Hybrid Rice Promotion Strategy in South and SE Asia

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Outline

• Hybrid rice production in China

• Hybrid rice in the World

• CNRRI’s Hybrid Rice in South & SE Asia
Rice to us, Chinese...

- Staple food for over 60% of the population
- Less than 30% of grain crop area and near 40% of grain production
To ensure food security, high yield is an eternal theme of world rice breeding. China has always been the leading in the high yield breeding.

Semi-dwarfing breeding
(1950s, 2t/ha-4t/ha)

Hybrid rice breeding
(1970s, 4t/ha-6t/ha)

Super rice breeding
(1996, 6t/ha-8t/ha)
Milestone of hybrid rice development

- 1926 – Heterosis was first reported
- 1964 – Hybrid rice research was started in China
- 1973 – Three-line hybrid rice was bred successfully
- 1976 – Hybrid rice varieties were planted in large
- 1991 – Hybrid rice planting area reached 50%
- 1994 – The first two-line hybrid rice variety was released
341 new rice varieties were released at provincial level and 53 varieties released at national level in 2015.

Among all the 394 new rice varieties, 205 varieties were three-line hybrids, accounting for over 50%.
Hybrid rice contribute to Yield continuous increase
2. Hybrid rice in the World

Hybrid Rice in the World

Area (million ha)

Year


China

World
### Major hybrid rice countries

<table>
<thead>
<tr>
<th>E Asia</th>
<th>S Asia</th>
<th>S-E Asia</th>
<th>Americas</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>India</td>
<td>Indonesia</td>
<td>United States</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>Myanmar</td>
<td></td>
<td>Brazil</td>
</tr>
<tr>
<td>Pakistan</td>
<td>Philippines</td>
<td></td>
<td>Uruguay</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Vietnam</td>
<td></td>
<td>Argentina</td>
</tr>
</tbody>
</table>
Major Challenges in the Tropics

- Low yield advantage (<1 t/ha), low heterosis (< 15%) & inconsistency performance
  - Genetic causes – Genetic diversity and heterotic groups
  - GxE (site & season) interaction & rice ecosystems
  - Field management – no specific field management for hybrid rice

- Low yield of seed production (1 - 2 t/ha) & high seed cost
  - Low out-crossing females & poor seed production technology
  - High cost of seed production
  - Weather & Market fluctuation

- Unacceptable grain quality
  - Low milling and head rice yield, high Chalk
  - Wide range of grain quality requirements/expectations
Major Challenges in the Tropics

- Lack of resistance to major diseases and insects
  - Various diseases / insects in the tropics
  - Lack of appropriate resistance screening & breeding
  - Poor education to farmer for Integrated Pest Management
- Poor seed quality
- Inconsistency of government policy (subsidy, seed production & extension)
- Insufficiency of education to hybrid rice farmers & technical personnel
Cooperation Priority Areas in hybrid rice

• Increase Heterosis
  o Min Requirement > 15%
  o Germplasm Diversity
  o 2-line Hybrid Rice
  o Reduce Rice Production costs (Seeds, Fertilizer and Simplified Technology of Rice Culture)

• Specific Attention for Breeding of Resistance to Diseases, Stressed Environment, & Grain Quality

• Training and Capacity Building
3. CNRRI’s Hybrid Rice in South & SE Asia

International Cooperation Network of CNRRI
Asia Agricultural Technology Transfer Center
(2015, Entity company)

- China National Rice Research Institute
- PT Biogene Plantation, Indonesia
- Tianjin Tianlong Seeds S&T Co., Ltd

(2016, Joint Research Center)
Seed Production Increase

Av. Yield 2.65 t/ha (SEMBADA B9, 40% Increase)
### Performance of CNRRI’s Hybrid Rice

<table>
<thead>
<tr>
<th>Code</th>
<th>Days from Sowing to Heading</th>
<th>Effective spike per plant</th>
<th>Yield (kg/mu)</th>
<th>Compared to control (%)</th>
<th>Comprehensive characterization</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT8</td>
<td>73</td>
<td>15.4</td>
<td>452.1</td>
<td>45.2</td>
<td>Good plant type, good lodging resistance, good quality</td>
</tr>
<tr>
<td>AT12</td>
<td>61</td>
<td>18.6</td>
<td>444.6</td>
<td>42.9</td>
<td>Early-maturity, strong tillering, good lodging resistance</td>
</tr>
<tr>
<td>AT43</td>
<td>69</td>
<td>14</td>
<td>444.7</td>
<td>42.9</td>
<td>Fragrance, big spike, good quality</td>
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<tr>
<td>AT21</td>
<td>58</td>
<td>18.0</td>
<td>392.8</td>
<td>26.0</td>
<td>Early-maturity, strong tillering, Blast resistance</td>
</tr>
<tr>
<td>AT24</td>
<td>71</td>
<td>13.8</td>
<td>400.2</td>
<td>28.6</td>
<td>good lodging resistance</td>
</tr>
<tr>
<td>168CK</td>
<td>63</td>
<td>13.4</td>
<td>311.2</td>
<td>-</td>
<td>high and loose plant type</td>
</tr>
</tbody>
</table>
Performance of CNRRI’s Hybrid Rice

AT12

AT21

AT43

CK
More Activities......
Commercialization Agreement of hybrid rice

- China National Rice Research Institute
- Savannah Seed Co., Ltd, India
- Rice Tec Company, USA
## Performance of CNRRI’s Hybrid Rice

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield (kg/ha)</th>
<th>Days from sowing to heading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Av.</td>
<td>Min</td>
</tr>
<tr>
<td>Zhong9you8012</td>
<td>8533</td>
<td>7439</td>
</tr>
<tr>
<td>Arize6444</td>
<td>7227</td>
<td>6503</td>
</tr>
<tr>
<td>Ratio</td>
<td>+18.1%</td>
<td>+14.4%</td>
</tr>
</tbody>
</table>
• China National Rice Research Institute
• International Center for Chemical and Biological Sciences, University of Karachi
• Tissue Culture Technologies International
According to the collaboration agreement between Tissue Culture Technologies International and China National Rice Research Institute, we will provide fifteen indica varieties for 2015 test in Pakistan. The information of the test varieties as follows:

<table>
<thead>
<tr>
<th>Entity No</th>
<th>Variety Name</th>
<th>Plant Maturity</th>
<th>Plant Height</th>
<th>Yield Potential (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CNRRRI-P-15-01</td>
<td>130</td>
<td>125</td>
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<tr>
<td>2</td>
<td>CNRRRI-P-15-02</td>
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<td>125</td>
<td>10-12</td>
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<td>3</td>
<td>CNRRRI-P-15-03</td>
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<td>120</td>
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<td>CNRRRI-P-15-05</td>
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<tr>
<td>6</td>
<td>CNRRRI-P-15-06</td>
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<td>8</td>
<td>CNRRRI-P-15-08</td>
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<td>11</td>
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<td>124</td>
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<td>14</td>
<td>CNRRRI-P-15-14</td>
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<td>124</td>
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<tr>
<td>15</td>
<td>CNRRRI-P-15-15</td>
<td>134</td>
<td>125</td>
<td>10-12</td>
</tr>
</tbody>
</table>
China National Rice Research Institute Rice Test Center in Cambodia (Operation in 2018)

- China National Rice Research Institute
- Sino-Cambodia Agricultural Promotion Center
- Guangxi Forward Co., Ltd, China
Thank you for your attention