Yellow section: **Buckwheat, Dry Bean, Field Pea, Flax, Lupin, Onion, Potato, Quinoa, Shelterbelt, Turf**

POST field pea weed control, Carrington, 2013. Greg Endres. The trial was conducted in cooperation with BASF to evaluate field pea response and weed control with labeled and experimental tank mixtures of POST bentazon and imazamox plus various adjuvants. Experimental design was a randomized complete block with three replicates. Inoculated 'Bridger' pea was seeded in conventional-tilled loam soil at 300,000 pls/A in 7-inch rows on May 15.
Herbicide treatments were applied with a CO_2-hand-boom plot sprayer delivering 10 gal/A at 35 psi through 8001 flat-fan nozzles on June 24 with 79 F, 46% RH, 10 mph wind, and 75% clear sky to 10- to 12-inch tall pea, 4- to 5-leaf (1- to 5-inch tall) yellow and green foxtail, and 0.5- to 5-inch tall broadleaf weeds.

Plant height was less and lower leaves also were partially desiccated with NIS or COC as herbicide adjuvants with Basagran, Basagran plus Raptor or Poast, and BAS76201H when visually evaluated 11 days after treatment (Table). Also, physiological maturity was delayed 5 to 11 days with the plant injury compared to the untreated check. Foxtail generally was suppressed (64 to 83% control) with all treatments except Basagran (no control) when evaluated 4 and 6 weeks after treatment (WAT). Pigweed control at 4 and 6 WAT ranged from 77 to 82% with Basagran as the sole broadleaf herbicide while other treatments provided excellent control. Common lambsquarters and kochia control was excellent (91 to 99%) at 6 WAT with NIS or COC as herbicide adjuvants. Weed control was similar at 6 WAT with Basagran plus Raptor and BAS76201H with UAN as the adjuvant.

Table.

		Weed control[1]										Field pea	
Herbicide		7/8			7/22			8/7				Plant	
Treatment[2]	Rate	fota	colq	pigw	fota	colq	pigw	fota	colq	pigw	KOCZ	injury[3]	PM[4]
	fl oz product/A	%										%	Jday
Untreated check	x	0	0	0	0	0	0	0	0	0	0	0	208
Bas + NIS + UAN	16	0	99	77	0	96	77	0	99	79	99	14	213
Bas + Raptor	16 + 3	57	47	99	75	48	99	78	40	96	79	0	208
BAS 76201H	16	58	13	99	80	40	x	80	40	92	60	0	211
Bas + Raptor + UAN	16 + 3	72	68	98	75	60	99	83	40	96	79	0	208
BAS 76201H + UAN	16	55	27	99	77	13	99	75	40	96	60	0	210
Bas + Raptor + NIS + UAN	16 + 3	72	90	89	78	95	97	78	91	99	99	16	218
BAS 76201H + Class Act NG	16	45	89	99	72	99	99	70	99	99	99	16.7	218
BAS 76201H + COC + UAN	16 + 1% v/v	73	88	99	72	78	98	72	93	99	99	13.3	219
BAS 76201H + Bas + NIS + UAN	16 + 16	47	89	93	72	90	99	72	99	99	99	17.7	217
Bas + Poast + COC + UAN	31 + 18.3 + 0.125% v/v	72	88	76	64	85	77	72	93	82	99	17.7	215
C.V. (%)		21.3	31.9	9.7	11.4	25.6	8.5	8.0	11.0	12.8	25.9	26.9	1.6
LSD (0.05)		19	35	14	12	29	13	9	13	19	35	4	6

[1]Fota=yellow and green foxtail; colq=common lambsquarters; pigw=redroot and prostrate pigweed; and KOCZ=kochia.

[2]Bas=Basagran (Arysta); NIS=Preference (Winfield) at 0.025% v/v; UAN at 2.5% v/v; BAS 76201H=experimental herbicide (BASF); Class Act NG (Winfield Solutions) at 2.5% v/v; COC=MSO (Drexel).

[3]Plant injury=heigth reduction.

[4]PM=physiological maturity.

Weed control in dry pea with Viper. (Jenks, Walter, and Willoughby). The objective of this study was to evaluate weed control in dry pea with an experimental premix of Basagran + Raptor (BAS 762) combined with various adjuvants. All treatments were applied June 13 to 4- to 5-inch peas. More crop injury was observed when BAS 762 was tank mixed with COC, NIS+AMS, or the addition of more Basagran. The injury was still visible 4 weeks after treatment, but the peas recovered by early August to less than 10% injury. None of the treatments provided more than 80% yellow foxtail control.

Table. Weed control in dry pea with Viper. (1311)

		Dry Pea			Weed Control		
		Injury			Yellow foxtail		
Treatment[a]	Rate	Jun-27	Jul-13	Aug-3	Jun-27	Jul-13	Aug-3
		----------%----------			----------%----------		
Untreated		0	0	0	0	0	0
Basagran + NIS + 28% N	16 oz + 0.25% + 2.5%	3	4	3	0	0	0
Basagran + Raptor	16 oz + 3 oz	5	4	1	69	64	61
BAS 762	16 oz	5	6	1	70	63	58
Basagran + Raptor + 28% N	16 oz + 3 oz + 2.5%	5	5	1	74	70	69
BAS 762 + 28% N	16 oz + 2.5%	5	5	2	73	68	67
Basagran + NIS + Raptor + 28% N	16 oz + 3 oz + 0.25% + 2.5%	8	10	3	79	73	71
BAS 762 + NIS + 28% N	16 oz + 0.25% + 2.5%	7	6	2	79	75	74
BAS 762 + NIS + AMS	16 oz + 0.25% + 4.41%	15	15	3	80	74	74
BAS 762 + COC + 28% N	16 oz + 1% + 2.5%	23	20	5	87	78	80
BAS 762 + Basagran + NIS + 28% N	16 oz + 16 oz + 0.25% + 2.5%	13	19	7	80	73	74
LSD (0.05)		2.5	4.4	2.6	6.7	8.5	10.8
CV		18	29.9	62.3	6.3	8.6	11.1

[a] *All treatments applied at 4-5 inch peas*

Specialty Crop Herbicides

Mike Ostlie

During the 2013 growing season a study was established to explore the potential of eight herbicides on four low-acreage crops; flax, buckwheat, lupine, and quinoa. The objective of the research was to acquire preliminary data regarding the crop safety of several products. With the exception of flax, the crops tested are present on few or no acres in North Dakota. If safe weed control products were identified, it would eliminate one of the major barriers for large-scale production of these promising crop species. To that end, three pre-emergent and five post-emergent products were utilized in the following research. Each plot in the study was 4.6 by 10 feet and each treatment was replicated four times. Treatments were applied with a CO_2 backpack sprayer with TT8002 nozzles, set at 28 PSI, and a 20 GPA application rate. Crops were 3-6" in height at the time of the post-emergence application, with the exception of buckwheat which was 6-8".

Among the pre-emergent options in the study, Sharpen proved to be the safest product across crop species (Table 1). By 35 DAT, no pre-emergent product caused more than 10% crop injury. Adequate rain activation was not achieved with these products, and so mechanical incorporation with a cultivator preceded planting. Even so, injury levels for the pre-emergent products were lower than expected which indicates that the products likely were not activated mechanically either. Among post-emergent options, Warrant provided the most crop safety. All other products injured at least one crop by greater than 20%.

Flax was the most tolerant crop tested across all herbicides, with no more than 5% injury occurring due to herbicide application (Table 1). Quinoa was the most sensitive crop tested, although Stinger and Warrant look to be promising options with some crop injury concession. Lupine were more tolerant to the tested products than expected with only Stinger and MCPA causing significant damage. Raptor was a safe product to apply to lupine, meaning that lupine inherently carries the tolerance trait for imazamox much like soybean and unlike lentils. Buckwheat was damaged by all post-emergent products except Warrant and Stinger (7.5%). It should be noted though that vigorous buckwheat growth continued, after initial stunting , with all treatments except MCPA. Pre-emerge products will require further investigation due to the activation problem mentioned above.

Table 1. Visual efficacy from pre-emergent and post-emergent herbicides applied to several broadleaf specialty crops

Treatment name	Rate	14 DAT				35 DAT			
		Flax	Buckwheat	Lupine	Quinoa	Flax	Buckwheat	Lupine	Quinoa
		%	%	%	%	%	%	%	%
Non treated check		0	0	0	0	0	0	0	0
Warrant	1.5 qt	0	0	0	2.5	5	0	0	10
Zidua (PRE)	3 oz	1.3	1.3	8.8	19.6	0	0	2.5	7.5
Raptor + NIS + UAN	4 oz	3.8	27.5	2.5	47.5	2.5	20	0	70
Stinger	4 oz	5.0	3.8	37.5	16.3	0	7.5	30	10
Dual II Magnum (PRE)	1 pt	2.5	0.0	8.7	14.6	5	2.5	0	0
Basagran	1 pt	2.5	10.0	2.1	26.3	2.5	20	2.5	20
Sharpen (PRE)	1 oz	1.3	0.0	0.0	8.7	0	0	0	7.5
MCPA-Amine	0.5 pt	3.8	20.0	38.8	79.3	0	37.5	52.5	90
LSD (0.05)		8.7	8.8	15.2	16.5	3.7	14.2	10.6	13.8

Dry Edible Bean Weed Control. Zollinger, Richard K., Devin A. Wirth, and Angela J. Kazmierczak. An experiment was conducted near Grand Forks, ND to evaluate weed efficacy in dry edible bean. Navy and Pinto beans were planted on May 15, 2013. PRE treatments were applied on May 15, 2013 at 1:40 pm with 87 F air 57.7F soil at a four inch depth, 15% RH, 20% cloud cover, 5-7 mph SW wind, and adequate soil moisture. POST treatments were applied on June 24, 2013 at 10:20 am with 81 F air, 68.7 F soil at a four inch depth, 35% RH, 35% cloud cover, 3-5 mph SW wind, dry soil moisture, good crop vigor, and no dew present. Weed species present at the time of POST were: bolt-3" (5-10/ft^2) mustard, cotyledon-1.2(5-10/yd^2) redroot pigweed, cotyledon-1-2" (5-10/yd^2) common lambsquarters, cotyledon-3" (5/ft^2) tree seedling, and cotyledon-2" (2/yd^2) Common purselane. Soil characteristics were: 23.5% sand, 52% silt, 24.5% clay, silt loam, 4% OM, and 8 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles for the PRE and 8.5 gpa at 40 psi through 8.5 11001 TT nozzles for the POST . The experiment had a randomized complete block design with three replicates per treatment.

All treatments gave excellent weed control. By 42 DAA, all treatments showed little to now crop injury. Wet conditions before and after PRE application activated PREs well resulting in increased weed control for all treatments including a PRE herbicide.

Table. Dry Edible Bean Weed Control. (Zollinger, Wirth, Kazmierczak)

		7 DAA		14 DAA		42 DAA		7 DAA				14 DAA				42 DAA			
Treatments	Rate	Pinto	Navy	Pinto	Navy	Pinto	Navy	Yeft	Wimu	Rrpw	Colq	Yeft	Wimu	Rrpw	Colq	Yeft	Wimu	Rrpw	Colq
	(Product/A)	% injury		% injury		% injury		% control				% control				% control			
Pre-Plant																			
Prowl H20+Spartan Charge	2pt+4fl oz	0	0	0	0	0	0	99	99	99	99	99	99	99	99	99	99	99	99
Pre-Plant/POST																			
Prowl H20	2 pt																		
Outlook+BAS 762+Superb HC+Class Act NG	12fl oz+21fl oz+0.25% v/v+2.5% v/v	7	7	3	3	0	0	99	99	99	99	99	99	99	99	99	99	99	99
POST																			
Raptor+Superb HC+Class Act NG	3.9fl oz+0.5% v/v+2.5% v/v	7	7	3	3	0	0	99	99	99	99	99	99	99	99	99	99	99	99
Basagran+Raptor+Superb HC+Class Act NG	21fl oz+3.9fl oz+0.5% v/v+2.5% v/v	8	12	7	8	0	0	99	94	99	99	99	96	99	99	99	96	99	99
BAS 762+Superb HC+Class Act NG	16fl oz+0.5% v/v+2.5% v/v	10	10	7	10	0	3	99	86	99	99	99	88	99	99	99	88	99	99
BAS 762+Superb HC+Class Act NG	21fl oz+0.5% v/v+2.5%v/v	10	20	10	12	2	0	99	93	99	99	99	94	99	99	99	94	99	99
Basagran+BAS 762+Superb HC+Class Act NG	10fl oz+21fl oz+0.5% v/v+2.5% v/v	12	10	7	8	2	0	99	96	98	99	99	98	99	99	99	99	99	99
Outlook+BAS 762+Superb HC+Class Act NG	12fl oz+21fl oz+0.25% v/v+2.5% v/v	10	20	12	13	2	0	99	99	99	99	99	99	99	99	99	99	99	99
Outlook+BAS 762+Superb HC+Class Act NG	12fl oz+16fl oz+0.25% v/v+2.5% v/v	8	12	8	12	0	0	99	99	99	99	99	99	99	99	99	99	99	99
LSD (0.05)		5	4	6	5	3	4	0	8	1	2	0	6	0	3	0	6	0	3

Fine Tuning Microrates for Early Season Broadleaf Weed Control in Onion. Harlene Hatterman-Valenti and Collin Auwarter. Early season weed control in onion is essential to produce marketable bulbs and is compounded by the crop's notoriously noncompetitive nature, especially during establishment when onion can take anywhere from 4-10 weeks to reach the 2-leaf stage. Broadleaf weeds such as common lambsquartes and redroot pigweed gain a competitive advantage over the establishing onion crop if weed control methods are not implemented. PRE and POST herbicide options prior to the 2-leaf stage are few, and often ineffective. This study was conducted at the Oakes Irrigation Research Facility near Oakes, ND to compare early-season weed control of bromoxynil (Buctril and Broclean) and oxyfluorfen (GoalTender) applied at microrates to a standard pre-emergence treatment of DCPA (Dacthal) and ethofumesate (Nortron) in onion. 'Sedona' and 'Crocket' onion was planted May 15 with 18" centers and a planting population of 175,000 seeds/a. PRE treatments included 1 and 2 lb/A ethofumesate and 13.33 lb/A DCPA and were applied 9 DAP. Microrate applications began between the flag and one leaf stage, 23 DAP. Bromoxynil and oxyfluorfen were applied at the 0.25 and 0.13X the lowest labeled rate along with 0.031 lb/A clethodim (Select) and applied in four or five sequential applications when weeds and onion were in seeding growth stages. Petroleum oil-surfactant (Herbimax) (1 pt/A) was tank mixed with the microrate application. The pre-emergence treatments received Buctril at 1 pt/A and Goal at 2 pt/A at the five-leaf stage.

Treatments.

Trt No	Trt Name	Rate	Rate Unit/A	App Code	Trt No	Trt Name	Rate	Rate Unit/A	App Code	Trt No	Trt Name	Rate	Rate Unit/A	App Code
1	Buctril	4	floz	B	4	Buctril	4	Floz	B	9	Buctril	2	Floz	B
	Select Max	4	floz	B		Select Max	4	Floz	B		Select Max	4	Floz	B
	Herbimax	1	pt	B		Herbimax	1	Pt	B		Herbimax	1	Pt	B
	Buctril	4	floz	C		Buctril	4	Floz	C		Buctril	2	Floz	C
	Select Max	4	floz	C		Select Max	4	Floz	C		Select Max	4	Floz	C
	Herbimax	1	pt	C		Herbimax	1	Pt	C		Herbimax	1	Pt	C
	Buctril	2	floz	D		Buctril	4	Floz	D		Buctril	2	Floz	D
	Goal Tender	2	floz	D		Select Max	4	Floz	D		Goal Tender	2	Floz	D
	Select Max	4	floz	D		Herbimax	1	Pt	D		Select Max	4	Floz	D
	Herbimax	1	pt	D		Buctril	4	Floz	E		Herbimax	1	Pt	D
	Buctril	2	floz	E		Select Max	4	Floz	E		Buctril	2	Floz	E
	Goal Tender	2	floz	E		Herbimax	1	Pt	E		Goal Tender	2	Floz	E
	Select Max	4	Floz	E		Buctril	4	Floz	F		Select Max	4	Floz	E
	Herbimax	1	Pt	E		Select Max	4	Floz	F		Herbimax	1	Pt	E
2	Buctril	2	Floz	B		Herbimax	1	Floz	F	10	Buctril	4	Floz	B
	Select Max	4	Floz	B	5	Goal Tender	2	Floz	B		Select Max	4	Floz	B
	Herbimax	1	Pt	B		Select Max	4	Floz	B		Herbimax	1	Pt	B
	Buctril	2	Floz	C		Herbimax	1	Pt	B		Buctril	4	Floz	C
	Select Max	4	Floz	C		Goal Tender	2	Floz	C		Select Max	4	Floz	C
	Herbimax	1	Pt	C		Select Max	4	Floz	C		Herbimax	1	Pt	C
	Buctril	2	Floz	D		Herbimax	1	Pt	C		Buctril	4	Floz	D
	Select Max	4	Floz	D		Goal Tender	2	Floz	D		Goal Tender	2	Floz	D
	Herbimax	1	Pt	D		Select Max	4	Floz	D		Select Max	4	Floz	D
	Buctril	2	Floz	E		Herbimax	1	Pt	D		Herbimax	1	Pt	D
	Goal Tender	2	Floz	E		Goal Tender	2	Floz	E		Buctril	4	Floz	E
	Select Max	4	Floz	E		Select Max	4	Floz	E		Goal Tender	2	Floz	E
	Herbimax	1	Pt	E		Herbimax	1	Pt	E		Select Max	4	Floz	E
	Buctril	2	Floz	F		Goal Tender	2	Floz	F		Herbimax	1	Pt	E
	Goal Tender	2	Floz	F		Select Max	4	Floz	F	11	Buctril	4	Floz	B
	Select Max	4	Floz	F		Herbimax	1	Pt	F		Select Max	4	Floz	B
	Herbimax	1	Pt	F	6	Dacthal	10	Lb	A		Herbimax	1	Pt	B
3	Goal Tender	1	Floz	B		Buctril	1	Pt	F		Buctril	4	Floz	C
	Buctril	2	Floz	B		Goal	2	Pt	F		Select Max	4	Floz	C
	Select Max	4	Floz	B		Select Max	12	Floz	F		Herbimax	1	Pt	C
	Herbimax	1	Pt	B		Herbimax	1	Pt	F		Buctril	4	Floz	D
	Goal Tender	1	Floz	C	7	Nortron	2	Pt	A		Select Max	4	Floz	D
	Buctril	2	Floz	C		Buctril	1	Pt	F		Herbimax	1	Pt	D
	Select Max	4	Floz	C		Goal	2	Pt	F		Buctril	4	Floz	E
	Herbimax	1	Pt	C		Select Max	12	Floz	F		Goal Tender	2	Floz	E
	Goal Tender	1	Floz	D		Herbimax	1	Pt	F		Select Max	4	Floz	E
	Buctril	2	Floz	D	8	Nortron	4	Pt	A		Herbimax	1	Pt	E
	Select Max	4	Floz	D		Buctril	1	Pt	F		Buctril	4	Floz	F
	Herbimax	1	Pt	D		Goal	2	Pt	F		Goal Tender	2	Floz	F
	Goal Tender	1	Floz	E		Select Max	12	Floz	F		Select Max	4	Floz	F
	Buctril	2	Floz	E		Herbimax	1	Pt	F		Herbimax	1	Pt	F
	Select Max	4	Floz	E						12	Untreated			
	Herbimax	1	Pt	E										
	Goal Tender	1	Floz	F										
	Buctril	2	Floz	F										
	Select Max	4	Floz	F										
	Herbimax	1	Pt	F										

13	Broclean	2	Floz	B		15	Nortron	2	Pt	A
	Select Max	4	Floz	B			Broclean	1	Pt	F
	Herbimax	1	Pt	B			Goal	2	Pt	F
	Broclean	2	Floz	C			Select Max	12	Floz	F
	Select Max	4	Floz	C			Herbimax	1	Pt	F
	Herbimax	1	Pt	C		16	Broclean	4	Floz	B
	Broclean	4	Floz	D			Select Max	4	Floz	B
	Select Max	4	Floz	D			Herbimax	1	Pt	B
	Herbimax	1	Pt	D			Broclean	4	Floz	C
	Broclean	2	Floz	E			Select Max	4	Floz	C
	Goal Tender	2	Floz	E			Herbimax	1	Pt	C
	Select Max	4	Floz	E			Broclean	4	Floz	D
	Herbimax	1	Pt	E			Goal Tender	2	Floz	D
	Broclean	2	Floz	F			Select Max	4	Floz	D
	Goal Tender	2	Floz	F			Herbimax	1	Pt	D
	Select Max	4	Floz	F			Broclean	4	Floz	E
	Herbimax	1	Pt	F			Goal Tender	2	Floz	E
14	Broclean	4	Floz	B			Select Max	4	Floz	E
	Select Max	4	Floz	B			Herbimax	1	Pt	E
	Herbimax	1	Pt	B						
	Broclean	4	Floz	C						
	Select Max	4	Floz	C						
	Herbimax	1	Pt	C						
	Broclean	4	Floz	D						
	Select Max	4	Floz	D						
	Herbimax	1	Pt	D						
	Broclean	4	Floz	E						
	Select Max	4	Floz	E						
	Herbimax	1	Pt	E						
	Broclean	4	Floz	F						
	Select Max	4	Floz	F						
	Herbimax	1	Pt	F						

Application information.

Date:		5/24/13	6/7/13	6/14/13	6/22/13	7/1/13	7/8/13
TIme:		A	B	C	D	E	F
Sprayer:	GPA:	20	20	20	20	20	20
	PSI:	40	40	40	40	40	40
	Nozzle:	11002	11002	11002	11002	8002	8002
Air Temperature(F):		62	62	77	77	82	80
Relative Humidity (%):		44	75	8156	71	34	54
Soil Moisture:		Adequate	Adequate	Adequate	Excessive	Adequate	Adequate
Wind (MPH):		14	10	11	8	4	5
Cloud Cover (%):		50	5	65	25	20	90
Onion Stage:		Seed Cracking	1 leaf	2 leaf	3 leaf	4 leaf	5 leaf

Weed and injury ratings.

	% CONTROL								
Trt	6/25/2013			7/16/2013			8/16/2013		
No	CHEAL	AMARE	Injury	CHEAL	AMARE	Injury	CHEAL	AMARE	Injury
1	100 a	100 a	10 a	98 ab	98 a	0 a	68 b	78 b	0 a
2	95 a	89 bcd	8 abc	98 ab	93 a	0 a	83 ab	85 ab	0 a
3	99 a	99 ab	10 a	99 ab	98 a	0 a	79 ab	93 ab	0 a
4	100 a	99 ab	6 a-d	100 a	99 a	0 a	84 ab	94 ab	0 a
5	100 a	99 ab	6 a-d	91 b	100 a	0 a	70 ab	94 ab	0 a
6	98 a	78 d	4 b-e	100 a	84 b	0 a	99 a	86 ab	0 a
7	59 c	96 abc	4 b-e	96 ab	95 a	0 a	86 ab	91 ab	0 a
8	80 b	94 abc	3 cde	96 ab	98 a	0 a	83 ab	96 a	0 a
9	94 a	100 a	6 a-d	93 ab	95 a	0 a	69 ab	86 ab	0 a
10	99 a	99 ab	9 ab	99 ab	99 a	0 a	75 ab	85 ab	0 a
11	100 a	99 ab	8 abc	100 a	99 a	0 a	95 ab	96 a	0 a
12	0 e	0 e	0 e	0 c	0 c	0 a	0 c	0 c	0 a
13	100 a	97 abc	10 a	100 a	95 a	0 a	96 ab	94 ab	0 a
14	100 a	99 ab	8 abc	99 ab	99 a	0 a	95 ab	95 a	0 a
15	53 d	86 cd	2 de	94 ab	95 a	0 a	93 ab	96 a	0 a
16	100 a	100 a	6 a-d	99 ab	99 a	0 a	76 ab	90 ab	0 a
LSD(P=.05)	4.53	9.87	3.23	4.84	4.96	0	17.17	10.17	0

Crocket Onion Yield results.

	1 Double Row X 6'												
Trt	<1"		1" – 2.25"		2.25" – 3"		3" – 4"		>4"		Total		
No	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	CWT/A
1	2 a	0 a	14 a	1.6 a	9 a	2.8 a	1.5 a	0.9 ab	0.0 a	0.0 a	25.8 a	5.28 a-e	511 a-e
2	1 a	0 a	5 bc	0.7 abc	9 a	2.9 a	5.8 a	4.1 ab	0.0 a	0.0 a	20.5 ab	7.7 a-d	748 a-d
3	0 a	0 a	7 abc	1 ab	9 a	2.9 a	1.5 a	0.8 ab	0.0 a	0.0 a	17.5 ab	4.7 a-e	453 a-e
4	2 a	0 a	10ab	1 ab	2 bc	0.4 b	0.3 a	0.1 b	0.0 a	0.0 a	13.3 b	1.6 de	152 de
5	0 a	0 a	6 bc	0.8 abc	9 a	3.2 a	4.8 a	3.1 ab	1.3 a	1.5 a	20.8 ab	8.5 abc	823 abc
6	1 a	0 a	4 bc	0.7 abc	8 ab	3.1 a	8.8 a	6.5 a	0.8 a	0.9 a	22.0 ab	11.1 a	1075 a
7	1 a	0 a	5 bc	0.6 abc	6 abc	2.0 ab	6.0 a	3.9 ab	0.5 a	0.6 a	17.3 ab	7.1 a-d	685 a-d
8	1 a	0 a	5 bc	0.8 abc	8 ab	2.6 a	8.0 a	5.5 ab	0.5 a	0.7 a	21.5 ab	9.6 ab	924 ab
9	1 a	0 a	8 ab	1.1 ab	8 ab	2.4 a	1.8 a	1.0 ab	0.0 a	0.0 a	18.8 ab	4.5 a-e	436 a-e
10	3 a	0 a	6 bc	0.6 abc	6 ab	1.9 ab	3.3 a	2.1 ab	0.0 a	0.0 a	18.5 ab	4.7 a-e	453 a-e
11	1 a	0 a	11ab	1.3 ab	5 abc	1.8 ab	4.0 a	2.7 ab	0.0 a	0.0 a	20.3 ab	5.8 a-e	561 a-e
12	0 a	0 a	0 c	0 c	0 c	0 b	0.0 a	0.0 b	0.0 a	0.0 a	0.0 c	0.0 e	0.0 e
13	1 a	0 a	4 bc	0.6 bc	8 ab	2.8 a	7.3 a	4.5 ab	0.8 a	0.8 a	20.8 ab	8.6 abc	835 abc
14	3 a	0 a	10ab	1.1 ab	2 bc	0.5 b	0.5 a	0.4 b	0.0 a	0.0 a	14.5 b	2.0 cde	194 cde
15	1 a	0 a	7 abc	1 ab	8 ab	2.9 a	6.8 a	4.3 ab	0.0 a	0.0 a	22.8 ab	8.2 abc	796 abc
16	2 a	0 a	6 bc	0.6 abc	5 abc	1.6 ab	2.0 a	1.0 ab	0.0 a	0.0 a	14.8 b	3.2 b-e	312 b-e
LSD (P=.05)	2.5	0	4.7	0.6	4.0	1.3	4.9	3.3	1.2	1.4	6.0	3.9	380

Sedona Onion Yield results.

	1 Double Row X 6'												
Trt	<1"		1" – 2.25"		2.25" – 3"		3" – 4"		>4"		Total		
No	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	#	Lbs	CWT/A
1	1 a	0 a	12 a	1.5 a	9 ab	2.8 ab	1.3 b	0.7 b	0.0 a	0.0 a	22.8 a	5.0 bcd	486 bcd
2	1 a	0 a	7 ab	0.7 ab	8 ab	2.7 ab	4.0 ab	2.8 ab	0.3 a	0.4 a	20.0 ab	6.5 abc	629 abc
3	1 a	0 a	5 ab	0.7 ab	13 a	4.4 a	5.5 ab	3.5 ab	0.0 a	0.0 a	23.5 a	8.5 ab	818 ab
4	1 a	0 a	8 ab	0.9 ab	2 bc	0.7 bc	0.3 b	0.1 b	0.0 a	0.0 a	11.0 b	1.7 cd	165 cd
5	0 a	0 a	6 ab	0.9 ab	11 a	3.7 a	5.3 ab	3.8 ab	0.3 a	0.4 a	22.0 a	8.7 ab	842 ab
6	0 a	0 a	5 ab	0.7 ab	7 ab	2.5 abc	11.3 a	7.8 a	0.8 a	0.9 a	24.0 a	11.9 a	1150 a
7	1 a	0 a	5 ab	0.8 ab	7 ab	2.0 abc	3.5 ab	2.2 ab	0.0 a	0.0 a	16.0 ab	5.0 bcd	484 bcd
8	0 a	0 a	3 ab	0.5 ab	6 abc	2.0 abc	8.5 ab	5.9 ab	1.0 a	1.0 a	18.5 ab	9.4 ab	908 ab
9	1 a	0 a	8 ab	1.2 ab	9 ab	2.9 ab	1.8 b	1.0 b	0.0 a	0.0 a	19.8 ab	5.0 bcd	484 bcd
10	2 a	0 a	9 ab	1.1 ab	7 ab	2.0 abc	2.3 b	1.2 b	0.3 a	0.3 a	19.8 ab	4.6 bcd	448 bcd
11	2 a	0 a	7 ab	1.0 ab	8 ab	2.7 ab	5.3 ab	3.4 ab	0.0 a	0.0 a	21.8 ab	7.2 abc	692 abc
12	0 a	0 a	0 b	0.0 b	0 ab	0.0 c	0.0 b	0.0 b	0.0 a	0.0 a	0.0 c	0.0 d	0 d
13	1 a	0 a	5 ab	0.7 ab	10 ab	3.1 ab	7.0 ab	4.4 ab	0.3 a	0.4 a	22.5 a	8.6 ab	833 ab
14	2 a	0 a	9 ab	0.9 ab	6 abc	1.8 abc	0.3 b	0.1 b	0.0 a	0.0 a	17.0 ab	2.9 bcd	276 bcd
15	0 a	0 a	5 ab	0.7 ab	7 ab	2.3 abc	8.0 ab	5.3 ab	0.0 a	0.0 a	19.8 ab	8.3 ab	801 ab
16	1 a	0 a	7 ab	0.9 ab	6 abc	1.7 abc	3.8 ab	2.2 ab	0.0 a	0.0 a	17.8 ab	4.8 bcd	467 bcd
LSD (P=.05)	1.3	0	5.3	0.7	4.4	1.6	4.9	3.4	0.8	0.9	6.5	3.8	371

Crocket + Sedona Yield results.

	CWT/A					
No	<1"	1" – 2.25"	2.25" – 3"	3" – 4"	>4"	Total
1	1.2 a	152 a	271 abc	74 bc	0 a	499 bcd
2	2.4 a	69 bc	270 abc	330 abc	17 a	689 abc
3	0.0 a	80 ab	350 a	206 bc	0 a	635 abc
4	0.0 a	93 ab	53 de	12 c	0 a	159 cd
5	0.0 a	80 ab	333 ab	330 abc	90 a	833 ab
6	0.0 a	67 bc	271 abc	687 a	87 a	1112 a
7	1.2 a	65 bc	191 a-d	298 abc	29 a	584 abc
8	0.0 a	62 bc	226 abc	547 ab	81 a	916 ab
9	0.0 a	110 ab	254 abc	95 bc	0 a	460 bcd
10	3.6 a	85 ab	190 a-d	160 bc	12 a	450 bcd
11	3.6 a	111 ab	217 abc	295 abc	0 a	627 abc
12	0.0 a	0 c	0 e	0 c	0 a	0 d
13	1.2 a	59 bc	288 abc	426 abc	59 a	834 ab
14	4.8 a	94 ab	110 cde	25 c	0 a	235 cd
15	0.0 a	85 ab	250 abc	463 abc	0 a	799 ab
16	1.2 a	73 abc	159 bcd	157 bc	0 a	390 bcd
LSD (P=.05)	3.9	49	107	278	98	335

Treatments that included bromoxynil during at least one of the application timings provided better common lambsquarters control throughout the trial compared to treatments without bromoxynil with the exception of treatment 1. Treatments that included a 5th microrate with bromoxynil or bromoxynil tank mixed with oxyfluorfen had better control of common lambsquarter than treatments with only 4 microrate applications.

The highest yielding treatment was the preemergence conventional treatment of DCPA applied at 7.5 lb/A followed by a tank mix of bromoxynil and oxyfluorfen at 0.25 lb/A with 1112 CWT/A. The lowest yielding treatment besides the untreated, which didn't produce anything, was when bromoxynil was applied at 0.0625 lb/A through all applications with 159 CWT/A. The highest yielding treatment using the microrate applications was with bromoxynil (Broclean treatment) at 0.031 lb/A followed by bromoxynil and oxyfluorfen at 0.031 lb/A with 834 CWT/A and oxyfluorfen at 0.031 lb/A applied throughout the season with 833 CWT/A.

Glyphosate Carryover Effect to Daughter Tubers from Simulated Glyphosate Drift to Four Potato Processing Cultivars. Harlene Hatterman-Valenti and Collin Auwarter.

Field research was conducted in 2012 at the Northern Plains Potato Grower's Association irrigation research site near Inkster, ND to evaluate the injury from glyphosate applied at the tuber initiation (TI), early tuber bulking (EB), and late tuber bulking stage (LB) on yield and carryover of daughter tubers that were planted in 2013. Russet Burbank, Umatilla, Ranger Russet and Bannock were planted on May 24, harvested October 4, and stored October 31, 2012. Glyphosate was applied at rates one-quarter, one-eighth, and one-sixteenth the lowest labeled rate of 0.47 lb/A during the TI and EB stages. During the LB stage glyphosate was applied at the one-quarter, one-eighth, and one-sixteenth the standard use rate of 0.95 lb/A. Ammonium sulfate was tank mixed at a rate of 4 lbs/100 gal. The treatments were applied using an ATV with a spray boom extended out to cover treated rows with 8002 flat fan nozzles, 20 GPA, and CO_2 at 40 psi.

Daughter tubers were planted June 12 and harvested October 25, 2013.

2012 Treatments.

Trt No	Trt Name	Rate	Rate Unit	AI	Rate	Rate Unit	App Code
1	Untreated						
2	Roundup WeatherMax	2.75	fl oz/A	glyphosate	0.095	lb ae/A	A
	AMS	4	lbs/100 gal				A
3	Roundup WeatherMax	1.375	fl oz/A	glyphosate	0.048	lb ae/A	A
	AMS	4	lbs/100 gal				A
4	Roundup WeatherMax	0.6875	fl oz/A	glyphosate	0.024	lb ae/A	A
	AMS	4	lbs/100 gal				A
5	Roundup WeatherMax	2.75	fl oz/A	glyphosate	0.095	lb ae/A	B
	AMS	4	lbs/100 gal				B
6	Roundup WeatherMax	1.375	fl oz/A	glyphosate	0.048	lb ae/A	B
	AMS	4	lbs/100 gal				B
7	Roundup WeatherMax	0.6875	fl oz/A	glyphosate	0.024	lb ae/A	B
	AMS	4	lbs/100 gal				B
8	Roundup WeatherMax	5.5	fl oz/A	glyphosate	0.19	lb ae/A	C
	AMS	4	lbs/100 gal				C
9	Roundup WeatherMax	2.75	fl oz/A	glyphosate	0.095	lb ae/A	C
	AMS	4	lbs/100 gal				C
10	Roundup WeatherMax	1.375	fl oz/A	glyphosate	0.048	lb ae/A	C
	AMS	4	lbs/100 gal				C

2012 Application Information.

Date:		7/24/2012	8/9/2012	9/4/2012
Time:		A	B	C
Sprayer:	GPA:	20	20	20
	PSI:	40	40	40
	Nozzle:	8002	8002	8002
Air Temperature (F):		78	69	80
Relative Humidity (%):		53	63	46
Wind (MPH):		10	7	9
Cloud Cover (%):		25	10	10
Potato Stage:		Tuber Initiation	Early Tuber Bulking	Late Tuber Bulking

2013 Bannock Yield.

Trt	Glyphosate	Rate	App	# Emg.	----------CWT/A----------					
No	Rate	Unit/a	Code	Plants/20'	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	>4 oz
1				20 a	52 a	78 a	227 a	121 ab	491 a	440 a
2	0.095	lb ae	A	12 ab	43 a	42 b-e	122 bc	66 abc	279 bcd	236 bcd
3	0.048	lb ae	A	20 a	45 a	55 a-d	222 a	100 ab	426 ab	381 ab
4	0.024	lb ae	A	20 a	37 a	56 a-d	229 a	161 a	484 a	447 a
5	0.095	lb ae	B	2 c	21 a	17 e	44 d	14 c	101 e	80 e
6	0.048	lb ae	B	7 bc	46 a	38 cde	125 bc	39 bc	249 cd	203 cde
7	0.024	lb ae	B	17 a	57 a	64 abc	170 ab	91 ab	388 abc	331 abc
8	0.19	lb ae	C	5 bc	32 a	24 de	68 cd	49 abc	176 de	144 de
9	0.095	lb ae	C	14 a	49 a	57 a-d	151 ab	66 abc	328 a-d	279 bcd
10	0.048	lb ae	C	18 a	43 a	74 ab	203 a	85 ab	409 abc	366 ab
LSD (P=.05)				6	20	22	55	4	116	109

2013 Bannock Tuber Counts.

Trt	Glyphosate	Rate	App	----------Tuber Counts/20'----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	% >4 oz
1				55 a	35 a	58 a	18 ab	165 a	67 a
2	0.095	lb ae	A	49 a	18 bcd	31 bc	10 bc	109 abc	56 ab
3	0.048	lb ae	A	45 a	24 abc	57 a	15 abc	142 ab	68 a
4	0.024	lb ae	A	39 a	24 abc	59 a	24 a	145 ab	74 a
5	0.095	lb ae	B	24 a	8 d	11 d	3 c	46 d	38 b
6	0.048	lb ae	B	45 a	17 bcd	32 bc	6 bc	100 bc	55 ab
7	0.024	lb ae	B	54 a	29 ab	43 ab	13 abc	139 ab	61 a
8	0.19	lb ae	C	34 a	11 cd	18 cd	7 bc	70 cd	52 ab
9	0.095	lb ae	C	49 a	25 abc	39 ab	10 bc	123 ab	60 a
10	0.048	lb ae	C	46 a	32 a	52 a	13 abc	143 ab	67 a
LSD (P=.05)				19	9	14	8	36	15

2013 Ranger Russet Yields.

Trt	Glyphosate	Rate	App	# Emg.	----------CWT/A----------					
No	Rate	Unit/a	Code	Plants/20'	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	>4 oz
1				20 a	98 a	112 a	225 a	95 a	536 a	438 a
2	0.095	lb ae	A	20 a	97 a	106 a	225 a	80 a	510 a	412 a
3	0.048	lb ae	A	20 a	107 a	116 a	213 a	72 a	512 a	405 a
4	0.024	lb ae	A	19 a	95 a	106 a	215 a	65 a	482 a	388 a
5	0.095	lb ae	B	20 a	85 a	92 a	197 a	68 a	451 a	366 a
6	0.048	lb ae	B	20 a	91 a	103 a	207 a	54 a	462 a	371 a
7	0.024	lb ae	B	20 a	104 a	100 a	202 a	75 a	485 a	381 a
8	0.19	lb ae	C	19 a	95 a	91 a	170 a	70 a	432 a	337 a
9	0.095	lb ae	C	20 a	86 a	97 a	188 a	77 a	451 a	365 a
10	0.048	lb ae	C	20 a	88 a	88 a	225 a	82 a	499 a	411 a
LSD (P=.05)				1	28	27	56	3	74	69

2013 Ranger Russet Tuber Counts.

Trt	Glyphosate	Rate	App	----------Tuber Counts/20'----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	% >4 oz
1				100 a	50 a	59 a	15 a	223 a	56 a
2	0.095	lb ae	A	107 a	46 a	60 a	11 a	224 a	54 a
3	0.048	lb ae	A	118 a	51 a	58 a	10 a	237 a	52 a
4	0.024	lb ae	A	101 a	47 a	58 a	10 a	215 a	55 a
5	0.095	lb ae	B	90 a	41 a	52 a	11 a	194 a	55 a
6	0.048	lb ae	B	101 a	45 a	55 a	9 a	209 a	53 a
7	0.024	lb ae	B	108 a	45 a	55 a	11 a	218 a	50 a
8	0.19	lb ae	C	100 a	41 a	45 a	11 a	196 a	50 a
9	0.095	lb ae	C	96 a	43 a	50 a	11 a	201 a	53 a
10	0.048	lb ae	C	97 a	39 a	61 a	13 a	209 a	57 a
			LSD (P=.05)	30	12	14	6	37	9

2013 Umatilla Yields.

Trt	Glyphosate	Rate	App	# Emg.	----------CWT/A----------					
No	Rate	Unit/a	Code	Plants/20'	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	>4 oz
1				20 a	113 ab	113 a	201 a	44 a	473 a	360 a
2	0.095	lb ae	A	20 a	116 ab	120 a	209 a	21 a	472 a	357 a
3	0.048	lb ae	A	19 a	93 ab	111 a	200 a	53 a	459 a	366 a
4	0.024	lb ae	A	20 a	131 a	122 a	186 a	26 a	469 a	338 a
5	0.095	lb ae	B	7 c	72 b	63 b	84 b	16 a	236 b	164 b
6	0.048	lb ae	B	19 a	88 ab	104 a	186 a	39 a	420 a	332 a
7	0.024	lb ae	B	20 a	111 ab	113 a	186 a	27 a	451 a	340 a
8	0.19	lb ae	C	11 b	84 ab	61 b	115 ab	46 a	308 b	224 ab
9	0.095	lb ae	C	19 a	97 ab	115 a	187 a	36 a	438 a	341 a
10	0.048	lb ae	C	19 a	110 ab	117 a	190 a	37 a	458 a	348 a
			LSD (P=.05)	2	34	31	64	3	97	101

2013 Umatilla Tuber Counts.

Trt	Glyphosate	Rate	App	----------Tuber Counts/20'----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	% >4 oz
1				111 a	50 a	56 a	7 a	224 a	51 a
2	0.095	lb ae	A	111 a	53 a	57 a	4 a	226 a	52 a
3	0.048	lb ae	A	91 a	49 a	55 a	8 a	203 a	55 a
4	0.024	lb ae	A	127 a	54 a	52 a	5 a	238 a	47 a
5	0.095	lb ae	B	75 a	28 b	23 b	3 a	128 b	43 a
6	0.048	lb ae	B	86 a	46 a	52 a	6 a	190 a	54 a
7	0.024	lb ae	B	110 a	50 a	51 a	6 a	217 a	50 a
8	0.19	lb ae	C	86 a	27 b	31 ab	7 a	151 b	42 a
9	0.095	lb ae	C	102 a	50 a	51 a	5 a	208 a	51 a
10	0.048	lb ae	C	122 a	52 a	51 a	6 a	231 a	48 a
			LSD (P=.05)	33	13	16	5	37	12

2013 Russet Burbank Yields.

Trt	Glyphosate	Rate	App	# Emg.	----------CWT/A----------					
No	Rate	Unit/a	Code	Plants/20'	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	>4 oz
1				20 a	80 a	76 a	173 a	42 a	385 a	305 a
2	0.095	lb ae	A	20 a	78 a	77 a	109 a	26 a	297 a	219 a
3	0.048	lb ae	A	20 a	70 a	78 a	193 a	98 a	441 a	370 a
4	0.024	lb ae	A	20 a	93 a	83 a	173 a	83 a	442 a	349 a
5	0.095	lb ae	B	13 b	69 a	68 a	67 a	12 a	224 a	155 a
6	0.048	lb ae	B	19 a	94 a	92 a	121 a	12 a	321 a	227 a
7	0.024	lb ae	B	20 a	106 a	91 a	178 a	20 a	396 a	290 a
8	0.19	lb ae	C	10 b	61 a	65 a	100 a	13 a	244 a	183 a
9	0.095	lb ae	C	18 a	91 a	89 a	100 a	22 a	315 a	224 a
10	0.048	lb ae	C	19 a	85 a	88 a	153 a	48 a	380 a	294 a
LSD (P=.05)				4	32	41	80	5	133	129

2013 Russet Burbank Tuber Counts.

Trt	Glyphosate	Rate	App	----------Tuber Counts/20'----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	% >4 oz
1				84 a	34 a	46 a	8 a	172 a	51 a
2	0.095	lb ae	A	79 a	34 a	30 a	5 a	148 a	47 a
3	0.048	lb ae	A	73 a	35 a	51 a	14 a	173 a	58 a
4	0.024	lb ae	A	101 a	37 a	46 a	13 a	198 a	49 a
5	0.095	lb ae	B	75 a	31 a	19 a	3 a	127 a	41 a
6	0.048	lb ae	B	100 a	41 a	35 a	2 a	177 a	42 a
7	0.024	lb ae	B	110 a	39 a	50 a	3 a	201 a	45 a
8	0.19	lb ae	C	60 a	29 a	28 a	3 a	120 a	48 a
9	0.095	lb ae	C	102 a	39 a	27 a	6 a	174 a	42 a
10	0.048	lb ae	C	89 a	40 a	41 a	8 a	177 a	50 a
LSD (P=.05)				33	18	21	8	53	14

Bannock showed the greatest difference among yield, tuber counts and plant emergence. The lowest yielding treatment was glyphosate applied during the ETB stage at 0.095 lb ae/A with 80 CWT/A. Glyphosate applied at 0.048 and 0.024 lb ae/A during the ETB stage had yields of 203 and 331 CWT/A, respectively. The untreated had a yield of 440 CWT/A. Tuber counts showed the lowest count with 46 total tubers, 38% marketable, during the ETB stage at 0.095 lb ae/A. The untreated had 165 tubers and 67% marketable. Only 10% of plants emerged during the ETB stage at a rate of 0.095 lb ae/A. 60% and 25% of plants emerged at the 0.095 lbae/A rate during the TI and 0.19 lb ae/A LTB stages, respectively.

During 2012, Bannock potatoes showed the greatest injury of tubers during the ETB stage at the 0.095 lb ae/A rate with 32% of total tubers showing symptoms of glyphosate. The other stages at the high rate, TI stage at 0.095 lb ae/A showed 16% injury and the LTB stage at 0.19 lb ae/A had 3% injury. Only 34% of tubers were >4 oz during the ETB stage at 0.095 lb ae/A. Also, during this stage and rate, it had the lowest yield with 194 CWT/A. All other treatments had at least 295 CWT/A. The ETB stage showed the greatest impact of daughter tubers from glyphosate in Bannock potatoes.

Ranger showed very little difference among treatments. There were at least 95% of plants emerged in all treatments. All yielded greater than 337 CWT/A, which was during the LTB stage at 0.19 lb ae/A. The untreated had a yield of 438 CWT/A. All treatments had between 50% and 57% of marketable tubers.
During 2012, Ranger potatoes showed the most injury during the ETB stage. There was 12% injury at the 0.095 lb ae/A rate and 9% injury at the 0.048 lb ae/A rate. All other treatments showed injury, including the untreated, but none more than 5%. The same potatoes that showed signs of injury during 2012 during ETB, yielded well in 2013. The 0.095 lb ae/A rate at the ETB stage had a yield of 381 CWT/A during 2012 and a yield of 366 CWT/A in 2013.

Umatilla potatoes showed similar results as Bannock, as potatoes treated during the ETB stage had the greatest impact on yield, tuber counts and plant emergence. The lowest yielding treatment was at 0.095 lb ae/A with 164 CWT/A at the ETB stage, while the untreated had 360 CWT/A. 35% of plants emerged at this stage, and produced the least amount of tubers, 57% of what the untreated produced. During the LTB stage at the 0.19 lb ae/A only 55% of plants emerged. All other treatments had at least 95% emergence of plants.
During 2012, Umatilla potatoes had 49% injury during the ETB stage at the 0.095 lb ae/A rate. However, it still yielded well with 277 CWT/A. The untreated had a yield of 283 CWT/A. In 2013, daughter tubers from this treatment yielded 164 CWT/A while the untreated had 360 CWT/A. During the LTB stage at 0.19 lb ae/A in 2012, only 5% of tubers showed injury. When daughter tubers were planted in 2013, only 55% if the tubers emerged.

Russet Burbank showed similar results as the Ranger potatoes in regards to no significant differences among yields and tuber counts. Plant emergence showed during the ETB stage at the 0.095 lb ae/A rate produced 65% plants and at the LTB stage at the rate of 0.19 lb ae/A only had 50% of emerged plants. All other treatments had at least 90% emerged plants. Yield varied between 155 and 370 CWT/A and 41% - 58% of tubers marketable.
During 2012, Russet Burbank showed the greatest injury symptoms during the ETB stage. There was 41% and 23% injury at the 0.095 and 0.048 lb ae/A, respectively. Those same daughter tubers planted in 2013 had significantly less plant emergence however no differences in yield and tuber counts.

Ranger Russet daughter tubers showed the least injury when plants were sprayed with glyphosate among the four cultivars that were studied. Russet Burbank fared well, but showed more injury than Ranger Russet potatoes even though there were no significant differences in yield or tuber counts. Bannock showed the greatest effect from glyphosate injury. It had a greater difference in yield and number of plants to emerge among the entire cultivar. Umatilla was more similar to Bannock than Russet Burbank. It showed a difference in yield and emergence, but not to the extent of Bannock. Potatoes applied with glyphosate during the ETB stage had the greatest effect on daughter tubers, followed by LTB. TI stage shows the greatest sign of glyphosate injury in the field, but carryover to the following year had the least effect compared to the other stages.

Ranger showed very little difference among treatments. There were at least 95% of plants emerged in all treatments. All yielded greater than 337 CWT/A, which was during the LTB stage at 0.19 lb ae/A. The untreated had a yield of 438 CWT/A. All treatments had between 50% and 57% of marketable tubers. During 2012, Ranger potatoes showed the most injury during the ETB stage. There was 12% injury at the 0.095 lb ae/A rate and 9% injury at the 0.048 lb ae/A rate. All other treatments showed injury, including the untreated, but none more than 5%. The same potatoes that showed signs of injury during 2012 during ETB, yielded well in 2013. The 0.095 lb ae/A rate at the ETB stage had a yield of 381 CWT/A during 2012 and a yield of 366 CWT/A in 2013.

Umatilla potatoes showed similar results as Bannock, as potatoes treated during the ETB stage had the greatest impact on yield, tuber counts and plant emergence. The lowest yielding treatment was at 0.095 lb ae/A with 164 CWT/A at the ETB stage, while the untreated had 360 CWT/A. 35% of plants emerged at this stage, and produced the least amount of tubers, 57% of what the untreated produced. During the LTB stage at the 0.19 lb ae/A only 55% of plants emerged. All other treatments had at least 95% emergence of plants.
During 2012, Umatilla potatoes had 49% injury during the ETB stage at the 0.095 lb ae/A rate. However, it still yielded well with 277 CWT/A. The untreated had a yield of 283 CWT/A. In 2013, daughter tubers from this treatment yielded 164 CWT/A while the untreated had 360 CWT/A. During the LTB stage at 0.19 lb ae/A in 2012, only 5% of tubers showed injury. When daughter tubers were planted in 2013, only 55% if the tubers emerged.

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Effect of Simulated Glyphosate Drift to Four Potato Processing Cultivars. Harlene Hatterman-Valenti Collin Auwarter and Andrew Robinson.

Field research was conducted at the Northern Plains Potato Grower's Association irrigation research site near Inkster, ND to evaluate the injury from glyphosate applied at the tuber initiation (TI), early tuber bulking (EB), and late tuber bulking stage (LB) on yield and carryover of daughter tubers that will be planted in 2014. Russet Burbank, Umatilla, Ranger Russet and Bannock were planted on June 12. Glyphosate was applied at rates one-quarter, one-eighth, and one-sixteenth the standard use rate of 0.95 lb/A. Ammonium sulfate was tank mixed at a rate of 4 lbs/100 gal. The treatments were applied using an ATV with a spray boom extended out to cover treated rows with 8002 flat fan nozzles, 20 GPA, and CO_2 at 40 psi.

Trt No	Trt Name	Rate	Rate Unit	AI	Rate	Rate Unit	App Code
1	Untreated						
2	Roundup WeatherMax	5.5	floz/a	glyphosate	0.19	lb ae/A	A
	AMS	4	lbs/100 gal				A
3	Roundup WeatherMax	2.75	floz/a	glyphosate	0.095	lb ae/A	A
	AMS	4	lbs/100 gal				A
4	Roundup WeatherMax	1.375	floz/a	glyphosate	0.048	lb ae/A	A
	AMS	4	lbs/100 gal				A
5	Roundup WeatherMax	5.5	floz/a	glyphosate	0.19	lb ae/A	B
	AMS	4	lbs/100 gal				B
6	Roundup WeatherMax	2.75	floz/a	glyphosate	0.095	lb ae/A	B
	AMS	4	lbs/100 gal				B
7	Roundup WeatherMax	1.375	floz/a	glyphosate	0.048	lb ae/A	B
	AMS	4	lbs/100 gal				B
8	Roundup WeatherMax	5.5	floz/a	glyphosate	0.19	lb ae/A	C
	AMS	4	lbs/100 gal				C
9	Roundup WeatherMax	2.75	floz/a	glyphosate	0.095	lb ae/A	C
	AMS	4	lbs/100 gal				C
10	Roundup WeatherMax	1.375	floz/a	glyphosate	0.048	lb ae/A	C
	AMS	4	lbs/100 gal				C

Application Information.

Date:		8/4/2013	8/22/2013	9/11/2013
Time:		A	B	C
Sprayer:	GPA:	20	20	20
	PSI:	40	40	40
	Nozzle:	8002	8002	8002
Air Temperature (F):		62	73	70
Relative Humidity (%):		65	6338	68
Wind (MPH):		11	5	12
Cloud Cover (%):		100	25	25
Potato Stage:		Tuber Initiation	Early Tuber Bulking	Late Tuber Bulking

Bannock Yield.

Trt	Glyphosate	Rate	App	----------CWT/A----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	>4 oz
1				46 c	61 a	189 a	163 a	459 a	413 a
2	0.19	lb ae	A	62 c	8 b	13 c	6 c	89 c	27 c
3	0.095	lb ae	A	167 a	50 a	29 c	6 c	251 b	85 c
4	0.048	lb ae	A	110 b	70 a	109 b	34 bc	323 ab	212 b
5	0.19	lb ae	B	43 c	48 a	161 a	127 ab	379 ab	336 a
6	0.095	lb ae	B	42 c	53 a	186 a	168 a	448 a	406 a
7	0.048	lb ae	B	43 c	53 a	153 a	120 ab	367 ab	325 a
8	0.19	lb ae	C	54 c	60 a	164 a	62 abc	340 ab	286 ab
9	0.095	lb ae	C	45 c	50 a	175 a	129 ab	399 ab	354 a
10	0.048	lb ae	C	38 c	55 a	186 a	133 ab	413 a	375 a
			LSD (P=.05)	30	17	35	73	100	92

Bannock Tuber Counts.

Trt	Glyphosate	Rate	App	----------Tuber Counts/20'----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	% >4 oz
1				51 c	27 a	48 a	23 a	147 b	66 a
2	0.19	lb ae	A	125 b	4 b	4 c	1 c	134 b	5 c
3	0.095	lb ae	A	225 a	22 a	8 c	1 c	256 a	12 c
4	0.048	lb ae	A	127 b	31 a	30 b	5 bc	192 b	35 b
5	0.19	lb ae	B	46 c	21 a	42 a	18 ab	126 b	63 a
6	0.095	lb ae	B	45 c	23 a	48 a	22 a	138 b	67 a
7	0.048	lb ae	B	43 c	24 a	40 a	17 ab	124 b	66 a
8	0.19	lb ae	C	59 c	27 a	43 a	9 abc	137 b	57 a
9	0.095	lb ae	C	45 c	22 a	47 a	18 ab	130 b	66 a
10	0.048	lb ae	C	40 c	24 a	48 a	17 ab	129 b	69 a
			LSD (P=.05)	41	7	9	9	48	9

Ranger Russet Yields.

Trt	Glyphosate	Rate	App	----------CWT/A----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	>4 oz
1				118 b	105 ab	144 a	26 a	393 ab	274 a
2	0.19	lb ae	A	180 a	70 b	54 b	13 a	317 b	137 b
3	0.095	lb ae	A	160 ab	86 ab	86 ab	18 a	350 ab	190 b
4	0.048	lb ae	A	136 ab	103 ab	140 a	37 a	416 a	280 a
5	0.19	lb ae	B	97 b	99 ab	153 a	41 a	390 ab	293 a
6	0.095	lb ae	B	118 b	112 a	142 a	47 a	419 a	300 a
7	0.048	lb ae	B	121 b	113 a	151 a	43 a	427 a	307 a
8	0.19	lb ae	C	119 b	98 ab	150 a	34 a	401 a	282 a
9	0.095	lb ae	C	123 b	118 a	134 a	46 a	421 a	298 a
10	0.048	lb ae	C	109 b	117 a	156 a	36 a	417 a	308 a
			LSD (P=.05)	38	25	45	29	57	66

Ranger Russet Tuber Counts.

Trt	Glyphosate	Rate	App	----------Tuber Counts/20'----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	% >4 oz
1				117 bc	46 ab	40 a	4 a	206 b	45 a
2	0.19	lb ae	A	241 a	32 b	16 b	2 a	290 a	17 c
3	0.095	lb ae	A	170 b	38 ab	24 ab	3 a	235 b	28 c
4	0.048	lb ae	A	128 bc	46 ab	39 a	5 a	218 b	42 a
5	0.19	lb ae	B	95 c	44 ab	44 a	6 a	188 b	50 a
6	0.095	lb ae	B	115 bc	50 a	40 a	7 a	211 b	47 a
7	0.048	lb ae	B	114 bc	51 a	42 a	6 a	213 b	47 a
8	0.19	lb ae	C	116 bc	44 ab	41 a	5 a	205 b	44 a
9	0.095	lb ae	C	116 bc	52 a	37 a	7 a	212 b	45 a
10	0.048	lb ae	C	104 bc	52 a	43 a	5 a	203 b	49 a
			LSD (P=.05)	43	11	12	4	39	10

Umatilla Yields.

Trt	Glyphosate	Rate	App	----------CWT/A----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	>4 oz
1				54 bc	60 a	153 a	99 a	366 a	313 a
2	0.19	lb ae	A	28 c	2 b	10 b	0 b	39 b	11 b
3	0.095	lb ae	A	100 ab	9 b	7 b	0 b	116 b	16 b
4	0.048	lb ae	A	134 a	36 a	43 b	18 b	231 a	97 b
5	0.19	lb ae	B	51 bc	70 a	152 a	102 a	375 a	324 a
6	0.095	lb ae	B	47 bc	47 a	147 a	108 a	349 a	302 a
7	0.048	lb ae	B	67 bc	67 a	133 a	69 ab	336 a	269 a
8	0.19	lb ae	C	64 bc	53 a	158 a	53 ab	328 a	264 a
9	0.095	lb ae	C	60 bc	57 a	131 a	51 ab	298 a	238 a
10	0.048	lb ae	C	53 bc	61 a	133 a	73 ab	320 a	267 a
			LSD (P=.05)	34	26	59	49	95	91

Umatilla Tuber Counts.

Trt	Glyphosate	Rate	App	----------Tuber Counts/20'----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	% >4 oz
1				53 b	27 a	41 a	14 a	134 bc	60 a
2	0.19	lb ae	A	77 b	1 b	3 b	0 c	81 c	2 b
3	0.095	lb ae	A	213 a	4 b	2 b	0 c	219 ab	3 b
4	0.048	lb ae	A	222 a	16 a	12 b	3 bc	252 a	14 b
5	0.19	lb ae	B	52 b	31 a	40 a	15 a	137 bc	62 a
6	0.095	lb ae	B	48 b	21 a	37 a	15 a	121 bc	59 a
7	0.048	lb ae	B	68 b	30 a	34 a	10 ab	141 bc	52 a
8	0.19	lb ae	C	70 b	24 a	41 a	8 abc	143 bc	51 a
9	0.095	lb ae	C	63 b	25 a	34 a	8 abc	129 bc	52 a
10	0.048	lb ae	C	52 b	27 a	35 a	11 ab	124 bc	59 a
			LSD (P=.05)	62	11	15	6	65	11

Russet Burbank Yields.

Trt	Glyphosate	Rate	App	----------CWT/A----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	>4 oz
1				129 ab	97 a	126 a	61 a	413 a	284 a
2	0.19	lb ae	A	131 ab	30 c	17 b	0 b	178 b	48 c
3	0.095	lb ae	A	189 a	49 bc	38 ab	1 b	277 ab	88 bc
4	0.048	lb ae	A	139 ab	73 ab	100 ab	21 ab	333 a	194 ab
5	0.19	lb ae	B	105 b	101 a	144 a	32 ab	381 a	276 a
6	0.095	lb ae	B	116 b	106 a	140 a	40 ab	401 a	286 a
7	0.048	lb ae	B	131 ab	110 a	150 a	42 ab	432 a	302 a
8	0.19	lb ae	C	130 ab	87 a	104 ab	32 ab	353 a	222 a
9	0.095	lb ae	C	123 ab	94 a	131 a	39 ab	387 a	265 a
10	0.048	lb ae	C	109 b	102 a	134 a	60 a	405 a	296 a
LSD (P=.05)				44	30	75	33	107	111

Russet Burbank Tuber Counts.

Trt	Glyphosate	Rate	App	----------Tuber Counts/20'----------					
No	Rate	Unit/a	Code	<4 oz	4-6 oz	6-10 oz	>10 oz	Total	% >4 oz
1				137 c	43 a	34 a	9 a	223 b	39 ab
2	0.19	lb ae	A	221 b	14 c	5 b	0 b	240 b	8 c
3	0.095	lb ae	A	271 a	23 bc	11 ab	0 b	305 a	11 c
4	0.048	lb ae	A	164 c	33 ab	27 ab	3 ab	227 b	28 b
5	0.19	lb ae	B	103 c	45 a	39 a	5 ab	192 b	46 a
6	0.095	lb ae	B	119 c	47 a	39 a	5 ab	210 b	43 ab
7	0.048	lb ae	B	133 c	49 a	43 a	7 ab	231 b	42 ab
8	0.19	lb ae	C	136 c	39 a	29 ab	5 ab	208 b	36 ab
9	0.095	lb ae	C	131 c	42 a	37 a	6 ab	216 b	41 ab
10	0.048	lb ae	C	111 c	45 a	36 a	9 a	201 b	44 ab
LSD (P=.05)				45	14	20	5	50	11

Bannock

Simulated glyphosate drift to Bannock during tuber initiation (A) reduced marketable yield compared to the untreated regardless of the sub-lethal rate that was applied. This was due to a reduction in tuber size instead of a reduction in tuber number. The number of tubers produced actually increased when Bannock plants were spray with 0.095 lb ae/A glyphosate at t compared to the untreated. Sub-lethal rates of glyphosate applied to Bannock plants in the early tuber bulking (B) or late tuber bulking (C) stages did not affect marketable tuber yield or tuber number compared to the untreated.

Ranger Russet

Simulated glyphosate drift to Ranger Russet during tuber initiation (A) reduced marketable yield compared to the untreated only when sub-lethal rates of 0.19 and 0.095 lb ae/A were applied. This was due to a reduction in tuber size instead of a reduction in tuber number, even though tuber number were

numerically less when sub-lethal rates of 0.19 and 0.095 lb ae/A glyphosate were applied compared to the untreated. The number of tubers produced actually increased when Ranger Russet plants were spray with 0.19 lb ae/A glyphosate at tuber initiation compared to the untreated. Sub-lethal rates of glyphosate applied to Ranger Russet plants in the early tuber bulking (B) or late tuber bulking (C) stages did not affect marketable tuber yield or tuber number compared to the untreated.

Umatilla

Simulated glyphosate drift to Umatilla during tuber initiation (A) reduced marketable yield compared to the untreated regardless of the sub-lethal rate that was applied. This was due to a reduction in tuber size instead of a reduction in tuber number. The number of tubers produced actually increased when Bannock plants were spray with 0.048 lb ae/A glyphosate at tuber initiation compared to the untreated. Sub-lethal rates of glyphosate applied to Umatilla plants in the early tuber bulking (B) or late tuber bulking (C) stages did not affect marketable tuber yield or tuber number compared to the untreated.

Russet Burbank

Simulated glyphosate drift to Russet Burbank during tuber initiation (A) reduced marketable yield compared to the untreated only when sub-lethal rates of 0.19 and 0.095 lb ae/A were applied. This was due to a reduction in tuber size instead of a reduction in tuber number. The number of tubers produced actually increased when Russet Burbank plants were spray with 0.095 lb ae/A glyphosate at tuber initiation compared to the untreated. Sub-lethal rates of glyphosate applied to Russet Burbank plants in the early tuber bulking (B) or late tuber bulking (C) stages did not affect marketable tuber yield or tuber number compared to the untreated.

Metribuzin and Rimsulfuron for eastern black nightshade weed control on potato. Harlene Hatterman-Valenti and Collin Auwarter.

This study was conducted at the Oakes Irrigation Research Extension Center near Oakes, ND to evaluate different rates of metribuzin and rimsulfuron applied POST (B-E) on Russet Burbank potatoes for eastern black nightshade control. Some treatments received a PRE (A) application of flumioxazin tank mixed with metribuzin at a rate of 0.3875 oz and 0.6 lb/A. Corn was grown during 2012. Plots were 4 rows by 20 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36 inch rows and 12 inch spacing on May 15, 2013. Potatoes were harvested on October 29. Spray applications, yield data and weed control ratings are listed below.

Applications.

Date:		6/14/2013	6/22/2013	7/1/2013	7/8/2013	7/16/2013
Timing:		A	B	C	D	E
Sprayer:	GPA:	20	20	20	20	20
	PSI:	40	40	40	40	40
	Nozzle:	8002	8002	8002	8002	8002
Air Temp. (F):		81	74	83	80	82
Rel. Hum. (%):		51	81	35	54	63
Wind (MPH):		11	9	4	5	9

Yield data.

Trt	Row A	Row B	Row A	Row B
No	----20'----	----20'----	--CWT/A--	--CWT/A--
1	59.80	63.90	434.2	463.9
2	74.00	74.63	537.2	541.8
3	73.75	74.15	535.4	538.3
4	76.53	81.58	555.6	592.3
5	59.73	67.65	433.6	491.1
6	62.43	72.15	453.2	523.8
7	69.40	67.33	503.8	488.8
8	68.68	74.03	498.6	537.5
9	67.35	69.90	489.0	507.5
LSD (P=0.05)	13.59	14.7	98.7	106.7

PRE applications of flumioxazin tank mixed with metribuzin had better weed control 14 DAA A and 6 DAA B. Applying a single application of metribuzin at 1.5 oz/A tank mixed with Matrix at 0.5 lb/A did just as well as multiple applications of the same tank mix and same amount of total product throughout trial. The untreated had the lowest yield while the highest yielding treatment had three applications of metribuzin at 0.5 oz/A tank mixed with Matrix at 0.167 lb/A.

Treatments and weed control ratings.

					6/28/2013				7/16/2013				8/14/2013			
Trt	Trt		Rate		% Control				% Control				% Control			
No.	Name	Rate	Unit	App	COLQ	RRPW	EBNS	GRFT	COLQ	RRPW	EBNS	GRFT	COLQ	RRPW	EBNS	GRFT
1	Unt				0 c	0 c	0 d	0 b	0 b	0 b	0 b	0 c	0 b	0 b	0 b	0 b
2	Class Act NG	2.5	%v/v	B	93 ab	94 ab	90 c	99 a	100 a	100 a	99 a	100 a	95 a	100 a	98 a	100 a
	Metribuzin	1.5	oz/A	B												
	Matrix	0.5	lb/A	B												
3	Class Act NG	2.5	%v/v	B	85 b	94 ab	93 bc	98 a	91 a	100 a	93 a	100 a	96 a	100 a	100 a	99 a
	Metribuzin	0.75	oz/A	B												
	Matrix	0.25	lb/A	B												
	Class Act NG	2.5	%v/v	D												
	Metribuzin	0.75	oz/A	D												
	Matrix	0.25	lb/A	D												
4	Class Act NG	2.5	%v/v	B	91 ab	94 ab	93 bc	99 a	95 a	100 a	98 a	100 a	98 a	100 a	100 a	100 a
	Metribuzin	0.5	oz/A	B												
	Matrix	0.167	lb/A	B												
	Class Act NG	2.5	%v/v	C												
	Metribuzin	0.5	oz/A	C												
	Matrix	0.167	lb/A	C												
	Class Act NG	2.5	%v/v	D												
	Metribuzin	0.5	oz/A	D												
	Matrix	0.167	lb/A	D												
5	Class Act NG	2.5	%v/v	B	85 b	90 b	89 c	98 a	95 a	100 a	98 a	100 a	98 a	99 a	100 a	98 a
	Metribuzin	0.375	oz/A	B												
	Matrix	0.125	lb/A	B												
	Class Act NG	2.5	%v/v	C												
	Metribuzin	0.375	oz/A	C												
	Matrix	0.125	lb/A	C												
	Class Act NG	2.5	%v/v	D												
	Metribuzin	0.375	oz/A	D												
	Matrix	0.125	lb/A	D												
	Class Act NG	2.5	%v/v	E												
	Metribuzin	0.375	oz/A	E												
	Matrix	0.125	lb/A	E												
6	Chateau	0.75	oz/A	A	99 a	100 a	98 ab	100 a	95 a	100 a	95 a	98 b	100 a	100 a	100 a	99 a
	Metribuzin	0.6	lb/A	A												
	Class Act NG	2.5	%v/v	B												
	Metribuzin	0.75	oz/A	B												
	Matrix	0.25	lb/A	B												
7	Chateau	0.75	oz/A	A	100 a	96 a	94 bc	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
	Metribuzin	0.6	lb/A	A												
	Class Act NG	2.5	%v/v	B												
	Metribuzin	0.75	oz/A	B												
	Matrix	0.25	lb/A	B												
	Class Act NG	2.5	%v/v	D												
	Metribuzin	0.75	oz/A	D												
	Matrix	0.25	lb/A	D												
8	Chateau	0.75	oz/A	A	100 a	99 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
	Metribuzin	0.6	lb/A	A												
	Class Act NG	2.5	%v/v	B												
	Metribuzin	0.75	oz/A	B												
	Matrix	0.25	lb/A	B												
	Class Act NG	2.5	%v/v	C												
	Metribuzin	0.75	oz/A	C												
	Matrix	0.25	lb/A	C												
	Class Act NG	2.5	%v/v	D												
	Metribuzin	0.75	oz/A	D												
	Matrix	0.25	lb/A	D												
9	Chateau	0.75	oz/A	A	98 a	98 a	94 bc	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a	100 a
	Metribuzin	0.6	lb/A	A												
	Class Act NG	2.5	%v/v	B												
	Metribuzin	0.75	oz/A	B												
	Matrix	0.25	lb/A	B												
	Class Act NG	2.5	%v/v	C												
	Metribuzin	0.75	oz/A	C												
	Matrix	0.25	lb/A	C												
	Class Act NG	2.5	%v/v	D												
	Metribuzin	0.75	oz/A	D												
	Matrix	0.25	lb/A	D												
	Class Act NG	2.5	%v/v	E												
	Metribuzin	0.75	oz/A	E												
	Matrix	0.25	lb/A	E												
			LSD (P=0.05)		7.05	4.15	4.62	3.08	7.66	0.00	7.55	1.4	5.25	1.22	2.43	3.00

Shelterbelt Weed Control. Zollinger, Richard K., Devin A. Wirth, and Angela J. Kazmierczak. An experiment was conducted near Absaraka, ND to evaluate weed efficacy of PRE herbicides in shelterbelts. Treatments were applied on October 26, 2013 at 2:15 pm with 42 F air 39.9 F soil at a four inch depth, 38% RH, 30% cloud cover, 6-8 mph NW wind, and adequate soil moisture. Soil characteristics were: 30.1% sand, 45.7% silt, 24.2% clay, loam, 2.2% OM, and 7.1 pH. Treatments were applied to the center 6.7 feet of the 10 by 40 foot plots with a backpack-type plot sprayer delivering 17 gpa at 40 psi through 11002 TT nozzles and dichlobenil was spread using a Earth Way commercial spreader. The experiment had a randomized complete block design with three replicates per treatment.

Alion (indaziflam) is a new residual herbicide used in shelterbelts. Alion is a group 29 Cellulose Inhibitor which is a new mode of action. Treatments were sprayed in the fall and melting snow cover from the winter will activate the herbicides in the spring. Alion and Matrix was comparable to Casoron and Prowl H2O which gave the best overall weed control one year after the study was sprayed. Study shows that for optimum weed control treatments need to be sprayed on bare ground with little surface organic matter to tie up the herbicide.

Table. Shelterbelt Weed Control. (Zollinger, Wirth, Kazmierczak)

		223 DAA								259 DAA								293 DAA							
Treatments	Rate	Colq	Shps	Bnyd	Yeft	Tree	Corw	Dali	Rcvr	Colq	Shps	Bnyd	Yeft	Tree	Corw	Dali	Rcvr	Colq	Shps	Bnyd	Yeft	Tree	Corw	Dali	Rcvr
	(Product/A)	% control								% control								% control							
PRE																									
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alion	5fl oz	99	91	74	74	93	73	72	70	96	86	66	66	96	70	70	70	96	90	55	55	95	66	60	70
Alion	6.5fl oz	99	99	93	93	94	99	80	94	99	99	79	79	93	96	80	86	99	99	83	83	91	94	68	83
Alion+Matrix	5fl oz+2oz	99	99	99	99	94	99	88	99	99	99	96	96	91	99	90	99	99	99	95	95	92	99	93	99
Goal 2XL+Prowl H2O	4pt+2qt	99	98	98	98	96	89	92	65	99	91	76	76	76	58	83	88	99	94	76	76	66	43	80	58
Casoron+Prowl H2O	100lb+2qt	99	99	99	99	83	99	99	89	99	99	73	73	79	79	83	63	99	99	91	91	96	98	99	93
Princep+Prowl H2O	3qt+2qt	99	98	99	99	93	99	66	99	99	98	99	99	43	99	70	99	99	98	96	96	37	96	62	96
LSD (0.05)		0	7	23	23	22	20	27	32	3	12	40	40	33	41	44	36	3	8	28	28	28	20	37	32

		334 DAA								369 DAA							
Treatments	Rate	Colq	Shps	Bnyd	Yeft	Tree	Corw	Dali	Rcvr	Colq	Shps	Bnyd	Yeft	Tree	Corw	Dali	Rcvr
	(Product/A)	% control								% control							
PRE																	
Untreated		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alion	5fl oz	96	90	55	55	95	66	52	66	96	90	56	56	95	66	52	66
Alion	6.5fl oz	99	91	81	81	93	94	68	83	99	91	81	81	93	93	69	83
Alion+Matrix	5fl oz+2oz	99	99	95	95	93	99	93	99	99	99	95	95	93	99	93	99
Goal 2XL+Prowl H2O	4pt+2qt	99	73	68	68	62	43	62	50	99	71	68	68	63	45	62	50
Casoron+Prowl H2O	100lb+2qt	99	99	91	91	95	99	99	93	99	96	91	91	95	99	99	93
Princep+Prowl H2O	3qt+2qt	99	89	93	93	35	96	62	95	99	89	94	94	35	98	63	95
LSD (0.05)		3	29	29	29	25	20	40	36	3	28	29	29	25	19	39	36

Dandelion control in turf. Howatt, Roach, and Harrington. A trial was established to test common components of lawn herbicides for dandelion control. Treatments were applied to 4 inch tall grass and flowering dandelion on June 3 with 65° F, 48% relative humidity, 60% cloud cover, 8 mph wind at 90°, and dry soil at 52° F, Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	7/1 Dali	7/17 Dali	10/9 Dali
	oz ae/A	%	%	%
Dicamba	1.5	0	63	3
2,4-D ester	8	75	91	0
2,4-D amine	8	13	83	38
MCPA	8	23	90	5
MCPP	8	0	56	5
Clopyralid	1.5	0	76	0
Triclopyr	3	5	68	0
MCPA&triclopyr&2,4-DP	21	33	93	8
Aminopyralid	1	93	96	18
Clpy&Tric	6	15	89	84
Carf+NIS	0.26+0.25%	8	68	15
Carf+dicamba+NIS	0.26+1.5+0.25%	8	70	0
Carf+2,4-D ester+NIS	0.26+8+0.25%	28	90	0
Carf+MCPA+NIS	0.26+8+0.25%	5	89	25
Carf+triclopyr+NIS	0.26+3+0.25%	0	79	0
Untreated	0	0	0	0
				0
CV		64	7	84
LSD 5%		17	8	15

Symptoms were slow to develop with most treatments, and only 2,4-D ester or aminopyralid provided 75% or more control of mature dandelion 4 weeks after treatment. Carfentrazone did not speed initial symptom expression but did not affect longer-term control either. While clopyralid plus triclopyr only gave 15% control on July 1, it gave similar control to the best treatments on July 17 and was by far the best treatment (84%) during evaluation on October 9. Activity of either clopyralid or triclopyr alone was not visible on October 9. While rates were not exactly the same from individual products to the premix, synergy of the two herbicides was strong. Control of mature dandelion with a single application midseason would be difficult with any of the treatments. The study will be evaluated again in the spring.

Fall application for dandelion control. Howatt, Roach, and Harrington. A trial was established to test common components of lawn herbicides for dandelion control. Treatments were applied to 4 inch tall Kentucky bluegrass turf, flowering dandelion, and vegetative Canada thistle on September 24 with 64° F, 75% relative humidity, cloud cover, calm wind, and damp soil at 60° F. Treatments were applied with a backpack sprayer delivering 8.5 gpa at 35 psi through TT11001 nozzles to a 7 foot wide area the length of 10 by 30 foot plots. The experiment was a randomized complete block design with four replicates.

Treatment	Rate	Dali 10/9	Cath 10/9	Dali 10/23	Cath 10/23
	oz/A	%	%	%	%
Dicamba	1.5	13	10	10	18
Salvo	8	20	25	10	30
Saber	8	13	18	8	25
MCPA	8	23	30	23	35
MCPP	8	18	28	15	30
Clopyralid	1.5	18	30	15	45
Triclopyr	3	15	23	13	20
Aminopyralid	1	65	73	71	94
Clopyralid&Triclopyr	6	25	38	28	64
MCPA&Triclopyr&2,4-DP	21	23	33	35	55
Untreated Check	0	0	0	0	0
CV		29	32	40	22
LSD 5%		9	13	12	12

Cool and wet conditions after application appeared to inhibit plant growth and symptom development after application. Mild growth deformity and slight discoloration was noticed on all herbicide treatments that was not similar to typical fall appearance of either weed. Only aminopyralid provided substantial herbicidal effect. This was especially apparent on Canada thistle with catastrophic necrosis, 94% control, of nearly all aboveground vegetation by 4 weeks after treatment. Premixes of herbicides gave reasonable suppression of Canada thistle, but other individual herbicides gave 45% control or less. Dandelion was less affected than Canada thistle by each treatment, but aminopyralid again gave the best control at 71%. Treatments will be evaluated again in the spring.

Effects of Linex as a Preemergence Herbicide on Russet Burbank Potato

Andy Robinson, Potato Extension Agronomist
Eric Brandvik, Research Specialist

Location: Perham, MN
Planting date: 24 May 2013
In-row spacing: 13 inches
Emergence: 17 June 2013
Harvest date: 26 September 2013

Spray information
Treatment application: 13 June 2013
Time: 10am – 12pm
Soil moisture: moist
Residue cover: 0%
Wind: 3.5 mph from the North
Dew presence: none
Cloud cover: 10%
Air temperature: 80 °F
Soil temperature: 70°F
Humidity: 40%
Growth stage majority: sprouts 2 inches below soil (70%)
Growth stage minimum: sprouts 1 inch below soil (20%)
Growth stage maximum: sprouts cracking to 1 inch above soil (10%)
Application: Nine-foot CO_2 backpack sprayer calibrated to deliver 15 gal/acre with XR11002 nozzles. Nozzles were spaced 18 inches apart and speed was 3 mph.

Objective: Evaluate the effects of Linex, Linex mixtures, and other preemergence herbicides in potato for weed control and yield.

Results: After herbicide treatment there was no difference in plant stand, plant height, chlorosis, necrosis, or overall crop injury compared to the untreated check. Differences in weed control and graded yield were found across the treatments. Eastern black nighshade pressure was not consistent across treatments, thus only common lambsquarters and wild proso millet control is reported. Linex applied alone was not efficacious in controlling the weed species in this trial. However, when Linex was applied with metribuzin control was excellent. Control over 90% was also found with Chateau + metribuzin and Dual Magnum + Chateau + metribuzin.

As expected, no weed control had the lowest total yield. The numerically highest total yield and marketable yield was found with the Linex at 12 oz/a + metribuzin at 1 lb/a. This treatment also had consistently high yields on the graded yield. This was likely because of good weed control and less herbicide for the potato plant to detoxify or sequester, allowing maximum yield potential. Linex at 12 oz/a + metribuzin at 1 lb/a was similar to Cheateau + metribuzin, which had consistently high yield. Fierce, not registered for potato, at 1.5 oz/a performed well. Although weed control was not above 90% at this rate, less stress on the plants likely resulted in higher yield. Chateau applied alone at lower rates likely had less yield then Chateau applied at higher rates because of reduced weed control. Overall, Linex (12 oz/a) applied with metribuzin (1 lb/a) was comparable with other herbicides at controlling weeds and produced a similar graded yield to other herbicide programs. Further research to confirm that tank mixing Linex with metribuzin is needed to confirm control of other weeds and that potato plants will not be injured in other environments.

Although plant stand, estimated biomass reduction, and estimated crop injury were not significant the data are presented for informative purposes (Table 3). Treatment 12, which had the highest percentage of tubers > 6 and 10 oz can be explained by a lower plant density. The injury and biomass reductions observed in the field were often the results of Chateau pinching the stems that resulted in reduced growth. All other ratings and assessments had 2% or less injury and are not presented.

Table 1. Efficacy of preemergence herbicides on Russet Burbank potato grown in Perham, MN 2013.

Treatment	Herbicide treatment	Application rate	Common lambsquarters control[a]				Wild proso millet control			
			3 WAT[b]		5 WAT		3 WAT		5 WAT	
1	Untreated		0	E[c]	0	C	0	C	0	C
2	Linex 4L	12 oz/a	30	DE	20	BC	67	AB	63	AB
3	Linex 4L	24 oz/a	55	CD	45	ABC	53	B	58	AB
4	Chateau	0.75 oz wt/a	78	ABC	66	AB	87	AB	75	AB
5	Chateau	1.5 oz wt/a	86	ABC	70	AB	98	A	78	AB
6	Chateau	3 oz wt/a	99	A	100	A	95	AB	80	AB
7	Chateau Metribuzin	0.75 oz wt/a 0.6 lb/a	99	A	90	A	93	AB	90	AB
8	Chateau Linex 4L	0.75 oz wt/a 12 oz/a	85	ABC	60	AB	70	AB	40	BC
9	Chateau Linex 4L	0.75 oz wt/a 24 oz/a	88	AB	64	AB	78	AB	89	AB
10	Linex 4L Metribuzin	12 oz/a 1 lb/a	96	A	95	A	100	A	91	AB
11	Linex 4L Metribuzin	24 oz/a 1 lb/a	100	A	100	A	100	A	100	A
12	Dual Magnum Chateau Metribuzin	1 pt/a 0.5 oz wt/a 1 lb/a	90	AB	95	A	100	A	94	AB
13	Dual Magnum Linex 4L	1 pt/a 12 oz/a	63	BCD	55	ABC	98	A	93	AB
14	Dual Magnum Linex 4L	1 pt/a 24 oz/a	40	D	78	A	96	A	94	AB
15	Fierce	1.5 oz/a	85	ABC	73	AB	77	AB	78	AB
16	Fierce	2.25 oz/a	91	AB	83	A	95	A	83	AB

[a] Visual estimate of weed control using a scale of 0 to 100% (0 = no injury and 100 = plant death).
[b] Abbreviation: WAT, weeks after treatment
[c] Within columns means followed by the same letter are not significantly different according to Tukey pairwise comparison ($P \leq 0.1$).

Table 2. Effect of preemergence herbicides on graded yield of Russet Burbank potato in Perham, MN in 2013.

Treatment	Herbicide	Rate	0-4 oz	4-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1s > 4 oz	#2s > 4 oz	Total marketable	> 6 oz	> 10 oz
			cwt / acre									%	
1	Untreated		103 ab[a]	112 ab	132 a	17 b	4 abc	369 ab	265 b	3 a	268 b	42 b	6 c
2	Linex 4L	12 oz/a	124 a	124 ab	137 a	27 ab	5 c	417 ab	292 ab	2 a	293 ab	41 b	8 c
3	Linex 4L	24 oz/a	97 ab	114 ab	159 a	54 ab	17 abc	440 ab	343 ab	6 a	349 ab	53 ab	16 abc
4	Chateau	0.75 oz wt/a	108 ab	101 ab	131 a	27 ab	9 abc	377 ab	267 ab	3 a	270 b	45 ab	10 bc
5	Chateau	1.5 oz wt/a	88 ab	100 ab	137 a	59 ab	13 abc	396 ab	307 ab	5 a	312 ab	53 ab	19 abc
6	Chateau	3 oz wt/a[b]	76 ab	91 ab	149 a	56 ab	30 ab	403 ab	325 ab	7 a	332 ab	58 ab	21 abc
7	Chateau	0.75 oz wt/a	97 ab	109 ab	176 a	81 a	26 ab	489 ab	390 ab	4 a	394 ab	58 ab	22 abc
	Metribuzin	0.6 lb/a											
8	Chateau	0.75 oz wt/a	65 ab	84 b	137 a	42 ab	18 ab	347 b	280 ab	10 a	290 ab	58 ab	18 abc
	Linex 4L	12 oz/a											
9	Chateau	0.75 oz wt/a	83 ab	113 ab	175 a	53 ab	12 abc	437 ab	351 ab	6 a	357 ab	55 ab	15 bc
	Linex 4L	24 oz/a											
10	Linex 4L	12 oz/a	108 ab	152 a	178 a	59 ab	10 abc	508 a	399 a	6 a	404 a	49 ab	14 bc
	Metribuzin	1 lb/a											
11	Linex 4L	24 oz/a	79 ab	121 ab	181 a	68 ab	4 abc	454 ab	373 ab	4 a	377 ab	56 ab	16 abc
	Metribuzin	1 lb/a											
12	Dual Magnum	1 pt/a	46 b	74 b	133 a	80 a	31 abc	364 ab	316 ab	11 a	327 ab	69 a	33 a
	Chateau	0.5 oz wt/a											
	Metribuzin	1 lb/a											
13	Dual Magnum	1 pt/a	103 ab	123 ab	170 a	55 ab	7 bc	458 ab	354 ab	4 a	358 ab	50 ab	13 bc
	Linex 4L	12 oz/a											
14	Dual Magnum	1 pt/a	89 ab	102 ab	175 a	36 ab	7 abc	409 ab	318 ab	5 a	323 ab	54 ab	11 bc
	Linex 4L	24 oz/a											
15	Fierce[c]	1.5 oz/a	72 ab	101 ab	170 a	73 ab	21 ab	437 ab	363 ab	8 a	371 ab	60 ab	21 abc
16	Fierce	2.25 oz/a	60 ab	89 ab	137 a	74 ab	30 a	390 ab	328 ab	5 a	333 ab	62 ab	26 ab

[a] Within columns means followed by the same letter are not significantly different according to Tukey pairwise comparison ($P \leq 0.1$).

[b] Not labeled rate for potato. Read and follow labels for proper use of pesticides.

[c] Fierce is not labeled for use in potato.

Table 3. Crop stand, biomass reduction, and visible injury at Perham, MN in 2013.

Treatment	Herbicide treatment	Application rate	Stand, July 10	Biomass reduction, July 4	Crop injury, July 17
			plants/25 ft	%	
1	Untreated		21.0[a]	0	0
2	Linex 4L	12 oz/a	20.3	2.5	0
3	Linex 4L	24 oz/a	20.8	6.3	0
4	Chateau	0.75 oz wt/a	20.0	1.3	0
5	Chateau	1.5 oz wt/a	20.8	12.5	0
6	Chateau	3 oz wt/a	20.5	17.5	2.5
7	Chateau Metribuzin	0.75 oz wt/a 0.6 lb/a	21.3	3.8	0
8	Chateau Linex 4L	0.75 oz wt/a 12 oz/a	20.0	11.3	2.5
9	Chateau Linex 4L	0.75 oz wt/a 24 oz/a	22.3	0	0
10	Linex 4L Metribuzin	12 oz/a 1 lb/a	20.0	0	0
11	Linex 4L Metribuzin	24 oz/a 1 lb/a	21.5	1.3	0
12	Dual Magnum Chateau Metribuzin	1 pt/a 0.5 oz wt/a 1 lb/a	18.3	5	0
13	Dual Magnum Linex 4L	1 pt/a 12 oz/a	20.8	5	0
14	Dual Magnum Linex 4L	1 pt/a 24 oz/a	22.3	3.8	0
15	Fierce	1.5 oz/a	21.3	8.8	0
16	Fierce	2.25 oz/a	22.8	10	1.25

[a]No differences were found according to Tukey pairwise comparison ($P \leq 0.1$).

Effect of Adjuvants on Russet Burbank Potato Tolerance

Andy Robinson, Potato Extension Agronomist
Eric Brankvik, Research Specialist

Location: Perham, MN
Planting date: 24 May 2013
In-row spacing: 13 inches
Emergence: 17 June 2013
Harvest date: 26 September 2013

Spray information
Treatment application: 10 July 2013
Time: 11:30am – 1:00pm
Soil moisture: dry
Residue cover: 0%
Wind: 7 mph from the WNW
Dew presence: none
Cloud cover: 10%
Air temperature: 75 °F
Soil temperature: 80°F
Humidity: 66%
Application: Nine-foot CO_2 backpack sprayer calibrated to deliver 15 gal/acre with XR11002 nozzles. Nozzles were spaced 18 inches apart and speed was 3 mph.
Matrix rate: Matrix was applied at 1.25 oz/a in all treatments, except the untreated.

Objective: Evaluate the effects adjuvants + rimsulfuron (Matrix) postemergence in potato for crop tolerance.

Results: This trial was established in a commercial Russet Burbank field. All agronomic management practices were done according to the University of Minnesota recommended practices. Crop injury, including chlorosis, necrosis, and biomass reduction was not observed in any of the treatments at 14 or 28 days after treatment. Graded potato yield was generally not different among treatments. The only difference found was for tubers greater than 10 oz where Trophy Gold had a higher percentage of large tubers than Liberate LeciTech and the Untreated check.

Table 2. Effect of adjuvants applied with Matrix postemergence on Russet Burbank potato graded yield, Perham, MN, 2013.

Treatment	Adjuvant	Rate	<3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1s > 4 oz	#2s > 4 oz	Total marketable	> 6 oz	> 10 oz	
			cwt / acre									%		
1	Untreated		52	157	115	12	2	337	268	17	285	39	4	b[a]
2	R-11	0.25% v/v	50	184	140	60	18	452	361	41	402	48	17	ab
3	R-11	0.5% v/v	48	154	140	43	16	401	323	30	353	49	14	ab
4	Liberate LeciTech	0.5% v/v	58	168	118	33	5	383	301	24	325	41	10	b
5	Prefer 90	0.5% v/v	50	169	166	47	26	459	349	59	408	54	17	ab
6	Preference	0.5% v/v	38	170	128	46	16	399	312	49	361	46	15	ab
7	Silkin	2 pt/100 gal	38	107	109	38	11	303	233	32	265	54	18	ab
8	Herbimax	2 pt/a	55	168	135	44	6	407	337	16	353	44	12	ab
9	Upland MSO	1.5 pt/a	47	165	154	60	18	444	374	23	397	53	18	ab
10	Destiny HC	0.75 pt/a	59	172	141	54	14	440	358	23	381	48	16	ab
11	Trophy Gold	0.5 pt/a	33	120	111	60	32	356	281	42	323	58	27	a
12	Renegade	1.5 pt/a	57	173	161	49	19	458	358	43	401	50	15	ab
13	Climb	3.125 % v/v	49	158	131	39	7	384	297	38	335	46	12	ab
14	Dyne-Amic	1 gal/100 gal	45	148	166	56	20	436	356	35	391	55	17	ab
15	Quad 7	1% v/v	47	140	105	54	18	365	273	46	318	47	19	ab

[a] Within columns means followed by the same letter are not significantly different according to Tukey pair-wise comparison (P≤0.1). No letters indicate no difference.

Russet Burbank Tolerance to High Matrix Rates

Andy Robinson, Potato Extension Agronomist
Harlene Hatterman-Valenti, High Value Crop Production
Eric Brandvik, Research Specialist

Executive summary:
Controlling broadleaf weeds postemergence in potato production is difficult because there are only two herbicides available, metribuzin and rimsulfuron. Nightshade is especially problematic because of its ability to act as an alternative host to many potato diseases, nematodes, and viruses. Reduced herbicide rates has been used in other crops to control multiple flushes of weeds and we wanted to test this method in potato production. A field was planted to Russet Burbank and herbicides treatments were applied preemergence and postemergence. Rates of metribuzin and rimsulfuron were switched and the thus too much rimsulfuron (2 to 8 oz/a) and too little metribuzin (0.02 to 0.09 lb/a) was applied. Because of this mistake we were able to analyze what would happen with an off label rate of rimsulfuron in potato. Weed control was better than 90% for all treated plots. Graded yield of treated plots was no different. This indicated that there was no difference of timing or rate of misapplication of rimsulfuron up to 8 oz/a.

Introduction
Nightshade and wild buckwheat populations are on the rise within a majority of potato acres in Minnesota and North Dakota. Nightshade is especially problematic because it acts as an alternative host to many potato diseases, nematodes, and viruses. It is also difficult to control because of its extended emergence pattern and density throughout the region. Previous research in other specialty crops has shown that multiple applications of reduced-rate herbicides can effectively control weeds. This project was designed to quantify the effect of multiple application timings and rates for weed control, while maintaining crop safety. The objectives were to determine the effect of treatment timings on season long nightshade control, quantify the effect of multiple applications of reduced-rates of rimsulfuron and metribuzin to control late emerging weeds, and to quantify the effect of treatments on crop tolerance and graded yield.

Materials and Methods
A field project was established in Perham, MN on a commercial field. Field preparation included fumigation with metam-sodium and spring chisel plow. Russet Burbank were planted on May 24, 2013 with 13 inch in-row spacing and 1 in below the soil level with a Logan cup planter. Soil temperature was 52 °F at planting. Emergence occurred on June 17. A randomized complete block arrangement of treatments was used with five replications.

All herbicide treatments were applied with a nine-foot CO_2 backpack sprayer calibrated to deliver 15 gal/acre. Treatments were metribuzin + rimsulfuron + the adjuvant Class Act NG and preemergence herbicides used were Chateau and metribuzin (Table 1). Herbicide application timings, dates, and rates are found in Table 1. Postemergence treatments occurred close to cotyledon formation of weed leaves. Plots were rated at 0, 14, and 28 days after treatment for estimated weed control ranging from 0 to 100. The middle 25 ft. row of each plot was harvested on September 26 with a single row plot harvester. Yield was graded at East Grand Forks, MN. Data were analyzed using SAS Proc Mixed to determine any significant effects of treatment. Tukey pairwise comparison was used to determine if herbicide treatment had a significant effect ($P \leq 0.05$) on weed control, crop tolerance, and graded yield.

Results
Rates of metribuzin and rimsulfuron were switched and the thus too much rimsulfuron and too little metribuzin was applied. Because of this mistake we were able to analyze what would happen with an off label rate of rimsulfuron in potato. The rates ranged from 2 to 8 oz/a of rimsulfuron, or 1.3 to 5.3x more than the labeled

field use rate per treatment. All treated plots received a total of 8 oz/a rimsulfuron. The amount of metribuzin was much lower than labelled rates (Table 1).

Weed Control and Crop Tolerance

There was no crop injury observed from the treatments. This may be because of the tolerance of Russet Burbank to rimsulfuron and the ideal growing conditions at treatment timings. Because this trial was in a commercial field there was low weed pressure and densities varied throughout the plots making it difficult to gather meaningful weed control data. Weeds present were common lambsquarters, wild proso millet, and eastern black nightshade. Of the weeds observed, control averaged 90-100% for all treatments. This is likely a result of too much rimsulfuron, but it also indicated that Russet Burbank was able to tolerate high levels of rimsulfuron and the rimsulfuron + metribuzin rates were effective weed control in this commercial field.

Graded Yield

There was little differences found in graded yield. Total marketable yield and the percent of tubers > 6 oz indicated that the untreated check had reduced yield in some cases. Amongst herbicide treatments there was no difference in yield. It would have been ideal to have had a hand weeded check to compare. These data show that up to 8 oz/a rimsulfuron used at multiple timings and rates were no different than a single application on yield.

Table 1. Herbicide treatments used in the Perham, MN on Russet Burbank potatoes for weed control.

Treatment	Timing	Herbicide	Rate	Application date
1 (untreated)		-	-	-
2	B	Matrix	8 oz/a	June 25
		Metribuzin	0.09 lb/a	
		Class Act NG	2.5% v/v	
3	B	Matrix	4 oz/a	June 25
		Metribuzin	0.09 lb/a	
		Class Act NG	2.5% v/v	
	D	Matrix	4 oz/a	July 10
		Metribuzin	0.09 lb/a	
		Class Act NG	2.5% v/v	
4	B	Matrix	2.7 oz/a	June 25
		Metribuzin	0.03 lb/a	
		Class Act NG	2.5% v/v	
	C	Matrix	2.7 oz/a	July 2
		Metribuzin	0.03 lb/a	
		Class Act NG	2.5% v/v	
	D	Matrix	2.7 oz/a	July 10
		Metribuzin	0.03 lb/a	
		Class Act NG	2.5% v/v	
5	B	Matrix	2 oz/a	June 25
		Metribuzin	0.02 lb/a	
		Class Act NG	2.5% v/v	
	C	Matrix	2 oz/a	July 2
		Metribuzin	0.02 lb/a	
		Class Act NG	2.5% v/v	
	D	Matrix	2 oz/a	July 10
		Metribuzin	0.02 lb/a	
		Class Act NG	2.5% v/v	
	E	Matrix	2 oz/a	July 16
		Metribuzin	0.02 lb/a	
		Class Act NG	2.5% v/v	
6	A	Chateau	0.75 fl oz/a	June 13
		Metribuzin	0.6 lb/a	
	B	Matrix	4 oz/a	June 25
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	
7	A	Chateau	0.75 fl oz/a	June 13
		Metribuzin	0.6 lb/a	
	B	Matrix	4 oz/a	June 25
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	
	D	Matrix	4 oz/a	July 10
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	
8	A	Chateau	0.75 fl oz/a	June 13
		Metribuzin	0.6 lb/a	
	B	Matrix	4 oz/a	June 25
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	
	C	Matrix	4 oz/a	July 2
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	
	D	Matrix	4 oz/a	July 10
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	
9	A	Chateau	0.75 fl oz/a	June 13
		Metribuzin	0.6 lb/a	
	B	Matrix	4 oz/a	June 25
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	
	C	Matrix	4 oz/a	July 2
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	
	D	Matrix	4 oz/a	July 10
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	
	E	Matrix	4 oz/a	July 16
		Metribuzin	0.05 lb/a	
		Class Act NG	2.5% v/v	

Table 2. Graded yield affected by metribuzin + rimsulfuron on Russet Burbank potato in 2013 in Perham, MN.

Treatment	< 3 oz	3-6 oz	6-10 oz	10-14 oz	>14 oz	Total	#1s > 3 oz	#2s > 3 oz	Total marketable		> 6 oz		> 10 oz
	cwt / acre										%		
1	49	128	83	24	6	286	237	26	263	b	36	b	9
2	36	147	159	60	12	412	376	40	416	a	56	a	18
3	40	148	156	46	12	403	363	34	397	ab	53	ab	15
4	35	131	124	37	11	330	295	36	330	ab	49	ab	12
5	34	119	126	31	11	315	280	46	326	ab	51	ab	12
6	34	107	135	54	21	342	308	43	351	ab	59	a	19
7	32	109	104	48	11	302	270	43	313	ab	52	ab	19
8	34	109	143	49	17	348	314	31	345	ab	60	a	18
9	30	123	132	37	17	328	298	35	333	ab	52	ab	13

[a] Within columns means followed by the same letter are not significantly different according to Tukey pairwise comparison ($P \leq 0.1$). No letters indicate no difference.