How Promising Is Rice Green Revolution in Sub-Saharan Africa? Evidence from Case Studies in Mozambique, Tanzania, Uganda, and Ghana

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Commonly Asked Question

Why hasn't Green Revolution taken place in SSA?

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What is the Green Revolution in Asia?

- Development and diffusion of a series of short-statured, fertilizer-responsive, high-yielding modern varieties (MVs) in irrigated and favorable rainfed areas.
- The Asian Green Revolution entailed a long-term evolutionary processes spanning more than three decades since the mid-1960s, in which irrigation investments increased, extension system and national research programs were built and strengthened, markets gradually worked better, fertilizer application increased, and so on.

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"Asian" Rice Green Revolution in Senegal River Basin

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Another Major Rice Green Revolution in Mwea in Kenya

- Basmati varieties are most popular accounting for 80% of areas (see left)
- IRRI-type varieties (BW 196, IR 2793, IR 190-90, ITA 310) are extremely high-yielding (see right)

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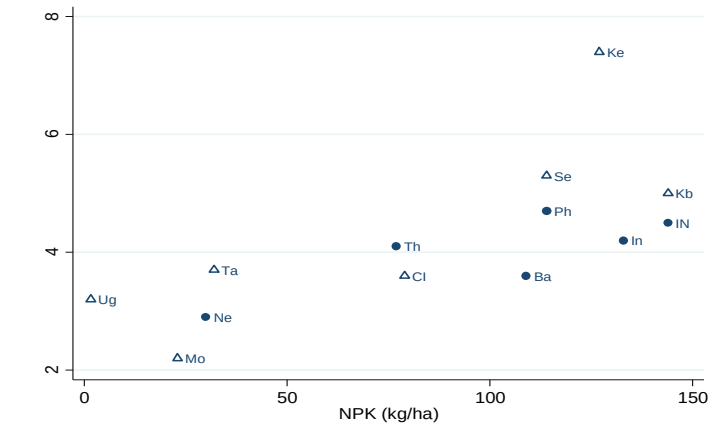
After all, as far as irrigated areas are concerned, productivity of rice farming in SSA is comparable to that in Asia



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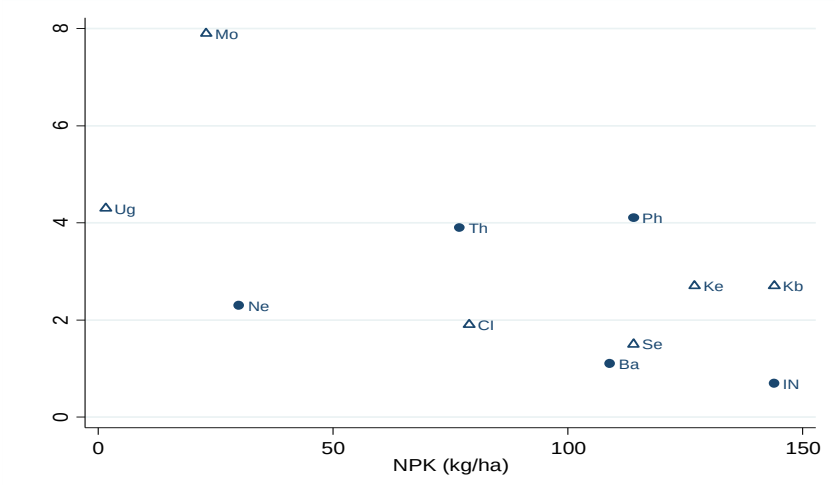
Fertilizer application is less in SSA importantly because its price is higher than in Asia



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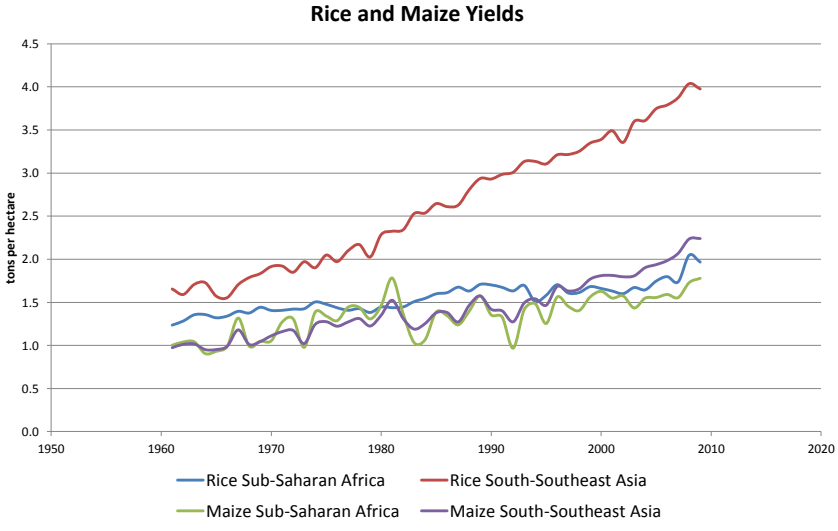
Asian rice as a starting point



Source: FAOSTAT (2011)

Rice in SSA

1. There is no question that rice Green Revolution has already taken place in irrigated areas in SSA, using Asian Green Revolution technologies.
2. It is remarkable to observe that paddy yield in SSA increased from 1.2 tons/ha to 1.8 tons/ha, which can be largely attributed to the introduction of Asian technologies.
3. A major question is whether there is a possibility of Green Revolution in rainfed areas in SSA.
4. Judging from substantial yield gap between Asia and SSA, it seems sensible to postulate that the Asian technologies can be transferred to SSA to boost productivity much further.

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Table 1. Paddy yields and production practices in Mozambique

	Chokwe irrigation scheme	Rainfed areas in central region		
		Bottom 1/3	Middle 1/3	Top 1/3
Yield per ha (tons)	2.1	0.3	0.8	2.2
Use of MVs (%)	92	0.0	0.0.	3.0
Fertilizer use (%)	52	0.0	0.0	0.0
Plot with bund (%)	100	52	41	43
Animal use (%)	48	0	2	5
Tractor use (%)	55	2	5	2
No. of sample households	176	66	66	65

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Assessment of Mozambique

- Rainfed areas: Very low yield, average being 1.1 tons/ha. No MVs, no fertilizer, and little use of draft animals and tractors leading to the absence of leveling and firmly built bunds.
- Irrigated areas: Very low yield importantly because of poor irrigation facilities and the use of old MVs developed in the 1960s and 70s. Top 20% of farmers, however, achieve 3.9 tons/ha, indicating high yield potential with proper water and production management.

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Table 2. Rice yield, the use of modern inputs and improved production practices by region and irrigation status in Tanzania

	Morogoro		Mbeya		Shinyanga	
	Rain-fed	Irrigated	Rain-fed	Irrigated	Rain-fed	Irrigated
Paddy yield (t/ha)	2.0	3.8	1.6	3.5	1.7	4.6
Modern inputs use						
Share of MVs (%)	17.8	87.5	0.0	2.1	1.9	13.1
Chemical fertilizer use (kg/ha)	11.7	40.4	10.7	31.7	0.9	0.0
Share of bunded plot (%)	8.2	84.8	16.3	89.6	95.3	100.0
Share of leveled plot (%)	22.0	69.6	38.5	78.1	87.6	100.0
Share of straight row transplanting plot	4.4	47.8	3.8	22.9	6.4	0.0
No. of sample households	182	46	104	96	234	10

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Assessment of Tanzania

- Rainfed areas: Yields range from 1.6 tons/ha to 2.0 tons/ha, which are much higher than in Mozambique. This can be explained by some adoption of MVs, some fertilizer use, and the adoption of some improved production practices.
- Irrigated areas: Yields are high and comparable to Asian average of 4 tons/ha. A combination of improved seeds, improved production practices, and the availability of irrigation results in "mini" Green Revolution.

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Table 3. Rice yields (ton/ha) according to the cultivation practices adopted in 2008-2009 in Uganda

	All	Bugiri	Mayuge	Bukedea	Pallisa
4 practices	4.13	4.47	2.89	1.22	0.37
3 practices	3.20	4.15	1.89	---	1.54
2 practices	2.25	3.07	2.00	3.95	2.26
1 practice	1.81	2.30	1.91	1.89	1.38
Non-adopters	1.33	---	0.79[b]	1.42	0.66[c]
Fertilizer use	7.55c	7.55[d]	---	---	---
Adoption of MVs (%)	19.6	43.8	40.0	5.0	1.6
No. of sample households	300	75	75	75	75

The adoption of 4 practices means bunding, leveling, proper timing of transplanting, and straight-row planting.

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Assessment of Uganda

- Bugiri, participatory training program with simple irrigation: High yields particularly when improved production practices are adopted.
- Mayuge, participatory training program with no irrigation, i.e., rainfed: Yields are lower but with adoption of improved production practices, yields reach 2 tons/ha.
- Bukeda and Pallisa, rainfed areas with no training: Low adoption rates of improved practices and their unclear yield effects.
- The results strongly indicate the importance of training.

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Table 4. Technology adoption, paddy yield, labor inputs, and factor share of labor in Northern Ghana

	No adoption	Partial adoption				Full adoption
		Modern inputs only[a]	At least modern inputs	Modern inputs, bunding, & leveling	At least modern inputs, bunding & leveling	
No. of households (%)	63 (11.6)	78 (14.3)	349 (64.0)	37 (6.8)	84 (15.4)	47 (8.6)
Yield (ton/ha)	1.46	1.70	1.95	1.98	2.33	2.59
Labor (days/ha)	102	152	187	204	238	264
Factor share of labor (%)	61.5	62.6	54.6	52.8	49.5	47.6

Modern inputs refer to the adoption of MVs and chemical fertilizer application.

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Assessment of Ghana, which is completely rainfed

- Selected 20 villages with the Lowland Rice Development Project, which attempted to transfer "Asian Green Revolution" technologies (MVs, fertilizer, bunding, leveling, and dibbling). Also elected 20 nearby villages within 20 km, and another 20 remote villages.
- Clear effects of improved production practices on yields.
- Improved technologies are labor-using but share of labor cost does not increase because yield effect is larger.
- As in the case of Uganda, we observe clear effects of rice production and management training on the improvement of production efficiency.

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A Summary

- Rice yield is much higher in Asia than in SSA (1.8 t/ha vs. 4.0 t/ha), suggesting the potential of transferring Asian technologies.
- But the yield difference is very small in irrigated areas, indicating that Green Revolution has taken place in SSA.
- Asian Green Revolution technologies (MVs, fertilizer, bunding and leveling) are directly transferable to SSA, particularly in irrigated areas. In fact, high yields are found in irrigated areas in Uganda, Tanzania, Kenya (Mwea), and Mozambique where "Asian" technologies are adopted.
- Yield and profitability of rice farming increase significantly even under rainfed conditions, if improved Asian-Type technologies are adopted, as shown in Uganda, Ghana, and Tanzania in contrast to the case of Mozambique.

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A Summary (continued)

- Judging from abundance of success stories in lowland rice farming, there is no question that lowland rice is truly promising crop in SSA.
- Demonstration project of improved rice production practices is found to be successful in Uganda and Ghana.
- Policy Implications: (1) strengthen capacity building for dissemination of improved technologies, and (2) promote improved water management and irrigation investment

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Way forward

- Strengthen research on marketing – Need to examine geographical variations in rice and fertilizer prices to analyze the efficiency of marketing (Tanzania, Uganda).
- Strengthen research on the impact of new technologies on poverty reduction (Tanzania, Uganda, and Senegal).

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Thank you very much
for your attention

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