No. 200600175

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

STATE of OREGON, acting by and through the State Board of Higher Education on behalf of OREGON STATE UNIVERSITY, representing the interests of Washington State University, the University of Idaho, and the United States of America, as represented by the Secretary of Agriculture. Oregon State University is a partner in the Northwest (Tri-State) Potato Variety Development Program and a signatory of the General Agreement on Policy and Procedure for Release of New Publicly Developed Plant Varieties in Idaho, Oregon and Washington, between Washington State University, Oregon State University, University of Idaho and the U.S. Department of Agriculture, Agricultural Research Service. In accordance with provision 2.2 of this Agreement, Oregon State University is applying for this PVPC.

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

An application requesting a certificate of protection for an alleged distinct variety of sexually reproduced, or tuber propagated plant, the name and description of which are contained in the application and exhibits, a copy of which is hereunto annexed and made a part hereof, and the various requirements of LAW in such cases made and provided have been complied with, and the title thereto is, from the records of the PLANT VARIETY PROTECTION OFFICE, in the applicant(s) indicated in the said copy, and Whereas, upon due examination made, the said applicant(s) is (are) adjudged to be entitled to a certificate of plant variety protection under the LAW.

Now, therefore, this certificate of plant variety protection is to grant unto the said applicant(s) and the successors, heirs or assigns of the said applicant(s) for the term of TWENTY years from the date of this grant, subject to the payment of the required fees and periodic replenishment of viable basic seed of the variety in a public repository as provided by LAW, the right to exclude others from selling the variety, or offering it for sale, or reproducing it, or importing it, or exporting it, or conditioning it for propagation, or stocking it for any of the above purposes, or using it in producing a hybrid or different variety therefrom, to the extent provided by the PLANT VARIETY PROTECTION ACT. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

POTATO

'Modoc'

In Testimony Whereof, *I have hereunto set my hand and caused the seal of the* Plant Variety Protection Office *to be affixed at the* ***City of Washington, D.C.*** *this twentieth day of February, in the year* ***two thousand and thirteen.***

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions*

Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER (RAD 1/14/2011)

STATE of OREGON, acting by and through the State Board of Higher Education on behalf of OREGON STATE UNIVERSITY, representing the interests of Washington State University, the University of Idaho, and the United States of America, as represented by the Secretary of Agriculture. (continued Exhibit E)

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME

NDO4300-1R

3. VARIETY NAME

MODOC
Modoc
RAD 7/29/10

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*

Office of Technology Transfer
Oregon State University
312 Kerr Administration Building
Corvallis, OR 97331

5. TELEPHONE *(include area code)*

(541) 737-0674

6. FAX *(include area code)*

(541) 737-3093

FOR OFFICIAL USE ONLY

PVPO NUMBER

200600175

FILING DATE

04/11/2006

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*

Nonprofit Public Education Institution

8. IF INCORPORATED, GIVE STATE OF INCORPORATION

9. DATE OF INCORPORATION

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*

Office of Technology Transfer
c/o Sarah Mabee
Oregon State University
A312 Kerr Administration Bldg
Corvallis, OR 97331-2140

RAD 10/17/10

FEES RECEIVED

FILING AND EXAMINATION FEES:
$ 4382.00
DATE 04/11/2006

CERTIFICATION FEE:
$
DATE

11. TELEPHONE *(Include area code)*

541-737-8100

12. FAX *(Include area code)*

541-737-3093

13. E-MAIL

Sarah.Mabee@oregonstat.edu
RAD 10/17/10

14. CROP KIND *(Common Name)*

Potato

16. FAMILY NAME *(Botanical)*

Solanaceae

15. GENUS AND SPECIES NAME OF CROP

Solanum tuberosum, L.

17. IS THE VARIETY A FIRST GENERATION HYBRID?

☐ YES ☐ NO

18. DOES THE VARIETY CONTAIN ANY TRANSGENES? (***OPTIONAL***)

☐ YES ☑ NO

IF SO, PLEASE GIVE THE ASSIGNED USDA-APHIS REFERENCE NUMBER FOR THE APPROVED PETITION TO DEREGULATE THE GENETICALLY MODIFIED PLANT FOR COMMERICALIZATION. _____

19. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED
(Follow instructions on reverse)

a. ☑ Exhibit A. Origin and Breeding History of the Variety
b. ☑ Exhibit B. Statement of Distinctness
c. ☑ Exhibit C. Objective Description of Variety
d. ☑ Exhibit D. Additional Description of the Variety *(Optional)*
e. ☑ Exhibit E. Statement of the Basis of the Owner's Ownership
f. ☑ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
g. ☑ Filing and Examination Fee ($3,652), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)*

☐ YES *(If "yes", answer items 21 and 22 below)* ☑ NO *(If "no", go to item 23)*

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES?

☐ YES ☐ NO

IF YES, WHICH CLASSES? ☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

22. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?

☐ YES ☐ NO

IF YES, SPECIFY THE NUMBER 1,2,3, etc. FOR EACH CLASS.

☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

(If additional explanation is necessary, please use the space indicated on the reverse.)

23. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?

RAD 7/29/10

☑ YES ☑ NO 2/15/2006

IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

24. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?

☐ YES ☑ NO

IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

25. The owners declare that a viable sample of basic seed of the variety has been furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER		SIGNATURE OF OWNER	
Craig Sheward 6/8/05			
NAME *(Please print or type)*		NAME *(Please print or type)*	
Craig Sheward			
CAPACITY OR TITLE	DATE	CAPACITY OR TITLE	DATE
Dir. of Technology Transfer		Dir. of Technology Transfer	

(See reverse for instructions and information collection burden statement)

ST-470 (04-03) designed by the Plant Variety Protection Office using Word 2002.

/

#200600175

GENERAL INSTRUCTIONS: To be effectively filed with the Plant Variety Protection Office (PVPO), **ALL** of the following items must be **received** in the PVPO: (1) Completed application form signed by the owner; (2) completed exhibits A, B, C, E, F; (3) for a tuber reproduced variety, verification that a viable *(in the sense that it will reproduce an entire plant)* tissue culture will be deposited and maintained in an approved public repository; and (4) payment by credit card or check drawn on a U.S. bank for $4,382 ($518 filing fee and $3,864 examination fee), payable to "Treasurer of the United States" *(See Section 97.6 of the Regulations and Rules of Practice).* **NEW:** With the application for a seed reproduced variety **or by direct deposit soon after filing**, the applicant must provide at least 3,000 viable untreated seeds of the variety *per se*, and for a hybrid variety at least 3,000 untreated seeds of each line necessary to **reproduce** the variety. Partial applications will be held in the PVPO for not more than 90 days; then returned to the applicant as un-filed. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 401, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. **DO NOT** use masking materials to make corrections. If a certificate is allowed, you will be requested to send a payment by credit card or check payable to "Treasurer of the United States" in the amount of $768 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. The fees for filing a change of address; owner's representative; ownership or assignment; or any modification of owner's name is specified in Section 97.175 of the regulations. *(See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of the Regulations and Rules of Practice.)*

Plant Variety Protection Office
Telephone: (301) 504-5518 **FAX:** (301) 504-5291
General E-mail: PVPOmail@usda.gov
Homepage: http://www.ams.usda.gov/science/pvpo/PVPindex.htm

SPECIFIC INSTRUCTIONS:
To avoid conflict with other variety names in use, the applicant must check the appropriate recognized authority and **provide evidence** that the permanent name of the application variety (even if it is a parental, inbred line) has been cleared by the appropriate recognized authority before the Certificate of Protection is issued. For example, for agricultural and vegetable crops, contact: U.S. Department of Agriculture, Agricultural Marketing Service, Livestock and Seed Programs, **Seed Regulatory and Testing Branch**, 801 Summit Crossing Place, Suite C, Gastonia, North Carolina 28054-2193 Telephone: (704) 810-8870. http://www.ams.usda.gov/lsg/seed.htm.

ITEM

19a. Give:
(1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;
(2) the details of subsequent stages of selection and multiplication;
(3) evidence of uniformity and stability; and
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified

19b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:

(1) identify these varieties and state all differences objectively;
(2) attach replicated statistical data for characters expressed numerically and demonstrate that these are clear differences; and
(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.

19c. Exhibit C forms are available from the PVPO Office for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.

19d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, *etc.*

19e. Section 52(5) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.

20. If "Yes" is specified *(seed of this variety be sold by variety name only, as a class of certified seed)*, the applicant **MAY NOT** reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. *(See Regulations and Rules of Practice, Section 97.103).*

23. *See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.*

24. *See Section 55 of the Act for instructions on claiming the benefit of an earlier filing date.*

22. CONTINUED FROM FRONT *(Please provide a statement as to the limitation and sequence of generations that may be certified.)*

23. CONTINUED FROM FRONT *(Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.)*

Update 6-21-07: The first license for commercial use of this variety was issued September 16, 2005.

24. CONTINUED FROM FRONT *(Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).)*

Exhibit A: Origin and Breeding History of the Variety

Modoc was initially selected as a red-skinned, white-fleshed cultivar by Oregon State University Agriculture Experiment Station scientists at the Klamath Experiment Station, Klamath Falls, Oregon, in 1991 from a cross between ND1196-2R and ND2225-1R performed in 1989 by Dr. Robert Johansen of North Dakota State University, Fargo, North Dakota.

Modoc was evaluated as NDO4300-1R in preliminary tests at Klamath Falls, Oregon, and Tulelake and Bakersfield, California, from 1991 through 1993. It 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 trials conducted at eight locations in California, Oregon, Idaho, Washington, Colorado, and Texas in 1998 through 2000. The Oregon State University Potato Variety Development Program, led by Dr. Alvin R. Mosley, and Oregon State University sponsored NDO4300-1R in all trials and supplied all seed. Modoc was released on March 25, 2003, by Oregon State University, in cooperation with the Agricultural Experiment Stations of North Dakota, California, Idaho, and Washington. The first license for commercial sale was issued September 16, 2005.

Breeding History:
Modoc was selected from a cross between ND1196-2R (female parent) and ND2225-1R (male parent); the attached pedigree chart shows the parental lineage for three preceding generations.

Breeding Method:
A traditional breeding process was used. Male and female parents were crossed to produce berries with seeds. Seedlings were grown in a greenhouse, and greenhouse-produced tubers were field-planted. Modoc was line-selected from these plantings using the criteria mentioned below.

Selection Criteria:
Modoc was selected for its bright skin color, retention of skin color in storage, higher marketable yield, and more desirable tuber size and shape for fresh market use. It is suited for marketing direct from the field or from storage.

Difference from Original Material:
Modoc is superior to its parents and siblings in yields with a more desirable size profile and shape, shallow eye depth, and a uniform bright skin color that does not fade significantly in storage.

Uniformity and Stability:
Modoc was observed annually from 1991 to 1993 in three locations for three generations in Oregon and California, in two locations for three generations in Oregon from 1995 to 1997, in two locations for one generation in California in 1997, and in Western Regional trials in seven states for three generations in 1998 to 2000, and was determined to be genetically uniform and stable ~~from generation to~~ generation with no apparent evidence of variants.

Most potato varieties eventually produce mutant plants known as "giant hills," "bolters," or "bull plants." It is expected that these plants may eventually be found in Modoc at a very low frequency.

for six

RAD 7/29/10

Variety Name:
As a permanent potato variety name, Modoc is unique to this variety as shown in The Potato Association of America "North American Potato Variety Inventory" (http://www.umaine.edu/PAA/PVI.htm).

Modoc (NDO4300-1R) Pedigree

The female parent is listed above the male parent.

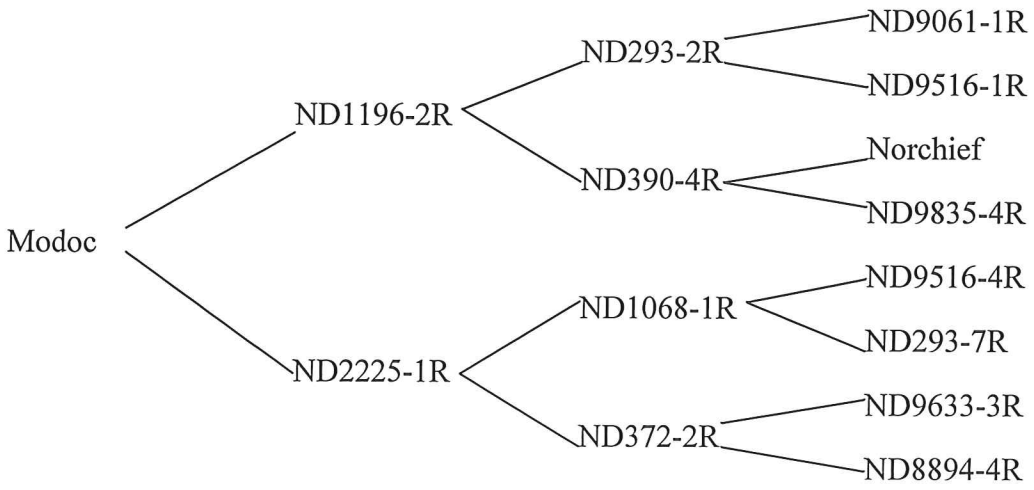


Exhibit B: Statement of Distinctness

Modoc is most similar to the potato varieties Red LaSoda and Dark Red Norland.

Red LaSoda and Dark Red Norland are commonly used as reference varieties in northwest potato variety development programs, against which potential new red-skinned varieties are compared. While Modoc has characters in common with both, it has a number of distinctive characters which are stated below.

1) Modoc produces significantly smaller tubers than either Red LaSoda or Dark Red Norland (6.1 oz./tuber vs. 7.6 and 6.9, respectively).
(See Document B-1.)

2) Modoc produces higher yields of 6-10 ounce tubers than Red LaSoda.
(See Document B-1.)

3) Modoc shows less greening than Red LaSoda.
(See Document B-1.)

4) Modoc has fewer eyes per tuber than either Red LaSoda or Dark Red Norland.
(See Document B-2.)

5) Modoc tuber eye depth is shallow, whereas Red LaSoda eye depth is very deep, and Dark Red Norland eye depth is deep.
(See Document B-3.)

6) Modoc eyes are predominantly apical, whereas both Red LaSoda and Dark Red Norland eyes are mostly evenly distributed.
(See Document B-3.)

7) Modoc tubers appear brighter red after storage than either Red LaSoda or Dark Red Norland.
(See Document B-4.)

8) Modoc calyx anthocyanin coloration is strong, whereas it is medium in Red LaSoda and weak in Dark Red Norland.
(See Document B-5)

Modoc Flower

- Calyx anthocyanin coloration is strong.

Red LaSoda Flower

- Calyx anthocyanin coloration is medium.

Dark Red Norland Flower

- Calyx anthocyanin coloration is weak.

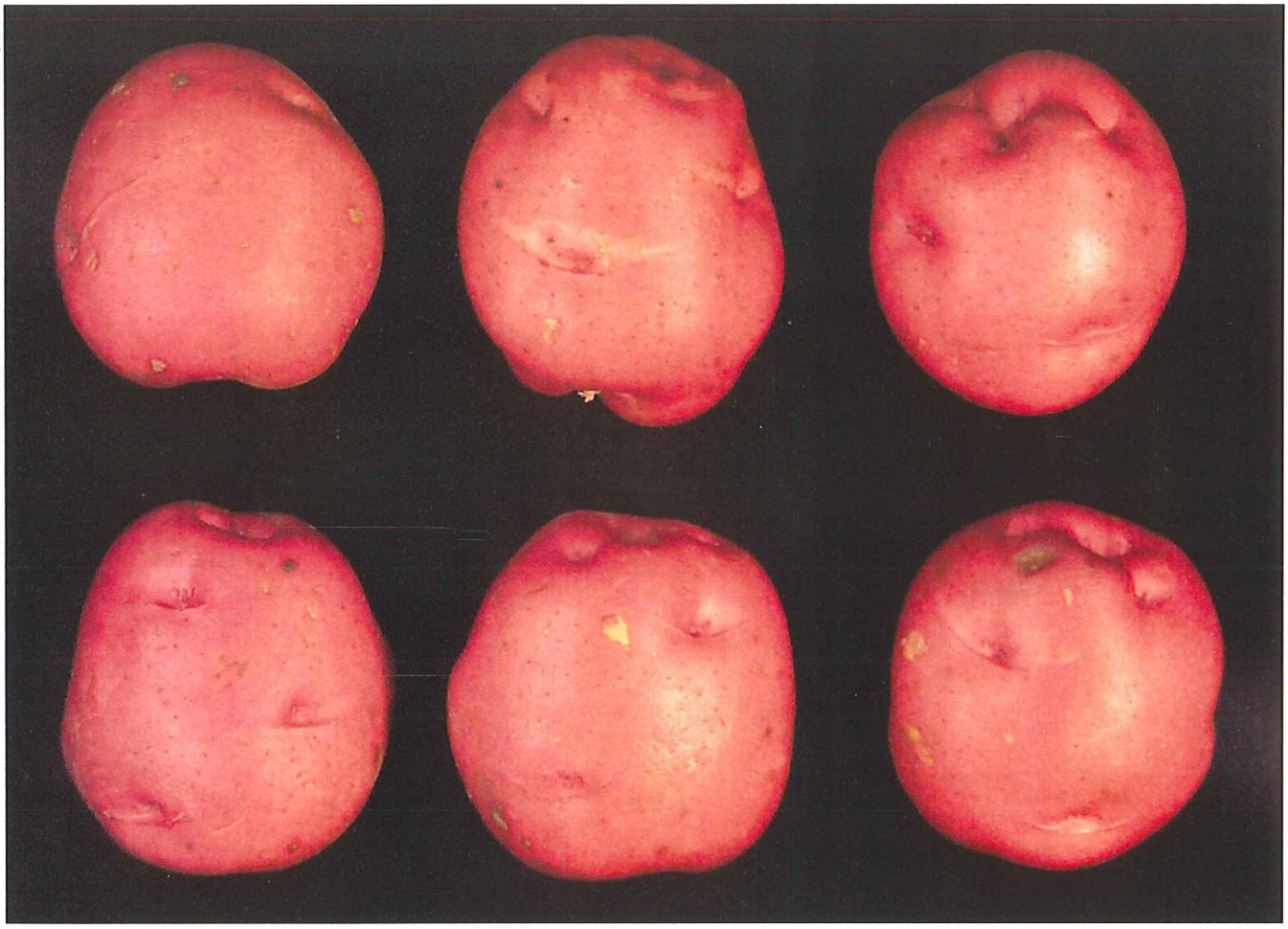
Exhibit B, Document B-3

Modoc Tubers

- Tuber eye depth is shallow.
- Eyes are predominantly apical.

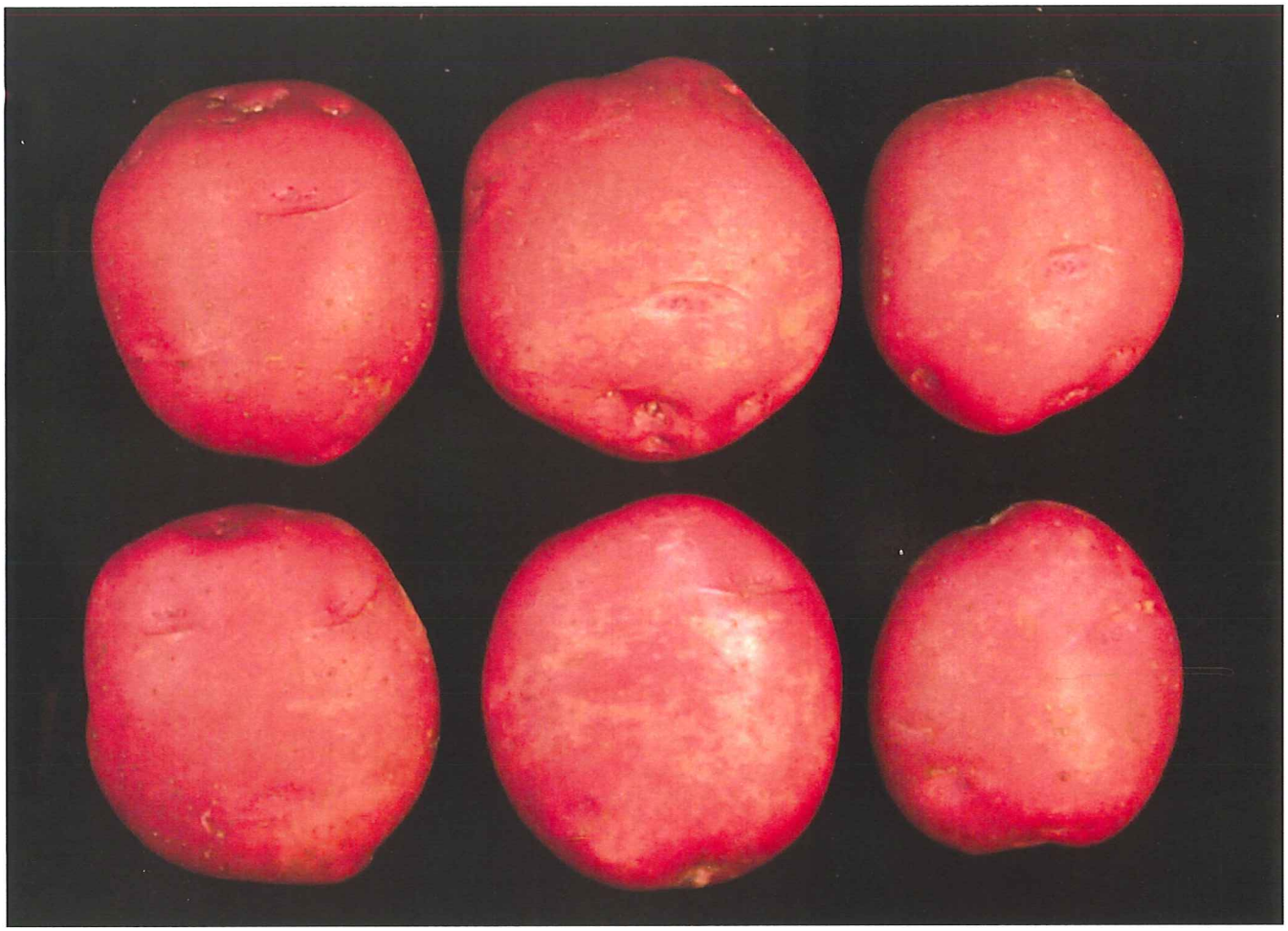
Red LaSoda Tubers

- Tuber eye depth is very deep.
- Eyes are mostly evenly distributed.



Dark Red NorlandTubers

- Tuber eye depth is deep.
- Eyes are mostly evenly distributed.



#200600175

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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

Exhibit C

OBJECTIVE DESCRIPTION OF VARIETY
Potato (*Solanum tuberosum* L.)

INSTRUCTIONS

The Objective Description Form:
The objective description form lists characteristics to be used as the basis for developing the description of potato varieties. It is designed to guide the applicant in describing a variety in detail so a meaningful comparison with other potato varieties can be accomplished. It is recommended that this form be completed in as much detail as possible to ensure an accurate description. Please fill in the requested data and place the appropriate number that describes the varietal characters typical of this potato variety and the reference varieties in the respective boxes.

Test Guidelines:
Any statistical and trial (field test) data that may be necessary to support the variety description should be attached to this form. Please include for trial data the plot size, number of replications, number of plants, plant spacing, trial locations and growing periods. Trials should normally be conducted at one place, in the region that the variety has been adapted for, with a minimum of one growing period in the United States. All comparative data should be determined from varieties entered in the same trials. The size of the plots should be such that plants or parts of plants may be removed for measuring and counting without prejudice to the observations which must be made at the end of the growing period. As a minimum, each test should include a total of 60 plants which should be divided between two or more replicates. Separate plots for observation and measuring can only be used if they have been subject to similar environmental conditions. To determine color for a plant or plant parts a recognized standard color chart must be used such as the Royal Horticultural Society (RHS) Color Chart or Munsell Color Chart (MCC).

Reference Varieties:
The application variety should be compared to at least one reference variety preferably a set of reference varieties. The reference varieties should be market class standard varieties currently grown in the United States and or the variety (ies) most similar. The following varieties are recommended as market class standards to be used as reference varieties:

Yellow-flesh table-stock	Yukon Gold
Round-white table-stock	Superior
Chip-processing	Atlantic, Snowden, Norchip
Frozen-processing	Russet Burbank
Russet table-stock	Russet Burbank, Russet Norkotah, Goldrush
Red table-stock	Red Pontiac, Red Norland, Red Lasoda

If the applicant does not use one of the recommended reference varieties by the PVP office, a complete description of the reference variety should be submitted by the applicant (Exhibit C).

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Characteristics:
Light sprout characteristics are supplied in **Figure 1**. The plant type and growth habit characteristics are collected at early first bloom. **Figure 2** is supplied to help visualize the growth habit. For this descriptor, look at the stems rather than the stems and foliage. Plant maturity is measured at natural vine senescence.

Stem characteristics are also collected at early bloom. Stem anthocyanin coloration is divided into two descriptors: Location and intensity. **Figure 3** is supplied to give an example of stem wings.

Leaf characteristics are observed at early first bloom. Fully-developed leaves located on the middle third of the plant should be used. Leaf pubescence refers to general trichomes. **Figure 4** is supplied for examples of leaf silhouette. Leaf stipules are shown in **Figure 5** for visual definition. **Figure 6** is supplied to define leaf characteristics. **Figure 7** should be used to describe terminal and primary leaflet shape. **Figures 8 and 9** are used to describe the terminal and primary leaflet shape of tip and base, respectively. To measure the total number of primary leaflets pairs, collect 10 fully developed petioles (with leaves attached from each replication) and take the average number of secondary and tertiary leaflets. Glandular trichomes should be described in the Additional Comments and Characteristics (Descriptor 15).

Inflorescence characteristics should be measured at early first bloom. **Figures 10, 11 and 12** are supplied to describe anther and stigma shape, respectively. Corolla, calyx, anther, stigma, and pollen should be observed on newly opened flowers. Berry production should be based on field-grown plants rather than greenhouse plants.

Tuber characteristics should be observed following harvest**. Figures 13 and 14** are available to describe distribution of secondary color and tuber shape, respectively.

Disease and pest reactions should be based upon specific tests or statistical analysis rather than just field observations, rating 1 as Highly Resistance and 9 as Highly Susceptible, please follow the scale on each descriptor. Other diseases or pests reactions not requested can be described if it is felt that it would be helpful to determine novelty of the variety.

Quality characteristics should be described according to the market use.

If the plant is transgenic, this gene insertion(s) should be described.

Chemical identification and any other characteristics can be described if they are helpful in distinguishing the variety.

Legend:

V = Application Variety

R1-R4 = Reference Varieties

* = Both the reference variety (ies) and application variety must be described for characteristics designated with an asterisk.

RHD 11/4/2011

STATE of OREGON, acting by and through the State Board of Higher Education on behalf of OREGON STATE UNIVERSITY, representing the interests of Washington State University, the University of Idaho, and the United States of America, as represented by the Secretary of Agriculture. (continued Exhibit E)	TEMPORARY OR EXPERIMENTAL DESIGNATION **NDO4300-1R**	VARIETY NAME **Modoc**

ADDRESS *(Street and No. or RD No., City, State, Zip Code, and Country)*

Office of Technology Transfer
Oregon State University
312 Kerr Administration Building
Corvallis, OR 97331

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PVPO NUMBER

#200600175

REFERENCE VARIETIES: Enter the reference variety name in the appropriate box.

Application Variety (V)	Reference Variety 1 (R1)	Reference Variety 2 (R2)	Reference Variety 3 (R3)	Reference Variety 4 (R4)
Modoc	Red LaSoda	Dark Red Norland		

PLEASE READ ALL INSTRUCTIONS CAREFULLY:

1. MARKET CHARACTERISTICS:

***MARKET CLASS:**
1 = Yellow-flesh Tablestock 2 = Round-white Tablestock 3 = Chip-processing 4 = Frozen-processing
5 = Russet Tablestock 6 = Other ROUND RED-SKIN WHITE-FLESH TABLESTOCK

V	R1	R2	R3	R4
6	6	6		

2. LIGHT SPROUT CHARACTERISTICS: (See Figure 1)

***LIGHT SPROUT: GENERAL SHAPE**
1 = Spherical 2 = Ovoid 3 = Conica 4 = Broad cylindrica 5 = Narrow cylindrical 6 = Other _____

V	R1	R2	R3	R4
2	2	4		

***LIGHT SPROUT BASE: PUBESCENCE OF TIP**
1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

V	R1	R2	R3	R4
5	4	3		

***LIGHT SPROUT BASE: ANTHOCYANIN COLORATION**
1 = Green 2 = Red-violet 3 = Blue-violet 4 = Other(describe) _____

V	R1	R2	R3	R4
3	2	2		

***LIGHT SPROUT BASE: INTENSITY OF ANTHOCYANIN COLORATION (IF PRESENT)**
1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

V	R1	R2	R3	R4
5	3	4		

***LIGHT SPROUT TIP: HABIT**
1 = Closed 2 = Intermediate 3 = Open

V	R1	R2	R3	R4
2	1	3		

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#200600175

2. **LIGHT SPROUT CHARACTERISTICS**: (continued)

LIGHT SPROUT TIP: PUBESCENCE
1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

V	R1	R2	R3	R4
2	3	3		

LIGHT SPROUT TIP ANTHOCYANIN COLORATION
1 = Green 2 = Red-violet 3 = Blue-violet 4 = Other(describe) _____

V	R1	R2	R3	R4
3	2	1		

LIGHT SPROUT TIP: INTENSITY OF ANTHOCANIN COLORATION (IF PRESENT)
1 = Absent 2 = Weak 3 = Medium 4 = Strong 5 = Very Strong

V	R1	R2	R3	R4
2	3	1		

LIGHT SPROUT ROOT INITIALS: FREQUENCY
1 = Absent 2 = Some 3 = Abundant

V	R1	R2	R3	R4
1	3	2		

3. **PLANT CHARACTERISTICS**:

GROWTH HABIT: (See Figure 2)
3 = Erect (>45° with ground) 5 = Semi-erect (30-45° with ground) 7 = Spreading

V	R1	R2	R3	R4
5	3	5		

TYPE:
1 = Stem (foliage open, stems clearly visible) 2 = Intermediate 3 = Leaf (Foliage closed, stems hardly visible)

V	R1	R2	R3	R4
2	2	2		

MATURITY: Days after planting (DAP) at vine senescence

V	R1	R2	R3	R4
100	115	110		

PLANTING DATE:

V	R1	R2	R3	R4
MAY 20	MAY 20	MAY 20		

***REGIONAL AREA**:
1 = Pacific North West (WA, OR, ID, CO, CA) 2 = North Central (ND, WI, MI, MN, OH) 3 = North East (ME, NY, PA, NJ, MD, MA, RI,)
4 = Mid-Atlantic Erect (VI, NC, SC, South NJ, FL) 5 = South (LA, TX, AZ, NE) 6 = Canada
7 = Europe 8 = England 9 = Latin America 10 = Brazil 11 = Other _____

V	R1	R2	R3	R4
1	1	1		

MATURITY CLASS:
1 = Very Early (<100 DAP) 2 = Early (100-110 DAP) 3 = Mid-season (111-120 DAP) 4 = Late (121-130 DAP) 5 = Very Late (>130 DAP).

V	R1	R2	R3	R4
2	3	2		

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4. STEM CHARACTERISTICS: Measure at early first bloom

*** STEM ANTHOCYANIN COLORATION:**
1 = Absent 3= Weak 5 = Medium 7 = Strong 9 = Very Strong

V	R1	R2	R3	R4
5	3	3		

STEM WINGS: (See Figure 3)
1 = Absent 3 = Weak 5 = Medium 7 = Strong 9 = Very Strong

V	R1	R2	R3	R4
5	3	3		

5. LEAF CHARACTERISTICS:

LEAF COLOR: (*Observe fully developed leaves located on middle 1/3 of plant)*
1 = Yellowing-green 2 = Olive-green 3 = Medium Green 4 = Dark Green 5 = Grey-green 6 = Other _____

V	R1	R2	R3	R4
3	3	3		

LEAF COLOR CHART VALUE: (Royal Horticulture Society Color Chart) or Munsell Color Chart
(*Observe fully developed leaves located on middle 1/3 of plant and circle the appropriate color chart)*

V	R1	R2	R3	R4
137A	137B	139A		

LEAF PUBESCENCE DENSITY:
1 = Absent 2 = Sparse 3 = Medium 4 = Thick 5 = Heavy

V	R1	R2	R3	R4
4	3	2		

LEAF PUBESCENCE LENGTH:
1 = None 2 = Short 3 = Medium 4 = Long 5 = Very Long

V	R1	R2	R3	R4
2	3	2		

(*Note Descriptor #15 can be used to describe the type and length of the glandular trichomes observed.)*

*** LEAF SILHOUETTE:** (See Figure 4)
1 = Closed 3 = Medium 5 = Open

V	R1	R2	R3	R4
3	5	5		

PETIOLES ANTHOCYANIN COLORATION:
1 = Absent 3 = Weak 5 = Medium 7 = Strong 9 = Very Strong

V	R1	R2	R3	R4
5	3	3		

LEAF STIPULES SIZE: (Se Figure 5)
1 = Absent 3 = Small 5 = Medium 7 = Large

V	R1	R2	R3	R4
3	5	5		

TERMINAL LEAFLET SHAPE (See Figures 6 and 7)
1 = Narrowly ovate 2 = Medium Ovate 3 = Broadly Ovate 4 = Lanceolate 5 = Elliptical 6 = Obovate 7 = Oblong 8 = Other _____

V	R1	R2	R3	R4
2	3	2		

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5. **LEAF CHARACTERISTICS**: (continued)

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TERMINAL LEAFLET TIP SHAPE: (See Figures 6 and 8)
1 = Acute 2 = Cuspidate 3 = Acuminate 4 = Obtuse 5 = Other _____

V	R1	R2	R3	R4
3	2	3		

* **TERMINAL LEAFLET BASE SHAPE**: (See Figure 9)
1 = Cuneate 2 = Acute 3 = Obtuse 4 = Cordate 5 = Truncate 6 = Lobed 7 = Other _____

V	R1	R2	R3	R4
4	4	4		

TERMINAL LEAFLET MARGIN WAVINESS:
1 = Absent 2 = Slight 3 = Weak 4 = Medium 5 = Strong

V	R1	R2	R3	R4
4	1	2		

NUMBER OF PRIMARY LEAFLET PAIRS: (See Figure 6)

AVERAGE:

V	R1	R2	R3	R4
6.3	5.8	6.0		

RANGE:

V	R1	R2	R3	R4
6 to 7	5 to 6	6 to 6	to	to

PRIMARY LEAFLET TIP SHAPE: (See Figures 6 and 8)
1 = Acute 2 = Cuspidate 3 = Acuminate 4 = Obtuse 5 = Other _____

V	R1	R2	R3	R4
3	2	2		

PRIMARY LEAFLET SIZE:
1 = Very Small 2 = Small 3 = Medium 4 = Large 5 = Very Large

V	R1	R2	R3	R4
3	4	4		

PRIMARY LEAFLET SHAPE: (See Figures 6 and 7)
1 = Narrowly ovate 2 = Medium ovate 3 = Broadly ovate 4 = Lanceolate 5 = Elliptical 6 = Ovate 7 = Oblong 8 = Other _____

V	R1	R2	R3	R4
2	2	2		

PRIMARY LEAFLET BASE SHAPE: (See Figures 6 and 9)
1 = Cuneate 2 = Acute 3 = Obtuse 4 = Cordate 5 = Truncate 6 = Lobed 7 = Other _____

V	R1	R2	R3	R4
4	4	4		

NUMBER OF SECONDARY AND TERTIARY LEAFLET PAIRS: (See Figure 6)

AVERAGE:

V	R1	R2	R3	R4
9.0	8.0	10.0		

RANGE:

V	R1	R2	R3	R4
7 to 11	7 to 13	8 to 13	to	to

5. **LEAF CHARACTERISTICS**: (continued)

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NUMBER OF INFLORESCENCE/PLANT:

AVERAGE:

V	R1	R2	R3	R4
4.4	3.3	3.6		

RANGE:

V	R1	R2	R3	R4
3 to 6	3 to 4	3 to 5	to	to

NUMBER OF FLORETS/INFLORESCENCE:

AVERAGE:

V	R1	R2	R3	R4
12.9	17.7	20.5		

RANGE:

V	R1	R2	R3	R4
9 to 17	11 to 27	14 to 29	to	to

* **COROLLA INNER SURFACE COLOR CHART VALUE:** (Royal Horticulture Society Color Chart) or Munsell Color Chart (Measure predominant color of newly open flower and circle the appropriate color chart)

V	R1	R2	R3	R4
82B	82D	76B		

* **COROLLA OUTER SURFACE COLOR CHART VALUE:** Royal Horticulture Society Color Chart or Munsell Color Chart (Measure predominant color of newly open flower and circle the appropriate color chart)

V	R1	R2	R3	R4
82B	82D	76B		

* **COROLLA INNER SURFACE COLOR:** (Measure predominant color of newly open flower, if flowers are bi-color please use the ratio codes)
1 = White 2 = Red-violet 3 = Blue-violet 4 = Cream 5 = Red-purple 6 = Blue 7 = Pink 8 = Pink-white 9 = Purple 10 = Violet 11 = Purple-violet 13 = Violet-White 1:1 14 = Violet-White 1:3 15 = Violet-White 3:1 16 = Violet-White Halo 17 = Pink-White 1:1 18 = Pink-White 1:3 19 = Pink-White 3:1 20 = Pink-White Halo 21 = RedViolet-White 1:1 22 = RedViolet-White 1:3 23 = RedViolet-White 3:1 24 = RedViolet-White Halo 25 = BlueViolet-White 1:1 26 = BlueViolet-White 1:3 27 = BlueViolet-White 3:1 28 = BlueViolet-White Halo 12 = Other _____

V	R1	R2	R3	R4
11	11	9		

COROLLA SHAPE: (See Figure 10)
1 = Very rotate 2 = Rotate 3 = Pentagonal 4 = Semi-stellate 5 = Stellate

V	R1	R2	R3	R4
3	3	4		

6. **INFLORESCENCE CHARACTERISTICS:**

CALYX ANTHOCYANIN COLORATION:
1 = Absent 3 = Weak 5 = Medium 7 = Strong 9 = Very strong

V	R1	R2	R3	R4
7	5	3		

ANTHER COLOR CHART VALUE: (Royal Horticulture Society Color Chart) or Munsel Color Chart (Measure when newly opened flower is fully expanded and circle the appropriate color chart)

V	R1	R2	R3	R4
14A	14A	17B		

ANTHER SHAPE: (See Figure 11)
1 = Broad cone 2 = Narrow cone 3 = Pear-shaped cone 4 = Loose 5 = Other

V	R1	R2	R3	R4
1	3	1		

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6. **INFLORESCENCE CHARACTERISTICS:** (continued)

POLLEN PRODUCTION:
1 = None 3 = Some 5 = Abundant

V	R1	R2	R3	R4
3	3	5		

STIGMA SHAPE: (See Figure 12)
1 = Capitate 2 = Clavate 3 Bi-lobed

V	R1	R2	R3	R4
1	1	1		

STIGMA COLOR CHART VALUE: (Royal Horticulture Society Color Chart) or Munsel Color Chart (Circle the appropriate color chart)

V	R1	R2	R3	R4
137C	137C	138A		

BERRY PRODUCTION: (Under field conditions)
1 = Absent 3 = Low 5 = Moderate 7 = Heavy 9 = Very Heavy

V	R1	R2	R3	R4
3	3	3		

7. **TUBER CHARACTERISTICS:**

* **PREDOMINANT SKIN COLOR:**
1 = White 2 = Light Yellow 3 = Yellow 4 = Buff 5 = Tan 6 = Brown 7 = Pink 8 = Red 9 = Purplish-red
10 = Purple 11 = Dark purple-black 12 = Other _____

V	R1	R2	R3	R4
9	9	9		

PREDOMINANT SKIN COLOR CHART VALUE: (Royal Horticulture Society Color Chart) or Munsell Color Chart (Circle the appropriate color chart)

V	R1	R2	R3	R4
58A	58A	58B		

SECONDARY SKIN COLOR:
1 = Absent 2 = Present (please describe)

V	R1	R2	R3	R4
1	1	1		

SECONDARY SKIN COLOR CHART VALUE: Royal Horticulture Society Color Chart or Munsell Color Chart (Circle the appropriate color)

V	R1	R2	R3	R4
–	–	–		

SECONDARY SKIN COLOR DISTRIBUTION: (See Figure 13)
1 = Eyes 2 = Eyebrows 3 = Splashed 4 = Scattered 5 = Spectacled 6 = Stippled 7 = Other _____

V	R1	R2	R3	R4

SKIN TEXTURE:
1 = Smooth 2 = Rough (flaky) 3 = Netted 4 = Russetted 5 = Heavily russetted 6 = Other _____

V	R1	R2	R3	R4
1	1	1		

7. TUBER CHARACTERISTICS: (continued)

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* TUBER SHAPE: (See Figure 14)
1 = Compressed 2 = Round 3 = Oval 4 = Oblong 5 = Long 6 = Other _____

V	R1	R2	R3	R4
2	3	3		

TUBER THICKNESS:
1 = Round 2 = Medium thick 3 = Slightly flattened 4 = Flattened 5 = Other _____

V	R1	R2	R3	R4
2	3	3		

TUBER LENGTH (mm):

AVERAGE:

V	R1	R2	R3	R4
80	85	84		

RANGE:

V	R1	R2	R3	R4
70 to 95	57 to 108	64 to 108	to	to

STANDARD DEVIATION:

V	R1	R2	R3	R4
6.5	15.5	12.4		

AVERAGE WEIGHT OF SAMPLE TAKEN: (6)

V	R1	R2	R3	R4
5000	5000	5000		

TUBER WIDTH (mm)

AVERAGE:

V	R1	R2	R3	R4
71	72	71		

RANGE:

V	R1	R2	R3	R4
64 to 98	51 to 92	54 to 89	to	to

STANDARD DEVIATION:

V	R1	R2	R3	R4
6.6	10.8	9.0		

AVERAGE WEIGHT OF SAMPLE TAKEN (g):

V	R1	R2	R3	R4
5000	5000	5000		

7. TUBER CHARACTERISTICS: (continued)

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TUBER THICKNESS (mm):

AVERAGE:

V	R1	R2	R3	R4
62	58	56		

RANGE:

V	R1	R2	R3	R4
52 to 89	41 to 70	41 to 64	to	to

STANDARD DEVIATION:

V	R1	R2	R3	R4
7.1	7.6	4.9		

AVERAGE WEIGHT OF SAMPLE TAKEN (g):

V	R1	R2	R3	R4
5000	5000	5000		

TUBER EYE DEPTH:

1 = Protruding 3 = Shallow 5 = Intermediate 7 = Deep 9 = Very deep

V	R1	R2	R3	R4
3	9	7		

TUBER LATERAL EYES:

1 = Protruding 3 = Shallow 5 = Intermediate 7 = Deep 9 = Very deep

V	R1	R2	R3	R4
3	7	5		

NUMBER EYE/TUBER:

AVERAGE:

V	R1	R2	R3	R4
7.2	13.4	14.2		

RANGE:

V	R1	R2	R3	R4
5 to 9	8 to 19	10 to 18	to	to

DISTRIBUTION OF TUBER EYES:

1 = Predominantly apical 2 = Evenly distributed

V	R1	R2	R3	R4
1	2	2		

PROMINENCE OF TUBER EYEBROWS:

1= Absent 2 = Slight prominence 3 = Medium prominence 4 = Very prominent 5 = Other _____

V	R1	R2	R3	R4
1	3	2		

7. **TUBER CHARACTERISTICS**: (continued)

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PREDOMINANT TUBER FLESH COLOR
1 = White 2 = Light Yellow 3 = Yellow 4 = Buff 5 = Tan 6 = Brown 7 = Pink 8 = Red 9 = Purplish-red
10 = Purple 11 = Dark purple-black 12 = Other _____

V	1	R1	1	R2	1	R3		R4	

PRIMARY TUBER FLESH COLOR CHART VALUE: (Royal Horticulture Society Color Chart) or Munsell Color Chart (Circle the appropriate color chart)

V	155 B	R1	155 B	R2	155 C	R3		R4	

SECONDARY TUBER FLESH COLOR:

1 = Absent 2 = Present, please describe: _____

V	1	R1	1	R2	1	R3		R4	

SECONDARY TUBER FLESH COLOR CHART VALUE: Royal Horticulture Society Color Chart or Munsell Color Chart (Circle the appropriate color chart)

V		R1		R2		R3		R4	

NUMBER OF TUBERS/PLANT:
1 = Low (<8) 2 = Medium (8-15) 3 = High (>15)

V	1	R1	1	R2	1	R3		R4	

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8. DISEASES CHARACTERISTICS:

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DISEASES REACTION: 0 = Not Tested 1 = Highly Resistant 2 = Resistant Few Symptoms 3 = Resistance Few Lessions in Number and Size 4 = Moderately Resistance 5 = Intermedia Susceptible 6 = Moderate Susceptible 7 = Susceptible 9 = Highly Susceptible

LATE BLIGHT: (Phytophthora)

V	R1	R2	R3	R4
7	7	7		

EARLY BLIGHT: (Alternaria)

V	R1	R2	R3	R4
7	7	7		

SOFT ROT (Erwinia)

V	R1	R2	R3	R4
7	7	7		

COMMON SCAB (Streptomyces)

V	R1	R2	R3	R4
7	7	7		

POWDERY SCAB (Spongospora)

V	R1	R2	R3	R4
0				

DRY ROT (Fusarium)

V	R1	R2	R3	R4
0				

POTATO LEAF ROLL VIRUS (PLRV)

V	R1	R2	R3	R4
7	7	7		

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8. DISEASES CHARACTERISTICS: (continued)

POTATO VIRUS X (PVX)

V	R1	R2	R3	R4
7	7	7		

POTATO VIRUS Y (PVY)

V	R1	R2	R3	R4
7	7	7		

POTATO VIRUS M (PVM)

V	R1	R2	R3	R4

POTATO VIRUS A (PVA)

V	R1	R2	R3	R4

GOLDEN NEMATODE (Globodera)

V	R1	R2	R3	R4
0	0	0		

ROOT – KNOT NEMATODE (Meloidogyne)

V	R1	R2	R3	R4
0				

OTHER DISEASE _____

V	R1	R2	R3	R4

PHYSIOLOGICAL DISORDER

1 = Malformed shape 2 = Tuber cracking 3 = Feathering 4 = Hollow heart 5 = Internal necrosis
6 = Blackheart 7 = Internal sprouting 8 = Other _____

V	R1	R2	R3	R4

9. PESTS CHARACTERISTICS:

PEST REACTION: 0 = Not Tested 1 = Highly Resistant 2 = Resistant Few Symptoms 3 = Resistance Few Lessions in Number and Size
4 = Moderately Resistance 5 = Intermedia Susceptible 6 = Moderate Susceptible
7 = Susceptible 9 = Highly Susceptible

COLORADO POTATO BEETLE (CPB) (*Leptinotarsa*)

V	R1	R2	R3	R4
0				

GREEN PEACH APHID (*Myzus*)

V	R1	R2	R3	R4
7	7	7		

OTHER:

V	R1	R2	R3	R4

OTHER:

V	R1	R2	R3	R4

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10. GENE TRAITS:

INSERTION OF GENES: 1 = YES 2 = NO [X] NO RAD 3/26/10

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IF YES, describe the gene(s) introduced or attach information:

11. QUALITY CHARACTERISTICS:

CHIEF MARKET:

SPECIFIC GRAVITY (wt. air/wt. air – wt. water)
1 = <1.060 2 = 1.060-1.069 3 = 1.070-1.079 4 = 1.080-1.089 5 = >1.090

V	2	R1	3	R2	2	R3		R4	

TOTAL GLYCOALKALOID CONTENT (mg./100 g. fresh tuber)

V	4.5	R1	3.5	R2	3.5	R3		R4	

OTHER QUALITY CHARACTERISTICS: Describe any other quality characteristics that may aid in identification, (e.g., chip-processing, french fry processing, baking, boiling, after-cooking darkening). Please attach data and corresponding protocol.

12. CHEMICAL IDENTIFICATION:

Describe chemical traits of the candidate variety that aid in its identification (e.g., protien or DSN electrophoresis). Please attach data and the corresponding protocol.

13. FINGER PRINTING MARKERS:

ISOZYMES 1 = YES 2 = NO [X]

IF YES, attach information

14. DNA PROFILE: 1 = YES 2 = NO [X]

IF YES, attach information

15. ADDDITIONAL COMMENTS AND CHARACTERISTICS:

Include any additional descriptors that would be useful in distringuishing the candidate variety.

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Distinctive Character:

- Modoc tubers appear brighter red after storage than either Red LaSoda or Dark Red Norland.

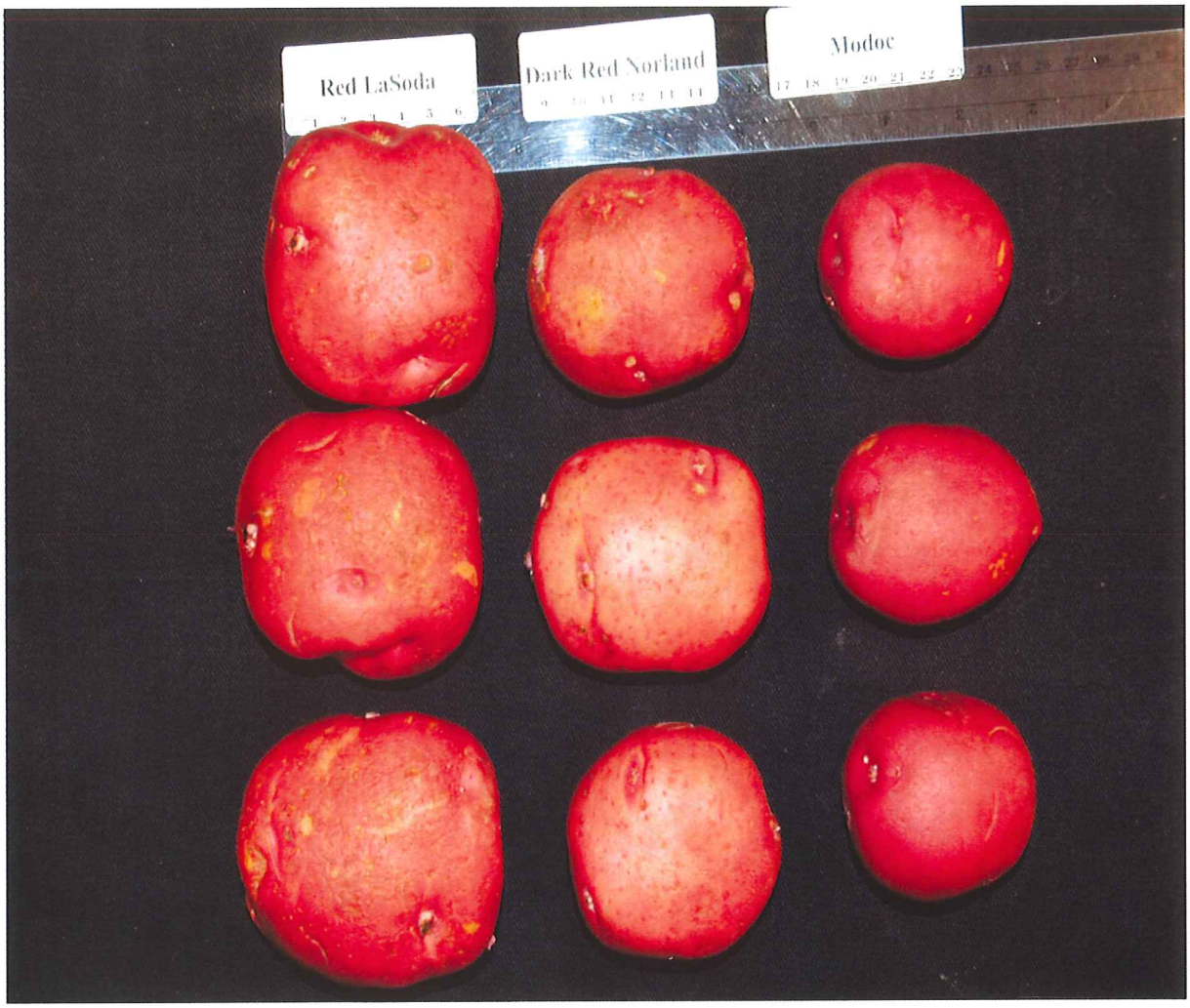

Figure 1. Red LaSoda, Dark Red Norland, and Modoc tubers after approximately seven months of storage.

Picture taken on May 16th, 2007 (~7 months after harvesting). A photographer's light table with four 150 W bulbs was used. The tubers were cleaned using a wet (water) paper towel and dried using a dry paper towel.

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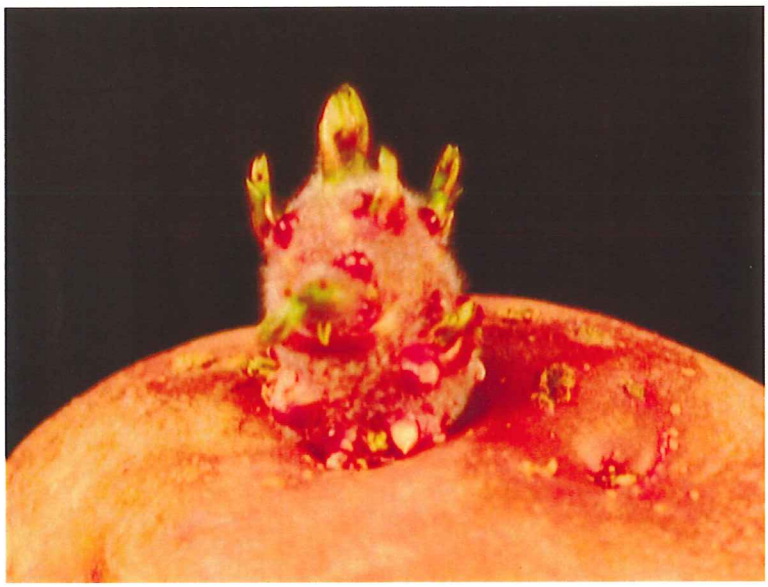
Modoc Light Sprout

- Ovoid sprout shape.
- Sprout tip habit is intermediate.
- Very strong pubescence of tip of light sprout base.
- Light sprout root initials absent.



Red LaSoda Light Sprout

- Ovoid sprout shape.
- Sprout tip habit is closed.
- Strong pubescence of tip of light sprout base.
- Abundant light sprout root initials.

Dark Red Norland Light Sprout

- Broad cylindrical sprout shape.
- Sprout tip habit is open.
- Medium pubescence of tip of light sprout base.
- Some light sprout root initials.

Distinctive Character:

- Modoc produces significantly smaller tubers than either Red LaSoda or Dark Red Norland (6.1 oz./tuber vs. 7.6 and 6.9, respectively).
- Modoc shows less greening than Red LaSoda.
- Modoc produces higher yields of 6-10 ounce tubers than Red LaSoda.

Table 1. Yield and Quality Characteristics of Dark Red Norland, Red LaSoda, and Modoc at Corvallis, Oregon, 1999-2003

Variety	Total Cwt/A[1]	U.S. No. 1 (Cwt/A)				Yield (Cwt/A)		% U.S. #1	Oz[2]/ Tub.	Sp. Grav.[3]	% Knobs	% GC[4]	% Green	Eyes[5]/ Tuber
		Total	4-6 oz	6-10 oz	>10 oz	<4 oz	Culls							
Dark Red Norland	457	342.5	47.5a	169.4a	125.6	33.8b	110.0a	70.7a	6.9b	1.06	2.1b	7.7b	1.5a	9.8
Red LaSoda	436	311.2	37.8b	128.5b	144.9	26.2c	139.3b	64.5b	7.6c	1.07	3.7a	9.7c	2.9b	8.8
Modoc	462	345.9	56.9a	**165.22a**	123.7	44.2a	103.2a	69.4a	**6.1a**	1.07	3.5a	1.7a	**1.0a**	6.3
Mean	452	333.2	47.4	154.37	131.4	34.7	117.5	68.3	6.85	1.07	3.1	6.4	1.8	8.3
LSD (0.05)[6]	NS	NS	11.3	27.2	NS	2.02	23.7	5.1	0.7	0	1.3	1.6	1.5	--

[1] Century weight (100-lb sacks) per acre
[2] Average weight of U.S. No. 1 tubers in ounces
[3] Specific gravities determined by weight in air/weight in water method
[4] GC = tuber growth cracks
[5] Based on 50 randomly-selected U.S. No. 1 tubers per cultivar.
[6] LSD = Least Significant Difference at the 0.05 probability level

Trial Information:
Location: OSU Experiment Station, Corvallis, OR. 1999-2003
Plot Size: Four rows x 25'/row (approximately 132 plants total)
Planting Date: Mid to late May
Harvest Date: Late September
Tuber evaluation for yield components and specific gravity: At grading, shortly after harvest.

Distinctive Character:

- Modoc has fewer eyes per tuber than either Dark Red Norland or Red LaSoda.

Modoc - Number of eyes/tuber	
Mean	6.28
Standard Error	0.17852
Median	6
Mode	6
Standard Deviation	1.262327
Sample Variance	1.593469
Kurtosis	-0.26849
Skewness	0.330958
Range	5
Minimum	4
Maximum	9
Sum	314
Count	50

Red LaSoda - Number of eyes/tuber	
Mean	8.8
Standard Error	0.166599
Median	9
Mode	9
Standard Deviation	1.17803
Sample Variance	1.387755
Kurtosis	-0.06708
Skewness	-0.53055
Range	5
Minimum	6
Maximum	11
Sum	440
Count	50

Dark Red Norland - Number of eyes/tuber	
Mean	9.76
Standard Error	0.224172
Median	10
Mode	11
Standard Deviation	1.585135
Sample Variance	2.512653
Kurtosis	0.308096
Skewness	-0.7401
Range	7
Minimum	5
Maximum	12
Sum	488
Count	50

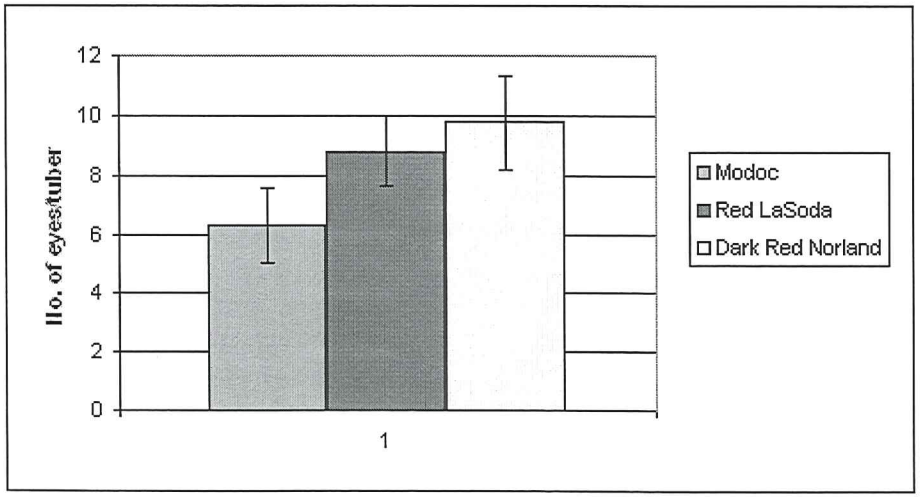


Figure 1. Average number of eyes per tuber in the varieties Modoc, Red LaSoda and Dark Red Norland.
Fifty random tubers per variety were evaluated. Bars indicate +/- standard deviation.

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Modoc:	
No. of eyes/tuber	*Frequency*
4	3
5	11
6	16
7	12
8	5
9	3
10	0
11	0
12	0
More	0

Red LaSoda	
No. of eyes/tuber	*Frequency*
4	0
5	0
6	2
7	6
8	8
9	20
10	12
11	2
12	0
More	0

Dark Red Norland	
No. of eyes/tuber	*Frequency*
4	0
5	1
6	0
7	4
8	5
9	10
10	10
11	15
12	5
More	0

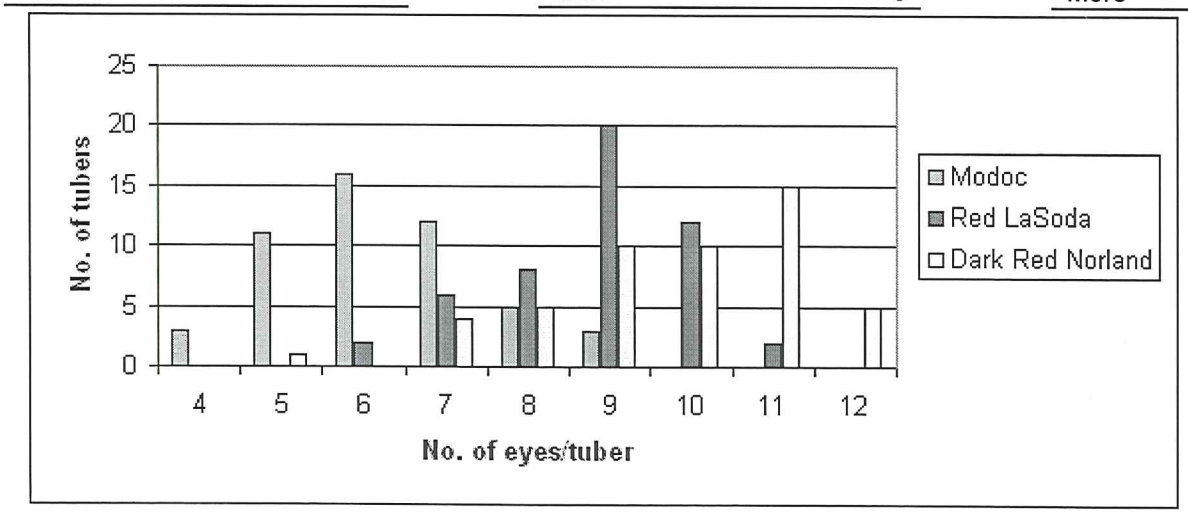
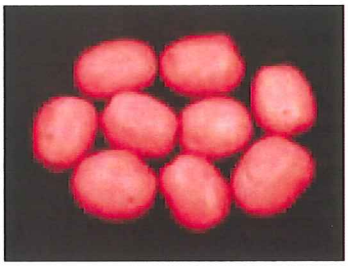


Figure 2. Phenotypic distribution of the number of eyes per tuber in a sample of fifty tubers of the varieties Modoc, Red LaSoda and Dark Red Norland.

Received August 30, 2007

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

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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

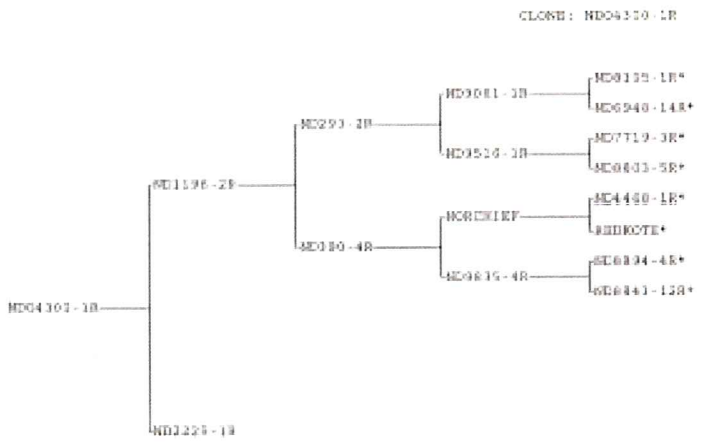

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Table 1. Yield and quality characteristics of NDO4300-1R, Red LaSoda, and Dk. Red Norland in Western Regional Trials, 1998 - 2000[1].

	Yield cwt/a								
Entry	Total	<4 oz	US No. 1 4-10 oz	Total Marketable[2]	US No. 1 >10 oz	Culls	% Marketable[2]	oz/ tuber	Spec. Grav.
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, Colorado

[2] 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 - 2000[1].

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, Colorado

[2] HH = Hollow Heart; BC = Brown Center

[3] Growth Cracks: 1 = Severe; 5 = None

[4] Skinning: 1 = Severe; 5 = None

[5] Vine Vigor: 1 = Weak; 5 = Strong

[6] Vine Maturity: 1 = Early; 5 = Late

[7] Tuber Shape: 1 = Round; 5 = Long, Narrow

[8] Skin Color: 1 = Pale; 5 = Dk. Red

[9] Eye Depth: 1 = Deep; 5 = Shallow

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

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 - 2000[1].

Entry	Location	Years	Yield cwt/a						% Marketable[2]	Spec. Grav.
			Total	<4 oz	US No. 1 4-10 oz	Total Marketable[2]	US No. 1 >10 oz	Culls		
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]					Yield		Specific Gravity
		>4oz	4-6oz	6-10oz	Total		>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.

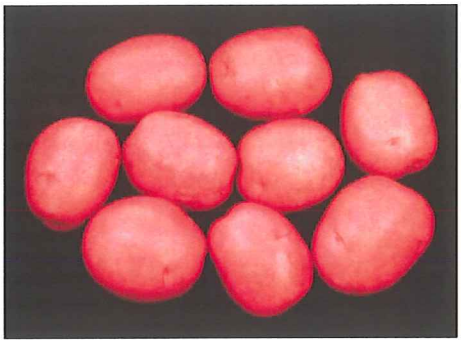
[2] 3 Trials grown in Idaho, 1998-2000, at Aberdeen and Kimberly.

[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.

MODOC

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 in 1989.



Developers: Oregon, North Dakota, California, Idaho and Washington Agricultural Experiment Stations.

Modoc consistently produces higher yields of marketable tubers than Red LaSoda or Dark Red Norland. Modoc tubers are round to oval and have bright red skin color that does not fade in storage. Modoc is suitable for table use and the red-skinned creamer market.

Strengths: good marketable yields, bright red skin color, shallow eyes, few internal and external defects, and excellent appearance.

Weaknesses: susceptible to most fungal diseases and to corky ringspot.

Incentives for Production: attractive tuber type, high percentage of marketable tubers, bright skin color with shallow eyes, and excellent pack-out.

Compared to Red LaSoda

Marketable Yield	++
Grade	+++
Skin Color	+++
Storability	0
External Defects	++++
Internal Defects	++++
Eye Depth	+++

+ = better, 0 = same, - = worse

Agronomic Characteristics

Maturity	Medium – Medium/Early
Tubers	Round - Oval, bright red skin, and smooth with shallow eyes
Marketable Yield	Medium (300 cwt./acre), with high percentage 4-8 oz.
Specific Gravity	Low (1.070)
Culinary Quality	Good
Diseases	**Susceptible** to most fungal diseases and corky ring spot.
Storability	Similar dormancy to other red varieties, skin color does not fade in storage

	Total Yield	Yield U.S. No. 1's			Yield		%	Specific
		<4 oz	4-10 oz	Marketable[1]	>10 oz	Culls	Marketable[1]	Gravity
Idaho[2]								
Modoc	365	110	229	339	22	4	93	1.070
Red LaSoda	315	22	117	139	153	23	46	1.066
Dk. Red Norland	430	52	216	268	151	11	63	1.067
Oregon[3]								
Modoc	461	59	260	319	93	50	68	1.066
Red LaSoda	491	31	169	199	154	138	41	1.071
Dk. Red Norland	519	31	233	264	177	78	51	1.069
Washington[4]								
Modoc	363	92	201	293	53	17	83	1.073
Red LaSoda	361	42	156	198	100	63	57	1.071
Dk. Red Norland	386	57	174	231	109	46	64	1.074

[1] < 4 oz - 10 oz. U.S. No. 1's
[2] 3 trials grown in Idaho, 1998, 1999, 2000, at Kimberly
[3] 6 trials grown in Oregon, 1998, 1999, 2000, at Corvallis and Klamath Falls
[4] 3 trials grown in Washington, 1998, 1999, 2000, at Granger

For full-text descriptions and additional data visit: http://oregonstate.edu/potatoes/Modoc.pdf

Modoc: A Potato Variety with Bright Red Skin and Early Maturity for Fresh Market

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ABSTRACT

Modoc is an early maturing, red-skinned, white-fleshed potato cultivar for fresh market use. The Agricultural Experiment Stations of Oregon, North Dakota, California, Idaho, and Washington jointly released Modoc in 2003. Modoc was derived from a 1989 cross of ND1196-2R and ND2225-1R performed at North Dakota State University. Modoc retains bright skin color in storage and is suited for marketing directly from the field or storage. It produces slightly lower total yield than Red LaSoda or Dark Red Norland, but higher marketable yield and more desirable tuber size and shape. Modoc tubers seldom exhibit growth cracks, secondary growth, hollow heart or other external or internal defects. Dry matter content of Modoc tubers is similar to Dark Red Norland and Red LaSoda (18.9% compared to 18.8% and 17.7%, respectively). Culinary quality of Modoc was rated equal to Dark Red Norland and Red LaSoda for boiling and microwaving preparation methods. Modoc tubers are similar to standard varieties in sugar, vitamin C, and glycoalkaloid (4.5 mg/100 g) concentration. Modoc foliage clearly expresses PVY symptoms and has not demonstrated high susceptibility to viral or fungal diseases during a decade of seed production and evaluation.

RESUMEN

Modoc es un cultivar de papa de madurez precoz, piel roja y de uso en fresco. Las Estaciónes Experimentales de Oregon, North Dakota, California, Idaho y Washington han liberado conjuntamente el cultivar Modoc en el 2003. Modoc deriva de un cruzamiento de ND1196-2R y ND2225-1R realizado en la Universidad del Estado de North Dakota en 1989. Modoc retiene el color rojo brillante de la piel en almacenamiento y es apropiada para su comercialización directa a partir del campo o del almacén. Tiene rendimientos totales ligeramente menores que la Red LaSoda o la Dark Red Norland, pero mayor cantidad de tubérculos comercializables y de forma y tamaño preferidos. Los tubérculos de Modoc raramente exhiben rajaduras de crecimiento, crecimiento secundario, corazón vacío u otros defectos internos y externos. El contenido de materia seca de Modoc es similar al de Dark Red Norland y Red LaSoda (18.9 comparado con 18.8 y 17.7 por ciento, respectivamente). Las cualidades culinarias de Modoc son iguales a las de Dark Red Norland y Red LaSoda para hervido y métodos de preparación en microondas. Los tubérculos de Modoc son similares a los de las variedades estándar en la concentración de azúcares, vitamina C y glicoalcaloides (4.5 mg/100 g). El follaje de Modoc muestra claramente síntomas de PVY pero no ha demostrado alta susceptibilidad a enfermedades virales o fungosas durante la década de producción y evaluación de semilla.

Accepted for publication 17 April 2003.
ADDITIONAL KEY WORDS: *Solanum tuberosum*, red variety, release.

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INTRODUCTION

Modoc was evaluated as NDO4300-1R and is a cooperative release by the Agricultural Experiment Stations of Oregon, North Dakota, California, Idaho, and Washington. The name "Modoc" is derived from an Indian tribe indigenous to the Klamath region of south central Oregon and northeastern California. The name is also affixed to numerous geographic features in the region. In addition, an 1872-1873 conflict between the U.S. Army and the Modoc Tribe is known as the Modoc War (Snyder 1988). The clone was derived from a 1989 cross between ND1196-2R and ND2225-1R (Figure 1) made by R. H. Johansen at North Dakota State University, Fargo, North Dakota. The clone was initially selected at the Klamath Experiment Station at Klamath Falls, Oregon in 1991.

Early Modoc evaluations were conducted in 1992 and 1993 at Klamath Falls, Oregon. Breeders seed was produced at the Klamath Experiment Station in 1992 and subsequent increases were made at the Central Oregon Agricultural Research Center, Powell Butte, Oregon. Modoc was more widely evaluated in replicated trials at Klamath Falls and Corvallis, Oregon, and Tulelake and Bakersfield, California, locations in 1994 to 1997 and in regional trials in seven western U.S. states in 1998 to 2000.

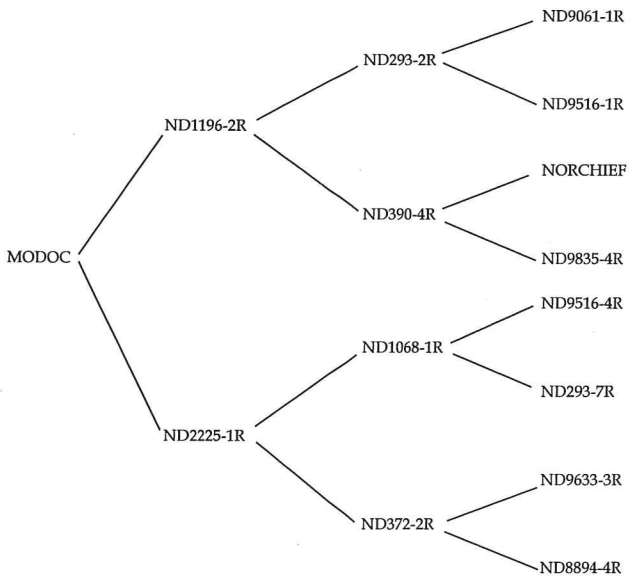


FIGURE 1.
Four generation pedigree of Modoc (upper parent is female).

DESCRIPTION

Pictures of Modoc plant, flower, tubers, and light sprout are presented in Figure 2.

Plants: *Growth habit:* Small to medium, semi-erect vine; intermediate foliage, with early maturity (100 days from planting to senescence compared with 110 days for Dark Red Norland). *Stems:* Weak to medium anthocyanin pigmentation, with weak to medium wings. *Leaves:* Medium green color; thick, short pubescence; medium-open silhouette; medium anthocyanin pigmentation in leaf midribs and petioles; with small leaf stipules. *Terminal leaflets:* Medium ovate, with acuminate tips, medium wavy margins, and cordate base. *Primary leaflets:* Six pairs per leaf; medium ovate, with acuminate tip, medium size, and cordate base. *Secondary and tertiary leaflets:* Seven to 11 pairs, average of 9.0.

Flowers: Moderate (three to six, average of 4.4) number of inflorescences per plant, nine to 17 (average of 12.9) florets per inflorescence. *Corolla:* Purple-violet (value of 82B, Royal Horticulture Society Color Chart (RHSC), London, England) with darker inner corolla, pentagonal shape. *Calyx:* Strong anthocyanin pigment. *Anthers:* Yellow-orange (value 14A RHSC); broad cone-shaped, with some pollen. *Stigma:* Capitate; olive-green (value 137C, RHSC). Berry production was not observed under field conditions.

Tubers: Skin is purplish-red (value 58A, RHSC) and smooth-textured, and tuber shape is round to oval. The length/width/thickness ratio, measured for 112 to 280 g tubers at Klamath Falls, Oregon, is approximately 1.3/1.1/1.0 compared with 1.5/1.2/1.0 for Red LaSoda and 1.5/1.3/1.0 for Dark Red Norland. Eyes are shallow, number about seven (five to nine) per tuber, and are concentrated near the apical end. Eyebrows are not prominent. Tuber flesh is white. Tuber numbers are low (<8 per plant), similar to Red LaSoda and Dark Red Norland.

Light Sprouts: Reddish anthocyanin pigmentation at base; elongated, green; open bud scales; with broad, heavily pubescent base.

CHARACTERISTICS

Modoc consistently produces lower total yields than either Red LaSoda or Dark Red Norland, but similar or higher marketable yields, with significantly greater yield of small tubers and fewer culls. In six replicated trials at Klamath Falls, Oregon, from 1995 through 2000, Modoc yields of U.S. No.1s

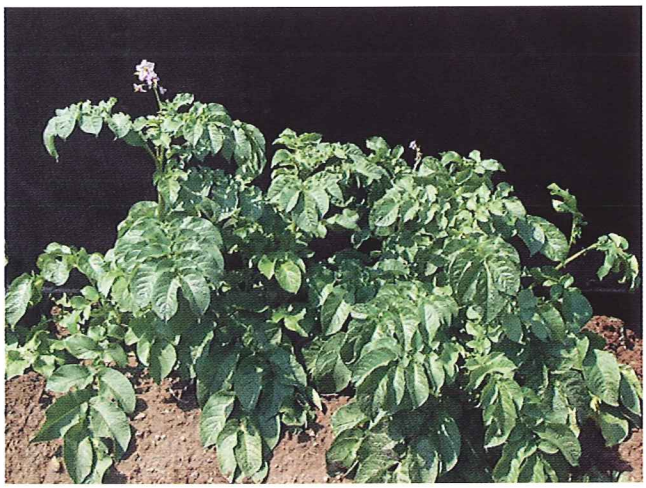
(total marketable) under 280 g averaged 170% and 163% of Red LaSoda and Dark Red Norland, respectively (Table 1). In 24 western regional trials in six states in 1998 to 2000, Modoc yields of U.S. No.1s under 280 g averaged 153% and 110% of Red LaSoda and Dark Red Norland, respectively (Table 2). Modoc consistently produces relatively few cull tubers.

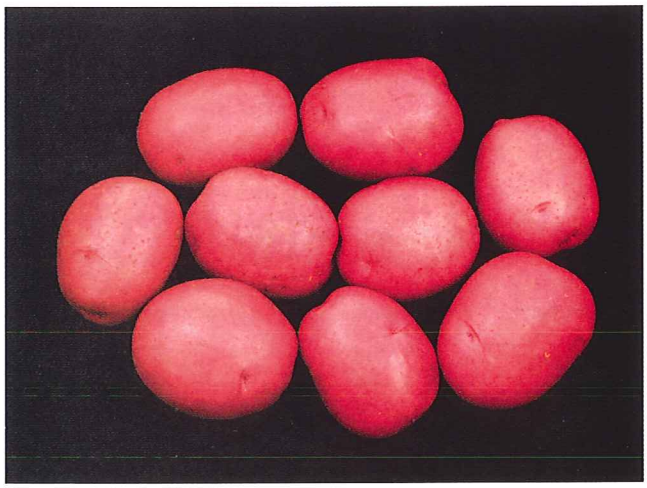
Specific gravity in regional trials averaged 1.067, 1.069, and 1.068 for Modoc, Red LaSoda, and Dark Red Norland, respectively (Table 2). Similar trends were observed in up to six years of trials at Klamath Falls and Corvallis, Oregon and Bakersfield and Tulelake, California (Table 1). Modoc, grown at Aberdeen, Idaho, from 1998 to 2000, was slightly lower than Red LaSoda and Dark Red Norland in protein content, and percent sucrose, and slightly higher in vitamin C and total glycoalkaloids (Table 3). Glycoalkaloid content has been consistently low in three years of testing at Aberdeen, Idaho.

RESISTANCE TO DISEASE AND PHYSIOLOGICAL DISORDERS

Modoc is susceptible to fungal diseases including early blight (*Alternaria solani*) and Fusarium dry rot (*Fusarium solani*), and *Erwinia* soft rot, but has not experienced more storage diseases than other selections at the Central Oregon Research and Extension Center. Experience from seed production and evaluation trials over a decade, indicates Modoc is not particularly susceptible to virus diseases and expresses readily discernible foliar symptoms when infected with PVY. In

FIGURE 2.
Plant, flower, tuber, and sprout characteristics of Modoc.





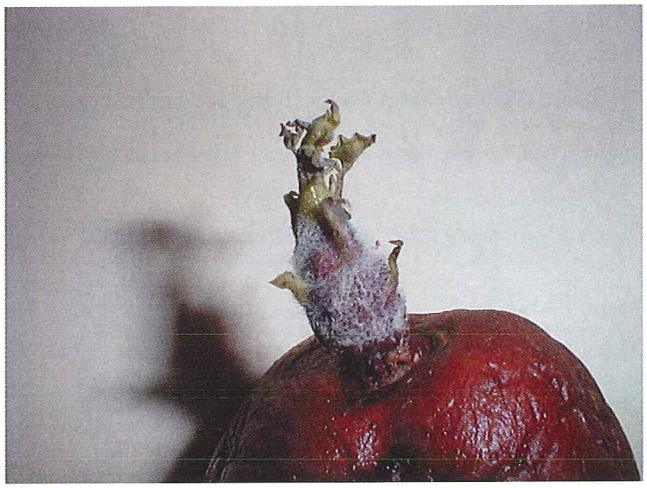


TABLE 1—*Yield and quality characteristics of Modoc, Red LaSoda, and Dark Red Norland in Oregon and California Trials, 1995-2000*[1].

			Yield (Mg ha^{-1})							
				US No. 1						
Entry	Location	Years	Total	<112 g	112-280 g	Total Marketable[2]	US No. 1 >280 g	Culls	% Marketable[2]	Spec. Grav.[3]
Modoc	Corvallis	6	51.9	7.2	30.4	37.5	9.1	5.4	72	1.068
	Klamath Falls	6	56.1	9.9	33.0	42.9	10.8	2.5	59	1.063
	Bakersfield	4	40.3	2.4	28.1	30.5	6.9	2.9	76	1.074
	Tulelake	4	46.5	3.4	34.3	37.6	6.9	1.9	81	1.068
	AVG.		48.7	5.7	31.5	37.1	8.4	3.2	72	1.068
Red LaSoda	Corvallis	6	56.3	3.6	22.5	26	17.2	12.9	46	1.075
	Klamath Falls	6	59.5	3.9	21.3	25.2	23.7	10.9	42	1.069
	Bakersfield	3	51.9	1.2	29.1	30.4	14.2	7.3	59	1.077
	Tulelake	3	53.0	1.6	19.7	21.3	18.3	13.6	40	1.065
	AVG.		55.2	2.6	23.2	25.8	18.4	11.2	47	1.072
Dark Red Norland	Corvallis	6	57.5	4.8	28.1	32.9	12.7	11.8	57	1.074
	Klamath Falls	6	56.8	5.5	26.3	31.8	18.6	6.4	56	1.067
	Bakersfield	4	55.6	1.2	37.1	38.3	12.4	4.7	69	1.075
	Tulelake	4	50.3	2.5	28.8	31.2	13.3	5.7	62	1.066
	AVG.		55.1	3.5	30.1	33.6	14.3	7.2	61	1.071
Overall Mean			53.0	3.9	28.2	32.1	13.7	7.2	61	1.070
CV (%)			6	29	15	15	11	26		0.220
LSD (0.05)			5.6	2.0	NS	8.2	2.6	3.2		NS

[1]Locations: Corvallis and Klamath Falls (Oregon); Bakersfield and Tulelake (California).
[2]Tubers of <112 g-<280 g.
[3]Tuber specific gravity determined using the weight-in-air/weight-in-water method.

TABLE 2—*Yield and quality characteristics of Modoc, Red LaSoda, and Dark Red Norland in western regional trials, 1998-2000*[1].

	Yield (Mg ha^{-1})								
		US No. 1							
Entry	Total	<112 g	112-280 g	Total Marketable[2]	US No. 1 >280 g	Culls	% Marketable[2]	g tuber^{-1}	Spec. Grav.[3]
Modoc	43.2	7.4	26.3	33.7	6.8	2.7	78	120	1.067
Red LaSoda	45.8	3.1	18.9	22.1	15.1	8.6	48	179	1.069
Dark Red Norland	49.2	4.8	25.8	30.6	14.1	4.5	62	157	1.068
Mean	46.1	5.2	23.6	28.8	12.0	5.3	62	151	1.068
CV (%)	5	9.1	7	7.1	12.3	9.3			0.120
LSD (0.05)	NS	1.1	3.8	4.6	3.4	1.1			NS

[1]Locations: California, Idaho, Oregon, Texas, Washington, Colorado.
[2]Tubers of <112-<280 g.
[3]Tuber specific gravity determined using the weight-in-air/weight-in-water method.

TABLE 3—*Relative tuber composition of Modoc, Red LaSoda, and Dark Red Norland at Aberdeen, ID*[1].

	% Oven	% F-DWB[2]			mg 100g^{-1} FWB	
Entry	Dried Solids	Dextrose	Sucrose	Protein	Vitamin C	Glycoalkaloids
Modoc	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
Dark Red Norland	18.8	0.06	0.27	5.5	28.8	3.5

[1]1998-2000 courtesy Dr. Steve Love, University of Idaho
[2]Dextrose and sucrose reported on fresh weight basis, protein on dry weight basis.

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TABLE 4—*Physiological defects and morphological characteristics of Modoc, Red LaSoda, and Dark Red Norland in Western Regional Trials, 1998-2000*[1].

Entry	% HH & BC[2]	Growth Cracks[3]	Skinning[4]	Vine Vigor[5]	Vine Mat.[6]	Tuber Shape[7]	Skin Color[8]	Eye Depth[9]
Modoc	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
Dark Red Norland	7	3.6	3.2	3.2	2.9	2.3	2.8	3.1
Dark Red Norland	18.8	0.06	0.27	5.5	28.8	3.5		

[1]Locations: California, Idaho, Oregon, Texas, Washington, Colorado
[2]HH = Hollow Heart; BC = Brown Center
[3]Growth Cracks: 1 = Severe; 5 = None observed
[4]Skinning: 1 = Severe; 5 = None observed
[5]Vine Vigor: 1 = Weak; 5 = Strong
[6]Vine Maturity: 1 = Early; 5 = Late
[7]Tuber Shape: 1 = Round; 5 = Long, Narrow
[8]Skin Color: 1 = Pale; 5 = Dk. Red
[9]Eye Depth: 1 = Deep; 5 = Shallow

TABLE 5—*Culinary quality of Modoc, Red LaSoda, and Dark Red Norland at Washington State University*[1].

Entry	Culinary Quality[2]		
	Boiling	Microwave	Total
Modoc	18.4	18.8	37.2
Red LaSoda	19.6	16.5	36.1
Dark Red Norland	9.7	20.3	40.0

[1]1998-2000 courtesy Dr. Rick Knowles and Nora Fuller, WSU.
[2]Higher score = better quality, maximum = 25 per test.

testing at Corvallis, Oregon, Modoc was susceptible to foliar infection by late blight (*Phytophthora infestans*), but experienced slightly but not significantly less tuber infection than Red LaSoda and Dark Red Norland in each of three years of evaluation. Corvallis screening consisted of a replicated trial with inoculation of spreader rows with zoospores of US-8 followed by irrigation to stimulate disease development.

Foliar symptoms of bacterial ringrot (*Corynebacterium sepedonicum*) are less clearly expressed by Modoc than by Red LaSoda (Oscar Gutbrod, Oregon State University, Seed Certification Service, unpublished data). In two years of evaluation, no leaf symptoms were observed. In the third year, several plants exhibited inter-venial mottling, stunting, and shinny leaves. Tuber symptoms were similar but mild in both cultivars. Modoc tuber symptoms were observed in tubers from 10% of plants in one year and not at all in two years. Early maturity may suppress symptom expression in both cultivars. Modoc is susceptible to powdery scab (*Spongospora subterranean*), corky ringspot (tuber symptom of infection by tobacco rattle virus), and infection by Columbia root-knot nematode (*Meloidogyne chitwoodi*).

Modoc tubers seldom exhibit internal or external defects. In three years of evaluation in regional trials, much less hollow heart and brown center was observed in Modoc than in Red LaSoda and Dark Red Norland (Table 4). Modoc tubers are not susceptible to growth cracks or shape defects. Vascular discoloration has not been identified as a concern at any location where Modoc has been evaluated. Modoc consistently received high ratings for skin color and eye depth and tubers are less susceptible to skinning damage at harvest than Red LaSoda.

USAGE

Modoc is a fresh market cultivar. Preliminary non-replicated evaluations at Klamath Falls, designed to detect serious culinary quality deficiencies, failed to detect after-cooking darkening, sloughing, or off-flavors in boiled, baked, or micro-waved Modoc tubers. Sensory evaluations at Washington State University indicated Modoc was similar to Dark Red Norland and Red LaSoda in culinary quality when boiled or microwaved (Table 5). Early maturity, an attractive appearance, uniform tuber size distribution, bright red skin color that does not fade appreciably in storage, and no observed storage deficiencies favor acceptance of Modoc for marketing directly from the field or from storage.

MANAGEMENT

Observations from trials conducted at Klamath Falls, Oregon, and other locations provide some guidance for cultural

management of the Modoc variety. Low numbers of eyes concentrated at the apical end results in the need to use relatively small tubers for seed to avoid stand loss due to blind seedpieces. Plant spacing at approximately 15 cm in 91-cm rows provides optimum tuber size distribution to minimize production of undesirable oversize tubers. This spacing produces acceptable tuber size for seed or fresh market use. Vine desiccation may be required to avoid excessive tuber size. Fertility practices should be similar to management of standard red varieties of similar maturity. Nitrogen banded at planting at 180 kg/ha has produced excellent yields in low organic matter mineral soils in Klamath Falls. Higher rates or split applications may delay maturity and skin set. Modoc's reaction to post emergence application of metribuzin at Aberdeen, Idaho, was rated as moderately resistant compared with resistant for Dark Red Norland and moderately susceptible for Red LaSoda.

Soils infested with Columbia root-knot nematode or stubby-root (*Trichodorous* spp.) nematodes should be fumigated or avoided. Soils with known powdery scab history should also be avoided.

AVAILABILITY

Limited quantities of *in vitro* plantlets and prenuclear seed stocks are available by request from the Foundation Potato Seed Program at Oregon State University, Corvallis, Oregon. Application for plant variety protection has been made for Modoc.

ACKNOWLEDGMENTS

The authors thank Oscar Gutbrod for evaluation of bacterial ringrot response, Soloman Yilma for production of *in vitro* plantlets and prenuclear seed stocks and our collaborators in the regional variety trials. The Oregon Agricultural Experiment Station, the Oregon Potato Commission, the USDA Cooperative Research, Education, and Extension Service, and the USDA Agricultural Research Service provided partial financial support of this research.

LITERATURE CITED

Snyder WS. 1988. Klamath history notes. Reprinted from Herald and News, Klamath Falls, OR.

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RAD 1/4/2011

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

Application is required in order to determine if a plant variety protection certificate is to be issued *(7 U.S.C. 2421)*. The information is held confidential until the certificate is issued *(7 U.S.C. 2426)*.

1. NAME OF APPLICANT(S)

STATE of OREGON, acting by and through the State Board of Higher Education on behalf of OREGON STATE UNIVERSITY, representing the interests of Washington State University, the University of Idaho, and the United States of America, as represented by the Secretary of Agriculture. (continued Exhibit E)

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER:
NDO4300-1R

3. VARIETY NAME:
Modoc

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)*

Office of Technology Transfer
Oregon State University
312 Kerr Administration Building
Corvallis, OR 97331

5. TELEPHONE *(Include area code)*
541-737-0674

6. FAX *(Include area code)*
541-737-3093

7. PVPO NUMBER
#200600175

8. Does the applicant own all rights to the variety? Mark an "X" in the appropriate block. **If no, please explain.** [X] YES [ ] NO

9. Is the applicant (individual or company) a U.S. national or a U.S. based company? **If no, give name of country.** [X] YES [ ] NO

10. Is the applicant the original owner? [X] YES [ ] NO **If no, please answer one of the following:**

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?
[ ] YES [ ] NO **If no, give name of country**

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?
[ ] YES [ ] NO **If no, give name of country**

11. Additional explanation on ownership *(Trace ownership from original breeder to current owner. Use the reverse for extra space if needed)*:

The STATE OF OREGON, Acting by and Through the State Board of Higher Education on behalf of OREGON STATE UNIVERSITY is a partner in the Northwest (Tri-State) Potato Variety Development Program and a signatory of the General Agreement on Policy and Procedure for Release of New Publicly Developed Plant Varieties in Idaho, Oregon and Washington, between Washington State University, Oregon State University, University of Idaho and the United States of America, as represented by the Secretary of Agriculture. In accordance with provision 2.2 of this Agreement, Oregon State University is applying for this PVPC.

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.

2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.

3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

EXHIBIT F
DECLARATION REGARDING DEPOSIT

NAME OF OWNER (S)		TEMPORARY OR EXPERIMENTAL DESIGNATION
STATE of OREGON, acting by and through the State Board of Higher Education on behalf of OREGON STATE UNIVERSITY, representing the interests of Washington State University, the University of Idaho, and the United States of America, as represented by the Secretary of Agriculture. (continued Exhibit E) RMD 1/4/2011		NDO4300-1R VARIETY NAME **Modoc**
NAME OF OWNER REPRESENTATIVE (S)	ADDRESS *(Street and No. or RD No., City, State, and Zip Code and Country)*	FOR OFFICIAL USE ONLY
Sarah E. Mabee	Office of Technology Transfer Oregon State University, 312 Kerr Administration Building, Corvallis, OR 97331 United States of America Ph: 541-737-8100	PVPO NUMBER #200600175

I do hereby declare that during the life of the certificate a viable sample of propagating material of the subject variety will be deposited, and replenished as needed periodically, in a public repository in the United States in accordance with the regulations established by the Plant Variety Protection Office.

Signature

8-24-2007
Date