

# Enhancing drought resilience of enset through nutrient management

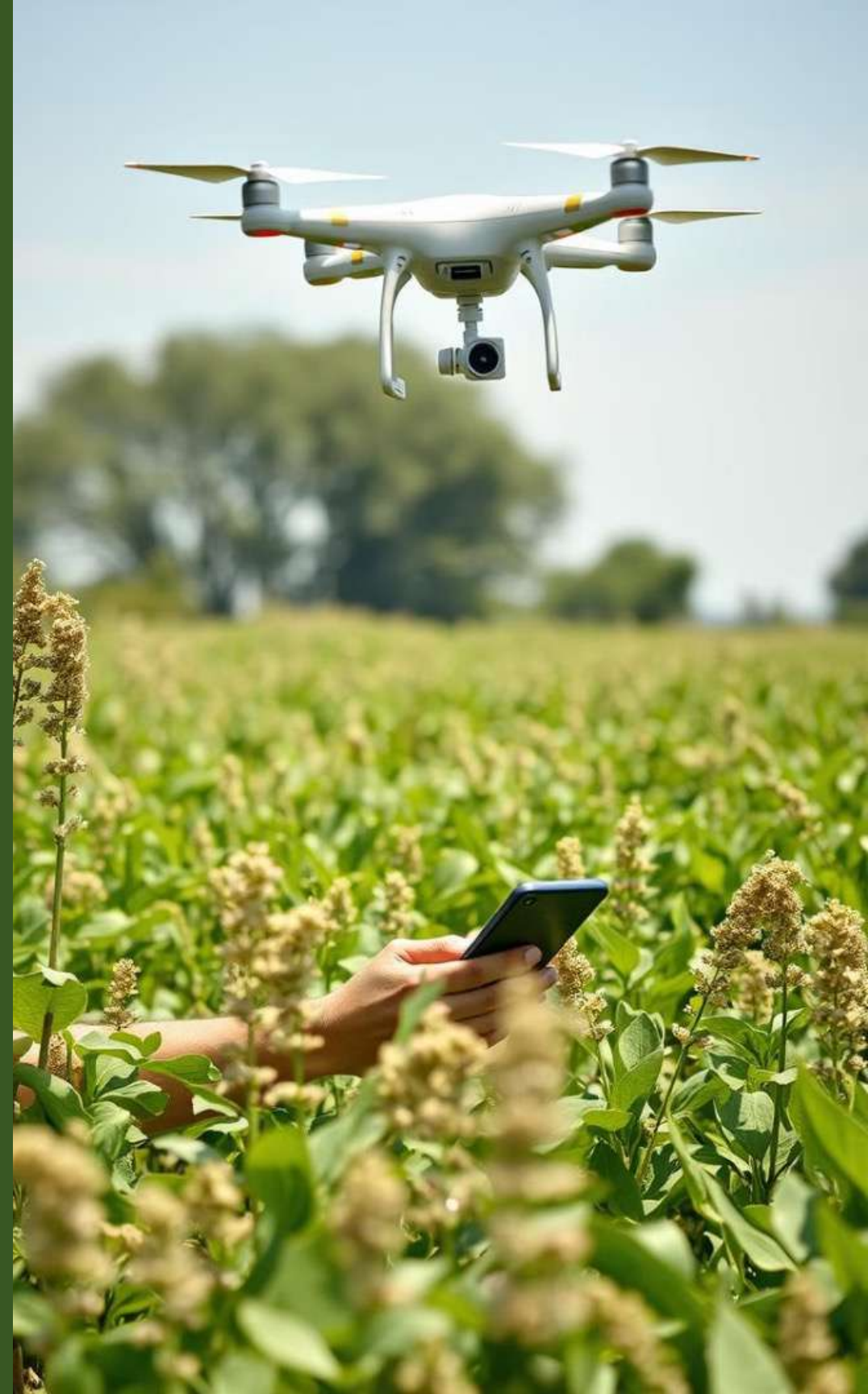


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How can we effectively integrate **traditional knowledge and practices** with **scientific innovations** to enhance sustainability of food systems?



# Adding a new question: drought resilience!

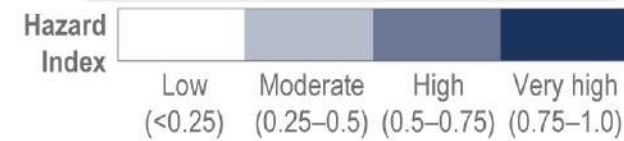
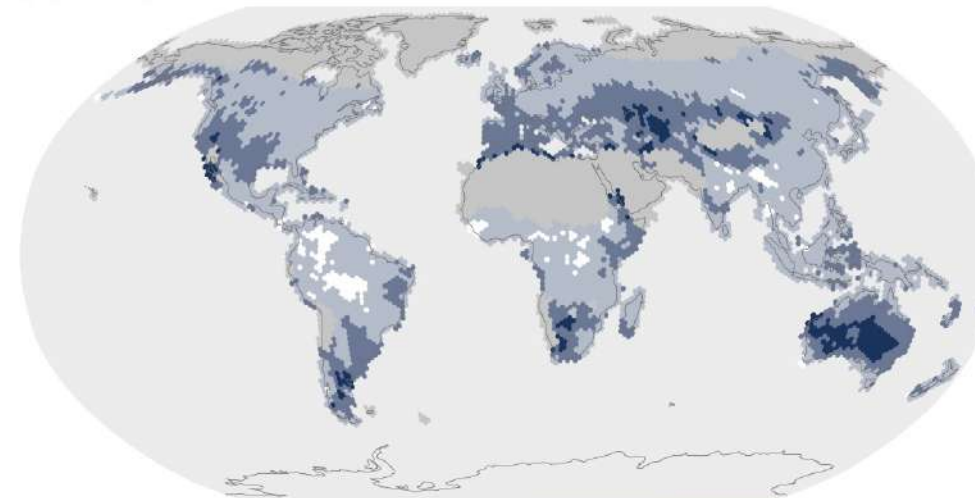


# Current global drought risk and its components

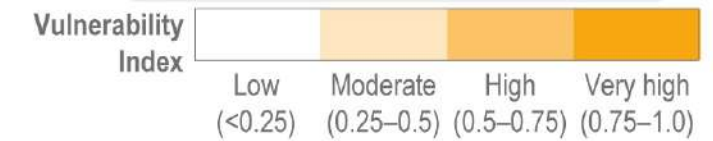
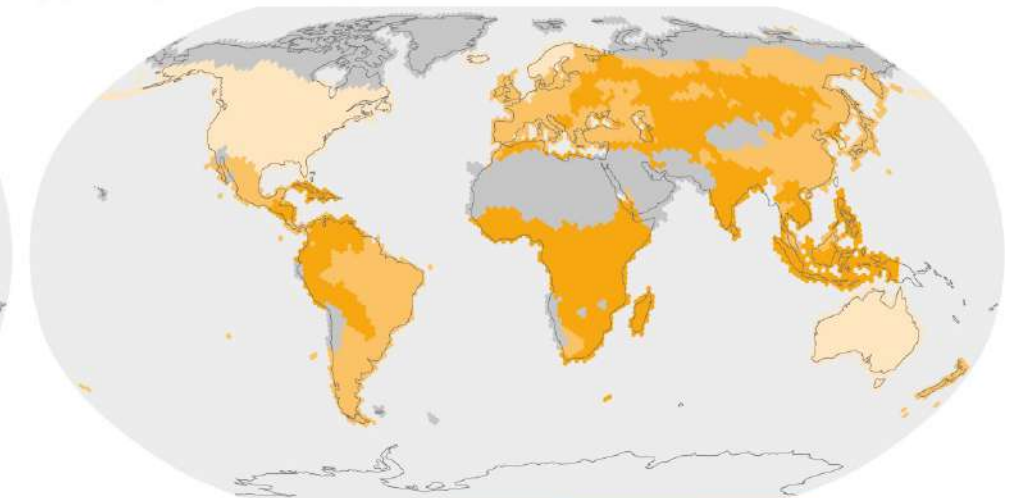
## Current global drought risk averages for period 1901–2010



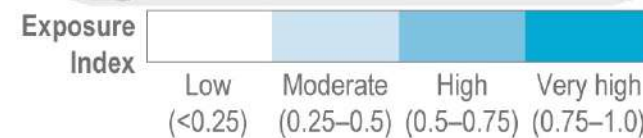
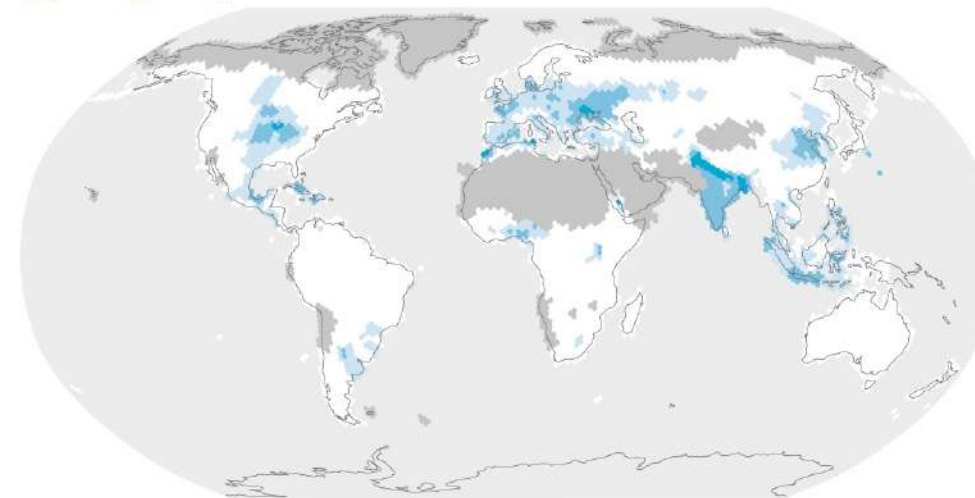
(a) Drought hazard



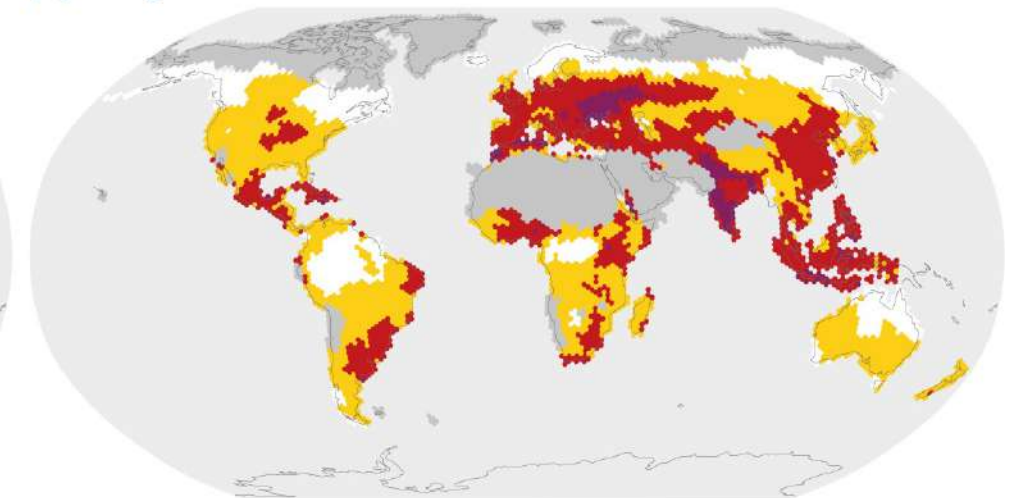
(b) Drought vulnerability

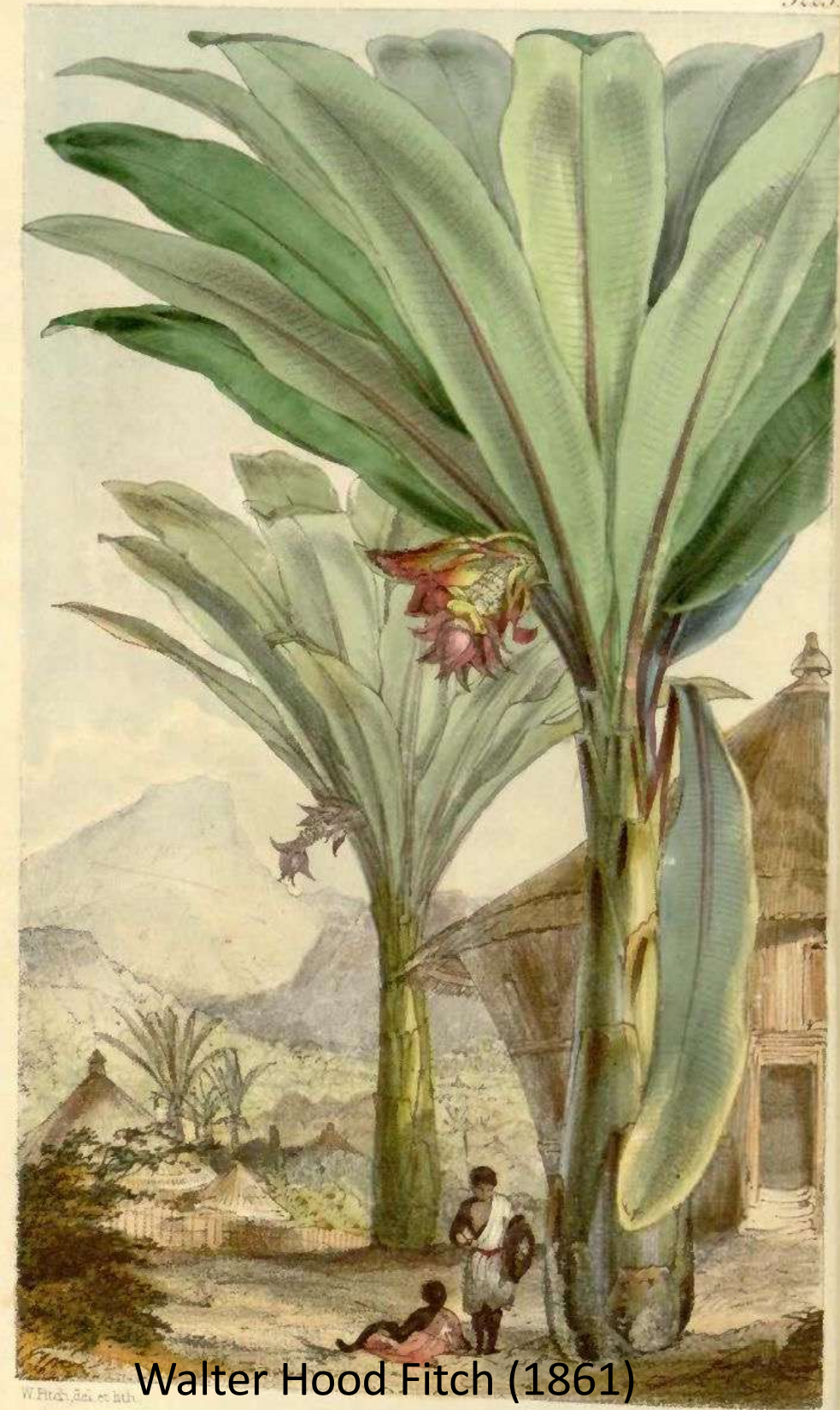


(c) Drought exposure



(d) Drought risk





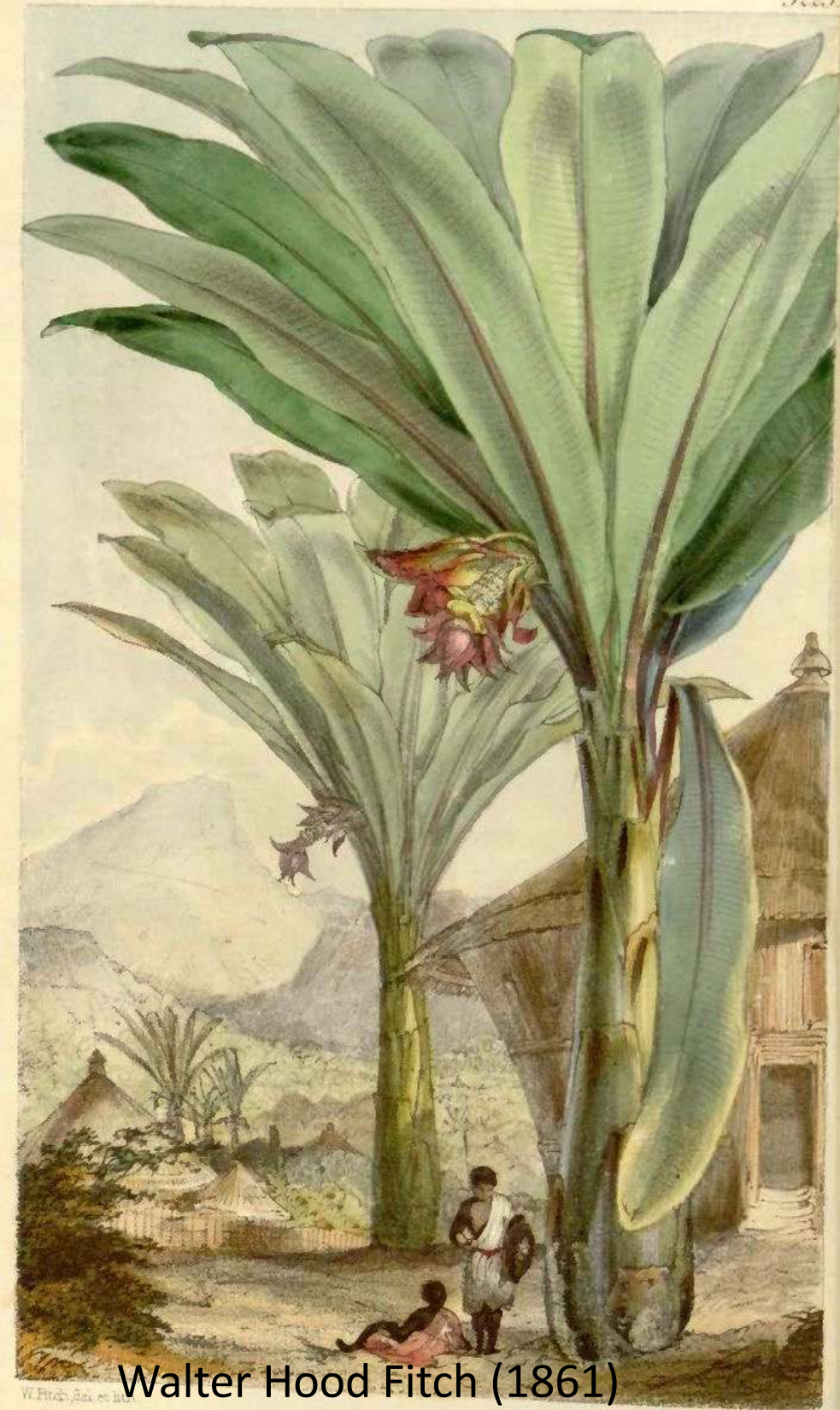
Walter Hood Fitch (1861)



Wondo Genet, Ethiopia (2024)

# Enset

- Enset (*Ensete ventricosum*): false banana
- Over 300 enset varieties- different beneficial characteristics of each variety
- A large non-woody plant (5-6 m tall, 250 kg, 4-5 years)
- Root crop- yield about 40 kg of food
- Utilize whole parts for different purposes: food, liquid
- **Famine food: a drought tolerance**
- **Enhancing soil carbon**



Walter Hood Fitch (1861)



## *Required fertilization*

*138kg N ha<sup>-1</sup>*

*20kg P ha<sup>-1</sup>*

*80kg K ha<sup>-1</sup>*

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Ayalew, 2015



Inorganic fertilizers are hard to find or too expensive for smallholder farmers.



***Biochar***

**+**

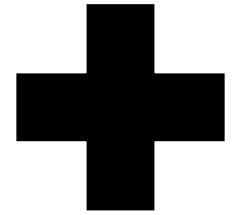
***Compost***

**||**

**???**



***Biochar***



***Compost***



**Better compost quality**  
**Yields increase**  
**Greenhouse gas mitigation**  
**Soil carbon increase**



# ***Biochar***

**How to produce biochar  
without an expensive  
pyrolysis?**



# How to produce biochar?



- A top-lit up-draft micro-gasifier (NOAH Stove)
- Eucalyptus wood chips
- Pyrolysis temperature between 500 and 600 °C
- Residence time of 40–50 min.



Micro-gasifier cook stove

Biochar



# How to get compost feedstocks without competition with other uses?

- Cattle manure
- Food waste
- Crop residues
- ....



# *Compost*

**Human excreta can be useful feedstocks for compost-providing multiple benefits.**



# How to get human excreta? – An ecological toilet



# How to generate biochar compost?

Biochar + human excreta + cattle manure + food waste + saw dust

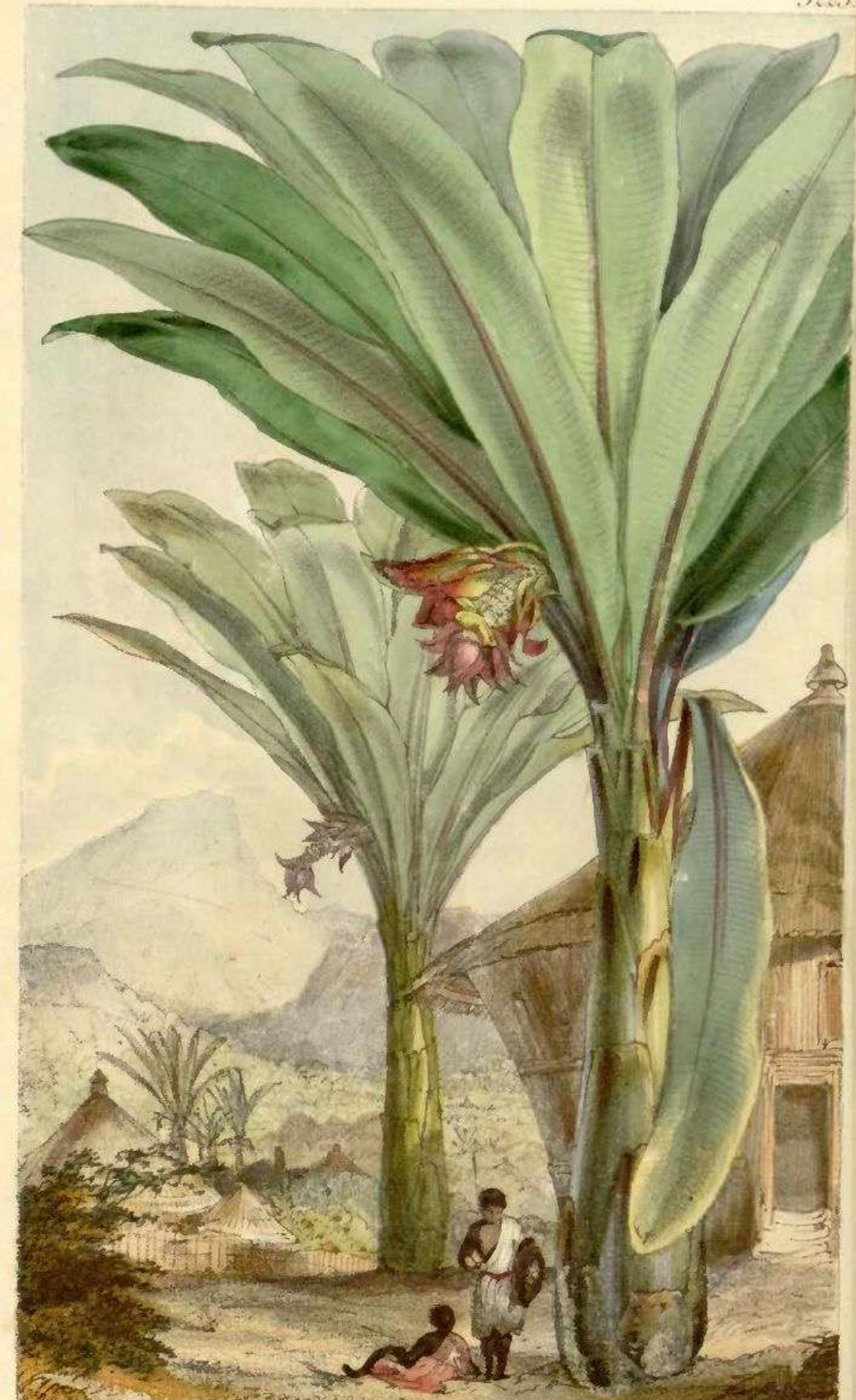




*Biochar*



*Compost*



Walter Hood Fitch (1861) Vincent Brooks, Imp.



## Research question

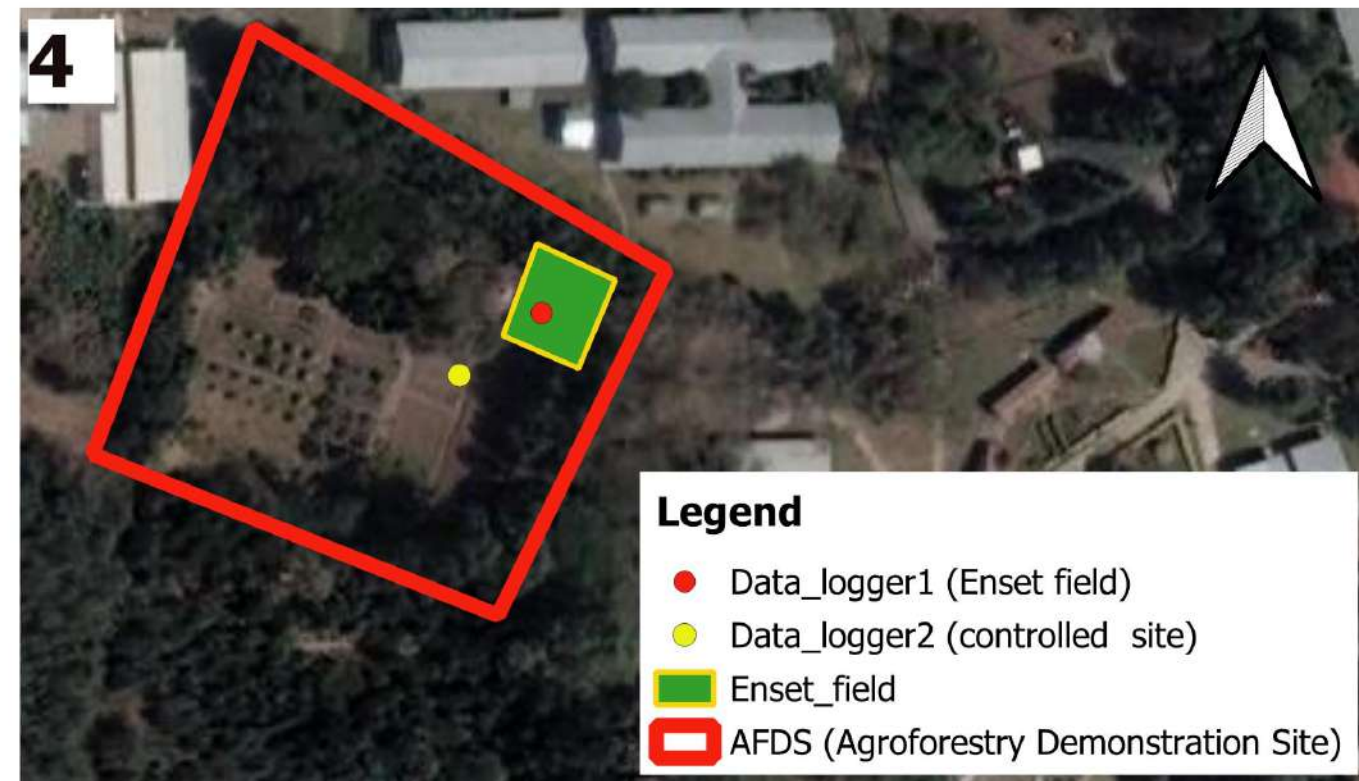
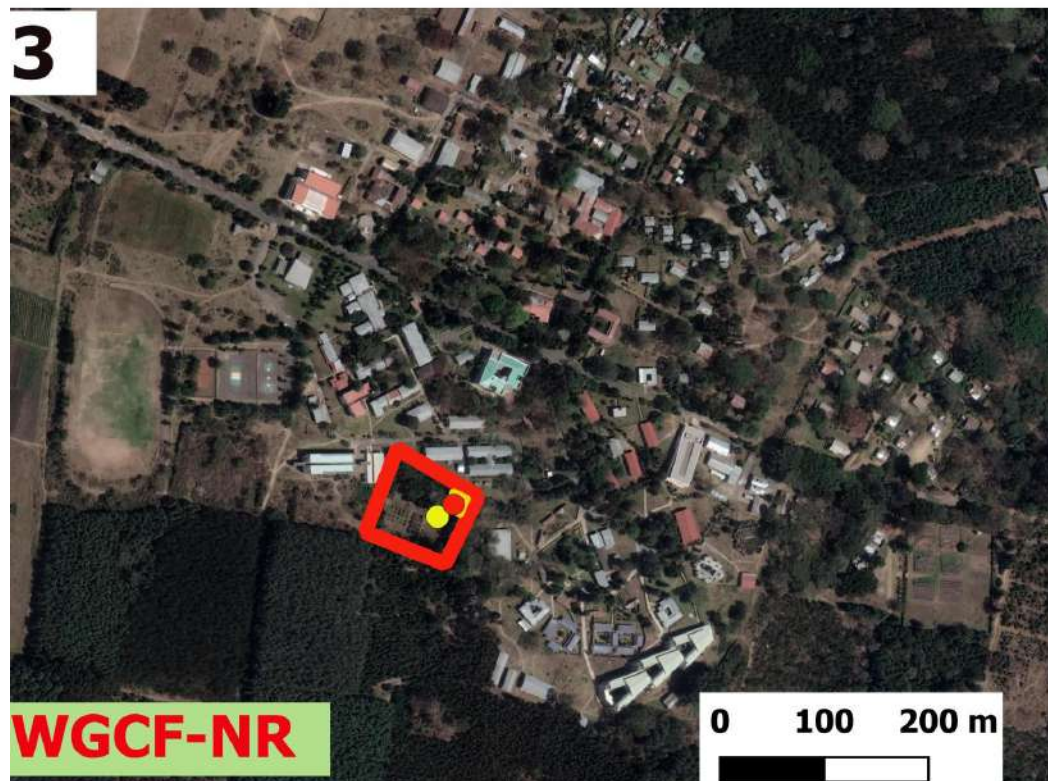
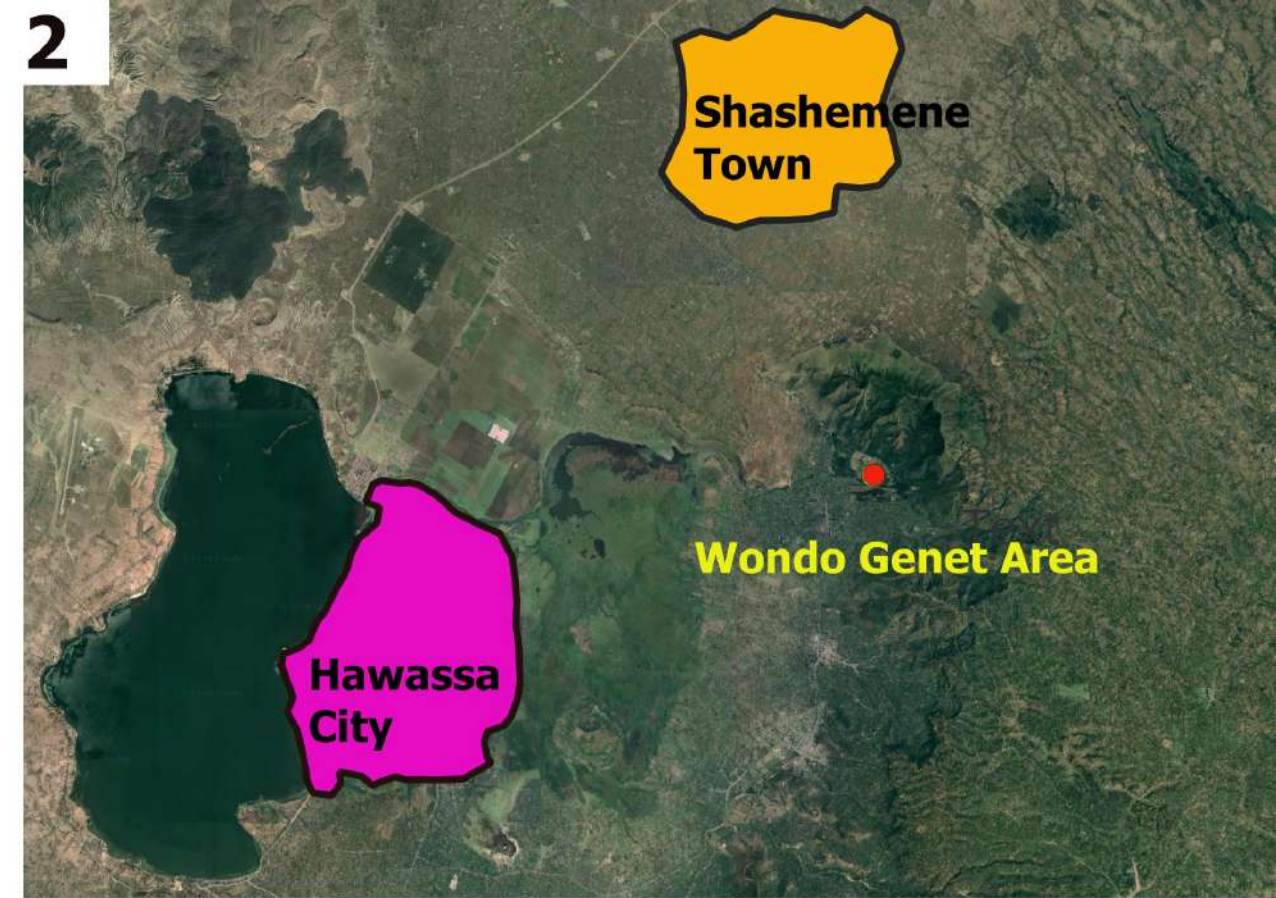
Can biochar and compost enhance yields, soil carbon sequestration and drought resilience of enset ?

# Materials and Methods

# Study area

Agroforestry  
Demonstration Site

Wondo Genet  
College,  
Hawassa University,  
Ethiopia



# Study area

- Enset fields
- Control (Bare soil)

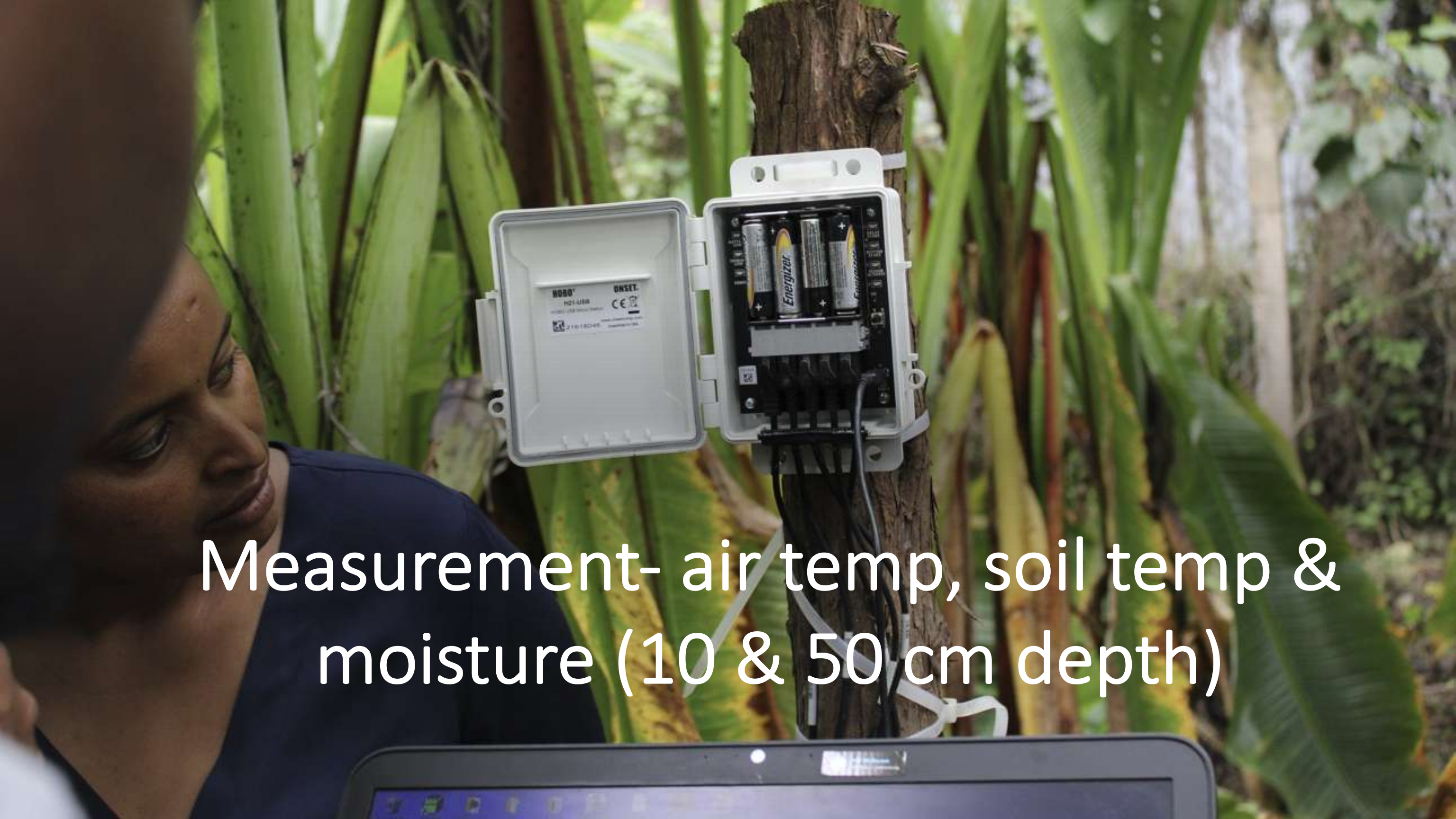
**@ Agroforestry  
Demonstration Site**



# Treatment

- **Biochar compost (50 kg N/ha/year)**
- **Synthetic fertilizer (Urea; 50 kg N/ha/year)**
- **Control (no input)**





Measurement- air temp, soil temp & moisture (10 & 50 cm depth)



## Enset growth monitoring

- monthly measurement of diameters & height

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-20 enset fields

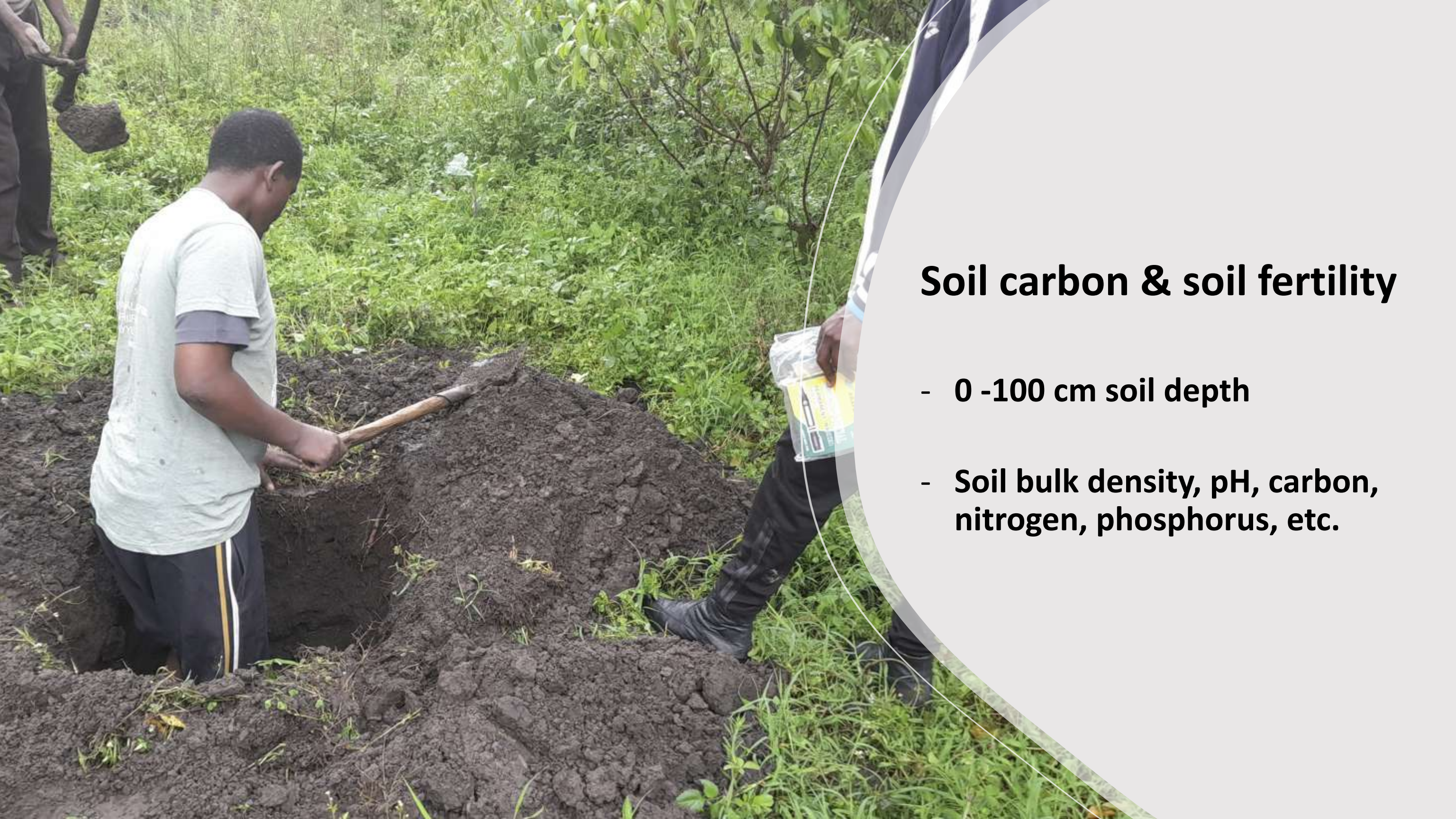


## Enset photosynthesis monitoring

- Chlorophyll Fluorescence
- Relative Chlorophyll
- ATP synthase conductivity,
- monthly measurement
- 30 ensets

Leaf Photosynthesis MutlisperQ v2.0

A person wearing a dark blue jacket is holding a white handheld device, the Leaf Photosynthesis MutlisperQ v2.0, against a large green leaf. The device has a circular logo on its side and a small green light. The background is a blurred outdoor setting.



## **Soil carbon & soil fertility**

- **0 -100 cm soil depth**
- **Soil bulk density, pH, carbon, nitrogen, phosphorus, etc.**

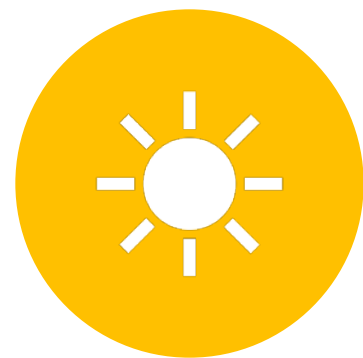
# Expected outputs



Air temp. and soil temp. & moisture in enset fields and control site in rain & dry seasons



Effects of biochar compost and urea fertilizer on enset growth in rain & dry seasons



Effects of biochar compost and urea fertilizer on enset photosynthesis in rain & dry seasons



Effects of biochar compost and urea fertilizer on soil carbon pools & soil fertility

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Thanks for your  
interest and  
support!

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