

Red-Skinned and Chipping Potato Variety Development

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Abstract

A red-skinned potato variety screening program was initiated at the Klamath Experiment Station (KES) in 1988 in a concerted effort to identify superior red clones for the Pacific Northwest. Breeding material was initially provided by the North Dakota State University potato-breeding program. Subsequently, Colorado State University and the Aberdeen, Idaho USDA-Agricultural Research Service (ARS) breeding programs provided material for evaluation. Single-hill, first-generation field screening at KES resulted in selection of NDO2686-6R and NDO2438-6R in 1989. These clones were released in 2000 as Mazama and Winema, respectively. A third clone, NDO4300-1R, will be released as Modoc in the near future. Each of these selections produces bright skin color that does not fade in storage. Mazama and Modoc produce many small tubers suitable for the high-value B and creamer markets. All three selections have smooth, shallow-eyed tubers, and they mature early.

The Oregon red-skinned variety selection program is being phased out. Single-hill screening ceased following the 1998 season. The Central Oregon Agricultural Research Center (COARC) retains several clones selected from single-hills in 1998 and prior years. These Oregon

red-skinned selections will continue through the evaluation process. However, cooperators in the program have decided to discontinue further efforts with red-skinned selections because of difficulties in seed production related to susceptibility to powdery scab and potato virus Y in many of the clones.

The Oregon program has also identified a clone with superior chipping quality. AO91812-1 completed 3 years of evaluation in the regional chip trial in 2000 and is planned for release as Willamette. This selection has excellent chip color out of 45⁰F storage. In 2000, KES conducted preliminary and advanced red-skinned trials and the regional chipping trial. Results of these trials are included in this report.

Introduction

California, Texas, Colorado, and the Skagit Valley in Washington are major production areas for red-skinned potato varieties. Red LaSoda and Dark Red Norland are currently the dominant varieties. Although both produce high yields, neither produces smooth, shallow-eyed, bright-colored tubers that retain good color in storage. The Oregon program initiated in 1988 has emphasized early maturity, bright skin color that does not fade in storage, shallow eyes, and production of high yields of small tubers suitable for high-value B size

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and creamer markets. These objectives have been largely achieved in the new varieties Mazama, Winema, and the soon-to-be-released, Modoc.

Production of potatoes for chips has increased in the Klamath Basin in recent years. In 2000, over 3,000 acres of chip potatoes were grown in the basin. KES has participated in the regional chip trial since 1998. This report summarizes results from red-skinned and chipping trials conducted at KES in 2000 and provides a long-term summary of performance for NDO4300-1R at KES and in regional trials.

Procedures

Red-skinned and chipping trials were conducted on Poe fine sandy loam soil at KES. Preceding crops at the site were spring cereals in 1999 and annual ryegrass in 1998. A preliminary yield trial for third-generation red-skinned clones included 16 selections planted in 20-hill plots with 2 replications. An advanced red-skinned trial included Dark Red Norland, Red LaSoda, and Yukon Gold as standards, 9 numbered red-skinned selections, a yellow-fleshed russet selection from Texas, the yellow-fleshed variety Yagana, and Winema and Mazama. Plots were 30 hills with 4 replications. The regional chip trial included Atlantic and Chipeta as standards and 7 numbered selections in 30-hill plots with 4 replications. The chip trial was planted on May 17 and both red-skinned trials were planted on May 18.

Seed for all trials was hand-cut to 1.5-2.5 oz/seedpiece on May 2, treated with Tops MZ (thiophanate-methyl, mancozeb, Gustafson), and stored at approximately 55⁰F and 95 percent relative humidity until planting. Seed was planted with an assisted-feed, 2-row planter at 8.7-in spacing in 32-in rows. Cultural practices were as described

for other variety trials on pages 19-20. Vines were desiccated with Diquat (diquat-dibromide, Seneca) applied with a ground sprayer at 1.0 pt/acre on September 9 (red-skinned trials) and September 15 (chip trial). Potatoes were harvested on September 26 (red-skinned trials) and September 29 (chip trial) with a one-row, digger-bagger. All tubers from each plot were stored at 55⁰F and 95 percent relative humidity until grading in mid-October.

External tuber characteristics were noted for all samples at grading. Ten large tubers from each plot were cut and inspected for internal defects. A sample of approximately 10 lb of U.S. No. 1 tubers was used to determine specific gravity by the weight-in-air, weight-in-water method. USDA grade standards were used to separate B size (<4 oz), U.S. No. 1s (4-6 oz, 6-10 oz, and >10 oz for red-skinned selections; 4-12 oz and >12 oz for chipping selections), and culls. Subsamples from each replication of the chip trial were evaluated for chip color at Corvallis.

Data from the preliminary trial were not analyzed statistically because the trial only included two replications. Yield, specific gravity, and internal defect data from advanced red and chip trials were analyzed using MSU STAT software. Least significant differences (LSD) are based on Student's *t* at the 5 percent probability level.

Results and Discussion

Sixteen red-skinned selections were grown in preliminary yield trials at KES and COARC. Ten of these were also evaluated in observational trials at the Intermountain Research and Extension Center (IREC) at Tulelake, California. Based on performance at all locations, six clones were selected for further evaluation (Table 1). Yields of all retained clones were high at KES (Table 2).

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Based on marketable yield, skin color, and attractive tuber appearance, AO93487-2R ranked first. It was rated worthy of retention at all locations. At KES, skinning was noted as the only deficiency. This clone resulted from a cross at Aberdeen, Idaho using Mazama as the male parent.

An advanced yield trial at KES included Dark Red Norland, Red LaSoda, and five formal entries in the regional red-skinned trial, three yellow-fleshed selections, and six additional red-skinned selections from the Oregon program (Tables 3 and 4). CO89097-2, NDO4300-1R, and NDO4588-5R have completed 3 years of evaluation in the regional trial. Colorado will continue evaluation and pursue release of CO89097-2. Oregon also intends to continue development of NDO4300-1R and has tentative plans to release this selection as Modoc. It has consistently produced moderately high yields with bright skin color and good tuber size distribution for markets favoring small tubers. The third selection graduating from the regional trial, NDO4588-5R, will be discarded from the Oregon program. NDO4323-2R and A92657-1R will be retained for further evaluation in the regional trial.

Yellow-fleshed entries in the trial included the standard and most commonly grown yellow-fleshed variety in North America, Yukon Gold; Yagana, a specialty variety from South America; and the russet-skinned Texas selection TX1523-1RU/Y. Yagana achieved the highest yield of all entries in the trial. Texas intends to continue evaluation of TX1523-1RU/Y.

Newly released varieties Winema and Mazama and four additional Oregon red-skinned selections were included in this trial. Mazama was second only to Yagana, and significantly higher than all other selections in yield of marketable-size tubers.

As in previous trials, Winema produced a relatively high yield, but many tubers were in the over-10-oz size range. The four numbered selections in this group are being discarded.

Performance of NDO4300-1R over 3 years in regional trials is summarized in Table 5. Although total yields were less than yields of Dark Red Norland and Red LaSoda, yield of tubers in the preferred size range (<4 oz to <10 oz) was higher than for either standard variety. A comparison of long-term performance of the standard varieties and NDO4300-1R at two Oregon and two California locations is presented in Table 6. Averaged over 20 location-years, the marketable yield of NDO4300-1R was 111 and 144 percent of yields of Dark Red Norland and Red LaSoda, respectively. NDO4300-1R was not superior to the standards in yields at Bakersfield, California.

Yields of varieties and selections in the 2000 regional chip trial were high (Table 7). Chipeta was among the highest in total No. 1 and total yield and specific gravity. Chip colors were determined on samples delivered to Corvallis. Exposure to cool temperatures in transit resulted in dark chips in all selections. The Oregon selection AO91812-1 completed 3 years in the regional trial. It is being considered for release as Willamette. It generally produces good chip color out of 45⁰F storage. A90467-14 will probably be discarded by Idaho. AC87340-2 has also completed 3 years in the trial and will continue to be evaluated in Colorado. AC89653-3 will be discarded. The remaining selections will continue in the regional trial in 2001.

Summary

Under conditions that resulted in very high yields, three Oregon red-skinned

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selections continued to demonstrate high yields, excellent appearance, and superior internal and external quality compared to industry standards in 2000 trials at KES. Mazama and Winema were formally released in 2000 and their seed is being increased in commercial production. A third selection from the Oregon program is planned for release as Modoc within the next year. Seed of Modoc is being increased in the Oregon Foundation Seed Potato Program.

Two chipping varieties that originated in the Oregon variety development program are planned for release in the near future. NDO1496-1 completed evaluation in the regional chip trial several years ago. Oregon decided not to pursue release of this selection because of susceptibility to shatter bruise. Commercial interest in this selection in Idaho has resulted in a decision by the Idaho potato variety development program to release the selection as Ivory Crisp. Oregon plans to release NDO91812-1 as Willamette. Both selections produce good chip color out of cool storage.

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Table 1. Parentage and tuber characteristics of red-skinned potato clones selected from 2000 preliminary yield trials, Oregon.

Selection	Female parent	Male parent	Tuber shape	Shape uniformity	Tuber size	Eye depth	Skin color
AO91854-1R	NDTX1068-11R	ND2224-5R	Round/Oblong	Good	Medium	Shallow	Red/Purple
AO93487-2R	NDO3503-5R	Mazama	Round/Oblong	Good	Medium	Shallow	Red
AO96747-2R	A90601-2RDY	A83350-9R	Round/Oblong	Fair	Medium	Medium	Purple
AO96751-1R	A91848-1R	CO86218-2R	Round/Oblong	Good	Medium	Shallow	Red/Purple
NDO7119-1R	ND4945-11R	Winema	Round/Oblong	Good	Medium	Shallow	Red
NDO7130-1R	ND5002-3R	ND5256-7R	Round/Oblong	Fair	Small	Shallow	Red/Purple

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Table 2. Yield, tuber size distribution, and grade of red-skinned potato clones selected from the preliminary yield trial, Klamath Falls, OR, 2000.

Selection	Yield U.S. No. 1s					Yield		
	<4 oz	4-6 oz	6-10 oz	>10 oz	total	marketable ¹	culls	total
	cwt/acre							
AO91854-1R	67	166	206	235	674	439	70	744
AO93487-2R	128	221	192	122	663	541	7	670
AO96747-2R	161	192	203	94	650	556	8	658
AO96751-1R	71	151	235	162	619	457	14	633
NDO7119-1R	100	155	161	125	541	416	14	555
NDO7130-1R	196	206	158	29	589	560	2	591

¹Marketable: <4 oz to 10 oz U.S. No. 1s.

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Table 3. Plant and tuber characteristics of advanced red-skinned and yellow-fleshed potato selections grown at Klamath Falls, OR, 2000.

Variety or selection	Percent stand	Vine vigor ¹	Vine maturity ²	Tuber characteristics ³			
				color	eyes	shape	skinning
Dk. Red Norland	99	4.0	2.8	3.0	3.5	2.0	4.1
Red LaSoda	98	2.5	3.0	3.0	2.0	3.0	3.3
Yukon Gold	93	3.0	2.8	Yellow	4.3	3.0	5.0
CO89097-2	96	2.3	3.0	4.8	5.0	2.0	4.3
NDO4300-1R	92	1.8	3.0	5.0	5.0	2.0	4.3
NDO4588-5R	94	3.3	2.8	5.0	4.0	2.0	2.5
NDO4323-2R	100	3.0	4.0	4.5	3.0	2.0	3.8
A92657-1R	88	2.0	3.0	4.3	4.0	2.0	3.0
TX1523-1RU/Y	97	5.0	2.5	Lt. Russ	4.0	2.0	4.5
NDO5108-1R	99	3.5	3.3	5.0	4.0	2.0	1.5
NDO6183-1R	97	4.0	2.3	4.8	4.0	1.0	2.5
NDO6184-1R	97	2.8	3.0	5.0	3.5	1.0	3.5
A092657-3R	99	3.5	2.3	5.0	3.5	1.0	3.3
Winema	97	2.3	2.0	4.5	3.8	2.0	4.0
Mazama	97	3.3	2.3	5.0	5.0	1.0	4.1
Yagana	98	4.8	4.5	Yellow	4.0	2.5	4.3
Mean	96	3.2	2.9	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.

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Table 4. Yield, grade, tuber size distribution, and specific gravity of advanced red-skinned and yellow-fleshed potato selections grown at Klamath Falls, OR, 2000.

Variety or selection	Yield U.S. No. 1s					Yield			Specific gravity
	<4 oz	4-6 oz	6-10 oz	>10 oz	total	marketable ¹	culls	total	
	cwt/acre								
Dk. Red Norland	36	93	216	319	664	345	42	707	1.069
Red LaSoda	35	49	137	248	469	221	122	591	1.067
Yukon Gold	17	37	121	410	585	175	26	610	1.085
CO89097-2	48	115	223	228	614	386	37	651	1.075
NDO4300-1R	73	149	203	115	540	425	25	564	1.064
NDO4588-5R	31	73	187	245	536	291	61	596	1.063
NDO4323-2R	53	130	214	142	539	397	190	728	1.078
A92657-1R	26	90	232	229	577	348	56	633	1.072
TX1523-1RU/Y	13	53	166	449	681	232	8	688	1.077
NDO5108-1R	60	142	218	117	537	420	123	659	1.068
NDO6183-1R	41	113	214	186	554	368	55	609	1.065
NDO6184-1R	88	130	152	81	451	370	10	462	1.082
A092657-3R	41	103	215	314	673	359	22	694	1.064
Winema	36	83	163	227	509	282	48	557	1.055
Mazama	105	180	220	67	572	505	12	582	1.069
Yagana	148	215	203	129	695	566	39	733	1.078
Mean	53	110	193	219	575	356	55	629	1.071
CV (%)	24	22	15	11	10	11	37	9	0.3
LSD (.05)	18	34	41	70	82	53	28	81	0.004

¹Marketable: <4 oz to 10 oz U.S. No. 1s.

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Table 5. Yield, grade, tuber size distribution, and specific gravity of NDO4300-1R, Dark Red Norland, and Red LaSoda potato varieties in Western Region Trials, 1998-2000¹.

Entry	Yield U.S. No. 1s				Yield			Specific gravity
	<4 oz	4-10 oz	>10 oz	total	marketable ²	culls	total	
	cwt/acre							
NDO4300-1R	66	235	61	362	301	24	386	1.067
Dark Red Norland	43	230	126	399	273	40	439	1.068
Red LaSoda	28	169	135	332	197	77	409	1.069

¹Locations: California, Idaho, Oregon, Texas, Washington.

²Marketable yield: U.S. No. 1s <4 oz to 10 oz.

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Table 6. Yield, grade, tuber size distribution, and specific gravity of NDO4300-1R, Dark Red Norland, and Red LaSoda potato varieties in trials at Corvallis and Klamath Falls, Oregon and Tulelake and Bakersfield, California, 1995-2000.

Entry	Location	Years tested	Yield U.S. No. 1s				Yield			Specific gravity
			<4 oz	4-10 oz	>10 oz	total	marketable ¹	culls	total	
cwt/acre										
NDO4300-1R	Corvallis	6	64	271	81	416	335	48	464	1.068
	Klamath Falls	6	88	295	96	479	383	22	501	1.063
	Bakersfield	4	21	251	62	334	272	26	360	1.074
	Tulelake	4	30	306	62	398	336	17	415	1.068
	Average			51	281	75	407	332	28	435
Dark Red Norland	Corvallis	6	43	251	113	407	294	105	512	1.074
	Klamath Falls	6	49	235	166	450	284	57	507	1.067
	Bakersfield	4	11	331	111	453	342	42	495	1.075
	Tulelake	4	22	257	119	398	279	51	449	1.066
	Average			31	269	127	427	300	64	491
Red LaSoda	Corvallis	6	32	201	154	387	233	115	502	1.075
	Klamath Falls	6	35	190	212	437	225	97	534	1.069
	Bakersfield	4	11	260	127	398	271	65	463	1.077
	Tulelake	4	14	176	163	353	190	121	474	1.065
	Average			23	207	164	394	230	100	494

¹Marketable yield: U.S. No. 1s <4 oz to 10 oz.

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Table 7. Yield, grade, tuber size distribution, specific gravity, and chip color of potato entries in the Western Regional Chip Trial grown at Klamath Falls, OR, 2000.

Variety or 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/acre								
Atlantic	120	154	271	545	40	22	607	1.088	3.0
Chipeta	112	267	207	586	31	62	679	1.093	2.8
A90467-14	123	195	193	511	43	28	582	1.095	2.8
A90490-1	147	271	167	585	64	13	662	1.089	3.0
A91790-13	258	164	76	498	162	0	660	1.090	1.8
AC87340-2	184	181	94	459	60	5	523	1.072	2.0
AC89653-3	237	193	58	487	104	10	601	1.083	3.0
AO91812-1	188	211	114	512	68	18	598	1.090	2.3
NDTX4930-5W	163	223	178	564	38	40	641	1.091	2.8
Mean	170	206	151	527	68	22	617	1.088	3.3
CV (%)	18	16	27	10	22	46	8	0.3	----
LSD (.05)	45	49	60	77	22	15	71	0.004	----

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