OVERVIEW OF RICE VALUE CHAIN DEVELOPMENT IN AFRICA

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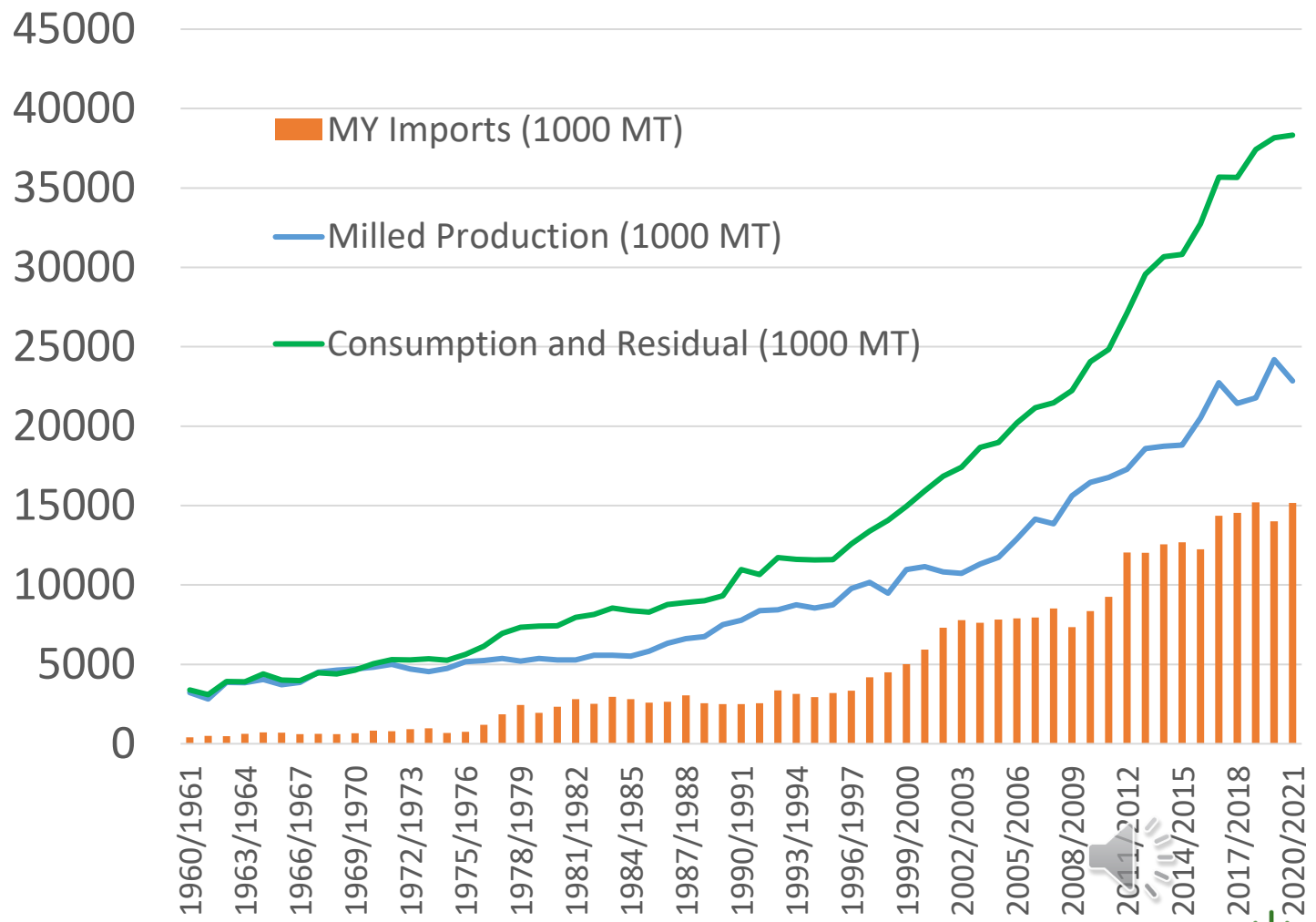
THE SITUATION IN AFRICA

- Rice is the staple food of 750 million people
- Source of employment especially for young people and women
- 15 million tons of rice ($6 billion) is imported annually
- NRDS for countries have been developed with support from CARD
- AfricaRice works with countries to accelerate rice production in Africa



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RICE-SELF SUFFICIENCY AND 2030 TARGETS

CARD
COALITION for African Rice Development

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HOME ABOUT CARD COUNTRIES NEWS & EVENTS STRATEGY KNOWLEDGE

Paddy Production

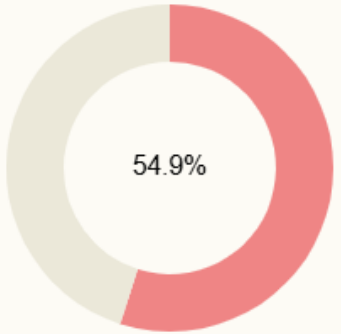
	Metric ton
2030 Target	56,000,000
Current (2022)	34,027,557
Phase 2 Baseline	33,552,534
Phase 1 Baseline	14,083,383

Area

	Ha
2030 Target	18,666,667
Current (2022)	15,874,621
Phase 2 Baseline	15,428,331
Phase 1 Baseline	8,059,255

Yield

	Metric ton/ha
2030 Target	3.00
Current (2022)	2.14
Phase 2 Baseline	2.17
Phase 1 Baseline	1.75



Self-sufficiency

	Metric ton
Import	18,198,000
Export	970,000
Consumption	29,066,000
Cons/capita (kg)	25.1

Baseline 2008 Current situation Increase during Phase 1 Target increase during Phase 2

Source: Calculated using data from FAOSTAT. Not only 32 CARD member countries but all Sub-Saharan African countries are included. Data from Food Balance Sheet are converted from paddy to milled rice equivalent, using the rate of 0.667, which is also used by FAOSTAT. Consumption refers to the element "Food" in Food Balance Sheet.

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POOR AGRONOMIC AND BIO-PHYSICAL FACTORS

Stresses	Yields (Weight)	Grain quality (Value)	Reference
High nighttime temperature (HNT)	7% decline	Increase chalky grains, grain fissures and breakage during milling	Su et al (2023)
High nighttime temperature (HDT)	6% decline	Increase chalky grains, grain fissures and breakage during milling.	
HNT and HDT		Decrease protein content	
Cold (temp < 8–20 °C – at the reproductive stage)	Sterility - decreased yield		Alemayehu et al., 2021
Severe drought conditions	65% decline	Increase chalkiness and grain breakage	Mapiemfu et al, 2017
Soil salinity (1 to 33% over 25 consecutive years)	64.52 % decline	Increase chalkiness and grain breakage	Rahman et al., 2018)
Stagnant flooding	Yield decline - reduced dry matter accumulation and lodging after water retreats		
Flash flooding	Complete crop loss especially at mature stage or seed loss for direct seeded fields – anaerobic conditions.		
Extreme conditions of temperature and humidity	Yield decline - increase diseases and weed infestation. 48% yield loss in areas where post-harvest practices are poor	28% loss in quality	Ndindeng et al., 2021
High humidity coupled with poor storage methods	100% loss of rice after three months due to mycotoxin contamination		Tang et al., 2018

HIGH PREVALENCE OF RUDIMENTARY HARVEST & POST-HARVEST PRACTICES

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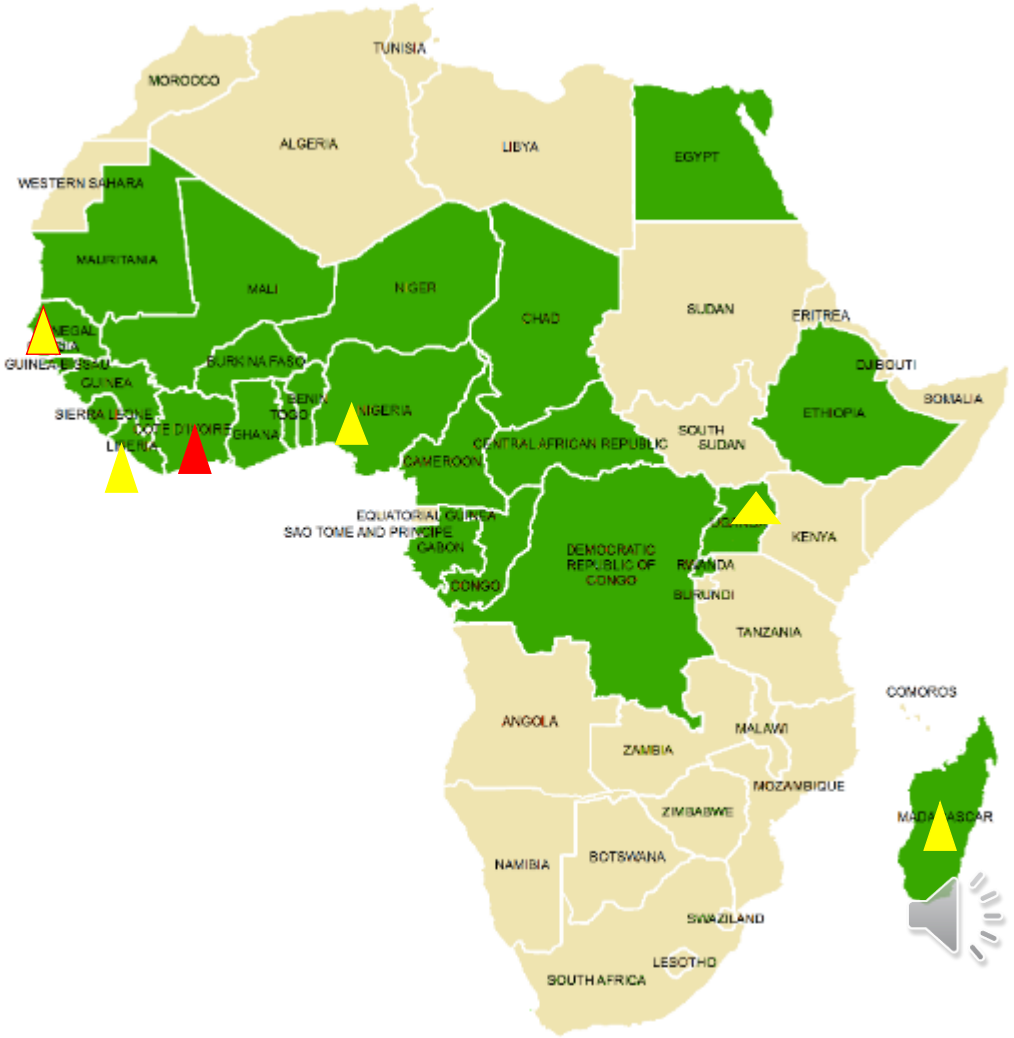
THE AFRICA RICE CENTER (AFRICARICE)

- AfricaRice is an intergovernmental association of 28 African countries,
- AfricaRice is one of the 15 international agricultural research centers of the ONE-CGIAR
- AfricaRice headquarters is in Abidjan with offices in Mbé (Bouaké), Senegal, Liberia, Nigeria, Uganda and Madagascar



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OPERATIONS AND PARTNERSHIPS FOR IMPACT

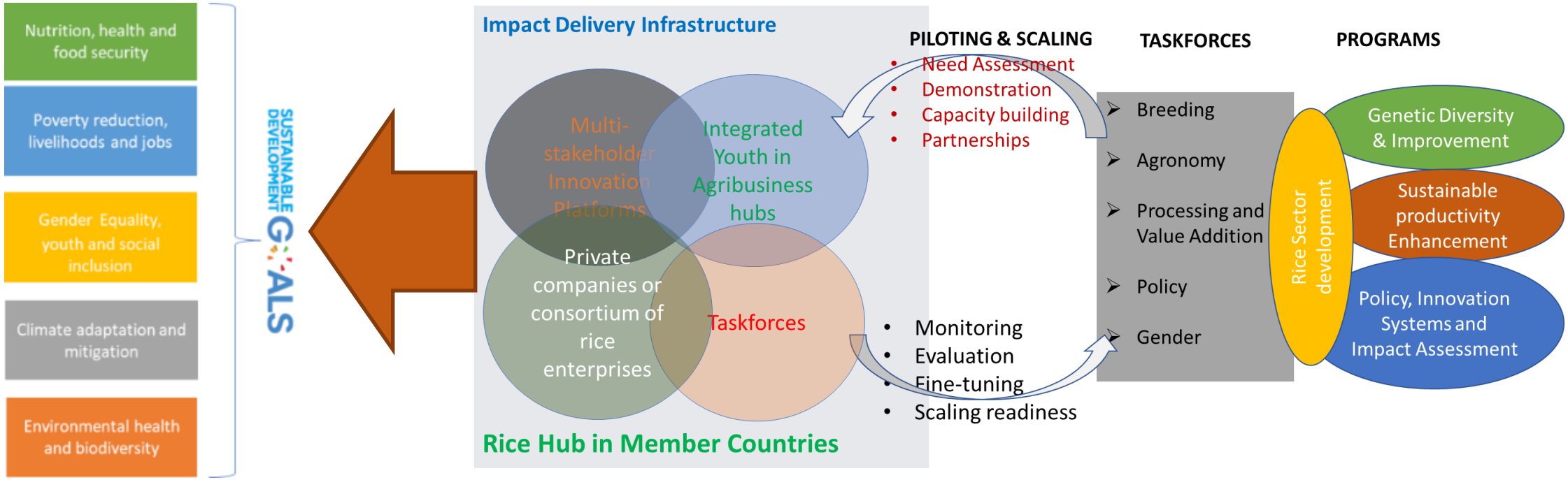

Figure 1: Outline of Rice Sector Development Program operations and linkages with other programs and its impact delivery infrastructure

VALUATION OF RICE POST-HARVEST LOSSES IN SSA AND PROPOSED STRATEGIES TO REDUCE LOSSES

Rice Science
Volume 28, Issue 3, May 2021, Pages 212-216

Letter

Valuation of Rice Postharvest Losses in Sub-Saharan Africa and Its Mitigation Strategies ☆, ☆☆

Sali Atanga Ndindeng [a], Alphonse Candia [b], Delphine Lamare Mapiemfu [c], Vohangisoa Rakotomalala [d], Nahemiah Danbaba [e], Kurahisha Kulwa [f], Paul Houssou [g], Sow Mohammed [h], Ousman M. Jarju [i], Salimata S. Coulibaly [j], Elvis A. Baldoo [k], Jean Moreira [a], Koichi Futakuchi [a]

Value chain segment	Loss as a percentage of total PHL (%)
After crop maturity and during harvesting	43.76
Qualitative loss along the entire value chain	28.8
Quantitative milling loss	15.5
Quantitative parboiling loss	6.1
Quantitative threshing loss	5.1
Quantitative drying loss	0.8

- Study was carried with 10 African partners institutions within the framework of the Africa-wide Processing and Value-Addition Taskforce.
- Total PHL (quantitative and qualitative) for rice in SSA in 2018 is estimated at about US$ 10.24 billion representing 47.63% of the value of rice trade.
- Wide scale adoption of improved technologies, practices and institutional innovations can reduce losses from 47.63% to about 3%.
- Loss reduction interventions should prioritize losses incurred after crop is ready for harvesting, losses during harvesting and quality loss along the entire rice value chain.

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BIG DATA FOR UNDERSTANDING RICE QUALITY TRAITS IN MARKETS ACROSS SSA

Agricultural and Resource Economics Review (2021), 1–17
doi:10.1017/age.2020.24

NAREA

RESEARCH ARTICLE

Hedonic Pricing of Rice Attributes, Market Sorting, and Gains from Quality Improvement in the Beninese Market

Sali Atanga Ndindeng[1], Edgar E. Twine[2*], Gaudiose Mujawamariya[3], Rose Fiamohe[4] and Koichi Futakuchi[1]

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Journal of Agricultural and Applied Economics (2022), 1–22
doi:10.1017/aae.2022.3

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

Pricing Rice Quality Attributes and Returns to Quality Upgrading in Sub-Saharan Africa

Edgar E. Twine[1*], Sali Atanga Ndindeng[2], Gaudiose Mujawamariya[3] and Koichi Futakuchi[2]

[1]Africa Rice Center, C/O National Crops Resources Research Institute, Kampala, Uganda, [2]Africa Rice Center, M'bé Research Station, Bouaké, Côte d'Ivoire and [3]Africa Rice Center, Antananarivo, Madagascar
*Corresponding author: Email: E.Twine@cgiar.org

- 2135 samples were purchased in urban and rural markets in eight African countries and analyzed for grain quality (Head rice ratio, Grain shape, Chalkiness, Grain Color, Amylose content, Viscosity profile, Impurities)
- Results indicate that consumers are willing to pay price premiums for head rice, slender grains, peak viscosity, parboiled rice, and rice sold in urban markets. However, they strongly discount amylose content, rice with impurities and imported rice.
- Investments in the production of domestic rice that is characterized by high head rice, slender grains, high peak viscosity, low amylose content and low impurities will be advantageous to the local rice industry.
- Promoting rice parboiling and removing barriers that prevent smallholders from accessing urban markets will also be advantageous.

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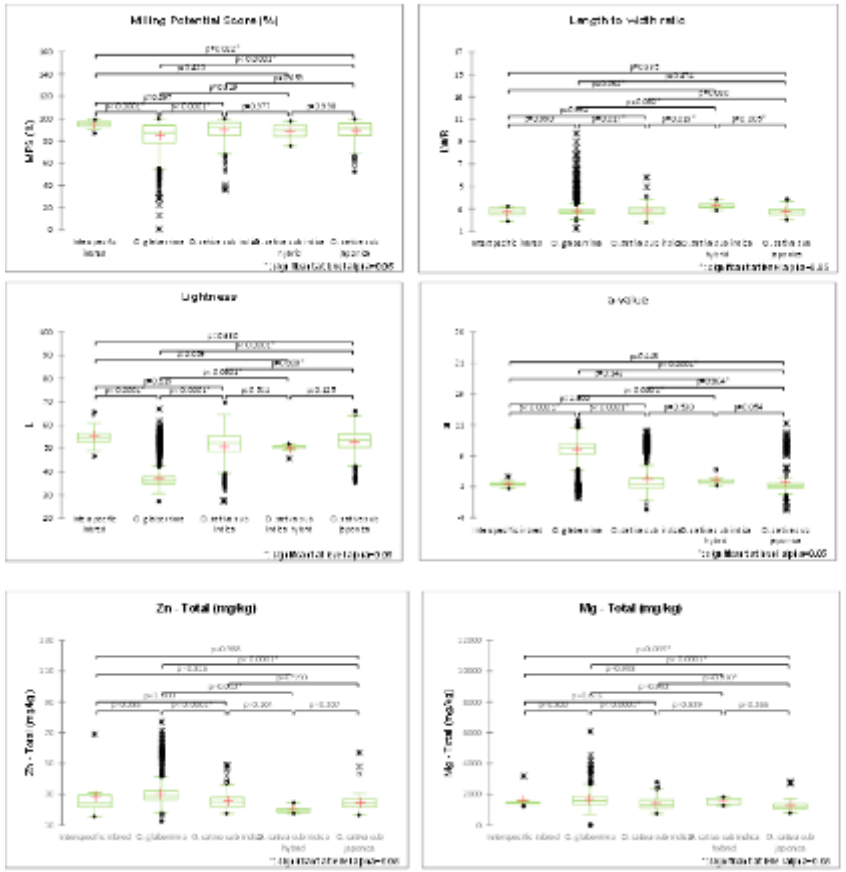
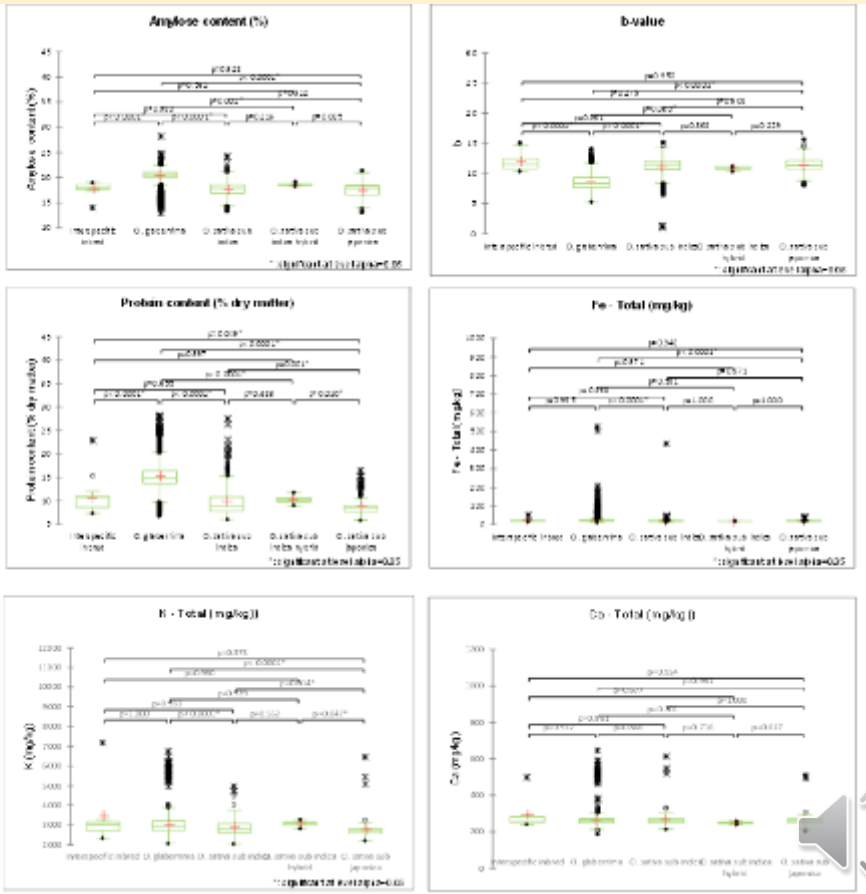
THE HETEROGENEITY IN THE PHYSICOCHEMICAL AND NUTRITIONAL TRAITS OF *ORYZA GLABERRIMA* PROVIDE OPPORTUNITIES FOR THE RICE INDUSTRY

4381 *O. glaberrima*, 557 *O. sativa ssp*. indica, 255 *O. sativa ssp*. japonica, 18 interspecific inbred and 8 *O. sativa ssp*. indica hybrid samples were analyzed for physicochemical and mineral properties.



- Some Glaberrimas have physicochemical, sensory and nutritional properties suitable for immediate promotion in Africa.
- Others have important traits that can be used for rice germplasm improvement and value-added products.



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CATALOGUE OF CLIMATE SMART INNOVATION

CLIMATE SMART VARIETIES HYBRIDS AND INBRED

- *DROUGHT TOLERANT VARIETIES.* 29% increase in yield of **ART1453-B-B-1-5** above the highest-yielding standard check (FARO 67) under drought stress.
- *COLD TOLERANT VARIETIES.* Based on agronomic traits, the varieties release by AfricaRice have >80% fertility and >5 ton per ha yield and good level of blast disease resistance. **Ex. FOFIFA 194, FOFIFA 195 and FOFIFA 196.**

CLIMATE SMART AGRONOMIC PRACTICES

- *THE SYSTEM OF RICE INTENSIFICATION AND ALTERNATE WETTING AND DRYING.* In the irrigated lowlands, the system of rice intensification and alternate wetting and drying reduced water use by 15–43% and increased water productivity by 8–87% without significantly affecting rice yield in comparison to continuous flooding.
- MID-SEASON DRAINAGE. Mid-season drainage reduced iron toxicity score by 40%, water use by 20% and increased water productivity by 18% compared to continuous flooding.

CLIMATE SMART AGRONOMIC PRACTICES

- ***INTEGRATED RICE-FISH SYSTEMS.*** Using an **iron toxicity tolerant** variety (**NERICA –L19**) and the **Nile Tilapia** in Liberia, yields were increase from 2 to 9 t/ha/year for rice and 1.5 to 4 ton/ha/year for fish in target site.
- In some instances, happas and floating cages can be installed upstream to rice plots to increase.

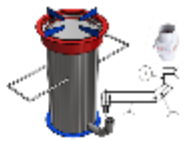
16 CORE INNOVATIONS

https://hdl.handle.net/10568/132330

CLIMATE SMART POST-HARVEST PRACTICES

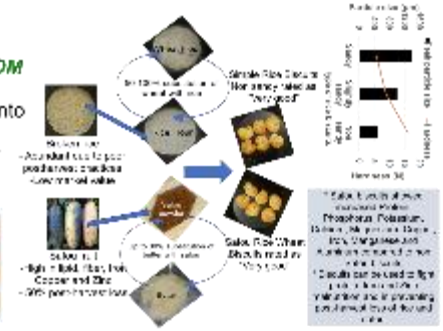
- *MINI-GEM PARBOILING* Improves milling rate by 5%, head rice rate by 32%, chalky rate by 3400% and slenderness rate by 6% compared to straight milled rice. In addition, parboiling improves the several micronutrient rates especially water solubke vitamins and Fe and reduces glycemic index by 40%.

- *SOLAR POWERED FAN-ASSISTED STOVES.* Replacement of firewood with rice husk reduces deforestation, saves about US$ 30 per ton of parboiled rice (30% of production cost). The husk stove also produces near-zero smoke and soot, thereby alleviating air-pollution and pot-blackening.



CLIMATE SMART POST-HARVEST PRACTICES

- ***RICE FLOUR AND BAKERY PRODUCTS PRODUCED FROM FINE BROKEN RICE.*** The processing of fine broken rice into flour and subsequently bakery products increased its value by more than 20%.



CLIMATE SMART POST-HARVEST PRACTICES

HERMETIC STORAGE BAGS AND COCOONS EQUIPMENT WITH SOLAR POWERED ECOWISE® MONITORING SYSTEM. This bags and cocoons can store rice seeds for 1 year and paddy for 2 years with seeds having germinative rate of >90%, while paddy will have the equilibrium moisture rate at 13-14%, CO_2 rate > 7% thus eliminating insect, fungal growth as well as mycotoxin contamination.

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MYCOTOXIN CONCENTRATION IN RICE IS AFFECTED BY CHALKINESS, GRAIN SHAPE, TYPE OF PROCESSING AND ORIGIN

SAMPLE COLLECTION

Brown, White and Parboiled rice;
Domestic and Imported;
5 countries;
54 markets;
Rural and Urban

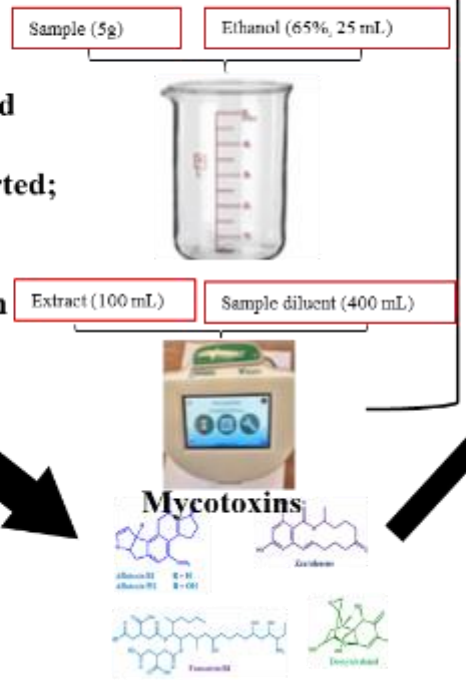
ANALYSES

Grain Quality

Grain shape

Chalkiness

Head rice ration etc…



RESULTS

- Slender grains exhibited higher total aflatoxin than medium and bold grains,
- Chalky rice had higher total aflatoxin than non-chalky grains,
- Parboiled rice had lower total aflatoxin than white rice

Mycotoxin contamination of rice from African markets

Toxin	No. samples	Range	No. samples considered contaminated	MRL*	No. samples > MRL
Aflatoxin (ppb)	527	3.00–89.8	379	4	180
Fumonisin (ppm)	50	0–0.09	9	1	0
Zearalenone (ppb)	50	9.5–596.7	20	75	6
Deoxynivalenol (ppm)	50	0–0.13	0	0.7	0

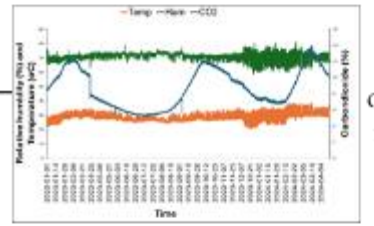
* MRL according to EU, USDA, Codex Alimentarius for aflatoxin and FAO–IITA for others. MRL, maximum regulatory limit; ppb, parts per billion; ppm, parts per million.

- 71.92% samples presented detectable levels for total aflatoxin (3.00 – 89.80 ppb),
- 47.49% exceeded the EU maximum residual limit,
- Aflatoxin cooccurrence with zearalenone but not with Fumonisin and Deoxynivalenol

MITIGATION STRATEGIES

Improvement of rice grain quality

Hermetic storage technologies



CO_2 optimization in hermetic system

Capacity building

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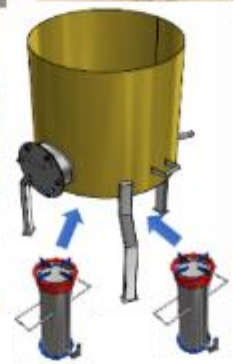
39 SMALL-SCALE RICE INNOVATION PROCESSING CENTERS ENHANCING POST-HARVEST INDUSTRIALIZATION SETUP



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MEDIUM SCALE RICE MILLING FACILITIES UPGRADED WITH MULTI-STAGE MILLS, RICE DESTONERS, MOISTURE METERS, MINI-GEM PARBOILERS AND IMPROVED PACKAGES TO ENHANCE MARKET ACCESS.

In 2023 in Cote d'Ivoire

- 19 Destoners
- 30 moisture meter
- 6 ASI-Threshers
- 9 multi-stage mills
- 96,000 hermetic packages

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THE INDUSTRIALIZATION OF THE RICE PROCESSING HAS STARTED WITH MASS FABRICATION OF PROCESSING EQUIPMENT BY TRAINED PRIVATE COMPANIES

Mini-ASI Thresher in Benin

Rice mill in Liberia

Mini-GEM in Cote d'Ivoire

ASI-Thresher in Nigeria

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ADOPTION RATES OF SOME KEY INNOVATIONS

GENETIC IMPROVEMENT

Sahel varieties
Irrigated varieties, high yielding
60–90%

NERICAs
Lowland and upland varieties, high yielding
20–40%

ARICAs
Lowland and upland varieties, high yielding, climate smart
10–11%

WITAs
Lowland varieties, high yielding, drought tolerant
18–33%

AGRONOMY

RiceAdvice and GAP
Android-based decision support tools providing specific crop management guidelines for rice production systems in Africa
10–35%

Smart valleys
Low-cost water control infrastructure increases water retention, reduces risk of fertilizer loss due to flooding, and increases rice yields
10–27%

POST-HARVEST

ASI thresher
High threshing capacity, low fuel costs, reduced grain loss rate, increased grain purity or grain-straw separation rate of 99%
16–67%

GEM
High-capacity parboiler equipment, gender friendly, low energy consumption
10–20%

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IMPACT OF AFRICARICE RESEARCH

50 ANNÉES DE RECHERCHE RIZICOLE POUR LE DÉVELOPPEMENT

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50

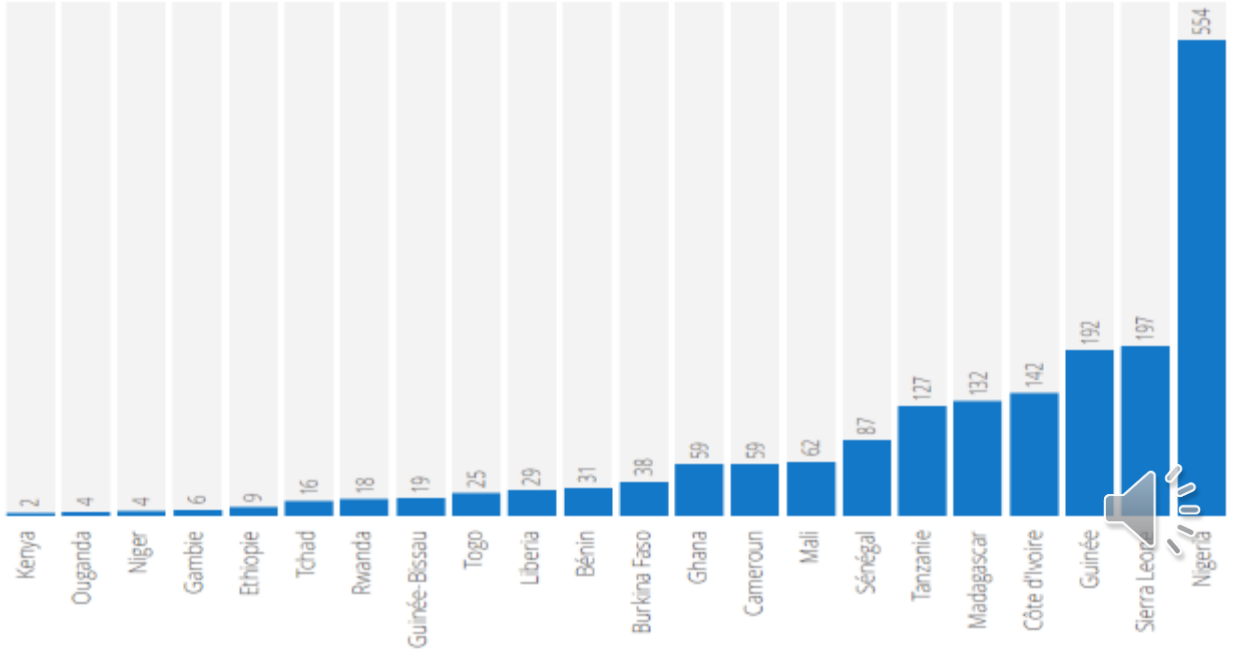
IMPACT À LONG TERME ET À GRANDE ÉCHELLE EN AFRIQUE

AfricaRice en chiffres :

15 millions de personnes sorties de la pauvreté en ASS en 2021

37 milliards de $US de bénéfice brut cumulé de la recherche

3,49 $US générés pour chaque dollar investi



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AKNOWLEDGEMENTS

Global Gateway

CGIAR Initiatives:
- PHI
- TAFS-WCA
- ABI
- SEEDEQUAL

TAAT
Technologies for African Agricultural Transformation

HD4A

IsDB 50

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

IFAD
Investing in rural people

AFD
AGENCE FRANÇAISE DE DÉVELOPPEMENT

BILL & MELINDA GATES foundation

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Thank you