

MODOC (NDO4300-1R)

K. Rykbost, B. Charlton, A. Mosley, S. James, D. Hane and C. Shock



The Oregon, North Dakota, California, Idaho, and Washington Agricultural Experiment Stations will soon announce the release of MODOC, an early maturing, round to oval, red-skinned clone suitable for fresh market use.

MODOC tested as NDO4300-1R, was selected in 1991 at Klamath Falls, Oregon from a cross between 1196-2R and 2225-1R performed by Dr. Robert Johansen of North Dakota State University, at Fargo, North Dakota in 1989 (Figure 1). Early selection and evaluations were done at Klamath Falls, Oregon and Tulelake and Bakersfield, California from 1991-1993. MODOC was included in replicated yield trials conducted at Klamath Falls and Corvallis, Oregon in 1995 through 1997 and at Tulelake and Bakersfield, California in 1997. MODOC was more widely evaluated in Western Regional red-skinned trials in seven states in 1998, 1999, and 2000. Initially, seed was multiplied at the Klamath Experiment Station, with subsequent seed increases at the Central Oregon Agricultural Research and Extension Center. The Oregon Foundation Potato Seed Program at Corvallis distributed pre-nuclear planting stock for limited-generation seed increase in 2002.

MODOC produces total yields slightly lower than those of Dark Red Norland and Red LaSoda but with a more desirable size profile, with higher yields of small, high-value tubers,

and fewer culls (Tables 1,4,5). MODOC tubers are round to oval, seldom exhibit growth cracks or irregular shape common to Dark Red Norland and Red LaSoda, produce uniform bright skin color that does not fade in storage, and have shallow eye depth compared to Red LaSoda.

MODOC tubers have specific gravity (total solids/starch) similar to Dark Red Norland and Red LaSoda (Tables 1,3,4,5). Internal defects, including hollow heart and brown center, and external growth cracks occur less frequently in MODOC than in Dark Red Norland or Red LaSoda (Table 2). Protein and sugar content of MODOC at Aberdeen, Idaho were slightly less than in Dark Red Norland and Red LaSoda, while vitamin C and glycoalkaloid content were slightly higher (Table 3). Preliminary culinary evaluations at Klamath Falls and Washington State University failed to detect after-cooking darkening, off-flavor, or sloughing problems in MODOC.

MODOC vines mature slightly earlier than Red LaSoda (Table 2). Vines are sensitive to metribuzin injury. MODOC is susceptible to most fungal diseases but has not experienced more storage diseases than other selections at the Central Oregon Research and Extension Center. Experience with seed increases indicate MODOC is not particularly susceptible to virus diseases and expresses readily discernible foliar

symptoms to PVY. It is susceptible to late blight foliar and tuber infection.

Limited quantities of in vitro and greenhouse limited-generation stocks of Modoc can be ordered from the Foundation Potato Seed Program at Oregon State University.

Origin and Breeding History of Modoc

Modoc was selected at Klamath Falls, Oregon in 1991 from a cross between 1196-2R and 2225-1R performed in 1989 by Dr. Robert Johansen, North Dakota State University, Fargo, North Dakota. Modoc was evaluated in preliminary tests as NDO4300-1R at Klamath Falls and Corvallis, Oregon and Tulelake and Bakersfield, California from 1995 to 1997. Formal evaluation of NDO4300-1R in Western Regional red-skinned variety trials occurred at eight locations in California, Oregon, Idaho, Washington, Colorado, and Texas in 1998, 1999, and 2000. Modoc was named and released by Oregon in 2003 in cooperation with North Dakota, California, Idaho, and Washington.

Modoc Morphological Characteristics

Modoc can be distinguished by its distinctive morphology and quality characteristics. Modoc vines are medium to small size, semi-erect, with intermediate foliage, slightly earlier maturing than Red LaSoda. Modoc stems contain weak to medium anthocyanin pigmentation compared to absent to weak coloration in Red LaSoda and Dark Red Norland. Leaves are medium green, slightly darker than Red LaSoda and lighter than Dark Red Norland, with thick, short pubescence, medium silhouette, medium anthocyanin in petioles, and small stipules. Modoc terminal leaflets are medium ovate with acuminate tips, cordate bases, and medium margin waviness. Modoc produces 6 to 7 medium, medium ovate primary leaflet pairs, with acuminate tips and cordate bases. Secondary and tertiary leaflet pairs range from 7 to 11 with an average of 9

compared to 8 for Red LaSoda and 10 for Dark Red Norland.

Modoc flowers are predominantly purple-violet with dark purple-violet inner corolla compared with lighter purple-violet for Red LaSoda and light purple-violet for Dark Red Norland. Modoc produces more inflorescences per plant than Red LaSoda or Dark Red Norland, with fewer florets per inflorescence (13) than Red LaSoda (18) or Dark Red Norland (20). Modoc corolla shape is pentagonal. Calyx anthocyanin coloration is strong in Modoc, medium in Red LaSoda, and weak in Dark Red Norland. Modoc anthers are yellow-orange, the same as Red LaSoda, but lighter in color than Dark Red Norland. Anthers of Modoc and Dark Red Norland are broad cone-shaped, while Red LaSoda anthers are pear-shaped cones. Pollen production for Modoc is intermediate between Red LaSoda and Dark Red Norland. Stigma shape is capitate and color is olive green for all three varieties. Berry production was not observed for any of the three varieties under field conditions.

Modoc tubers are purplish-red, compared to pink for Red LaSoda and red for Dark Red Norland. Modoc tubers retain darker color in storage with less fading than either Red LaSoda or Dark Red Norland. Modoc tubers are round to oval, with more uniform size and shape than Red LaSoda and Dark Red Norland. Modoc tubers are slightly lower in length/width ratio and length/thickness ratio than Red LaSoda and Dark Red Norland tubers. Eye depth is shallow in Modoc compared to very deep for Red LaSoda and deep for Dark Red Norland. Average eye numbers are 7 for Modoc, 13 for Red LaSoda, and 14 for Dark Red Norland with eyes predominantly at the apical end in Modoc and evenly distributed in Red LaSoda and Dark Red Norland. Modoc eyebrows are not prominent, while Dark Red Norland has slightly prominent and Red LaSoda medium prominent eyebrows. All three varieties have white flesh. Tuber numbers per plant are similar, less than 8 for each variety.

Modoc tubers are slightly lower than Red LaSoda and Dark Red Norland in dry matter, sugar, and protein content and slightly higher in vitamin C and total glycoalkaloid content. Modoc tubers seldom exhibit hollow heart, brown center, growth cracks, or malformation. Modoc produces lower total yield than either Red LaSoda or Dark Red Norland, but is usually similar in marketable yield with a smaller size profile. Yield of Modoc cull tubers is usually about 50 percent of culls in Dark Red Norland and 30 percent of Red LaSoda cull yields.

Figure 1. Modoc Ancestry

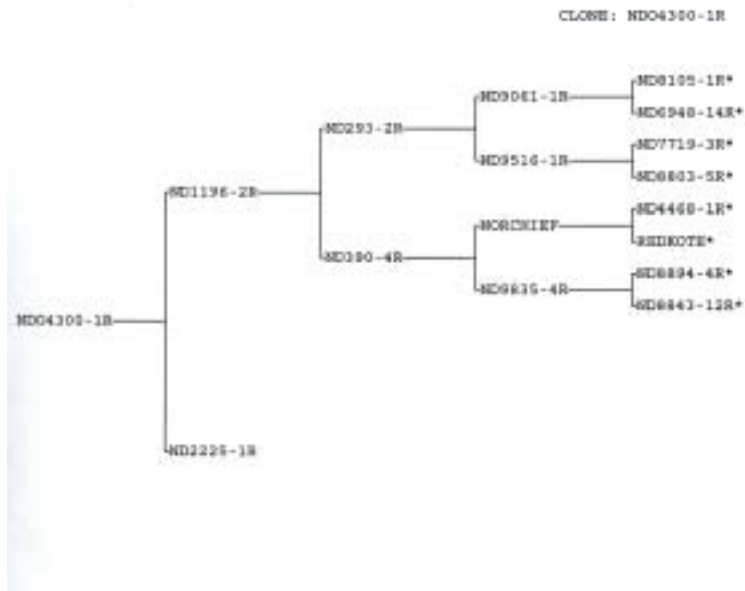


Table 1. Yield and quality characteristics of NDO4300-1R, Red LaSoda, and Dk. Red Norland in Western Regional Trials, 1998 - 2000¹.

Entry	Yield cwt/a						Culls	% Marketable ²	oz/ tuber	Spec. Grav.
	Total	<4 oz	US No. 1 4-10 oz	Total Marketable ²	US No. 1 >10 oz					
NDO4300-1R	386	66	235	301	61	24	78	4.3	1.067	
Red LaSoda	409	28	169	197	135	77	48	6.4	1.069	
Dk. Red Norland	439	43	230	273	126	40	62	5.6	1.068	
Mean	412	46	211	257	107	47	62	5.4	1.068	
CV (%)	5	9.1	7	7.1	12.3	9.3			0.120	
LSD (0.05)	NS	10	34	41	30	10			NS	

¹ Locations: California, Idaho, Oregon, Texas, Washington, Colorado² Yield < 4 oz. - ≤ 10 oz.**Table 2.** Physiological defects and Morphological characteristics of NDO4300-1R, Red LaSoda, and Dark Red Norland in Western Regional Trials, 1998 - 2000¹.

Entry	% HH & BC ²	Growth Cracks ³	Skinning ⁴	Vine Vigor ⁵	Vine Mat. ⁶	Tuber Shape ⁷	Skin Color ⁸	Eye Depth ⁹
NDO4300-1R	2	4.7	3.9	2.5	2.7	1.8	3.8	4.0
Red LaSoda	13	3.0	2.9	3.2	3.1	2.3	2.2	2.1
Dk. Red Norland	7	3.6	3.2	3.2	2.9	2.3	2.8	3.1

¹ Locations: California, Idaho, Oregon, Texas, Washington, Colorado² HH = Hollow Heart; BC = Brown Center³ Growth Cracks: 1 = Severe; 5 = None⁴ Skinning: 1 = Severe; 5 = None⁵ Vine Vigor: 1 = Weak; 5 = Strong⁶ Vine Maturity: 1 = Early; 5 = Late⁷ Tuber Shape: 1 = Round; 5 = Long, Narrow⁸ Skin Color: 1 = Pale; 5 = Dk. Red⁹ Eye Depth: 1 = Deep; 5 = Shallow

Table 3. Relative tuber composition of NDO4300-1R, Red LaSoda, and Dk. Red Norland at Aberdeen, ID¹.

Entry	% Oven Dried Solids	% DWB			Mg/100g FWB	
		Dextrose	Sucrose	Protein	Vitamin C	Total Glycoalkaloids
NDO4300-1R	18.9	0.04	0.20	5.1	31.2	4.5
Red LaSoda	17.7	0.14	0.23	6.2	29.5	3.5
Dk. Red Norland	18.8	0.06	0.27	5.5	28.8	3.5

¹ 1998 - 2000 courtesy Dr. Steve Love, University of Idaho

Table 4. Yield and quality characteristics of NDO4300-1R, Red LaSoda, and Dk. Red Norland in Oregon and California Trials 1995 - 2000¹.

Entry	Location	Years	Yield cwt/a					Culls	% Marketable ²	Spec. Grav.
			Total	<4 oz	US No. 1 4-10 oz	Total Marketable ²	US No. 1 >10 oz			
NDO4300-1R	Corvallis	6	463	64	271	335	81	48	72	1.068
	Klamath Falls	6	501	88	295	383	96	22	59	1.063
	Bakersfield	4	360	21	251	272	62	26	76	1.074
	Tulelake	4	415	30	306	336	62	17	81	1.068
	AVG.		435	51	281	332	75	28	72	1.068
Red LaSoda	Corvallis	6	503	32	201	233	154	115	46	1.075
	Klamath Falls	6	534	35	190	225	212	97	42	1.069
	Bakersfield	3	463	11	260	271	127	65	59	1.077
	Tulelake	3	473	14	176	190	163	121	40	1.065
	AVG.		493	23	207	230	164	100	47	1.072
Dk. Red Norland	Corvallis	6	513	43	251	294	113	105	57	1.074
	Klamath Falls	6	507	49	235	284	166	57	56	1.067
	Bakersfield	4	496	11	331	342	111	42	69	1.075
	Tulelake	4	449	22	257	279	119	51	62	1.066
	AVG.		491	31	269	300	127	64	61	1.071
Overall Mean			473	35	252	287	122	64	61	1.070
CV (%)			6	29	15	15	11	26		0.220
LSD (0.05)			50	18	NS	73	23	29		NS

¹ Locations: Corvallis and Klamath Falls (Oregon); Bakersfield and Tulelake (California).

² Yield < 4 oz. - ≤ 10 oz.

Table 5. Modoc Tri-State yields and performance, 1998-2000.

	Total Yield	Marketable ¹			Total	%	Yield		Specific Gravity
		>4oz	4-6oz	6-10oz			>10oz	Culls	
	cwt/A	-----cwt/A-----				%	---cwt/A---		
Idaho ²									
NDO4300-1	365	110	120	110	344	94	22	4	1.070
Red LaSoda	315	22	30	87	216	64	153	23	1.066
Dk Red Norland	430	52	60	157	338	77	151	11	1.069
Oregon ³									
NDO4300-1	461	59	94	166	352	75	93	50	1.066
Red LaSoda	496	31	44	125	271	54	154	126	1.070
Dk Red Norland	515	31	59	174	308	60	177	90	1.069
Washington ⁴									
NDO4300-1	363	92	96	105	300	86	53	17	1.073
Red LaSoda	361	42	61	95	228	65	100	63	1.071
Dk Red Norland	386	57	66	108	256	69	109	46	1.074

¹ U.S. No. 1 tubers >4oz. and <10oz.

² 3 Trials grown in Idaho, 1998-2000, at Aberdeen and Kimberly.

³ 6 Trials grown in Oregon, 1998-2000, at Corvallis and Klamath Falls.

⁴ 3 Trials grown in Washington, 1998-2000, at Granger and Pasco.