Sustainable Root & Tuber Crop Production Systems for Sub-Saharan Africa

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Background

- Cassava and Yam – two major mandate crops of IITA
- Traditionally research strongly focused on breeding
  - High yield potential
  - Pest and disease tolerance/resistance
- Agronomy and crop husbandry not strongly developed
- Changes in germplasm due to disease pandemics
- Continuous soil degradation
- Increased weed pressure and species shifts.

=> cassava yields remained low (Figure1) in Nigeria, the world's largest cassava producer.

=> Root & Tuber crop agronomy requires a revision and a fresh start, considering today's farmers' conditions.

Here, we describe the new approaches on R&T agronomy and present some early results.

New approaches

The concept of **Integrated Soil Fertility Management (ISFM)** as guideline to achieve sustainable intensification of Root & Tuber crop systems (Figure 1).

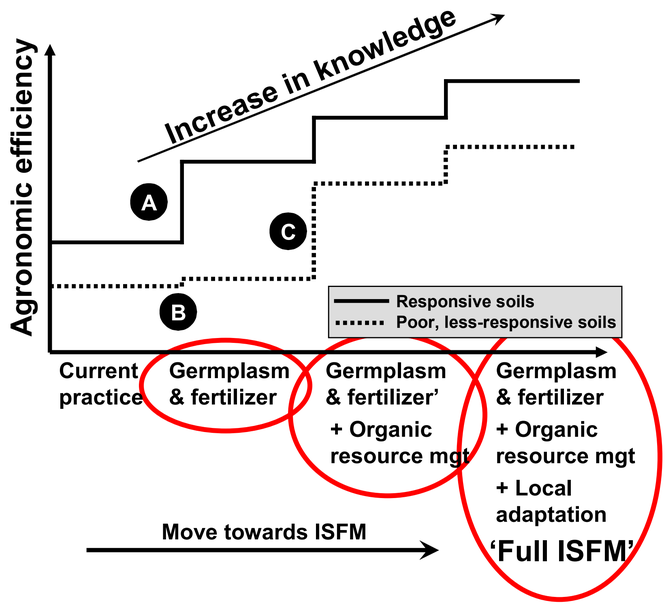


Figure 1: Conceptual approach towards Integrated Soil Fertility Management and hypothetical yield changes as a consequence of interventions on responsive and non responsive soils. A, B, C indicating differential responses to interventions on different soils.

The concept follows a **stepwise introduction of factors and interventions to maximize the agronomic efficiency of inputs and changes**. The interventions are not limited to the examples in figure 1 but comprise any measure to improve R&T crop yields and productivity.

Sets of trials are being implemented in IITA target countries, looking into:

- **Varietal choice by site and production targets,**
- **Fertilizer requirements through omission trials,**
- **Compatibility with maize and grain legumes,**
- **Planting densities and patterns,**
- **Weed control frequency and methods,**
- **Leaves in human nutrition and root yield response**,

and specifically for yam:

- **on promoting and accelerating sprouting.**
- **and combating the yam nematode**.

Results

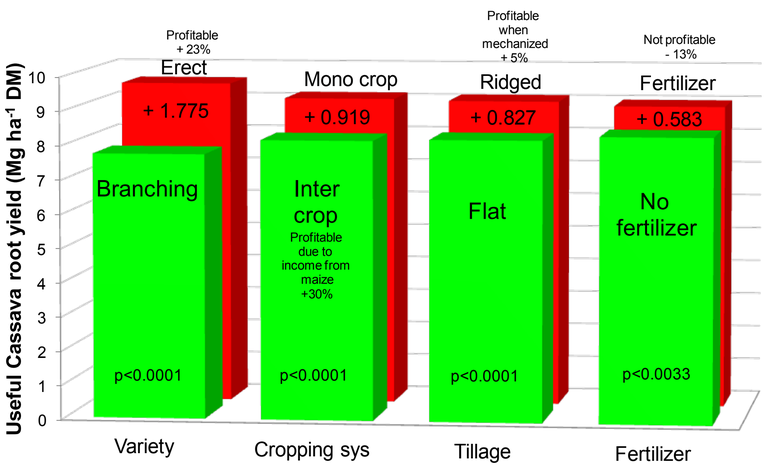


Figure 2: Cassava root dry matter response to varietal change, intercropping, tillage and fertilizer application and estimates of profitability of individual factors (based on 7000N per ton fresh roots).

Results continued

Cassava:

Varietal choice: Erect, non-branching varieties have no disadvantage compared with branching varieties; weed competition and yield are better in erect and taller varieties (Figure 2).

Intercropping: Even at high maize densities the cassava densities, the cassava root yield loss was more than compensated for by the income from the maize. Maize yields were around 2 Mg/ha, being equivalent to the monetary value of 10-20 Mg/ha fresh cassava roots, depending on seasonal price fluctuations.

Tillage: ridging produced a marginal advantage if done by tractor. However weed suppression after ridging was significantly better than on flat soil.

Fertilizer: despite being significant, the fertilizer induced yield increase did not recover the fertilizer cost and was thus unprofitable.

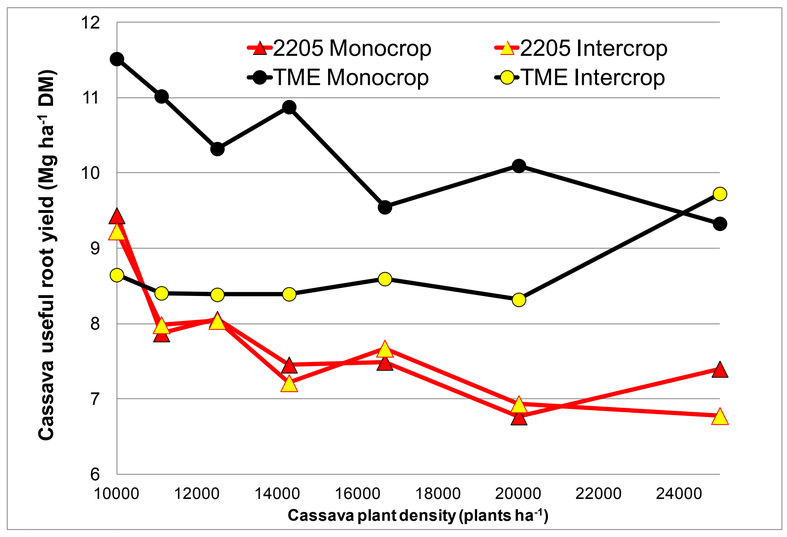


Figure 3: Cassava root yield response to plant density and intercropping with maize

Cassava density: Variety, intercropping and plant density interacted (Figure 3): Variety 2205 is a branching and TME an erect variety. The branching variety having no response to intercropping and a steep yield decline with increased density. The erect variety responds as the branching one when monocrop but has an inverse response as intercrop.

Yam:

a similar trial was conducted in close by sites on yam with one variety, tillage, intercropping, fertilizer and increasing densities.

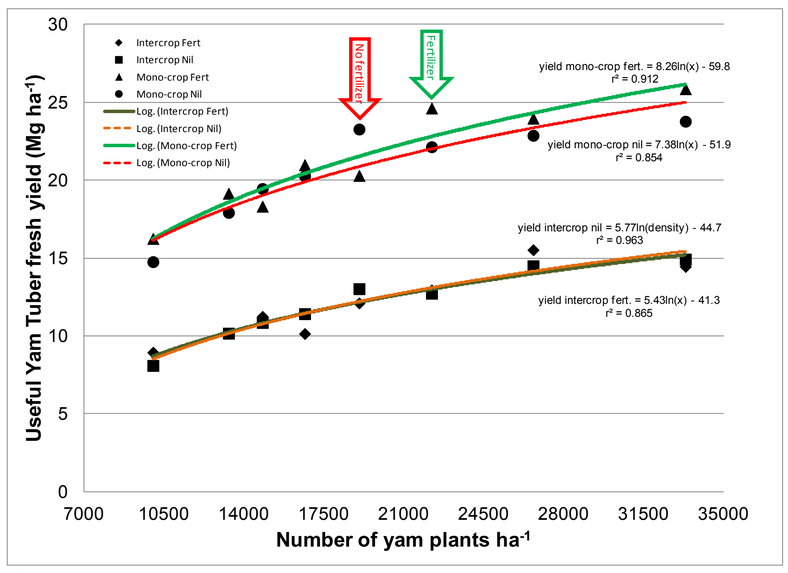


Figure 4: Yam tuber yield response to plant density, fertilizer application and intercropping with maize.

Tillage: no effect against all believes on tuber yields

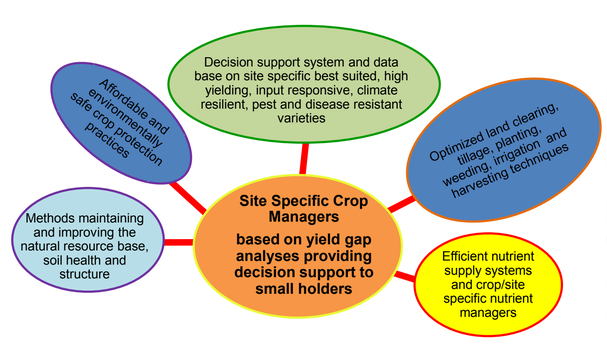
Fertilizer: no effect on tuber yields

Intercropping with maize: caused up to 48% yield loss

Densities: increased yam densities allowed almost 10 Mg ha^{-1} higher tuber yields (Figure 4).

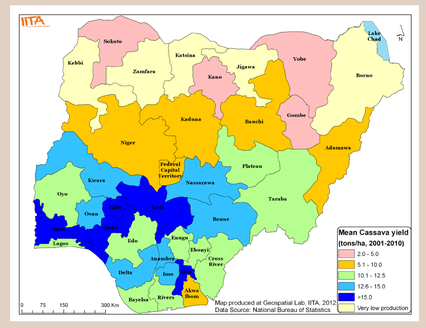
New initiatives

IITA as a member of the **CRP on Roots Tubers and Bananas (RTB**) has initiated a **research cluster on "Sustainable RTB Crop Production Systems".** The goal is to develop a set of **decision support tools** to facilitate farmers' choice of varieties, crop husbandry, nutrient (fertilizer) supply, crop protection measures and options to maintain their natural resource base in the context of sustainable intensification.



These decision support tools will target field by smallholder farmers. Once the modules on major production aspects are created (see figure to he left) they will be available from a common platform to combine into 'Site Specific Crop Manager' expert systems, publicly accessible through smart phones and other, mainly mobile devices.

Developing new **bilateral projects** like the **African Cassava Agronomy Initiative** where research and users, from industry to small holder farmers, jointly work on solutions to **user defined challenges encountered** in cassava value chains. This comprises the challenge in the supply chain such as fertilizer blending and recommendations, agronomy such as intercropping, optimum planting/harvest times for high starch content, staggered planting for continuous root supply, and best planting practises, marketing and processing and most important all measures to bringing solutions to scale.



Mean cassava fresh root yields in Nigeria.

Typical across Central and east Africa, a bundle of fresh cassava leaves for consumption as vegetable.

Typical yam monocrop trailed on nylon string suspended from bamboo poles. Note the dense canopy and lush green .

Typical yam /maize intercrop trailed on nylon string suspended from bamboo poles. Note the sparser canopy , lack of leaves at lower levels and less lush green leaves.

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