Research Questions

The objectives of this proposal are to i) develop improved varieties and germplasm combining high grain yield, disease resistance, and end-use quality; and ii) provide performance data on wheat varieties adapted to the state of Minnesota.

Results

During the 2010/2011 crossing cycle, 352 crosses were made. The Variety Trial, which contained 32 released varieties, 9 University of Minnesota experimental lines, and 4 experimental lines from other programs was grown at Crookston, Fergus Falls, Hallock, Lamberton, Morris, Oklee, Roseau, St. Paul, Stephen, Strathcona, and Waseca. During the 2011 growing season, 160 advanced experimental lines were evaluated in advanced yield trials at 10 locations. A total of 533 preliminary yield trial lines were tested in unreplicated plots at Crookston, Morris, and St. Paul. Fusarium-inoculated, misted nurseries were established at Crookston, and St. Paul. Inoculated leaf rust nurseries were conducted at Crookston and St. Paul and a stem rust nursery was also conducted at St. Paul. The disease nurseries involve collaboration with agronomists and pathologists at Crookston and with personnel from the Plant Pathology Department and the USDA-ARS. Data from the yield and scab nurseries are summarized and published in Prairie Grains and the U of M Extension Service’s Minnesota Varietal Trials Results.

The breeding program expanded the number of yield plots grown in 2011 vs. 2010. A total of 6,628 yield plots were planted in 2011 compared with 5,683 in 2010. This increase was due to 1) increasing the number of 1st year yield trial lines from 437 to 533; and 2) increasing the number of locations where 2nd year yield trial lines were evaluated from 5 to 10.

One advanced experimental line, MN03196, underwent a seed increase via Minnesota Crop Improvement Association in 2011. MN03196 has good straw strength, high test weight, competitive grain yield in the northern regions of the state, and grain protein content intermediate between RB07 and Faller (Table 1). MN03196’s good leaf rust resistance is due to genes other than Lr21. Varieties that contain gene Lr21, especially Faller and Prosper, are susceptible to leaf rust races that have increased since 2010. MN03196 is a candidate for 2012 release.

Table 1. Comparison of MN03196 with higher yielding varieties, RB07, and Rollag. Genotypes are in order by yield.

<table>
<thead>
<tr>
<th>Line</th>
<th>Release Year</th>
<th>Grain Yield, North 3 Yr (Bu/A)*</th>
<th>Protein</th>
<th>Test Wt.</th>
<th>Straw Strength (1-9)</th>
<th>Scab (1-9)</th>
<th>Leaf Rust (1-9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albany</td>
<td>2009</td>
<td>90.9</td>
<td>13.9</td>
<td>59.4</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Faller</td>
<td>2007</td>
<td>87.2</td>
<td>14.4</td>
<td>58.9</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Samson</td>
<td>2007</td>
<td>84.2</td>
<td>14.3</td>
<td>58.3</td>
<td>3</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>MN03196</td>
<td>–</td>
<td>80.4</td>
<td>14.6</td>
<td>60.7</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Jenna</td>
<td>2009</td>
<td>80.4</td>
<td>14.8</td>
<td>59.0</td>
<td>4</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>RB07</td>
<td>2007</td>
<td>78.5</td>
<td>14.7</td>
<td>59.0</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Rollag</td>
<td>2011</td>
<td>77.4</td>
<td>15.1</td>
<td>60.1</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

* 20 environments from 2009-2011.
Two other experimental lines were approved for winter increase in 2011/2012: **MN06028** (MN97695-4/Ada) is short, and has very strong straw, high protein, and excellent end-use quality. Yield is above average and scab resistance is average. **MN07098-6** (SD3696/Ulen sel) has been a consistent high yielder with good adaptation across the entire state and good scab resistance. **MN07098-6** has higher grain protein than the varieties with higher yield. End-use quality and pre-harvest sprouting reaction of MN07098-6 is below average.

**Application/Use**

Experimental lines that show improvement over currently available varieties are recommended for release. Improved germplasm is shared with other breeding programs in the region. Scientific information related to efficiency of breeding for particular criteria is presented at local, regional, national, and international meetings and published.

**Materials and Methods**

All yield nurseries are grown in small, replicated plots (typically 40–50 sq. ft. harvested area per plot). Fusarium-inoculated nurseries at Crookston and St. Paul consist of single 4 to 6 ft. rows, with 1 to 3 replications. Fusarium-infected corn seed or spray-applied macroconidia are used as inoculum. The plot areas are misted periodically to maintain a high humidity environment for at least three weeks after anthesis.

**Economic Benefit to a Typical 500 Acre Wheat Enterprise**

Choice of variety is one of the most important decisions growers make each year. The development of high-yielding varieties that are resistant to the prevalent diseases and have good end-use quality are necessary to increase grower profit and protect against constantly changing pathogens and pests. As an example, a new variety that yields 4% higher will produce 3 extra bushels in a field that averages 75 bu/A.

**Related Research**

These funds provide general support for our breeding/genetics program. Additional monetary support for breeding-related research in 2011 came from the Minnesota Small Grains Initiative and Rapid Agricultural Response fund via the Minnesota Agricultural Experiment Station, the U.S. Wheat and Barley Scab Initiative via USDA-ARS, and National Research Initiative Competitive Grant no. 2011-68002-30029 (Triticaceae-CAP) from the USDA National Institute of Food and Agriculture.

**Publications**


