Klamath Russet: A Full Season, Fresh Market, Long Russet[1]

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ABSTRACT

Klamath Russet, a late-maturing cultivar for fresh market use, was jointly released by the Agricultural Experiment Stations of Oregon, Idaho, and Washington and the U.S. Department of Agriculture in 2000. Klamath Russet was tested in irrigated trials in Oregon from 1990 to 1999 and in Western Regional Trials from 1994 to 1996. Klamath Russet yields of U.S. #1s have exceeded those for Russet Burbank and Russet Norkotah by more than 30%, averaged across all trials. Klamath Russet is moderately resistant to *Verticillium* wilt and highly resistant to common scab. Specific gravity for Klamath Russet has averaged 1.076 across all trials compared with 1.070 and 1.081 for Russet Norkotah and Russet Burbank, respectively. Klamath Russet is not considered suitable for french fry production because of high sugar and low starch contents.

BACKGROUND

Klamath Russet was evaluated as AO85165-1. The clone was selected from a cross made in 1985 between Russet Norkotah (Johansen et al. 1988) and A79172-6 by J.J. Pavek at the University of Idaho Research Center, Aberdeen, Idaho. The initial selection was made at Powell Butte, Oregon in 1987, followed by two years of seed increase and preliminary evaluations. From 1990 through 1999, Klamath Russet was included in replicated statewide trials at Powell Butte, Hermiston, Klamath Falls, and Ontario, Oregon. It was included in 1993 Tri-State Trials at one location each in Oregon, Washington, and Idaho. From 1994 through 1996, Klamath Russet was evaluated at 13 locations in seven western states in formal Western Regional Trials. Additional studies have evaluated the response of Klamath Russet to nitrogen fertilizer rates, plant population, and diseases.

The pedigree of Klamath Russet is presented in Figure 1.

DESCRIPTION

Plants: *Growth habit:* Large, erect. *Stems:* No anthocyanin pigmentation, weak wings. *Leaves:* Medium green; medium pubescent; open silhouette; no anthocyanin pigment in leaf midribs and petioles. *Terminal leaflets:* Broadly ovate with cuspidate tip, slightly wavy margins, and cordate base. *Primary leaflets:* Four to six pairs per leaf; narrowly ovate with cuspidate tip, small size, and cordate base. *Secondary leaflets:* Medium frequency. *Tertiary leaflets:* Few in number. Vine maturity is late, similar to or slightly later than Russet Burbank.

Inflorescence: Numerous (16) flowers per plant. *Corolla:* Blue-violet on inner and outer surfaces, pentagonal shape. *Calyx:* Weak anthocyanin pigment. *Anthers:* Yellow-orange; broad cone; abundant pollen. *Stigma:* Capitate; olive-green. No berry production.

Tubers: Skin is tan colored with russetted surface; tuber shape is oblong to long. The length/width/thickness ratio, mea-

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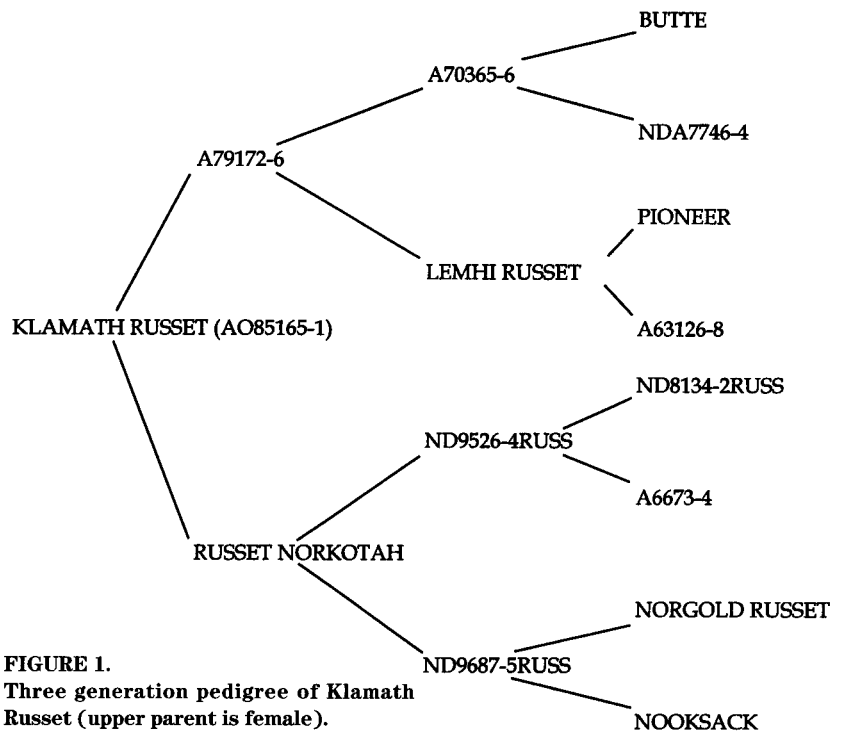

FIGURE 1.
Three generation pedigree of Klamath Russet (upper parent is female).

sured at Klamath Falls, Oregon, is approximately 12.3/6.4/5.5 compared with 11.2/6.2/5.3 for Russet Burbank and 13.0/6.6/5.4 for Russet Norkotah. Eye depth is shallow with about 16 eyes per tuber, fairly well distributed. Eyebrows are slightly prominent. Tuber flesh is white. Dormancy is longer than that of Russet Burbank stored at 7 C. Maturity is similar to Russet Burbank.

CHARACTERISTICS

Klamath Russet consistently produces higher U.S. #1 yields and larger tubers than either Russet Burbank or Russet Norkotah. In 38 Oregon statewide trials over nine years, Klamath Russet U.S. #1 yields averaged 141% and 136% of yields for Russet Burbank and Russet Norkotah, respectively (Table 1); corresponding specific gravity averaged 1.075, 1.081, and 1.071. Klamath Russet was evaluated in 17 early-harvest and 26 late-harvest Western Regional Trials in 7 states from 1994 to 1996. Averaged over all early-harvest trials, Klamath Russet achieved U.S. #1 yields of 134% of Russet Norkotah and in late trials, 131% of Russet Burbank (Table 2). Mean specific gravities in late-harvest trials were 1.077 and 1.083 for Klamath Russet and Russet Burbank, respectively. Klamath Russet has been consistently darker in fry color than Russet Burbank in all trials and is not considered suitable for french fry processing (data not shown).

RESISTANCE TO DISEASE AND PHYSIOLOGICAL DISORDERS

Compared with Russet Burbank, Klamath Russet is less susceptible to *Verticillium* wilt; equal in susceptibility to potato leafroll virus (PLRV), tuber net necrosis caused by PLRV, foliar infection by late blight caused by *Phytophthora infestans*, and Fusarium dry rot (*Fusarium* spp.); and more susceptible to tuber late blight infection and Erwinia soft rot (*Erwinia* spp.) (Tables 3 and 4). Compared with Russet Norkotah, Klamath Russet is less susceptible to *Verticillium* wilt and early blight caused by *Alternaria solani*. Klamath Russet is moderately susceptible to potato virus Y and expresses foliar symptoms clearly, is susceptible to corky ringspot infection caused by tobacco rattle virus, but shows less severe symptom expression than Russet Burbank, and is susceptible to root-knot nematode (*Meloidog-*

TABLE 1—*Performance of Klamath Russet (KR), Russet Burbank (RB), and Russet Norkotah (RN) at four Oregon locations from 1990 to 1999.*

Location	Number of years	Total Yield (T/ha)			Mkt. Yield (T/ha)			Specific Gravity		
		KR	RB	RN	KR	RB	RN	KR	RB	RN
Powell Butte	10	44.2	43.5	38.3	33.8	28.9	30.9	1.077	1.084	1.074
Klamath Falls	10	60.9	54.4	47.9	53.5	36.8	41.0	1.078	1.085	1.070
Hermiston	8	82.0	74.9	51.0	70.0	43.2	39.7	1.068	1.075	1.067
Ontario	10	54.2	58.4	47.8	45.7	35.5	38.1	1.078	1.079	1.074
Overall Mean		60.3	57.8	46.3	50.8	36.1	37.4	1.075	1.081	1.071

FIGURE 2. Plant, flower, and tuber characteristics of Klamath Russet.

TABLE 2—*Performance of Klamath Russet (KR), Russet Burbank (RB), and Russet Norkotah (RN) in Western Regional Trials from 1994 to 1996.*

	Total Yield (T/ha)			Mkt. Yield (T/ha)			Specific Gravity		
Year	KR	RB	RN	KR	RB	RN	KR	RB	RN
				Early Harvest[1]					
1994	49.3	—	31.5	37.8	—	26.1	1.070	—	1.077
1995	43.6	—	37.8	34.2	—	29.3	1.072	—	1.071
1996	45.0	—	33.8	36.9	—	25.7	1.079	—	1.075
Overall Mean	46.0	—	34.4	36.3	—	27.1	1.074	—	1.074
				Late Harvest[2]					
1994	73.0	73.8	—	63.6	51.7	—	1.078	1.085	—
1995	64.7	50.6	—	58.4	35.8	—	1.077	1.083	—
1996	61.3	57.0	—	52.0	39.0	—	1.077	1.080	—
Overall Mean	66.3	60.5	—	58.0	42.2	—	1.077	1.083	—

[1]Locations: Kern County, CA, Kimberly, ID, Clovis, NM, Hermiston, OR, Springlake, TX, and Othello, WA..
[2]Locations: Tulelake, CA, Aberdeen, ID, Kimberly, ID, Farmington, NM, Hermiston, OR, Klamath Falls, OR, Ontario, OR, and Othello, WA.

yne chitwoodi). Foliar and tuber symptoms of bacterial ringrot are less clearly expressed by Klamath Russet than by Russet Burbank. Disease susceptibility evaluations presented in Table 3 are based on non-replicated field trials conducted over three years. Response to late blight (Table 4) was determined in a replicated field trial.

In Oregon statewide trials, hollow-heart plus brown-center incidence in tubers was 6.6% for Klamath Russet, 11.5% in Russet Burbank and 3.7% in Russet Norkotah (Table 5). Klamath Russet had less brown center than either standard cultivar, but more vascular discoloration. In Western Regional Trials, Klamath Russet experienced less hollow-heart and brown center than Russet Burbank (Table 6). Hollow-heart has usually been observed only in oversized Klamath Russet tubers (>400 g). Klamath Russet was similar to Russet Burbank in blackspot bruise and shatter bruise in Oregon (Table 5) and Western Regional Trials (Table 6). Growth cracks are seldom observed in Klamath Russet.

In two years of evaluation in Western Regional Trials at

TABLE 3—*Average disease reactions for Klamath Russet, Russet Burbank, and Russet Norkotah in Western Regional Trials from 1994 to 1996.*

Disease	Klamath Russet	Russet Burbank	Russet Norkotah
Vert. Wilt	MR - R[1]	S - MS	VS
Early blight (foliar)	MS	S - MS	VS
Late blight (foliar)	S	MS - S	VS
Late blight (tubers)	MS - S	MS - R	S
PLRV	VS	S	S
Net necrosis	S	S	MR
PVY (foliar symptoms)[2]	C	C	P
Erwinia soft rot	MS - S	MR - S	S
Fusarium dry rot	S	S	S
Common scab	R - VR	R	R

[1]S - susceptible; R - resistant; M - moderately; V- very.
[2]C - symptoms expressed clearly; P - symptoms expressed poorly.

Aberdeen, Idaho, Klamath Russet averaged 2.0 mg/100 g fresh weight of total glycoalkaloids while Russet Burbank averaged 6.6 mg/100 g fresh weight (Table 7). Vitamin C content averaged 18.2 and 17.2 mg/100 g fresh weight for Klamath Russet and Russet Burbank, respectively. Dextrose and sucrose content were higher in Klamath Russet than in Russet Burbank by 205% and 142%, respectively.

USAGE

Klamath Russet will be used primarily for the fresh market. Preliminary culinary evaluations failed to detect after-cooking darkening, sloughing, or off-flavors in Klamath Russet. An attractive appearance, high yields of marketable tubers, and good long-term storability favor acceptance of Klamath Russet. With maturity similar to Russet Burbank, Klamath Russet requires a 120-day growing season to achieve optimum yield and quality. Plant populations should be 25% to 30% higher than for Russet Burbank to avoid excessive size and hollow-heart in large tubers. Reduced nitrogen fertilizer rates are recommended to limit vine growth and hasten maturity. Seed conditioning to promote early emergence may be beneficial, as Klamath Russet requires several more days from planting to emergence than Russet Burbank under similar seed management. Limited seed is available from commercial seed growers and the Oregon Foundation Potato Seed program. Application for plant variety protection has been submitted for Klamath Russet by the Oregon Agricultural Experiment Station.

TABLE 4—*Response to late blight at Corvallis, Oregon, in 1998 for Klamath Russet and standard cultivars.*

Variety	Foliar Rating[1]	% Tuber Infection[2]	Decay Index[3]
Klamath Russet	61.2	42.5	4.5
Russet Burbank	71.2	22.5	6.0
Russet Norkotah	92.5	12.5	2.0
LSD (0.05)[4]	17.8	18.8	4.2

[1]Foliar injury rating: 0 = 0%; 50 = 50%; 100 = 100% of leaf surface necrotic.
[2]Percentage of tubers with late blight infection at harvest.
[3]Tuber decay severity rating: 0 = no infection; 10 = uncontrollable decay.
[4]LSD's based on a trial including 40 cultivars and experimental lines.

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LITERATURE CITED

Johansen, R.H., B. Farnsworth, D.C. Nelson, G.A. Secor, N. Gudmestad, and P.H. Orr. 1988. Russet Norkotah: A new russet-skinned potato cultivar with wide adaptation. Am Potato J 65:597-604.

TABLE 5—*Physiological defects in Klamath Russet, Russet Burbank, and Russet Norkotah in 38 Oregon statewide trials, 1990-99.*

	Internal Defects[1]				External Defects[2]	
Variety	HH/BC	IBS	BS	VD	GC	SB
	%				rating scale[3]	
Klamath Russet	6.6	0.2	4.5	7.6	4.6	4.5
Russet Burbank	11.5	3.0	5.0	3.0	4.0	4.3
Russet Norkotah	3.7	0.3	4.7	2.9	4.9	4.7

[1]HH/BC = hollow heart + brown center; IBS = internal brown spot; BS = blackspot bruise; VD = vascular discoloration.
[2]GC = growth cracks; SB = shatter bruise.
[3]Scale: 1 = severe; 5 = none.

TABLE 6—*Physiological defects in Klamath Russet and Russet Burbank in Western Regional Trials, 1994-96.*[1]

Entry	Year	Internal Defects[2]			External Defects[3]		
		HH & BC	IBS	BS	K	GC	SB
		%		Scale[4]	Scale[5]		
Klamath R.	1994	3.0	0.0	1.9	4.8	4.8	4.5
	1995	4.0	0.3	3.8	4.7	4.8	4.4
	1996	6.0	0.7	3.8	5.0	4.6	4.5
	Avg.	4.3	0.3	3.2	4.8	4.7	4.5
R. Burbank	1994	7.0	4.0	2.5	3.5	3.9	4.6
	1995	7.0	1.3	3.6	4.1	4.6	4.3
	1996	16.0	2.1	3.8	3.4	3.7	4.7
	Avg.	10.0	2.5	3.3	3.7	4.1	4.5

[1]Locations: California, Colorado, Idaho, New Mexico, Oregon, Texas, Washington.
[2]HH = hollow heart; BC = brown center; IBS = internal brown spot; BS = blackspot bruise.
[3]K = knobbiness; GC = growth cracks; SB = shatter bruise.
[4]Scale: 1 = poor, 5 = best.
[5]Scale: 1 = severe, 5 = none.

TABLE 7—*Relative tuber composition of Klamath Russet and Russet Burbank in Western Regional Trials at Aberdeen, ID, in 1995-1996.*

Entry	% Oven	% Fresh Wt. Basis			Mg/100g Fresh Wt. Basis	
	Dried Solids	Dextrose	Sucrose	Protein	Vitamin C	Total Glycoalkoids
Klamath Russet	20.9	0.20	0.24	4.7	18.2	2.0
Russet Burbank	21.2	0.10	0.17	4.7	17.2	6.6