United Nations Conference on Trade and Development

13th Multi-Year Expert Meeting on Commodities and Development

10-12 October 2022, Geneva

The role of phosphorus in smallholder production systems and its sustainable management to improve crop yields and farm profit while reducing environmental impacts

By

Mr. Kaushik Majumdar, Director General, African Plant Nutrition Institute, Morocco

UNCTAD Multi-Year Expert Meeting on Commodities and Development (MYEGM)
10-12 October, 2022

AFRICAN PLANT NUTRITION INSTITUTE

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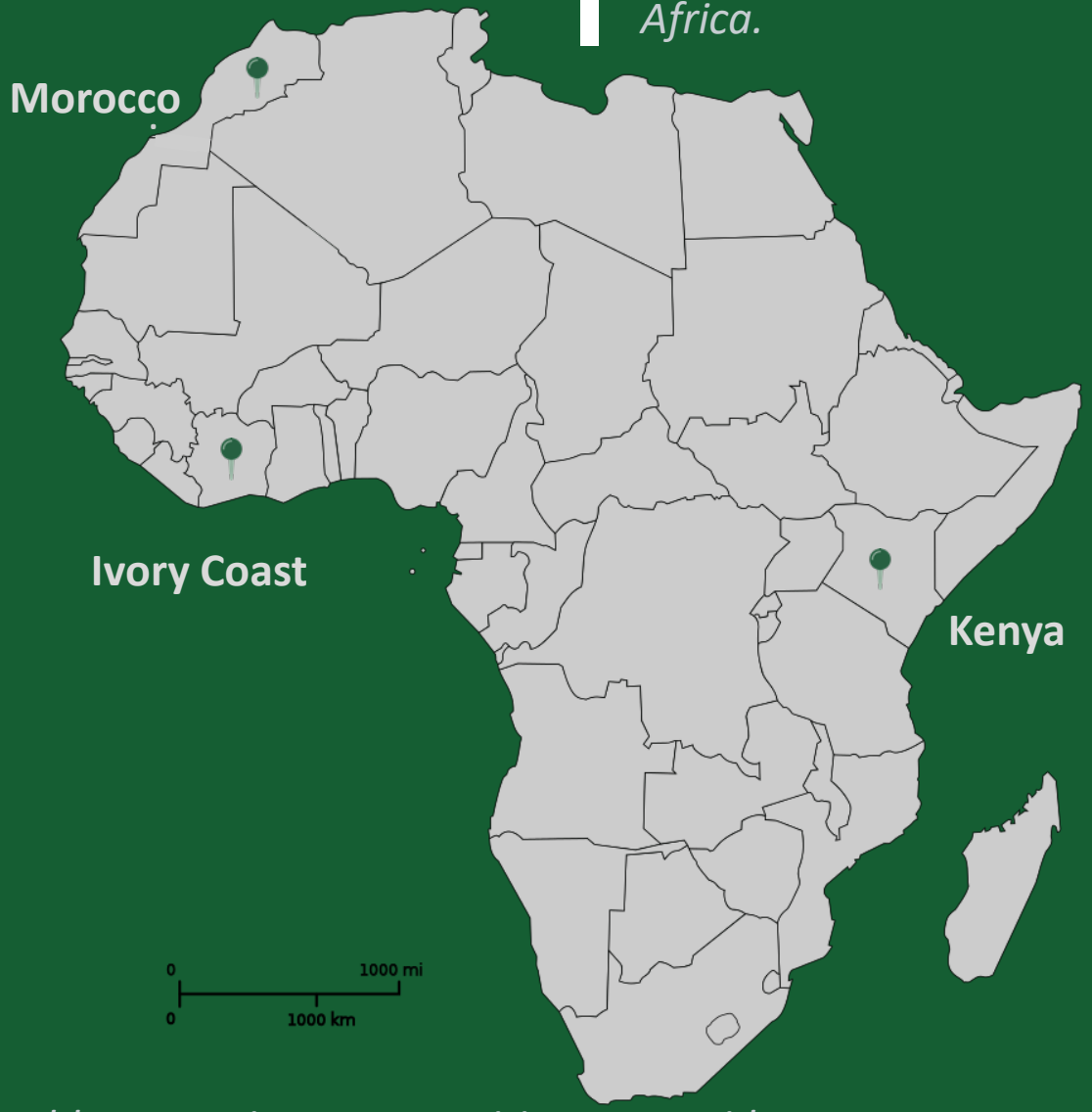
Kaushik Majumdar

OUR MISSION

Enhanced plant nutrition for a resilient and food-secure Africa.



OUR VISION

Prosperous African farmers sustainably managing crop nutrition to provide consumers with a secure supply of nutritious foods at a reasonable price.

Our Strategic Themes

Climate & Weather-Smart Plant Nutrition

Soil Health for Improved Livelihoods

Precision Nutrient Management

Key Achievements in 2021

11
Countries we work in

14,682
In-field trials

362
On-farm trainings

120
R&D partners & collaborators

36
Scientific publications

36
Scientific presentations

17
Awards granted

15
On-going research projects

8
New research proposals

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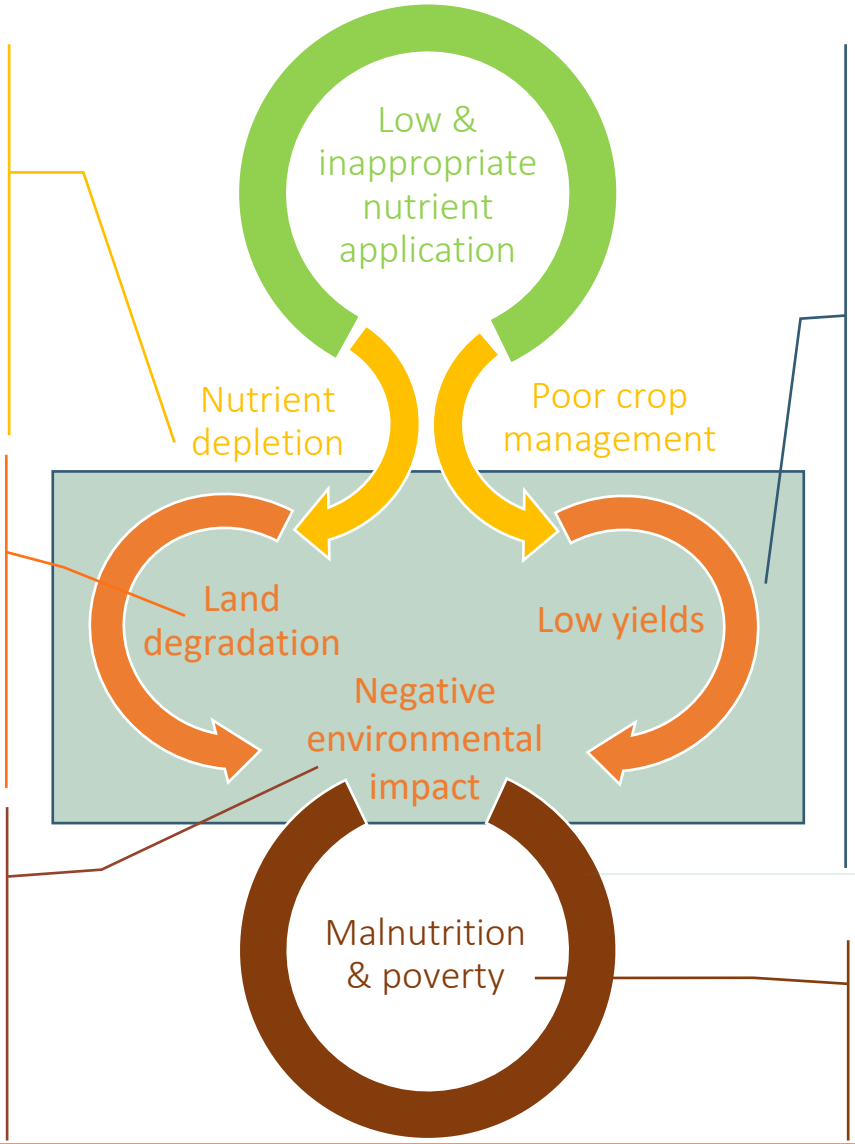
Soil health at the core of agricultural sustainability in Africa

The Soil Health Crisis

- 30 kg nutrients ha^{-1} lost from 50% of the cropland in Africa's ($4-10 B yr^{-1})
- Overgrazing in livestock systems

- 65% of cropland degraded
- Land degradation cost: ~ $68 B yr^{-1}
- Higher risk of 'non-responsive soils'

↑ Extensive agricultural systems
↑ Carbon & biodiversity losses
↓ Ecosystem services
↑ GHG (burning biomass)
↑ Climate change aggravation



Building Soil Health & System Resilience

- **Farmer-centric, integrated soil fertility, crop and water management** interventions for soil health sustainability & climate change resilience to meet SDGs
- Context-specific targeting of investments & technologies
- Optimize return of investment and reduce investment risks

VIRTUOUS CYCLE

↓ Livelihood qualities
↓ Socio-economic outcomes
300 million people malnourished

VICIOUS CYCLE

Fertilizer value-chain constraints

Low & fragmented demand
Inefficient importation of small volumes
Poor port infrastructure
High financing costs

Limited technical knowledge
High prices & low accessibility of fertilizer
Inconsistent subsidy programs
Risks: land degradation, rainfall & output price volatility
Poor access to storage / processing channels

Importation → **Distribution** → **Local Distribution** → **Farmer** → **Output Market**

Poor transport infrastructure
Poor transport logistics
Limited working capital
Limited storage

Limited dealer network & reach
Limited storage capacity
Inconsistent subsidy programs
Inconsistent availability of fertilizer
Limited access to agronomic & market information

Output markets poorly developed, especially for staple crops
Poor transportation infrastructure
Limited post-harvest storage & value-added processing

Uncertainties faced by farmers

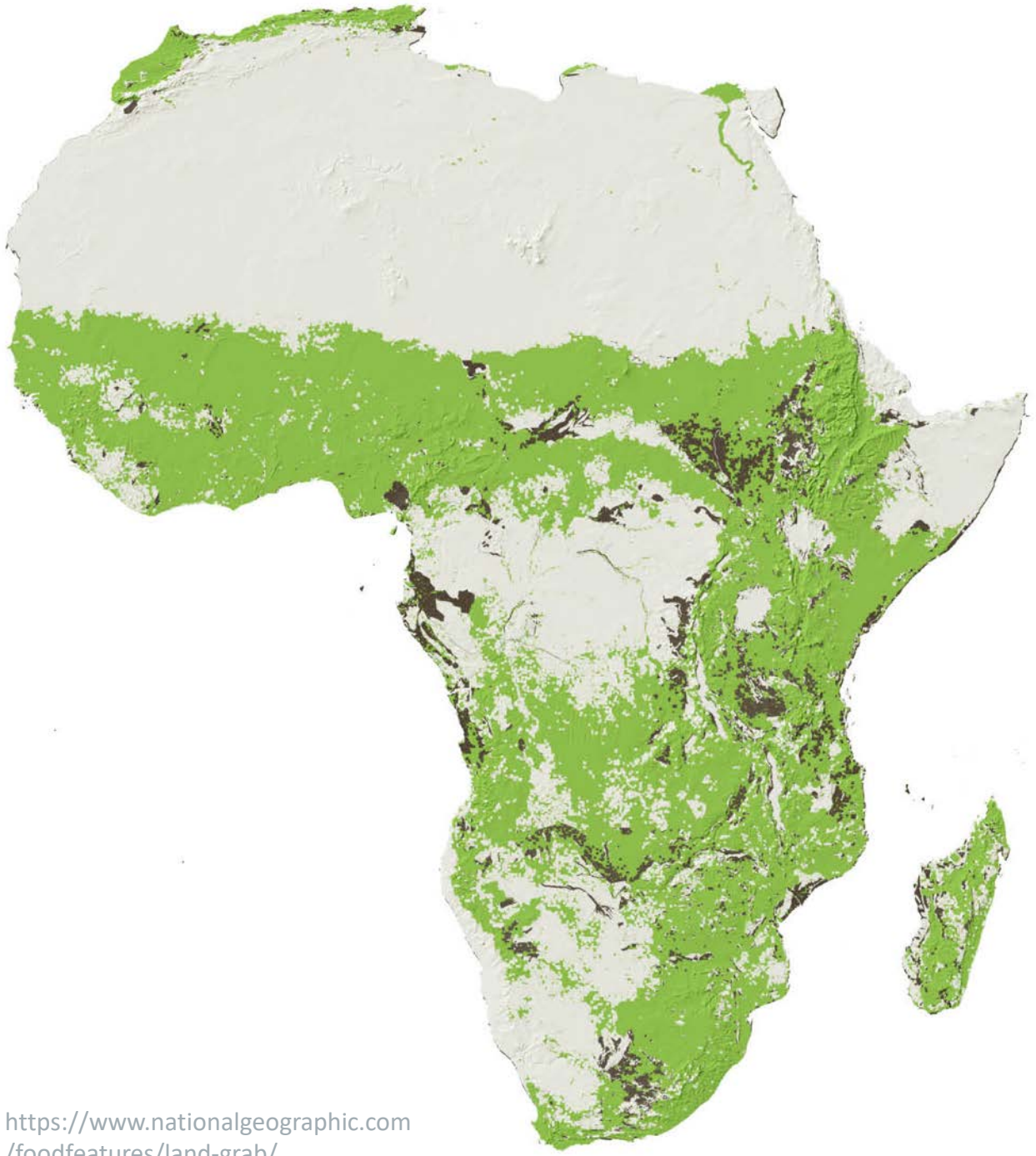
METRIC
Uncertainty about the precision of input to achieve an outcome

TRANSLATIONAL
Uncertainty related to issues external to the decision

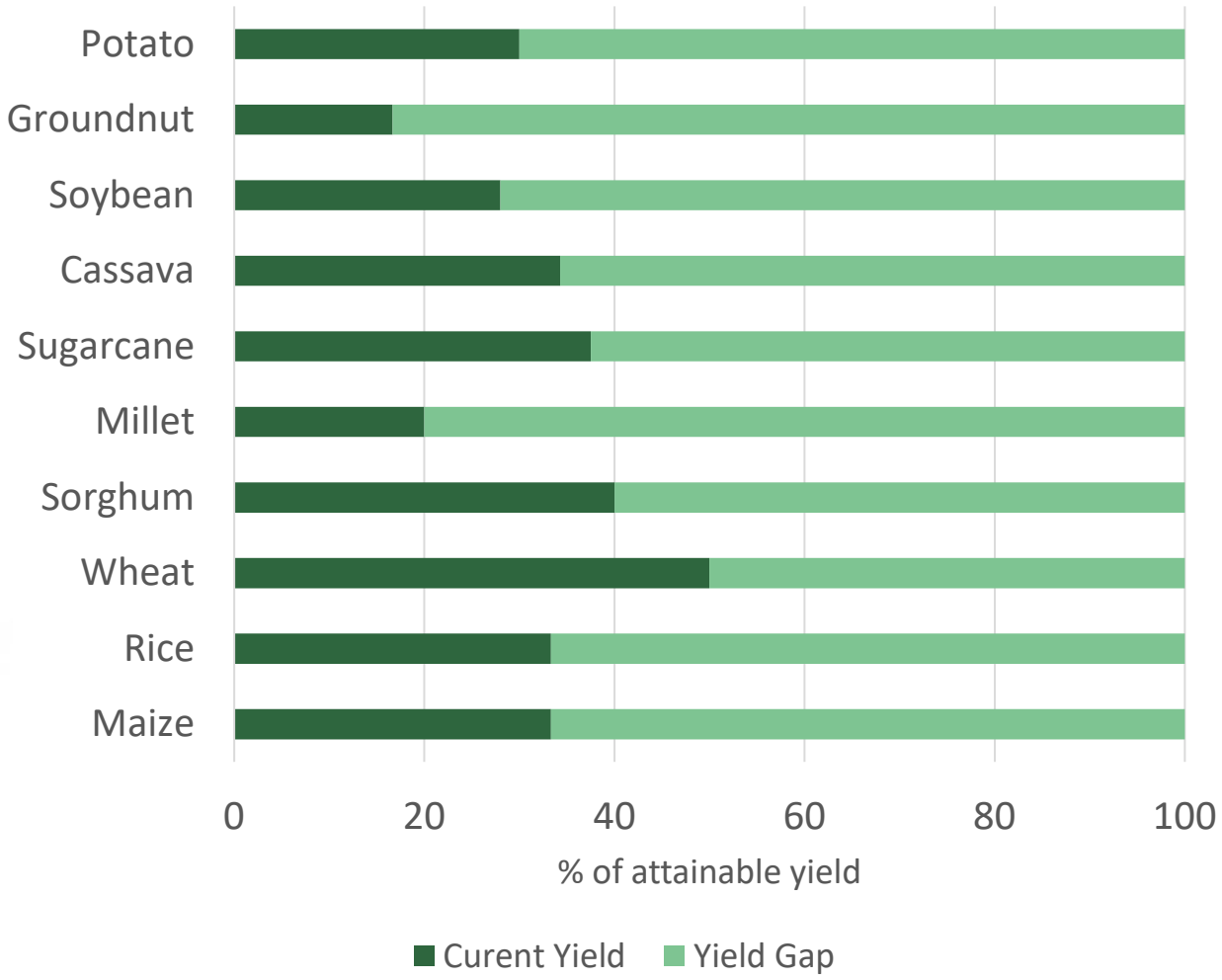
TEMPORAL
Uncertainty related to past / future events

STRUCTURAL
Uncertainty about impact of other internal factors relevant to the decision

Yield gaps in Africa

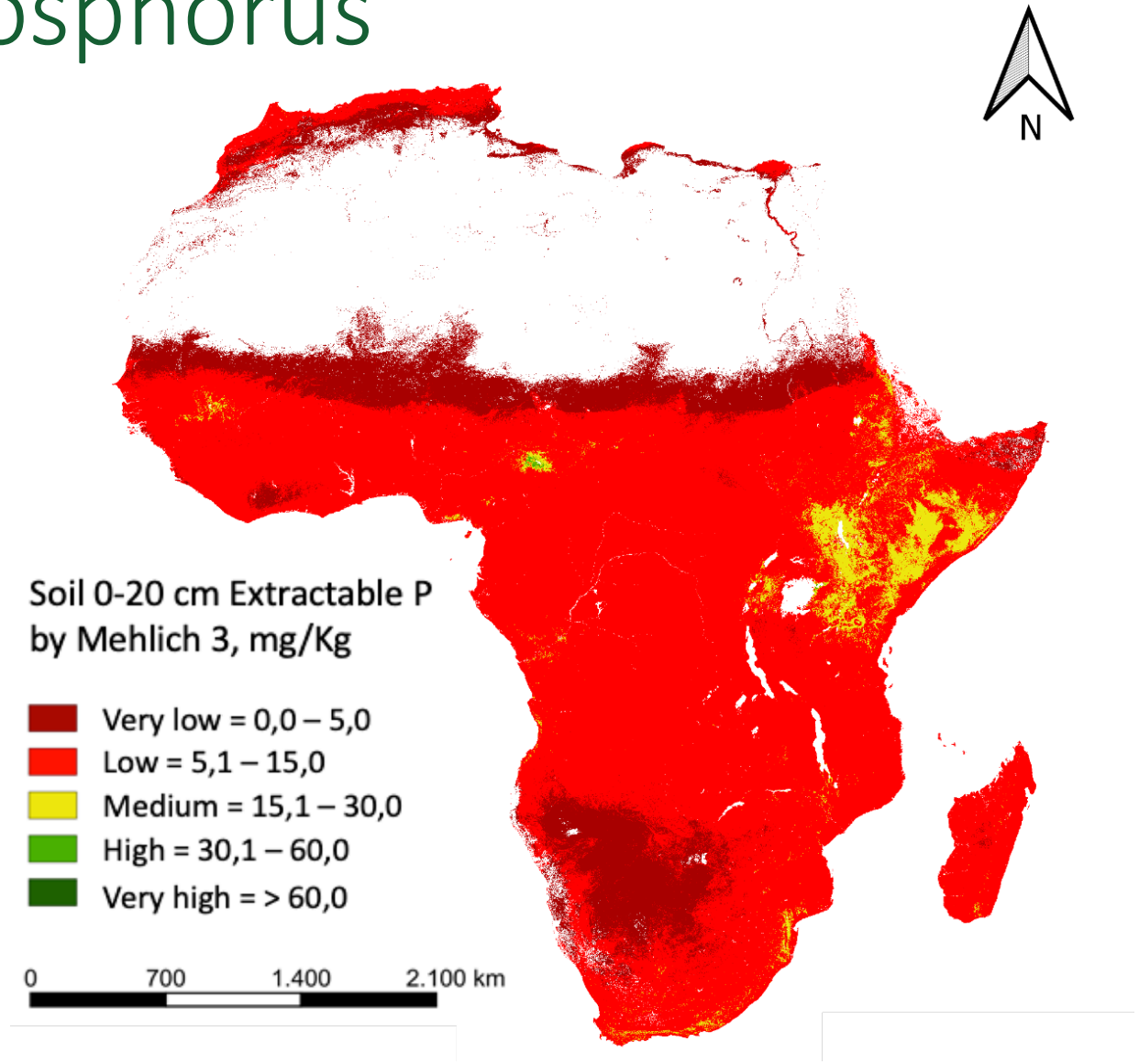


https://www.nationalgeographic.com/foodfeatures/land-grab/



Adiele et al., 2021; Ronner et al., 2016; Schut et al., 2018; Tanaka et al., 2017; Van Ittersum et al., 2016; APNI Research

African soils are low in phosphorus



Global Phosphorus Institute, Unpublished 2022

Modified from Hengel et al. (2021) and iSDA

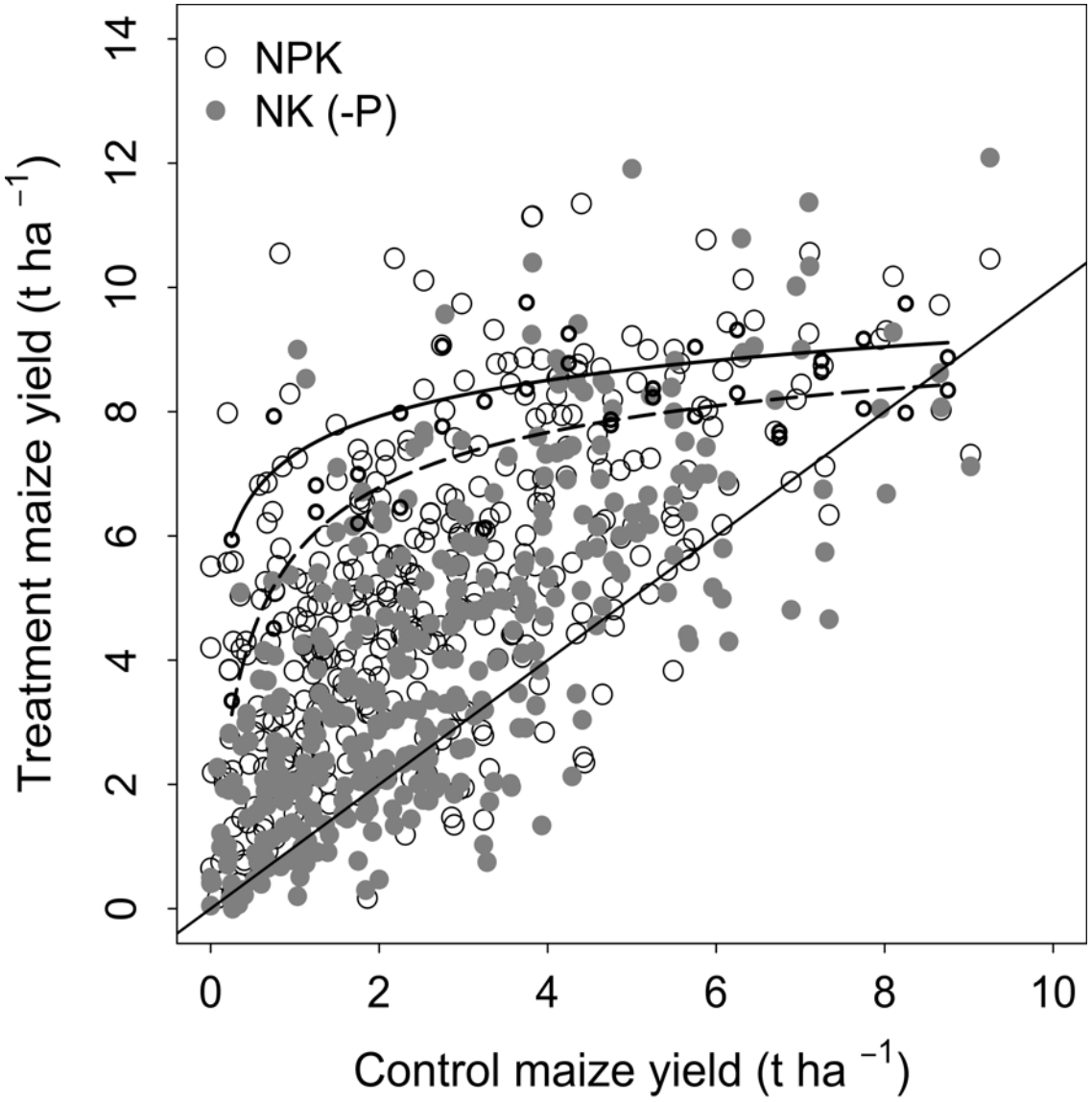
Nutrient-induced yield gaps and fertilizer use efficiency

	Mean regional yield responses		
Crop yield response	N	P	K
Maize	2.2	1.0	0.2
Rice	1.4	0.8	0.6

	Performance indicator		
Treatment	Grain yield (t/ha)	CV (%)	Partial factor productivity (kg/kg)
N+K	2.9	67	25
N+P+K	4.1	49	35

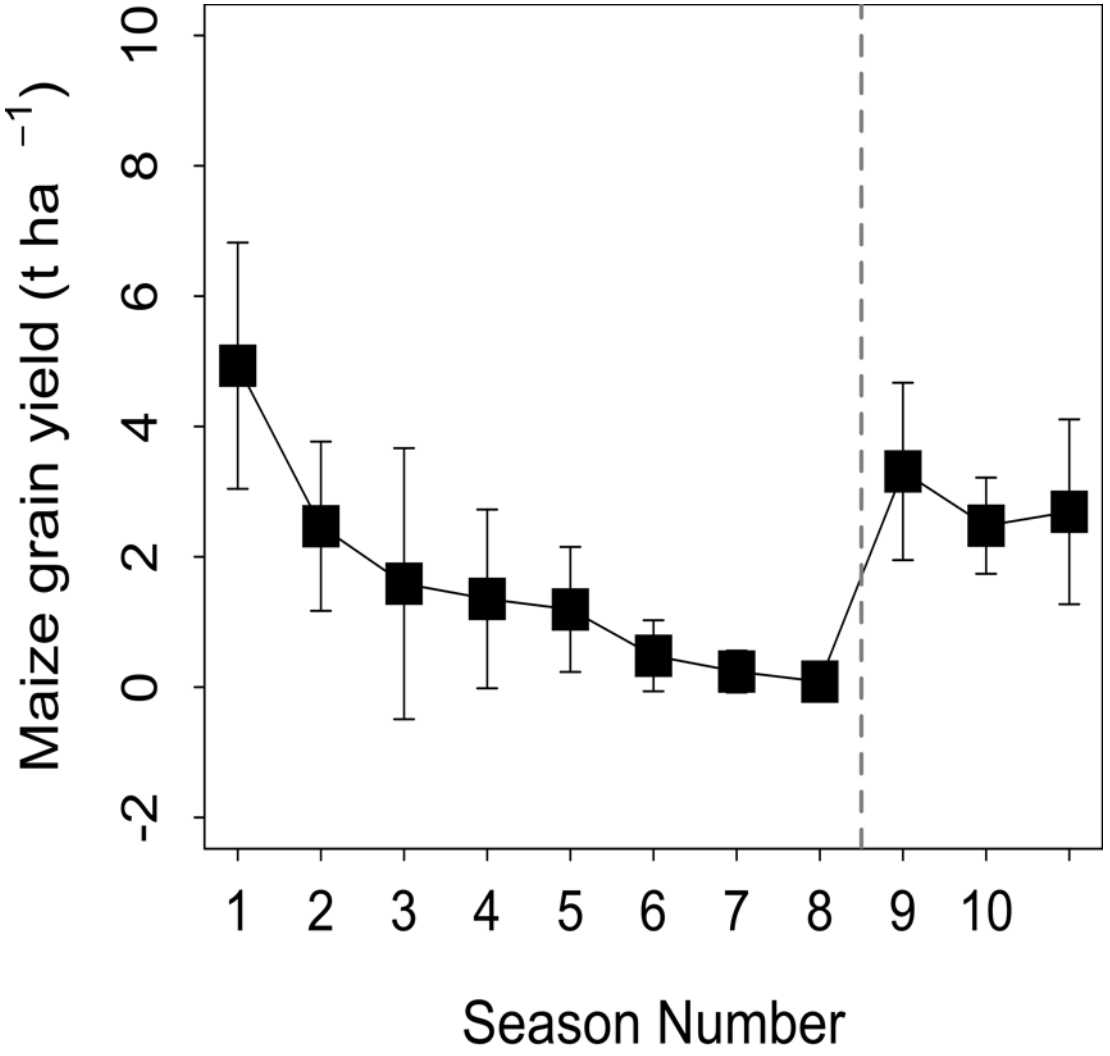
Zingore et al., 2022

Response to P increases with decreasing soil fertility



Zingore et al., 2022

Balanced P application can resolve yield limitations from P deficiency



Njoroge et al., 2019

Nutrient Yield Gaps: Potential Nutrient Needs in SSA

Maize Scenario

Production gap = 120 M t

Area = 40 M ha
Average yield = 2.0 t/ha
Attainable yield = 5.0 t/ha
Manageable yield gap = 3.0 t/ha

Nutrient rate requirement:

N = 129 kg/ha
P_2O_5 = 41 kg/ha
K_2O = 38 kg/ha

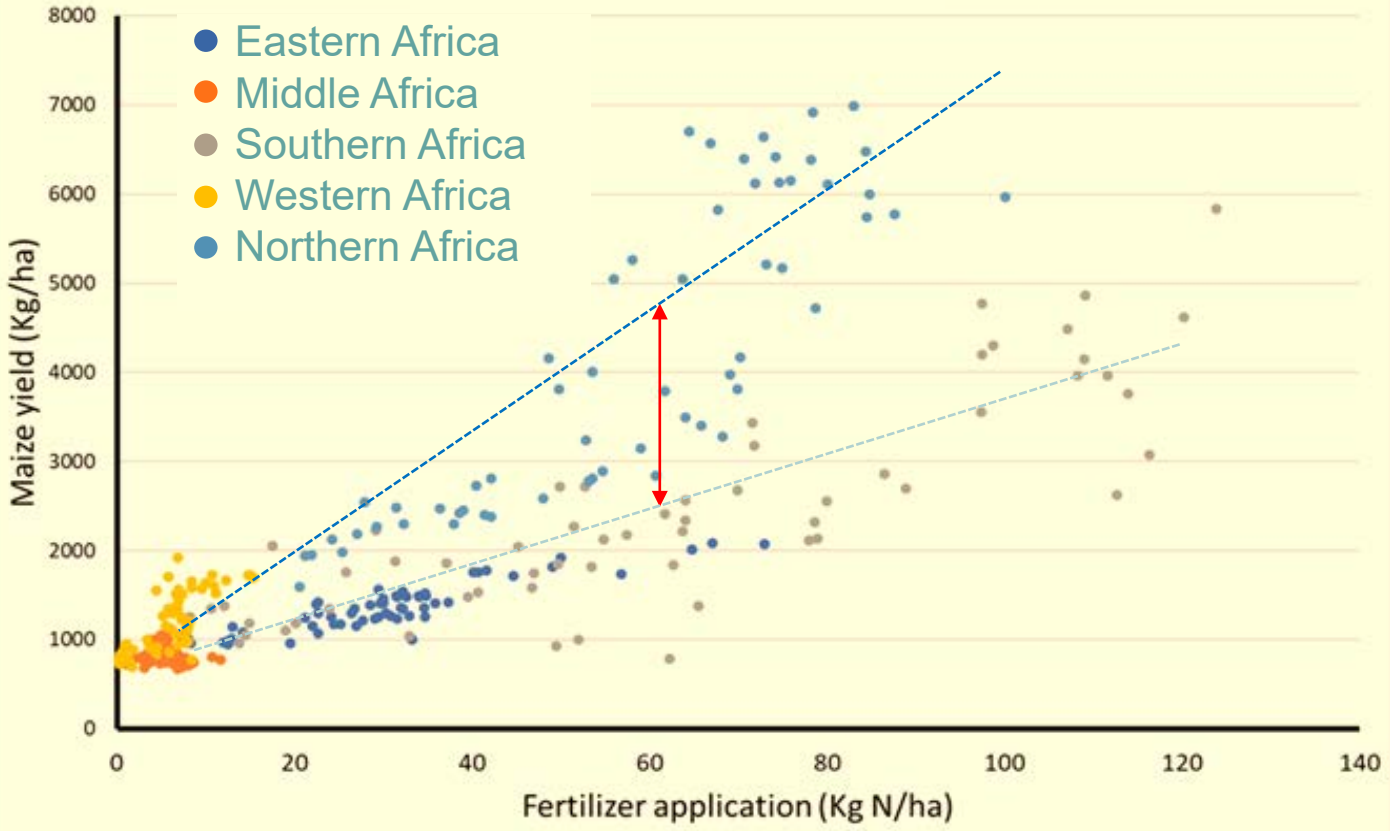
Total potential nutrient demand = 8.32 M t

Total N = 5.16 M t
Total P_2O_5 = 1.64 M t
Total K_2O = 1.52 M t

Total current NPK fertilizer use = 4.3 Mt

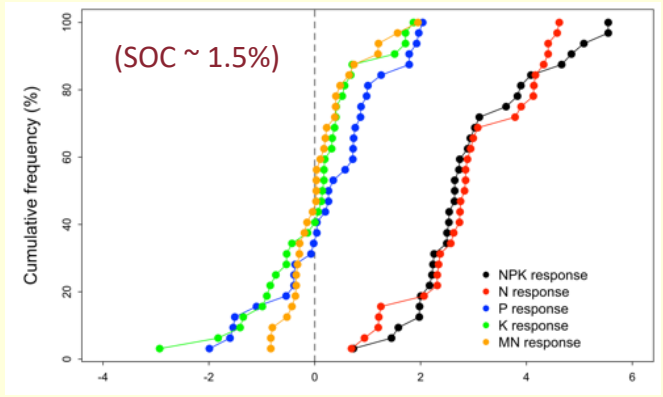
The imperative need for investment in increased use and improved management of FERTILIZER

Maize yield in relation to sub-regional N fertilizer use

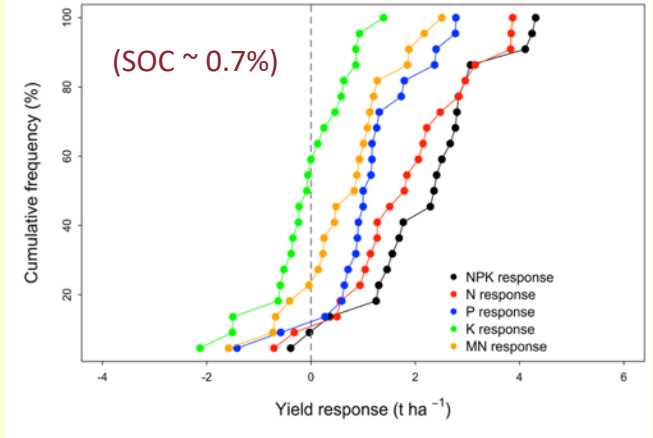


FAOSTATS, 1961-2016

N-dominated yield response in Ethiopia



Multiple nutrient responses in Ghana

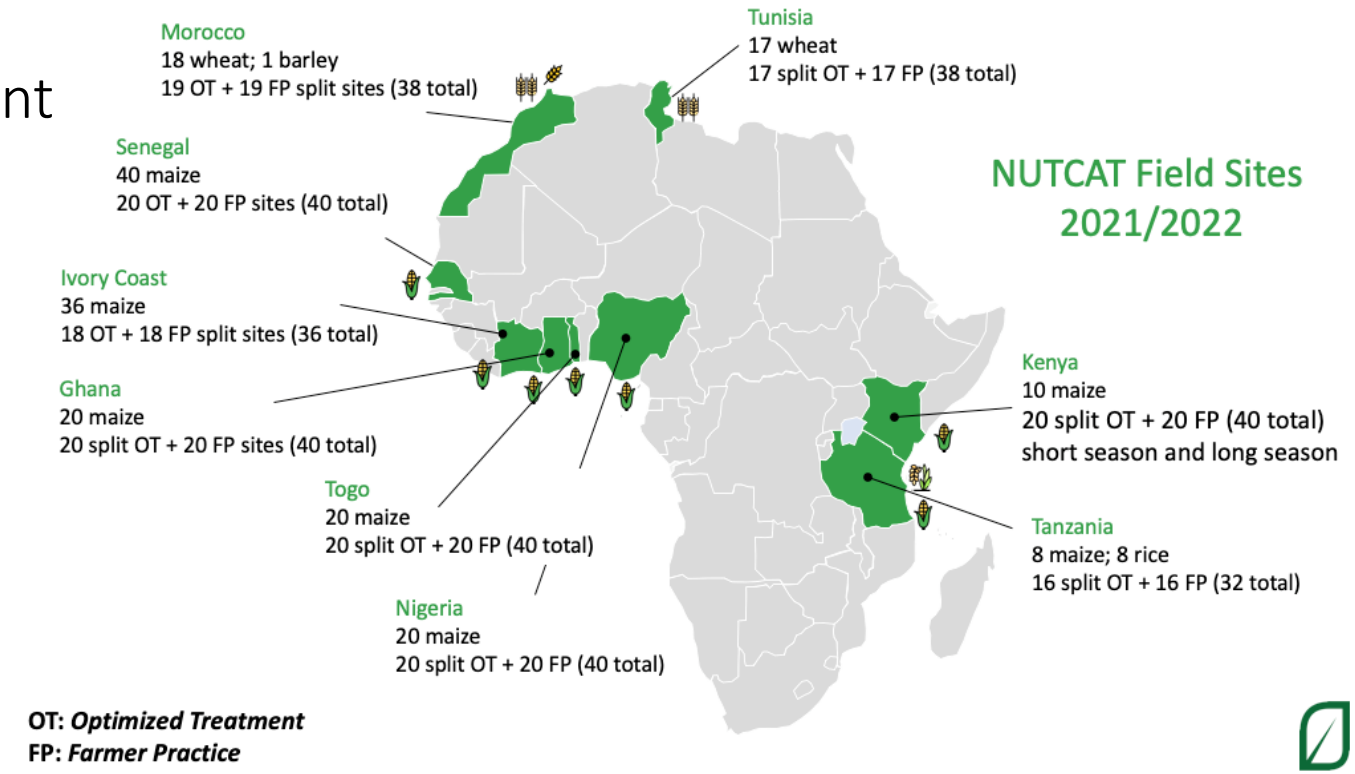


4R Solutions Project, 2022

Nutrient-Catalyzed Agricultural Transformation (NUTCAT) Remote Sensing to Support OFE

Farmer-centric & farm-scale research focused on the adoption of precision nutrient management.

- 340 locations in nine countries
- Protocols deployed for collecting high quality, site-specific yield data in Africa
- Deployment of survey tool for collecting farmer perceptions of within-field variability
- Discussion in progress with several institutions for co-investment and scaling to new regions



4R SOLUTIONS PROJECT

www.4Rsolution.org

+ Integrate 4R Nutrient Stewardship

+ Improve agricultural productivity and farm income

+ Incorporate important gender and environmental resilience strategies

Target: Improve the livelihoods of **80,000 smallholder farmers** with 4R practices

Activities led by apni

- Identification of crop production constraints
- Development of site-specific 4R-based recommendations
- Dissemination & scaling of 4R recommendations

IMPLEMENTING PARTNERS

Fertilizer Canada / Fertilisants Canada

Co-operative Development Foundation of Canada (since 1947)

apni African Plant Nutrition Institute

Global Affairs Canada / Affaires mondiale Canada

Plant Nutrition Canada

Ethiopia

- Ethio-Wetlands & Natural Resource Association
- Amhara Agricultural Research Association

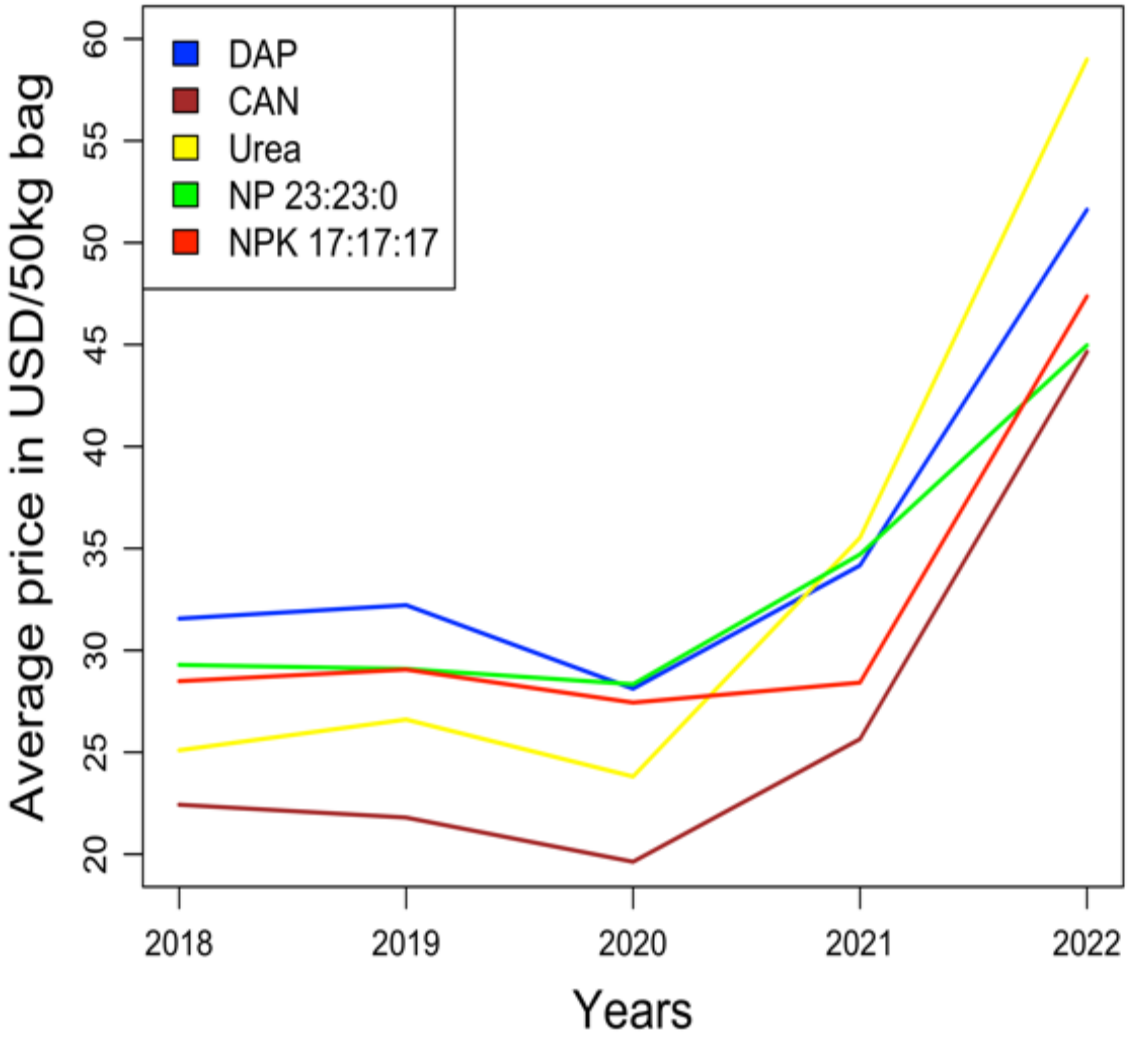
Ghana

- Send Ghana
- Savanna Agricultural Research Institute

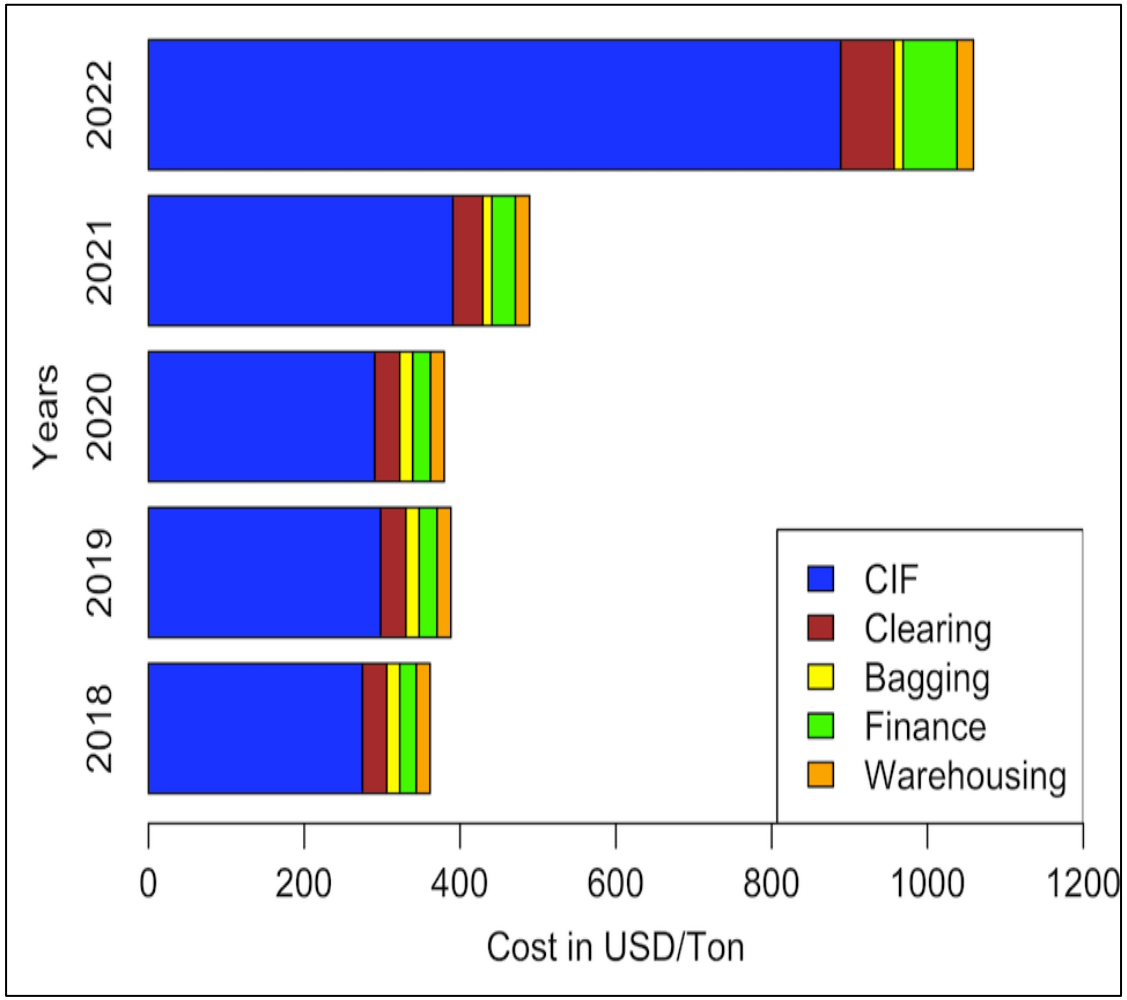
Senegal

- ONG 7a

Fertilizer Crisis: Prices in Africa have risen sharply (Kenya)



Urea



Source: AfricaFertilizer.org

Fertilizer Crisis: Impacts and responses differ

Rwanda October 2021

- Higher prices
- Increased demand
- No reported shortages

Malawi October 2021

- Higher prices, even with subsidies
- Increased demand but low fertilizer use due to high prices

Ghana Mid-2022

- Supply deficits
- Commonly used fertilizer unavailable
- Various organic products on the market

Burkina Faso August 2021

- High Prices
- Fertilizer difficult to find
- Blending factories at standstill

Source: AfricaFertilizer.org

Fertilizer Crisis: APNI Research Questions

1. To what extent have the prices, availability, accessibility and use of fertilizer in Africa been affected by the current fertilizer crisis?
2. What have been the responses to the fertilizer crisis at the macro-level by various stakeholders, including government, non-government, private sector, and fertilizer industry?
3. How is the fertilizer crisis affecting farmers' investment decisions and the consequent impact on crop productivity?
4. What coping strategies have micro-level actors (farmers and local stakeholders) adopted to mitigate the impact of the fertilizer crisis?
5. What insights have been gained from the current crisis for managing and building resilience to future shocks?













Thank you!

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