On the Possibility of a Green Revolution in Sub-Saharan Africa

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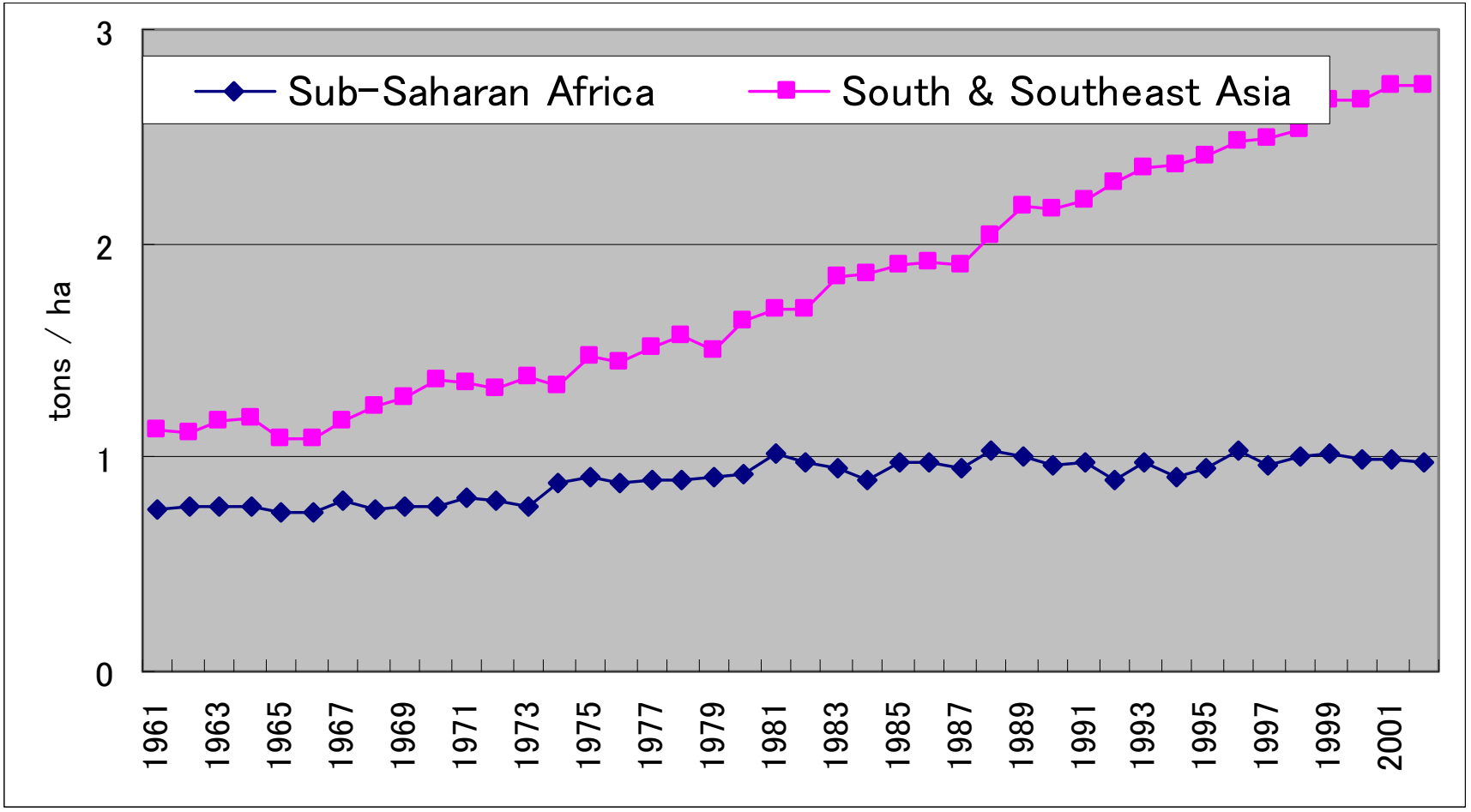
In the 1950s and the early 1960s in Asia, population grew rapidly, grain yield was stagnant, and uncultivated land was being exhausted. Therefore, there was serious fear of famine in Asia.

- Contemporary Sub-Saharan Africa (SSA) is so similar to tropical Asia several decades ago.
- A main difference is that we now have accumulated knowledge and technology in Asia which is potentially useful for SSA.

Figure 1. Changes in Grain Yield (ton per ha) in Sub-Saharan Africa and South/South-East Asia



Contents

1. What is the essence of the Asian Green Revolution?
2. Why has it been so difficult to realize a GR in SSA?
3. Is it possible to realize a GR in SSA? Is there any encouraging evidence?
4. What should be strategy to realize a Green Revolution in SSA?

How can we increase crop yield per ha?

1) Shift production function upward (develop fertilizer-responsive varieties, capable of converting nutrients to grains efficiently)

2) Apply more inputs, particularly fertilizer

Essence of the Green Revolution in Asia:

Development and diffusion of a series of fertilizer-responsive, high-yielding modern varieties (MVs).

Comparison of IR8, the original shorter modern rice variety, with Peta, a traditional tall variety and one IR8's parents (1st two photos); lodging (bottom photo)

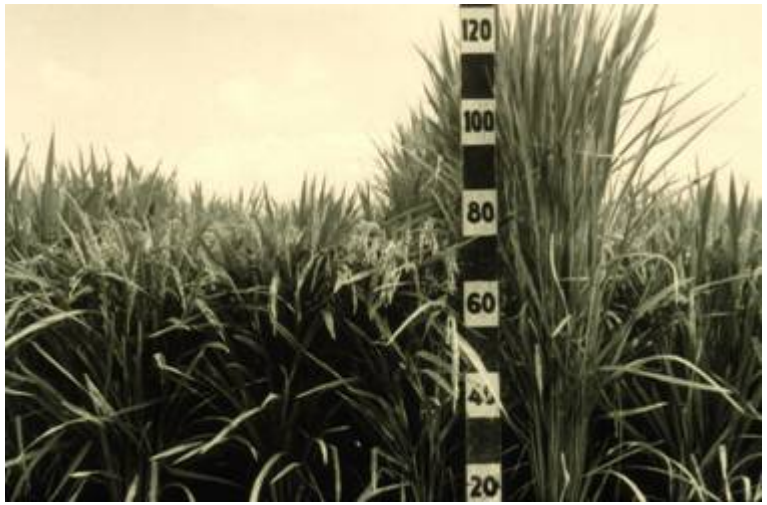


Figure 2. Yield Curves of Traditional Varieties (TVs) and Modern Varieties (MVs)

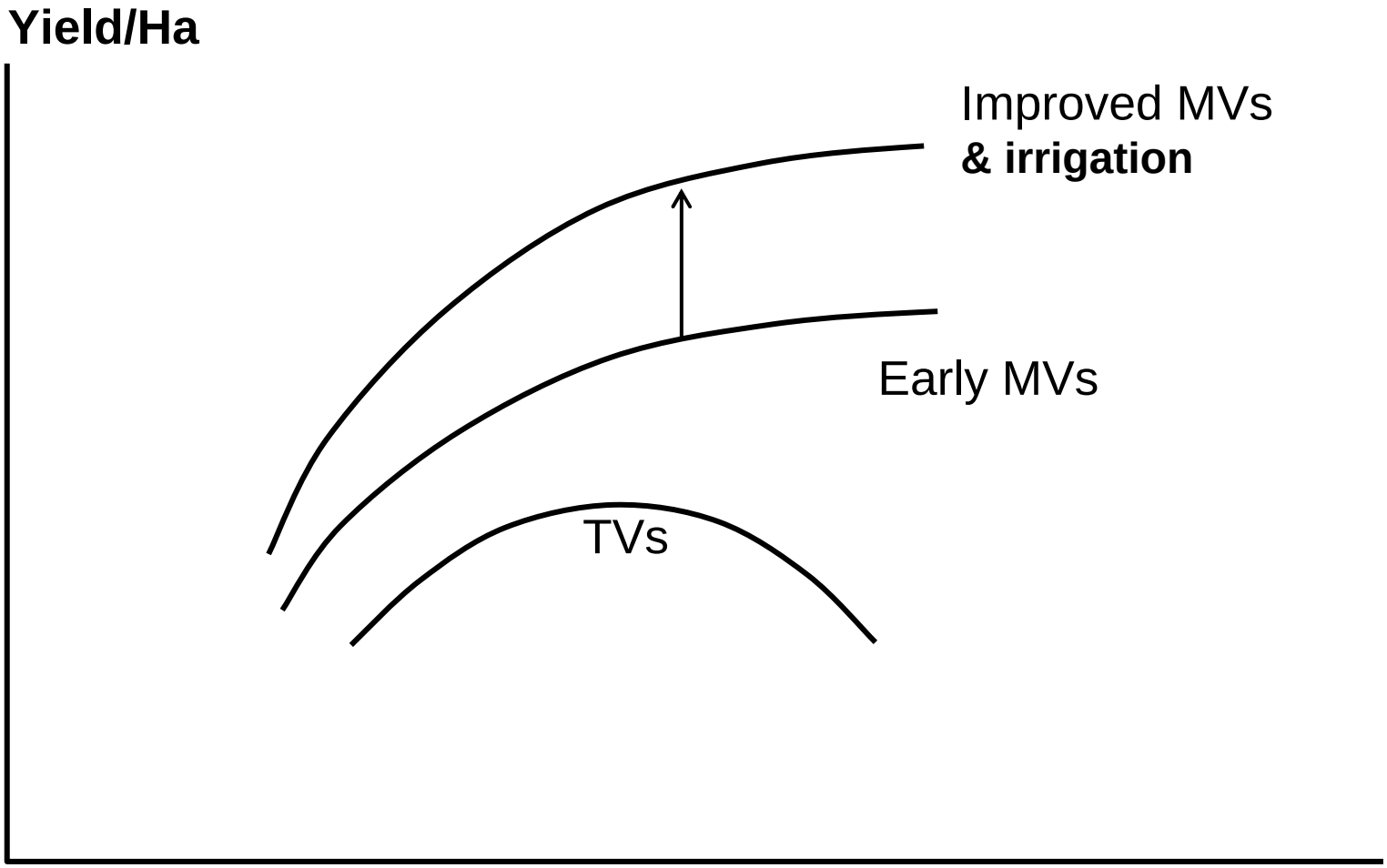
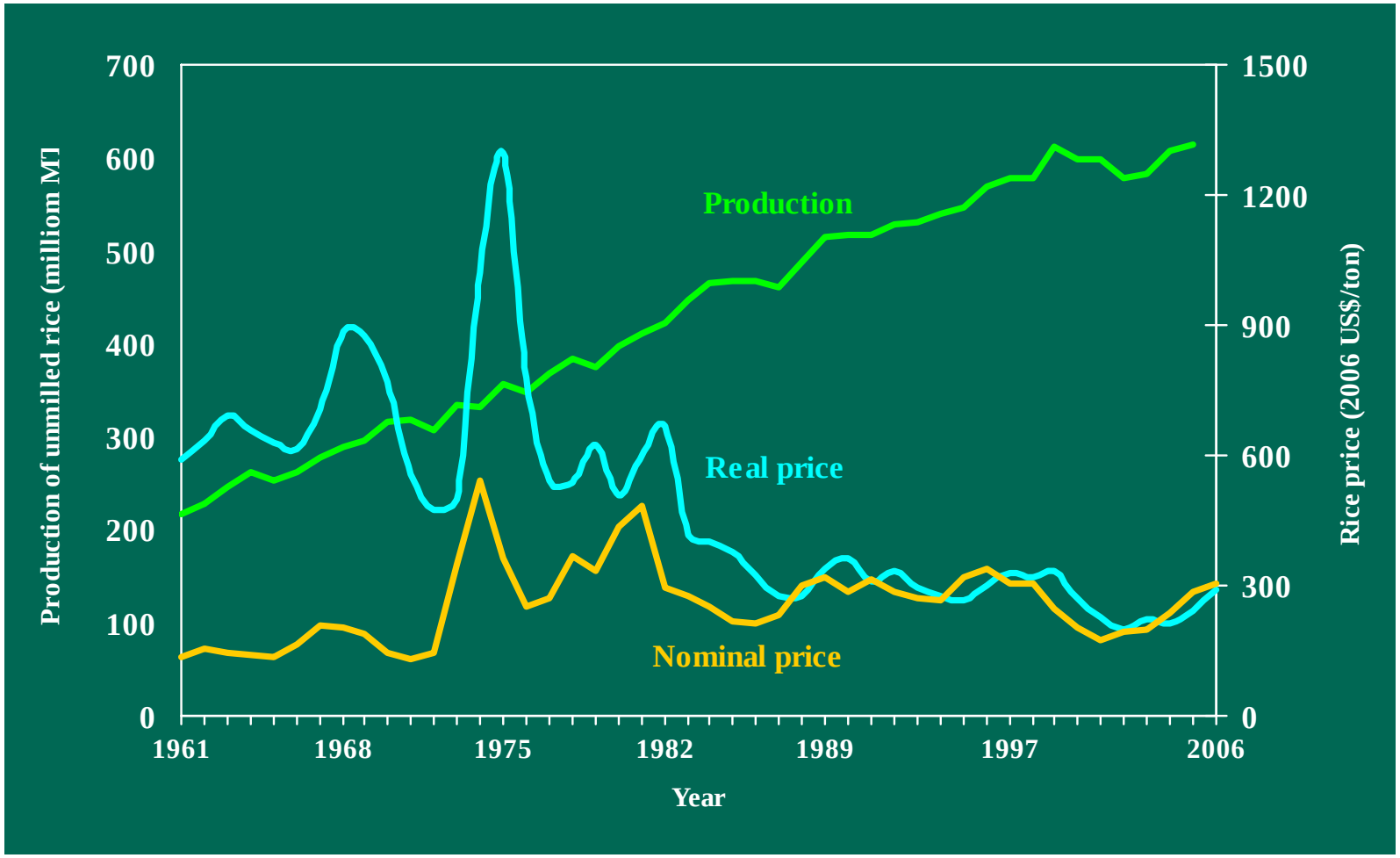


Figure 3. Trends in world rice production and real rice price,1961-2006



Source: Production: FAOSTAT Electronic Database, FAO.20Apr2006 udpate.
Rice Price: Relate to Thai rice 5%-broken deflated by G-5 MUV Index deflator (adjusted based on 1 March 2007 data up
Source: www.,WorldBank.org

Summary of the Asian Green Revolution (GR)

- Continuous development and diffusion of fertilizer-responsive and pest- and disease-resistant MVs made GR possible.
- MVs are particularly high-yielding in favorable areas, such as irrigated areas and shallow rainfed areas.
- There is, however, a strong sign that the GR is ending.
- MV adoption rate now is 70-75% in Asia, implying that nearly 25% of areas has been bypassed by the GR.
- Such unfavorable areas are primarily drought-prone areas, where people are particularly poor.

Lessons of Asian Green Revolution for Sub-Saharan Africa

1. Need fertilizer-responsive and drought-tolerant varieties for SSA where rainfall is low and unpredictable.
2. Need fertilizer, where chemical fertilizer is often prohibitively expensive.
3. The use of cow manure may be recommended.
4. For manure production, stall-feeding and cultivation of feed crops are essential, as the Agricultural Revolution in 18th century England clearly attested.

Case 1: Organic Maize and Banana Green Revolution in East Africa

- Stall-feeding of highly productive *dairy cows*, which are cross-breeds between European cows and local cows
- Use of manure and compost, as well as chemical fertilizer
- Use of high-yielding hybrid maize varieties and locally improved banana varieties


Dairy Cows in Kenya

Bananas (Plantains) and Improved Cows in Uganda

Fig. 4 Maize Yield in Kenya and Uganda

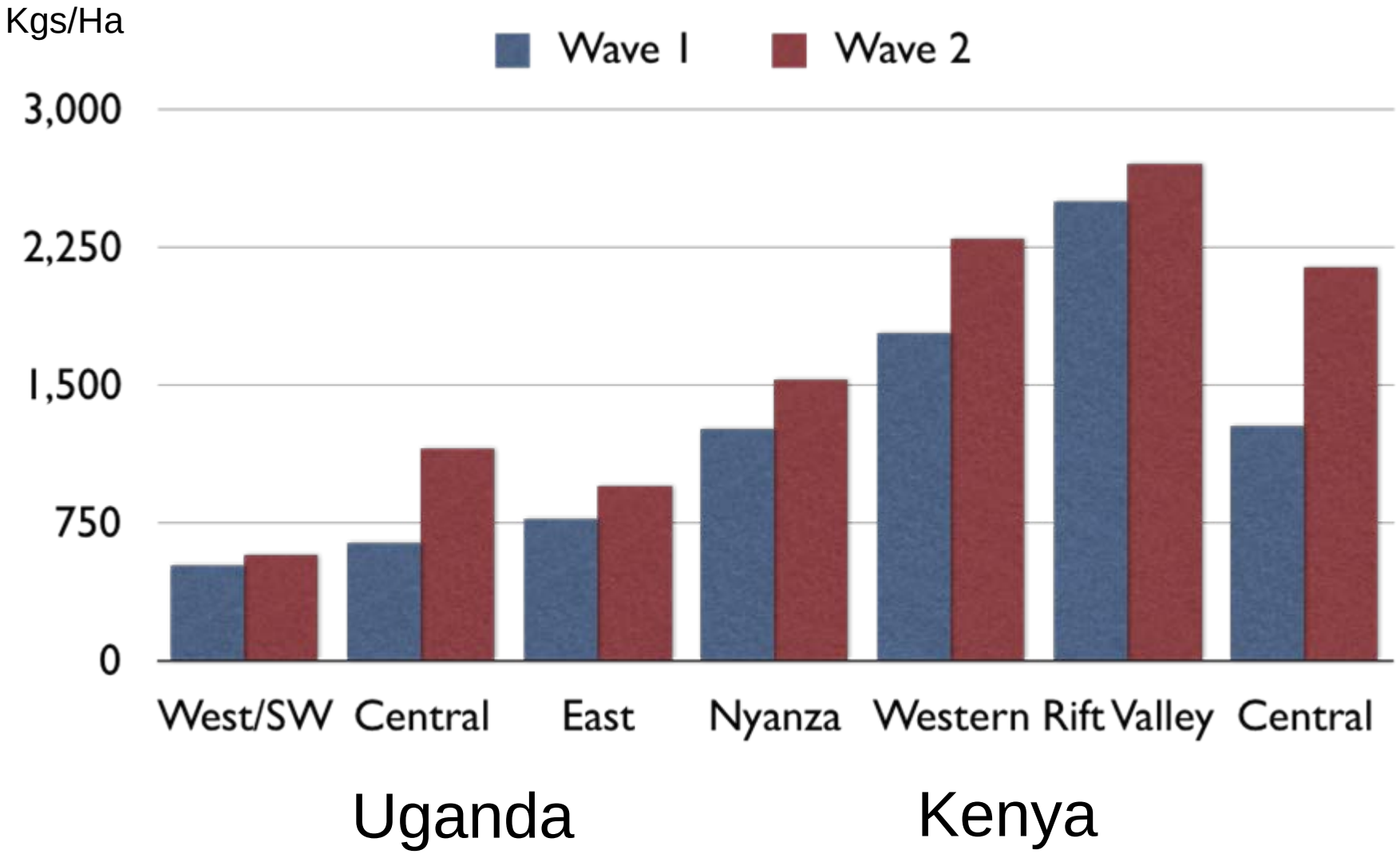


Fig. 5 Chemical Fertilizer Use

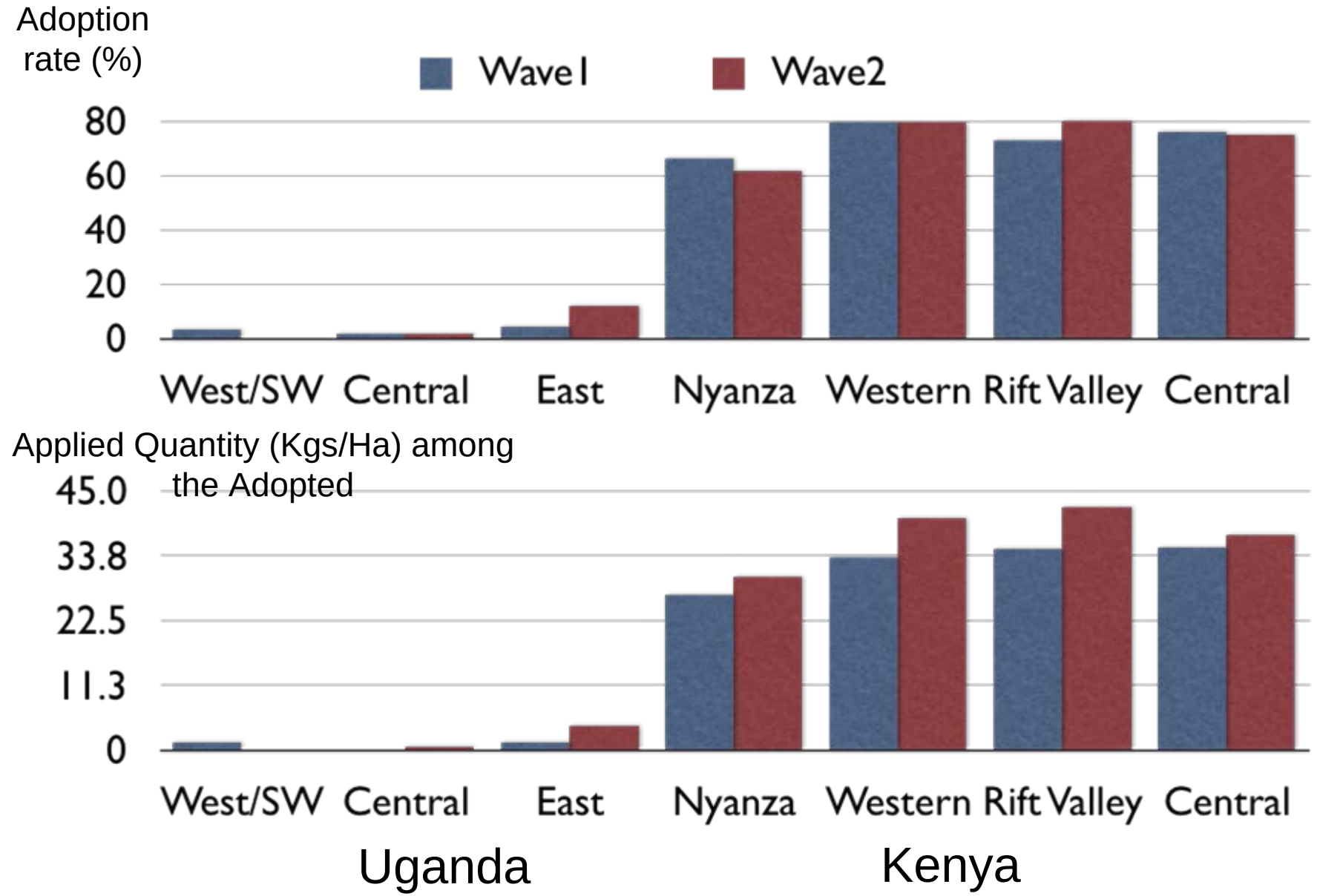


Fig. 6 Organic Fertilizer Use

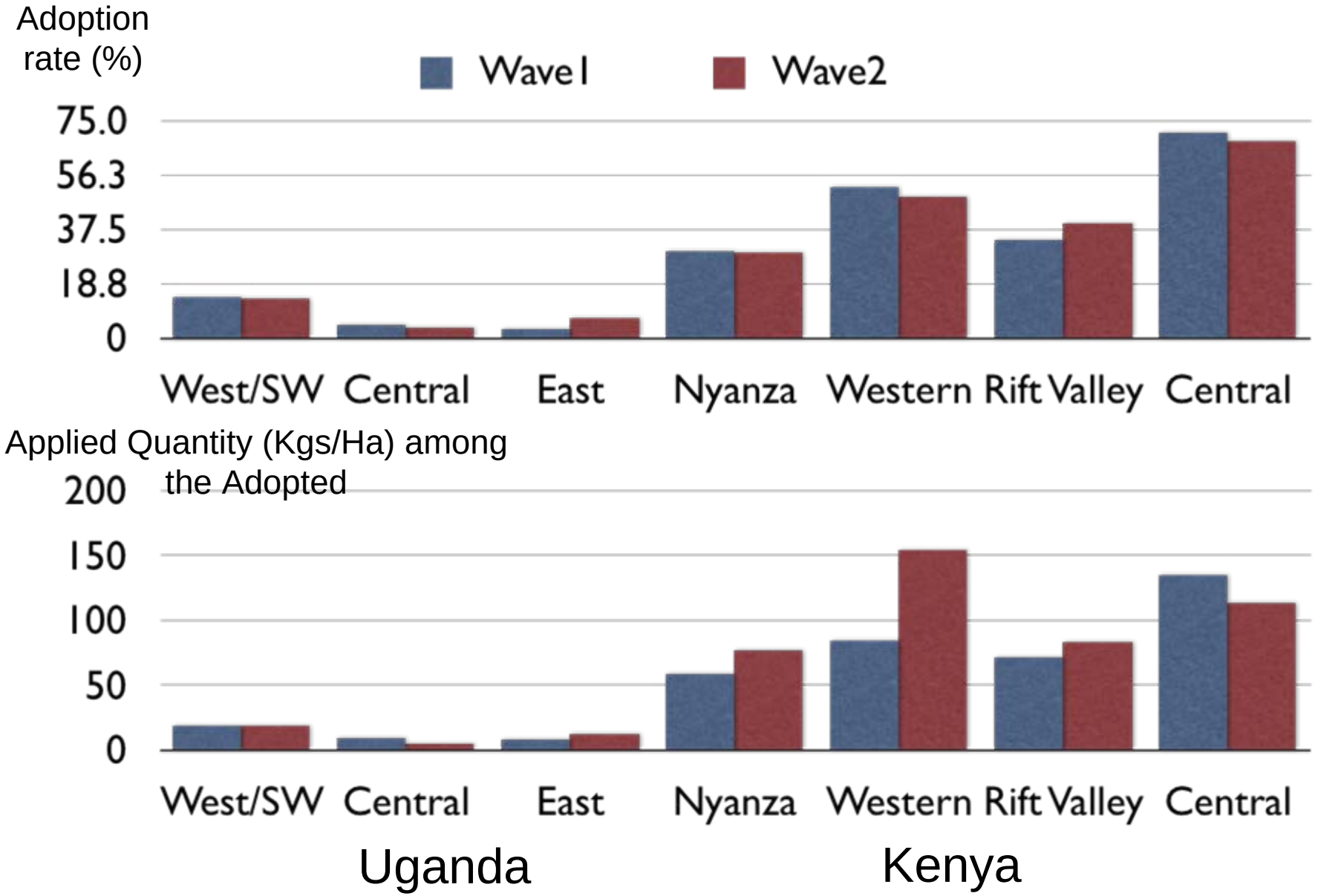
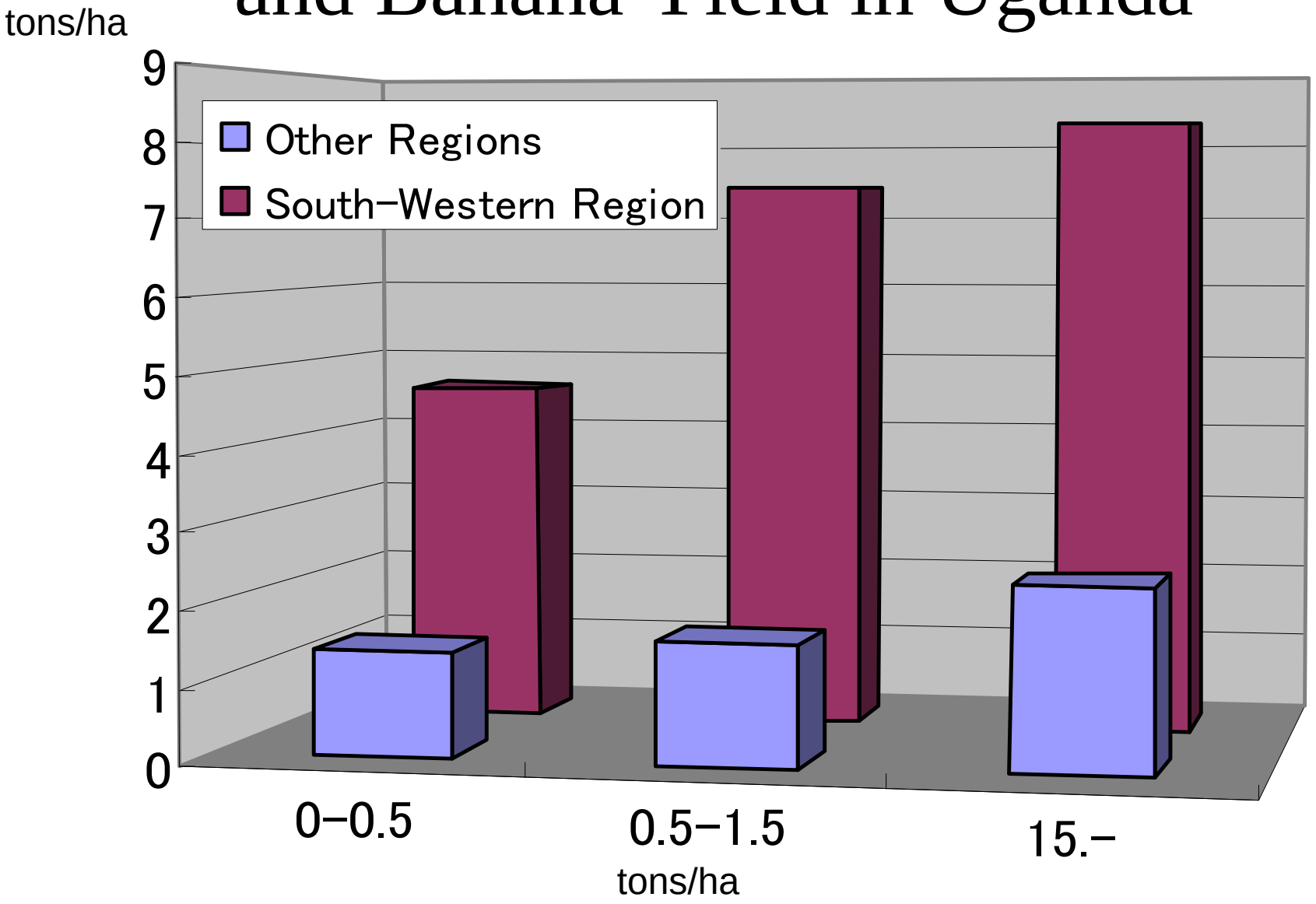


Fig. 7 Organic Fertilizer Application and Banana Yield in Uganda



Summary of Major Findings about OGRs

1. Stall-fed dairy cows produce a lot of manure.
2. Maize yield is nearly 3 tons per ha, if both organic and chemical fertilizers are applied and improved varieties are adopted simultaneously.
3. Banana yield increases significantly with an increase in manure application.
4. The maize and banana OGRs are taking place in highlands of Kenya and Uganda *without* strong government support.

Case 2: NERICA in Uganda

- NERICA is “New Rice for Africa,” high-yielding and short-maturing upland rice varieties developed by WARDA.
- Like the case of Asian Green Revolution, policy-makers are excited about shining prospects of NERICA in Uganda.
- FASID conducted the first empirical study on NERICA.

NERICA in Uganda (5 tons/ha?)

Yield of NERICA in Uganda by previous crop and region (ton/ha)

Previous crops	Average	Traditional rice region	New rice region
Rice/maize	1.8	2.4	1.5
Leguminous crops	2.6	3.0	2.1
Tobacco	3.1	3.3	2.5
Average	2.1	2.7	1.5

How Revolutionary is NERICA?

- The average NERICA yield of 2.1 tons/ha is twice as high as the average rice yield in SSA. (In Japan it took 100 years to increase upland rice yield from 1 ton/ha to 2 tons/ha.)
- Yield of 3.3 tons/ha on fields planted previously to fertilizer-using tobacco in traditional rice growing areas is truly revolutionary, suggesting that NERICA is also fertilizer-responsive high-yielding varieties.
- In order to sustain the NERICA Revolution, the application of manure and/or chemical fertilizer is essential.

Prospect of Green Revolution in SSA

1. It is no longer a dream to realize a Green Revolution in SSA, as OGRs and NERICA Revolution indicate.
2. In order to realize a GR, we need to invest more in research and development of drought-tolerant and yield-enhancing technologies.
3. In order to sustain a GR, we need to develop effective soil management practices based on crop-livestock interactions or the use of chemical fertilizer.

But what about extension systems, farmers' health and education, fertilizer market, credit, and irrigation?

1. We have limited resources. Thus, the key question is where to invest limited fund.
2. Strengthening extension systems before developing new profitable technologies?
3. Fertilizer subsidy, cheap credit, and irrigation investments before developing fertilizer-responsive MVs for SSA?

What is ***really*** needed?

1. What really matters is “excitement” about new technological possibilities.
2. Excitement about new technology will stimulate irrigation investments, initiation of credit programs, and strengthening extension systems, because the excitement is translated into high expected returns.
3. Politicians and farmer are excited about NERICA in Uganda. IRRI, Rockefeller & Gates Foundations, and KO are extremely excited about high potential of lowland rice production in Mozambique.

Thank you very much
for your attention