83	60	0	100	95
Sulfentrazone + metribuzin	3 + 8	0	98	100	0	98	100
Flumioxazin + metribuzin	1 + 8	20	100	100	0	100	99
Dimethenamid-P + metribuzin	10.5 + 8	1	94	100	0	100	100
Metribuzin + metolachlor	8 + 22.8	0	97	93	0	100	100
LSD 5%		8	10	19	NS	11	12

Significant potato injury was observed at the first evaluation date and none by the time of the second evaluation. Eastern black nightshade and common lambsquarters control was excellent for all treatments except dimethenamid-P at 10.5 oz/A.

All flumioxazin treatments gave significant crop injury. All treatments except dimethenamid-P gave good common lambsquarters control. EBNS was controled best by flumioxazin early in the season but all treatments except the low rate of dimethenamid-P showed good ebns control at the second evaluation.

Potato Desiccants on Russet Burbank at Dawson, ND. Harlene Hatterman-Valenti and Wayne Larson. An experiment was conducted on an irrigated site near Dawson, ND to evaluate potato desiccation from labeled and experimental herbicides. The field was chisel plowed prior to planting May 12, 2001. Fertilizer, irrigation, insecticides, and fungicides were applied as needed. Desiccant herbicides were applied September 11 at 11:30 with an average wind speed of 6 mph NE, 68% RH, 70° F, and partly cloudy skies. Vines were at the beginning of natural senescence. All treatments were applied to the middle rows of a 4-row plot with a CO_2 ATV sprayer. Delivery rate for treatments containing F8426 was 40 gpa at 40 psi through 8004 flat-fan nozzles while other treatments were applied with a delivery rate of 20 gpa at 40 psi through 8002 flat-fan nozzles. Repeat applications at a 7-day interval were made for all F8426 treatments and Reglone alone. Treatments 21 and 22 received sequential applications at a 7-day interval as indicated in table 1. Sequential/repeat applications were made September 18 at 1:00 with an average wind speed of 4 mph SE, 72% RH, 63° F, and clear skies. Plots were four 25-ft long rows with 36-inch row spacing. The experiment was a randomized complete block design with three replicates.

Initial evaluations indicated that any treatment with Desicate II (F8426 + MSO + Desicate II, Desicate II, Desicate II + Rely, and Desicate II + Reglone provided statistically similar to the standard two applications of Reglone. The greatest burn leaf burn occurred with Desicate II at 64 oz/A and Desicate II + Reglone (48 + 24 oz/A). Evaluations on September 25 indicated that all treatments except F8426 + MSO (1.6 oz/A), F8426 + Silicone (2.4 and 3.2 oz/A), and F8426 40 DF + COC (0.094 lb/A) provided greater than 85% and 62% leaf and stem desiccation, respectively. Greatest leaf and stem desiccation occurred with Desicate II (64 oz/A) with 98% and 82%, respectively. Skin set measurements taken on three tubers and 4 different locations showed no differences between treatments. Likewise, no stem discoloration was observed. Total tuber harvest, marketable harvest, and specific gravity varied only slightly with no consistent trend.

Table 1. Leaf / stem desiccation 1 and 2 wks after initial desiccant application and potato skin set at harvest.

Treatment[a]	Rate	Desiccation (%) 1 & 2 WAA				Skin Set (PSI)		
	Product/A	Leaf	Stem	Leaf	Stem	Sample1	Sample2	Sample3
Untreated[b]		0	0	15	5	42	41	49
F8426 + MSO	**1.6 oz**	5	5	50	23	54	56	52
F8426 + Silwet	**1.6 oz**	20	13	85	65	52	54	53
F8426 + MSO	**2.4 oz**	20	18	85	53	48	57	58
F8426 + Silwet	**2.4 oz**	22	20	78	47	46	49	53
F8426 + MSO	**3.2 oz**	37	22	82	62	60	56	53
F8426 + Silwet	**3.2 oz**	23	15	78	57	62	57	54
F8426 + MSO + DesicateII	**2.4 + 32 oz**	60	40	98	75	54	47	49
F8426 + MSO + DesicateII	**3.2 + 32 oz**	63	43	98	78	56	49	55
F8426 + MSO + Reglone	**1.6 + 16 oz**	37	20	88	55	54	52	62
F8426 + MSO + Reglone	**2.4 + 16 oz**	55	28	95	78	54	54	54
F8426 + MSO + Reglone	**3.2 + 16 oz**	35	23	88	58	59	59	63
F8426[c] + COC	**0.094 lb**	20	17	73	52	49	53	52
F8426[d] + COC	**2.4 oz**	42	23	88	63	47	107	54
Rely + AMS	**48 oz**	45	15	87	68.3	49	52	51
Rely + AMS + SuperTin	**48 + 3.75 oz**	50	13	87	72	58	55	50
Rely	**48 oz**	40	12	95	75	54	48	53
Rely + SuperTin	**48 + 3.75 oz**	52	17	97	63	57	64	59
Reglone + NIS	**16 oz**	50	23	93	67	54	59	48
Desicate II + AMS	**64 oz**	83	40	98	82	51	50	46
Desicate II + AMS + Reglone + NIS (2nd appl.)	**48 + 24 oz**	82	33	92	73		61	62
Desicate II + AMS + Rely	**32 + 16 oz**	77	33	97	65	50	50	51
Reglone + NIS	**24 oz**	75	42	98	78	57	54	51
LSD 0.05		26	15	18	22	15	36	12

[a] MSO is a methylated seed oil at 1 qt/A; Silwet is a surfactant with silicone at 1 pt/A; AMS is ammonium sulfate at 3 lb/A, COC is a crop oil concentrate at 0.5% v:v; and NIS is a non ionic surfactant at 0.25% v:v.

[b] Untreated plots were mechanically topped just prior to harvest on September 26.

[a] MSO is a methylated seed oil at 1 qt/A; Silwet is a surfactant with silicone at 1 pt/A; AMS is ammonium sulfate at 3 lb/A, COC is a crop oil concentrate at 0.5% v:v; and NIS is a non ionic surfactant at 0.25% v:v.

[b] Untreated plots were mechanically topped just prior to harvest on September 26.

[c] F8426 40 DF

[d] F8426 2 EW

Table 2. Estimated treatment yields and quality characteristics.

Treatment[a]	Rate Product/A	Spec. Gravity	Estimated treatment yield (cwt/A) 4-6 oz.	6-10 oz.	10-16 oz.	> 16 oz.	Total	US #1
Untreated[b]		1.0792	162	120	23	7	357	304
F8426 + MSO	**1.6 oz**	1.0772	113	99	79	0	311	291
F8426 + Silwet	**1.6 oz**	1.0791	148	129	65	0	369	342
F8426 + MSO	**2.4 oz**	1.0724	153	124	97	0	412	375
F8426 + Silwet	**2.4 oz**	1.0746	125	123	67	11	353	315
F8426 + MSO	**3.2 oz**	1.0770	153	132	58	0	380	343
F8426 + Silwet	**3.2 oz**	1.0827	144	113	70	0	354	326
F8426 + MSO + DesicateII	**2.4 + 32 oz**	1.07693	114	103	68	0	310	285
F8426 + MSO + DesicateII	**3.2 + 32 oz**	1.07923	130	126	80	0	365	336
F8426 + MSO + Reglone	**1.6 + 16 oz**	1.0762	116	101	77	2	329	295
F8426 + MSO + Reglone	**2.4 + 16 oz**	1.0791	168	122	55	0	385	345
F8426 + MSO + Reglone	**3.2 + 16 oz**	1.0741	143	121	65	0	364	329
F8426[c] + COC	**0.094 lb**	1.0808	146	124	42	2	341	312
F8426[d] + COC	**2.4 oz**	1.0790	139	101	98	0	364	339
Rely + AMS	**48 oz**	1.0801	186	145	63	0	441	393
Rely + AMS + SuperTin	**48 + 3.75 oz**	1.0720	133	124	68	0	356	326
Rely	**48 oz**	1.0759	145	138	66	2	376	348
Rely + SuperTin	**48 + 3.75 oz**	1.0827	125	118	67	0	342	310
Reglone + NIS	**16 oz**	1.0742	150	112	66	0	365	327
Desicate II + AMS	**64 oz**	1.0790	173	137	76	0	432	387
Desicate II + AMS + Reglone + NIS (2nd appl.)	**48 + 24 oz**	1.0752	127	118	105	0	381	350
Desicate II + AMS + Rely	**32 + 16 oz**	1.0748	154	102	66	0	352	322
Reglone + NIS	**24 oz**	1.0761	137	123	63	0	356	323
LSD 0.05		0.0066	54	43	46	4	103	97

[a] MSO is a methylated seed oil at 1 qt/A; Silwet is a surfactant with silicone at 1 pt/A; AMS is ammonium sulfate at 3 lb/A, COC is a crop oil concentrate at 0.5% v:v; and NIS is a non ionic surfactant at 0.25% v:v.

[b] Untreated plots were mechanically topped just prior to harvest on September 26.

[c] F8426 40 DF

[d] F8426 2 EW

Quad 7 as an adjuvant with selected SU'S for weed control in safflower, Williston 2001. (Neil Riveland, Gordon Bradbury). This experiment was conducted to evaluate Quad 7, a basic blend adjuvant,for use with selected SU's for weed control in safflower. 'Finch' safflower was planted on May 11 on land cropped to canola in 2000 in 7.5 inch rows at 30 lbs/a. Treatments were applied on June 29 to 6 to 8-leaf safflower, 1 to 6 inch Russian thistle with 86 F, 31% RH, clear sky, and 5-10 mph W wind with damp topsoil at 75 F. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed density for Russian thistle was 2-3 plts/ft^2. Assure II + MSO was applied to all plots to control green foxtail on June 17. Plots were evaluated on July 24. Safflower was machine harvested on September 27.

Treatment[a]	Rate	Crop Inj.	Crtl Ruth	Test Weight	Seed Oil	Yield
	oz ai/ac	----%	-----	lbs/b	%	lbs/ac
Harm.GT+Act.90	0.125+0.25%	1	77	41.5	34.6	773
Harm.GT+Quad 7	0.125+0.25%	0	88	41.2	35.1	863
Harm.GT+Quad 7	0.125+0.5%	3	95	41.3	35.1	790
Harm.GT+Quad 7	0.125+1.0%	2	94	41.3	34.8	747
Harm.GT+MSO	0.125+0.25G	4	93	41.3	35.0	739
Harm.GT+Act.90	0.15+0.25%	1	85	41.7	35.4	794
Harm.GT+Quad 7	0.15+0.25%	1	93	41.5	35.4	783
Ally+Act.90	0.04+0.25%	2	81	40.7	34.8	721
Ally+Quad 7	0.04+0.25%	6	94	41.3	34.8	779
Ally+Act.90	0.05+0.25%	7	93	41.7	35.2	776
Ally+Quad 7	0.05+0.25%	7	97	41.5	35.0	795
Glean+Act.90	0.125+0.25%	1	91	41.2	34.5	838
Glean+Quad 7	0.125+0.25%	4	95	40.9	34.6	786
Weedy Control	0	0	0	40.1	33.8	696
C.V. %		104	4	1.1	1.3	10
LSD 5%		4	5	NS	NS	NS
# OF REPS		4	4	2	2	4

[a] - Act90 = Activator 90 nonionic surfactant from Loveland
Quad 7 = Basic blend adjuvant from AGSCO

Summary: The addition of Quad 7 to Harmony GT and Ally applied at the lowest application rates increase Russian thistle control compared to using Activator 90 with each of those herbicide rates.

Safflower response to Starane, Williston, 2001. (Neil Riveland, Gordon Bradbury). This experiment was conducted to evaluate safflower response to Starane and combinations with selected SU herbicides. 'Finch' safflower was planted on May 11 on land cropped to canola in 2000 in 7.5 inch rows at 30 lbs/a. Treatments were applied on June 29 to 6 to 8-leaf safflower, 1 to 6 inch Russian thistle, 4 to 6 leaf volunteer canola (VCano) with 83 F, 40% RH, clear sky, and 6-10 mph W wind with damp topsoil at 75 F. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed populations ranged from 1 to 4 plts/ft^2 for common lambsquarters,3-5 plts/ft^2 for Russian thistle and 1-5 plts/ft^2 volunteer canola. Assure II + MSO was applied to all plots to control green foxtail on June 17. Plots were evaluated on July 24 and on September 27. Safflower was machine harvested on September 27.

				Weed Control					
		Crop Injury		---- 7/24 -----			Test	Seed	
Treatment[a]	Rate	7/24	9/27	Ruth	VCano	CoLq	Weight	Oil	Yield
	oz ai/ac	--- % ---		----- % ------			lbs/b	%	lb/ac
Starane	1.0	13	23	23	6	0	40.2	33.8	412
Starane	1.5	60	55	30	13	0	38.5	33.2	204
Starane	1.75	39	43	43	22	0	35.0	33.5	356
Starane	2.0	49	63	48	29	0	39.0	33.0	216
Harm.GT+Star+Act90	0.125+1.5+0.25%	48	46	83	56	85	39.8	33.4	443
Harm.GT+Star+Act90	0.15+1.0+0.25%	20	13	89	58	79	41.3	34.3	561
Harm.GT+Star+Act90	0.15+1.5+0.25%	59	78	85	70	86	39.9	32.5	317
Harm.GT+Star+Act90	0.1875+1.0+0.25%	63	63	91	74	90	40.4	33.2	390
Harm.GT+Star+Act90	0.1875+1.5+0.25%	64	69	92	75	92	40.0	32.8	330
Glean+Starane+ACT	0.125+1.5+0.25%	70	68	92	94	96	39.3	31.9	270
Glean+Starane+ACT	0.15+1.0+0.25%	78	70	96	91	95	39.9	32.9	297
Ally+Starane+Act90	0.04+1.5+0.25%	76	63	96	98	96	40.6	32.7	454
Ally+Starane+Act90	0.05+1.0+0.25%	88	75	95	97	97	39.4	32.1	226
Harm.GT+ACT	0.1875+0.25%	4	9	84	90	94	41.2	33.9	672
Glean+ACT	0.15+0.25%	3	6	96	98	97	40.9	34.2	729
Ally+ACT	0.05+0.25%	10	8	96	97	97	41.4	34.1	773
Aim+ACT	0.2+0.25%	24	30	78	40	86	40.5	33.9	500
Weedy Control	0	0	0	0	0	0	39.9	32.5	770
C.V. %		27	32	9	30	11	5.5	2.5	25
LSD 5%		16	20	9	26	10	NS	NS	157
# OF REPS		4	4	4	4	4	2	2	4

[a] - Act90 = Activator 90 nonionic surfactant from Loveland.

Summary: Severe crop injury occurred when Starane alone or in combination with selected SU's were applied to safflower. Aim also injured safflower.

Broadleaf weed control in safflower, Williston. 2001. (Neil Riveland, Gordon Bradbury). This experiment was conducted to evaluate Russian thistle control and safflower response to selected SU herbicides. 'Finch' safflower was planted on land cropped to canola in 2000 on May 11 in 7.5 inch rows at 30 lbs/a. Treatments were applied on June 25 to 4-8 leaf safflower, 3-5 inch common lambsquarters, 4-6 inch volunteer canola and 1 to 2 inch Russian thistle with 82 F, 32% RH, mostly clear sky, and 5-10 mph N wind with damp topsoil at 70 F. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed densities ranged from 1 to 4 plants/ft^2 for common lambsquarters, >5 plants/ft^2 for Russia thistle and < 2 plt/ft^2 for volunteer canola. Assure II + MSO was applied to all plots to the grassy weeds on June 12. Plots were evaluated for crop injury on July 4, on July 24 for crop injury and weed control and on September 27 for crop injury. Safflower was machine harvested on September 27.

		Crop Injury			- Weed Control -			Test	Seed	
Treatment[a]	Rate	7/4	7/24	9/27	Ruth	Colq	Vcano	Weight	Oil	Yield
	oz ai/ac	------	%	------	----	%	--------	lbs/b	%	lb/a
Harm.GT+Act90	0.094+0.25%	0	0	1	66	33	50	40.9	33.6	877
Harm.GT+Act90	0.125+0.25%	0	0	5	79	43	63	40.1	33.7	877
Harm.GT+Act90	0.15+0.25%	1	0	5	83	45	50	40.7	33.9	890
Harm.GT+Act90	0.1875+0.25%	3	4	10	90	58	58	40.1	33.8	781
Harm.GT+Act90	0.25+0.25%	3	1	8	94	59	77	40.5	34.0	855
Ally+Act90	0.03+0.25%	1	2	8	65	69	70	39.9	34.1	841
Ally+Act90	0.04+0.25%	2	1	9	84	85	60	39.9	34.1	893
Ally+Act90	0.05+0.25%	6	5	10	80	93	86	40.5	35.0	874
Ally+Act90	0.06+0.25%	10	9	18	91	94	92	40.3	34.4	854
Glean+Act90	0.094+0.25%	0	0	3	74	65	88	40.1	33.7	931
Glean+Act90	0.125+0.25%	0	0	6	87	89	95	40.0	33.8	938
Glean+Act90	0.15+0.25%	2	3	5	89	84	95	40.3	34.2	926
Glean+Act90	0.1875+0.25%	4	1	4	91	93	96	40.7	33.5	884
Finesse+Act90	0.125+0.25%	8	8	10	94	88	93	40.4	34.2	785
Finesse+Act90	0.15+0.25%	10	9	11	96	89	94	40.0	34.0	784
Finesse+Act90	0.1875+0.25%	15	16	20	98	97	99	39.8	34.5	703
Weedy Control	0	0	0	0	0	0	0	37.5	32.6	457
C.V. %		86	81	107	8	14	14	1.5	2.0	13
LSD 5%		5	4	NS	9	14	17	1.3	NS	149
# OF REPS		4	4	4	4	4	3	2	2	4

[a] - Act90 = Activator 90 NIS from Loveland Industries.

Summary: Treatments increased crop yield from 53% to 105% compared to the weedy control. Finesse and Ally caused significant crop injury. The highest rates of each treatment showed the most injury. Because of the dry weather, crop injury was most evident at harvest, though more variable.

Broadleaf weed control in an SU tolerant safflower, Williston. 2001. (Neil Riveland, Gordon Bradbury). This experiment was conducted to evaluate kochia and Russian thistle control and crop response to Starane and selected SU herbicides. '94B2869' safflower, an experimental safflower selection that is very tolerant to some SU herbicides that normally destroy safflower, was planted notill on May 11 on land cropped to durum in 2000 in 7.5 inch rows at 30 lbs/a. Treatments were applied on June 25 to 4 to 6-leaf safflower, 3-4 leaf green foxtail, 1 to 3 inch Russian thistle, 1 to 6 inch kochia with 75 F, 70% RH, clear sky, and 6-10 mph NW wind with damp topsoil at 75 F. Treatments were applied with a small plot sprayer with wind cones, mounted on a G-Allis Chalmers tractor and delivering 8.6 gals/a at 30 psi through 8001 flat fan nozzles to a 6.67 ft wide area the length of 10 by 25 ft plots. The experiment was a randomized complete block design with four replications. Weed populations ranged from 1/2ft^2 to 2/ft^2 for kochia and 4-5 plants/ft^2 for Russia thistle. Assure II + MSO was applied to all plots to control green foxtail on June 17. Plots were evaluated on July 24 and on August 25. Safflower was machine harvested on October 8.

				Weed Control					
		Crop Injury		---7/24-----		8/25--	Test	Seed	
Treatment[a]	Rate	7/24	8/25	Kocz	Ruth	Kocz	Weight	Oil	Yield
	oz ai/ac	---	%	---	---	%	--- lbs/b	%	lb/ac
Harmony GT+Act90	0.30+0.25%	0	0	38	91	20	40.4	33.6	533
Ally+Act90	0.06+0.25%	2	3	34	89	20	39.4	32.9	265
Glean+Act90	0.1875+0.25%	1	0	71	92	53	39.7	34.1	562
Finesse+Act90	0.1875+0.25%	0	3	71	96	68	39.8	34.5	593
Express+Act90	0.30+0.25%	0	1	53	94	71	39.9	33.9	456
HarmonyXtra+Act90	0.30+0.25%	1	1	53	93	51	39.7	33.6	475
Amber+Act90	0.30+0.25%	14	26	46	58	35	39.9	32.5	240
Starane	1.0	16	18	79	28	84	38.6	34.5	336
Starane	2.0	43	21	89	38	96	39.0	34.1	319
Aim 40DF+Act90	0.2+0.25%	50	31	70	60	65	39.1	34.7	293
Weedy Control	0	0	0	0	0	0	37.4	33.7	390
C.V. %		46	65	19	14	31	2.3	1.8	22
LSD 5%		8	9	15	14	23	NS	NS	129
# OF REPS		4	4	4	4	4	2	2	4

[a] - Act90 = Activator 90 nonionic surfactant from Loveland.

Summary: Dry soil conditions at planting resulted in uneven seed germination and erratic stand establishment. All commercially grown safflower varieties are severely injured by Express and Amber. The safflower line 94B2869 is very tolerant to Express, Ally, Harmony Gt and Finesse as well as Harmony Xtra. However 94B2869 appears to be susceptible to Amber. Aim and Starane also caused considerable injury to this safflower selection. Only Starane gave adequate control of kochia. Amber and Starane alone do not adequately control Russian thistle.

Weed control and crop tolerance in sunflower. Jenks, Willoughby, and Markle. Sunflower 'CL320' was planted May 29, 2001 at 20,000 seeds/acre into 30-inch rows. Individual plots were 10 by 30 ft arranged in a RCBD with three replications. PPI treatments were applied on May 29 just prior to planting. PRE treatments were applied June 2. PPI and PRE treatments were applied with a CO_2 pressurized bicycle sprayer delivering 20 gpa at 30 psi using XR80015 nozzles. Aim and Everest were applied postemergence on June 28 at 10 gpa, 40 psi, using XR8001 nozzles. Poast + COC was applied to selected plots on July 3.

		Sunflower Injury			Grft Control[a]				
Treatment	Rate	Jul 5	Jul 18	Aug 15	Jul 5	Jul 18	Aug 15	Yield	Test wt
		%						lb/A	bu/A
Untreated		0	0	0	0	0	0	1138	29.3
PPI									
Sonalan	2 pt	0	0	0	55	94	97	2520	30.9
Sonalan + Spartan	2 pt + 2.67 oz	2	0	0	81	94	99	2568	31.4
PRE									
Flufenacet	14 oz	11	9	2	89	72	57	1923	30.8
Flufenacet	20 oz	16	7	3	93	78	73	2132	30.9
Spartan + Flufenacet	4 oz + 14 oz	14	8	3	94	75	60	2256	30.9
Spartan + Prowl	3 oz + 3 pt	4	0	0	73	94	97	2645	31.1
Spartan + Prowl	3.5 oz + 3 pt	3	0	0	78	97	100	2618	30.7
POST									
Aim + NIS	0.008 lb ai + 0.25 %	43	62	40	10	87	87	1278	30.2
Aim + NIS	0.016 lb ai + 0.25 %	75	82	72	10	87	75	519	28.5
Everest	0.4 oz	33	40	43	57	67	73	1214	29.4
Everest	0.6 oz	43	58	55	60	74	87	668	29.2
LSD		9	13	10	25	7	7	470	1.2
CV		25	33	32	25	6	6	16	2

[a] Poast at 1 pt/A was applied on July 3 to the following treatments: Spartan + Prowl, Aim, Sonalan, and Sonalan + Spartan

Aim and Everest caused unacceptable crop injury at either rate. A postemergence application of Poast + COC was warranted on all treatments, but was only applied to those indicated above. Green foxtail control with flufenacet was excellent early, but did not provide residual control through July and August. Yields from Sonalan, Sonalan + Spartan, and Spartan + Prowl (all followed by Poast) were significantly higher than most other treatments.

Weed control in sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Valley City and Hazelton, ND, to evaluate weed control in sunflower from herbicides applied PRE and POST. At Valley City, Pioneer '63M80' sunflower was planted on May 25, 2001. Spartan at 4 oz/A was applied PRE over the entire area to control broadleaf weeds on May 29 at 12:15 pm with 72 F air, 67 F soil at a depth of 4 inches, 42% relative humidity, 40% clouds, 12 mph SE wind, dry soil surface, and moist subsoil. POST treatments were applied June 27 at 11:00 am with 79 F air, 77 F soil surface, 79% relative humidity, 90% clouds, 5 mph SE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V4 to V6 sunflower. Weed species present were: 1 to 6 inch, tillering (3-10/ft^2) foxtail spp.; 1 to 3 inch (1-3/ft^2) volunteer wheat; 1 to 5 inch (1-5/ft^2) common lambsquarters; 1 to 2 inch (1/yd^2) eastern black nightshade; and 4 to 10 inch, tillering (1-2/yd^2) wild oat.

An identical randomized study to the Valley City site was established at Hazleton, ND. Pioneer '63M80' sunflower was planted on June 1, 2001. Spartan at 4 oz/A was applied over the entire area to control broadleaf weeds on June 8 at 10:00 am with 71 F air, 62 F soil at a depth of 2 to 4 inches, 58% relative humidity, 0% clouds, 6 mph SW wind, dry soil surface, and moist subsoil. POST treatments were applied July 7 at 1:00 pm with 88 F air, 109 F soil surface, 65% relative humidity, 0% clouds, 0-5 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V8 to V14 sunflower. Weed species present: 1 to 12 inch (20-50/ft^2) foxtail spp.

Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a hooded bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles on a non-hooded sprayer for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

At Valley City (no data presented), light hail occurred on June 20, damaged sunflower at the V2 stage, and gave 0 to 30% injury. Sunflowers recovered and no injury was observed on July 4. Spartan provided complete common lambsquarters, eastern black nightshade, and marshelder control. All treatments gave complete green and yellow foxtail, volunteer wheat, and wild oat control when evaluated 7, 14, and 28 DAT. Select was applied with insecticides Warrior at 0.4 oz/A instead of Asana XL. The trial was abandoned on August 8 after a wind and hail storm caused 70-90% lodging.

At Hazleton, no treatments caused sunflower injury. At 7 DAT no weeds had emerged. Spartan provided complete common lambsquarters, redroot pigweed, and wild buckwheat control. (Department of Plant Sciences, North Dakota State University, Fargo).

Table. Weed control in sunflower, Hazelton (Zollinger and Ries).

		July 19	August 3
Treatment[1]	Rate	Fxtl	Fxtl
	(product/A)	----- % control -----	
Select+PO+AMS	4fl oz+1qt+2.5lb	78	86
Select+PO+AMS	6fl oz+1qt+2.5lb	96	99
Select+PO+AMS	8fl oz+1qt+2.5lb	96	99
Select+Quad7	6fl oz+1% v/v	80	90
Select+Quad7	8fl oz+1% v/v	80	90
Select+Assert+NIS	6fl oz+0.6pt+0.25% v/v	80	90
Select+Assert+NIS	8fl oz+0.6pt+0.25% v/v	80	90
Select+Assert+NIS	6fl oz+0.3pt+0.25% v/v	88	99
Select+Asana XL+PO	6fl oz+4.5fl oz+1qt	83	93
LSD (0.05)		9	6

[1]PO = petroleum oil concentrate = Herbimax; AMS = ammonium sulfate; Quad 7 = basic blend adjuvant; NIS = nonionic surfactant = Activator 90.

Weed control in Clearfield sunflower. Jenks, Willoughby, and Markle. Imidazolinone resistant sunflower was seeded June 22 at 20,000 seeds/acre into 30-inch rows. Individual plots were 10 by 30 ft arranged in a RCBD with three replications. Herbicide treatments were applied July 16 with a CO_2 pressurized bicycle sprayer delivering 10 gpa at 40 psi using XR8001 nozzles. The sunflowers were 9 inches tall, pigweed was 4-6 inches tall, and foxtail was 4-lf to heading at time of application.

		Jul 30			Oct 16	
Treatment	Rate	Injury	Foxtail[a]	Pigweed[b]	Yield	Test wt.
		— % —	—— % control ——		lb/A	lb/bu
Raptor + NIS	4 fl oz + 0.25 %	7	87	93	1237	26.4
Raptor + COC	4 fl oz + 1 %	4	82	90	1177	26.3
Raptor + MSO	4 fl oz + 1.5 pt	10	91	97	1349	26.7
Raptor + Quad 7	4 fl oz + 1 %	12	92	100	1142	26.5
Poast + COC	1 pt + 2 pt	1	75	0	1070	26.3
Untreated		0	0	0	1204	26.7
LSD		6	5	4	NS	NS
CV		57	4	4	13	3

[a] *Green and yellow foxtail.*

[b] *Redroot and prostrate pigweed.*

Slight crop injury was observed. Raptor applied with Quad 7 tended to cause the greatest crop injury, and provide the greatest foxtail and pigweed control. However, sunflower yield reflected no differences between treatments regardless of crop injury or weed control.

Clearfield sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Prosper, ND, to evaluate weed control in sunflower from herbicides applied EPOST, POST, and LPOST. Each treatment consisting of four rows contained two outside rows of Pioneer conventional seed, and two inside rows, one a Mycogen Clearfield line 'CMSHA425XRHA426' and the other Clearfield line 'USDA Imi-improved CMSHA425XRHA426'.The site was planted on June 1, 2001. EPOST treatments were applied June 26 at 11:30 am with 85 F air, 91 F soil surface, 47% relative humidity, 10% clouds, 5 mph NE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V-2 to V-4 sunflower. Weed species present were: 1 to 3 inch (1-5/yd^2) foxtail; 0.5 to 1 inch (1-3/yd^2) redroot pigweed; 0.5 to 2 inch (1-2/yd^2) common lambsquarters; and 0.5 to 2 inch (1/yd^2) wild mustard. POST treatments were applied July 3 at 7:30 pm with 75 F air, 95 F soil surface, 54% relative humidity, 10% clouds, 5-10 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V-6 to V-8 sunflower. Weed species present were: 3 to 5 inch (1-5/yd^2) foxtail; 2 to 3 inch (1-3/yd^2) redroot pigweed; 2 to 3 inch (1-2/yd^2) common lambsquarters; and rosette (1/yd^2) wild mustard. LPOST treatments were applied July 10 at 7:30 am with 66 F air, 71 F soil surface, 66% relative humidity; 10% clouds, 6 mph N wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V-10 to V-14 sunflower. Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 8.5 gpa at 40 psi through 8001 flat fan nozzles on a hooded sprayer for POST and a non-hooded sprayer for EPOST and LPOST treatments. The experiment had a randomized complete block design with four replicates per treatment. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table. Clearfield sunflower (Zollinger and Ries).

Treatment [1]	Rate	Days After Treatment				August 15	Line A[2]	Line B[3]
		7	14	28	56	Lodging	Yield	Yield
	(fl oz/A)	% sunflower injury				%	lb/A	
EPOST (V2-V4 snfl)								
Raptor+NIS+28-0-0	4	4	1	1	0	1	1101	1656
Raptor+NIS+28-0-0	8	21	8	6	1	0	1005	1802
Raptor+NIS+28-0-0	12	33	18	15	4	0	1147	1406
Raptor+Scoil+28-0-0	4	59	60	54	44	0	892	1249
POST (V6-V8 snfl)								
Raptor+NIS+28-0-0	4	0	0	0	0	0	911	2002
Raptor+NIS+28-0-0	8	9	8	3	0	0	1355	2411
Raptor+NIS+28-0-0	12	13	12	9	0	1	738	2010
Raptor+Scoil+28-0-0	4	24	21	19	6	0	1287	1470
LPOST (V10-V14 snfl)								
Raptor+NIS+28-0-0	4	0	0	0	0	4	1333	1614
Raptor+NIS+28-0-0	8	12	4	4	1	1	822	1099
Raptor+NIS+28-0-0	12	3	6	5	1	13	1485	1364
Raptor+Scoil+28-0-0	4	1	4	1	0	3	1243	1627
Untreated		0	0	0	0	0	901	1433
LSD(0.05)		8	9	9	6	8	620	909

[1]NIS = non-ionic surfactant = Activator 90 at 0.25% v/v; 28-0-0 = urea ammonium nitrate at 2.5% v/v; Scoil = methylated seed oil at 2.5% v/v.
[2]Line A = Mycogen CMSHA425XRHA426.
[3]Line B = USDA imi-improved CMSHA425XRHA426.

The study was conducted in weed free environment. Only rep 2 and 3 were hand harvested on November 7 after snow had melted following a winter blizzard on October 23 which caused significant snow trap and lodging in reps 1 and 4. Lodging was not specific to any treatment. Some lodging occurred in rep 2 and 3 and blackbird feeding were observed on some sunflower heads which may account for yield differences.

Generally, sunflower is more tolerant to Raptor as plant size increases but Raptor at X (4 fl oz/A and 2X (8 fl oz/A) did not result in significant visible injury. Yield of the USDA sunflower line was more than the Mycogen sunflower line. For the USDA line, Yields from plots applied by POST treatments yielded more than from plots at other applications. There were no clear indication for safety from yields of the Mycogen line. Raptor at 4 fl oz/A plus an MSO adjuvant caused more injury and usually lower yields than Raptor at higher rates with NIS + 28-0-0.

Clearfield resistant sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Valley City and Hazleton, ND, to evaluate weed control in sunflower from herbicides applied PRE, early postemergence (EPOST), and late postemergence (LPOST). Each plot consisted of four rows, two outside rows of Pioneer '63M80' conventional sunflower seed, and two inside imidazolinone resistant sunflower rows, one BASF 'CMA425XCMA426' and the other Mycogen "X81350'. At Valley City, sunflower was planted on May 25, 2001. PRE treatments were applied May 29 at 11:00 am with 72 F air, 67 F soil at a depth of 4 inches, 42% relative humidity, 40% clouds, 12 mph SE wind, dry soil surface, and moist subsoil. EPOST treatments were applied June 27 at 10:00 am with 76 F air, 77 F soil surface, 80% relative humidity, 100% clouds, 2 mph NE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V4 to V6 sunflower. Weed species present were: 2 to 6 inch (1-5/yd^2) foxtail spp.; 0.5 to 1 inch (1-2/yd^2) common purslane; 1 to 3 inch (1-5/yd^2) common lambsquarters; 0.5 to 2 inch (1-20/yd^2) eastern black nightshade; 2 to 6 inch, tillering (3-5/yd^2) volunteer wheat; and 3 to 6 inch, tillering (1-2/yd^2) wild oat. LPOST treatments were applied July 5 at 12:30 pm with 76 F air, 79 F soil surface, 33% relative humidity, 0% clouds, 4 mph SE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V8 to V10 sunflower.

At Hazelton, sunflower was planted on June 1, 2001. PRE treatments were applied June 8 at 10:00 am with 71 F air, 62 F soil at a depth of 4 inches, 58% relative humidity, 0% clouds, 6 mph SW wind, dry soil surface, and moist subsoil. EPOST treatments were applied July 7 at 11:00 am with 88 F air, 109 F soil surface, 65% relative humidity, 0% clouds, 0-5 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V8 to V14 sunflower. Weed species present were: 1 to 12 inch (20-50/ft^2) foxtail spp.; 1 to 10 inch (1-2/yd^2) redroot pigweed; and 6 to 12 inch, vining (1-2/yd^2) wild buckwheat. LPOST treatments were applied July 13 at 11:00 am with 72 F air, 74 F soil surface, 95% clouds, 5 mph SW wind, dry soil surface, moist subsoil, good crop vigor, and no dew present.

Treatments were applied to the center two rows of the 10 by 40 foot plots with a hooded bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles on a hooded sprayer for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles on a non-hooded bicycle-wheel-type sprayer for EPOST and LPOST treatments. The experiment had a randomized complete block design with three replicates per treatment.

At Valley City, light hail occurred on June 20 causing 0 to 30% sunflower damage to V2 leaves. Plant quickly recovered and no injury was attributed to the hail at later evaluations. At June 25, all PRE or PRE/POST treatments controlled eastern black nightshade, common purslane, and common lambsquarters. At July 25, all treatments controlled common lambsquarters, redroot pigweed, marshelder, and eastern black nightshade. All treatments controlled foxtail and eastern black nightshade except BAS 63500. Sunflower injury was primarily stunting. The trial was abandoned on Aug 8 after a wind and hail storm caused 70% to 90% lodging. Treatments containing MSO type adjuvants caused more injury than treatments containing NIS + 28% nitrogen or Quad 7 adjuvants.

At Hazelton, treatments were applied much later than at Valley City. Sunflower were V8 to V14 stage at application. No 28% liquid nitrogen was applied with any treatment as was at Valley City. No weeds were emerged on July 13 at 7 DAT. All treatments controlled redroot pigweed and common lambsquarters on July 20 at 14 DAT and at August 3 at 28 DAT. All treatments caused minimal sunflower injury, except BAS 63500, in Valley City, demonstrating greater sunflower tolerance to imidazolinone herbicides when applied to larger sunflower. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table 1. Clearfield resistant sunflower, Valley City (Zollinger and Ries).

Treatment[1]	Rate	June 27				Sunflower		
		Fxtl	Vwht	Wioa	Corw	July 4	July 11	July 25
	(product/A)	% control				% injury		
PRE								
Prowl	3pt	97	96	88	80	0	0	0
Spartan	3oz	82	92	93	81	0	0	0
Spartan	3.5oz	93	92	70	86	0	5	0
Prowl+Spartan	3pt+3oz	96	92	90	94	0	0	0
Prowl+Spartan	3pt+3.5oz	94	92	94	99	0	0	0
PRE/EPOST								
Prowl+Spartan/Raptor+NIS+28-0-0	3pt+3oz/4fl oz	98	91	96	99	17	0	8
Prowl+Spartan/Raptor+NIS+28-0-0	3pt+3oz/5fl oz	98	85	93	99	11	0	0
Prowl+Spartan/Raptor+ Arsenal+NIS+28-0-0	3pt+3oz/4.25floz+ 1fl oz	93	84	83	99	15	5	0
Prowl/Raptor+NIS+28-0-0	3pt/4fl oz	93	88	83	99	13	5	8
Prowl/Raptor+Scoil+28-0-0	3pt/4fl oz	98	89	62	99	20	8	10
EPOST								
Prowl+Raptor+NIS+28-0-0	3pt+4fl oz					25	25	17
Prowl+Raptor+Scoil+28-0-0	3pt+4fl oz					30	23	8
Raptor+Scoil+28-0-0	4fl oz					13	12	10
Raptor+NIS+28-0-0	4fl oz					17	3	0
Raptor+Scoil+28-0-0	5fl oz					30	18	12
Raptor+NIS+28-0-0	5fl oz					12	7	0
Raptor+Arsenal+NIS+28-0-0	4.25fl oz+1fl oz					20	13	5
Raptor+Arsenal+Scoil+28-0-0	4.25fl oz+1fl oz					32	25	20
Raptor+Arsenal+Quad 7	4.25fl oz+1fl oz					23	12	5
Raptor+Arsenal+Quad 7	8.5fl oz+2fl oz					40	35	20
BAS 63500+NIS	10oz					99	99	99
EPOST/LPOST								
Raptor+Arsenal+Quad 7/ Raptor+Arsenal+Quad7	2.125fl oz+0.5fl oz/ 2.125fl oz+0.5fl oz					9	15	7
Raptor+Arsenal+Quad7/ Raptor+Arsenal+Quad 7	1.6fl oz+0.38fl oz/ 1.6fl oz+0.38fl oz					12	15	10
Untreated		0	0	0	0	0	0	0
LSD (0.05)		10	13	13	10	9	7	6

[1]NIS = nonionic surfactant = Activator 90 at 0.25% v/v; 28-0-0 = urea ammonium nitrate at 2.5% v/v; Scoil = methylated seed oil at 1.25% v/v; Quad 7 = basic blend adjuvant at 1% v/v.

Table 2. Clearfield resistant sunflower, Hazelton (Zollinger and Ries).

Treatment[1]	Rate	Sunflower			July 20		August 3	
		July 13	July 20	Aug 3	Fxtl	Wibw	Fxtl	Wibw
	(product/A)	------ % injury ------			---------- % control ----------			
PRE								
Prowl	3pt	0	0	0	70	20	63	0
Spartan	3oz	0	0	0	40	99	17	99
Spartan	3.5oz	0	0	0	37	99	23	99
Prowl+Spartan	3pt+3oz	0	0	0	92	99	99	99
Prowl+Spartan	3pt+3.5oz	0	0	0	93	99	99	99
PRE/EPOST								
Prowl+Spartan/Raptor+NIS	3pt+3oz/4fl oz	11	3	2	96	99	99	99
Prowl+Spartan/Raptor+NIS	3pt+3oz/5fl oz	6	3	0	96	99	99	99
Prowl+Spartan/Raptor+ Arsenal+NIS	3pt+3oz/4.25floz+ 1fl oz	10	5	0	99	99	99	99
Prowl/Raptor+NIS	3pt/4fl oz	4	3	0	96	50	99	70
Prowl/Raptor+Scoil	3pt/4fl oz	10	3	0	95	57	99	99
EPOST								
Prowl+Raptor+NIS	3pt+4fl oz	6	0	0	70	30	77	0
Prowl+Raptor+Scoil	3pt+4fl oz	6	0	0	77	30	83	0
Raptor+Scoil	4fl oz	6	0	0	73	30	83	0
Raptor+NIS	4fl oz	4	3	0	70	30	70	0
Raptor+Scoil	5fl oz	5	0	0	83	37	80	13
Raptor+NIS	5fl oz	5	5	0	68	30	67	7
Raptor+Arsenal+NIS	4.25fl oz+1fl oz	6	3	0	67	47	63	27
Raptor+Arsenal+Scoil	4.25fl oz+1fl oz	6	7	3	70	50	83	30
Raptor+Arsenal+Quad 7	4.25fl oz+1fl oz	8	6	2	67	37	73	17
Raptor+Arsenal+Quad 7	8.5fl oz+2fl oz	12	8	5	70	57	93	27
BAS 63500+NIS	10oz	70	99	99	0	50	0	30
EPOST/LPOST								
Raptor+Arsenal+Quad 7/ Raptor+Arsenal+Quad7	2.125fl oz+0.5fl oz/ 2.125fl oz+0.5fl oz	4	0	0	63	33	80	7
Raptor+Arsenal+Quad7/ Raptor+Arsenal+Quad 7	1.6fl oz+0.38fl oz/ 1.6fl oz+0.38fl oz	4	0	0	57	40	43	0
Untreated		0	0	0	0	0	0	0
LSD (0.05)		3	5	2	11	7	8	12

[1]NIS = nonionic surfactant = Activator 90 at 0.25% v/v; Scoil = methylated seed oil at 1.25% v/v; Quad 7 = basic blend adjuvant at 1% v/v.

Weed control in imidazolinone-resistant sunflower. Endres, Gregory J. and Richard K. Zollinger. Weed control and crop response to selected herbicide treatments in imidazolinone-resistant (Clearfield™) sunflower were investigated. The trial had a randomized complete block design with a strip-split arrangement and three replicates. The main plots were herbicide treatments and the split plots were the sunflower lines stripped across the main plots. The experiment was conducted on a loam soil with 8.0 pH and 2.5% organic matter at Carrington, ND in 2001. On June 1, the trial area was cultivated at a 2-inch depth with a Melroe culti-harrow. Cargill 'SF290', a conventional hybrid, and USDA experimental line 'CMSH425 xRHA426' and Mycogen experimental line 'x81350' were planted on June 1 in 30-inch rows at the rate of three seeds/ft of row. The trial was hand-thinned to a population of about 20,000 plants/A on July 17. Herbicide treatments were applied to the center 6.7 ft of 10 by 30 ft plots with a CO_2 pressurized hand-held plot sprayer. PRE treatments were applied on a dry soil surface at 14 gal/A and 30 psi through 8002 flat fan nozzles on June 2 with 55 F, 81% RH, clear sky, and 6 mph wind. A total of 2.15 inches of rainfall occurred during the 10-day period following application of PRE treatments. POST treatments were applied at 14 gal/A and 30 psi through 80015 flat fan nozzles on June 28 with 79 F, 84% RH, clear sky, and 5 mph wind to V4-stage sunflower, 3- to 5-leaf green and yellow foxtail, 0.5- to 1-inch tall common lambsquarters, 0.5- to 2-inch tall redroot and prostrate pigweed, 1- to 4-inch tall wild mustard, 1- to 2-inch tall wild buckwheat, and 0.5-inch tall eastern black nightshade. The late-POST (LPOST) treatments were applied on July 5 with 55 F, 84% RH, clear sky, and 5 mph wind to V8-stage sunflower, 1- to 6-inch tall green and yellow foxtail, 2- to 3-inch tall common lambsquarters, 0.5- to 2-inch tall redroot and prostrate pigweed, 3- to 4-inch tall wild mustard, 1- to 2-inch tall wild buckwheat, and 0.5- to 1-inch tall eastern black nightshade.

Weed control was generally good to excellent (78 to 99%) with PRE treatments followed by POST imazamox or imazamox+imazapyr (Table 1). Without a PRE treatment, imazamox provided good to excellent control (81-99%) of foxtail, pigweed, and eastern black nightshade. Common lambsquarters and wild buckwheat control improved with a tank mixture of imazamox and imazapyr compared to imazamox alone. The low rate of sequentially-applied imazamox+imazapyr+Quad7 provided 80 to 99% weed control. Sunflower height was reduced in the imidazolinone-resistant lines with imazamox or imazamox+imazapyr, but the effect lessened as plants developed (Table 2). (Carrington Research Extension Center, North Dakota Agric. Exp. Stn., North Dakota State Univ., Carrington.)

Table 1. Weed control in imidazolinone-resistant sunflower (Endres and Zollinger).

Treatment[a]	Rate	4 wk after treatment						8 wk after treatment				
		SETSS	CHEAL	AMASS	SINAR	POLCO	SOLPT	SETSS	CHEAL	AMASS	POLCO	SOLPT
	(lb/A)	(% control)										
Untreated	---	0	0	0	0	0	0	0	0	0	0	0
PRE												
Pendimethalin	1.24	62	63	58	70	91	61	69	62	62	65	57
Sulfentrazone	0.14	63	99	75	35	75	78	65	99	92	92	93
Sulfentrazone	0.16	59	99	97	58	70	99	69	99	99	76	95
Pend+suen	1.24+0.14	76	99	97	70	87	99	79	99	97	82	97
Pend+suen	1.24+0.16	75	99	98	78	99	99	77	99	97	92	97
PRE/POST												
Pend+suen/Imazamox+NIS +28%N	1.24+0.14/0.031+ 0.25%+2.5%	95	99	99	99	96	99	94	99	99	87	99
Pend+suen/Immx+NIS+ 28%N	1.24+0.14/0.039+ 0.25%+2.5%	96	99	99	99	92	99	94	99	99	99	99
Pend+suen/Immx+ imazapyr+NIS+28%N	1.24+0.14/0.039+ 0.016+0.25%+2.5%	90	99	99	99	99	99	89	99	99	99	99
Pend/Immx+NIS+ 28%N	1.24/0.031+0.25%+2.5%	93	95	98	99	81	91	93	95	99	78	88
Pend/Immx+MSO+28%N	1.24/0.031+1.25%+2.5%	94	96	96	99	93	99	93	98	97	90	97
POST												
Pend+immx+NIS+ 28%N	1.24+0.031+0.25%+2.5%	91	98	98	99	72	99	91	91	98	81	87
Pend+immx+MSO+28%N	1.24+0.031+1.25%+2.5%	94	97	97	99	79	96	94	91	99	76	94
Immx+MSO+28%N	0.031+1.25%+2.5%	91	87	98	99	71	96	92	78	99	73	94
Immx+NIS+28%N	0.031+0.25%+2.5%	84	86	98	99	69	96	81	67	99	70	91
Immx+MSO+28%N	0.039+1.25%+2.5%	91	86	97	99	70	90	91	76	96	68	92
Immx+NIS+28%N	0.039+0.25%+2.5%	93	78	96	99	72	94	94	73	94	72	88
Immx+impr+NIS+ 28%N	0.25%+2.5%	94	94	99	99	91	98	93	91	98	85	99
Immx+impr+MSO+28%N	1.25%+2.5%	91	93	98	99	94	98	84	89	99	92	99
Immx+impr+Quad7	0.031+0.016+1%	90	97	99	99	96	98	87	96	96	96	99
Immx+impr+Quad7	0.063+0.031+1%	98	99	99	99	98	99	97	98	99	99	99
POST/LPOST												
Immx+impr+Quad7/Immx+ impr+Quad7	0.016+0.008+1%/ 0.016+0.008+1%	97	99	99	99	93	99	97	98	98	90	98
Immx+impr+Quad7/Immx+ impr+Quad7	0.012+0.006+1%/ 0.012+0.006+1%	95	98	99	99	84	99	96	96	98	80	99
LSD (0.05)		10	8	12	18	20	14	7	8	7	16	10

[a]NIS=Induce, a nonionic surfactant from Helena Chemical Co., Memphis, TN; MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN; Quad7=a surfactant blend from AGSCO, Grand Forks, ND.

Table 2. Imidazolinone-resistant sunflower response to herbicide treatments (Endres and Zollinger).

Treatment[a]	Rate	Growth reduction[b] 2 WAT Con	Imi1	Imi2	4 WAT Con	Imi1	Imi2
	(lb/A)	(%)					
Untreated		0	0	0	0	0	0
PRE							
Pendimethalin	1.24	0	0	0	0	0	0
Sulfentrazone	0.14	0	0	0	0	0	0
Sulfentrazone	0.16	0	0	0	0	0	0
Pend+suen	1.24+0.14	5	9	7	0	3	0
Pend+suen	1.24+0.16	0	9	7	0	0	0
PRE/POST							
Pend+suen/Imazamox+NIS+28%N	1.24+0.14/0.031+0.25%+2.5%	95	14	10	98	7	8
Pend+suen/Immx+NIS+28%N	1.24+0.14/0.039+0.25%+2.5%	95	17	13	98	6	7
Pend+suen/Immx+imazapyr+NIS+28%N	1.24+0.14/0.039+0.016+0.25%+2.5%	96	17	13	99	4	6
Pend/Immx+NIS+28%N	1.24/0.031+0.25%+2.5%	96	15	12	99	16	8
Pend/Immx+MSO+28%N	1.24/0.031+1.25%+2.5%	96	15	17	98	3	0
POST							
Pend+immx+NIS+28%N	1.24+0.031+0.25%+2.5%	95	21	21	98	12	7
Pend+immx+MSO+28%N	1.24+0.031+1.25%+2.5%	95	19	19	97	13	8
Immx+MSO+28%N	0.031+1.25%+2.5%	95	17	12	99	11	5
Immx+NIS+28%N	0.031+0.25%+2.5%	95	11	5	99	9	2
Immx+MSO+28%N	0.039+1.25%+2.5%	96	13	7	95	7	5
Immx+NIS+28%N	0.039+0.25%+2.5%	95	14	12	98	5	3
Immx+impr+NIS+28%N	0.031+0.016+0.25%+2.5%	98	13	11	99	7	3
Immx+impr+MSO+28%N	0.031+0.016+1.25%+2.5%	96	11	14	98	4	5
Immx+impr+Quad7	0.031+0.016+1%	97	10	9	99	9	0
Immx+impr+Quad7	0.063+0.031+1%	99	31	23	99	16	11
POST/LPOST							
Immx+impr+Quad7/Immx+impr+Quad7	0.016+0.008+1%/0.016+0.008+1%	97	7	9	97	0	3
Immx+impr+Quad7/Immx+impr+Quad7	0.012+0.006+1%/0.012+0.006+1%	93	13	3	96	3	3
LSD (0.05)		4	9	9	3	9	NS

[a]NIS=Induce, a nonionic surfactant from Helena Chemical Co., Helena, TN; MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN; Quad7=a surfactant blend from AGSCO, Grand Forks, ND.
[b]Growth reduction=height or biomass reduction; WAT=weeks after treatment; Con=Cargill 'SF290', Imi1=USDA 'CMSH425 xRHA426', Imi2=Mycogen 'x81350'.

Weed control in SU-resistant sunflower. Jenks, Willoughby, and Markle. Sulfonylurea resistant sunflower was seeded June 22 into 30-inch rows. Individual plots were 10 by 30 ft arranged in a RCBD with three replications. Herbicide treatments were applied July 16 with a CO_2 pressurized bicycle sprayer delivering 10 gpa at 40 psi using XR8001 nozzles. The sunflowers were 9 inches tall and foxtail was 4-lf to heading at time of application.

		Aug 10		Oct 16	
Treatment	Rate	Injury	Foxt[a]	Yield	Test wt.
		— % —	% control	lb/A	lb/bu
Express + NIS + Assure II	0.33 oz + 0.25 % + 8 fl oz	1	84	1392	26.1
Express + NIS + Assure II	0.66 oz + 0.25 % + 8 fl oz	6	88	1651	25.9
Express + COC + Assure II	0.33 oz + 1 % + 8 fl oz	2	92	1286	25.8
Express + Quad 7 + Assure II	0.33 oz + 1 % + 8 fl oz	5	94	1314	26.5
Express + NIS + Assure II + COC	0.33 oz + 0.25 % + 8 fl oz + 1 %	1	97	1462	26.6
Untreated		0	0	1093	26.7
LSD		4	6	NS	NS
CV		97	5	23	1.9

[a] *Green and yellow foxtail.*

Slight crop injury was observed. Sunflowers were slightly yellowed by herbicide treatments; however, no stunting or head deformations were observed. Sunflower yield and test weight were not affected by crop injury.

Sulfonylurea resistant sunflower. Zollinger, Richard K. and Jerry L. Ries. An experiment was conducted near Valley City and Hazelton, ND, to evaluate weed control in sunflower from herbicides applied PRE and POST. At Valley City, Pioneer '01RL004' sunflower was planted on May 25, 2001. PRE treatments were applied May 29 at 11:30 am with 72 F air, 67 F soil at a depth of 4 inches, 42% relative humidity, 40% clouds, 12 mph SE wind, dry soil surface, and moist subsoil. POST treatments were applied June 27 at 9:30 am with 74 F air, 77 F soil surface, 75% relative humidity, 90% clouds, 6 mph SE wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V4 to V6 sunflower. Weed species present were: 2 to 6 inch, tillering (3-5/yd^2) foxtail spp.; 0.5 to 1 inch (1-2/yd^2) redroot pigweed; 1 to 3 inch (1-3/yd^2) common lambsquarters; and 0.5 to 3 inch (2-5/ft^2) eastern black nightshade.

At Hazelton, Pioneer '01RL004' sunflower was planted on June 1, 2001. PRE treatments were applied June 8 at 10:00 am with 71 F air, 62 F soil at a depth of 4 inches, 58% relative humidity, 0% clouds, 6 mph SW wind, dry soil surface, and moist subsoil. POST treatments were applied July 7 at 12:30 pm with 88 F air, 109 F soil surface, 65% relative humidity, 0% clouds, 0-5 mph W wind, dry soil surface, moist subsoil, good crop vigor, and no dew present to V8 to V14 sunflower. Weed species present were: 1 to 12 inch, tillering (20-50/ft^2) foxtail spp.; 1 to 10 inch (1-2/yd^2) redroot pigweed; and 6 to 12 inch, vining (1-2/yd^2) wild buckwheat.

Treatments were applied to the center 6.67 feet of the 10 by 40 foot plots with a bicycle-wheel-type plot sprayer delivering 17 gpa at 40 psi through 8002 flat fan nozzles on a hooded sprayer for PRE treatments and 8.5 gpa at 40 psi through 8001 flat fan nozzles on a non-hooded sprayer for POST treatments. The experiment had a randomized complete block design with three replicates per treatment.

At Valley City, light hail occurred on June 20 causing 0 to 30% sunflower damage to V2 leaves. Plant quickly recovered and there no injury was attributed to hail at later evaluations. All treatments on July 11 controlled common lambsquarters, marshelder, and eastern black nightshade. All treatments on July 25 controlled common lambsquarters and marshelder and sunflower injury was stunting. The trial was abandoned on August 8 after a wind and hail storm caused 70% to 90% lodging. Express was relatively safe except when MSO was added. All other ALS herbicides seriously injured resistant sunflower. Foxtail control was reduced when Assure II was added to Express but not with Select.

At Hazelton, treatments were applied much later than at Valley City. Sunflower were at the V8 to V14 at application. Generally, Express treatments were safer at Hazelton than at Valley City due to larger sunflower stage at application. ALS herbicides other than Express seriously injured resistant sunflower. Injury was severe stunting and chlorosis and/or plant death. Foxtail control was reduced when Assure II was added to Express but not with Select. Wild buckwheat control was not greater than 40%. (Dept. of Plant Sciences, North Dakota State University, Fargo).

Table 1. Sulfonylurea resistant sunflower, Valley City (Zollinger and Ries).

Treatment[1]	Rate	Sunflower			July 11	July 25	
		July 5	July 11	July 25	Fxtl	Fxtl	Ebns
	(product/A)	---------- % injury ----------			---------- % control ----------		
PRE/POST							
Spartan/Express+Select+PO	3oz/0.25oz+4fl oz+1qt	6	0	0	98	99	99
POST							
Express+NIS	0.25oz+0.25% v/v	5	0	0	99	99	40
Express+PO	0.25oz+1qt	8	0	7	99	99	53
Express+Scoil	0.25oz+1.5pt	17	12	22	99	99	67
Express+Quad 7	0.25oz+1% v/v	10	16	9	99	99	50
Express+Quad 7	0.167oz+1% v/v	7	5	7	99	99	43
Express+Quad 7	0.33oz+1% v/v	10	3	6	99	99	73
Express+Quad 7	0.66oz+1% v/v	10	9	15	99	99	77
Raptor+Quad 7	4fl oz+1% v/v	50	67	63	99	99	99
FirstRate+Quad 7	0.6oz+1% v/v	80	99	99	99	99	13
Accent+Quad 7	0.67oz+1% v/v	40	57	50	99	99	13
Ally+Quad 7	0.1oz+1% v/v	30	37	30	99	99	0
Express+Assure II+PO	0.25oz+8fl oz+1% v/v	12	8	3	77	73	67
Express+Select+PO	0.25oz+6fl oz+1qt	9	5	0	96	99	83
LSD (0.05)		3	9	12	3	3	6

[1]PO = petroleum oil concentrate = Herbimax; NIS = nonionic surfactant = Activator 90; Scoil = methylated seed oil; Quad 7 = basic blend adjuvant.

Table 2. Sulfonylurea resistant sunflower, Hazelton (Zollinger and Ries).

Treatment[1]	Rate	Sunflower			July 19				August 3		
		Jul 13	Jul 19	Aug 3	Fxtl	Rrpw	Colq	Wibw	Fxtl	Rrpw	Colq
	(product/A)	----- % injury ------			---------- % control ----------				---- % control ----		
PRE/POST											
Spartan/Express+ Select+PO	3oz/0.25oz+ 4fl oz+1qt	0	0	0	90	99	99	99	96	99	99
POST											
Express+NIS	0.25oz+0.25% v/v	1	0	0	99	99	99	40	99	99	99
Express+PO	0.25oz+1qt	3	0	0	99	99	99	40	99	99	99
Express+Scoil	0.25oz+1.5pt	5	0	0	99	99	99	40	99	99	99
Express+Quad 7	0.25oz+1% v/v	6	0	0	99	99	99	40	99	99	99
Express+Quad 7	0.167oz+1% v/v	0	0	0	99	99	99	17	99	99	66
Express+Quad 7	0.33oz+1% v/v	11	0	0	99	99	99	30	99	99	99
Express+Quad 7	0.66oz+1% v/v	11	2	0	99	99	99	50	99	99	99
Raptor+Quad 7	4fl oz+1% v/v	28	50	47	93	99	99	30	99	99	99
FirstRate+Quad 7	0.6oz+1% v/v	60	99	99	99	20	20	37	99	0	0
Accent+Quad 7	0.67oz+1% v/v	48	53	53	90	99	70	30	99	99	73
Ally+Quad 7	0.1oz+1% v/v	33	57	50	99	99	99	30	99	99	99
Express+Assure II+ PO	0.25oz+8fl oz+ 1% v/v	3	0	0	70	99	99	30	77	99	99
Express+Select+ PO	0.25oz+6fl oz+ 1qt	3	0	0	87	99	99	30	83	99	99
LSD (0.05)		7	10	4	6	3	0	8	3	3	13

[1]PO = petroleum oil concentrate = Herbimax; NIS = nonionic surfactant = Activator 90; Scoil = methylated seed oil; Quad 7 = basic blend adjuvant.

Express Tolerant Sunflower, Carrington, 2001. (Hendrickson and Zollinger) The study was conducted at the NDSU Carrington Research Extension Center on a loam soil with a 7.9 pH and 3.1% organic matter. Express tolerant sunflower 'Pioneer 01RL0004' was seeded May 28, 2001 into 30 inch rows at 30,000 seeds/A. Guard plots were present between treated plots. Individual plots were 5 by 30 ft arranged in a randomized complete block design with three replications. Herbicide treatments were applied with a CO_2 pressurized hand-held plot sprayer at 20 gal/A and 20 psi through XR8003 flat fan nozzles. Sulfentrazone was applied PRE on May 29, 2001 with 62° F, 70% RH, 5% cloud cover, 7 mph wind, and soil temperature of 60° F. All other herbicides were applied on June 26, 2001 with 74° F, 60% RH, 10% cloud cover, 8 mph wind, and 77° F soil temperature to 4-leaf sunflower, emerging to 3-inch tall redroot pigweed, and 3- to 5-leaf green and yellow foxtail.

On 7/25, sunflower injury was not detected with tribenuron (Express), while imazomox caused moderate injury (30%) and injury from cloransulam was 99%. On 8/20, treatments containing imazomox quizalofop, clethodim, and sulfentrazone gave greater than 95% yellow and green foxtail control. On 8/20, all treatments controlled redroot pigweed (≥98%) except cloransulam.

Express tolerant sunflowers are not cross-tolerant to other sulfonylurea herbicides. Although no crop injury was observed from nicosulfuron and metsulfuron at this location, significant crop injury from both herbicides has occurred at other sites.

Table.

					Weed control							
		Crop injury			Yellow and green foxtail				Redroot pigweed			
Treatment		6/25	7/11	7/25	6/25	7/11	7/25	8/20	6/25	7/11	7/25	8/20
	oz ai/A	%										
Tribenuron + NIS	0.1875 + 0.25%		0	0		0	0	0		94	96	98
Tribenuron + PO	0.1875 + 1qt		0	0		0	0	0		98	99	99
Tribenuron + Scoil	0.1875 + 1.5pt		0	0		0	0	0		97	97	100
Tribenuron + Quad 7	0.1875 + 1%		0	0		0	0	0		96	94	98
Tribenuron + Quad 7	0.125 + 1%		0	0		0	0	0		96	89	98
Tribenuron + Quad 7	0.25 + 1%		3	0		0	0	0		94	98	99
Tribenuron + Quad 7	0.5 + 1%		0	0		0	0	0		99	99	100
Imazamox + Quad 7	0.5 + 1%		30	30		96	94	97		99	100	100
Cloransulam + Quad 7	0.5 + 1%		98	99		0	0	0		30	33	33
Nicosulfuron + Quad 7	0.5 + 1%		0	0		98	97	100		88	94	100
Metsulfuron + Quad 7	0.06 + 1%		0	0		0	0	0		99	99	100
Tribenuron + Quizalofop + PO	0.1875 + 0.88 + 1qt		0	0		97	94	98		94	93	100
Tribenuron + Clethodim + PO	0.1875 + 1.5 + 1qt		0	0		97	96	98		98	93	98
Sulfentrazone / Tribenuron + clethodim + PO	2.25 / 0.1875 + 1 + 1qt	0	0	0	87	98	97	97	91	100	100	100
Untreated check		0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		ns	0	0	7	2	5	3	17	8	7	3

Post-emergence common cocklebur control in sunflower with PPO inhibitors. (Howatt, Roach, and Davidson-Harrington) "63M80" sunflowers were seeded May 31. Treatments were applied to 4 to 6 leaf sunflower and cotyledon to 6 leaf common cocklebur on June 29 with 78 F, 69% relative humidity, 5% cloudcover with light haze, 0 to 1 mph wind, and 73 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa through 11001 flat fan nozzles for broadcast (BC) treatments or through 9501 even flat fan nozzles for post direct (PD) treatments at 35 and 30 psi, respectively, 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. Common cocklebur population was 25 plants/ft^2.

		7/03		7/13		7/25	
Treatment	Rate	SUFL	Cocb	Sufl	Cocb	Sufl	Cocb
	oz/A			%			
Carfentrazone+NIS (BC)	0.128+0.25%	63	80	8	64	1	71
Carfentrazone+NIS (BC)	0.256+0.25%	75	87	31	80	15	80
Carfentrazone+PO (BC)	0.128+1%	73	88	14	74	10	76
Carfentrazone+PO (BC)	0.256+1%	84	96	50	90	26	86
Acifluorfen+NIS (BC)	4+0.25%	59	85	21	71	10	61
Lactofen+PO (BC)	2+2%	86	97	75	94	65	91
Fomesafen+MSO (BC)	2.5+1%	78	87	60	73	60	64
Carf+NIS (PD)	0.128+0.25%	13	78	4	64	1	63
Carf+NIS (PD)	0.256+0.25%	16	84	3	81	3	78
Carf+PO (PD)	0.128+1%	13	86	3	76	1	74
Carf+PO (PD)	0.256+1%	18	89	4	88	0	81
Acifluorfen+NIS (PD)	4+0.25%	14	85	4	71	1	75
Lactofen+PO (PD)	2+2%	10	89	3	89	0	84
Fomesafen+MSO (PD)	2.5+1%	54	85	5	64	5	45
Untreated	0	0	0	0	0	0	0
C.V. %		11	5	26	6	39	11
LSD 5%		7	5	7	6	7	11
# OF REPS		4	4	4	4	4	4

Hot, humid weather following application accentuated sunflower injury from herbicides. Injury manifested as necrotic tissue and stunted plants; however, no sunflower plants died. Post directed treatments did not eliminate sunflower injury but greatly reduced the severity and duration of injury compared to broadcast treatments. At four days after application, sunflower response to lactofen was more similar to broadcast treatments than other post directed treatments. Petroleum oil was a better adjuvant than non-ionic surfactant for carfentrazone, increasing common cocklebur control 8 to 10% but also increasing sunflower injury 10 to 20%. Carfentrazone at 0.256 oz/A was needed to achieve 80% cocklebur control on July 25, but as a broadcast treatment this caused at least 15% sunflower injury. Lactofen provided good control of cocklebur at 84 to 91%, but sunflower still showed 65% injury on July 25 to the broadcast application.

Post-emergence marshelder control in sunflower with PPO inhibitors. (Howatt, Roach, and Davidson-Harrington) "Pioneer 63M80" sunflowers at a rate of 25,000 in 10 inch rows on 30 inch centers were seeded May 23 near Oriska, ND. Treatments were applied to 4 to 6 leaf sunflower and 2 to 4 leaf marshelder on June 22 with 72 F, 50% relative humidity, 10 mph wind, 20% cloudcover, and 70 F soil temperature. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 30 psi. Both broadcast and post direct treatments were applied through 11001 flat fan nozzles to a 7 ft wide area the length of 10 by 30 ft plots. The experiment was a randomized complete block design with four replicates.

		6/29	7/11	
Treatment	Rate	Sufl	Sufl	Mael
	oz/A		%	
Carfentrazone+NIS (BC)	0.128+0.25%	44	29	54
Carfentrazone+NIS (BC)	0.256+0.25%	63	56	68
Carfentrazone+PO (BC)	0.128+1%	66	50	63
Carfentrazone+PO (BC)	0.256+1%	83	73	78
Acifluorfen+NIS (BC)	4+0.25%	40	43	29
Lactofen+PO (BC)	2+2%	83	73	69
Fomesafen+MSO (BC)	2.5+1%	95	90	83
Carfentrazone+NIS (PD)	0.128+0.25%	18	14	8
Carfentrazone+NIS (PD)	0.256+0.25%	33	24	33
Carfentrazone+PO (PD)	0.128+1%	14	28	21
Carfentrazone+PO (PD)	0.256+1%	30	39	74
Acifluorfen+NIS (PD)	4+0.25%	18	25	44
Lactofen+PO (PD)	2+2%	68	66	75
Fomesafen+MSO (PD)	2.5+1%	66	79	79
Untreated (PD)	0	0	0	0
C.V. %		22	20	17
LSD 5%		15	13	13
# OF REPS		4	4	4

Fomesafen provided the most marshelder control at 83%. This herbicide also caused the greatest sunflower injury, 90%. Injury manifested as necrotic tissue, stunted plants, and stand loss. Sunflower injury was much greater than that observed in a similar study near Casselton, ND. Post directed treatments slightly reduced the amount of injury observed, but injury persisted to July 11 compared with the Casselton location where herbicide injury to sunflower was not different from untreated plants two weeks after application. In this study, no treatment gave adequate weed control with acceptable sunflower injury. Study was terminated early because of insect, hail, and wind damage.

Weed control in Juneberry, Absaraka, ND. Hatterman-Valenti, Larson, and Fronning. An experiment was conducted near Absaraka, ND to evaluate weed control in newly transplanted juneberry using chemical and non-chemical methods. Cultivars 'Lee 8' and 'Smokey' were transplanted June 8. The micropropagated stock was purchased from AgriForest Bio-Technologies Ltd. (Kelowna, B.C.). Plants had been headed back prior to shipment due to sunscald during the hardening-off procedure. Preemergence applications were made June 12 at 12:10 (mostly sunny, 3 mph NE, 74° F, 34% RH, damp soil) using CO_2 pressurized backpack sprayer with XR8002 flat-fan nozzles delivering 17 gpa at 40 psi. Seedlings were covered with narrow plastic cones prior to spraying to avoid spray contact. Plots consisted of a single row of four seedlings on 2-ft centers with 10-ft between rows. The experiment was arranged as a split-block, replicated four times with cultivar as the main plot and weed control method as the sub-plot.

Injury ratings were not taken after the initial evaluation due to the poor quality of transplants. Several seedlings in the non-chemical plots had died by July 31 and many others were not growing. The high rate of Milestone and both rates of Valor caused severe juneberry injury (>50%). All treatments except Treflan and the untreated provided excellent season-long redroot pigweed control. The lack of control with Treflan was attributed to the lack of incorporation even though a ¼-inch rainfall occurred the evening after application. Solicam was extremely weak on witchgrass with most plots covered with the grass. Several other treatments also did not provide sufficient season-long control of one or more species. However, the trend was not consistent between blocks. Weed escapes with the black fabric and black plastic occurred around each juneberry seedling where the soil was exposed due to the X cutting pattern used to bring the seedlings through the physical barriers. Weed escapes with the woodchips occurred from squirrels and other rodents digging in the chips and from soil exposure when creeping perennial weeds (i.e. Canada Thistle) emerged.

No	Treatment	Rate Pdt	Injury 6/24	Rrpw 6/24	Rrpw 7/31	Rrpw 8/24	Colq 6/24	Colq 7/31	Colq 8/24	Copu 6/24	Copu 7/31	Copu 8/24	Wigr 6/24	Wigr 7/31	Wigr 8/24	Grft 6/24	Grft 7/31	Grft 8/24
			%															
Smokey Cultivar																		
1	Black Fabric		18	99	100	99	98	95	95	94	91	86	98	98	99	100	99	96
2	Black Plastic		9	100	100	100	100	100	100	96	93	93	100	100	100	99	99	99
3	Woodchips		8	91	94	96	99	99	99	89	88	93	99	98	98	100	99	99
4	Mechanical		8	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
5	Untreated		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Valor	8 oz	51	100	99	98	100	100	100	100	96	99	100	98	95	100	98	95
7	Valor	12 oz	73	100	100	100	100	100	100	99	99	100	100	99	100	98	99	100
8	Solicam	2.5 lb	13	91	88	91	73	70	83	69	73	73	56	40	30	71	83	80
9	Solicam	3.75 lb	5	88	85	93	78	78	88	74	60	70	59	38	28	100	100	100
10	Goal	4 pt	34	100	99	100	100	100	100	98	96	96	99	100	100	99	98	99
11	Goal	8 pt	60	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100
12	Treflan	3 pt	24	23	39	36	33	48	49	23	39	38	24	30	28	38	43	38
13	Surflan	12 pt	19	100	100	100	100	100	100	93	94	95	55	58	64	78	80	83
14	Milestone	7.5 oz	40	100	100	100	100	100	100	99	99	99	100	100	99	100	100	100
15	Milestone	15 oz	51	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Lee 8 Cultivar																		
16	Black Fabric		15	100	100	100	100	100	100	90	94	91	98	100	95	100	100	100
17	Black Plastic		14	99	100	100	95	93	100	98	96	98	93	95	100	100	99	100
18	Woodchips		10	86	78	85	86	86	90	83	79	80	93	79	79	96	95	93
19	Mechanical		9	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
20	Untreated		20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	Valor	8 oz	83	100	100	100	100	100	99	98	93	95	99	100	98	100	99	100
22	Valor	12 oz	58	100	100	100	100	100	100	99	95	99	100	96	98	100	100	100
23	Solicam	2.5 lb	9	89	86	94	91	86	90	90	75	79	93	79	79	96	100	96
24	Solicam	3.75 lb	10	93	94	99	88	85	86	80	74	81	81	70	63	93	88	94
25	Goal	4 pt	24	100	100	100	100	100	100	95	93	95	100	99	100	100	99	100
26	Goal	8 pt	34	100	100	100	100	100	100	100	100	100	100	100	100	99	99	100
27	Treflan	3 pt	15	89	85	74	78	75	60	83	80	78	78	74	68	83	78	78
28	Surflan	12 pt	26	99	100	100	100	100	100	98	100	98	93	96	99	99	100	100
29	Milestone	7.5 oz	35	100	100	100	99	100	100	96	94	98	99	95	98	99	99	100
30	Milestone	15 oz	69	100	100	100	100	100	100	100	99	100	100	100	100	100	100	100
	LSD (P=.05)		29	14	10	8	15	15	11	15	15	12	13	16	16	16	12	12

No	Treatment	Rate Pdt	Injury	Stgr	Broadleaf	Injury	Stgr	Broadleaf
				------- 7/7 -------			------- 8/22 -------	
Smokey Cultivar			----------	----------	%	----------	----------	
1	Black Fabric		11	96	95	14	90	86
2	Black Plastic		5	98	95	10	84	83
3	Woodchips		3	96	95	9	79	88
4	Mechanical		13	100	100	25	100	100
5	Untreated		14	0	0	30	0	0
6	Valor	8 oz	25	91	99	24	85	98
7	Valor	12 oz	43	95	95	28	88	93
8	Solicam	2.5 lb	13	88	64	21	79	75
9	Solicam	3.75 lb	21	78	78	29	48	65
10	Goal	4 pt	20	96	100	26	89	100
11	Goal	8 pt	16	94	99	25	90	100
12	Treflan	3 pt	13	93	84	6	78	79
13	Surflan	12 pt	8	89	85	28	94	84
14	Milestone	7.5 oz	15	94	89	21	93	94
15	Milestone	15 oz	31	95	98	61	98	98
Lee 8 Cultivar								
16	Black Fabric		6	93	95	8	73	96
17	Black Plastic		13	96	99	25	68	88
18	Woodchips		9	98	91	11	78	84
19	Mechanical		16	100	100	28	100	100
20	Untreated		23	0	0	34	0	0
21	Valor	8 oz	51	95	100	41	83	99
22	Valor	12 oz	34	96	99	48	90	95
23	Solicam	2.5 lb	16	84	78	23	71	75
24	Solicam	3.75 lb	16	91	69	16	88	84
25	Goal	4 pt	26	95	99	23	80	95
26	Goal	8 pt	23	99	100	31	86	99
27	Treflan	3 pt	6	94	75	13	80	65
28	Surflan	12 pt	19	91	86	24	81	81
29	Milestone	7.5 oz	30	95	100	38	95	94
30	Milestone	15 oz	43	96	100	73	99	100
		LSD(P=.05)	15	9	14	29	16	13

Weed control in Juneberry, Dawson, ND. Hatterman-Valenti, Larson, and Fronning. An experiment was conducted at Dawson Creek Farm near Dawson, ND to evaluate weed control in newly transplanted juneberry using chemical and non-chemical methods. Cultivars 'Lee 8' and 'Smokey' were transplanted June 9. The micropropagated stock was purchased from AgriForest Bio-Technologies Ltd. (Kelowna, B.C.). Plants had been headed back prior to shipment due to sunscald during the hardening-off procedure. Preemergence applications were made June 15 at 10:30 (mostly sunny, 5 mph NW, 65° F, 69% RH, dry soil) using CO_2 pressurized backpack sprayer with XR8002 flat-fan nozzles delivering 17 gpa at 40 psi. Seedlings were covered with narrow plastic cones prior to spraying to avoid spray contact. Plots consisted of a single row of four seedlings on 1.5-ft centers with 20-ft between rows. The experiment was arranged as a split-block, replicated four times with cultivar as the main plot and weed control method as the sub-plot.

Stinkgrass was the only species uniformly present in all plots. Annual broadleaf species representation varied greatly between replicates and plots and thus was grouped for evaluation. Broadleaf species consisted of common lambsquarters, common purselane, hairy nightshade, goosefoot, kochia, marshelder, redroot pigweed and tumble pigweed. Unacceptable juneberry injury (>20%) occurred in the most of the chemically treated plots. Treflan was the safest herbicide, but it also did not provide satisfactory stinkgrass or annual broadleaf control. Valor and the high rate of Milestone were the most injurious treatments. Solicam weed control decreased with time to less than 85% regardless of the rate used. Weed escapes with the black fabric and black plastic occurred around each juneberry seedling where the soil was exposed due to the X cutting pattern used to bring the seedlings through the physical barriers. Weed escapes with the woodchips occurred from squirrels and other rodents digging in the chips and from soil exposure when creeping perennial weeds (i.e. Canada Thistle) emerged. Split applications of reduced herbicide rates will be included in next year's experiment in an attempt to provide crop safety.