Improving food security and coping with biotic and abiotic constraints using improved crop germplasm in Central Asia and the Caucasus

Ram Sharma
Zakir Khalikulov
ICARDA-CAC

Scope of presentation

1. Constraints to winter crop production under climate change
2. Germplasm introduction
3. Progress on yellow rust resistant wheat varieties
4. Progress on salinity tolerant wheat
5. Out-scaling of improved varieties
6. Capacity development
Constraints to winter crop production under climate change

Climate and Constraints

• 2009: mild and wet winter, cool and wet spring
  – Severe epidemics of yellow rust
  – Moderate epidemics of leaf rust

• 2010: mild winter, wet spring followed by high temperatures in spring
  – Severe epidemics of yellow rust
  – Terminal heat stress

• 2011: dry autumn, winter and spring followed by high temperatures in spring
  – All season drought
  – Terminal heat stress
## Germplasm Introduction: 2011

<table>
<thead>
<tr>
<th>Crop</th>
<th>Nursery No.</th>
<th>Set</th>
<th>Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread Wheat</td>
<td>20</td>
<td>58</td>
<td>1126</td>
</tr>
<tr>
<td>Durum</td>
<td>2</td>
<td>10</td>
<td>124</td>
</tr>
<tr>
<td>Barley</td>
<td>27</td>
<td>112</td>
<td>740</td>
</tr>
<tr>
<td>Chickpea</td>
<td>7</td>
<td>35</td>
<td>280</td>
</tr>
<tr>
<td>Lentil</td>
<td>10</td>
<td>26</td>
<td>355</td>
</tr>
<tr>
<td>Faba bean</td>
<td>3</td>
<td>4</td>
<td>56</td>
</tr>
<tr>
<td>Grasspea</td>
<td>2</td>
<td>3</td>
<td>41</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>71</strong></td>
<td><strong>248</strong></td>
<td><strong>2722</strong></td>
</tr>
</tbody>
</table>

### Germplasm Introduction:

- High yield
  - Under fully irrigated condition
  - Under supplementary irrigated condition
  - Under rainfed condition
- Improved quality
- Drought / heat / salinity / cold tolerance
  - Yellow rust, *Ug99*
- Resistance to prevalent diseases and insect pests
- Early to medium maturity
- Superior for other agronomic traits
## Progress on Wheat Yellow Rust Resistance

<table>
<thead>
<tr>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 23 lines YR resistant and high yield selected in field in Uzbekistan</td>
<td>• 23 lines remained resistant to YR under greenhouse screening in Kazakhstan</td>
</tr>
<tr>
<td>• Seed distributed to NARS partners in the CAC</td>
<td>• 2 lines are going to be submitted to SVTC in Uzbekistan</td>
</tr>
<tr>
<td>• 3 resistant varieties provided to SVTC in Uzbekistan</td>
<td>• Resistant lines being used in crossing program</td>
</tr>
</tbody>
</table>

- 3 resistant varieties provided to SVTC in Uzbekistan

- Resistant lines being used in crossing program
Wheat Rust Surveillance and Screening for stem rust Ug99

- Rust surveillance conducted in Azerbaijan, Georgia, Tajikistan and Uzbekistan
- Advanced breeding lines sent to Kenya for screening against stem rust Ug99

Salinity Tolerant Winter Wheat Greenhouse Screening, ICARDA, Aleppo
Salinity Tolerant Winter Wheat
Field Testing Central Asia

Progress on Salinity Tolerance Wheat

<table>
<thead>
<tr>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 400 lines were tested in Uzbekistan</td>
<td>• 120 breeding lines were tested in Uzbekistan, Kazakhstan and Turkmenistan</td>
</tr>
<tr>
<td>• Salinity tolerant lines were selected for further testing</td>
<td>• 20 tolerant lines were identified for low to medium salinity</td>
</tr>
</tbody>
</table>
Outscaling of improved crop varieties

- Chickpea
  - Tajikistan, Uzbekistan, Armenia, Georgia and Kazakhstan
- Salinity tolerant Dustlik wheat
  - Uzbekistan
- Pulodi barley
  - Tajikistan

Autumn planting of chickpea becoming popular

*Autumn vs. spring planting*

Planted on 19 Dec, crop maturity in May

Winter-kill of susceptible lines
New Chickpea Variety – Tajikistan, 2011

Sino

Capacity Building – Synthetic Wheat
Use of GreenSeeker
Capacity Building – Synthetic Wheat
Salinity Measurement

Capacity Building - Azerbaijan
Training of Young Researchers

Germplasm Characterization Using Modern and Conventional Tools
9-16 June 2011, Baku, Azerbaijan
Capacity Building
Training of Young Researchers

Field Plot Experimental Design and Analysis
14-26 February 2011
Tashkent, Uzbekistan

Capacity Building
Training of Young Researchers

PGR Characterization Using Modern and Conventional Tools
3-9 April 2011
Tbilisi, Georgia
Capacity Building Participation in Yellow Rust Conference ICARDA, Aleppo, 18-24 April 2011

PhD Scholars

1. Selecting Ug99 and stripe rust resistant winter wheat varieties
2. Stability analysis of quality traits in winter wheat
3. Effect of harvesting date on quality traits in winter wheat
4. Comparative analysis of traits associated with rainfed and irrigated durum genotypes

PhD Scholars Wheat Improvement
Wheat Breeders’ Field Day
(16 May 2011, Uzbekistan)

Winter Wheat Travelling Seminar
(1-6 June 2011, Turkey, Bulgaria, Romania)
Summary

1. Constraints to winter crop production under climate change
2. Germplasm introduction
3. Progress on yellow rust resistant wheat varieties
4. Progress on salinity tolerant wheat
5. Out-scaling of improved varieties
6. Capacity development