THE GREEN REVOLUTION

Lessons for Africa

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Outline

- Characteristics and spread of the Green Revolution in Asia
- The secondary Green Revolution and the spread to rainfed areas
- The differences with Africa, and what Africa has achieved
- The transfer of the benefits of the Green Revolution from Farmers to Consumers
- The growing potential in Africa
- Some lessons
Characteristics of GR varieties of rice and wheat

First CIMMYT wheat and IRRI rice varieties released in Asia in 1965/66
Based on long research history elsewhere

- Shorter, fertilizer responsive, more tillers, shorter duration
- Photoperiod insensitive,
  - As a consequence, adaptable to many irrigated environments
- Highly dependent on water control,
## Where and how fast did GR spread

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Na</td>
<td>95%*</td>
<td>37.2</td>
<td>37.0</td>
</tr>
<tr>
<td>Philippines</td>
<td>67.4</td>
<td>84.1</td>
<td>11</td>
<td><strong>16.6</strong></td>
</tr>
<tr>
<td>Indonesia</td>
<td>57.7</td>
<td>81.8</td>
<td>15.0</td>
<td>15.2</td>
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<tr>
<td>Sri Lanka</td>
<td>52.8</td>
<td>87.1</td>
<td>24.6</td>
<td>29.2</td>
</tr>
<tr>
<td>Pakistan</td>
<td>38.7</td>
<td>46.3</td>
<td>67</td>
<td>79.6</td>
</tr>
<tr>
<td>India</td>
<td>34.6</td>
<td><strong>54.1</strong></td>
<td>18.4</td>
<td><strong>31.8</strong></td>
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<tr>
<td>Nepal</td>
<td>17.5</td>
<td>35.9</td>
<td>5.9</td>
<td><strong>29.8</strong></td>
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<tr>
<td>Bangladesh</td>
<td>13.5</td>
<td>24.8</td>
<td>11.6</td>
<td><strong>37.6</strong></td>
</tr>
<tr>
<td>Thailand</td>
<td>11.3</td>
<td>13.0 **</td>
<td>14.2</td>
<td><strong>22.7</strong></td>
</tr>
<tr>
<td>Burma</td>
<td>9.1</td>
<td>49.1</td>
<td>8.0</td>
<td><strong>15.4</strong></td>
</tr>
</tbody>
</table>

**Notes:** * derived from both Chinese and IRRI materials; **1981/82

**Green:** Adoption increase by more than 50 percent in six years

**Red:** Irrigation increase more than 50% in 24 years
Essential factors

- Water control from canals, wells and tanks
- Remunerative Prices:
  - From domestic scarcity at onset of GR
  - Via market liberalization in China
  - From domestic price support (often to compensate for overvalued exchange rates and high industrial protection)
  - From international price spike of the 1970s
- Road infrastructure
Supporting factors

- Agricultural extension
- Marketing
- Input supply and input subsidies
- Credit
The well-driven secondary GR in wheat and rice

- Alluvial areas in the Indo-Gangetic Plains adopted tube well technology
  - Spread of winter wheat to Eastern India and Bangladesh dependent on well revolution
- Hard rock areas of peninsular India adopted open dug wells
Improvements of rainfed crops in Asia

- Maize, Sorghum, Pearl Millet Hybrids:
  - Modestly from the late 1960s
  - Now doing much better: vibrant private seed sector
- Chickpea, Pigeon Pea, Mung Bean, Groundnuts
  - From the 1980s,
  - With further improvements recently
- Clean seed for potatoes and sweet potatoes since the late 1980s
- The BT cotton revolution: since 1996
In early 1960s, Bracchiaria-based artificial pastures led to revolution in livestock grazing.

Since late 1960s, soil science based soil improvements and tropical soya beans created a new economic base, with lots of immigration.

Since early 1990s, maize, cotton, rice, and broilers spreads, spurred by devaluations and withdrawal of the state from marketing.

In Asia, rapid economic growth led to massive diversification

- Horticulture and livestock, including milk,
  - In India they are now more than 50 percent of value of agricultural output
  - Aquaculture also did well
- Exports have emerged as a major driver in China, South East Asia, and less so in India
- Some diversification products do well in areas with little irrigation
The sharply different African environments

- A multitude and diversity of farming systems
- Farming systems with many, rather than a dominant crop
- Many endemic plant and animal diseases
- Weathered soils with low fertility, erratic rainfall
- Only 4 percent of land area is irrigated
- Heterogeneity limits transfers of science and technology from developed World and within Africa

These features imply a greater scientific and adaptive research effort than in other Regions
### The spread of HYVs in SSAfrica

<table>
<thead>
<tr>
<th>Crop</th>
<th>Adoption Rate 2000/2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>22 (late 1980s)</td>
</tr>
<tr>
<td>Wheat</td>
<td>70</td>
</tr>
<tr>
<td>Maize</td>
<td>45</td>
</tr>
<tr>
<td>Rice</td>
<td>26</td>
</tr>
<tr>
<td>Cassava</td>
<td>19</td>
</tr>
<tr>
<td>Sorghum</td>
<td>15</td>
</tr>
<tr>
<td>Potatoes</td>
<td>12</td>
</tr>
<tr>
<td>Beans in SADC, EAC</td>
<td>10 million farmers</td>
</tr>
</tbody>
</table>

Source: Pardey et al, 2006
Low population density and limited infrastructure imply
- Costly marketing
- Low availability of labor, limiting farming intensity
- Low demand for inputs
- High costs of services, rural finance, input supply

A different technology path, relying more on area expansion and rainfed farming
The benefits of the GR

- Spread first to larger farmers
- But small farmers quickly caught up
- Led to increases in labor demand
  - Higher wages and higher landless labor income
- Spillover of benefits to migrant workers from untouched areas
- Linkages to the nonfarm and urban economy
  - Forward, backward and especially consumer demand linkages
### The transfer of the benefits to consumers

<table>
<thead>
<tr>
<th></th>
<th>60/61</th>
<th>65/66</th>
<th>70/71</th>
<th>75/76</th>
<th>80/81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Ag output</td>
<td>79.3</td>
<td>81.2</td>
<td>100</td>
<td>97.8</td>
<td>119.6</td>
</tr>
<tr>
<td>Terms of Trade</td>
<td>91.0</td>
<td>100.0</td>
<td>103</td>
<td>100.0</td>
<td>78.0</td>
</tr>
<tr>
<td>Agri profits</td>
<td>64.2</td>
<td>67.9</td>
<td>100</td>
<td>85.1</td>
<td>76.4</td>
</tr>
<tr>
<td>Agri employment</td>
<td>98.2</td>
<td>100.1</td>
<td>100</td>
<td>118.8</td>
<td>118.5</td>
</tr>
<tr>
<td>Real Agri wage bill</td>
<td>71.9</td>
<td>83.6</td>
<td>100</td>
<td>104.9</td>
<td>105.4</td>
</tr>
<tr>
<td>Rural poor</td>
<td>101.0</td>
<td>99.0</td>
<td>100</td>
<td>97.4</td>
<td>107.0</td>
</tr>
<tr>
<td>Rural rich</td>
<td>88.5</td>
<td>88.6</td>
<td>100</td>
<td>92.4</td>
<td>88.9</td>
</tr>
<tr>
<td>Urban poor</td>
<td>91.9</td>
<td>100.4</td>
<td>100</td>
<td>100.7</td>
<td>136.0</td>
</tr>
<tr>
<td>Urban rich</td>
<td>87.6</td>
<td>102.3</td>
<td>100</td>
<td>102.2</td>
<td>136.7</td>
</tr>
</tbody>
</table>

Source: Quizon and Binswanger, 1986, Figure 1 and Table 2
Who benefits from GR depends on trade regime, international prices

1. If the economy cannot export its surplus, the farm sector will not gain.

2. If international prices decline, the farm sector will lose absolutely even with a GR.

3. The farm sector will make a double gain, from increased production and increased prices if international prices are also rising, as they just have
The rising potential in Africa

1. Higher international prices
2. Economic growth in Africa
3. Domestic and Regional demand for staple food and livestock products is expanding rapidly
4. Higher profits will lead to higher farm investments and higher adoption
5. Higher farm and labor incomes will transmit themselves to non-farm economy and to urban areas via forward, backward and consumer demand linkages

Demand and prices have to be transmitted across the Region via regional integration, and open trade
Lessons for rainfed areas such as Guinea Savannas

- Expand production of staple foods, fibers and livestock products for domestic, regional markets

- Via infrastructure, area expansion, soil science, new varieties, improved livestock

- Supported via mechanization (animal draft and rental hire of machines)

- Will most likely require immigration, as in West Africa

- Via private sector development
  - in upstream and downstream activities,
  - and possibly in large scale farming

- Land rights for migrants and large scale farms
Expand staple food production, and diversify into higher valued products for domestic and regional markets

Via agricultural intensification, increased use of labor and inputs

Supported by irrigation, mainly from low cost pumps where ground and surface water available
- Burkina Faso in the lead

Improved infrastructure

Better agricultural marketing, input supply, services, credit

Facilitated by governments
Overall Lessons

- Policy focus on prices, farm profits,
- And on Regional and international trade

- Research, research, including GMOs
- Infrastructure is essential
- Profitable innovations spread to their appropriate environments with little state support
- Markets, credit and extension are also helpful, but often follow development, rather than lead it