No. 200300287

# 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

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, CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE , OR CONDITIONING IT PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE, OR USING IT IN PRODUCING A HYBRID OR T VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. (84 ST AMENDED, 7 U.S.C. 2321 ET SEQ.)

*WHEAT, COMMON*

*'Tubbs'*

*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 eighth day of October, in the year two thousand and four.*

*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: State of Oregon, by and through the State Board of Higher Education on behalf of Oregon State University

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME: OR939526

3. VARIETY NAME: Tubbs

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*:
c/o Office of Technology Transfer
Oregon State University
312 Kerr Administration Building
Corvallis, OR 97331-2140

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

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

**FOR OFFICIAL USE ONLY**

PVPO NUMBER: 200300287

FILING DATE: July 22, 2003

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*: Non-profit public institution of higher education

8. IF INCORPORATED, GIVE STATE OF INCORPORATION: Oregon

9. DATE OF INCORPORATION:

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*
William Hostetler, Director
Office of Technology Transfer
Oregon State University
312 Kerr Administration Bldg
Corvallis, OR 97331-2140

FEES RECEIVED
FILING AND EXAMINATION FEES: $3652.00 DATE 7/22/2003
CERTIFICATION FEE: $432.00 DATE 9/27/2004

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

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

13. E-MAIL: William.Hostetler@oregonstate.edu

14. CROP KIND *(Common Name)*: soft white common wheat

15. GENUS AND SPECIES NAME OF CROP: Triticum aestivum

16. FAMILY NAME *(Botanical)*: Graminacae

17. IS THE VARIETY A FIRST GENERATION HYBRID? ☐ YES ☒ NO

18. 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)*

19. 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 20 and 21 below)* ☒ NO *(If "no", go to item 22)*

20. 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

21. 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.)*

22. 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?
☒ YES ☐ NO
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.)*

23. 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.)*

24. 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 | |
|---|---|---|---|
| William Hostetler | | | |
| NAME *(Please print or type)* | | NAME *(Please print or type)* | |
| William W. Hostetler | | | |
| CAPACITY OR TITLE | DATE | CAPACITY OR TITLE | DATE |
| Director Technology Transfer | 7/14/03 | | |

ST-470 (02-10-2003) designed by the Plant Variety Protection Office using Word 2000. Replaces former versions of ST-470, which are obsolete.

*(See reverse for instructions and information collection burden statement)*

INSTRUCTIONS

200300287

**GENERAL:** 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; (3) for a seed reproduced variety at least 2,500 viable untreated seeds, for a hybrid variety at least 2,500 untreated seeds of each line necessary to **reproduce** the variety, or for tuber reproduced varieties 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; (4) check drawn on a U.S. bank for $3,652 ($432 filing fee and $3,220 examination fee), payable to "Treasurer of the United States" *(See Section 97.6 of the Regulations and Rules of Practice.)* Partial applications will be held in the PVPO for not more than 90 days, then returned to the applicant as unfiled. 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 check payable to "Treasurer of the United States" in the amount of $432 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

**Plant Variety Protection Office**
**Telephone: (301) 504-5518**
**FAX: (301) 504-5291**
**Homepage:** http://www.ams.usda.gov/science/pvpo/pvp.htm

**ITEM**

18a. 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

18b. 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 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.

18c. 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.

18d. 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.*

18e. 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.

19. 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).*

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

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

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

**22. 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.)*

First date of Foundation seed sale: 8/21/02

**23. 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).)*

**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. There is no charge for filing a change of address. The fee for filing a change of 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.)*

**To avoid conflict with other variety names in use, the applicant must check the appropriate recognized authority. For example, for agricultural and vegetable crops, contact: Seed Branch, AMS, USDA, Room 213, Building 306, Beltsville Agricultural Research Center--East, Beltsville, MD 20705. Telephone: (301) 504-8089. http://www.ams.usda.gov/lsg/seed.htm**



ST-470 (02-10-2003) designed by the Plant Variety Protection Office with Word 2000. Replaces former versions of ST-470, which are obsolete.

2

**PVP Application - Tubbs Soft White Winter Wheat**

## Exhibit A - Origin and Breeding History

Tubbs is a semidwarf soft white winter wheat derived from the cross 'Malcolm'/'Madsen' made in 1990. Tubbs is an $F_3$-derived line, which was identified in 1994 as an $F_4$ headrow and designated as experimental number OR939526 in 1995.

Tubbs (OR939526, PI 629114) is derived from the single cross 'Malcolm'/'Madsen' made in 1990. The original selection was obtained from a single head from an F2 plant identified and selected at the Oregon State University Hyslop Agricultural Research Farm. The initial selection was based on spike size and fertility, maturity, semi-dwarf stature, and reaction to foliar diseases including Septoria leaf blotch and stripe rust (Puccinia striiformis). F3 and F4 generations were advanced through a head to row pedigree breeding method. Selections in the F3 and F4 generation were made at a field research site near Adams, Oregon, based on plant height, maturity, spike size, reaction to stripe rust and the soilborne disease Cercosporella herpotrichoides. A single F4 row was bulked and subsequently given the identification OR939526. In the F5 generation, Tubbs (OR939526) was evaluated in a single unreplicated yield trial. In addition to previous traits, Tubbs was then evaluated and selected for grain yield, grain test weight.

Beginning in the F6 generation, Tubbs was evaluated in mulilocation yield trials in North Central Oregon and the Willamette Valley. In these trials, Tubbs was evaluated and selected for grain yield, yield stability, adaptation, grain quality, and response to major diseases of the Northwest, including Stripe rust, Leaf rust, Septoria leaf blotch, Cercosporella herpotrichoides, Cephalosporium stripe, and Fusarium crown rot.

For each year from the F5 generation through release, Tubbs was evaluated and selected for end-use quality traits in comparison with major varieties Stephens and Madsen. The evaluations were conducted through the USDA-ARS Western Wheat Quality Laboratory in Pullman, Washington. Traits measured include kernel hardness, kernel weight, break flour and total flour yield, flour ash, flour protein, water absorption, cookie diameter, and sponge cake volume.

Tubbs was evaluated in the USDA-ARS Western Regional Uniform Soft Wheat Nursery in 1999 and 2000, the Oregon State-wide Variety Trials in 1999 through 2001, and in the Washington and Idaho State Variety Trials in 2000 and 2001.

In fall 2000, 1,500 heads of Tubbs were threshed, screened for seed color and seed size, and provided to Washington Foundation Seed for production of Breeder seed. These were planted as individual headrows and off-type rows were removed prior to bulk harvest of Breeder seed.

## Evidence of Uniformity and stability

Tubbs has been observed to be uniform and stable. From the F5 generation through its release as a variety in 2002, uniformity and stability were evaluated each year in multilocation replicated yield trials. From 1998 to 2001, Tubbs was evaluated in a total of 120 replicated yield trials, including breeding trials in Oregon, USDA-ARS sponsored Regional Nurseries, and State Variety Trials in Oregon, Washington and Idaho.

Tubbs may contain up to 5 red kernels per pound in Breeders, Foundation, Registered, or Certified classes of seed multiplication. Tubbs also may contain up to a total of 1 in 10,000 combined of the naturally occurring variants: plants that are 8 to 15 cm taller or plants with bronze (red or tan) chaff spikes. These variants described are distinct within the variety and are stable and predictable with a degree of reliability comparable to other varieties of the same kind, and within recognized tolerances, when the variety is reproduced or reconstructed, and was originally part of the variety when released.

To further determine variants in kernel color, a phenol staining reaction was determined. It was observed that 38% of the kernels stained are ivory, with 62% being light brown. No brown or brown-black staining kernels were observed.

## Exhibit B – Statement of Distinctness

Tubbs is most similar to the commercial varieties Madsen, Malcolm, and Weatherford. All are soft white market class, winter type, semi-dwarf, awned, and have similar levels of winterhardiness. Madsen and Malcolm are parents of the variety Tubbs. Weatherford has parentage similar to Tubbs. Tubbs carries the Pch-1 gene which confers resistance to Psuedocercosporella foot rot. Weatherford and Madsen also carry this gene, but Malcolm does not.

DNA fingerprinting analysis of the wheat varieties Tubbs, Weatherford, Malcolm, and Madsen was conducted, based on the polymerase chain reaction (PCR) amplification of twenty wheat microsatellite markers.

Between Tubbs and Weatherford, distinct alleles were detected with markers gwm60, gwm608, gwm234, gwm282, gwm334, and gwm437.

Between Tubbs and Madsen, distinct alleles were detected with markers gwm155, gwm190, gwm46, gwm60, gwm608, gwm595, gwm234, gwm282, gwm577, gwm337, gwm437, and gwm389.

Between Tubbs and Malcolm, distinct alleles were detected with markers gwm135, gwm155, gwm608, gwm148, gwm282, gwm334, and gwm389.

Summary of microsatellite markers[a] and allele sizes (base pairs) for the varieties Tubbs, Weatherford, Madsen, and Malcolm

| | Varieties | | | |
|---|---|---|---|---|
| Marker[a] | Tubbs | Weatherford | Madsen | Malcolm |
| Gwm135 | 118 and 152 | 118 and 152 | 118 and 152 | 118 |
| Gwm155 | 144 and 146 | 144 and 146 | 144 | 146 |
| Gwm160 | 180 and 204 | 180 and 204 | 180 and 204 | 180 and 204 |
| Gwm190 | 212 | 212 | 202 | 212 |
| Gwm46 | 173 | 173 | 169 | 173 |
| Gwm60 | 213 | 190 | 190 | 213 |
| Gwm95 | 119 | 119 | 119 | 119 |
| Gwm469 | 173 | 173 | 173 | 173 |
| Gwm608 | 152 and 156 | 150 | 150 and 152 | 156 |
| Gwm595 | 186 | 186 | 192 | 186 |
| Gwm513 | 156 | 156 | 156 | 156 |
| Gwm148 | 163 | 163 | 163 | 165 |
| Gwm234 | 202 and 228 | 202 | 202 | 202 and 228 |
| Gwm261 | 175 | 175 | 175 | 175 |
| Gwm282 | 164 and 200 | 164 and 194 | 164 and 194 | 154 and 200 |
| Gwm577 | 186 | 186 | 192 | 186 |
| Gwm337 | 173 and 190 | 173 and 190 | 169 and 190 | 173 and 190 |
| Gwm334 | 117 | 117 and 119 | 117 | 119 |
| Gwm437 | 117 | 108 and 117 | 108 | 117 |
| Gwm389 | 118 and 137 | 118 and 137 | 118 | 137 |

[a] Microsatellite markers described by Röder et al. (1998).

# Supplemental Information

## DNA Fingerprinting Analysis of the Wheat Varieties Tubbs, Weatherford, Madsen, and Malcolm

Prepared by Dr. Oscar Riera-Lizarazu, Molecular geneticist,
Oregon State University

Tissue collection and DNA extraction

Kernels of the wheat varieties Tubbs, Weatherford, Malcolm, and Madsen were germinated in moistened filter papers in petri dishes for five days. Subsequently, genomic DNA from each coleoptile produced (16 per variety) was individually isolated using the procedures described by Riera-Lizarazu et al. (2000). DNA from the individual coleoptiles (16 per variety) was then pooled and used in subsequent analyses. Thus, the DNA of each variety analyzed represented a composite of 16 independent samples.

Microsatellite marker analysis

DNA fingerprinting analysis of the wheat varieties Tubbs, Weatherford, Malcolm, and Madsen was based on the polymerase chain reaction (PCR) amplification of twenty wheat microsatellite markers (gwm135, gwm155, gwm160, gwm190, gwm46, gwm60, gwm95, gwm469, gwm608, gwm595, gwm513, gwm148, gwm234, gwm261, gwm282, gwm577, gwm337, gwm334, gwm437, gwm389) described by Röder et al. (1998). The DNA of each variety was tested twice with each marker.

PCR–based amplification of microsatellite markers were performed on 50 ng of pooled DNA from 16 coleoptiles per variety from each of the four varieties (Tubbs, Weatherford, Malcolm, and Madsen). PCR reactions were carried out in a final volume of 10 uL, with 1X Taq buffer (Qiagen, Inc., Valencia, CA), 200 uM of each of the deoxyribonucleotide triphosphates dATP, dCTP, dGTP, and dTTP (Fermentas Life Sciences, Hanover, MD), 0.5 uM of each microsatellite primer (MWG Biotech AG., High Point, NC), and 0.3 units of Taq polymerase (Qiagen, Inc., Valencia, CA). One of the primers for each marker was labeled with TET (4,7,2',7'-tetrachloro-6-carboxyflourescein), FAM (6-carboxyflourescein), or HEX (4,7,2',4',5',7'-hexachloro-6-carboxyflourescein) for fluorescence-based detection of amplification products. The cycling parameters for the PCR were 40 cycles of 94°C for 30 sec., a primer-dependent annealing temperature ranging from 50 to 60°C for 30 sec., 72°C for 30 sec, and a final extension of 72°C for 10 min.

PCR products were diluted (at ratios ranging from 1:5 to 1:60), multiplexed, and sized on an ABI PRISM® 377 DNA Sequencer at the Central Services Laboratory at Oregon State University, using GeneScan ® 3.1 and GenoTyper ® 2.5 software (Applied Biosystems, Foster City, CA). The internal fragment size

standard used was GeneScan 500-TAMRA (Applied Biosystems, Foster City, CA). Allele sizes (base pairs) were rounded to the nearest integer.

Data analysis

Estimates of genetic relatedness between wheat varieties were based on the proportion of shared alleles (Bowcock et al., 1994) and a corresponding distance measure (Chakraborty and Jin, 1993). For individual pairwise comparisons the proportion of shared alleles ($P_{SAI}$) was estimated by

$$P_{SA_I} = \frac{\sum_r^n S}{2r}$$

where the number of shared alleles $S$ is summed over all loci $r$. Genetic distance between varieties ($D_{SAI}$) was then estimated by,

$$D_{SA_I} = 1 - P_{SA_I}$$

Summary of results and interpretation

When the wheat varieties Tubbs, Weatherford, Madsen, and Malcolm were assayed with microsatellite markers, we detected 20 loci with one to four alleles with an average of two alleles per locus (Table A). The proportion of shared alleles and the shared-allele based genetic distance between varieties is presented in Table B. The proportion of shared alleles between the varieties Tubbs and Weatherford was 0.80. Alleles detected with markers gwm60, gwm608, gwm234, gwm282, gwm334, and gwm437 in Tubbs and Weatherford were distinct. The proportion of shared alleles between Tubbs and Madsen was 0.55 while that between Tubbs and Malcolm was 0.78. The proportion of shared alleles between Weatherford with either Madsen or Malcolm was 0.65. Genetic distance measurements also show that Tubbs and Weatherford were genetically distinct ($D_{SAI}$ = 0.20). Tubbs was found to be both less closely related to Madsen ($D_{SAI}$ = 0.45) and more closely related to Malcolm ($D_{SAI}$ = 0.23) than Weatherford ($D_{SAI}$ = 0.35).

References

Bowcock AM, A Ruiz-Linares, J Tomfohrde, E Minch, JR Kidd, and LL Cavalli-Sforza. 1994. High resolution of human evolutionary trees with polymorphic microsatellites. Nature 368:455-457.

Chakraborty R, and L Jin. 1993. A unified approach to study hypervariable polymorphisms: statistical considerations of determining relatedness and population distances. EXS 67:153-175

Riera-Lizarazu, O, MI Vales, EV Ananiev, HW Rines, and RL Phillips. 2000. Production and characterization of maize chromosome 9 radiation hybrids derived from an oat-maize addition line. Genetics 156: 327-339.

Röder, MS, V Korzun, K Wendehake, J Plaschke, M-H Tixier, P Leroy, and MW Ganal.1998. A microsatellite map of wheat. Genetics 149: 2007-2023.

Table A. Microsatellite markers[a] and allele sizes (base pairs) for the varieties Tubbs, Weatherford, Madsen, and Malcolm

| | Varieties | | | |
|---|---|---|---|---|
| Marker[a] | Tubbs | Weatherford | Madsen | Malcolm |
| gwm135 | 118 and 152 | 118 and 152 | 118 and 152 | 118 |
| gwm155 | 144 and 146 | 144 and 146 | 144 | 146 |
| gwm160 | 180 and 204 | 180 and 204 | 180 and 204 | 180 and 204 |
| gwm190 | 212 | 212 | 202 | 212 |
| gwm46 | 173 | 173 | 169 | 173 |
| gwm60 | 213 | 190 | 190 | 213 |
| gwm95 | 119 | 119 | 119 | 119 |
| gwm469 | 173 | 173 | 173 | 173 |
| gwm608 | 152 and 156 | 150 | 150 and 152 | 156 |
| gwm595 | 186 | 186 | 192 | 186 |
| gwm513 | 156 | 156 | 156 | 156 |
| gwm148 | 163 | 163 | 163 | 165 |
| gwm234 | 202 and 228 | 202 | 202 | 202 and 228 |
| gwm261 | 175 | 175 | 175 | 175 |
| gwm282 | 164 and 200 | 164 and 194 | 164 and 194 | 154 and 200 |
| gwm577 | 186 | 186 | 192 | 186 |
| gwm337 | 173 and 190 | 173 and 190 | 169 and 190 | 173 and 190 |
| gwm334 | 117 | 117 and 119 | 117 | 119 |
| gwm437 | 117 | 108 and 117 | 108 | 117 |
| gwm389 | 118 and 137 | 118 and 137 | 118 | 137 |

[a] Microsatellite markers described by Röder et al. (1998).

Table B. Proportion of shared alleles ($P_{SAI}$) and genetic distance ($D_{SAI}$) between Tubbs, Weatherford, Malcolm, and Madsen

| | | $P_{SAI}$[a] | | | |
|---|---|---|---|---|---|
| | | Tubbs | Weatherford | Malcolm | Madsen |
| $D_{SAI}$[b] | Tubbs | | 0.80 | 0.78 | 0.55 |
| | Weatherford | 0.20 | | 0.65 | 0.65 |
| | Malcolm | 0.23 | 0.35 | | 0.33 |
| | Madsen | 0.45 | 0.35 | 0.68 | |

[a] Proportion of shared alleles (Bowcock et al., 1994)
[b] Shared allele genetic distance (Chakraborty and Jin, 1993)

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
BELTSVILLE, MD 20705

EXHIBIT C
(*Wheat*)

# OBJECTIVE DESCRIPTION OF VARIETY
# WHEAT (*Triticum* spp.)

NAME OF APPLICANT(S) State of Oregon, Acting by and through the State Board of Higher Education on behalf of Oregon State University

ADDRESS (*Street and No. or RD No., City, State, and Zip Code*)
c/o Office of Technology Transfer
Oregon State University
312 Kerr Administration Bldg.
Corvallis, OR 97331-2140

FOR OFFICIAL USE ONLY

PVPO NUMBER 200300287

VARIETY NAME
Tubbs

TEMPORARY OR EXPERIMENTAL DESIGNATION
OR939526

PLEASE READ ALL INSTRUCTIONS CAREFULLY: Place the appropriate number that describes the varietal character of this variety in the boxes below. Place a zero in the first box (e.g. [0][9] or [0][9]) when number is either 99 or less or 9 or less respectively. Data for quantitative plant characters should be based on a minimum of 100 plants. Comparative data should be determined from varieties entered in the same trial. Royal Horticultural Society or any recognized color standard may be used to determine plant colors; designate system used: _____

Please answer all questions for your variety; lack of response may delay progress of your application.

1. KIND:

[1]
1=Common
2=Durum
3=Club
4=Other (SPECIFY) : _____

2. VERNALIZATION:

[2]
1=Spring
2=Winter
3=Other (SPECIFY) : _____

3. COLEOPTILE ANTHOCYANIN:

[1] 1 = Absent 2 = Present

4. JUVENILE PLANT GROWTH:

[2] 1 = Prostrate 2 = Semi-erect 3 = Erect

5. PLANT COLOR (boot stage):

[2]
1 = Yellow-Green
2 = Green
3 = Blue-Green

6. FLAG LEAF (boot stage):

[1] 1 = Erect
2 = Recurved

[2] 1 = Not Twisted
2 = Twisted

[1] 1 = Wax Absent
2 = Wax Present

7. EAR EMERGENCE:

[1][5][0] Number of Days (Average)

[ ][1] Number of Days Earlier Than Madsen *

Same as _____ *

[ ][2] Number of Days Later Than Stephens *

9

* Relative to a PVPO-Approved Commercial Variety Grown in the Same Trial

8. ANTHER COLOR:

[1]
1 = Yellow
2 = Purple

9. PLANT HEIGHT (from soil to top of head, excluding awns):

[ ][9][3] cm (Average)

[ ][3] cm Taller Than Madsen *

Same as Weatherford *

[ ][ ] cm Shorter Than *

10. STEM:

A. ANTHOCYANIN

[1]
1= Absent
2 = Present

B. WAXY BLOOM

[1]
1 = Absent
2 = Present

C. HAIRINESS
(last internode of rachis)

[1]
1 = Absent
2 = Present

D. INTERNODE

[1] 1 = Hollow 2 = Semi-solid 3 = Solid

[4] Number of Nodes

E. PEDUNCLE

[3] 1 = Erect 2 = Recurved 3 = Semi-erect

[2][9] cm Length (Same as Stephens)

F. AURICLE

[1] Anthocyanin 1 = Absent 2 = Present

[1] Hair 1 = Absent 2 = Present

11. HEAD (at Maturity):

A. DENSITY

[2]
1 = Lax
2 = Middense (Laxidense)
3 = Dense

B. SHAPE

[1]
1 = Tapering
2 = Strap
3 = Clavate
4 = Other (SPECIFY):_____

C. CURVATURE

[2]
1 = Erect
2 = Inclined
3 = Recurved

D. AWNEDNESS

[4]
1 = Awnless
2 = Apically Awnletted
3 = Awnletted
4 = Awned

200300287

12. GLUMES (at Maturity):

A. COLOR

[1]
1 = White
2 = Tan
3 = Other (SPECIFY) : _____

B. SHOULDER

[1]
1 = Wanting 2 = Oblique
3 = Rounded 4 = Square
5 = Elevated 6 = Apiculate
7 = Other (SPECIFY):_____

C. SHOULDER WIDTH

[2]
1 = Narrow
2 = Medium
3 = Wide

D. BEAK

[3]
1 = Obtuse
2 = Acute
3 = Acuminate

E. BEAK WIDTH

[2]
1 = Narrow
2 = Medium
3 = Wide

F. GLUME LENGTH

[2]
1 = Short (ca. 7mm)
2 = Medium (ca. 8mm)
3 = Long (ca. 9mm)

G. WIDTH

[2]
1 = Narrow (ca. 3mm)
2 = Medium (ca. 3.5mm)
3 = Wide (ca. 4mm)

13. SEED

A. SHAPE

[2]
1 = Ovate
2 = Oval
3 = Elliptical

B. CHEEK

[1]
1 = Rounded
2 = Angular

C. BRUSH

[3]
1 = Short
2 = Medium
3 = Long

[2]
1 = Not Collared
2 = Collared

D. CREASE

[1]
1 = Width 60% or less of Kernel
2 = Width 80% or less of Kernel
3 = Width Nearly as Wide as Kernel

[2]
1 = Depth 20% or less of Kernel
2 = Depth 35% or less of Kernel
3 = Depth 50% or less of Kernel

E. COLOR

[1]
1 = White
2 = Amber
3 = Red
4 = Other (SPECIFY): _____

F. TEXTURE

[2]
1 = Hard
2 = Soft
3 = Other (SPECIFY): _____

G. PHENOL REACTION (*see instructions*):

[3,2]
1 = Ivory
2 = Fawn
3 = Light Brown
4 = Dark Brown
5 = Black

62% Light Brown
38% Ivory

H. SEED WEIGHT

[3][6] g/1000 seed (Whole number only)

I. GERM SIZE

[2]
1 = Small
2 = Midsize
3 = Large

14. Disease : (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE INDICATE THE SPECIFIC RACE OR STRAIN TESTED 200300287

| | | | |
|---|---|---|---|
| [0] | Stem Rust *(Puccinia graminis* f. sp. *tritici)* | [0] | Leaf Rust *(Puccinia recondita* f. sp. *tritici)* |
| [3] | Stripe Rust *(Puccinia striiformis)* field races | [0] | Loose Smut *(Ustilago tritici)* |
| [0] | Tan Spot *(Pyrenophora tritici-repentis)* | [0] | Flag Smut *(Urocystis agropyri)* |
| [0] | Halo Spot *(Selenophoma donacis)* | [2] | Common Bunt *(Tilletia tritici* or *T. laevis)* |
| [0] | *Septoria nodorum* (Glume Blotch) | [1] | Dwarf Bunt *(Tilletia controversa)* |
| [0] | *Septoria avenae* (Speckled Leaf Disease) | [0] | Karnal Bunt *(Tilletia indica)* |
| [1] | *Septoria tritici* (Speckled Leaf Blotch) | [0] | Powdery Mildew *(Erysiphe graminis* f. sp. *tritici)* |
| [0] | Scab (*Fusarium* spp.) | [0] | "Snow Molds" |
| [0] | "Black Point" (Kernel Smudge) | [3] | Common Root Rot *(Fusarium, Cochliobolus* and *Bipolaris* spp.*)* |
| [0] | Barley Yellow Dwarf Virus (BYDV) | [0] | Rhizoctonia Root Rot *(Rhizoctonia solani)* |
| [0] | Soilborne Mosaic Virus (SBMV) | [0] | Black Chaff *(Xanthomonas campestris* pv. *translucens)* |
| [0] | Wheat Yellow (Spindle Streak) Mosaic Virus | [0] | Bacterial Leaf Blight *(Pseudomonas syringae* pv. *syringae)* |
| [0] | Wheat Streak Mosaic Virus (WSMV) | [ ] | Other (SPECIFY) _____ |
| [ ] | Other (SPECIFY) _____ | [ ] | Other (SPECIFY) _____ |
| [ ] | Other (SPECIFY) _____ | [ ] | Other (SPECIFY) _____ |
| [ ] | Other (SPECIFY) _____ | [ ] | Other (SPECIFY) _____ |

15. INSECT: (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE SPECIFY BIOTYPE (where needed)

| | | | |
|---|---|---|---|
| [0] | Hessian Fly *(Mayetiola destructor)* | [ ] | Other (SPECIFY) _____ |
| [0] | Stem Sawfly *(Cephus* spp.) | [ ] | Other (SPECIFY) _____ |
| [0] | Cereal Leaf Beetle *(Oulema melanopa)* | [ ] | Other (SPECIFY) _____ |
| [0] | Russian Aphid *(Diuraphis noxia)* | [ ] | Other (SPECIFY) _____ |

15. INSECT: *Continued* (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE SPECIFY BIOTYPE (where needed) 200300287

| | | | |
|---|---|---|---|
| 0 | Greenbug *(Schizaphis graminum)* | ☐ | Other (SPECIFY) _____ |
| 0 | Aphids | ☐ | Other (SPECIFY) _____ |

16. ADDITIONAL INFORMATION ON ANY ITEM ABOVE, OR GENERAL COMMENTS

## Exhibit D. Additional Description of the Variety

'Tubbs' (PI 629114) is a soft white winter wheat (*Triticum aestivum L.*) developed and released by Oregon State University. Tubbs was released for its superior yield potential and broad adaptation to wheat growing areas of the Pacific Northwest. The name was chosen to recognize the leadership and contributions of Frank Tubbs to the Oregon wheat industry. Seed of Tubbs has been deposited in the USDA National Small Grains Collection, Aberdeen, Idaho. It is requested that the source of this material be acknowledged in future use by wheat breeding and genetics programs.

## Additional Information

Sources of data summarized in Table 1:

OSU Breeding Trials, 1998 through 2002 - total of 29 site/years

OSU Statewide Variety Trials, 1999 through 2002 - total of 31 site/years

USDA-ARS Uniform Western Regional Soft White Nursery, 1999 through 2000 - total of 25 site/years

Washington State Variety Trials, 2000 through 2002 - total of 54 site/years

N. Idaho State Variety Trials, 2000 through 2002 - total of 14 site/years

S. Idaho State Variety Trials, 2000 through 2001 - total of 10 site/years

Table 1. Balance paired t-tests for agronomic comparisons of Tubbs with check varieties Madsen, and Weatherford. Data is summarized from OSU breeding trials, USDA Western Regional Soft White Nursery, and State Variety Trials from Oregon, Washington, and Idaho for years 1998 through 2002.

| Check | Trait | N | Check mean | Tubbs mean | Std Error of difference | t-value for difference | Pr > t | Significance |
|---|---|---|---|---|---|---|---|---|
| Madsen | Test weight, lb/bu | 141 | 60.2 | 59.3 | 0.091 | 8.41 | <0.0001 | ** |
| Weatherford | Test weight, lb/bu | 104 | 60 | 59.4 | 0.093 | 8.17 | <0.0001 | ** |
| Madsen | Grain protein, % | 113 | 10.3 | 10 | 0.068 | 5.12 | <0.0001 | ** |
| Weatherford | Grain protein, % | 90 | 10.3 | 9.8 | 0.0775 | 6.3 | <0.0001 | ** |
| Madsen | Plant height, in | 72 | 35.5 | 36.7 | 0.1996 | -5.68 | <0.0001 | ** |
| Weatherford | Plant height, in | 53 | 37.57 | 37.01 | 0.2872 | 1.94 | 0.0572 | |
| Madsen | Heading date, from 1/1 | 42 | 155.4 | 154.2 | 0.255 | 4.86 | <0.0001 | ** |
| Weatherford | Heading date, from 1/1 | 33 | 154.1 | 153.2 | 0.348 | 2.7 | 0.011 | * |

*, ** indicate sigificance at P=0.05 and P=0.01, respectively; NS indicates not significant at P=0.05.

Table 2. Influence of Pseudocercosporella, Cephalosporium stripe, and Fusarium dryland footrot on yield and growth of OR939526 in innoculated trials.

| | Pseudocercosporella | | | Cephalosporium stripe | | | Fusarium dryland footrot | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5/24/2001 | | | 6/22/2001 | | | 1999-00 | | | 2000-01 | | |
| | | | | | | | | Grain yield | | | Grain yield | |
| | % lodging | | | % white heads | | | White-heads | Non-inoc. control | Yield loss | White-heads | Non-inoc. control | Yield loss |
| Name | Rep 1 | Rep 2 | average | Rep 1 | Rep 2 | Average | % | bu/a | % | % | bu/a | % |
| STEPHENS | 95 | 99 | 97 | 65 | 50 | 57.5 | 1 | 113 | 21 | 2 | 91 | 9 |
| MADSEN | 0 | 10 | 5 | 12 | 15 | 13.5 | 1 | 108 | 2 | 5 | 87 | 13 |
| WEATHERFORD | 0 | 60 | 30 | 25 | 18 | 21.5 | 1 | 118 | 5 | 3 | 84 | 10 |
| | | | | | | | | | | | | |
| **OR 939526** | **0** | **7** | **3.5** | **30** | **30** | **30** | **tr** | **120** | **4** | **1** | **91** | **14** |
| | | | | | | | | | | | | |
| Coda | | | | | | | 4 | 114 | 23 | -3 | 85 | 19 |
| Cashup | | | | 10 | 7 | 8.5 | | | | | | |
| Rod | | | | | | | 1 | 118 | 4 | 4 | 92 | 20 |
| Gene | | | | | | | 1 | 102 | 5 | 1 | 91 | 9 |
| | | | | | | | | | | | | |

Influence of Fusarium crown rot on yield of winter wheat, 1999-2001

R. Smiley, J. Peterson, J. Gourlie, R. Whittaker, L.Patterson, S. Easley, D. Thompson, and K. Rhinhart; Columbia Basin Agric. Research Center

Influence of Pseudocercosporella strawbreaker footrot and Cephalosporium stripe, 2001

C. Mundt, LaRae Wallace, J. Peterson; OSU Botany and Plant Pathology

TABLE 3. STRIPE RUST PERCENT (%) AND INFECTION TYPE (T) ON CULTIVARS AND LINES IN THE WINTER DISEASE NURSERY (EXP17) AT WHITLOW FARM NEAR PULLMAN, WA (LOC04) AND MT VERNON, WA, (LOC23) FOR 2000. Data provided by Dr. Chen, USDA-ARS, Pullman, WA.

| OSU Disease Nursery | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | LOC04 Whitlow farm 30-Jun STAGE 6 | | LOC23 Mt Vernon 19-Apr STAGE 3 | | LOC23 Mt Vernon 19-May STAGE 4 | | LOC02 OB Hill - Pullman 7-Jun Stage 6 | | LOC02 OB Hill - Pullman 30-Jun Stage 8 | |
| ID NUMBER | CULTIVAR OR CROSS | PLOT | % | T | % | T | % | T | % | T | % | T |
| SWEL001 | Stephens | 001 | 02 | 2 | 05 | 2 | 10 | 8 | | | | |
| SWEL002 | Madsen | 002 | 00 | 0 | 00 | 0 | 00 | 0 | | | | |
| SWEL003 | Gene | 003 | 00 | 0 | 00 | 0 | 10 | 8 | | | | |
| SWEL004 | Weatherford | 004 | 00 | 0 | 00 | 0 | 05 | 8 | | | | |
| | | | | | | | | | | | | |
| SWEL011 | OR939526 | 011 | 05 | 8 | 20 | 8 | 60 | 8 | | | | |
| | | | | | | | | | | | | |
| SWRAN01 | Stephens | 065 | 01 | 2 | 00 | 0 | 10 | 2 | | | | |
| SWRAN02 | Gene | 066 | 01 | 8 | 05 | 8 | 10 | 8 | | | | |
| SWRAN03 | Madsen | 067 | 00 | 0 | 00 | 0 | 00 | 0 | | | | |
| SWRAN04 | Weatherford | 068 | 00 | 0 | 00 | 0 | 00 | 0 | | | | |
| | | | | | | | | | | | | |
| HWEL02 | Eltan | 212 | 00 | 0 | 00 | 0 | 00 | 0 | | | | |
| HWEL03 | Nuplains | 213 | 80 | 8 | 05 | 5 | 20 | 8 | | | | |
| USDA Regional Disease Nursery | | | | | | | | | | | | |
| Regional | OR939526 | | 10 | 8 | 30 | 8 | 40 | 8 | 10 | 8 | 20 | 2=8 |
| | | | | | | | | | | | | |
| Regional | Malcom | | 0 | 0 | 30 | 2 | 30 | 2=5 | 5 | 2=5 | 5 | 2=5 |
| Regional | Stephens | | 0 | 0 | 5 | 2 | 5 | 2 | 0 | 0 | 5 | 2 |
| Regional | Madsen | | 0 | 0 | 5 | 2 | 5 | 2=5 | 0 | 0 | 0 | 0 |
| Regional | Weatherford | | 0 | 0 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 |
| Regional | Brundage | | 10 | 8 | 50 | 8 | 80 | 8 | 30 | 8 | 50 | 5=8 |

TABLE 3b. STRIPE RUST PERCENT (%) AND INFECTION TYPE (T); PETERSON DISEASE NURSERY (EXP05) AT WHITLOW FARM (LOC04) NEAR PULLMAN, WA AND MT VERNON, WA (LOC5) AT NOTED DATES AND STAGES OF PLANT GROWTH, 2001.
FIELD SUSCEPTIBILITY TO POWDERY MILDEW (PM) NOTED WITH 'X'. Provided by USDA-ARS, Pullman, WA.

| EXPT | ENTRY | PREID | CULTIVAR OR CROSS | PLOT | STRIPE RUST | | | | | | PM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | LOC04 | | LOC05 | | | | |
| | | | | | 5-Jul STAGE 6-7 | | 24-Apr STAGE 3 | | 23-May STAGE 4-5 | | |
| | | | | | % | T | % | T | % | T | |
| Check | | | WB470 | 001 | 05 | 8 | 30 | 8 | 80 | 8 | |
| SWELT | 1 | STEPHENS | STEPHENS | 002 | 00 | 0 | 05 | 2 | 05 | 2 | |
| SWELT | 2 | MADSEN | MADSEN | 003 | 00 | 0 | 02 | 2 | 00 | 0 | |
| SWELT | 3 | GENE | GENE | 004 | 00 | 0 | 02 | 2 | 05 | 8 | |
| SWELT | 4 | WEATHERFORD | WEATHERFORD | 005 | 00 | 0 | 05 | 2 | 02 | 2 | X |
| | | | | | | | | | | | |
| SWELT | 8 | OR 939526 | MADSEN/MALCOLM | 009 | 00 | 0 | 10 | 8 | 10 | 5 | |
| | | | | | | | | | | | |
| SWRAN | 1 | STEPHENS | STEPHENS | 053 | 00 | 0 | 02 | 2 | 05 | 2 | X |
| SWRAN | 2 | MADSEN | MADSEN | 054 | 00 | 0 | 02 | 2 | 00 | 0 | |
| SWRAN | 3 | GENE | GENE | 055 | 00 | 0 | 02 | 2 | 00 | 0 | |
| SWRAN | 4 | WEATHERFORD | WEATHERFORD | 056 | 01 | 5 | 02 | 2 | 02 | 2 | |
| | | | | | | | | | | | |
| Check | | | WB470 | 031 | 10 | 8 | 20 | 8 | 80 | 8 | |
| HWELT | 2 | ELTAN | ELTAN | 173 | 00 | 0 | 02 | 2 | 00 | 0 | X |
| HWELT | 3 | NuPlains | NUPLAINS (N94L205) | 174 | 01 | 8 | 15 | 8 | 60 | 8 | |

Table 4. Winterhardiness based on LT-50 calculations from crown freezing tests conducted by USDA-ARS, Pullman, WA.

| Experiment | KEY | Est. LT50 | U 95% | L 95% | Pr>Chi |
|---|---|---|---|---|---|
| LT50-31 | Bruehl | -11.42601 | -9.60 | -12.58 | 0.000 |
| LT50-31 | Coda | -13.60596 | -11.56 | -15.60 | 0.000 |
| LT50-31 | Edwin | -14.73997 | -13.51 | -16.01 | 0.000 |
| LT50-31 | Eltan | -18.82234 | -15.52 | -19.53 | 0.000 |
| LT50-31 | Madsen | -12.26766 | -0.80 | -13.35 | 0.000 |
| **LT50-31** | **OR939526** | **-11.29085** | **-9.34** | **-12.47** | **0.000** |
| LT50-31 | Rod | -10.99735 | -8.58 | -12.36 | 0.000 |
| LT50-31 | Stephens | -11.87175 | -10.65 | -12.81 | 0.000 |
| LT50-31 | Finch | -11.34851 | -9.98 | -12.30 | 0.000 |
| LT50-31 | Weatherford | -11.57885 | -9.79 | -12.73 | 0.000 |
| LT50-13 | Coda | -11.21 | -10.07 | -12.12 | 0.000 |
| LT50-13 | Eltan | -17.92 | -16.68 | -20.31 | 0.000 |
| LT50-13 | Madsen | -12.14 | -11.36 | -12.90 | 0.000 |
| LT50-13 | Rod | -11.89 | -10.98 | -12.74 | 0.000 |
| LT50-13 | Stephens | -11.99 | -9.69 | -14.68 | 0.003 |
| LT50-13 | Finch | -11.04 | -10.02 | -11.87 | 0.000 |
| LT50-24 | Coda | -14.27 | -12.97 | -16.18 | 0.001 |
| LT50-24 | Coda | -14.27 | -12.97 | -16.18 | 0.001 |
| LT50-24 | Eltan | -17.29 | -15.58 | -23.51 | 0.000 |
| LT50-24 | Eltan | -17.29 | -15.58 | -23.51 | 0.000 |
| LT50-24 | Gene | -8.36 | ** | ** | 0.790 |
| LT50-24 | Gene | -8.36 | ** | ** | 0.790 |
| LT50-24 | Madsen | -13.78 | -11.78 | -16.66 | 0.000 |
| LT50-24 | Madsen | -13.78 | -11.78 | -16.66 | 0.000 |

Table 5. Balance paired t-tests for end-use quality comparisons of Tubbs with check varieties Stephens, Madsen, and Weatherford. Data provided by USDA-Western Wheat Quality Laboratory, Pullman, WA. Data if summarized for years 1995 through 2001. Grain samples were obtained from OSU breeding trials and USDA-ARS Western Regional Soft White Nursery.

| Check | Trait | N | Check mean | Tubbs mean | Std Error of difference | t-value for difference | Pr > t | Significance |
|---|---|---|---|---|---|---|---|---|
| Stephens | Grain hardness, SKCS | 14 | 27.7 | 40.8 | 1.607 | -8.17 | <0.0001 | ** |
| Madsen | Grain hardness, SKCS | 9 | 37.8 | 41.6 | 1.343 | -2.83 | 0.0221 | * |
| Weatherford | Grain hardness, SKCS | 10 | 36.9 | 38.8 | 2.003 | -0.96 | 0.363 | NS |
| Stephens | Break Flour Yld, % | 14 | 46.6 | 46.9 | 0.469 | -0.49 | 0.634 | NS |
| Madsen | Break Flour Yld, % | 9 | 50.2 | 47.9 | 0.557 | 4.23 | 0.0029 | ** |
| Weatherford | Break Flour Yld, % | 9 | 48.4 | 48.3 | 1.06 | 0.08 | 0.935 | NS |
| Stephens | Flour Yield, % | 13 | 71.1 | 71.7 | 0.568 | -1.08 | 0.2996 | NS |
| Madsen | Flour Yield, % | 8 | 71.7 | 71.6 | 0.878 | 0.13 | 0.9017 | NS |
| Weatherford | Flour Yield, % | 9 | 71.4 | 71.8 | 0.748 | -0.64 | 0.5406 | NS |
| Stephens | Flour ash, % | 14 | 0.4 | 0.4 | 0.007 | 0 | 1 | NS |
| Madsen | Flour ash, % | 9 | 0.4 | 0.39 | 0.009 | 0.37 | 0.72 | NS |
| Weatherford | Flour ash, % | 10 | 0.42 | 0.41 | 0.011 | 1.3 | 0.2259 | NS |
| Stephens | Cookie Diameter, cm | 14 | 9.2 | 9 | 0.082 | 2.84 | 0.0141 | * |
| Madsen | Cookie Diameter, cm | 8 | 9.2 | 9 | 0.08 | 2.26 | 0.0586 | NS |
| Weatherford | Cookie Diameter, cm | 10 | 8.9 | 9 | 0.053 | -1.69 | 0.1261 | NS |
| Stephens | Sponge cake vol., cc | 3 | 1138 | 1231 | 39.3 | -2.37 | 0.1408 | NS |
| Madsen | Sponge cake vol., cc | 2 | 1215 | 1220 | 42.5 | -1.24 | 0.4332 | NS |
| Weatherford | Sponge cake vol., cc | 1 | 1182 | 1235 | . | . | . | . |

*, ** indicate sigificance at P=0.05 and P=0.01, respectively; NS indicates not significant at P=0.05.

Oregon State University Seed Laboratory
Corvallis, Oregon 97331
(Member Association of Official Seed Analysts)
Phone: (541) 737-4464
Fax: (541) 737-2126
http://www.oscs.orst.edu

200300287

# Report of Seed Analysis

NAMES AND ADDRESSES:
**Jim Peterson**
**OSU CROP & SOIL SCIENCE**
**ROOM 231B**
**CORVALLIS OR 97331**

| DATE RECEIVED | DATE COMPLETED | TEST NO |
|---|---|---|
| 04-23-2003 | 04-24-2003 | 64492 |

**SENDERS INFORMATION***

KIND: **Wheat**
VARIETY:
GENUS/SPECIES: **Triticum aestivum**
LOT NUMBER: **TUBBS**
SIZE OF LOT: **Not Stated**
FIELD NUMBER: **Not Stated**
SAMPLE TYPE: **Commercial**
OTHER INFORMATION: **02-P; Drill Strip**

*The information provided here is that of the sender and not of the laboratory.

**This sample has been examined for:** **PHENOL STAINING REACTION**

**Found:**

**Phenol Color Reaction:**

| | |
|---|---|
| **Ivory** | **38.0%** |
| **Fawn** | **0.00%** |
| **Light Brown** | **62.0%** |
| **Brown** | **0.00%** |
| **Brown-Black** | **0.00%** |
| **Mixture** | **0.00%** |

TEST CODES AND FEES: **ph-$45.00**

RULES FOLLOWED OTHER THAN AOSA: _____ SIGNATURE _____ 22

The purity and germination test results reported on this form have been carried out in accordance with AOSA rules unless otherwise specified. Test results reflect the condition of the submitted sample and may not reflect the condition of the seed lot from which the sample was taken.

REPRODUCE LOCALLY. Include form number and edition date on all reproductions. FORM APPROVED - OMB No. 0581-0055

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

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER: OR939526

3. VARIETY NAME: Tubbs

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

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

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

7. PVPO NUMBER: 200300287

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

10. Is the applicant the original owner? [XX] 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)?
[XX] 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?
[XX] 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)*:

**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.