

RED-SKINNED AND CHIPPING POTATO VARIETY DEVELOPMENT

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Abstract

The tri-state potato variety development program for Oregon, Washington, and Idaho emphasizes russet-skinned selections and processing quality. Screening for red-skinned selections was initiated at the Klamath Experiment Station (KES) in 1988 with single-hill, first generation seedlings provided by North Dakota State University and Colorado State University. Limited seedlings also have been provided from the Aberdeen, Idaho USDA-ARS breeding program in recent years. The single-hill screening program was terminated in 1999. Two selections from this program will be released in 2000. Mazama is an early maturing selection with bright skin color, shallow eyes, and a high tuber set which results in a high proportion of small tubers. Winema is also early maturing, shallow eyed, with bright skin color. It produces fewer tubers per plant and larger tuber size than Mazama. Both varieties retain bright color in storage. Additional releases from this program are anticipated.

Introduction

Red-skinned varieties are grown extensively in Southern California and the Skagit Valley in Washington. The stan-

dard varieties currently in use do not meet several quality criteria of buyers. The KES screening program initiated in 1988 has emphasized early vine maturity, shallow eyes, bright skin color that is retained in storage, and high yield of small sized tubers. The pending release of two selections that meet most of these criteria is one measure of success of the program. Another measure is the use of KES selections as parents for crosses made in the Colorado and Idaho breeding programs. Although the single-hill-screening program was terminated after the 1998 season, several selections remain in the pipeline. In 1999, five KES selections were evaluated in the regional red-skinned trial. Earlier generation selections remaining in the program included 46 clones selected from single hills in 1998. These were planted as 4-hill observational plots at KES and 12-hill seed increase plots at Powell Butte. About 15 lines were saved for further evaluation.

Production of potatoes for chipping in the Klamath Basin has increased in recent years to about 3,000 acres. KES started participation in the regional chip trial in 1998 and continued this trial in 1999. This report summarizes results from red-skinned potato selection evaluation in

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1999, results from the regional chipping variety trial at KES, and long-term performance of Mazama and Winema compared to standard varieties.

Procedures

Red-skinned and chipping potato screening trials were conducted on Poe fine sandy loam soil at the Klamath Experiment Station (KES). Spring cereals were grown at the site in 1997 and 1998. Fertilizer was banded on both sides of rows at planting at 160 lb N/acre, 80 lb P₂O₅/acre, 80 lb K₂O/acre and 140 lb S/acre. The insecticide Di-syston (disulfoton) was applied in the seed furrow at 3.0 lb ai/acre. Weeds were controlled with Dual (metolachlor) and Prowl (pendimethalin) applied at 1.5 pt/acre each with a conventional ground sprayer on May 26; and Matrix (rimsulfuron) applied at 1.75 oz/acre on June 28. The fungicides Bravo (chlorothalonil), Dithane (mancozeb), and Ridomil (metalaxyl) were applied aerially at recommended rates at approximately 2-week intervals from late June through August. Monitor (methamidaphos) was applied aerially at 0.75 lb ai/acre on July 24. Irrigation was applied with solid-set sprinklers arranged on a 40- by 48-foot pattern. Vines were desiccated with Diquat (diquat dibromide) applied at 1.0 pt/acre with a ground sprayer on September 6. Vines were shredded with a rotobeaer 1 day before harvest.

A four-hill screening trial for second-generation red-skinned selections from the 1998 single-hill screening included 46 entries planted on May 20. Seed furrows were opened, and fertilizer and insecticide were applied with a two-row,

assisted-feed planter. Seed was hand-cut to 2.0 to 3.0 oz/seedpiece and planted by hand. Seedpieces were spaced at 9 inches in 32-inch rows with a 2-foot gap between clones. Seed was covered by hand. Tubers were harvested with a one-row, digger-bagger on September 27. All tubers from each entry were stored until October 6, when they were evaluated visually for appearance and yield.

Eight regional red-skinned entries, standard varieties Dark Red Norland and Red LaSoda, and four advanced KES red-skinned selections were included in an advanced red-skinned trial. The regional chipping variety trial included standard varieties Atlantic and Chipeta and four numbered selections. Both trials were arranged as randomized complete blocks with four replications. Seed was hand-cut to 1.5 to 2.5 oz/seedpiece, treated with Tops-MZ (thiophanate-methyl, mancozeb) at 1.0 lb/cwt of cut seed, and suberized for 10 days at 55°F and 95 percent relative humidity before planting on May 20. Individual plots were single rows with 30 hills at 8.7-inch seed spacing in 32-inch rows. Potatoes were harvested with a one-row, digger-bagger on September 24. All tubers were saved for grading in late October. Subsamples from two replications of the chipping variety trial were sent to Corvallis for evaluation of chip color.

Results and Discussion

Thirteen of the four-hill clones were selected at KES for further evaluation. Seed of these clones was saved at the Powell Butte location, along with seed of

two additional clones that were not selected at KES. This material represents the last generation of formal red-skinned screening lines in the Oregon program. The clones will be evaluated in replicated plots at KES and Powell Butte in 2000.

Plant and tuber characteristics of entries in the advanced red-skinned trial are presented in Table 1. All entries except NDO2686-4R achieved high populations. Seed of several clones was infected with Potato Virus Y. The greatest incidence was noted in NDO4323-2R and NDO5437-7R. The latter clone was seriously affected, with poor canopy vigor and early senescence. Early maturity was noted for NDO4300-1R, AO92657-3R, and NDO2686-4R among the formal entries in the trial. Early maturity was also observed, as in previous years, for NDO2438-6R and NDO2686-6R, which are planned for release as Winema and Mazama, respectively. All selections were ranked superior to Dark Red Norland and Red LaSoda in skin color and eye depth. Good skin set and minimum skinning was observed in A79543-4R and NDO2438-6R.

Relatively high yields were achieved by most of the selections (Table 2). However, in both standard varieties and several clones, tuber size was excessive. The highest yields of tubers under 10 oz were found in A79543-4R and NDO2686-4R. Selections with relatively high yields of the desirable smaller tubers included NDO4300-1R, NDO4592-3R, and NDO2686-6R. Several entries had high yields of culls, which were usually associated with excessive size. As in other 1999 trials at KES, specific gravity was lower than is experienced normally at this site.

Two entries have completed 3

years in the regional trial. A79543-3R will be released from the California program as CalRed. NDO2686-4R originated from the same cross as NDO2686-6R, which is being released. Although yield performance has been similar for these selections, experience in California trials indicates that NDO2686-4R is more susceptible to skinning damage at harvest. This selection will be discarded from the program.

Oregon selections AO92657-3R and NDO4592-3R also will be discarded. AO92657-3R is very susceptible to sloughing when boiled. NDO4592-3R produced lower yields than all other selections in the regional trial conducted at eight locations. All other entries in the regional trial are being retained for further evaluation. NDO4300-1R is the leading candidate for release among Oregon advanced selections. This clone combines good yields of medium tuber size, bright skin color that does not fade in storage, and early maturity.

NDO4323-2R and NDO5437-7R were not included in the regional trial. At KES, NDO4323-2R produced high yield, while NDO5437-7R was significantly lower in No. 1 yield than all other selections. NDO4323-2R will advance to the 2000 regional trial. NDO5437-7R is being discarded.

NDO2438-6R and NDO2686-6R were included in the KES trial to provide additional experience with these clones planned for release in 2000 as Winema and Mazama, respectively. As in previous trials, NDO2686-6R produced moderately high yields with a high proportion of small tubers. Tuber size distribution and yield for NDO2438-6R was similar to

performance for Dark Red Norland. Both selections had excellent skin color.

In the regional chip variety trial, the Oregon selection AO91812-1 was similar in yield to all other entries (Table 3). This clone has consistently produced high yields in Oregon trials and is usually among the best entries for chip color out of storage. A90467-14 produced the lowest yield at KES and over all trial locations. All entries in this trial will be continued in the 2000 regional trial. If seed quantities are sufficient, AO91812-1 will also be entered in the National Snack Food Association trial in 2000.

The long-term performance of two red-skinned clones originally selected at KES in 1989 and planned for release in 2000 is presented in Tables 4 and 5. In both cases, yield and specific gravity data are averages of replicated yield trials conducted at KES over 7 years. Winema (NDO2438-6R) data are from 1993 through 1999 trials, inclusive. Mazama (NDO2686-6R) was evaluated in 1992 through 1997, and in 1999. Data for standard varieties is from the same years for each comparison. Winema yield has been similar to Dark Red Norland with slightly larger tuber size but fewer culls. It has much superior skin color and more uniform shape than both Dark Red Norland and Red LaSoda. The main deficiency of this selection is its susceptibility to Potato Virus Y coupled with very mild symptom expression.

Mazama has consistently produced a high proportion of tubers under 6 oz. Averaged over 7 years, Mazama produced 70 cwt/acre more U.S. No.1s under 10 oz than either Dark Red Norland or Red LaSoda at KES. Its skin color, uniform

shape, early maturity, and high yield of small tubers make Mazama a very promising selection for high-value, red-skinned markets. Potato Virus Y symptoms are expressed clearly in Mazama.

Summary

With the release of two red-skinned selections and at least one more promising clone under evaluation, the Oregon variety development program is phasing out the red-skinned selection effort. In 2000, in addition to the Oregon releases, Idaho plans to release IdaRose, a selection of interest for home gardens, and California plans to release CalRed. These varieties offer a major increase in options for a limited market segment.

Red-skinned selections have presented disease risks for the seed increase program at Powell Butte. Most red-skinned and white-skinned selections are very susceptible to powdery scab (*Spongospora subterranea*). This disease is common at the Powell Butte site, and infected seed has been a source of concern for research sites believed to be free of the disease. Several of the red-skinned clones in the program, though very susceptible to Potato Virus Y, express only mild symptoms, which increases the difficulty to maintain low disease incidence in all seed lots.

Several clones from 1998 single-hills will move through the screening process over the next 6 to 8 years. KES will continue to screen this material and evaluate clones from the Oregon and regional programs. However, emphasis on red-skinned potato selections will decline in the future.

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Table 1. Plant and tuber characteristics of advanced, red-skinned potato selections grown at Klamath Falls, OR, 1999.

Variety/ selection	Percent stand		Vine vigor ¹	Vine maturity ²	Tuber characteristics ³			
	6/16	7/12			Color	Eyes	Shape	Skinning
Dk. Red Norland	85	100	5.0	3.0	3.0	2.8	3.0	3.8
Red LaSoda	18	98	3.5	3.8	2.3	1.0	3.0	3.5
A79543-4R	38	99	3.8	5.0	5.0	3.3	1.0	4.5
AO92657-3R	76	97	3.8	2.5	4.5	3.0	2.0	4.0
CO89097-2	50	98	4.3	4.0	4.0	4.0	2.5	3.9
NDC 4655-1	62	100	4.0	3.3	5.0	3.0	3.0	2.5
NDO 2686-4R	45	89	4.0	2.8	4.8	4.0	1.5	4.0
NDO4300-1R	58	98	3.5	2.5	5.0	4.0	2.0	4.0
NDO4588-5R	36	98	3.5	3.5	5.0	4.0	2.0	3.8
NDO4592-3R	38	98	4.0	3.3	5.0	3.0	2.5	4.0
NDO4323-2R	90	99	4.3	4.0	5.0	3.5	2.0	4.0
NDO5437-7R	43	94	2.8	1.3	4.0	5.0	1.0	4.4
NDO2438-6R	49	99	3.8	2.8	5.0	3.8	2.0	4.5
NDO2686-6R	64	98	4.0	2.3	5.0	4.0	2.0	4.1
Mean	54	98	3.9	3.2	4.5	3.5	2.1	3.9

¹Vine vigor rating: 1 is small, weak, to 5 for large, robust.

²Vine maturity: 1 is early, to 5 for a late maturing plant.

³Color: 1 is pale to pink, to 5 for bright red.

Eye depth: 1 is deep, to 5 for shallow.

Shape: 1 is round, 2 for oval, 3 for oblong.

Skinning: 1 is severe, to 5 for none.

Research in the Klamath Basin

Table 2. Yield, grade, tuber size distribution, and specific gravity of varieties and selections in the Western Regional Red-skinned Potato Trial at Klamath Falls, OR, 1999.

Variety/ selection	Yield U.S. No. 1s				Yield			Specific gravity
	4-6 oz	6-10 oz	> 10 oz	total	< 4 oz	culls	total	
	cwt/acre							
Dk. Red Norland	72	154	253	479	28	62	569	1.063
Red LaSoda	47	104	237	388	27	118	532	1.063
A79543-4R	161	170	82	413	94	6	513	1.067
AO92657-3R	106	180	186	472	39	3	515	1.060
CO89097-2	84	155	274	513	33	69	615	1.066
NDC4655-1	91	158	167	416	43	71	505	1.066
NDO2686-4R	149	157	56	363	91	5	458	1.065
NDO4300-1R	118	166	133	417	53	48	518	1.061
NDO4588-5R	97	169	191	457	29	25	511	1.059
NDO4592-3R	128	162	129	419	58	45	522	1.067
NDO4323-2R	107	186	211	504	53	58	614	1.069
NDO5437-7R	105	42	4	151	143	6	300	1.067
NDO2438-6R	85	151	247	484	27	22	533	1.056
NDO2686-6R	113	175	110	399	60	8	467	1.067
Mean	105	152	163	418	56	39	512	1.064
CV (%)	31	22	32	19	30	67	18	0.3
LSD (p = 0.05)	47	49	76	113	24	38	129	0.004

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Table 3. Yield, grade, tuber size distribution, specific gravity, and chip color of entries in the Western Regional Chip Trial grown at Klamath Falls, OR, 1999.

Variety/ selection	Yield U.S. No. 1s				Yield			Specific gravity	Chip color ¹
	4-8 oz	8-12 oz	>12 oz	total	Bs	culls	total		
	cwt/A								
Atlantic	127	141	185	453	30	9	492	1.082	3.0
Chipeta	132	191	204	527	17	23	567	1.081	2.3
A90467-14	192	151	75	418	54	2	475	1.087	2.3
AC87340-2	223	226	82	531	42	1	574	1.074	2.3
AC89653-3	278	181	29	489	107	4	599	1.081	2.8
AO91812-1	170	178	129	477	32	5	514	1.079	2.5
Mean	187	178	117	482	47	7	537	1.081	2.5
CV (%)	22	19	34	9	28	167	9	0.2	----
LSD (p = 0.05)	62	51	61	68	20	NS	74	0.003	----

¹ Color using Snack Food Association chip color standards (1 is light to 5 for dark)

Research in the Klamath Basin

Table 4. Mean yield, grade, tuber size distribution, and specific gravity for Dark Red , Norland Red LaSoda, and Winema grown at Klamath Falls, OR, 1993-99.

Variety	Marketable yield ¹				Yield			Specific gravity
	< 4 oz	4-6 oz	6-10 oz	total	> 10 oz	culls	total	
cwt/acre								
Dk. Red Norland	52	92	141	285	127	49	360	1.066
Red LaSoda	36	76	149	261	216	98	442	1.071
Winema	45	105	152	302	170	25	426	1.066

¹Marketable yield includes all U.S. No. 1s less than 10 oz.

Table 5. Mean yield, grade, tuber size distribution, and specific gravity for Dark Red Norland, Red LaSoda, and Mazama grown at Klamath Falls, OR, 1992-97 and 1999.

Variety	Marketable yield ¹				Yield			Specific gravity
	< 4 oz	4-6 oz	6-10 oz	total	> 10 oz	culls	total	
cwt/acre								
Dk. Red Norland	58	101	138	297	111	38	446	1.066
Red LaSoda	37	93	160	291	216	73	579	1.071
Mazama	86	141	145	372	53	6	430	1.072

¹Marketable yield includes all U.S. No. 1s less than 10 oz.