New Wheat Varieties

**Tubbs**

Soft White Winter Wheat

Michael Flowers, C. James Peterson, Andrew Hulting, John Burns, Stephen Guy, and John Kuehner

**Variety description**

‘Tubbs’ is a common soft white winter wheat developed by Oregon State University in cooperation with the USDA Agricultural Research Service (USDA-ARS). It is an awned, short-statured, semidwarf variety with broad adaptation, high yield potential, and midseason maturity. Tubbs is resistant to *Pseudocercosporella* strawbreaker (eyespot) foot rot and moderately susceptible to current races of stripe rust (*Puccinia striiformis*) and *Fusarium* crown rot (dryland foot rot). The name Tubbs was chosen to recognize the leadership and contributions of Frank Tubbs to the Oregon wheat industry.

**Area of adaptation**

Tubbs is best adapted to dryland and irrigated wheat-growing regions in northeast Oregon and southeast Washington (Figure 1, blue-shaded regions). It is also adapted to a larger production region in Oregon and Washington (red-shaded regions). However, in these additional areas, Tubbs is at a greater risk of yield loss from diseases such as *Septoria*, snow mold, or stripe rust.

Figure 1. Regions of Oregon and Washington where Tubbs is best adapted (blue) and secondary regions of adaptation where Tubbs can be grown (red).

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Year released
Tubbs was released in 2002 and is protected under the Plant Variety Protection Act without the Title 5 option.

Agronomic characteristics

Height and lodging resistance
In trials over 19 site-years in Oregon and 37 site-years in Washington, the plant height of Tubbs averaged 36.2 and 36.1 inches, respectively. Its height is similar to that of ORCF-102, Tubbs 06, and Eltan and approximately 1–3 inches taller than AP 700 CL, Brundage 96, Madsen, Masami, ORCF-101, Salute, Stephens, and Xerpha (Tables 1 and 2). Straw strength of Tubbs is very good, and lodging has not been a constraint in any production environment.

Maturity
Tubbs is a midseason-maturing variety, similar to Brundage 96, ORCF-101, ORCF-102, Salute, Skiles, and Tubbs 06. It heads approximately 2–4 days earlier than Madsen, Masami, and Xerpha. Tubbs heads 2 days later than Stephens and 3–4 days later than Goetze and Westbred 528 (Tables 1 and 2).

Table 1. Grain yield and agronomic data for 14 soft white winter wheat varieties grown across a range of environments in Oregon, 2006–2008.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Grain yield (bu/acre)</th>
<th>Agronomic data (2-year mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Northeast Oregon</td>
<td>Oregon</td>
</tr>
<tr>
<td></td>
<td>2-year mean</td>
<td>14 site-years</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tubbs</td>
<td>76.4</td>
<td>76.7</td>
</tr>
<tr>
<td>AP 700 CL</td>
<td>78.7</td>
<td>—</td>
</tr>
<tr>
<td>Brundage 96</td>
<td>80.2</td>
<td>77.3</td>
</tr>
<tr>
<td>Goetze</td>
<td>81.8</td>
<td>77.9</td>
</tr>
<tr>
<td>Madsen</td>
<td>72.2</td>
<td>71.4</td>
</tr>
<tr>
<td>ORCF-101</td>
<td>76.3</td>
<td>75.2</td>
</tr>
<tr>
<td>ORCF-102</td>
<td>82.6</td>
<td>80.6</td>
</tr>
<tr>
<td>ORCF-103</td>
<td>81.8</td>
<td>79.1</td>
</tr>
<tr>
<td>Salute</td>
<td>83.4</td>
<td>94.6</td>
</tr>
<tr>
<td>Skiles</td>
<td>81.6</td>
<td>85.2</td>
</tr>
<tr>
<td>Stephens</td>
<td>75.7</td>
<td>74.5</td>
</tr>
<tr>
<td>Tubbs 06</td>
<td>81.3</td>
<td>79.8</td>
</tr>
<tr>
<td>Westbred 528</td>
<td>82.5</td>
<td>81.5</td>
</tr>
<tr>
<td>Xerpha</td>
<td>87.4</td>
<td>—</td>
</tr>
<tr>
<td>Mean</td>
<td>79.5</td>
<td>77.3</td>
</tr>
<tr>
<td>LSDb (0.05)</td>
<td>3.3</td>
<td>2.5</td>
</tr>
<tr>
<td>CVc (%)</td>
<td>10.0</td>
<td>9.6</td>
</tr>
</tbody>
</table>

a Oregon Winter Elite Yield Trials
b Day of year
c Least significant difference
d Coefficient of variation

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Vernalization and cold tolerance

Tubbs is a winter wheat that requires vernalization to initiate flowering. Results from crown freezing tests (a measure of cold tolerance) conducted by the USDA-ARS have shown that the cold tolerance of Tubbs is similar to that of Madsen, Masami, ORCF-102, and Tubbs 06 (Table 3). Under typical conditions, growers in northeast Oregon and southeast Washington are unlikely to observe winter injury.

Disease resistance

Tubbs is resistant to strawbreaker (eyespot) foot rot. It is moderately susceptible to stripe and leaf rust, *Fusarium* crown rot (dryland foot rot), and *Septoria* leaf blotch. It is susceptible to *Cephalosporium* stripe and snow mold (Table 3). A fungicidal seed treatment is recommended to control common bunt and other seedborne diseases.

Table 2. Grain yield and agronomic data for 11 soft white winter wheat varieties grown across a range of environments in Washington, 2005–2007.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Grain yield (bu/ac)</th>
<th>Test weight (lb/bu)</th>
<th>Grain protein (%)</th>
<th>Plant height (in)</th>
<th>Heading date (DOY)a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-year mean</td>
<td>3-year mean</td>
<td>2-year mean</td>
<td>3-year mean</td>
<td></td>
</tr>
<tr>
<td>Tubbs</td>
<td>107.5</td>
<td>108.3</td>
<td>107.5</td>
<td>110.4</td>
<td>58.5</td>
</tr>
<tr>
<td>Brundage</td>
<td>96.0</td>
<td>99.5</td>
<td>103.1</td>
<td>103.8</td>
<td>58.5</td>
</tr>
<tr>
<td>Eltan</td>
<td>97.3</td>
<td>96.0</td>
<td>99.3</td>
<td>97.7</td>
<td>59.3</td>
</tr>
<tr>
<td>Madsen</td>
<td>98.2</td>
<td>103.0</td>
<td>98.4</td>
<td>102.1</td>
<td>59.1</td>
</tr>
<tr>
<td>Masami</td>
<td>101.7</td>
<td>104.3</td>
<td>102.0</td>
<td>104.5</td>
<td>58.1</td>
</tr>
<tr>
<td>ORCF-101</td>
<td>95.7</td>
<td>102.0</td>
<td>96.2</td>
<td>101.3</td>
<td>59.1</td>
</tr>
<tr>
<td>ORCF-102</td>
<td>105.8</td>
<td>110.2</td>
<td>105.3</td>
<td>108.4</td>
<td>59.9</td>
</tr>
<tr>
<td>Stephens</td>
<td>98.9</td>
<td>102.5</td>
<td>97.7</td>
<td>101.1</td>
<td>58.9</td>
</tr>
<tr>
<td>Tubbs 06</td>
<td>102.9</td>
<td>—</td>
<td>103.7</td>
<td>—</td>
<td>58.3</td>
</tr>
<tr>
<td>Westbred 528</td>
<td>103.0</td>
<td>102.8</td>
<td>101.1</td>
<td>102.4</td>
<td>60.8</td>
</tr>
<tr>
<td>Xerpha</td>
<td>103.5</td>
<td>—</td>
<td>109.9</td>
<td>—</td>
<td>59.0</td>
</tr>
<tr>
<td>Mean</td>
<td>101.4</td>
<td>103.9</td>
<td>102.1</td>
<td>103.5</td>
<td>59.0</td>
</tr>
<tr>
<td>LSDb (0.05)</td>
<td>2.7</td>
<td>2.4</td>
<td>2.4</td>
<td>2.1</td>
<td>0.2</td>
</tr>
<tr>
<td>CVc (%)</td>
<td>10.7</td>
<td>11.0</td>
<td>10.5</td>
<td>10.9</td>
<td>1.7</td>
</tr>
</tbody>
</table>

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*a* Day of year  
*b* Least significant difference  
*c* Coefficient of variation
Table 3. Agronomic and disease ratings for soft white winter wheat varieties grown in Oregon and Washington.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Maturity</th>
<th>Winter hardiness</th>
<th>Rust</th>
<th>Septoria</th>
<th>Crown rot</th>
<th>Cephalosporium stripe</th>
<th>Strawbreaker foot rot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubbs</td>
<td>Midseason</td>
<td>5</td>
<td>MS</td>
<td>S</td>
<td>S</td>
<td>R</td>
<td>MR/MS</td>
</tr>
<tr>
<td>AP 700 CL</td>
<td>Midseason</td>
<td>5</td>
<td>MR</td>
<td>R</td>
<td>MS</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Brundage 96</td>
<td>Midseason</td>
<td>5</td>
<td>MR</td>
<td>MS</td>
<td>MR/MS</td>
<td>S</td>
<td>MR/MS</td>
</tr>
<tr>
<td>Eltan</td>
<td>Mid–late</td>
<td>9</td>
<td>MR</td>
<td>S</td>
<td>MS/MS</td>
<td>MR/MS</td>
<td></td>
</tr>
<tr>
<td>Goetze</td>
<td>Early–mid</td>
<td>2</td>
<td>R</td>
<td>MR</td>
<td>MR</td>
<td>MS</td>
<td></td>
</tr>
<tr>
<td>Madsen</td>
<td>Midseason</td>
<td>5</td>
<td>MR</td>
<td>S</td>
<td>MR</td>
<td>MR/MS</td>
<td></td>
</tr>
<tr>
<td>Masami</td>
<td>Midseason</td>
<td>5</td>
<td>MS</td>
<td>S</td>
<td>MR</td>
<td>MR/MS</td>
<td></td>
</tr>
<tr>
<td>ORCF-101</td>
<td>Midseason</td>
<td>5</td>
<td>MS</td>
<td>S</td>
<td>R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORCF-102</td>
<td>Midseason</td>
<td>5</td>
<td>R/MR</td>
<td>MR</td>
<td>MS/MS</td>
<td>MR/MS</td>
<td></td>
</tr>
<tr>
<td>ORCF-103</td>
<td>Midseason</td>
<td>4</td>
<td>R/MR</td>
<td>MR</td>
<td>MS/MS</td>
<td>MR/MS</td>
<td></td>
</tr>
<tr>
<td>ORCF-104</td>
<td>Midseason</td>
<td>8</td>
<td>R/MR</td>
<td>—</td>
<td>MS/MS</td>
<td>MR/MS</td>
<td></td>
</tr>
<tr>
<td>Salado</td>
<td>Midseason</td>
<td>8</td>
<td>R</td>
<td>—</td>
<td>MS</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Salix</td>
<td>Midseason</td>
<td>8</td>
<td>R</td>
<td>—</td>
<td>MS</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Stephens</td>
<td>Early–mid</td>
<td>8</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Tubbs 06</td>
<td>Midseason</td>
<td>5</td>
<td>MR/MS</td>
<td>MS</td>
<td>MS</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Westbred 28</td>
<td>Early–mid</td>
<td>4</td>
<td>MS/MS</td>
<td>MS</td>
<td>S</td>
<td>S</td>
<td></td>
</tr>
<tr>
<td>Xerper</td>
<td>Midseason</td>
<td>7</td>
<td>MR</td>
<td>—</td>
<td>MS</td>
<td>MR/MS</td>
<td></td>
</tr>
</tbody>
</table>


a Scale: 1–10 (10 = excellent; 1 = poor)

b R = resistant; MR = moderately resistant; MS = moderately susceptible; S = susceptible
Test weight and quality

The test weight of Tubbs averaged 58.8 pounds per bushel across 21 site-years in Oregon and 58.5 pounds per bushel across 37 site-years in Washington. These test weights are similar to those for Salute, Masami, Stephens, and Tubbs 06. Test weight of Tubbs was approximately 1–1.5 pounds per bushel less than ORCF-102, Skiles, and Westbred 528.

Grain protein of Tubbs in these trials averaged 9.4% in Oregon and 10.8% in Washington, similar to Brundage 96, Masami, Tubbs 06, and Xerpha.

Milling and baking evaluations from the USDA-ARS Western Wheat Quality Laboratory and the Pacific Northwest Wheat Quality Council suggest that Tubbs is similar to Madsen for important grain quality attributes and is acceptable for the soft white market class. Grain hardness values for Tubbs are similar to Madsen and 10 points higher than Stephens when measured with the Pertin Single Kernel Characterization System. Average break flour yields were similar to that for Stephens. The overall milling score for Tubbs was similar to that of Madsen. The average flour protein content of Tubbs was 0.5% and 0.8% lower than Stephens and Madsen, respectively. The average cookie spread for Tubbs was 0.14 and 0.21 centimeters less than Madsen and Stephens, respectively. Flour swelling volume tests suggest Tubbs has normal starch properties (Table 4).

Development

Tubbs was derived from the cross ‘Madsen’/‘Malcolm’ made in 1990 at the OSU Hyslop Field research farm, Corvallis, Oregon. Tubbs is an F3-derived line, identified in 1994 when it was selected from an F4 headrow at the OSU breeding site located near Pendleton, Oregon. The selection was evaluated under the experimental number OR939526.

Table 4: End-use quality analyses of Tubbs soft white winter wheat in paired comparisons with Stephens and Madsen.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Kernel hardness (SKCS)</th>
<th>Break flour yield (%)</th>
<th>Flour yield (%)</th>
<th>Flour ash (%)</th>
<th>Milling score</th>
<th>Flour protein (%)</th>
<th>Mix absorption (%)</th>
<th>Cookie diameter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubbs</td>
<td>41.3a</td>
<td>47.9</td>
<td>68.7</td>
<td>0.42</td>
<td>81.9</td>
<td>8.7b</td>
<td>55.1</td>
<td>9.15</td>
</tr>
<tr>
<td>Stephens</td>
<td>31.6b</td>
<td>47.8</td>
<td>69.3</td>
<td>0.40b</td>
<td>84.0b</td>
<td>9.2</td>
<td>55.3</td>
<td>9.36b</td>
</tr>
<tr>
<td>Tubbs</td>
<td>41.3</td>
<td>47.3</td>
<td>68.2</td>
<td>0.42</td>
<td>81.5</td>
<td>8.3b</td>
<td>55.0</td>
<td>9.16</td>
</tr>
<tr>
<td>Madsen</td>
<td>41.3</td>
<td>48.9b</td>
<td>68.8</td>
<td>0.41</td>
<td>82.7</td>
<td>9.1</td>
<td>55.2</td>
<td>9.30b</td>
</tr>
</tbody>
</table>

Data provided by USDA-ARS Western Wheat Quality Laboratory, Pullman, Washington.

a Single Kernel Characterization System
b Statistically significant difference ($p < 0.05$), based on a paired $t$-test

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Seed availability

Breeder and Foundation seed will be maintained by the Washington State Crop Improvement Association. Tubbs is protected under U.S. Plant Variety Protection without the Title 5 option (PVP 200300287). Certification classes recognized for Tubbs include Foundation, Registered, and Certified.

Seed of Tubbs has been deposited in the USDA National Small Grains Collection, Aberdeen, Idaho (PI 629114). It is requested that the source of this material be acknowledged in future use by wheat breeding and genetics programs.

Acknowledgments

Appreciation is extended to the Oregon Wheat Commission for financial support in the development of Tubbs.

Variety development team

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