Philippines Rice Breeding and Production

Elvira D. Morales
Plant Variety Protection Office
Philippines
**GOAL**

Increase productivity in the different rice growing ecosystems

**OBJECTIVE**

To identify high yielding rice lines with tolerance to biotic and abiotic stresses and good grain quality that can adapt to the different rice growing ecosystems
Plant Breeding Priorities

- Increasing yield potential
- Multiple resistance to diseases and insects
- Increasing tolerance for abiotic Stresses
- Superior quality
- Appropriate growth duration
- Efficient nutrient uptake and utilization
- Adaptation to climate change
Breeding Centers

- IRRI
- UPLB
- PhilRice
- Other private companies
Role of Breeding Centers

Generate promising lines and submit to national programs for test in specific regions/sites

→ a line performing better than commercially cultivated varieties = recommended for release as new variety

The agency sponsoring the line for release provides the breeder seed for foundation seed production.
Breeding Programs

- DEVELOPMENT OF IRRIGATED LOWLAND RICE
  - Transplanted Inbred Rice
  - Direct seeded Inbred Rice
- DEVELOPMENT OF HYBRID RICE
- DEVELOPMENT OF SPECIAL PURPOSE RICE
- Variety development for rainfed, upland and abiotic stress-prone environments
Strategies and breeding methods
Conventional hybridization and selection procedures

- Basic, time-tested
- To generate and utilize existing genetic variation
- Generates a wide array of combinations of the genes coming from the parent plants
- Cross-pollination followed by several cycles of selection and self-pollination $\rightarrow$ stable promising lines $\rightarrow$ candidate varieties
Cutting-edge Technology Development in support to breeding

- Biotechnology
  - increasing breeding efficiency
  - improving resistance/tolerance to biotic & abiotic stresses
- Molecular marker technology
  - using marker-aided selection
  - germplasm characterizations
- Induced mutations
  - *In vitro* techniques- developing lines for adverse environments
  - Physical & Chemical mutagenesis
- Genetic engineering
  - cloning/introduction of important genes
- Wide hybridization
  - transferring resistance genes
Process of Varietal Release at the NCT

Multi-location Tests (NCT)
- Yield Trial
- Insect Screening
- Disease Screening
- Grain Quality Evaluation

Evaluates results of NCT, drop and accept new entries

Recommends promising entries

Approve release of new varieties

Rice Technical Working Group

Technical Secretariat

National Seed Industry Council
Hybridization of selected parents

Breeding objectives

Segregating population

Performance Trial

Year 1

Year 2-3

NCT Phase I (on-station)

MAT (on-farm)

New variety for release

Year 4-6

Year 7-8.5

Year 9

Year 9.5-11

Year 12

NFIC

Seed Increase (Breeding Institution)

Basic Seed Production (PBBD)

Breeder/Foundation SP(IGO)

Foundation/Registered SP(IGO/Seed Net/Seed Growers)

Certified Seeds

Farmers

Grain millers & retailers

Consumers
The Philippine Rice R&D Network

Composition (57)
- 2 national centers
- 6 branch stations
- 12 regional research stations
- 37 cooperating stations

Testing Sites.....
### Number of Recommended Varieties by Ecosystem from 1968 to 2013

<table>
<thead>
<tr>
<th>Period</th>
<th>Irrigated lowland</th>
<th>Rainfed lowland</th>
<th>Upland</th>
<th>Cool elevated</th>
<th>Saline</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968-1988</td>
<td>43</td>
<td>4</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>54</td>
</tr>
<tr>
<td>1990-2010</td>
<td>87</td>
<td>17</td>
<td>6</td>
<td>6</td>
<td>13</td>
<td>129</td>
</tr>
<tr>
<td>2011-2013</td>
<td>57</td>
<td>11</td>
<td>1</td>
<td>-</td>
<td>13</td>
<td>82</td>
</tr>
<tr>
<td>TOTAL</td>
<td>187</td>
<td>32</td>
<td>14</td>
<td>6</td>
<td>26</td>
<td>265</td>
</tr>
</tbody>
</table>
Trends in Philippine Rice Production
Classes of Seeds

Breeder Seed → comes directly from plant breeder

Foundation Seed → grown from breeder seed

Registered Seed → grown from foundation seed

Certified Seed → grown from either foundation, registered or certified seed

Good Quality Seed → grown from certified and maybe used in times of emergencies

Seed that are of seed increase status as determined by the RTWG
Paddy yield, 2000-2011

Yield peaked in 2007 at 3.80 mt/ha. Highest yield was 4.21 mt/ha in irrigated areas; 2.98 mt/ha in non-irrigated areas.
## GROWTH IN YIELD

<table>
<thead>
<tr>
<th></th>
<th>2000-2010</th>
<th>2010-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growth (in mt/year)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Ecosystems</td>
<td>63</td>
<td>55</td>
</tr>
<tr>
<td>Irrigated</td>
<td>58</td>
<td>36</td>
</tr>
<tr>
<td>Non-Irrigated</td>
<td>66</td>
<td>146</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2000-2010</th>
<th>2010-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growth (in %)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Ecosystems</td>
<td>1.83</td>
<td>1.54</td>
</tr>
<tr>
<td>Irrigated</td>
<td>1.53</td>
<td>0.90</td>
</tr>
<tr>
<td>Non-Irrigated</td>
<td>2.53</td>
<td>5.36</td>
</tr>
</tbody>
</table>
Harvest area grew by 12% in the last 12 years. Irrigated areas comprised 68%.
## GROWTH IN HARVEST AREA

<table>
<thead>
<tr>
<th></th>
<th>2000-2010</th>
<th>2010-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Growth (in mt/year)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Ecosystems</td>
<td>47,773</td>
<td>182,481</td>
</tr>
<tr>
<td>Irrigated</td>
<td>38,655</td>
<td>64,312</td>
</tr>
<tr>
<td>Non-Irrigated</td>
<td>9,118</td>
<td>118,169</td>
</tr>
<tr>
<td><strong>Growth (in %)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Ecosystems</td>
<td>1.13</td>
<td>4.24</td>
</tr>
<tr>
<td>Irrigated</td>
<td>1.35</td>
<td>2.15</td>
</tr>
<tr>
<td>Non-Irrigated</td>
<td>0.66</td>
<td>9.07</td>
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Production grew by 35% in the last 12 years. Irrigated areas contributed 74%.
# Growth in Production

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>All Ecosystems</td>
<td>428,236</td>
<td>911,743</td>
</tr>
<tr>
<td>Irrigated</td>
<td>314,394</td>
<td>366,472</td>
</tr>
<tr>
<td>Non-Irrigated</td>
<td>113,842</td>
<td>545,271</td>
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</table>

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<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>All Ecosystems</td>
<td>2.96</td>
<td>5.78</td>
</tr>
<tr>
<td>Irrigated</td>
<td>2.88</td>
<td>3.06</td>
</tr>
<tr>
<td>Non-Irrigated</td>
<td>3.19</td>
<td>14.43</td>
</tr>
</tbody>
</table>
Thank you