Agriculture in Africa: Context, R *for* D challenges and opportunities, and an update on NERICA

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01 BP 2031
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WARDA: The Africa Rice Center

- CGIAR member
- Association of 21 African member states (4 countries from ECA joined recently)
- 12-14 million US$ / year budget
- HQ temporarily based in Cotonou, Benin
- Outstations: St. Louis, Senegal; Ibadan Nigeria, Lusaka; Dar-es-Salaam, Tanzania
- 124 research staff (33 IRS)

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- African agriculture in a global context
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- Success stories
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  - NERICA before TICADIII
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  - Gaps in NERICA research and dissemination
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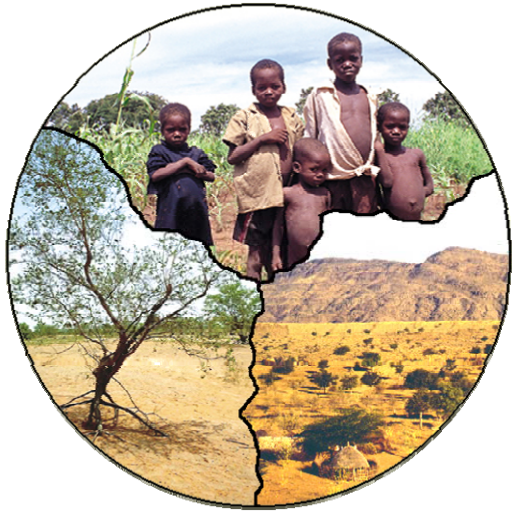
- Conclusions

Agriculture in Africa: challenges

240 million people
live on less
than US$ 1
per day;
vast majority active
in agriculture



- Poor soil fertility, drought
- Low productivity
- Fertilizer use: lowest in the world
- High transport costs
- Small markets
- Food imports (SSA, mln tons, 2003): rice: 7; wheat: 12; maize: 3

Globalisation and urbanisation

- Globalisation and rising ‘transforming’ powers in Asia and Latin America
- Will Asia remain a rice exporter?
- >50% of SSA population in urban centers by 2015, consuming rice: rice farming will become even more female-led

Global market shifts

- Greater emphasis on high value products and quality standards, also in urban centers in Africa

- Emerging markets for animal feed and biofuels…

Uncertainties

- Climate change, trade regimes, higher energy and staple food prices, water shortage, environmental degradation, emerging diseases…


LES NOUVELLES

N°0226 • Samedi 20 novembre 2004 — Quotidien national d'information et d'analyse — www.les-nouvelles.com • Prix : 1000 Fmg

André Ramaroson de la Savonnerie tropicale réclame la protection des industries existantes et souhaite la reconsidération du Code des investissements ▶ 18

Exclusif ▶ 4

"Je suis victime d'une injustice", clame Rah-Ckiky

Monde ▶ 23

Le personnel de l'ONU pourrait voter la défiance à l'égard de Kofi Annan

RANGER

MADASMART

Panique sur le riz : la folie à la hausse n'est plus maîtrisée

1450 330 — 1200 340 — 1450 420

Ces derniers jours et de façon brutale, soudaine, inattendue, bien que prévisible, la panique s'est emparée de la filière riz d'un bout à l'autre du pays. Dans la capitale, le prix du kilo est déjà le double du prix officiel conseillé ! Et plus on s'éloigne des centres bien approvisionnés, plus les prix grimpent dans les zones les plus pauvres. Face à cette situation, les responsables semblent dépassés par les événements, comme pris de panique. Les réponses données dans l'urgence ne sont pas satisfaisantes, encore moins rassurantes. "Le plan riz" du gouvernement semble avoir échoué avant d'avoir commencé. ▶ 3 - 5

▶ 4

Culture ▶ 17

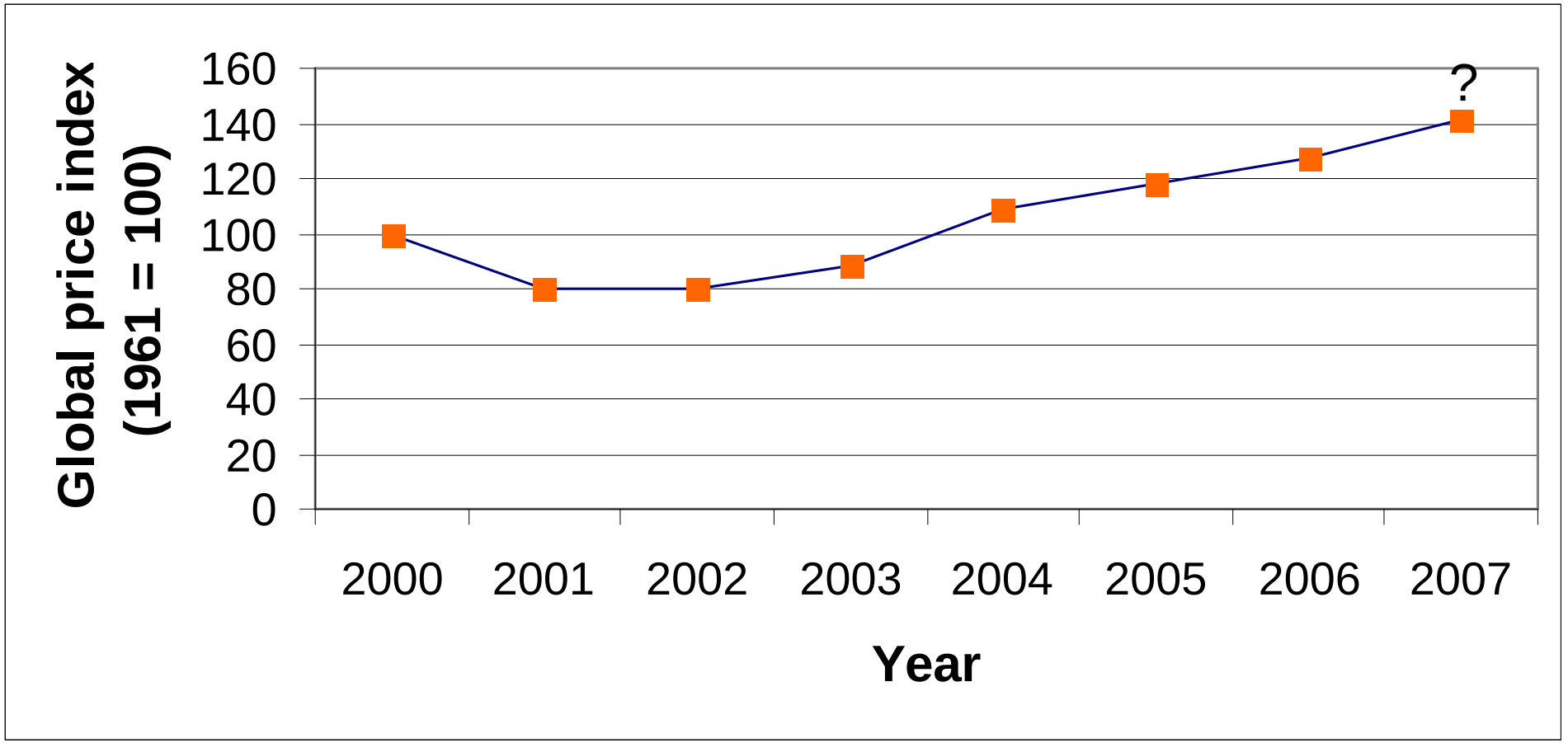
Jane Birkin au programme du CCAC l'année prochaine

Sport ▶ 20

L'élection du président de la Fédération de rugby reportée pour le 18 décembre

TOYOTA Rasseta Tél. 22 257 70

Variability of paddy rice prices on the world market



Source: Cirad, OSIRIZ network

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Responding to the Challenges …

Africa's vision

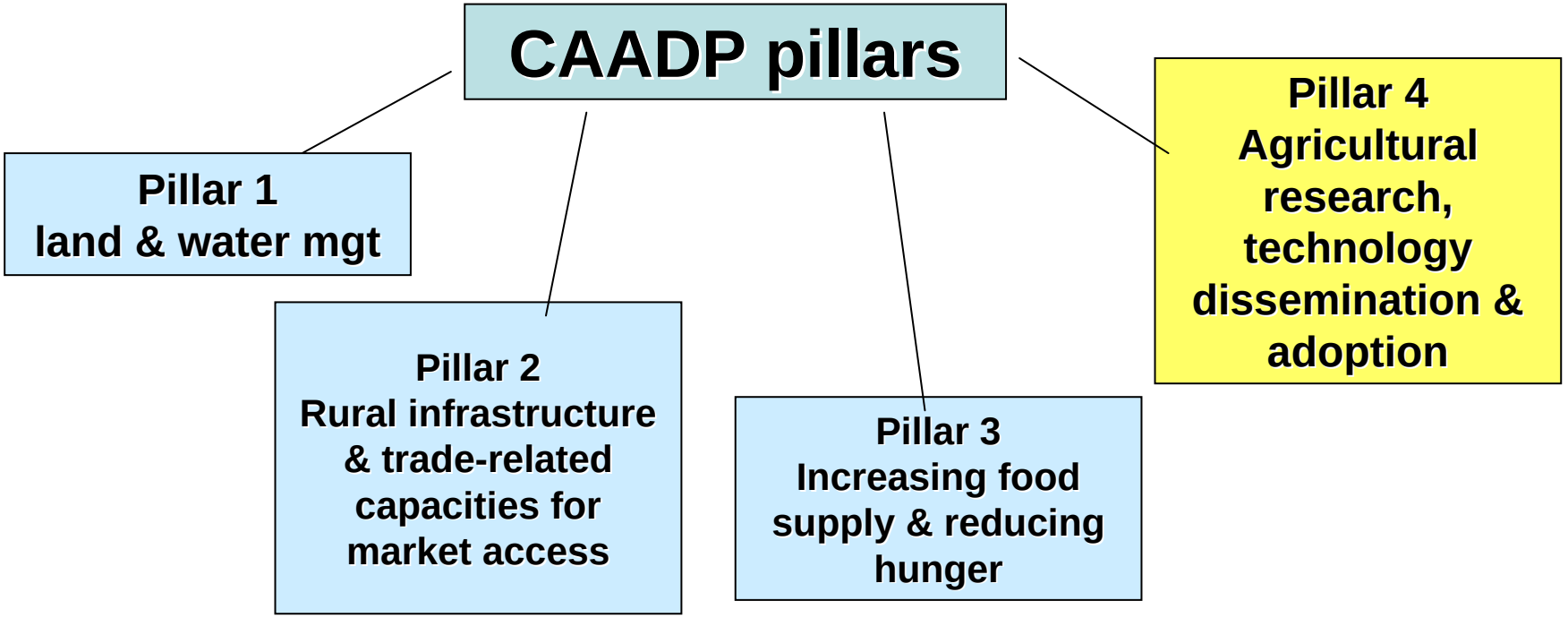
Regional agricultural production to grow at an annual rate of 6% by 2020

Achieved by:

- **Dynamic agricultural markets** among nations and between regions
- Be a **net exporter** of agricultural products
- Have **food available and affordable,** and **equitable distribution of wealth**
- Be a **strategic player** in agricultural S&T development
- Have a culture of **sustainable use** of natural resource base

The African leadership

- New Partnership for African Development (NEPAD): Comprehensive African Agricultural Development Program (CAADP)



Pillar 4: agricultural research, technology dissemination and adoption

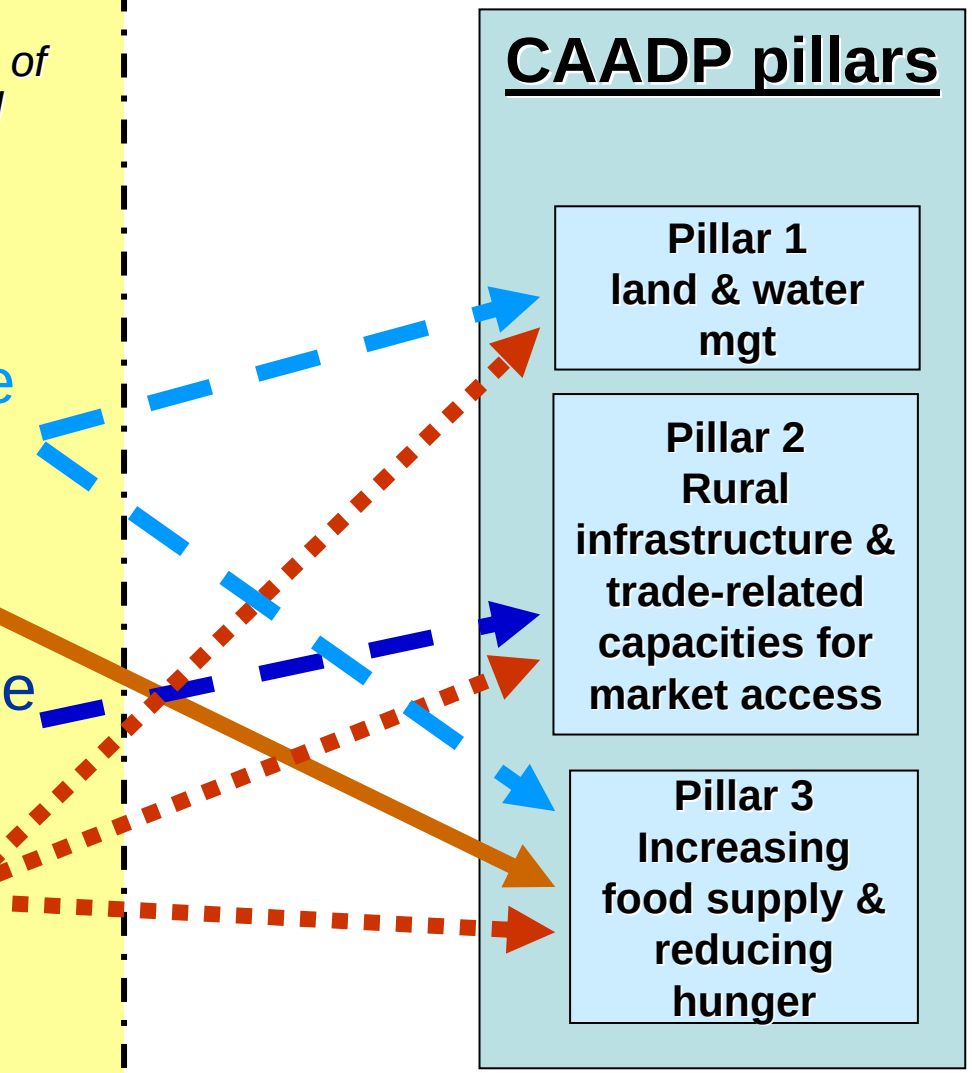
Purpose:

to overcome the constraints to sustainable use of Africa's natural resources with improved technologies and policies

Themes

- Integrated natural resource management
- Adoptive management of appropriate germplasm
- Development of sustainable market chains
- **Policies for sustainable agriculture**

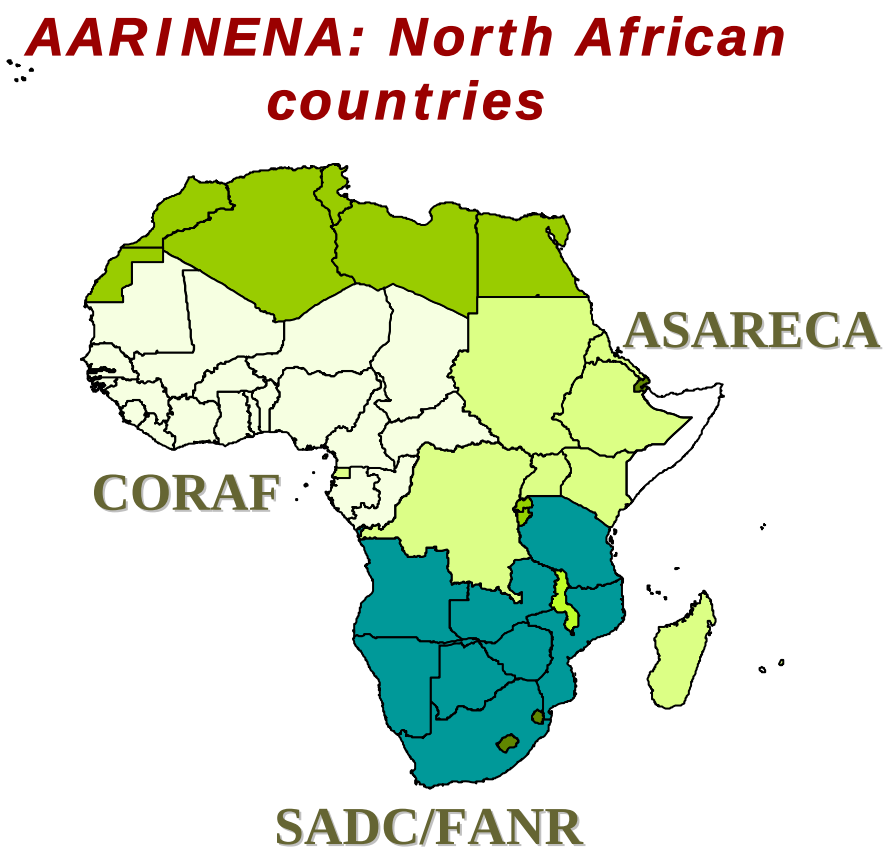
The role of agricultural research



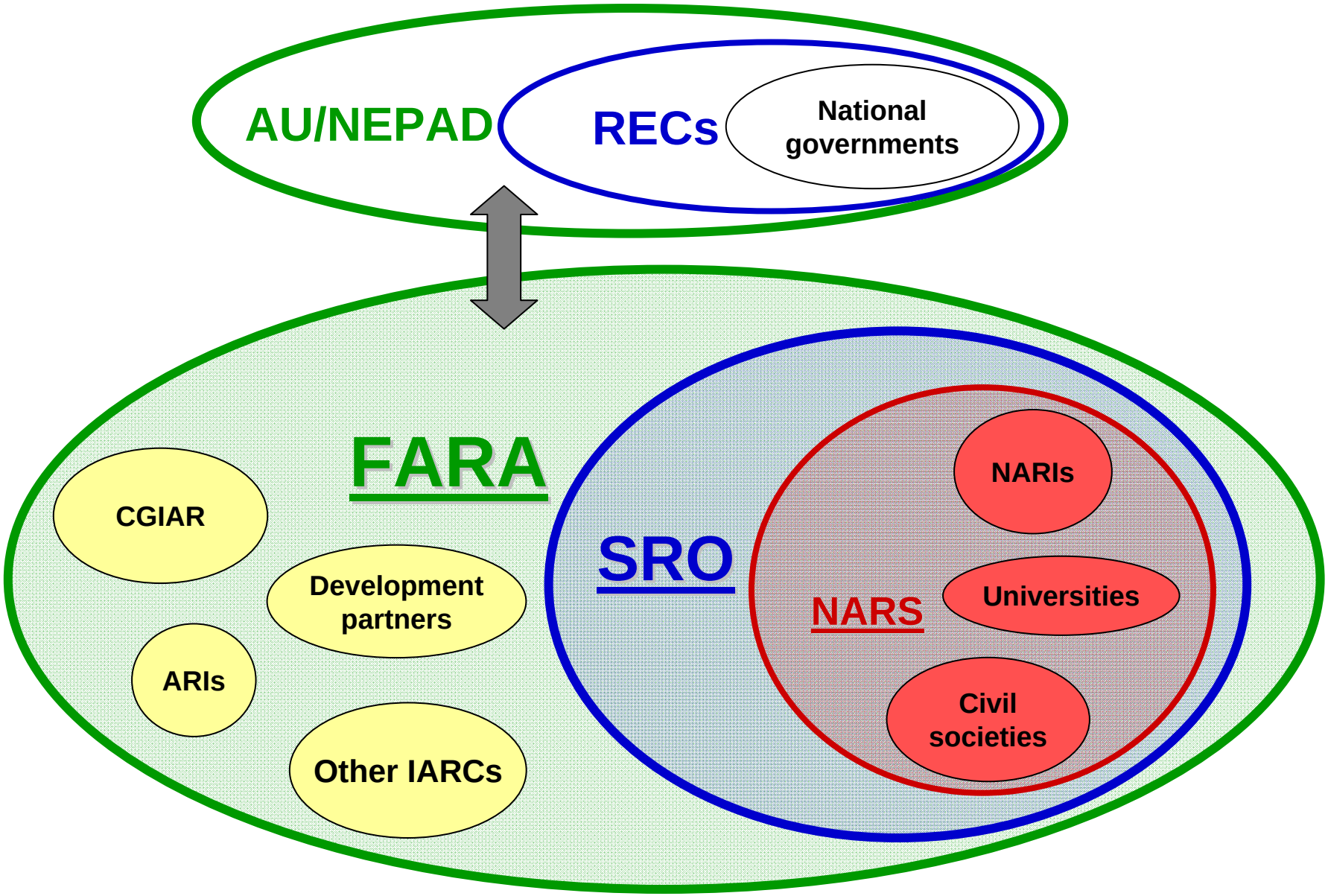
Forum for Agricultural Research in Africa (FARA) - recognized technical arm of the African Union and NEPAD

FARA's Networking support functions:

- **Advocacy and resource mobilisation**
- **Access to knowledge and technologies**
- **Regional policies and markets**
- **Capacity strengthening**
- **Partnerships and strategic alliances**



Evolving institutional ARD environment in Africa



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Selected Success Stories

Kenya flower business

- Kenya Agricultural Research Institute (KARI) providing technical support to tissue culture through research and training
- Local farmers gets training on increased production and use of new technologies
- Private firms investing in tissue culture laboratory to service local farmers

Results:

- Kenyan farmers exporting to Europe
- Competitive local farmers
- Increased income

Selected Success Stories

Nigeria national cassava initiative

- National government initiative to maximize production, processing and industrial use of cassava
- National government provide funding to research and technology application
- the International Institute for Tropical Agriculture (IITA) giving basic research and training to national researchers and extension workers

Results

- Improved varieties of cassava immediately available to farmers
- Fight against the cassava mosaic disease before spread
- Post harvest processing improved use
- Increase income of farmers

Selected Success Stories

New Rice for Africa (NERICA)

- Africa Rice Centre developed new technology NERICA
- National research centres practicing participatory research to test
- Extension agents teaching farmers to grow its own seeds for planting

Results

- West African rice farmers increased rice production
- National governments save on import duty
- Increased farmer's income

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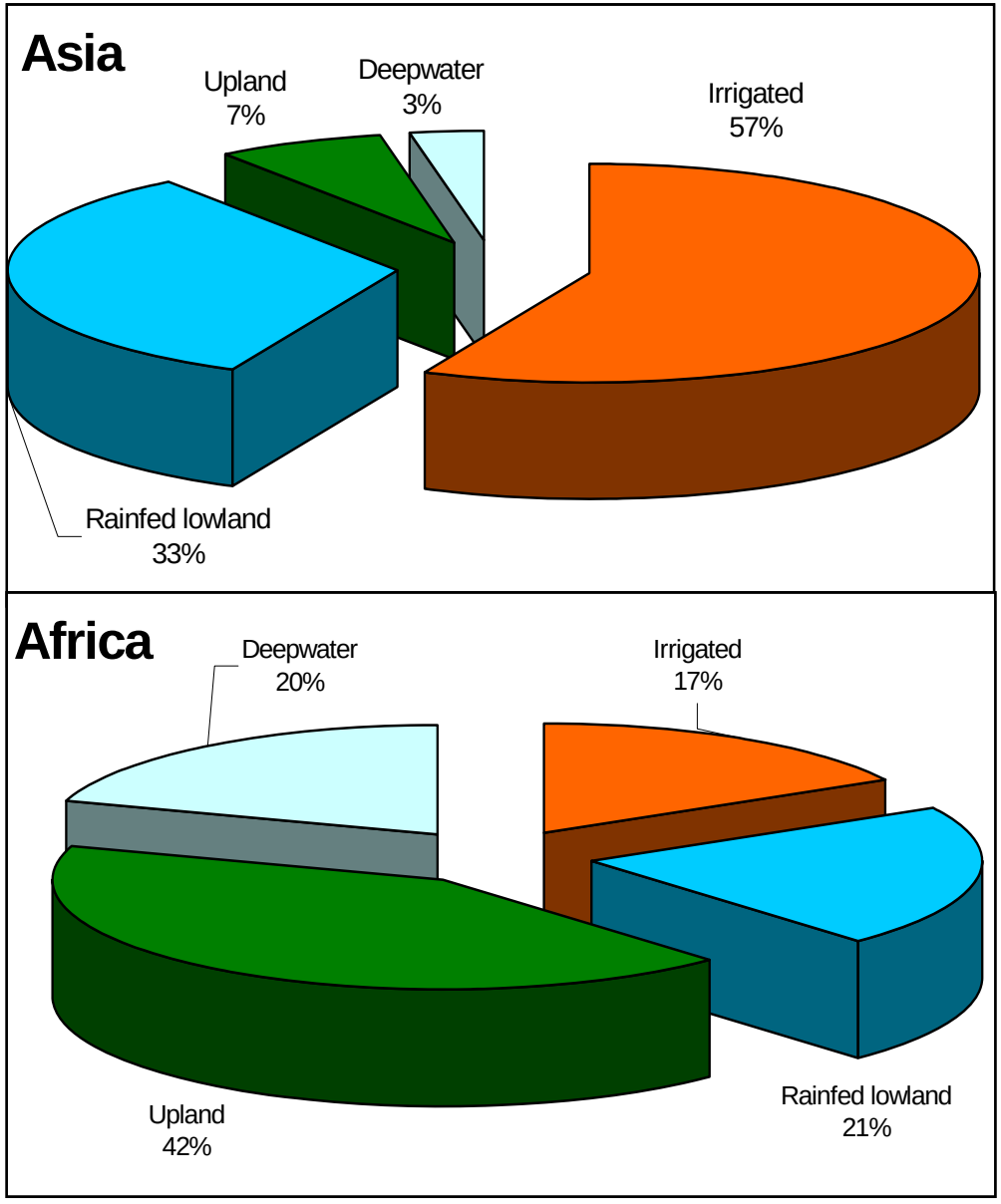
Rice in sub-Saharan Africa

- 8.5 mln ha: 80% rainfed
- 13 mln t paddy /yr
- 27 kg milled rice per capita (kg/person/year)
- 9.2 mln t import / yr (1/3 of world market!)
- WCA: imports 40-50% of rice needs
- By 2015: 10 mln t paddy / yr extra needed

Source: IRRI / WARDA (2004-2006 data)

Distribution of rice area



(FAO 2001)

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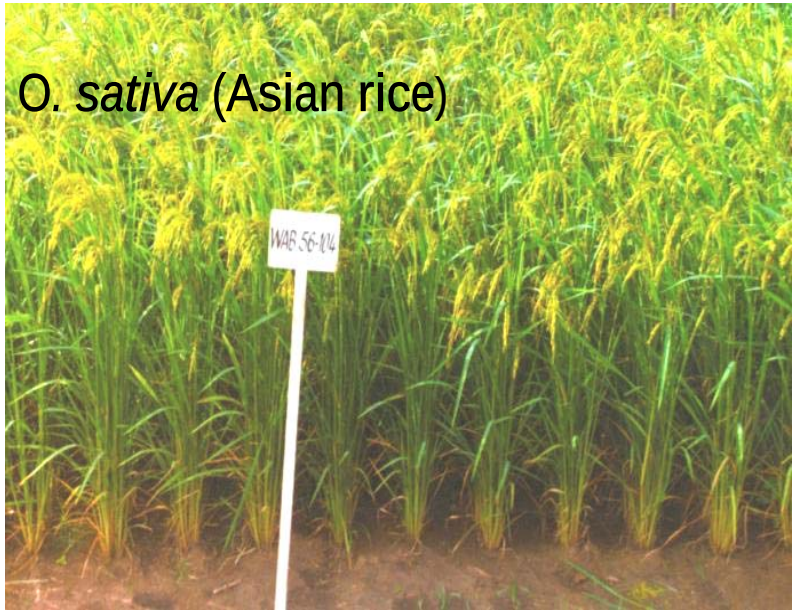
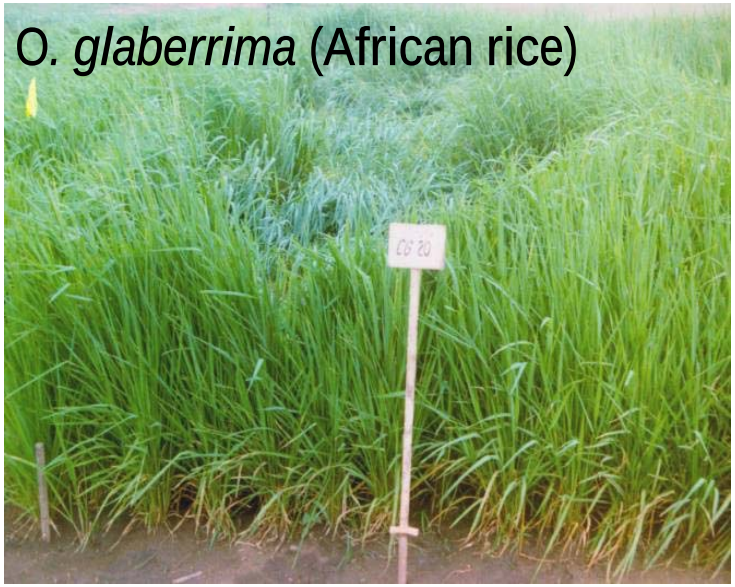
Two cultivated rice species in Africa



High yield potential



Higher resistance to major stresses in Africa but low yielding due to grain shattering

Basic concept of inter-specific breeding at WARDA

- To develop NERICAs possessing the adaptability of *O. glaberrima* to local conditions in WCA and the characteristics of *O. sativa* associated with high yielding (Combination of the resistance of *O. glaberrima* and the high yield potential of *O. sativa*)

- At the beginning (early 90's), the target ecology as upland due to the lowest yield (< 1 t/ha) and largest area among the rice ecologies

Brief history of NERICA development

- 1990 and 1991: Screening of WARDA's germplasm
- collection, *O. glaberrima* (1130), improved *O. sativa*
- (316) and traditional *O. sativa* (275)
- 1992: Crossing *O. glaberrima* (8 lines) x *. sativa* (5 vars)
- 1994: First fixed fertile inter-specific progeny (NERICA)
- 1996: Start of farmers' participatory varietal selection
- (PVS) in Côte d'Ivoire (CI)
- 1997: Start of Inter-specific Hybridization Project (IHP)
- funded by Japan and UNDP
- (1998: TICAD II)
- 2000: First release of NERICA's (Ivory Coast and Guinea)
- 2000: NERICA 1–7 numbered
- (2003: TICAD III)

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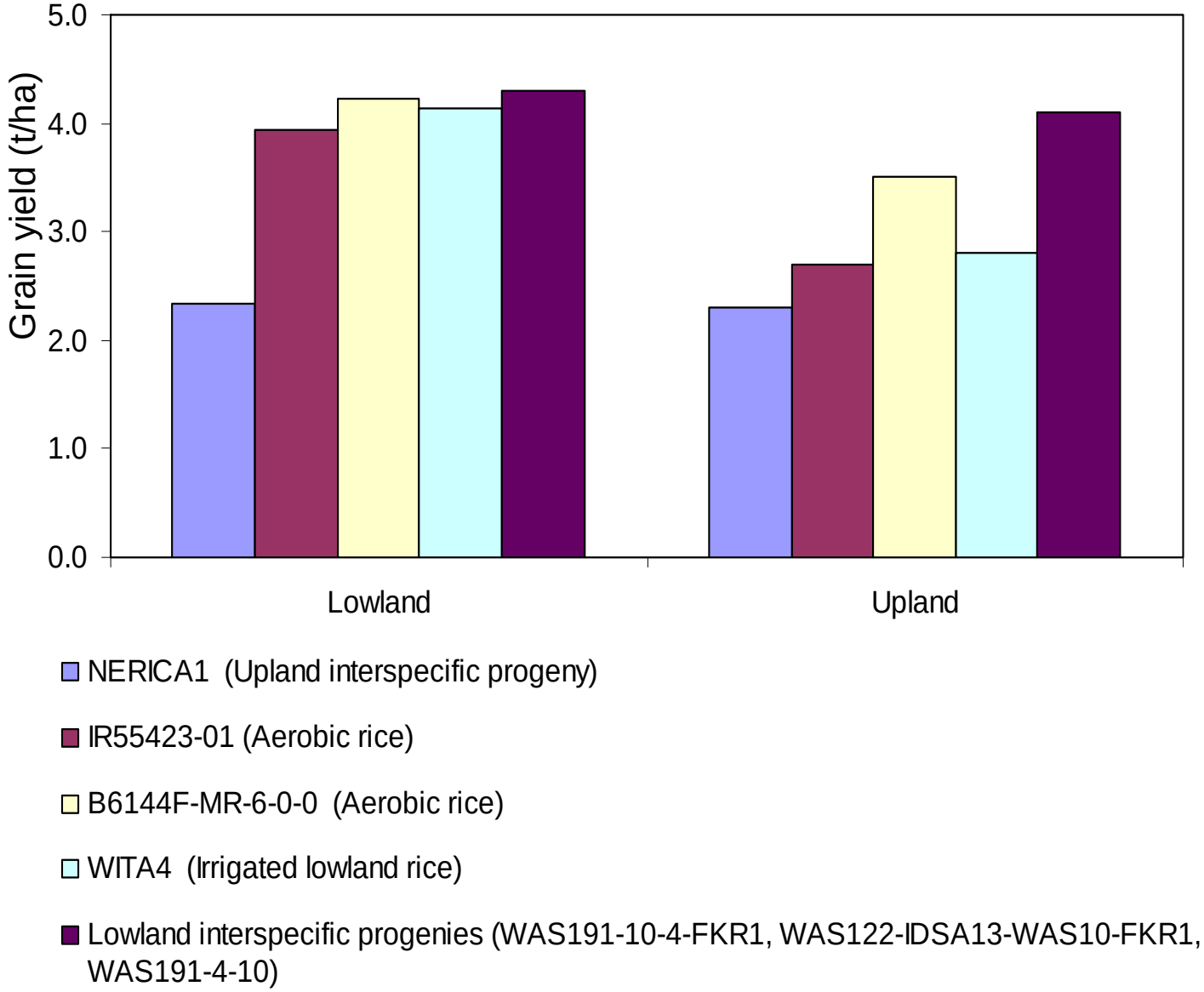
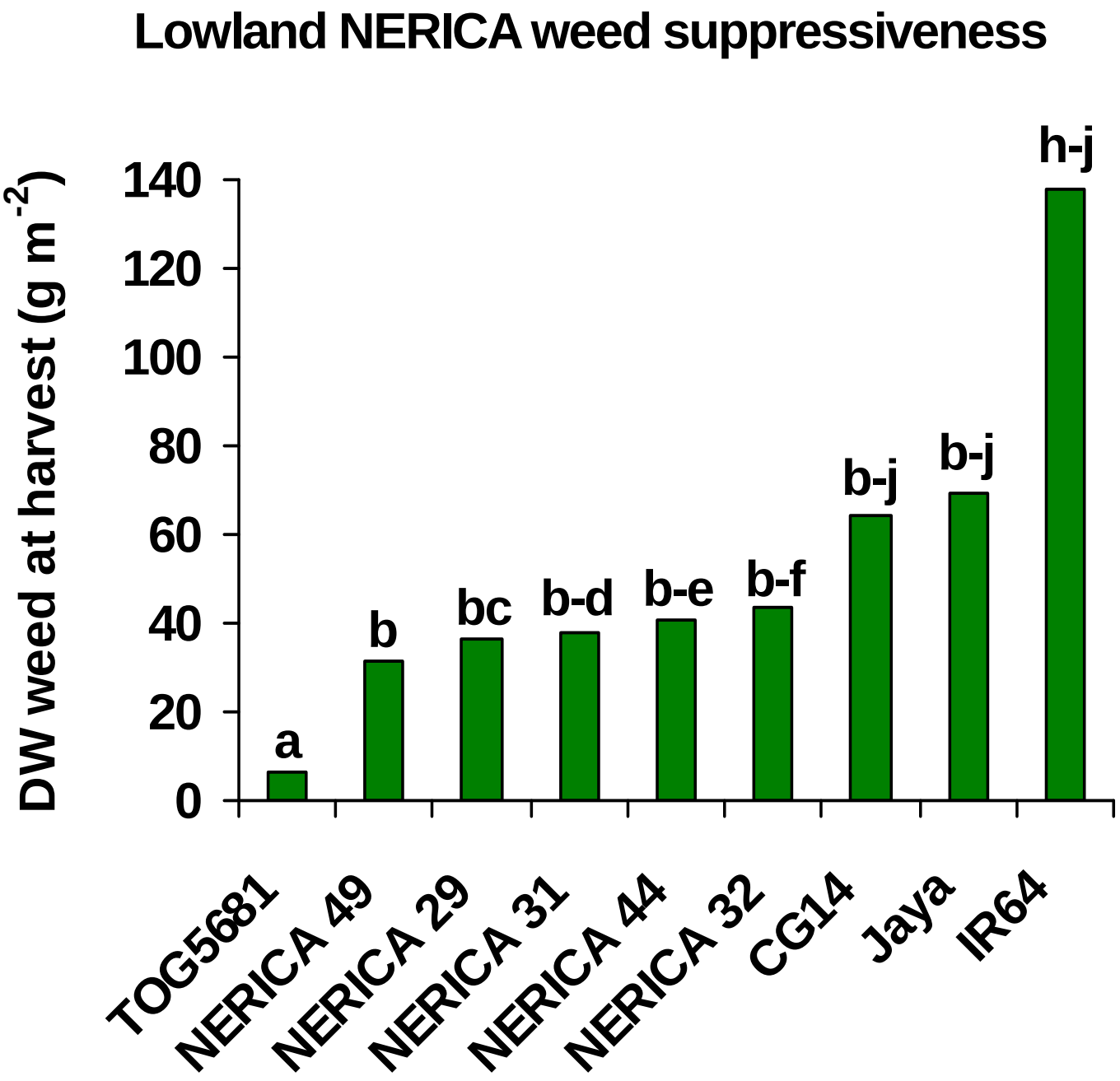
Major progress and achievements after TICAD III

- Identification of 11 new upland NERICA (total 18)
- Development of lowland NERICA (strong collaboration with NARS: 60 varieties in total)
- Molecular profile of upland and lowland NERICAs (about 10% from *glaberrima* parent)
- Up-scaled and improved participatory varietal selection (PVS)
- Varietal release: 11 lowland NERICAs in 7 countries; 10 upland NERICAs in 8 countries; adoption through PVS in 16 countries
- Impact analyses

Performance of Lowland NERICA




Lowland NERICA weed suppressiveness
DW weed at harvest (g m-2)
140
120
100
80
60
40
20
0
a
b
bc
b-d
b-e
b-f
b-j
b-j
h-j
TOG5681
NERICA 49
NERICA 29
NERICA 31
NERICA 44
NERICA 32
CG14
Jaya
IR64

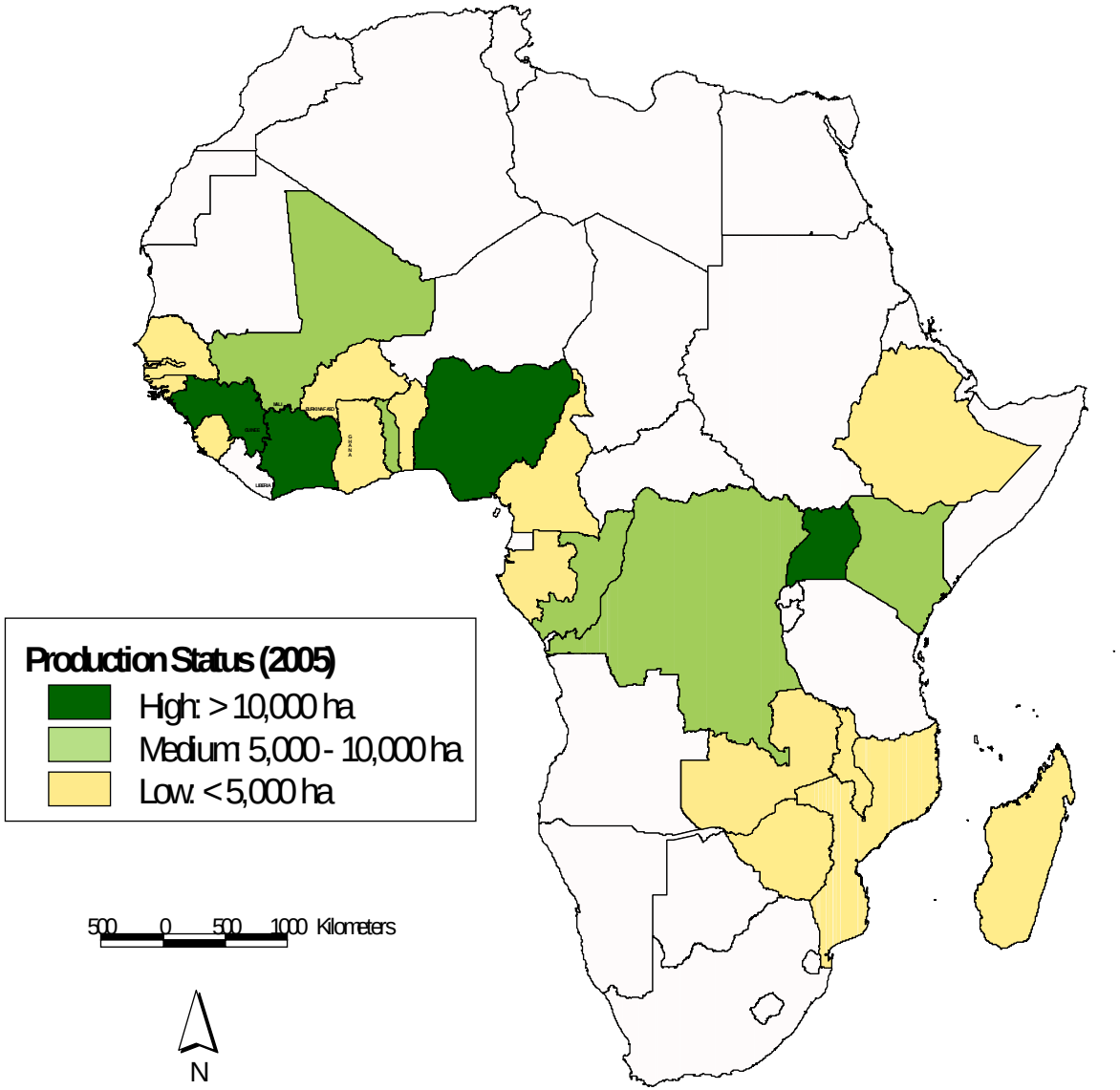
Up-scaled and improved PVS

PVS moved into East and Central Africa

A 3-year program

- 1st year: farmers are exposed to a range of promising cultivars (30-60 varieties in a rice garden)
- 2nd year: Farmers plant selections from among previous varieties
- 3rd year: Farmers adopt preferred varieties

NERICA production area in Africa



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Gaps in NERICA Research and Dissemination

RESEARCH

- Resistance to local constraints such as weeds
- Narrow genetic diversity: all NERICAs named are derived from only two *O. glaberrima* lines (CG 14 and TOG 5681)
- Sterility barrier between the two species has not been
- completely overcome in spite of the use of backcrossing and anther culture
- Lack of integrated approach, not enough focus on entire cropping calendar (development of integrated crop management options) and rice value chain

DISSEMINATION

- Inadequate seed supply systems
- Post-harvest problems

Africa Rice Initiative (ARI)

- Community based seed system (CBSS) approach enhanced
- NARS seed technicians trained
- Strong NARS utilized to produce seeds
- Private sector sensitized to invest in seeds
- Under current emergency situations where seed demand is rapidly increasing, ARI is also producing foundation seed to catch up with demand

Capacity building of NARS technicians for seed production

Several training courses on seed production conducted by WARDA with more than 100 technicians trained

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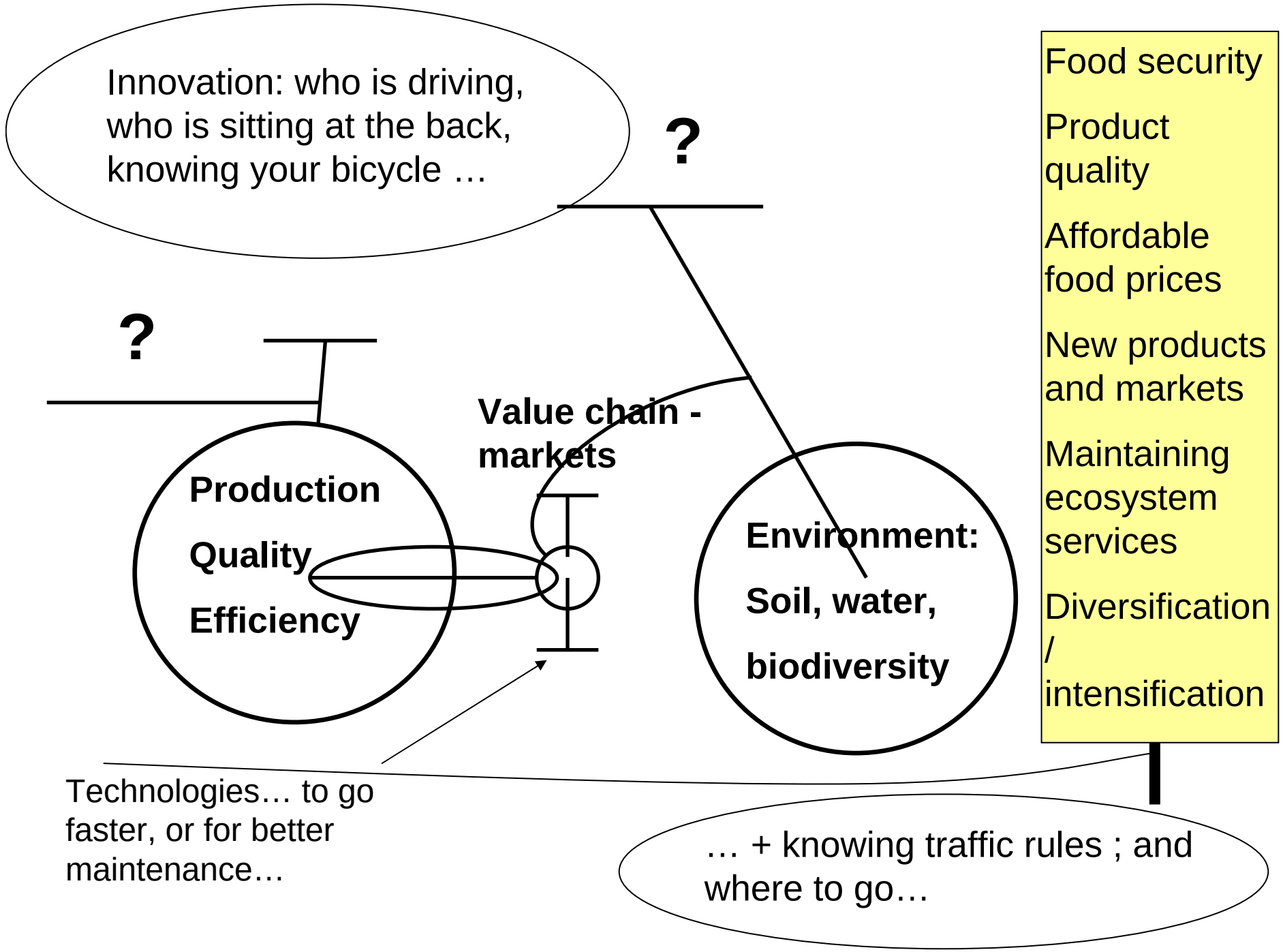
Challenges

- Producing more food in Africa to close the widening gap between supply and demand
- Raising agricultural productivity and profitability per unit land, water, labour
- Preserving the natural resources and coping with climate change
- Adding value to agricultural produce and allowing smallholder farmers (especially women) to enter such value chains


Innovation: who is driving, who is sitting at the back, knowing your bicycle …
?
?
Value chain - markets
Production
Quality
Efficiency
Environment:
Soil, water,
biodiversity
Food security
Product quality
Affordable food prices
New products and markets
Maintaining ecosystem services
Diversification / intensification
Technologies… to go faster, or for better maintenance…
… + knowing traffic rules ; and where to go…

Opportunities

- Large yield gaps in irrigated and rainfed lowland systems
- Potential to expand agricultural areas
- Renewed interest in Africa and agriculture
- Rapid ICT developments
- Strong African partnerships
- Greater private sector involvement (e.g. seed and fertilizer sector)

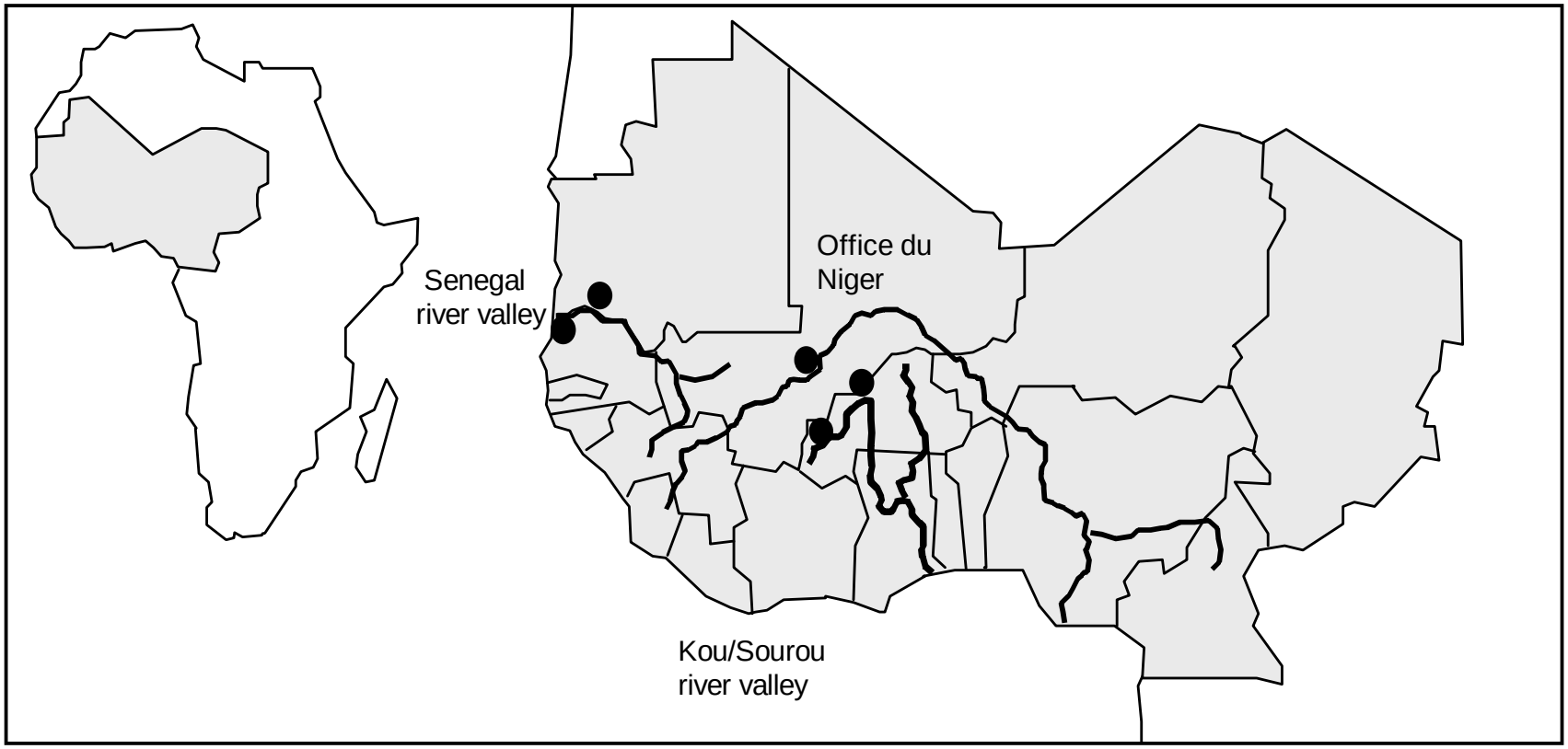
Production systems in Africa

Farming system	Potential for poverty reduction	Potential for agricultural growth
Irrigated systems (rice, vegetables)	Low	High
Tree crop system (tubers, cash tree crops)	High	Moderate / High
Cereal-root crop mixed system	Low	High
Maize-mixed (cassava, livestock)	High	Moderate / High
Agro-pastoral millet-sorghum-livestock	High	Low/Moderate

Source: Dixon et al., 2001: Global farming systems study. FAO, Rome, 90 p.

High-input irrigated rice systems

- Key issues
- Field level modeling (QUEFTS) and testing
- Options
- Scaling up/out



High fertilizer use, but important losses
(N recovery: 0.18 – 0.45 kg kg^{-1})
Variable yields (average 4.5 t ha^{-1}) and large yield gaps

-> Clear scope for increasing productivity and nutrient use

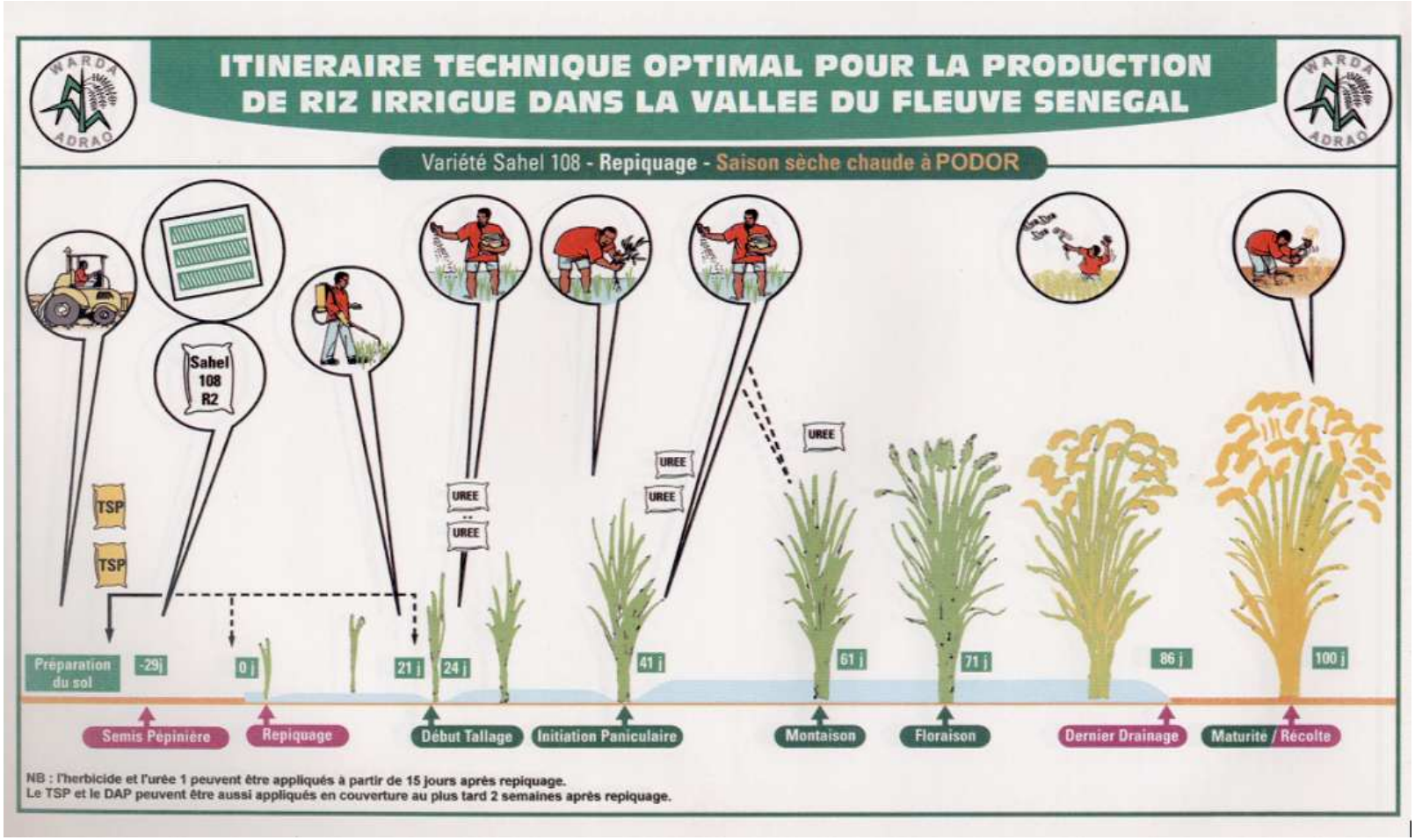
What can be done to improve productivity and nutrient use?

- Improve existing ‘blanket fertilizer recommendations’ and make them more specific to soil type and sowing date
- Improve timing and quality of crop management practices to reduce losses

Improving productivity and nutrient use in Bagré, Burkina Faso

- Decreasing P and K dose, but increasing N dose
- P balance neutral; negative K balance tolerated
- Yield gains of up to 0.5 t ha^{-1} simulated, equal costs
- More than confirmed in farmers' fields in 4 seasons
- Gross returns above fertilizer costs: US$ 160 $season^{-1}$

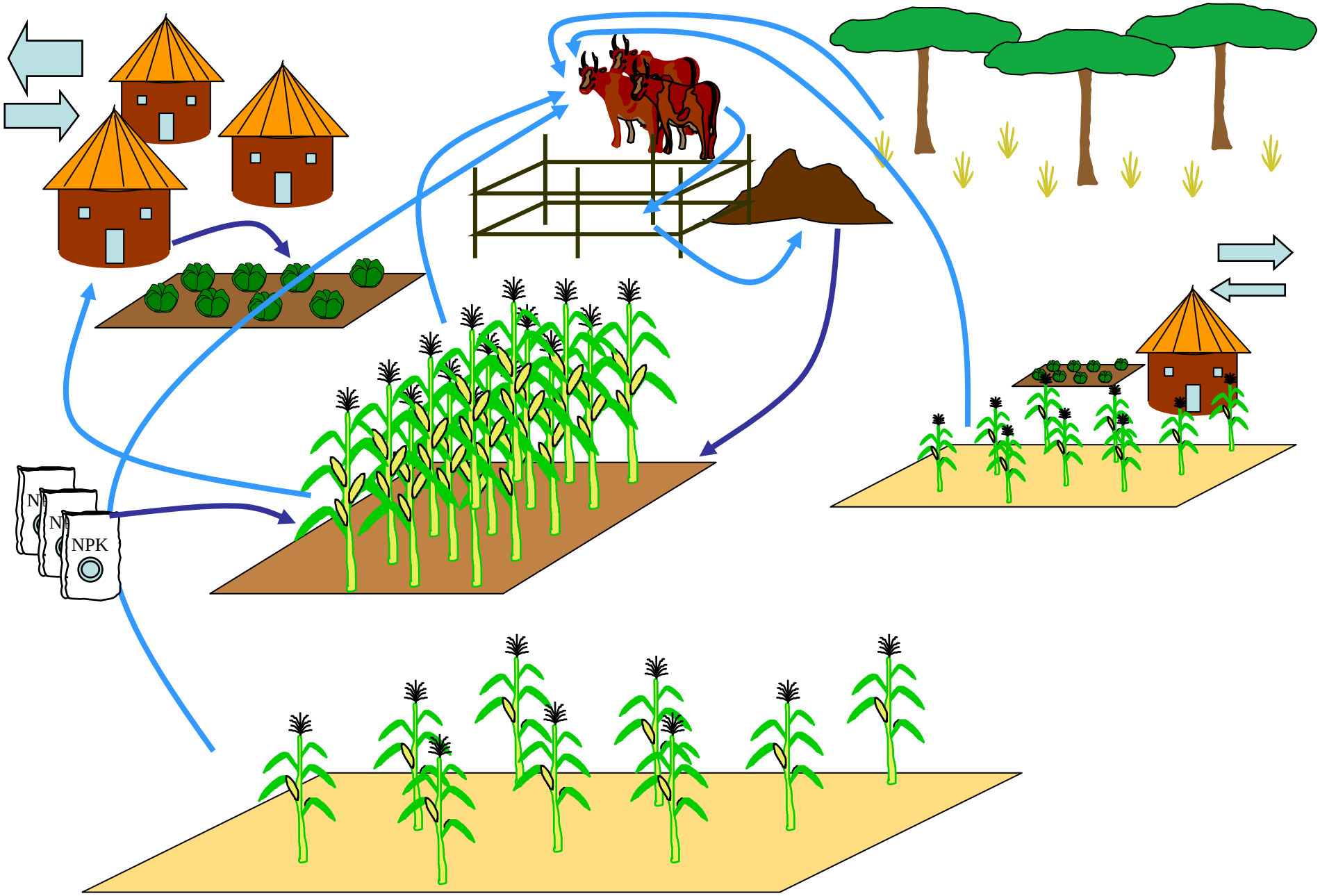
Example of cropping calendar distributed to farmers



Low-input mixed maize systems

- Key issues
- Farm level modeling (FARMSIM) and testing
- Options
- Scaling-up/out

Soil fertility gradients: infields - outfields


NPK

What can be done to improve productivity and nutrient use?

- Analyze alternative resource allocation strategies
- Improve timing and quality of crop/livestock management practices to reduce nutrient losses
- Promote mineral fertilizer use (small packs, micro-dosing, inventory credit, subsidies, farmer organization, infrastructure…)

Field specific nutrient management

Field type	Labor	Fertilizer	Organic inputs
Homefield, clay	++	+	++ (legumes)
Homefield-sand; Outfield-Clay	++	++	+ (legumes)
Outfield-sand	+	0	+ (transfer of biomass)

Participatory learning and action-research

- Testing of soil fertility management options
- Testing organizational arrangements to facilitate access to input and output markets
- Villages become learning and ultimately knowledge centers
- Farmer to farmer training

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What can research institutions contribute?

- Enable a more coherent and effective way of conducting agricultural research (e.g. adhere to regional plans FARA, CORAF, CGIAR, alignment IRRI-WARDA-CIAT for rice…)
- Establish strategic partnerships to conduct research on regional or global issues (e.g. inland valley lowland development, soil fertility, climate change, water productivity, high value crops)
- Improve access to knowledge and technology for innovation (e.g. testing by NARS of Asian technology, ICT based knowledge exchange)
- Develop strategic decision-making options for policy, institutions, and markets (stimulate inter-regional trade)

What can research institutions contribute?

- Develop human and institutional capacity for innovation (MSc/PhD exchange students, e-learning, participatory research, adapt agricultural learning curricula…)
- Develop multi-stakeholder platforms for agricultural innovation (profit from agricultural development projects!)
- Develop tools for priority setting, M&E, impact analyses and up- and out-scaling (GIS, modeling, remote sensing…)

Acknowledgement

The Africa Rice Center (WARDA) wishes to express its sincere gratitude to the people, R *for* D institutions and Government of Japan for their highly valuable and consistent support

Thank you