



# Food Security in the Tropics of Africa: Building from the Soils Perspective

By

**Dr. Patrick Musinguzi**

+256774068824; email: musipato7@@gmail.com

Department of Agricultural Production

College of Agricultural and Environmental Sciences (CAES)

Makerere University- Kampala, Uganda

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**Is Africa (SSA) Food Secure?**





# Food Security in SSA - Introduction



- ✓ Food security on global agenda- SDGs 2 ( *End hunger, achieve food security*)
- ✓ Persistent food insecurity in developing world is evident (**780 m of 795 m** people undernourished- mainly from developing countries (UN, 2015)
- ✓ In SSA, 35% of population in East Africa is malnourished –yet the challenges due to soil degradation, extreme events, poverty, disease are on the rise...(FAO, 2017)
- ✓ Feeding SSA is the real challenge amidst limited land for production due to rapid population–hence **intensifying** land use/soil fertility replenishment vital
- ✓ Interventions are needed with integration techniques –to **deal with soil health** as a foundation infrastructure for nutrients and water for crops, livestock, etc



# Contextualizing Food Security in Homesteads of Africa



## Scenario 1

“A household has access to sufficient and safe food that can meet dietary needs, the only problem we have is water....we hardly have clean water, especially for drinking”.

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Is the household food secure?

NO...?





## Contextualizing Food Security at communities of Africa Scenario 2



“Our village has sufficient and safe food, we have enough from the previous season that can sustain all our dietary needs for the next three months. The nearby villages usually buys from our markets, however there **has been a lot of rain** in the last two weeks and the road to our village is inaccessible to the neighboring villages”

**Are the nearby  
villages fully food secure?**

**NO**





# Regional Food Security- context



## Scenario 3

“This year has been a year of bumper harvest in our region, all crops performed well, even those who didn’t grow enough should be able to buy sufficient, and quality food throughout this year”

**Is our regional food secure this year?**



YES...?





# Is Food Security in Africa achievable?



Food security is when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 1996).

Has this been achieved in Africa? – **NOT YET FULLY!**



# The 4 “pillars” of Food Security



## Availability:

Production  
Processing  
Water and soil  
mgt  
Trade and stocks  
Food aid

sufficient quantity and  
quality

## Access:

Transport  
Marketing  
Affordability  
Purchasing  
power

-Resources to get  
food

## Utilization:

Food quality  
Food safety  
Good health  
Clean water  
Sanitation

Nutritious  
food-metabolisable

**Stability**

- Maintenance of availability, access and utilization
- No risk of loss of supply
- Permanent-durable food supply



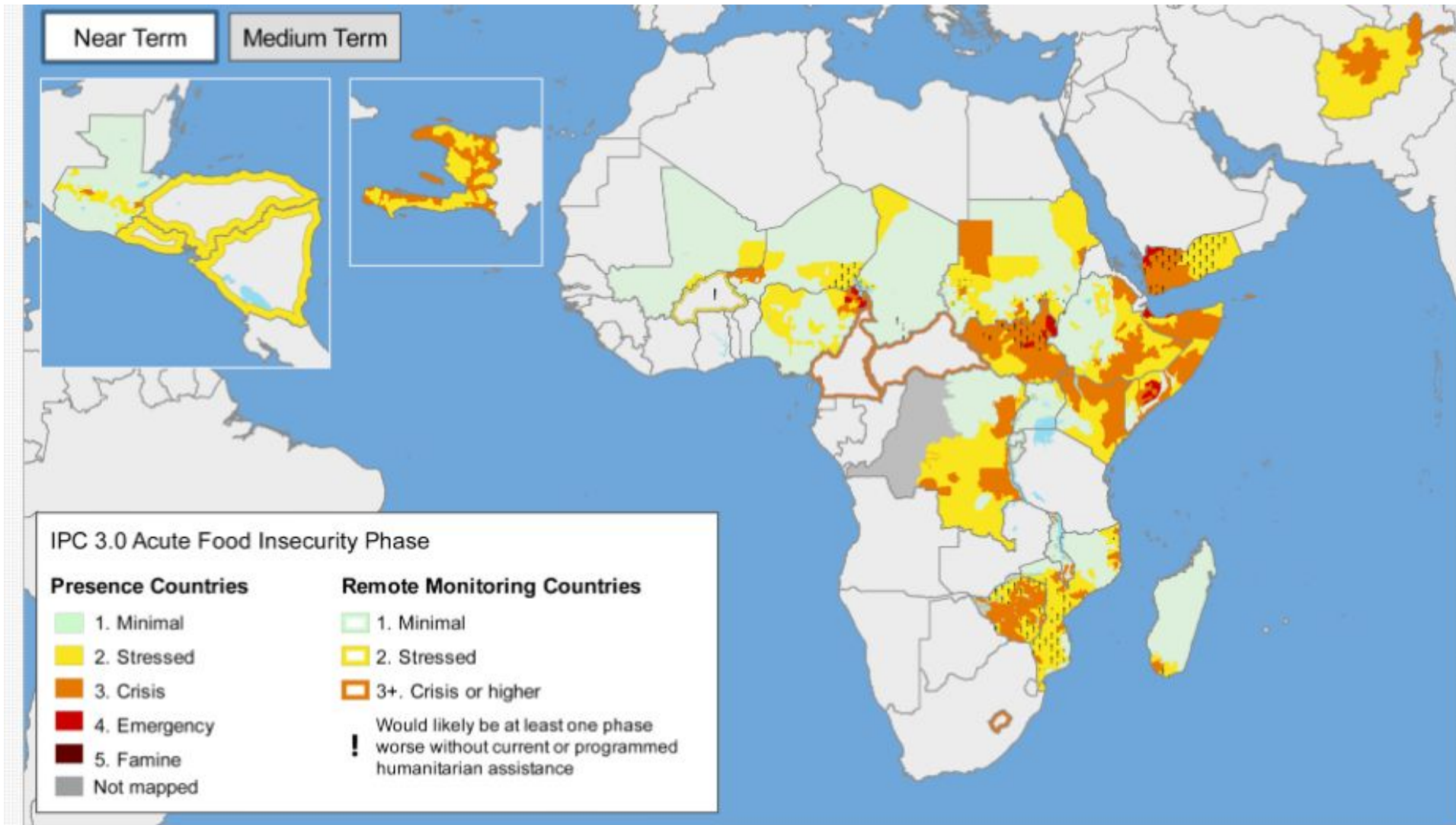


# Drivers of food insecurity in Africa- soils perspective





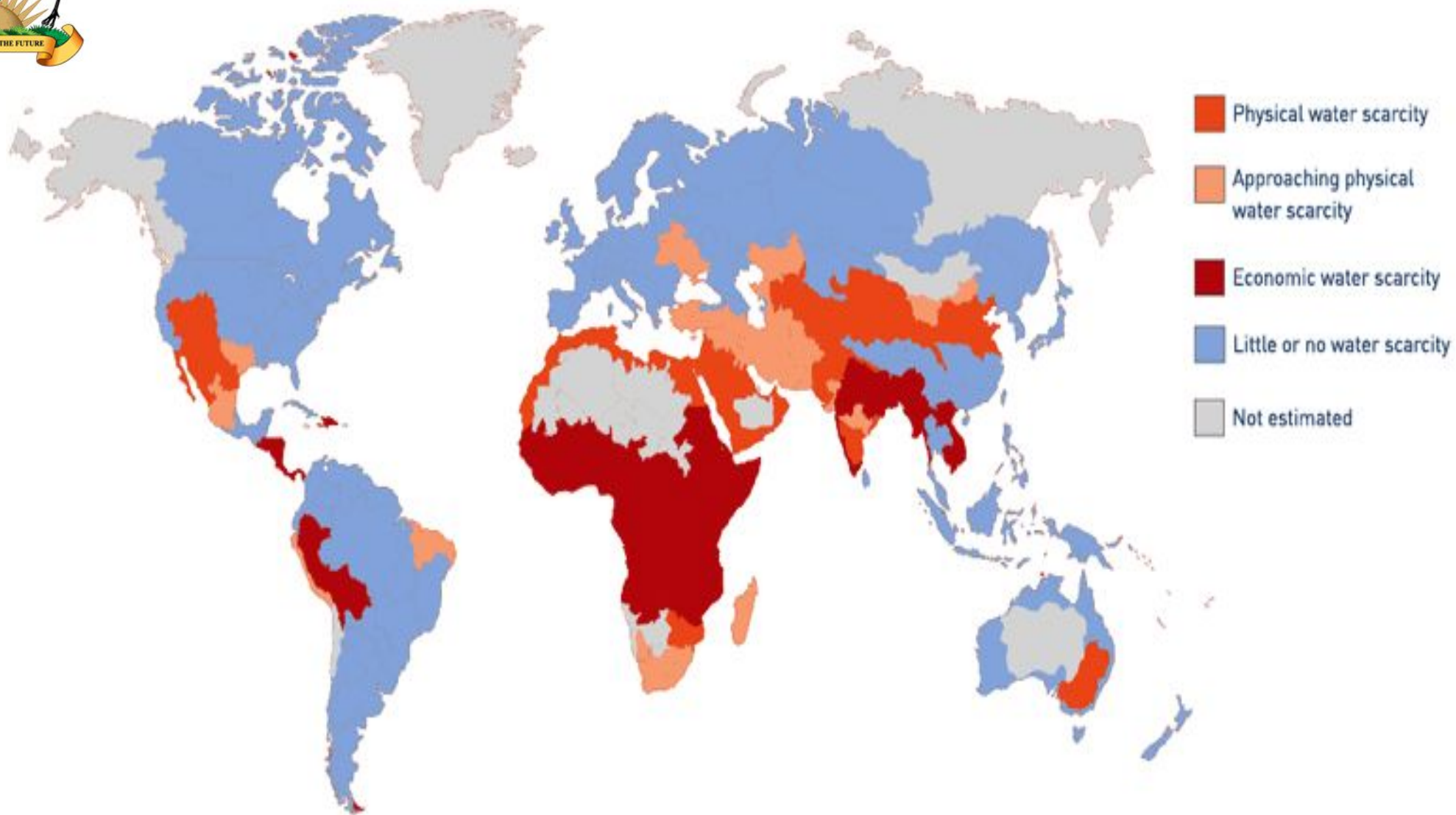
# Food insecurity to acute levels evident in Africa





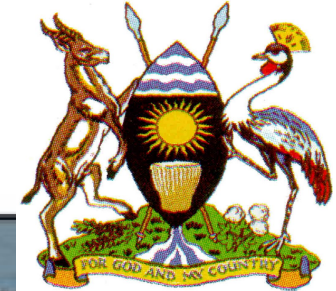


# Physical & economic water scarcity in Africa

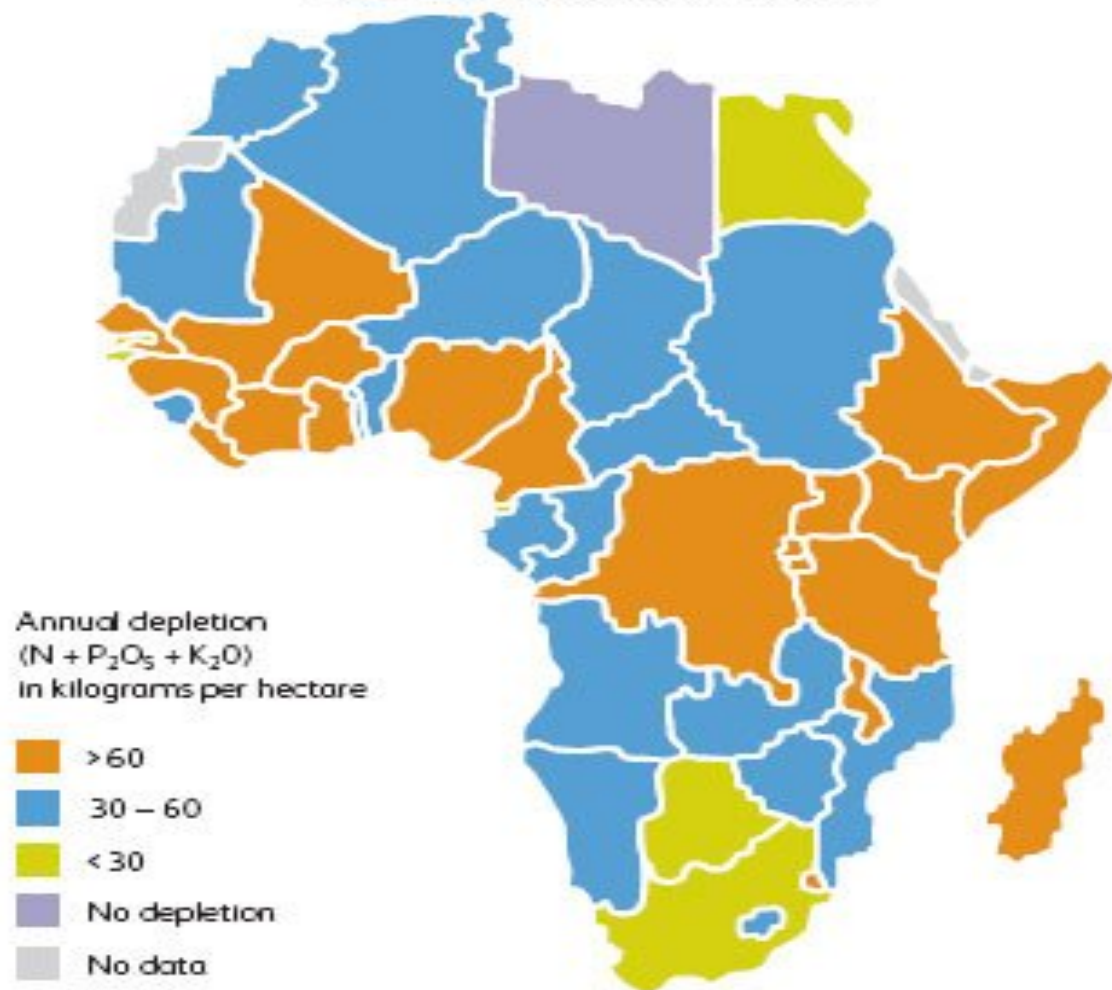




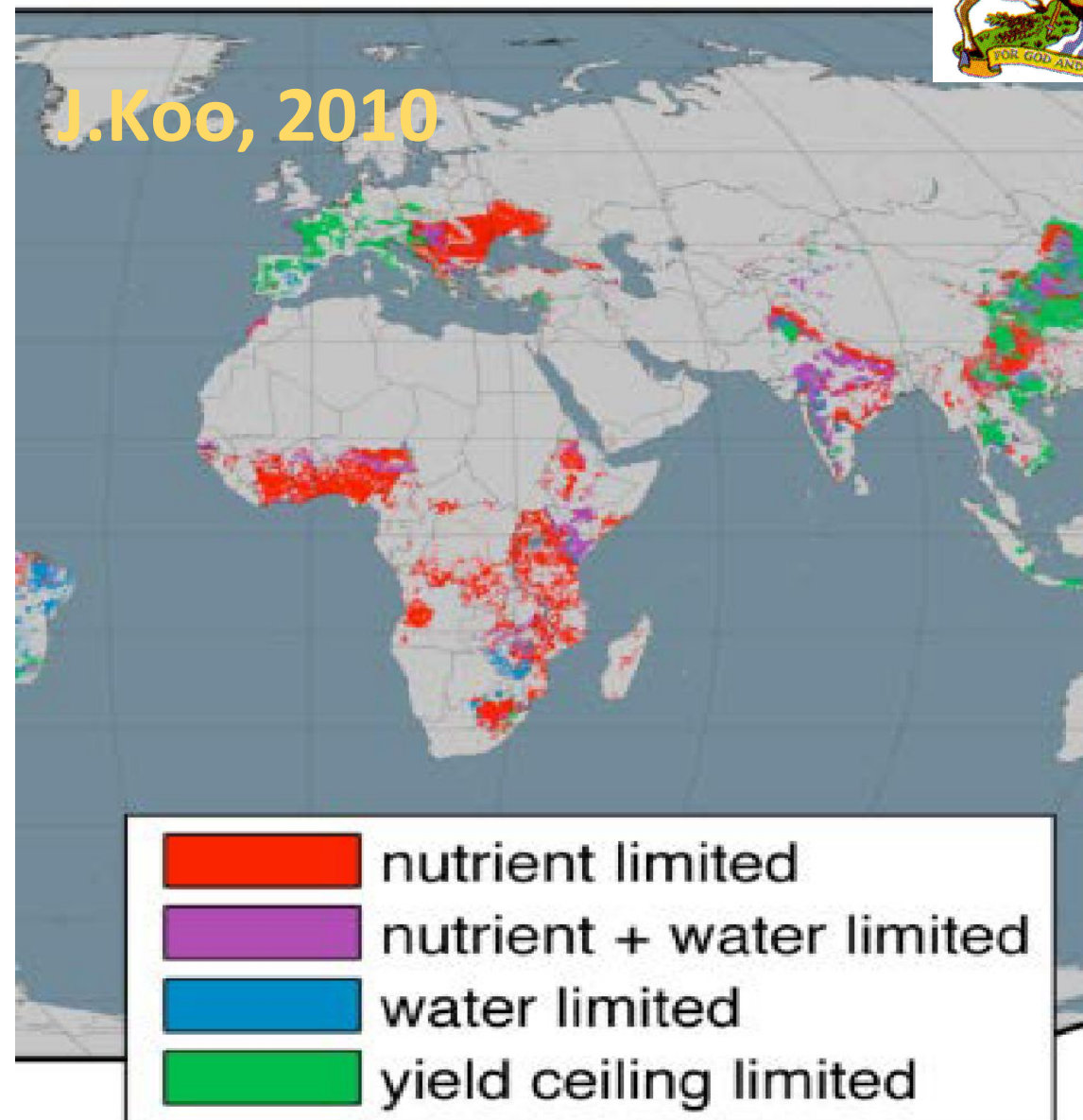
# Nutrient depletion in Africa



Average annual nutrient  
depletion (NPK) in Africa, 1993 – 1995



J.Koo, 2010







## Dominant soils – FERRALSOL – poor inherent chemical properties



- ✓ Low CEC
- ✓ Highly weathered
- ✓ High Al and Fe Oxides
- ✓ Sandy-loam, low nutrient reserve capacity
- ✓ Have kaolinitic mineralogy
- ✓ -Low SOC





# High P fixing Luvic ANDOSOLS- a challenge



Highlands regions

- ✓ More clay
- ✓ more Al+Fe oxides;
- ✓ High P fixing/phosphate retention
- ✓ Rich in organic matter
- ✓ Highly volcanic –with pyroclastic deposits





## Other tropical soils - HAPLIC ARENOSOLS – near lakes



*Near lakes*

- ✓ Sandy textured
- ✓ Low P (P) fixation capacity
- ✓ Soil structure is absent or very weak
- ✓ very permeable
- ✓ Rapid infiltration
- ✓ High hydraulic conductivity,
- ✓ Low water holding capacity
- ✓ low CEC

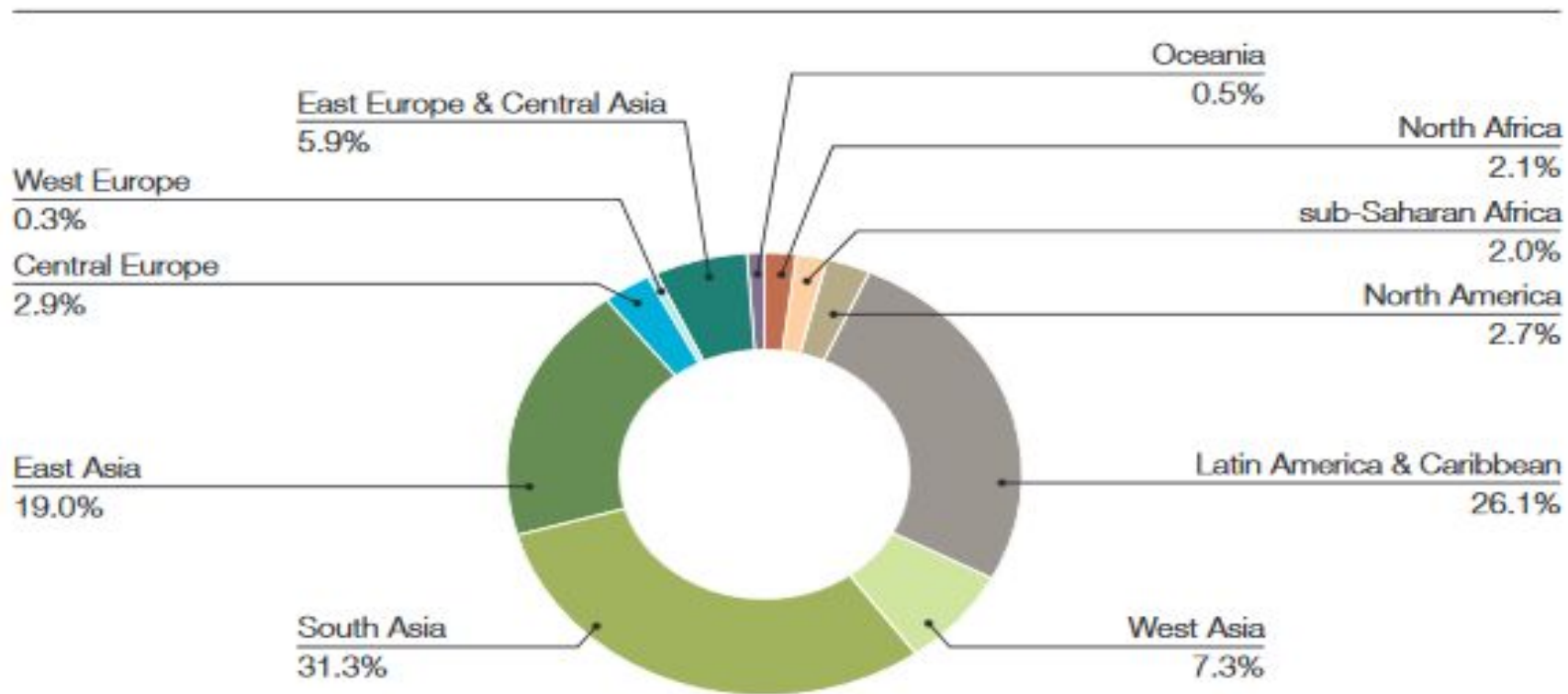




# Fertiliser use in the World – lowest in SSA

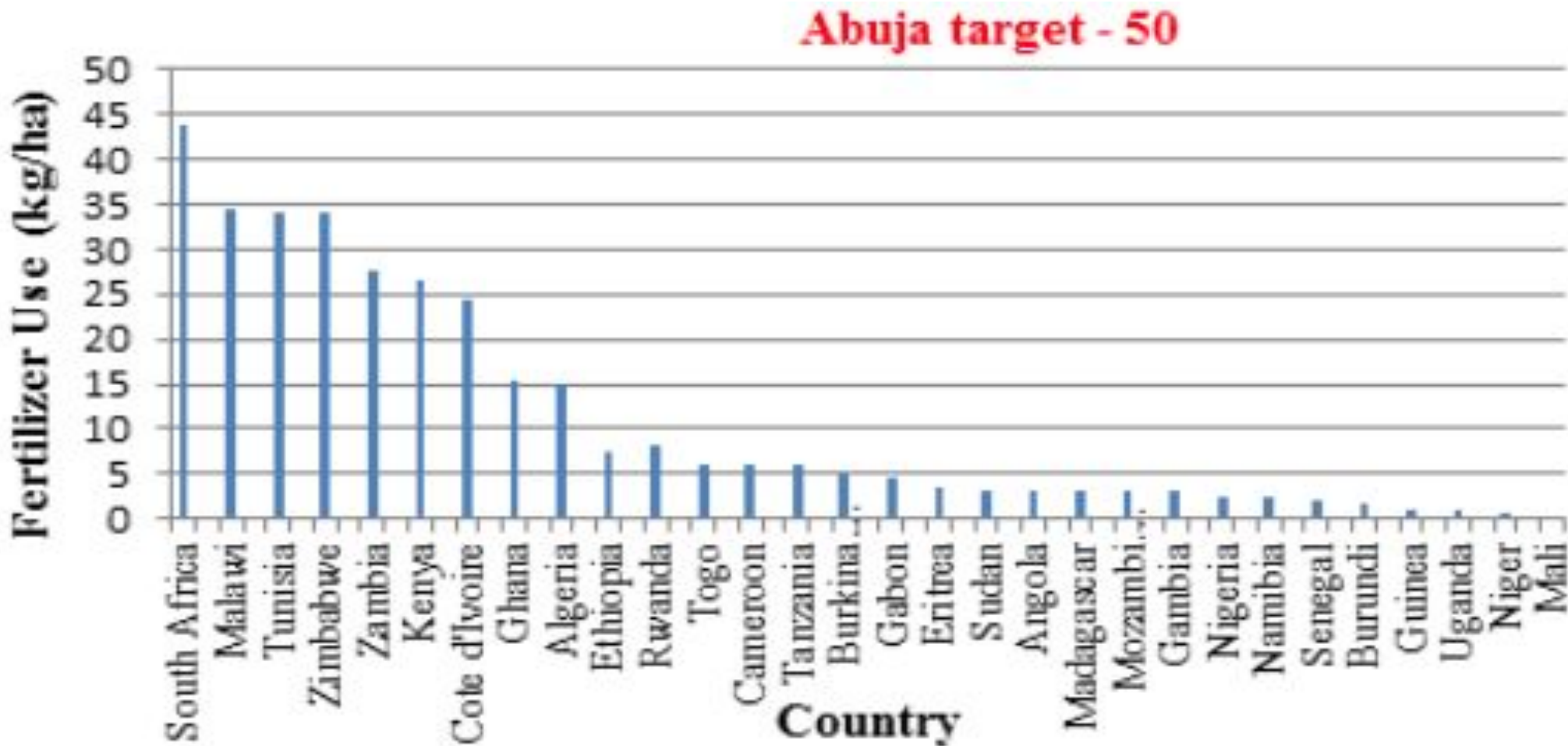


- Fertilizer use in SAA does not exceed 10 kg/ha/year compared to South Asia, East Asia, Latin America, US, Europe,
- Regional and sub-regional share of world increase in phosphate fertilizer consumption, 2014-2018 (FAO, 2015)





# Fertiliser use in East Africa (Thigpen ,2011)- low use is a challenge



(Uganda -  $<5 \text{ kg ha}^{-1}\text{yr}^{-1}$ )





# Human led degradation rampant – a challenge



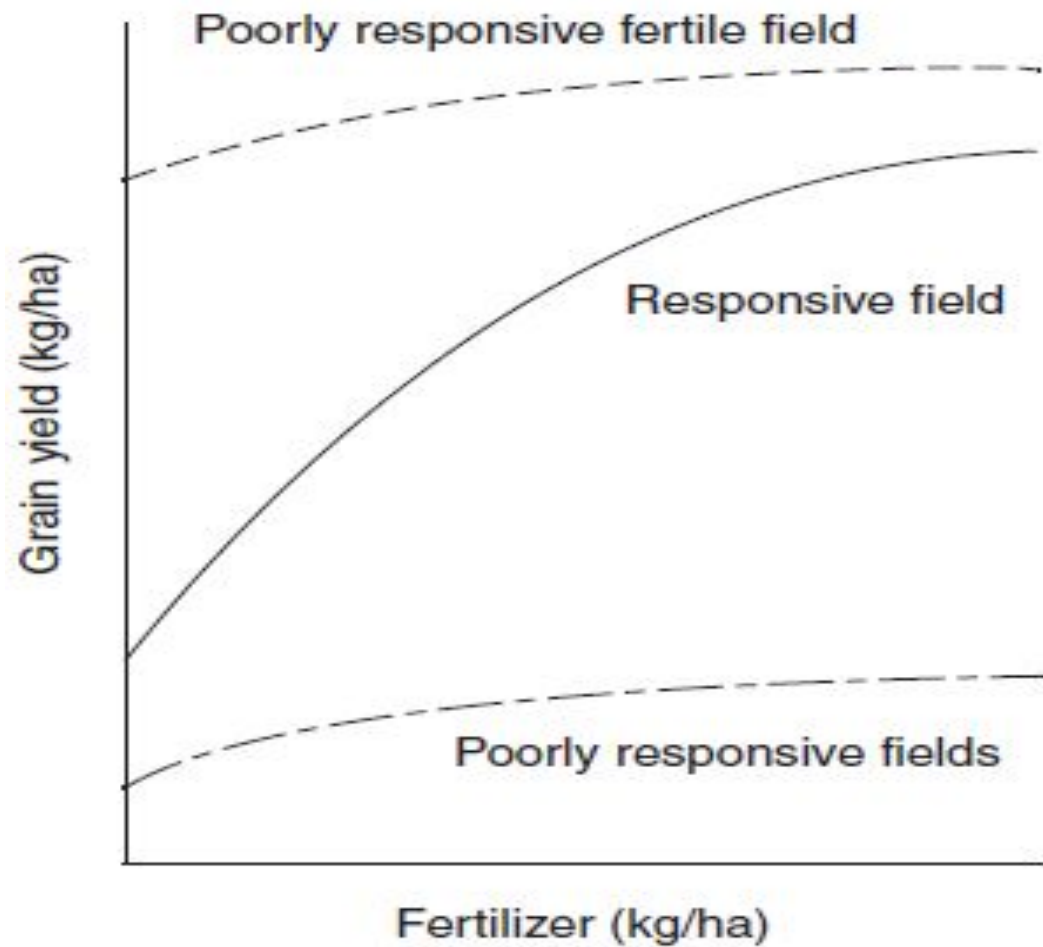
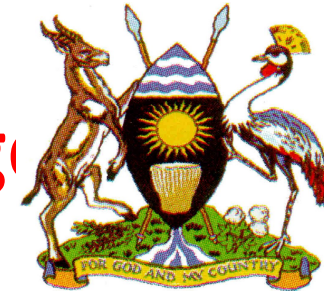
- Over 60% of the land in Africa is under intensive cultivation and unsustainable practices
- Most land very prone to soil loss – in highlands areas
- Severe signs of land degradation - soil loss ( $30\text{-}70 \text{ t ha yr}^{-1}$ )







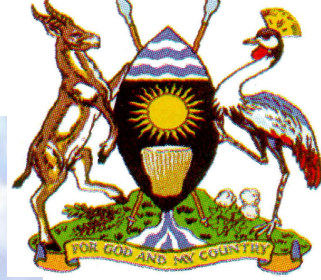
# High variability to nutrient response – a challenge







# Nutrient mining & limited re-cycling- a challenge



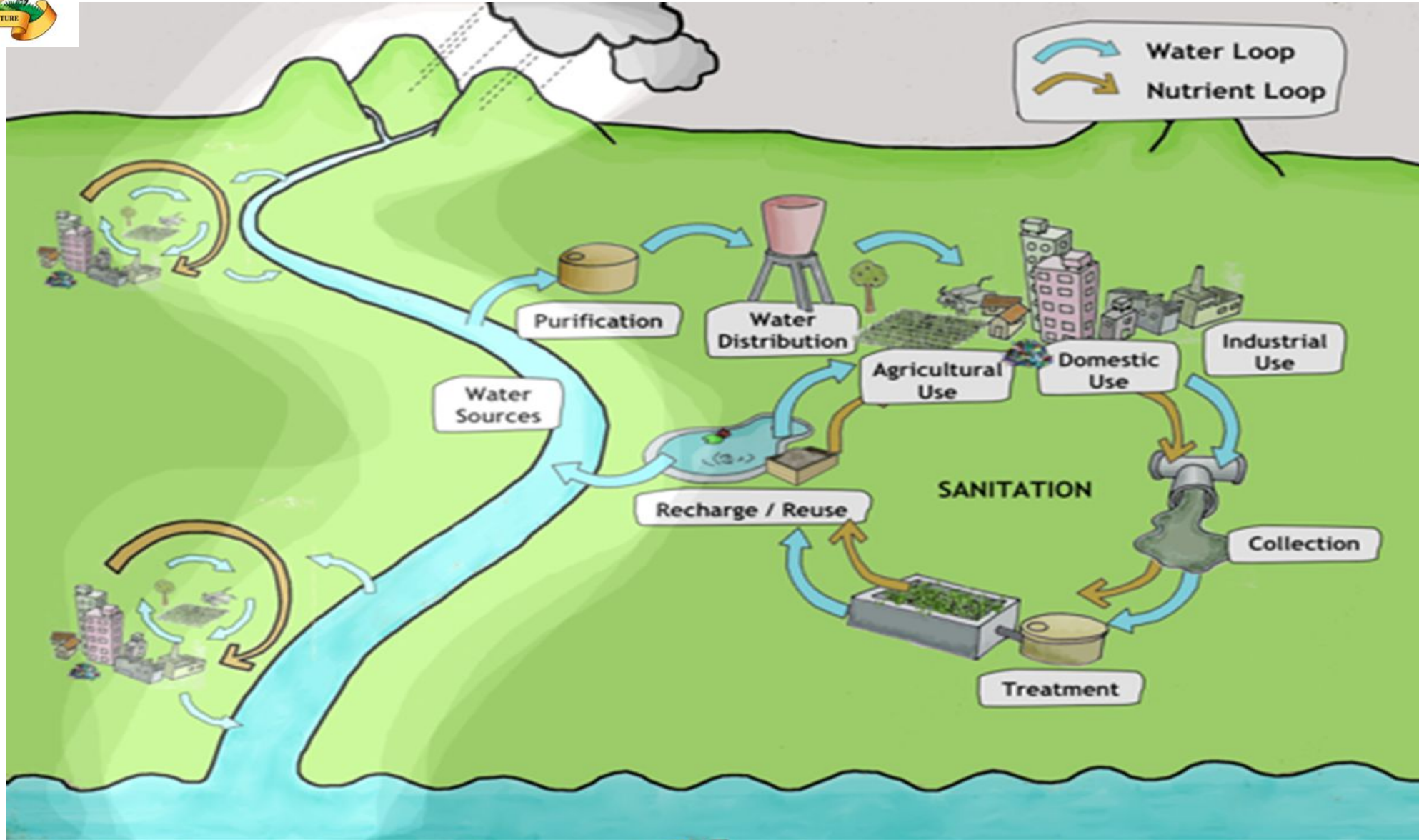


# Interventions on soils for food security





# Integrated, holistic Approaches - key



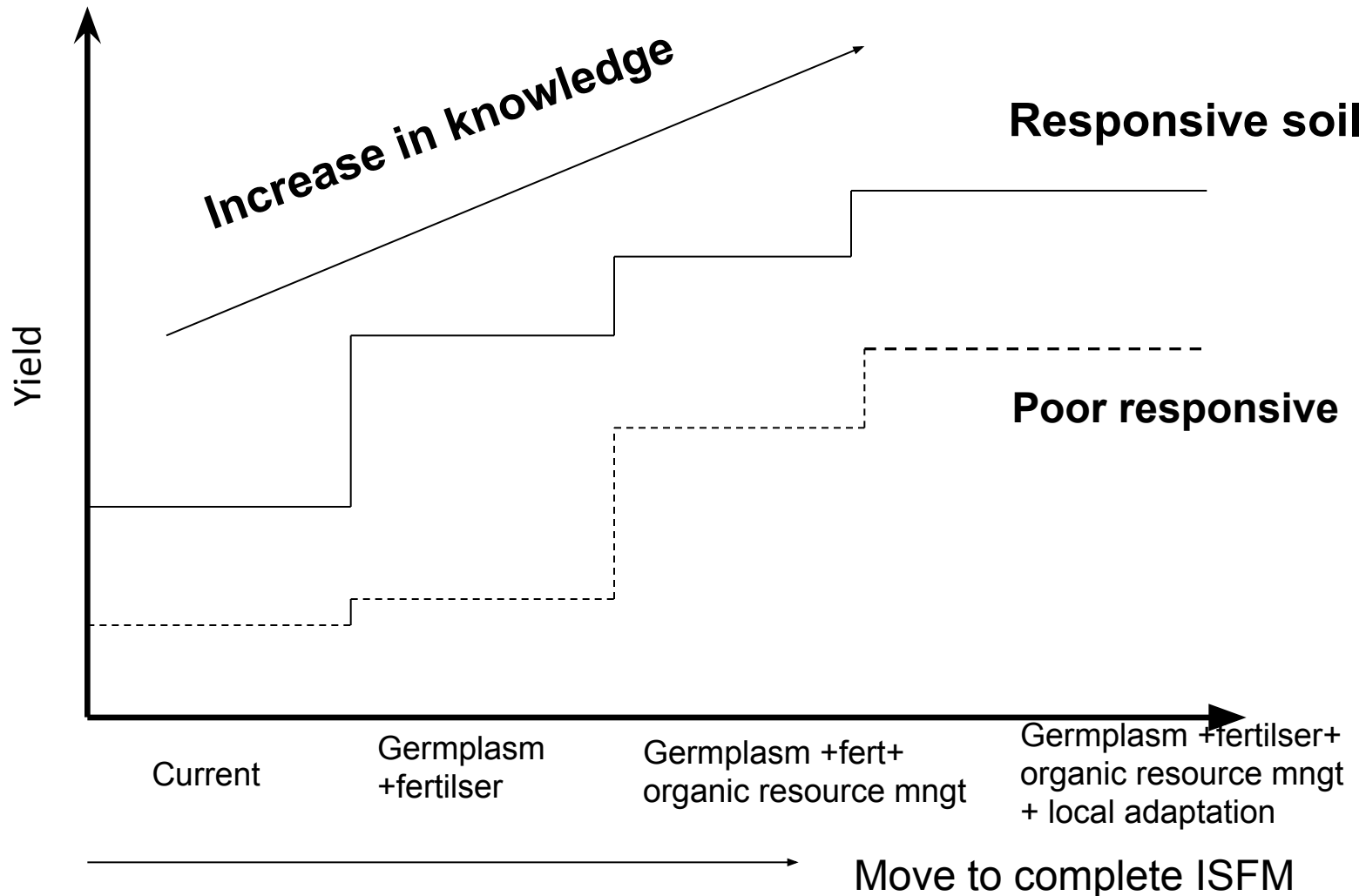


# ISFM pathway – toward integrated soil management



## The ISFM approach:

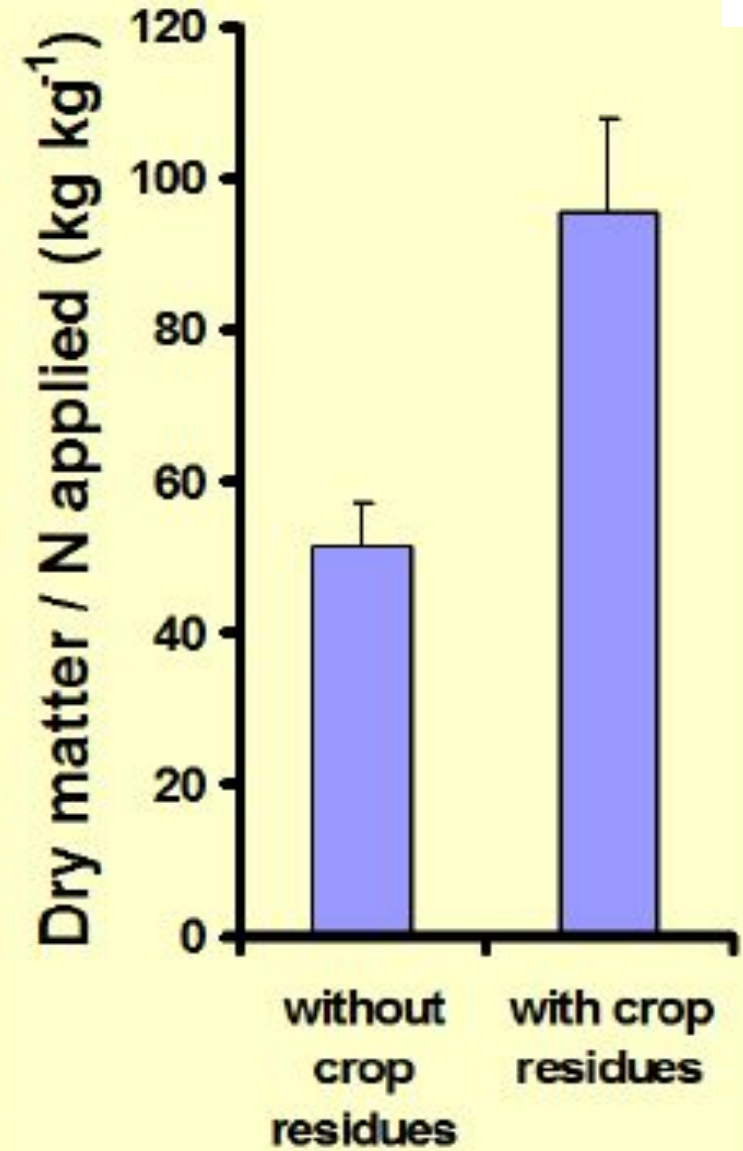
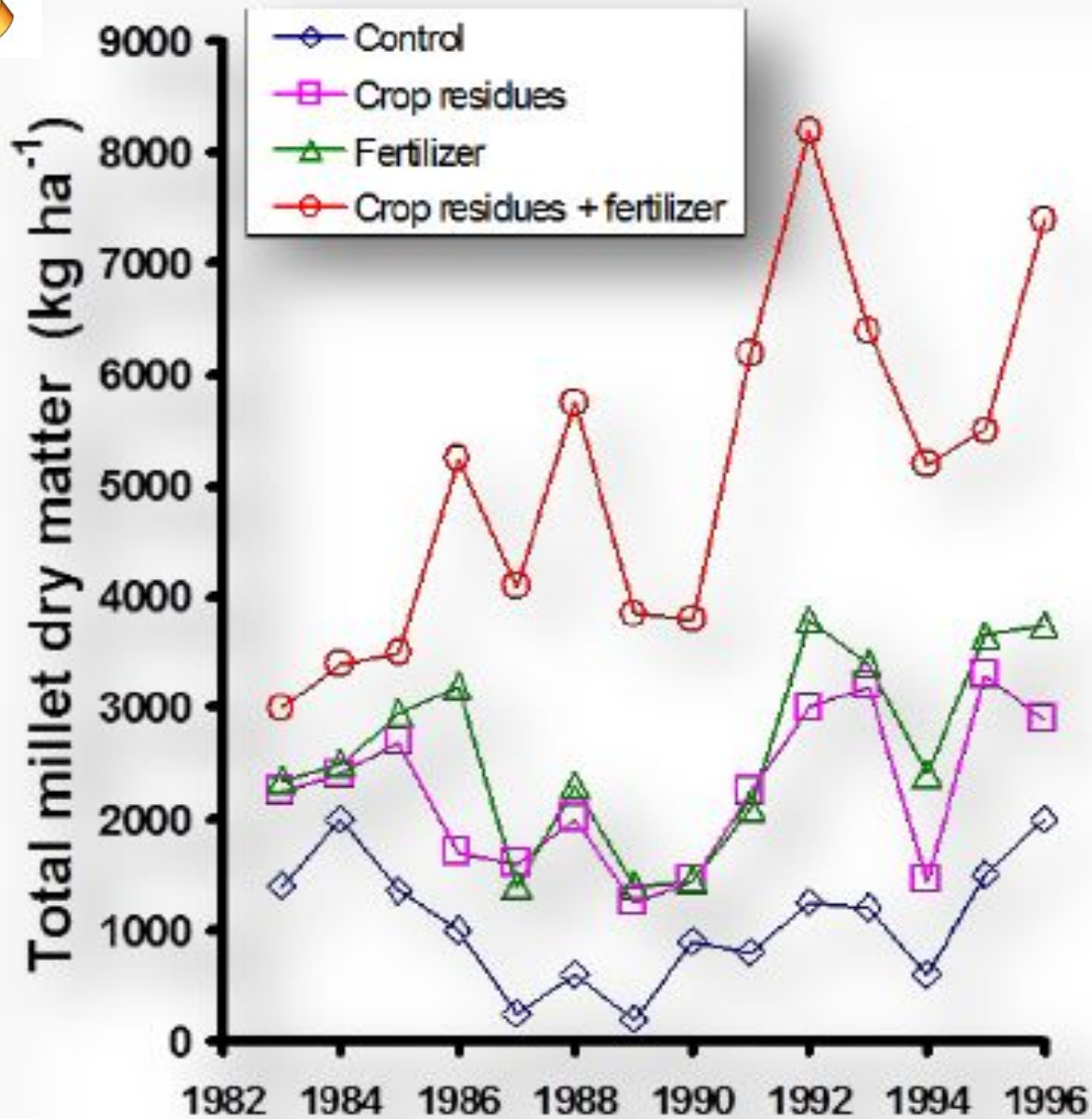
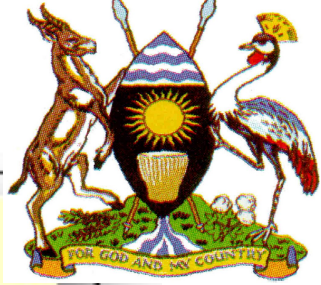
A set of soil fertility management practices that necessarily include use of fertilisers, organic inputs, improved germplasm combined with knowledge on how to adapt these practices to local conditions, aiming at maximising agronomic use efficiency of applied nutrients and improving crop productivity







## Combined use of organic and inorganic inputs – promising







# ollective action – soil protection and use -vital







# SOC sequestration technological options – promises



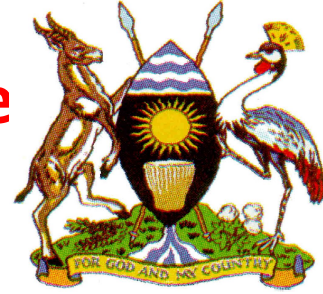
- ✓ Conservation Agriculture/CSA - minimum tillage, soil cover and mix/rotating crops)- boosting C sequestration and yields







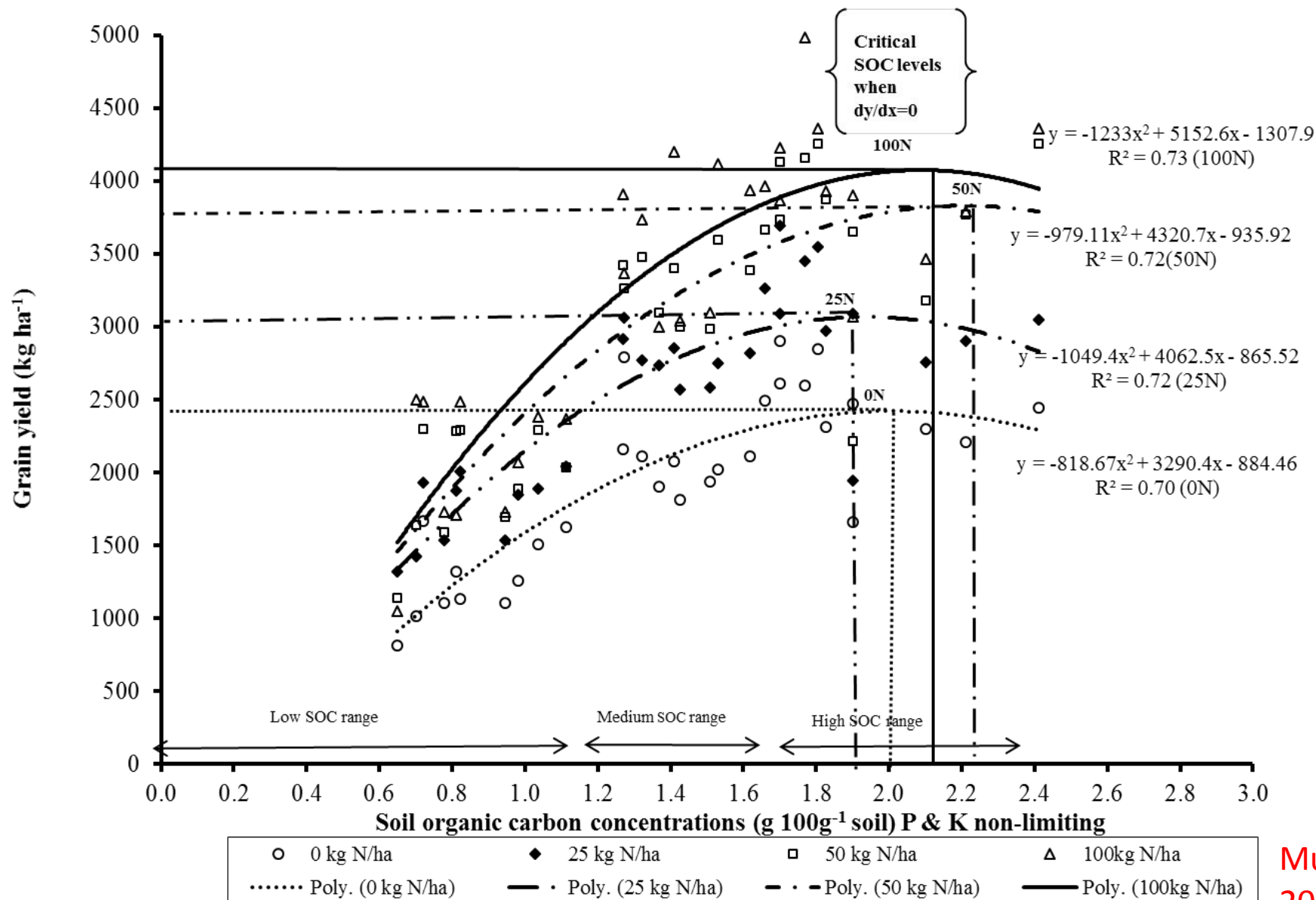
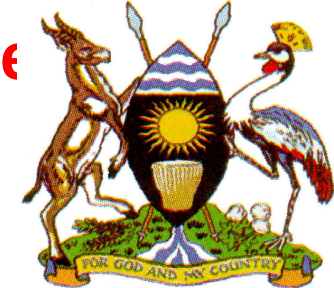
# Applied fertilizer with 4Rs (Time, Amount, Type, Placeme - site specific management – PROMISING for Africa







# Land use intensification: Optimal SOC X fertilizer benefits ve promising: Musinguzi et al., 2016. J. Exptal Agriculture



Musinguzi et al.,  
2016



# Adopting agroforestry- for soil health improvement



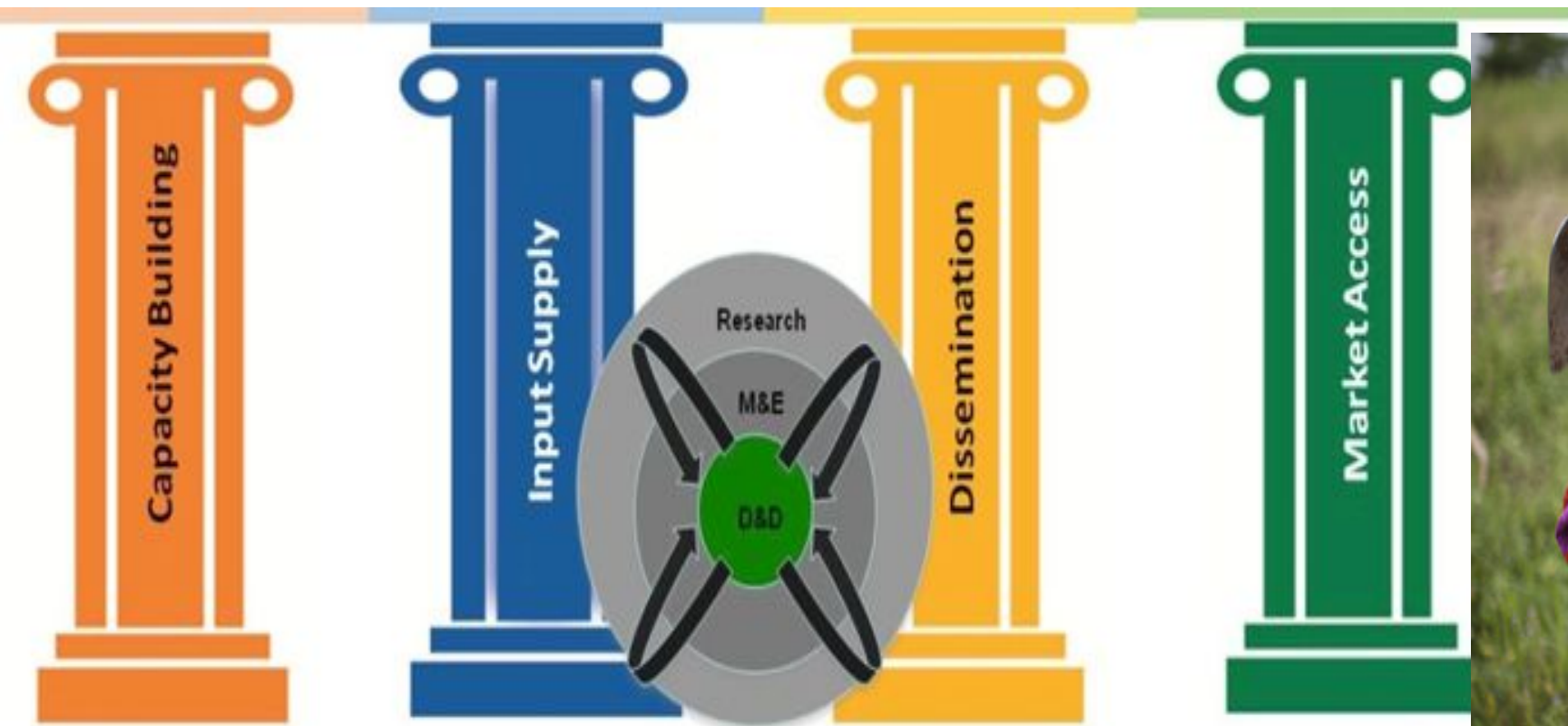
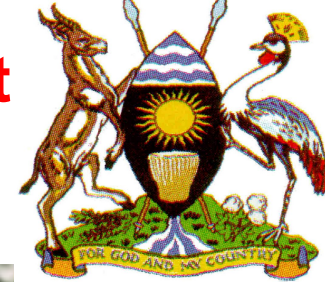
- ✓ Alley cropping - row intercropping
- ✓ Silvopasture
- ✓ Riparian forest buffers
- ✓ Windbreaks
- ✓ Improved fallows
- ✓ Multi-storied agroforestry cropping
- ✓ Scattered trees on farmland







# Need for Sustainability strategy with integrated soil management for food security



- ✓ Enabling policy environment, Right technologies, Sound Management, Gov't support services, technical support, and Decision support Systems
- ✓ Building a critical mass/investment in soil scientists critical to the region from 2-15 soil scientist per 1 million people)- WB report



# Conclusion



- ✓ Many regions in the tropical regions of Africa are food insecure
- ✓ There is rampant soil quality depletion demonstrated by negative nutrient balance and soil loss
- ✓ Integrated approaches to soil management are promising boosted by capacity building interventions in soil science
- ✓ Innovative interventions are vital if adaptable to the African conditions





***World Soils Day (Soil is Wealth-Let Us Protect it for the future)***