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EFFECT OF NATURAL AND *MUCUNA PRURIENS* FALLOW ON SOIL PROPERTIES AND CROP PERFORMANCE IN *DIOSCOREA ALATA* (WATER YAM) BASED SYSTEMS IN LILIYO AND TIENINGBOUÉ (CÔTE D'IVOIRE) AND LÉO (BURKINA FASO)

Master Thesis Janine Steinmann

PRESENTATION

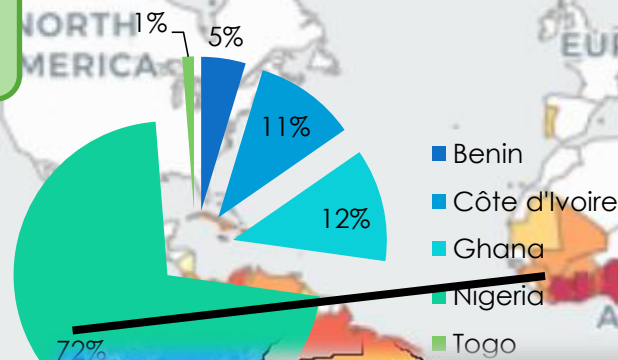
- Introduction
 - Dioscorea spp.
 - Project YAMSYS
- Objective
- Experimental Layout
- Main Findings
 - Tuber Yield
 - Soil Properties
- Main Conclusion & Outlook



YAMS-

67.3 Mio Tons / Year

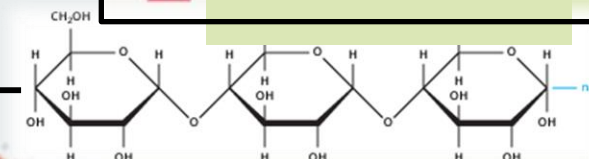
1st: Manioc
2nd: Yams



Production quantities in 2017

[tons]

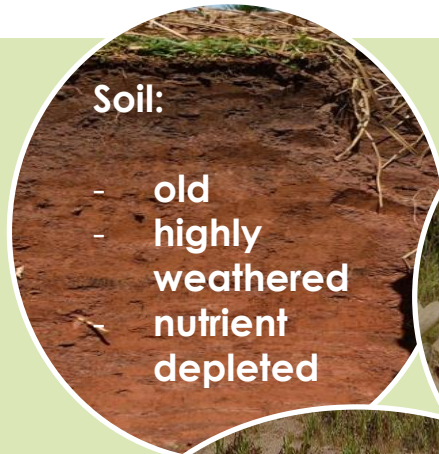
- < 1'000
- < 5'000
- < 150'000
- < 3'150'000
- > 3'150'000



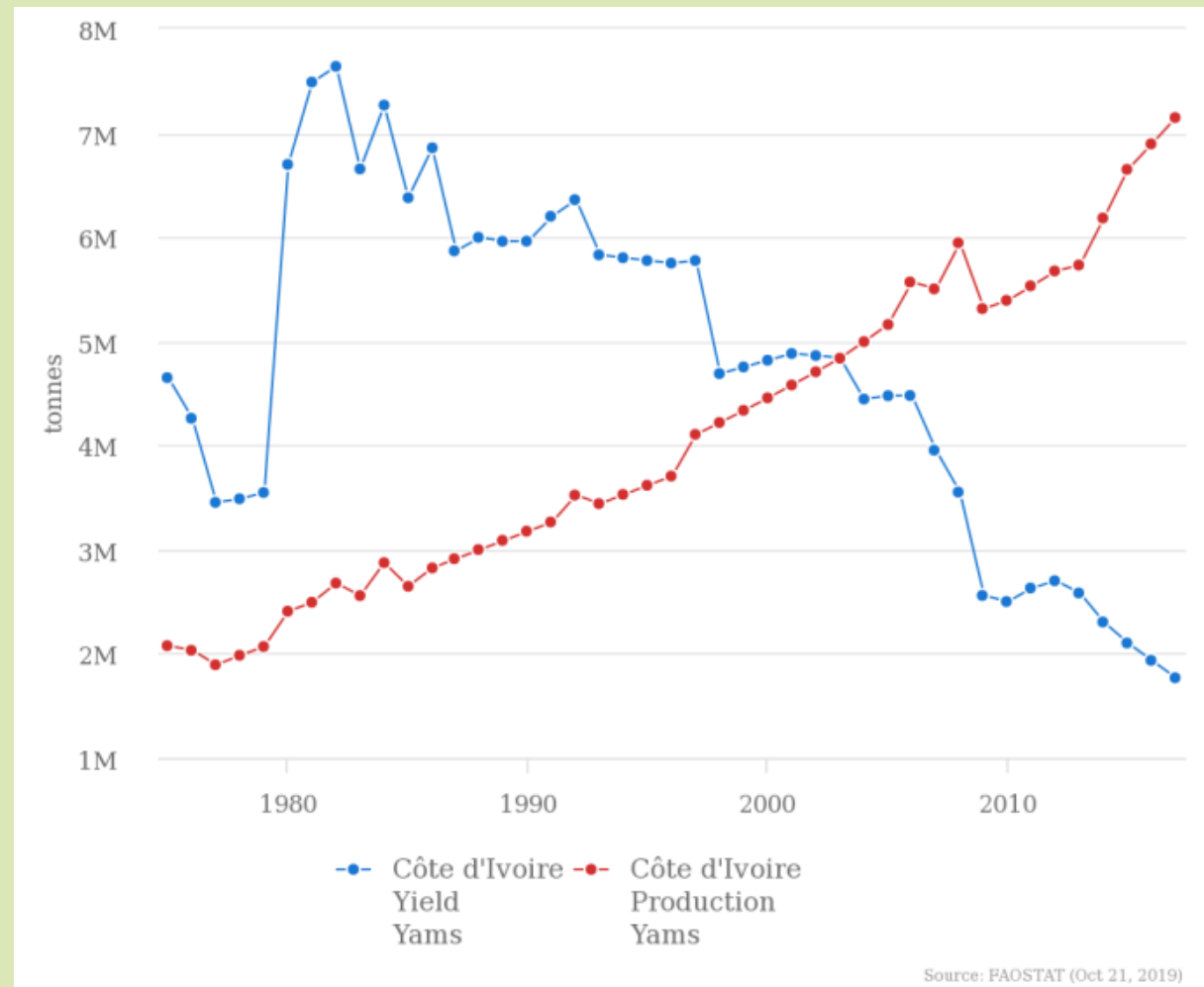
FAOSTAT: yam production in 2017



TRADE OFF IN YAM CROPPING SYSTEM



long term fallow period



Source: FAOSTAT (Oct 21, 2019)

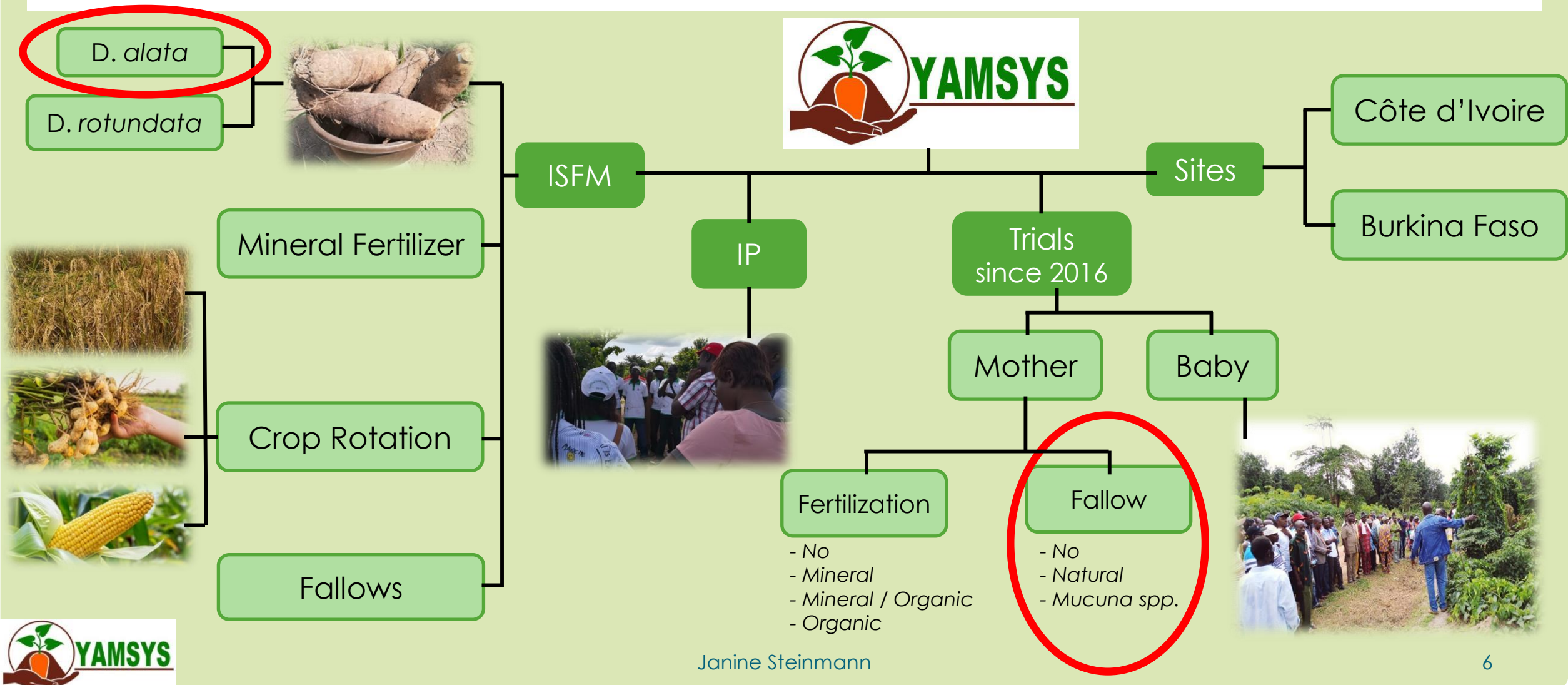


PROJECT YAMSYS

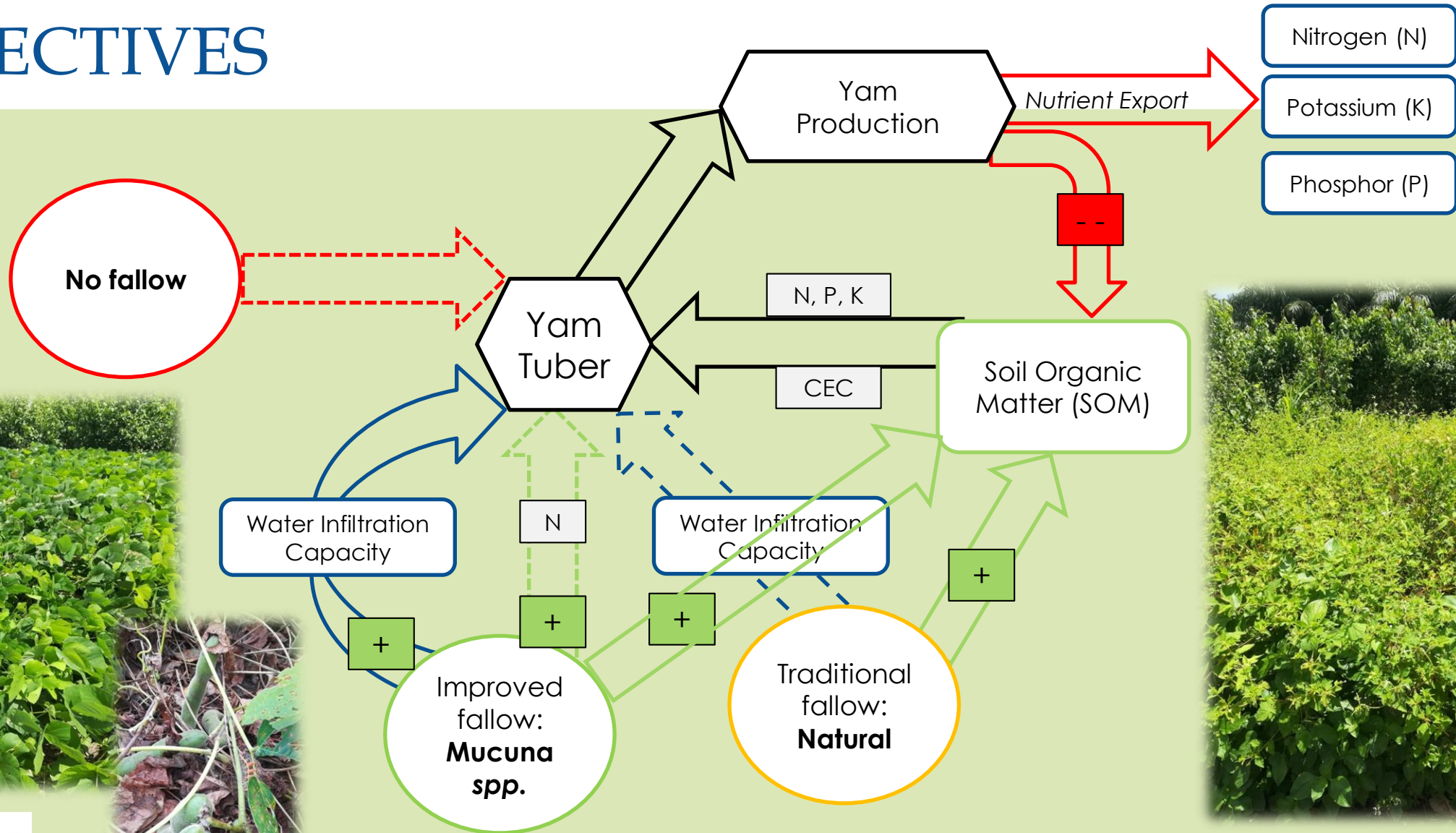
“Biophysical, institutional and economic drivers of sustainable soil use in yam systems for improved food security in West Africa” (YAMSYS).



PROJECT YAMSYS



OBJECTIVES



STUDY SITES



- Liliyo (Côte d'Ivoire)
 - Humid Forest: 2 rainy seasons
 - acric pisoplinthic Ferralsol
 - cocoa, rubber tree, palm oil, rice and cassava
- Tieningboué (Côte d'Ivoire)
 - Forest-savannah transitional zone: 1 rainy season
 - acric plinthic Ferralsol
 - rice, maize, groundnut, cotton, cashew
- Léo (Burkina Faso)
 - South Sudan Savanna: 1 dry season
 - pisoplinthic Plinthosol
 - maize, sorghum, millet (food crop), cotton, cowpea, manioc and sesame cash crop

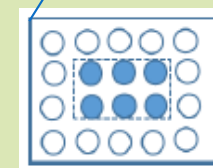
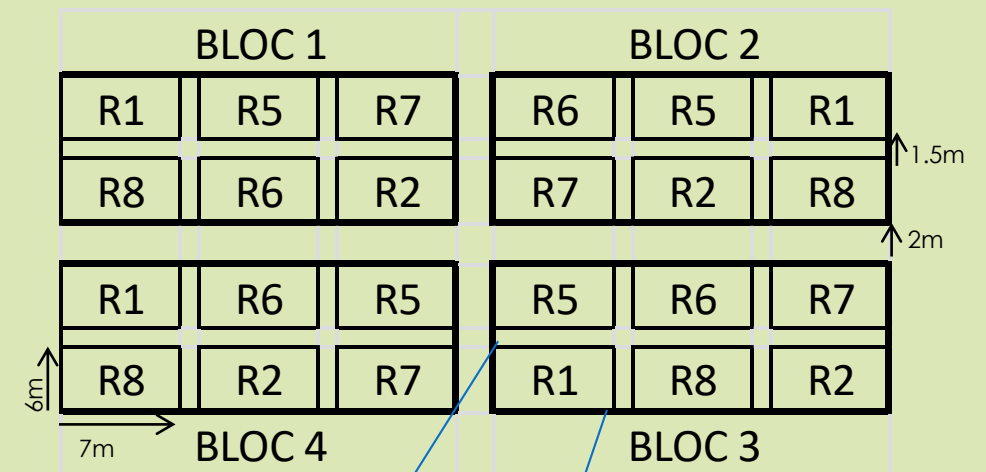
EXPERIMENTAL LAYOUT

- main tested factor: fallow types (no, natural, mucuna)
- secondary factor: crop rotation (maize, rice, groundnut)

Rotation	Year 1 2016	Year 2 2017	Year 3 2018	Year 4 2019	Year 5 2020
R1	Yam	Maize (<i>Li, Le</i>) Rice (<i>Tg</i>)	Yam	Maize (<i>Li, Le</i>) Rice (<i>Tg</i>)	Yam
R2	Yam	Groundnut	Yam	Groundnut	Yam
R5	Natural Fallow	Natural Fallow	Yam	Maize (<i>Li, Le</i>) Rice (<i>Tg</i>)	Yam
R6	Natural Fallow	Natural Fallow	Yam	Groundnut	Yam
R7	Mucuna spp.	Mucuna spp.	Yam	Maize (<i>Li, Le</i>) Rice (<i>Tg</i>)	Yam
R8	Mucuna spp.	Mucuna spp.	Yam	Groundnut	Yam

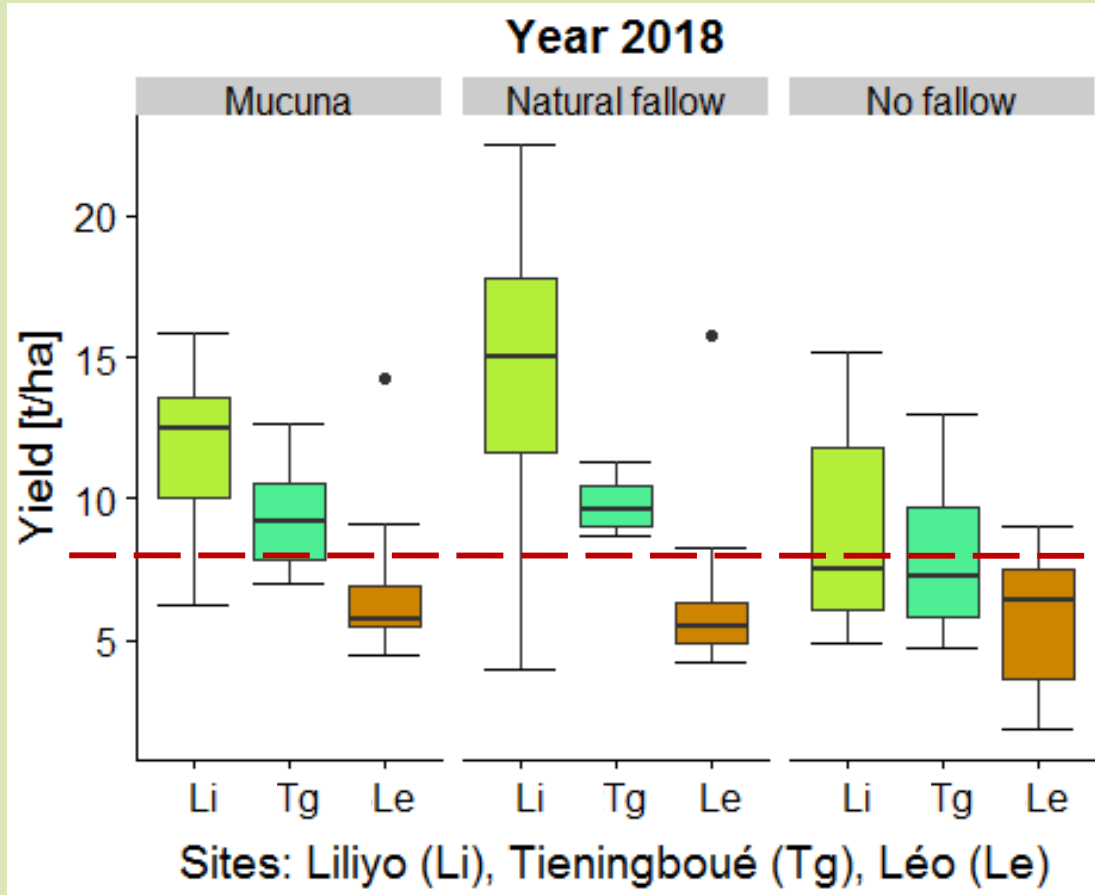
Li: Liliyo
Tg: Tieningboué
Le: Léo

improved variety:
C18 (Cameroon)



elemental parcel

MAIN FINDINGS: TUBER YIELD



**statistically significant
(fallow types)**

Liliyo no < mucuna spp.
< natural fallow

Tieningboué no sig. effect

Léo no sig. effect

West Africa
8.5 t/ha



MAIN FINDINGS: SOIL PROPERTIES



statistically significant (years & fallow types)

Site	N _{total}	P _{resin}	K ⁺	Ca ²⁺	Mg ²⁺	CEC	SOM
Liliyo	√	√	√	√	√	√	√
Tieningboué	X	X	X	√	√	√	X
Léo	√	X	X	X	X	X	√

Liliyo no > mucuna spp. > natural fallow

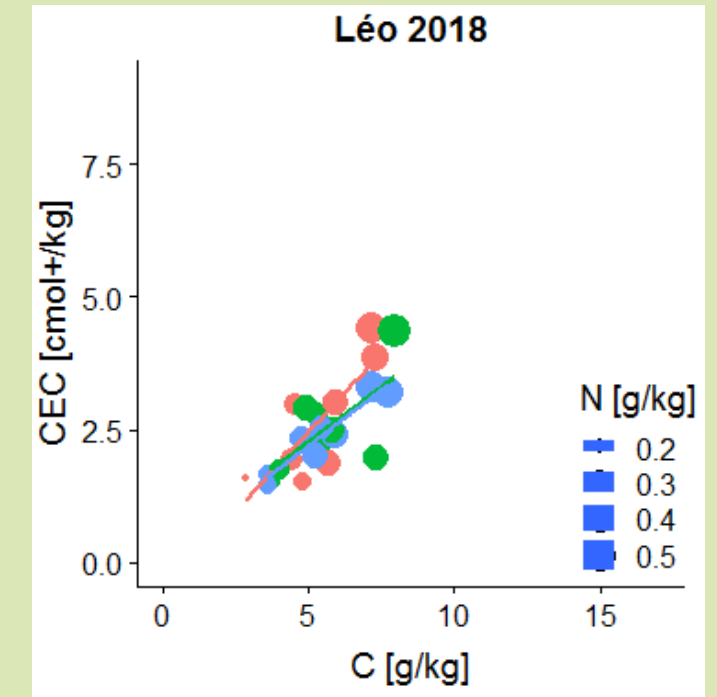
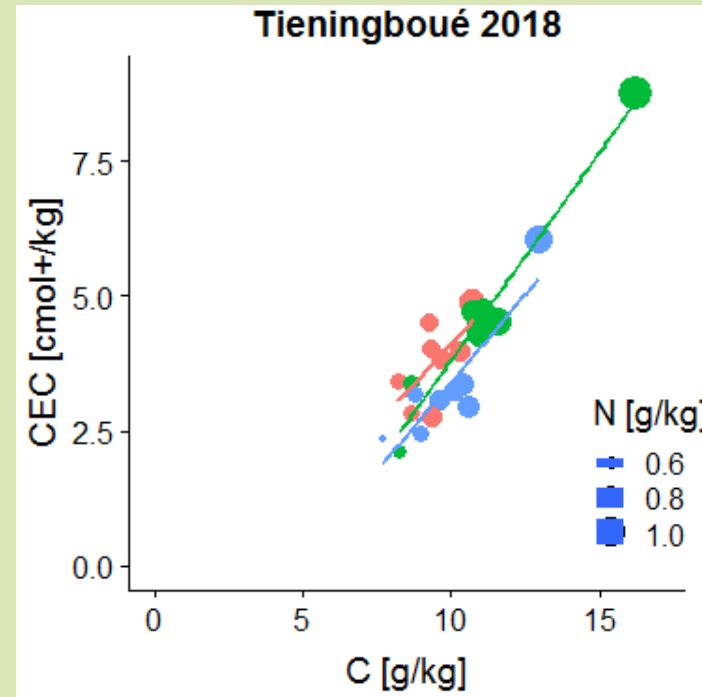
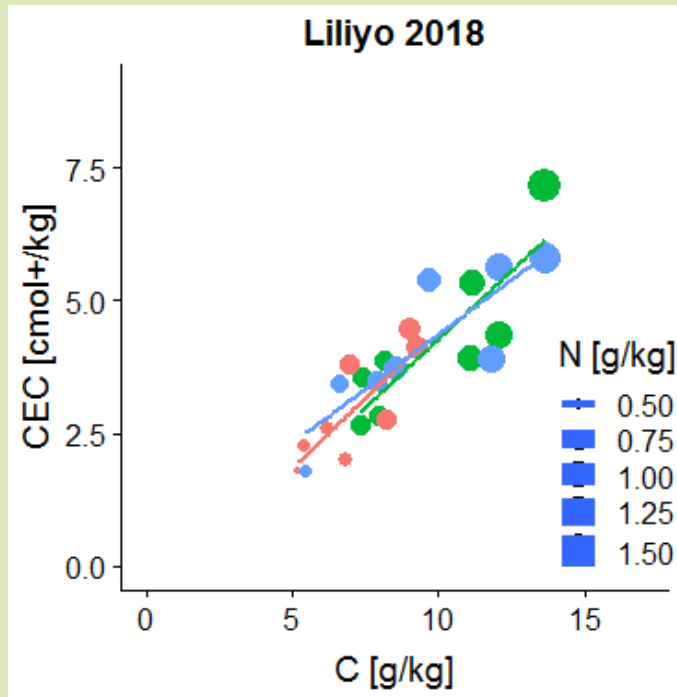
Tieningboué no > mucuna spp. > natural fallow

Léo no = mucuna spp. = natural fallow

**nutrient
depletion**

**external
effects**

MAIN FINDINGS: SOIL PROPERTIES



Color

- 1 No fallow
- 2 Natural fallow
- 3 Mucuna spp. fallow

MAIN CONCLUSION & OUTLOOK

SOIL

- **importance of SOM**
- **impacts soil physics & soil nutrients:**
 - total N, resin P, exchangeable cations

FALLOW ? natural vs. mucuna ?

- **continue fallow trials to see effectiveness**
- **consider external effects:**
 - harmattan wind

PRODUCER ? space & time/labor force ?

Mucuna

- **rapid growth:**
 - SOM production
 - suppress weeds
 - prevent bare soil from erosion & nutrient leaching
→ **Climate Change**
- **N₂ fixation:**
 - ~100 kg/ha
- **suppress nematodes**

SOM

- **biochar**
- **mulch application:**
 - mucuna spp. mulch incorporation



THANK YOU!