

OREGON'S POTATO VARIETY DEVELOPMENT PROGRAM

CENTRAL OREGON RESEARCH

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The potato variety development program is a major endeavor at Central Oregon Experiment Station. The Russet Burbank variety has been grown many years. However, recent advances in russet-skinned potato variety development in the eastern U.S. coupled with disease and physiological disorders of the Russet Burbank variety have threatened the Northwest potato industry. New potato varieties are needed that possess high yield potential, disease resistance, a high percentage of U.S. No. 1 tubers, and excellent processing and cooking qualities.

More than 20,000 potato lines were grown during 1983. Seed of nearly 700 lines was increased to provide seedstock for 1984 potato variety trials. Evaluation of a large number of lines at many locations will increase the likelihood of identifying superior potato varieties.

METHODS

Twenty thousand seedling tubers (small tubers grown from true potato seed) were planted on 27-inch centers in 3-foot rows at Powell Butte. Five thousand seedling tubers were obtained from the Colorado potato breeding program and 15,000 from the Aberdeen, Idaho, breeding program.

Four hundred thirty-five lines selected from 1982 seedling tubers were planted at Redmond. Plots contained 3 seedpieces which were quartered and planted as tuber units. Also, 56 advanced lines were increased at Powell Butte to provide seedstocks for 1984 variety trials in the western U.S.. Thirty tuber units of each variety were planted in 3-foot rows.

An application of 5.25 pt/A of Eptam 7-E was incorporated into the soil four days before planting. All seed increases were hand planted the fourth week of May, 1983. An iron age potato planter was used to open furrows for hand planting and also band 800 lb/A of 10-20-20 (NPK) fertilizer. Plots were hilled after hand planting and re-hilled and cultivated upon emergence. Commencing at plant emergence, seed increases were sprayed weekly with a high pressure (200 psi) application of Stylet Spray-Oil and Orthene to curb aphid populations and reduce the spread of potato virus Y (PVY). One-third of a gallon/A of Stylet Spray-Oil was applied in 35 gallons water/A. One

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1b/A of Orthene 75S was added to the spray mixture each week. Sevin (1.1 lb/A) was applied on July 26, 1983, to control Colorado potato beetles. Potato vines were dessicated on Sept. 9, 1983, with an application of 2 qt/A of Dinitro.

The 20,000 seedling tubers were dug and visually evaluated by a team of potato researchers from Oregon, Washington, Idaho and North Dakota. Tubers were evaluated for yield, grade, shape, russetting, and eye depth. Five tubers were selected and were eye-indexed and screened for viruses during the 1983-84 winter season in the Corvallis greenhouses. The 12-hill lines in Redmond were evaluated on the visual criteria above, as well as specific gravity and fry color. Fifteen tubers of selected lines were winter eye-indexed and evaluated.

Before digging, leaf samples from 5 tuber units of each of the 56 seed increase lines were taken. These leaf samples were ELISA tested for PVX, PVY, and potato leaf-roll virus (PLRV). Units that tested clean were hand dug and 35 tubers retained for winter eye-indexing and subsequent seedstock for 1984 seed increases. The remaining hills were later harvested and stored to provide seedstocks for variety trials.

A variety trial containing 32 advanced lines was planted May 17, 1983, at Powell Butte. Twenty-seven seedpieces were planted nine inches apart in 3-foot rows. Varieties were separated by two hills of "All Blue" potatoes. The plots were arranged in a randomized block design replicated four times. Plots were banded with 900 lb/A of 16-16-16 (NPK) at planting time. Colorado potato beetles were controlled with an application of Parathion in late July and a follow-up application of Sevin two weeks later. Vines were killed by frost in mid-September and plots were harvested on October 10, 1983. Tuber characteristic notes were taken at harvest. A 10 pound sample from each plot was taken for french frying, specific gravity determination, and internal defect grading.

Specific gravities were determined by weighing approximately 10 pounds of tubers in water and air. Eighteen tubers per plot were cut and internal defects recorded as percent of tubers with a given defect. Four tubers were stored two months at 55 degrees F for french frying. Four ¼-inch square strips from each of four tubers was fried for four minutes at 350 degrees F. Each strip was evaluated for color and dark ends. Color was scored from 0-4 based on the USDA Standard Color Chart for frozen french-fried potatoes.

RESULTS

Of the 20,000 seedling tubers planted, 486 lines were selected for further evaluation and seed increase. Eighty-three lines were selected from Colorado seedling tubers and 403 lines were selected from Aberdeen, Idaho, seedling tubers. The selected lines will be planted in a 4-hill screening trial at Hermiston in 1984. Also, all selections will be increased for seed in 16-hill plots at Powell Butte in 1984.

One hundred-thirteen selections were made from the 12-hill plots in Redmond. The selections included 2 white-skinned varieties, 4 red varieties, and 107 russet-skinned varieties. The selected lines will be placed in a twice replicated preliminary yield trial at Hermiston and Klamath Falls in 1984. Fifteen tubers of each line will be increased for seed at Powell Butte in 1984.

Fifty-six lines were increased to provide seedstock for 1984 statewide and regional variety trials. Twenty lines were dropped from the program because of poor yields, poor grade, fry color, specific gravity, or internal quality problems. Table 1 lists the 1983 seed increase entries and their disposition.

Also, 39 selections were made from the 12-hill plots grown in Aberdeen, Idaho. These selections will be placed in 4/16 hill screening plots at Hermiston and Powell Butte in 1984.

Yield and quality characteristics for the 1983 Powell Butte statewide variety trial are shown in Table 2. The overall trial was excellent; yields were high, percent USDA No. 1's was very high, and fry colors generally light. The coefficient of variation for total yield was 9.32%. The relatively long growing season allowed tubers to size in most varieties; undersize tubers (less than 4 oz.) averaged 9.0% for the entire trial. Selections A77236-6 and A77532-4 failed to size well and yielded 29.7% and 20.4% undersize respectively.

Although TXA657-27 was an excellent yielding selection, it was dropped from the testing program. The specific gravity was low and it did not yield as well at other statewide trial locations (Hermiston and Klamath Falls). The regional trial entries, A69870-10, A72685-2, and A74212-1 performed well. Only A69870-10 appears to have processing potential. A72685-2 has an acceptable specific gravity but does not fry well; it has been dropped from the regional trial because it has been tested three years. This selection will undergo further large scale commercial testing. A69870-10, A74132-7, and A74212-1 were selected as entries for the 1984 Western Regional Variety Trial.

Selection A7279-12 yielded well in all statewide locations, has a very high specific gravity (1.104), and fries well (0.6). The seedstock of this variety has contained potato virus X and potato virus S. Clean seed will be planted in the 1984 seed increase block. A7279-12 shows excellent multi-purpose potential and will be entered in the 1985 Western Regional Trial. Black spot may be a minor problem in A7279-12. This selection showed no hollow heart, internal brown spot, or stem end browning.

The selections entered in the variety trial for the first time performed poorly as a group. Only A77153-3 of the new entries will be returned for further testing. The poor yields of these new entries has uncovered the need to examine the early selection techniques of the program. A preliminary yield trial will be grown at two locations (Hermiston and Klamath Falls) in 1984. This should produce better material for future statewide variety trials.

Table 3 highlights the internal defects and tuber characteristics of the

Powell Butte variety trial. Hollow heart was a minor problem in the 1983 trial. Only selection A77131-5 had a hollow heart problem. Lemhi is the standard of comparison for black spot; only selection A77254-1 had more black spot than Lemhi. Russet Burbank has had problems with internal brown spotting in the northwest. Selection A7742-6 is similar to Russet Burbank in susceptibility to internal brown spot. A fault of A69870-10 is stem end browning. This defect has been noted several years in that selection. Selection A71997-8 also had 16.7% stem end browning and also had many, shallow growth cracks (Table 3).

Eighteen lines were dropped from the 1983 trial. These were evaluated for yield, size, grade, specific gravity, fry color, internal quality, and appearance at Powell Butte, Hermiston and Klamath Falls. The following lines have been dropped because of failure to meet the above criteria.:

A7596-1	A77131-5	ATP62-3
A7683-16	A77236-6	B8972-1
A7727-1	A77254-1	ND385-4
A7735-1	A77254-9	NDA848-3
A7742-6	A77529-8	TXA582-4
A7787-3	A77532-4	TXA657-27

Eighteen new entries will replace the discarded selections in 1984 trials. The seed of these was increased in 1983 (Table 1).

Increasing the number of new selections brought into Oregon from regional breeding programs will greatly enhance the prospect of identifying potato varieties better suited for commercial production and processing. The greater the number of lines evaluated from good parents, the greater the likelihood of finding a superior variety. Also, as more selections are obtained, research techniques will be improved to provide quality selections for intensive evaluation in later generation variety trials. Table 4 outlines the plans for 1984 and compares them with work accomplished in 1981, 1982, and 1983.

Table 1. Potato lines increased at Powell Butte in 1983 for seedstock in 1984 statewide and regional variety trials

NO.	VARIETY	INCREASE	DISP.	NO.	VARIETY	INCREASE	DISP.
1	All Blue	S	Keep	29	A77254-1	S	Drop
2	Bintje	0	Drop	30	A77254-9	S	Drop
3	Butte	0	Drop	31	A77529-8	S	Drop
4	Denali	0	Keep	32	A77532-4	S	Drop
5	Lemhi	S,R	Keep	33	A7811-16	(S)	Keep
6	Norchip	0	Keep	34	A7814-6	(S)	Keep
7	Norgold	S,R	Keep	35	A7836-28	(S)	Keep
8	Rosa	0	Keep	36	A7869-5	(S)	Keep
9	1982 VTSC	S,R	Keep	37	AOR79492-2	(S)	Keep
10	1981 VTSC	S,R	Keep	38	ATP62-3	S	Drop
11	A68678-2	S	Keep	39	B8972-1	S	Drop
12	A69870-10	S,R	Keep	40	COOR7908-1	(S)	Keep
13	A71997-8	S	Keep	41	COOR7921-1	(S)	Keep
14	A7242-3	S	Keep	42	ND385-4	S	Drop
15	A7279-12	S	Keep	43	ND388-1	(S)	Keep
16	A72685-2	S,R	Keep	44	ND534-4	(S)	Keep
17	A74132-7	S	Keep	45	ND681-3	S	Keep
18	A74212-1	S,R	Keep	46	ND678-8	(S)	Keep
19	A7532-1	(S)	Keep	47	NDA815-1	(S)	Keep
20	A7596-1	S	Drop	48	NDA848-3	S	Drop
21	A7683-16	S	Drop	49	NDA1238-2	(S)	Keep
22	A7727-1	S	Drop	50	NDA1242-1	(S)	Keep
23	A7735-1	S	Drop	51	NDA1242-3	(S)	Keep
24	A7742-6	S	Drop	52	NDA1246-4	(S)	Keep
25	A7787-3	S	Drop	53	NDA1276-3	(S)	Keep
26	A77131-5	S	Drop	54	NDA1309-6	(S)	Keep
27	A77153-3	S	Keep	55	TXA582-4	S	Drop
28	A77236-6	S	Drop	56	TXA657-27	S	Drop

S - State Increase R - Regional Increase () - New Entry 0 - Other

Table 2. Yield and quality characteristics for thirty-two selections and varieties, Powell Butte statewide variety trial, 1983

SELECTION	YIELD RANK	YIELD (CWT/A)		% NO. 1	OZ./ TUBER ¹	SPECIFIC GRAVITY ²	FRY COLOR ³
		TOTAL	NO. 1				
R. Burbank	21	476	418	88	5.6	1.088	0.3
Lemhi	4	566	534	95	8.4	1.087	0.1
Norgold	30	374	316	84	5.2	1.074	1.8
81 VTSC	6	560	477	85	6.1	1.087	0.8
A68678-2	7	558	532	96	12.3	1.081	0.9
A69870-10	9	544	493	91	6.7	1.088	0.0
A71997-8	16	511	437	86	5.9	1.077	1.3
A7242-3	17	496	441	89	7.1	1.080	3.3
A7279-12	11	541	523	97	9.2	1.104	0.6
A72685-2	5	564	515	92	6.7	1.089	1.8
A74132-7	2	592	551	93	8.3	1.082	1.7
A74212-1	13	529	502	95	8.3	1.078	1.4
A7596-1	3	581	518	89	7.0	1.087	0.6
A7683-16*	25	434	397	91	6.3	1.084	1.8
A7727-1*	10	542	438	81	5.4	1.105	1.0
A7735-1*	18	492	404	82	6.8	1.085	1.7
A7742-6*	27	431	370	86	6.9	1.073	0.7
A7787-3*	19	485	440	90	6.2	1.081	1.6
A77131-5*	28	407	376	93	7.0	1.109	0.0
A77153-3*	12	538	500	93	8.2	1.088	1.5
A77236-6*	24	435	306	70	4.0	1.094	1.8
A77254-1*	20	483	444	92	6.7	1.085	1.4
A77254-9*	23	454	378	83	5.2	1.080	0.8
A77529-8*	29	396	368	93	7.5	1.083	0.0
A77532-4*	31	365	289	79	4.9	1.082	1.0
ATP62-3*	26	432	385	89	5.9	1.076	2.3
B8972-1*	32	364	324	89	6.3	1.083	0.0
ND385-4	22	464	403	87	7.3	1.085	0.0
ND681-3	14	522	499	96	8.9	1.083	0.5
NDA848-3*	15	521	473	91	8.9	1.082	0.9
TXA582-4*	8	545	464	85	5.8	1.106	0.3
TXA657-27*	1	593	557	94	9.3	1.078	1.0
Average		494	440	89	7.0	1.086	1.0
LSD 5%		65	63	5	1.0	.005	0.6

* - New entry.

1 - Average weight of all tubers.

2 - Air/Water method.

3 - Stored 2 months at 55 degrees F, Fresh fried 4 minutes at 350 degrees F.

Table 3. Internal defects and tuber characteristics for thirty-two selections and varieties, Powell Butte statewide variety trial, 1983

SELECTION	% INTERNAL DEFECTS ¹				TUBER CHARACTERISTICS		
	HH	BS	IBS	SEB	RUSSET ²	SHAPE ³	GR. CRACKS ⁴
R. Burbank	1.4	0	16.7	0	MD	LN	NONE
Lemhi	0	13.9	0	0	MD	BL	FEW, SH
Norgold	1.4	0	5.6	0	MD	BL, RD	NONE
81 VTSC	4.2	2.8	15.3	0	MD	LN	NONE
A68678-2	1.4	5.6	0	0	MD	BL	NONE
A69870-10	0	5.6	0	23.6	MD-HV	BL	FEW, SH
A71997-8	0	0	0	0	MD-HV	BL	MANY, SH
A7242-3	1.4	5.6	0	0	LT	RD, FL	NONE
A7279-12	0	5.6	0	0	MD	BL, RD	NONE
A72685-2	0	5.6	0	0	MD	BL	NONE
A74132-7	0	4.2	0	0	LT	BL	NONE
A74212-1	0	5.6	0	5.6	LT	BL	NONE
A7596-1	0	4.2	0	0	MD HV	BL	MANY, DP
A7683-16*	0	0	1.4	0	LT	BL, PR	NONE
A7727-1*	0	0	0	0	MD	BL	NONE
A7735-1*	1.4	4.2	0	0	HV	BL	FEW, SH
A7742-6*	4.2	0	15.3	0	MD	BL, LN	NONE
A7787-3*	0	2.8	0	0	MD-HV	BL	NONE
A77131-5*	38.9	4.2	0	0	HV	BL, RD,	NONE
A77153-3*	0	6.9	1.4	0	LT	BL, PR	NONE
A77236-6*	0	0	1.5	0	MD	BL, LN	NONE
A77254-1*	0	19.4	0	1.4	MD	FL, BL	NONE
A77254-9*	0	4.2	0	2.8	LT	BL	NONE
A77529-8*	2.8	1.4	0	0	HV	BL	NONE
A77532-4*	0	2.8	1.4	0	MD	BL	NONE
ATP62-3*	0	1.4	0	0	MD	BL, PR	NONE
B8972-1*	0	0	0	0	HV	BL	FEW, SH
ND385-4	0	5.6	0	0	--	--	--
ND681-3	0	1.4	0	0	MD	BL	FEW, SH
NDA848-3*	0	0	2.8	0	MD-HV	RD, BL	NONE
TXA582-4*	0	1.4	0	5.6	MD-HV	RD, BL	NONE
TXA657-27	1.4	1.4	0	0	LT	BL	NONE

* - New entry.

1 - HH = Hollow Heart, BS = Black Spot, IBS = Internal Brown Spot, SEB = Stem End Browning.

2 - Russetting - LT = Light, MD = Medium, HV = Heavy.

3 - Shape - LN = Long, BL = Blocky, RD = Round, PR = Pear, FL = Flat.

4 - Growth Cracks - SH = Shallow, DP = Deep.

Table 4. The number of selections in the Oregon Potato Variety Development Program from 1981-1984

GENERATION	1981	1982	1983	1984
	----- number of lines -----			
Seedling Tubers	5,000	15,000	20,000	27,000
4/12 Hill Screening	39	94	435	528
Preliminary Yield Trials	0	0	22	116
Statewide Yield Trials	50	45	32	32
Total	5,089	15,139	20,467	27,676