Expanded Wheat Breeding and Genetics

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Research Question

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 2009/2010 crossing cycle, 176 crosses were made. The Variety Trial, which contained 30 released varieties, 11 University of Minnesota experimental lines, and 4 experimental lines from other programs was grown at Crookston, Fergus Falls, Hallock, Lamberton, Morris, Oklee, Perley, Roseau, St. Paul, Stephen, Strathcona, and Waseca. During the 2010 growing season, 132 advanced experimental lines were evaluated in advanced yield trials at five to nine locations. A total of 437 preliminary yield trial lines were tested in unreplicated plots at Crookston, Morris, and St. Paul. Fusarium-inoculated, misted nurseries were established at Crookston, Morris, 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 Morris 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.

One advanced experimental line, MN05214-3 underwent a seed increase via Minnesota Crop Improvement Association in 2010. MN05214-3 has excellent straw strength and scab resistance equivalent to the best varieties available today. MN05214-3 has above average grain protein, similar to RB07. The grain yields of MN05214-3 are less than the highest varieties available, but in the northern region where it is best adapted it outyields all varieties that have the same scab resistance rating (3 on 1-9 scale). MN05214-3 is a candidate for 2011 release.

Experimental line MN03196 was approved for winter increase during 2010/2011. MN03196 (Alsen-1//Parshall/MN97665) is a competitive yiellder, placing 3rd in northern region yields in 2010 and 5th in the 3-year average (Table 1). Protein is below average, equal to Faller, less than RB07.

MN03196 has some unique characteristics, having much higher test weight than the other lines, and equal or better straw strength. MN03196 also contains different genes for leaf rust resistance compared to Faller and RB07, the state’s two leading varieties in acreage.

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, Morris, 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 comes from the Minnesota Small Grains Initiative and Rapid Agricultural Response fund via the Minnesota Agricultural Experiment Station and the U.S. Wheat and Barley Scab Initiative via USDA-ARS.

Publications


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

<table>
<thead>
<tr>
<th>Line</th>
<th>Release Year</th>
<th>2010</th>
<th>3 Year</th>
<th>Protein</th>
<th>Test Wt.</th>
<th>Straw Strength</th>
<th>Scab</th>
<th>Leaf rust</th>
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<tbody>
<tr>
<td>Albany</td>
<td>2009</td>
<td>98.5</td>
<td>96.6</td>
<td>13.9</td>
<td>60.8</td>
<td>4</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Faller</td>
<td>2007</td>
<td>90.5</td>
<td>93.7</td>
<td>14.5</td>
<td>60.5</td>
<td>5</td>
<td>4</td>
<td>2</td>
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<tr>
<td>Samson</td>
<td>2007</td>
<td>87.2</td>
<td>90.3</td>
<td>14.1</td>
<td>59.6</td>
<td>3</td>
<td>7</td>
<td>5</td>
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<tr>
<td>Jenna</td>
<td>2009</td>
<td>77.2</td>
<td>89.8</td>
<td>14.7</td>
<td>59.9</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>MN03196</td>
<td>-</td>
<td>88.0</td>
<td>87.4</td>
<td>14.5</td>
<td>62.2</td>
<td>3</td>
<td>5</td>
<td>2</td>
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<tr>
<td>RB07</td>
<td>2007</td>
<td>82.0</td>
<td>86.7</td>
<td>15.1</td>
<td>60.2</td>
<td>5</td>
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* 21 environments from 2008 - 2010