

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

Country	Rice HYV adoption		Irrigation %	
	1976-77	1982-82	1971	1995
China	Na	95%*	37.2	37.0
Philippines	67.4	84.1	11	16.6
Indonesia	57.7	81.8	15.0	15.2
Sri Lanka	52.8	87.1	24.6	29.2
Pakistan	38.7	46.3	67	79.6
India	34.6	54.1	18.4	31.8
Nepal	17.5	35.9	5.9	29.8
Bangladesh	13.5	24.8	11.6	37.6
Thailand	11.3	13.0 **	14.2	22.7
Burma	9.1	49.1	8.0	15.4

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

Rainfed agriculture in Brazil Cerrado

- ▣ In early 1960s, Brachiaria-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
- ▣ Since 1995: The GMC revolution in soya beans, maize, cotton

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

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

Source: Pardey et al, 2006

Limiting economic and social factors

- ▣ 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

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

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 upsteam and downstream activities,
 - and possibly in large scale farming
- ▣ Land rights for migrants and large scale farms

Lessons for medium and high population density areas

- ▣ 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