Developing & Promoting Adoption of Rice Varieties: WARDA's Experience in SSA

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Outline

Importance of Rice in SSA

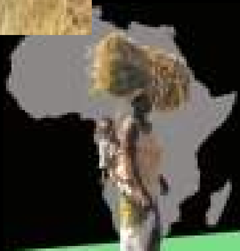
Crop Improvement

NERICA Story - Dissemination & Adoption

Success Factors?

Challenges

Concluding Remarks

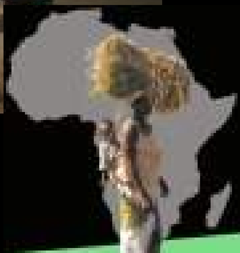


Importance of Rice

- Strategic crop for food security and poverty alleviation in SSA
- Long history of rice cultivation
- African rice species domesticated at ~3000 BC in West Africa
- Asian rice species introduced into West Africa at ~1500 by the Portuguese
- Upper coastal part of West Africa historically known as the “Rice Coast

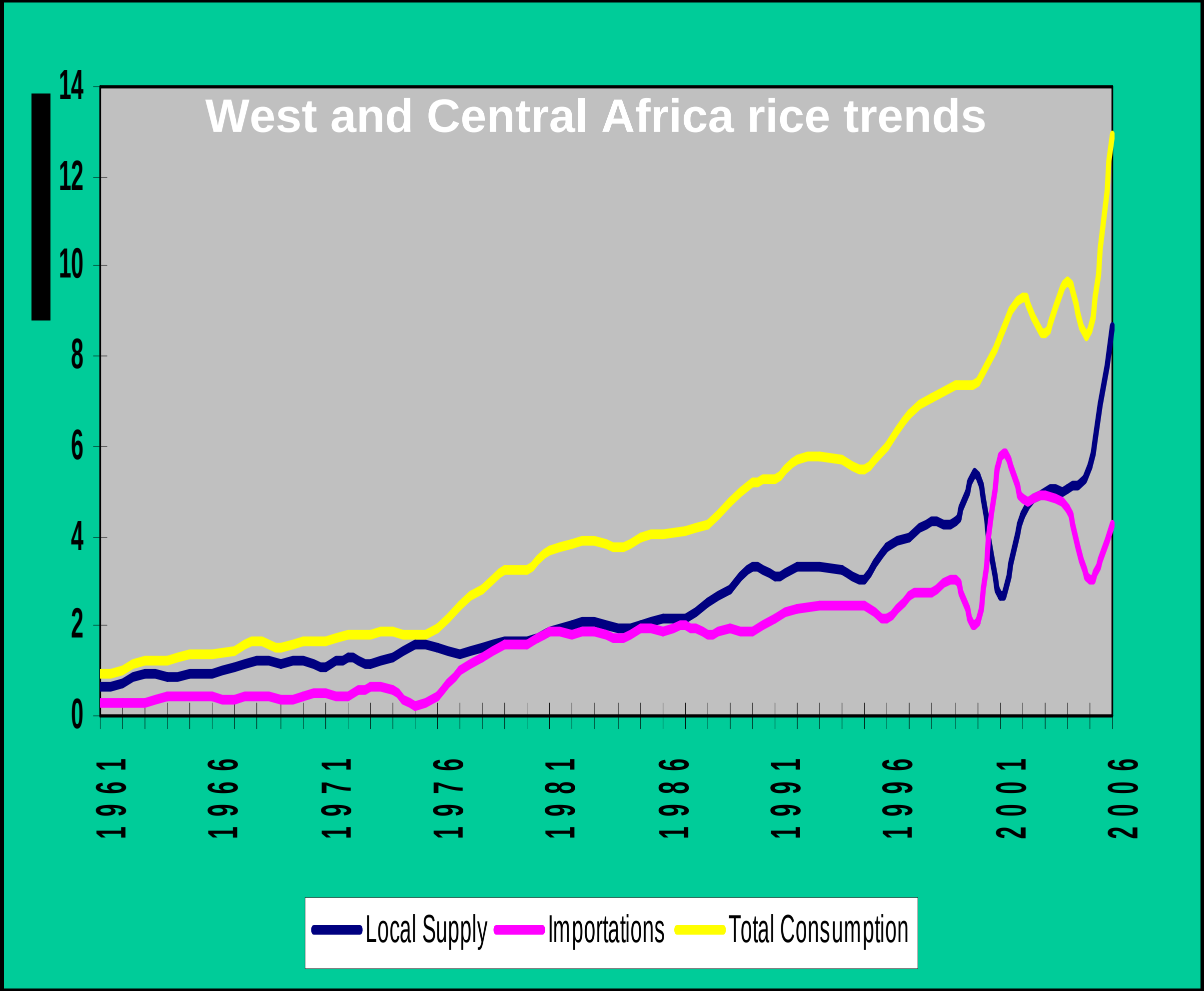
Importance of Rice in SSA

- Employs more than 20 million farmers
- Sustains the livelihood of 100 million people



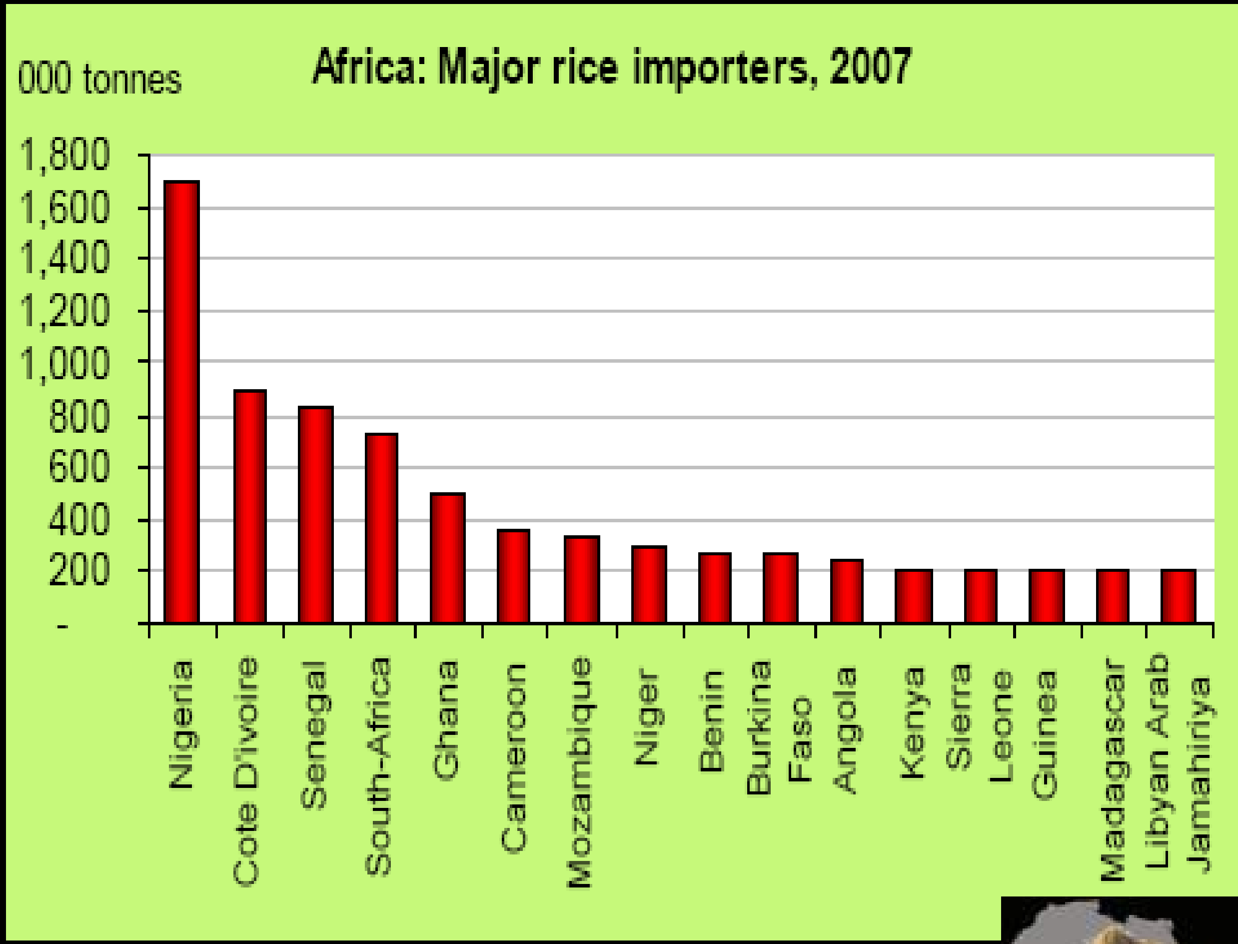
Importance of Rice in SSA:

- Consumption increasing at 4% per year
- Ever growing demand, Production not kept pace with consumption
- Widening domestic deficit met by importation (> US$ 2 billion/year)



Importance of Rice in SSA

- 4 of 11 world's largest rice importing nations
- Nigeria Africa's largest rice importer
- Soaring prices threat to food security, civil order
- Riots in Burkina, Cameroon, Senegal, Guinea, Egypt, Cote d'Ivoire




Main rice-growing ecologies in SSA:

Upland - Lowland (irrigated and rainfed) - Mangrove


Major problems by rice - ecosystem

UPLAND | HYDROMORPHIC | LOWLAND | SAHEL IRRIGATED

UPLAND

Drought *

Weeds Blast *

N and P deficiency

Erosion

Acidity/Acidity

Stemborers

Termites*

HYDROMORPHIC / LOWLAND

Weeds *

Water Control *

N Deficiency *

Drought *

Iron Toxicity *

Stemborers *

Africa Rice Gall Midge *

Rice Yellow Mottle Virus *

Bacterial leaf blight *

SAHEL IRRIGATED

Poor Water Control

* Extreme temperat

* N Deficiency

* Salinity

Alkalinity/Acidity

* Bacterial leaf blig

Varietal Improvement

Breeding Strategies

Conventional :

- Early success with development of **OS6, Sahel 202** & **108**

- Poor on-farm performance due to susceptibility to biotic and abiotic stresses in Africa

- Limited impact due to greater diversity of conditions in Africa

Breeding Strategies

Biotechnology:

- Marker Assisted Selection (MAS)
- Tissue Culture
- Anther Culture
- Embryo Rescue

NERICA Development

Two cultivated rice species in Africa

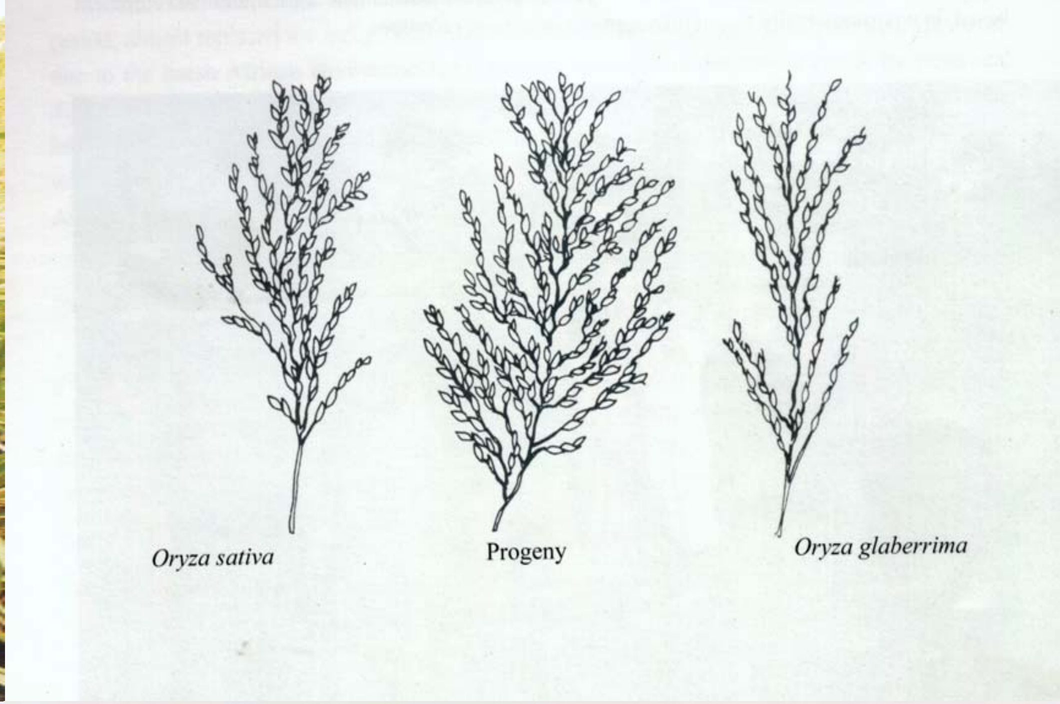
O. sativa (Asian rice)

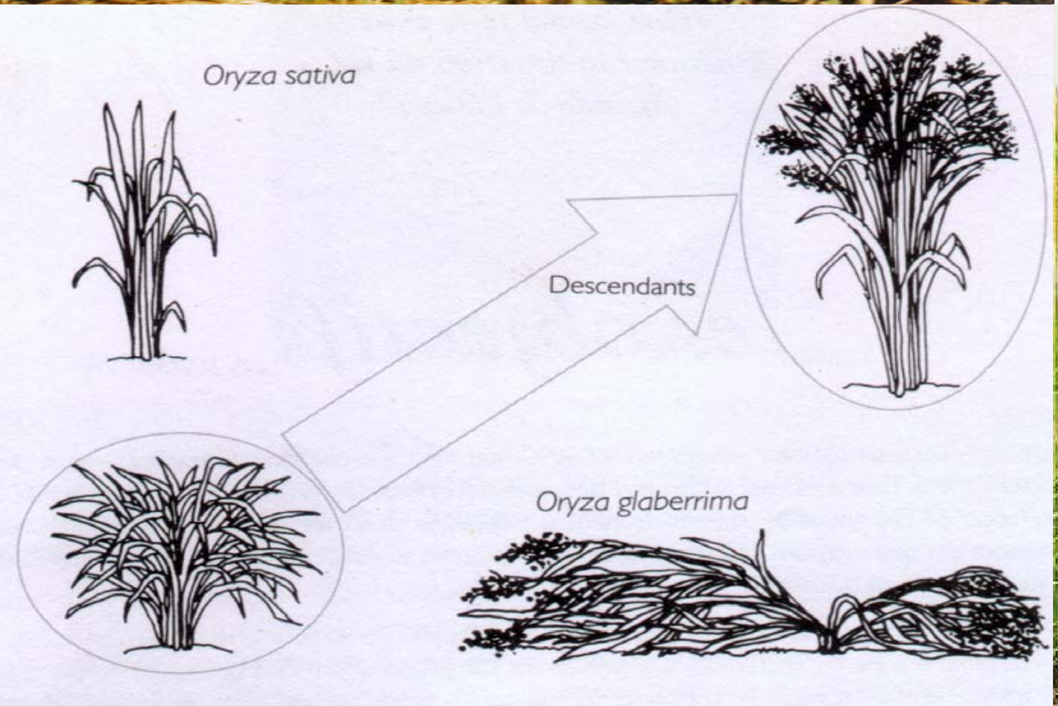
High yield potential

O. glaberrima (African rice)

- Higher resistance to major stresses in Africa (biotic and abiotic)
- Low yielding due to grain shattering


O. glaberrima


Oryza sativa
Progeny
Oryza glaberrima


Oryza sativa
Descendants
Oryza glaberrima


NERICA at flowering

Interspecific Hybridization Project

Cornell University
IRD
Gene-tagging for resistance to RYMV, AfRGM and drought.
Genetic diversity of *O. glaberrima*

IRRI
CIAT
Development of new interspecific progenies.
Evaluation of WARDA's interspecifics.
Providing new interspecifics to WARDA for evaluation in SSA.

YAAS
Determination of sterility genes in interspecific hybrid rice production.

Coordination and implementation.
Technology generation, dissemination and training.
Africa Rice Center (WARDA)

Nihon University
JICA
JIRCAS
Physiological characterization of new interspecifics

NARES
Development agents
Farmers
Assessment of new interspecific progenies in their own environments.
Involvement in participatory research.

Key NERICA development successes

18 upland & 11 lowland NERICAs released

Short growing cycle (<100 days), High yields (>2 t)

Resistance/tolerance to African stresses

High protein content (up to 25%)

Opening up of new gene pools & increased rice biodiversity to scientific community

No single NERICA variety combines all useful characteristics (agro-physiological traits cannot be generalized)

Participatory Varietal Selection (PVS)

Why ?

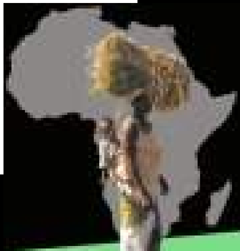
- Key to rapid upscaling of NERICA development, release & adoption
- Shortens time lag between varietal development and release (3 years vs. 7 years for conventional breeding)
- Accelerates rate of adoption of promising rice varieties
- Elicits farmer criteria for choosing/adopting rice varieties so such information is available to researchers for further refining technology

PVS Methodology

A tool for efficient transfer of improved rice technologies to farmers

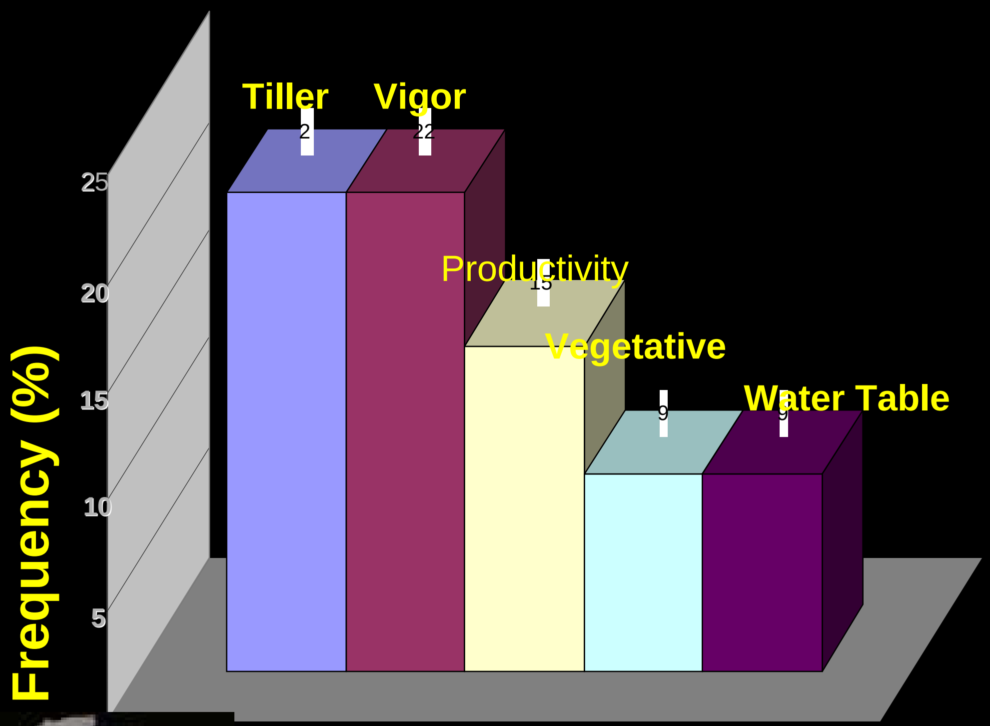
3-year program

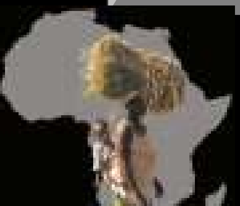
- **1st year: Farmers exposed to 30-60 promising varieties in rice garden**
- **2nd year: Farmers plant selections from among previous varieties**
- **3rd year: Farmers adopt preferred varieties**



PVS Results

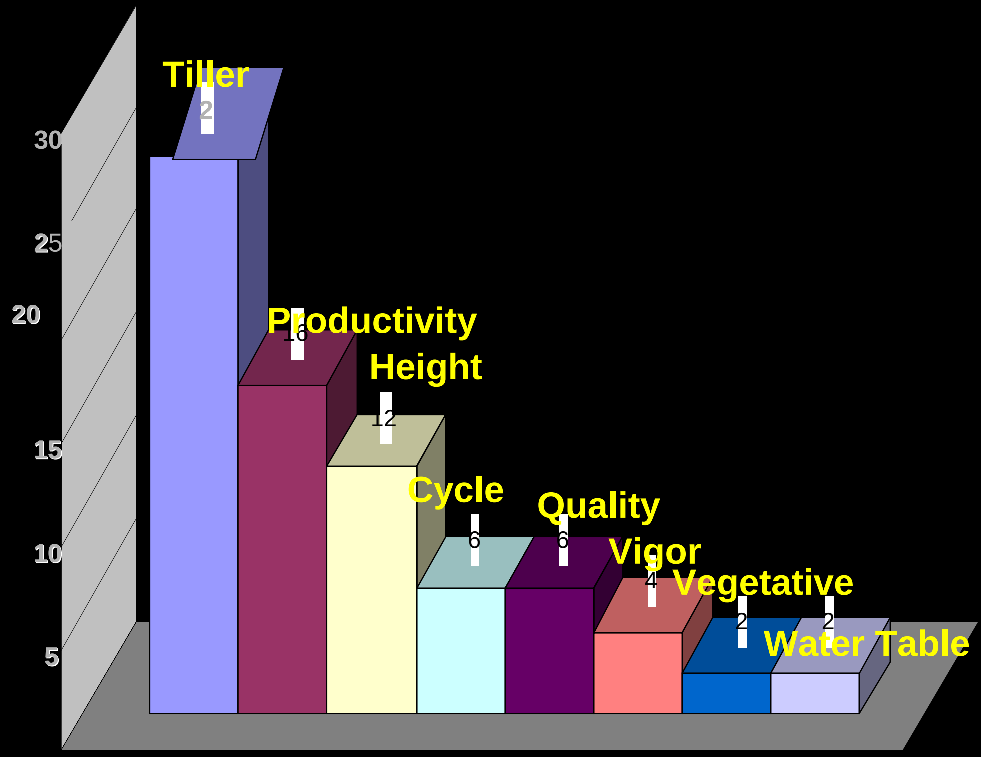
Choice criteria for women





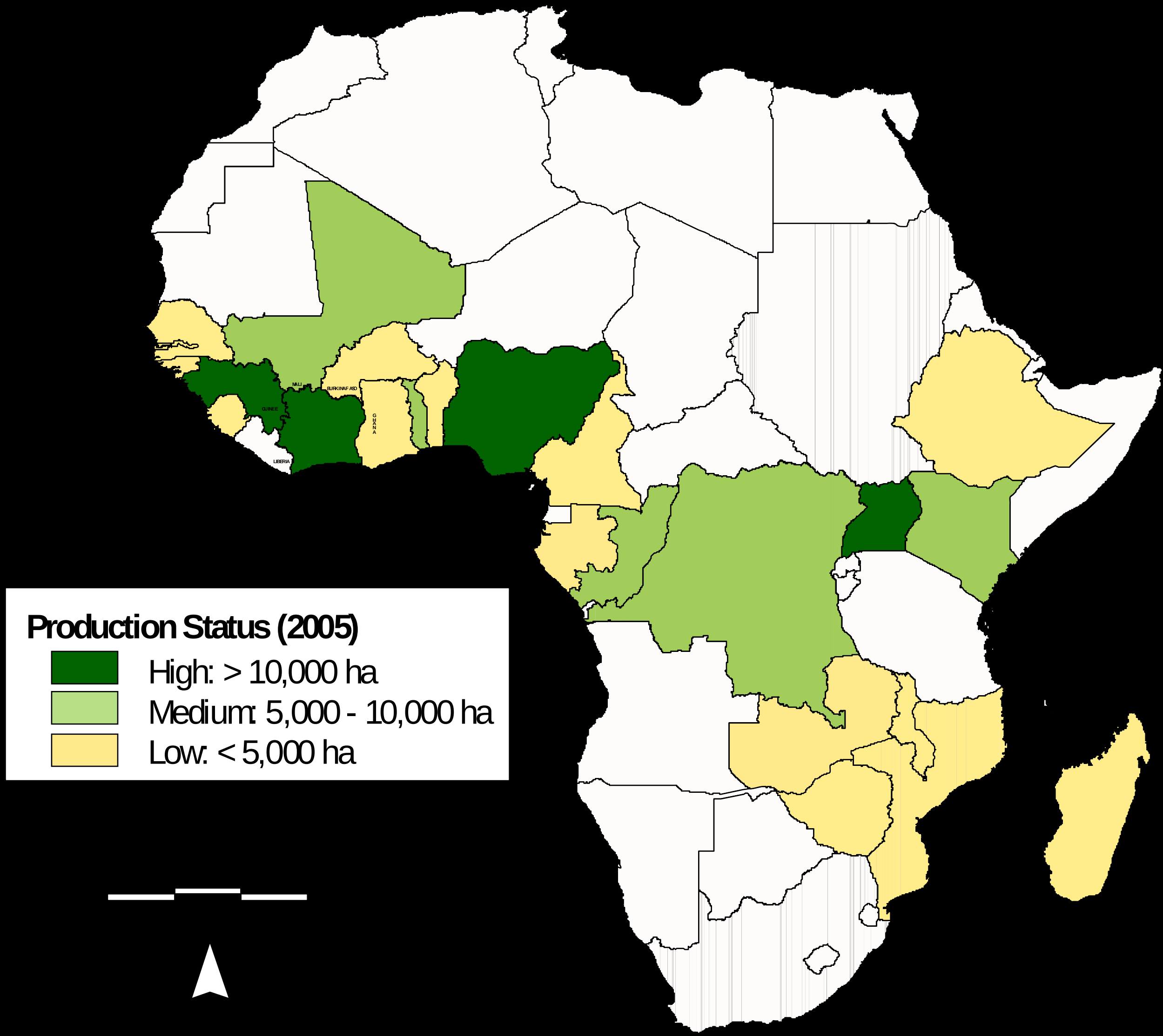
Agronomic traits

Choice criteria for men



Agronomic traits

Upland NERICA production areas in Africa



Status of NERICA Dissemination

17 upland NERICA adopted/released across SSA …

COUNTRY	NERICA																
	1	2	3	4	5	6	7	8	10	11	12	13	14	15	17	18	Total
Benin	A	A		A				A									4
Burkina Faso											R	R		A	R	A	5
Congo Brazza									A								1
Congo DRC				A		A	A										3
Côte d’Ivoire	R	R	A	A	A												5
Ethiopia	R	R	R	R													4
The Gambia	A	A	A	A	A	A	A										7
Ghana	R	A															

… 17 NERICA lines adopted/released across SSA

COUNTRY	NERICA																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Kenya	A			A						A	A								4
Liberia	A			A			A	A											4
Madagascar		A	A	A															3
Mali				R				A	A					A				A	5
Nigeria	R	R	A					A											4
Sierra Leone	A	A	A	A	A	A													6
Togo	A		A	A															3
Uganda	R		A	R						R									4
Total	12	7	9	13	4	4	4	3	1	3	1	1	1	1	1	0	1	2	

NERICA Production in Africa

Over 250,000 ha currently reported under NERICA cultivation in SSA countries

Leading countries are Guinea, Nigeria, Côte d'Ivoire and Uganda

Emerging countries:

Ethiopia - cultivated area increased (2,000 ha in 2006 to 12,000 ha in 2007)

Benin - massive intervention of private sector & Government; Rice production increased (52,000 t in 2005 to 85,000 t in 2007)

Mali - over 20,000 ha projected for 2008

Record rice harvest in Africa in 2006 credited to NERICA adop
(FAO Rice Monitor – March 207)

Rice R&D Boosting the productivity of upland rice : Case of Uganda

"First and the most important finding is that the yield of NERICA in the normal cropping season is exceedingly high. The average yield of 2.1 tons per hectare is twice as large as the average in sub-Saharan Africa. In Japan it took approximately 100 years to increase the upland rice yield from 1 ton per hectare in the late 19th century to 2 tons per hectare in the late 20th century."

Kijima *et al.* (2005)

Rice R&D contributing to the Millennium Development Goals: case of NERICA in Benin

- **Impact on rice productivity:**
  - Impact on rice yield: 1,587 kg/ha
  - Impact on rice income: $28 per capita
- **Impact on child schooling:**
  - 6% increase in school attendance rate
  - About $20 increase per child in school expenditure
- **Impact on child health:**
  - 5% increase in the hospital attendance frequency when sick
  - About $12 increase in health expenses per sick child

Rice R&D contributing to the Millennium Development Goals: case of NERICA in Benin

- **Impact on poverty:**
  - Consumption spending: +$0.30 adult equivalent
  - Daily calories intake: +36 kcal/adult equivalent/day
  - Consumption expenditure deficit ratio : -19% (compared to the poverty line)
- **Higher impact for women:**
  - Yield impact higher for women - 850 versus 517 kg per hectare
  - Impact on income higher for women - $337 versus $277 per hectare

New Rice for Africa (NERICA)

- Critical Success factors:

  - Emphasis on participatory approaches
  - Branding (creating interest in PGR)
  - Technology nurtured until dissemination
  - Political support at the highest level (NERICA Champions)
  - Sustained funding (visionary donors)
  - Technology adapted to local farming conditions (Sustainability)
  - Gender effects

Challenges

Challenges

- Quality Seed
- Climate change
- Crop Management (NRM)
- Capacity building (Extension Services, rice scientists)
- Policy
- Markets (inputs, outputs)

- Funding research & development

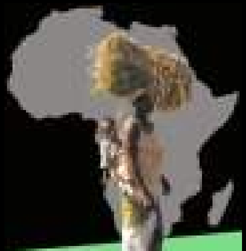
Seed Strategy

- Recurrent bottleneck
- Need for increased farmer access to improved seed
- Strengthen or develop national extension services (training)
- Develop viable private seed sector
- CBSS Approach enhanced

Climate Change

Consequences

- Water availability (greater, more intense rainfall; increasing drought)
- Increased surface temp, evapotranspiration & decrease in crop yields
- Salt water intrusion



Natural Resource Management

- Soil fertility
- Water management
- IPM (insect pests, diseases, and weeds)
- Scaling-up Integrated Crop Management technologies

Concluding Remarks

Rice farming… a critical driver for poverty reduction in SSA

IFPRI study (2006):

- among agricultural commodities, rice “shows the highest potential for growth and could subsequently generate the largest producer benefits among many countries and for the region as a whole”
- “Rice could be considered a region-wide strategic commodity”
- “To take advantage of rice’s potential, joint investments in rice research and development at the regional level can provide even higher returns given its potential for transferability across borders”

Concluding Remarks

- Unique opportunity to realize potential for rice production with high rice prices

- Enhance rice production/productivity through:
  - available modern rice technologies
  - large & diversified rice ecologies suitable for rice
  - underutilized water resources
  - competitive domestic rice productions systems

Concluding Remarks

Improved agricultural technology (including new rice varieties) will play an important role as part of:

Broad mix of technology, infrastructure, institutional reform and enabling policy environment if an African Green Revolution is to become a reality


MERCI
Rice is a beautiful crop.
Rice is a beautiful crop.