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# State-of-the-art of agricultural mechanization in rice-based systems in SSA

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# Background

The greatest constraint to increasing rice production in sub Sahara Africa is that farm operations are rarely completed in a timely and efficient manner.

This means crops are rarely

“Planted on time and Harvested on time”

# Why?

1. Lack of knowledge - best planting dates, in-crop losses, post harvest losses, markets
2. Lack of incentives-financial return for better quality product
3. Lack of power to do the job on time

**-not enough power in system**

# Examples of wait

- Wait for rain to prepare land
- Wait until seedlings 40-60days before transplanting
- Wait until see weeds above crop
- Wait until grain reaches 15-16% moisture before harvesting
- Wait until see insects in storage

# Power and Work rates

Power is rate of doing work = energy x time

## Work rates to plow 1 ha

- Human - (750m<sup>3</sup> soil = 100truck loads) =140 days
- Animal-(walk 50km) =12 days
- 2 wheel tractor(15hp)-(walk 20km) =1 day
- 4 wheel tractor (60 hp)-(7.2 km/hr) = 1-1.5hr

# Present system of farming



# Power sources in sub Sahara Africa

## Power sources

- Human 80-90%
- Animal 9-16%
- Engine -less1%

## Labor requirement =250+ person days/ha

- Land preparation 140-160 days
- Transplanting 30-40 days
- Weeding 60-80 days
- Harvesting and transport 60-80 days

# Cost of present operations

## Input costs

- Labor \$1-2/day
- Pump 1mega liter water = \$25
- Contract 4-wheel tractor plowing=\$80-100/ha 2 passes
- Contract Milling = \$80-100/ton

## Purchase price

- 4wheel Tractor (60hp)= \$25,000 (\$420/hp)
- 2 wheel tractor (15hp) = \$3,800-\$5000 (\$266/hp)
- Mechanical weeders (cone)= \$20-50
- Mechanical thresher =\$3500-\$4000
- Pedal thresher- \$2-300 (local producer)
- Single pass rice mill-\$3000-4000



# Losses/Opportunities

- Late planting (Mozambique) 1 month = 1ton/ha loss
- Poor land preparation = double seeding rates from 80 to 150-200kg/ha)
- Late weeding = 300kg weeds within 21 days
- Post harvest losses = 30-50%
- Drying time in field – takes 1 month from 20%-14% (decrease quality and quantity)
- Market variability = 20-30% increase 2 months after harvest
- Local buyers will pay a premium for local rice

## Matching equipment to area

- 2wheel 15hp tractor = 15-20ha (\$230/ha)
- 4wheel 60hp tractor =160-200 ha (\$115/ha)
- Cone weeder = 0.2 ha/day
- Thresher (15hp)=1t/hr = 100ha (\$40/ha)
- Combine harvester (60hp)=1ha/hr =300ha (\$80/ha)
- Rice mill- single pass-300kg/hr = 2-300 ton(10/t)
- Knapsack sprayer=0.5ha/hr=3-4ha/day (

# Transition into mechanization

Learn from Asian experience

- 2-wheel tractor (transport, plow, pump)
- Mechanical weeder- line planting
- Mechanical threshers-engine and pedal
- Hermetic storage systems-local materials
- Single pass rice mills-local ownership

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# Dry land preparation



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# Wet Land preparation



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# Land Leveling



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# Bund building



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# Wet Planting options





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# Dry seeding



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# Weeding Options



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# Post Harvest



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# Drying



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# Safe Storage systems



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# Small Rice Mills



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# Village Rice mills in Mozambique



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# Sustainable mechanization

1. Government policies to support equipment importation and local manufacturer-import tariffs and tax relief
2. International and local manufacturers deal directly with dealerships (no middlemen)
3. Direct dealerships supplied with demonstration equipment, trained sales people, service support staff, and appropriate spare parts inventory
4. Credit institutions to provide fair interest rate loans to dealerships, farmers and service providers
5. Farmers shown and realize the financial benefit of improving timeliness and efficiency through use of machines (cost benefit analysis)
6. Extension service supporting mechanization by providing support and advice to farmers, service providers and feedback to manufacturers
7. Patience-time from trial to uptake 8-10 years



# Pitfalls

- Government should support private sector, not try and act like private sector-give tax breaks reduce importation duties ect
- Government should not subsidize cost of production (Thai experience)
- Farmers buy on price-be careful of cheap and inappropriate imports
- Middlemen are inefficient
- Credit schemes run by government are prone to failure
- Farming system may have to modified to suit machine-not the other way around

# Summary

- Private sector based
- Subsidize purchaser not manufacturer
- Transition must be supported by building local capacity for service and supply of spare parts
- Farming system may need to be changed