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"Global food security and food safety:
The role of universities"

Optimal Fertilization for Oil Palm (*Elaeis guineensis* Jacq.) Plantations: Conclusions from a Long-Term Fertiliser Trial in Nigeria

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Context: Oil palm in Nigeria and the world

- Most productive oil crop with yield potentials of 4-8 tons of oil per hectare
- 21 million hectares worlwide (average yield 3.8t/ha) and 4.1 million in West-Africa (average yield 0.7t/ha) (FAOSTAT, 2016)
- Fertilization is a major yield gap and can represent 50% of plantation running costs
- Insufficient fertilization will underutilise the potential and limit productivity
- Excessive fertilization gives reduced economic return and risks of leaching
- Need to rationalize and optimize fertilization over large areas
- Use of reference fertilizer trials and annual leaf sampling for nutrient content as diagnostic tool for palm nutritional status

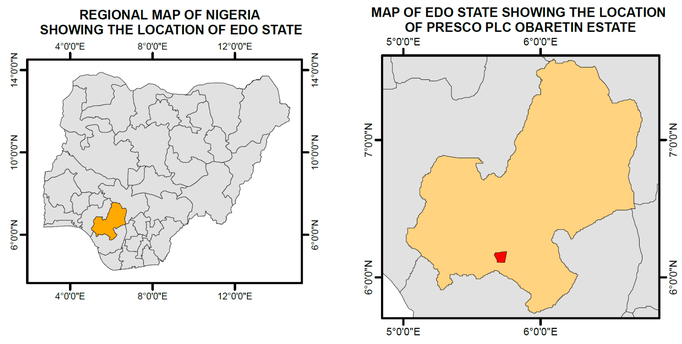

Figure 1: Map of Nigeria and Edo State showing the location of the Presco plc Ologbo estate where the trial was located

Material and methods

- A factorial replicated fertilizer trial started in 2000 on a field planted in 1997 and entering production
- 4 levels of potassium fertilization: 0, 1.5, 3 and 4.5 kg of MOP/palm/year
- 2 levels of phosporus fertilization: 0 and 1 kg of TSP/palm/year
- 2 levels of magnesium fertilization: 0 and 1 kg of kieserite/palm/year
- Monitoring of bunch production for each season from July 2000 to June 2018
- Yearly leaf sampling for nutrient analysis

Results - Key findings:

1— K is the main nutrient for yield in the West-African context. No effect from P and Mg on bunch production.

2— Cumulative yields are 14 to 18% higher with application of MOP

3— Leaf K content decreases with age for all treatments but stabilizes in time

Results - Application for optimal fertilization in oil palm plantations

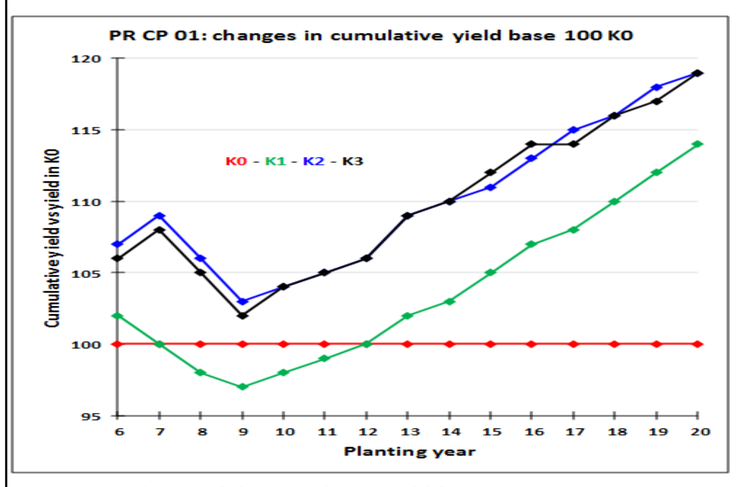

Figure 2: Evolution of the cumulative yield for treatments receiving K fertilizer as compared to the control

Steady state after 10 years of trial
Stabilized yield and leaf K% content

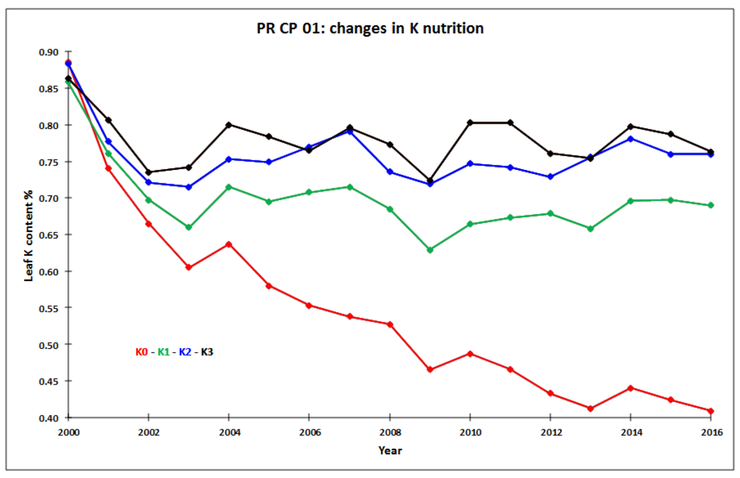

Figure 3: Evolution of the leaf K content for the different K treatments

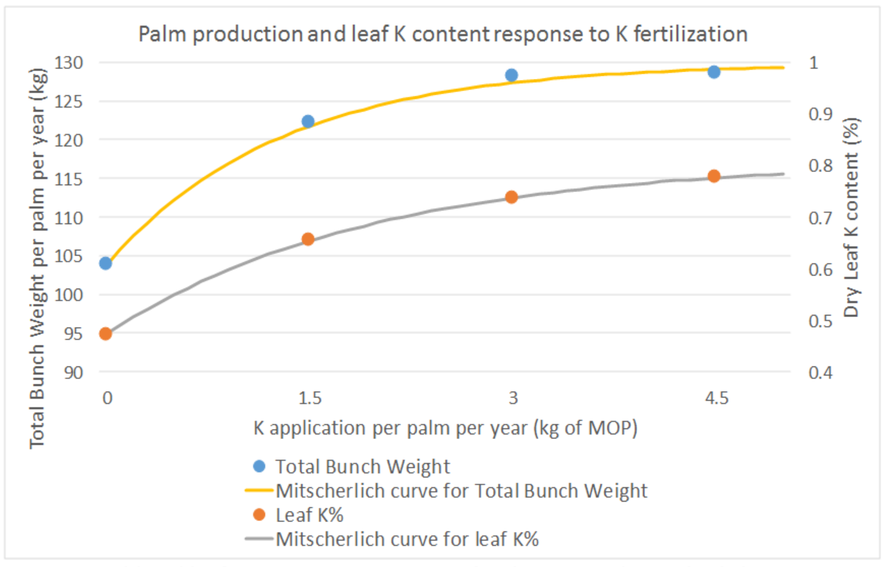

Figure 4: Yield and leaf K content response to K fertilization and Mitscherlich curves (average data from 2009-2012)

Application to sustainable plantation management

Production fields data

Field Leaf sampling
- — Per 50-100 ha of uniform plantation fields
- — Sample same palms yearly for nutrient content

Field Production
- — Yield per hectare
- — Production per palm

Statistical interpretation
- — Optimal leaf nutrient content

Integration of economic factors
- — Optimal Economic Dosage

Production fields fertilization

Field level recommendation of type and amount of fertilizer to be applied yearly
- — Optimum economic return
- — Adequate nutrition for high yields
- — Minimized losses from excessive application

Conclusions

- Reference fertilizer trials are an empirical basis for optimizing fertilization in oil palms and a guide to translate leaf nutrient contents into fertilizer recommendations
- Yield and leaf nutrient content response to fertilization will vary with soil climate and planting material
- Reference fertilizer trials should be set up whenever large areas are planted to ensure maximum and sustainable yields
- More research is needed to better understand the interactions between planting material, fertilization and leaf nutrient content so that fertilization can be optimized across a variety of production systems and areas

Collaborators

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References

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