

Simulated glyphosate drift to red potatoes. Harlene M. Hatterman-Valenti and Collin P. Auwarter.

This study was conducted at the Northern Plains Potato Growers Association Non-irrigated research site near Grand Forks, ND to evaluate the effect of glyphosate drift to current season growth and yield for three commonly grown red cultivars (Red Norland, Red LaSoda, and Sangre). Plots were 4 rows by 25 ft arranged in a randomized complete block design with four replicates. Seed pieces (2 oz) were planted on 36-inch rows and 12-inch spacing on June 10, 2009. Plots were 4 rows by 25 ft arranged in a split-block design with cultivar as the main factor and the combination of application timing and herbicide rate as sub-plots with 3 replicates. Glyphosate was applied with a CO₂ pressurized sprayer equipped with 8001XR flat fan nozzles with a spray volume of 5 GPA and a pressure of 35 psi. The first application timing (TI) occurred on July 23, 2009. Extension recommendations were used for cultural practices throughout the year. Plots were desiccated on September 19, harvested October 11 and graded into the various categories after harvest.

Date:	7/23/09	8/6/09	9/9/09
Treatment:	TI	EB	LB
Air temperature (F):	59	74	75
Rel. hum. (%):	92	47	45
Wind (mph):	3	3	12
Soil moisture:	above normal	above normal	above normal
Cloud cover (%):	50	90	0

Red Norland appeared to be the most sensitive cultivar to glyphosate. Plants treated with glyphosate at the TI stage or with at least 0.125 lb ai/A glyphosate at the EB stage produced significantly more cull tubers (< 4 oz) compared to the untreated control. In contrast, potatoes treated with glyphosate at the TI stage or with at least 0.125 lb ai/A glyphosate at the EB stage produced significantly less 4-6 oz. tubers compared to the untreated and other treatments. This resulted in 37 to 50% decrease in marketable tubers size-wise. Unfortunately, excessive tuber cracking and russet skinning occurred with most of the tubers in these application timings, further reducing marketable yields. A slight shift to smaller tubers occurred when plants were treated with 0.063 lb ai/A glyphosate at the EB stage. No yield differences and few visible tuber defects were observed when plants were treated with glyphosate at the LB stage.

Red LaSoda was the next most sensitive cultivar to glyphosate. Plants treated with 0.25 lb ai/A glyphosate at the TI stage or with at least 0.125 lb ai/A glyphosate at the EB stage produced significantly more cull tubers (< 4 oz) compared to the untreated control. Other grade categories were similar regardless of the glyphosate treatments. Marketable yields were reduced 34 to 57% when plants were treated with 0.25 lb ai/A glyphosate at the TI stage or with at least 0.125 lb ai/A glyphosate at the EB stage. Excessive tuber cracking and russet skinning was most severe in the EB stage with 70 to 100% rejection of marketable tubers due to visible tuber defects.

Sangre was the least sensitive tested cultivar to glyphosate. Plants treated with 0.25 lb ai/A glyphosate at the TI or EB stage produced significantly more cull tubers (< 4 oz) compared to the untreated control. Other grade categories were similar regardless of the glyphosate treatments. Marketable yields were reduced 31 to 58% when plants were treated with 0.25 lb ai/A glyphosate at the TI or EB stage. Excessive tuber cracking and russet skinning was most severe in the EB stage with 30 to 100% rejection of marketable tubers due to visible tuber defects.

Potato cultivar yield and grade in response to glyphosate

Treatment	0-4 oz		4-6 oz		6-10 oz		>10 oz		TOTAL		>4 oz	
Red Norland Chk	73	c-h	140	a-d	52	abc	50	def	316	a-e	243	a-f
Red Norland TI	65	c-h	64	a-f	30	abc	26	ef	184	cde	120	d-g
Glyphosate 0.25												
Red Norland TI	75	c-h	51	c-f	25	abc	16	ef	167	de	92	efg
Glyphosate 0.13												
Red Norland TI	153	a	60	b-f	12	bc	4	f	229	a-e	76	fg
Glyphosate 0.06												
Red Norland EB	105	a-f	39	f	11	c	1	f	157	e	52	g
Glyphosate 0.25												
Red Norland EB	131	ab	45	def	9	c	8	f	193	b-e	62	g
Glyphosate 0.13												
Red Norland EB	104	a-f	139	a-d	32	abc	16	ef	291	a-e	187	a-g
Glyphosate 0.06												
Red Norland LB	76	c-h	152	ab	66	a	35	ef	329	a-e	253	a-e
Glyphosate 0.25												
Red Norland LB	75	c-h	132	a-f	54	abc	33	ef	295	a-e	220	a-g
Glyphosate 0.13												
Red Norland LB	58	d-h	147	ab	63	a	47	def	315	a-e	257	a-e
Glyphosate 0.06												
Red LaSoda Chk	40	h	124	a-f	62	a	161	ab	387	a	347	a
Red LaSoda TI	107	a-e	77	a-f	26	abc	66	c-f	276	a-e	169	a-g
Glyphosate 0.25												
Red LaSoda TI	46	fgh	122	a-f	69	a	136	abc	373	abc	327	ab
Glyphosate 0.13												
Red LaSoda TI	50	e-h	113	a-f	55	abc	123	a-d	342	a-e	292	a-d
Glyphosate 0.06												
Red LaSoda EB	112	a-d	115	a-f	31	abc	4	f	261	a-e	149	b-g
Glyphosate 0.25												
Red LaSoda EB	102	b-g	83	a-f	31	abc	21	ef	237	a-e	135	c-g
Glyphosate 0.13												
Red LaSoda EB	60	c-h	146	abc	69	a	60	c-f	336	a-e	275	a-d
Glyphosate 0.06												
Red LaSoda LB	45	gh	110	a-f	66	a	152	ab	374	abc	329	ab
Glyphosate 0.25												
Red LaSoda LB	47	fgh	121	a-f	65	a	146	ab	379	ab	332	ab
Glyphosate 0.13												
Red LaSoda LB	43	gh	113	a-f	64	a	150	ab	369	abc	327	ab
Glyphosate 0.06												
Sangre Chk	36	h	104	a-f	57	ab	151	ab	348	a-d	312	abc
Sangre TI	117	abc	43	ef	10	c	8	f	178	de	61	g
Glyphosate 0.25												
Sangre TI	33	h	111	a-f	67	a	170	a	381	ab	348	a
Glyphosate 0.13												
Sangre TI	71	c-h	157	a	69	a	85	b-f	383	ab	312	abc
Glyphosate 0.06												
Sangre EB	86	b-h	75	a-f	26	abc	27	ef	214	a-e	128	c-g
Glyphosate 0.25												
Sangre EB	71	c-h	138	a-e	66	a	63	c-f	338	a-e	267	a-e
Glyphosate 0.13												
Sangre EB	47	fgh	123	a-f	67	a	97	a-e	334	a-e	287	a-d
Glyphosate 0.06												
Sangre LB	52	e-h	128	a-f	67	a	84	b-f	331	a-e	279	a-d
Glyphosate 0.25												
Sangre LB	42	gh	109	a-f	61	a	135	abc	347	a-e	305	a-d
Glyphosate 0.13												
Sangre LB	49	e-h	114	a-f	58	a	118	a-d	339	a-e	290	a-d
Glyphosate 0.06												
LSD (P=.05)	32		52		26		48		102		103	

Potato cultivar tuber set in response to glyphosate

Treatment	0-4 oz	4-6 oz	6-10 oz	>10 oz	TOTAL	>4 oz
	----- Tuber no. -----					
Red Norland Chk	93 d-h	67 abc	19 abc	11 d-g	191 bc	97 abc
Red Norland TI	132 c-g	29 a-e	11 abc	6 fg	178 bc	46 b-e
Glyphosate 0.25						
Red Norland TI	118 c-h	24 b-e	9 abc	4 fg	156 bc	38 cde
Glyphosate 0.13						
Red Norland TI	273 a	31 a-e	4 bc	1 g	309 a	37 cde
Glyphosate 0.06						
Red Norland EB	177 bc	20 e	4 bc	0 g	201 bc	24 e
Glyphosate 0.25						
Red Norland EB	182 bc	24 cde	4 c	2 g	211 bc	29 de
Glyphosate 0.13						
Red Norland EB	138 c-f	71 a	12 abc	3 fg	225 bc	87 a-d
Glyphosate 0.06						
Red Norland LB	95 d-h	70 a	25 a	8 fg	198 bc	103 abc
Glyphosate 0.25						
Red Norland LB	90 d-h	63 a-e	20 abc	8 fg	181 bc	91 abc
Glyphosate 0.13						
Red Norland LB	74 e-h	68 ab	22 a	10 efg	175 bc	101 abc
Glyphosate 0.06						
Red LaSoda Chk	52 fgh	55 a-e	21 a	33 a	161 bc	109 ab
Red LaSoda TI	162 bcd	37 a-e	9 abc	14 c-g	222 bc	60 a-e
Glyphosate 0.25						
Red LaSoda TI	58 fgh	54 a-e	23 a	27 a-d	162 bc	104 abc
Glyphosate 0.13						
Red LaSoda TI	67 e-h	50 a-e	20 abc	25 a-e	163 bc	96 abc
Glyphosate 0.06						
Red LaSoda EB	145 cde	59 a-e	11 abc	1 g	217 bc	71 a-e
Glyphosate 0.25						
Red LaSoda EB	129 c-g	40 a-e	12 abc	5 fg	186 bc	57 a-e
Glyphosate 0.13						
Red LaSoda EB	70 e-h	66 a-d	24 a	13 c-g	173 bc	103 abc
Glyphosate 0.06						
Red LaSoda LB	52 fgh	47 a-e	23 a	32 a	154 c	102 abc
Glyphosate 0.25						
Red LaSoda LB	56 fgh	53 a-e	23 a	29 abc	161 bc	105 abc
Glyphosate 0.13						
Red LaSoda LB	56 fgh	48 a-e	22 a	30 ab	157 bc	101 abc
Glyphosate 0.06						
Sangre Chk	41 h	46 a-e	20 abc	31 a	139 c	97 abc
Sangre TI	220 b	22 de	4 c	2 g	247 b	28 de
Glyphosate 0.25						
Sangre TI	40 h	47 a-e	23 a	32 a	142 c	102 abc
Glyphosate 0.13						
Sangre TI	78 e-h	74 a	24 a	18 a-g	194 bc	116 a
Glyphosate 0.06						
Sangre EB	118 c-h	37 a-e	10 abc	6 fg	171 bc	53 a-e
Glyphosate 0.25						
Sangre EB	88 d-h	64 a-e	23 a	15 b-g	190 bc	102 abc
Glyphosate 0.13						
Sangre EB	55 fgh	55 a-e	23 a	20 a-f	154 c	98 abc
Glyphosate 0.06						
Sangre LB	58 fgh	58 a-e	23 a	18 a-g	157 bc	99 abc
Glyphosate 0.25						
Sangre LB	48 gh	48 a-e	21 a	26 a-e	143 c	95 abc
Glyphosate 0.13						
Sangre LB	53 fgh	50 a-e	21 ab	26 a-e	150 c	97 abc
Glyphosate 0.06						
LSD (P=.05)	47	24	9	10	49	37