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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

## 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 worldwide (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

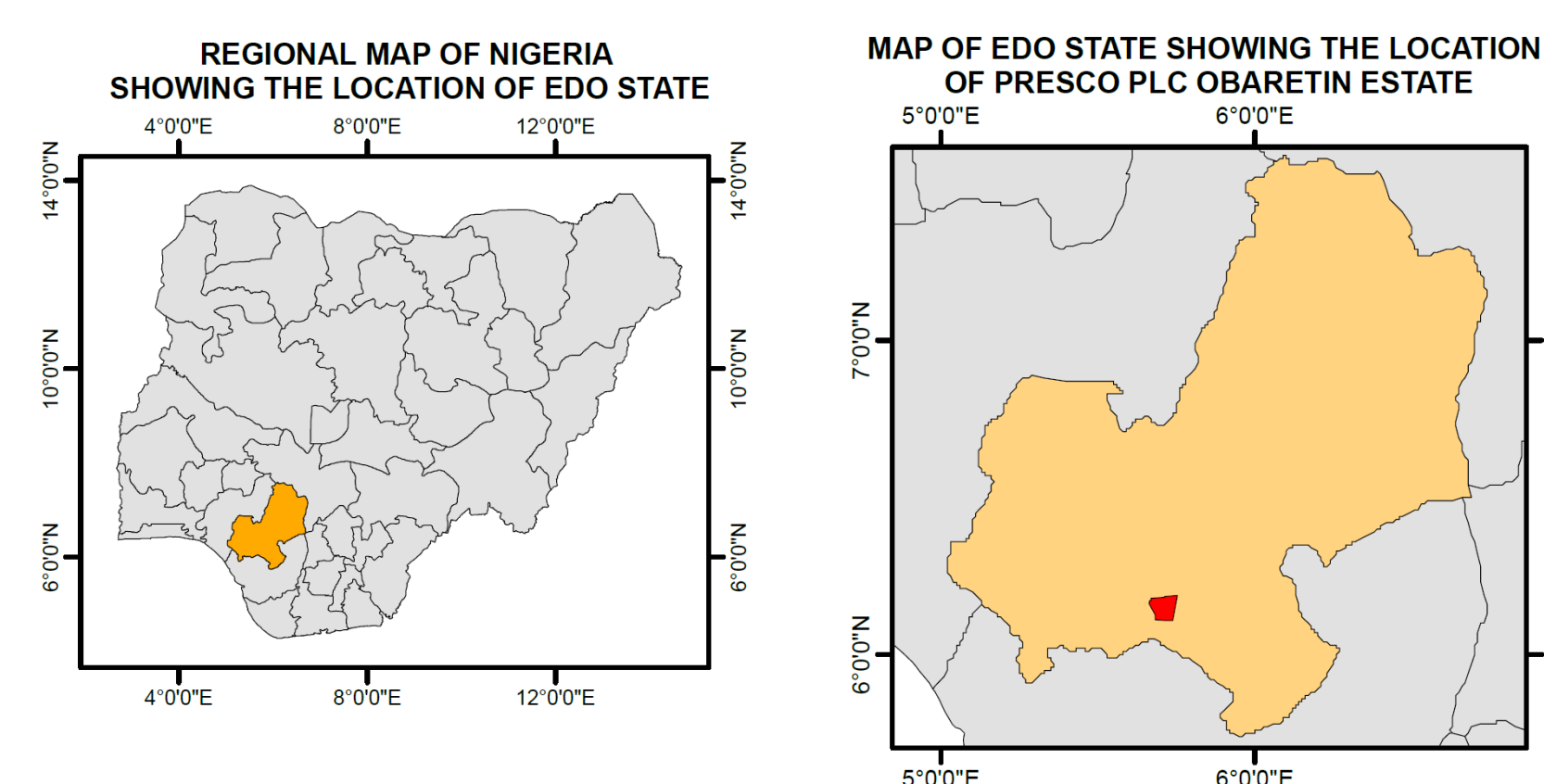


Figure 1: Map of Nigeria and Edo State showing the location of the Presco plc Ologbo estate where the trial was located

## 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 phosphorus 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

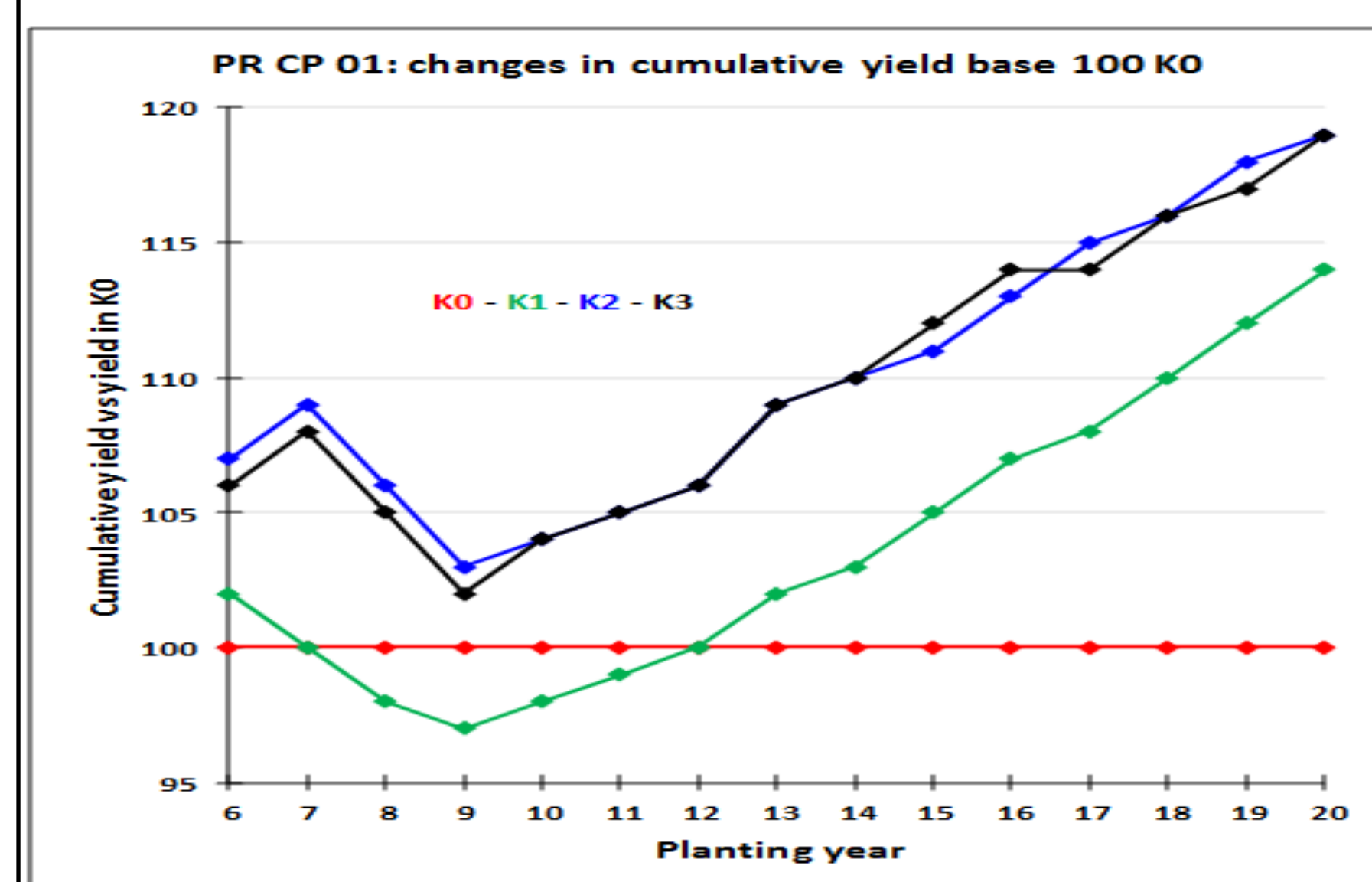


Figure 2: Evolution of the cumulative yield for treatments receiving K fertilizer as compared to the control

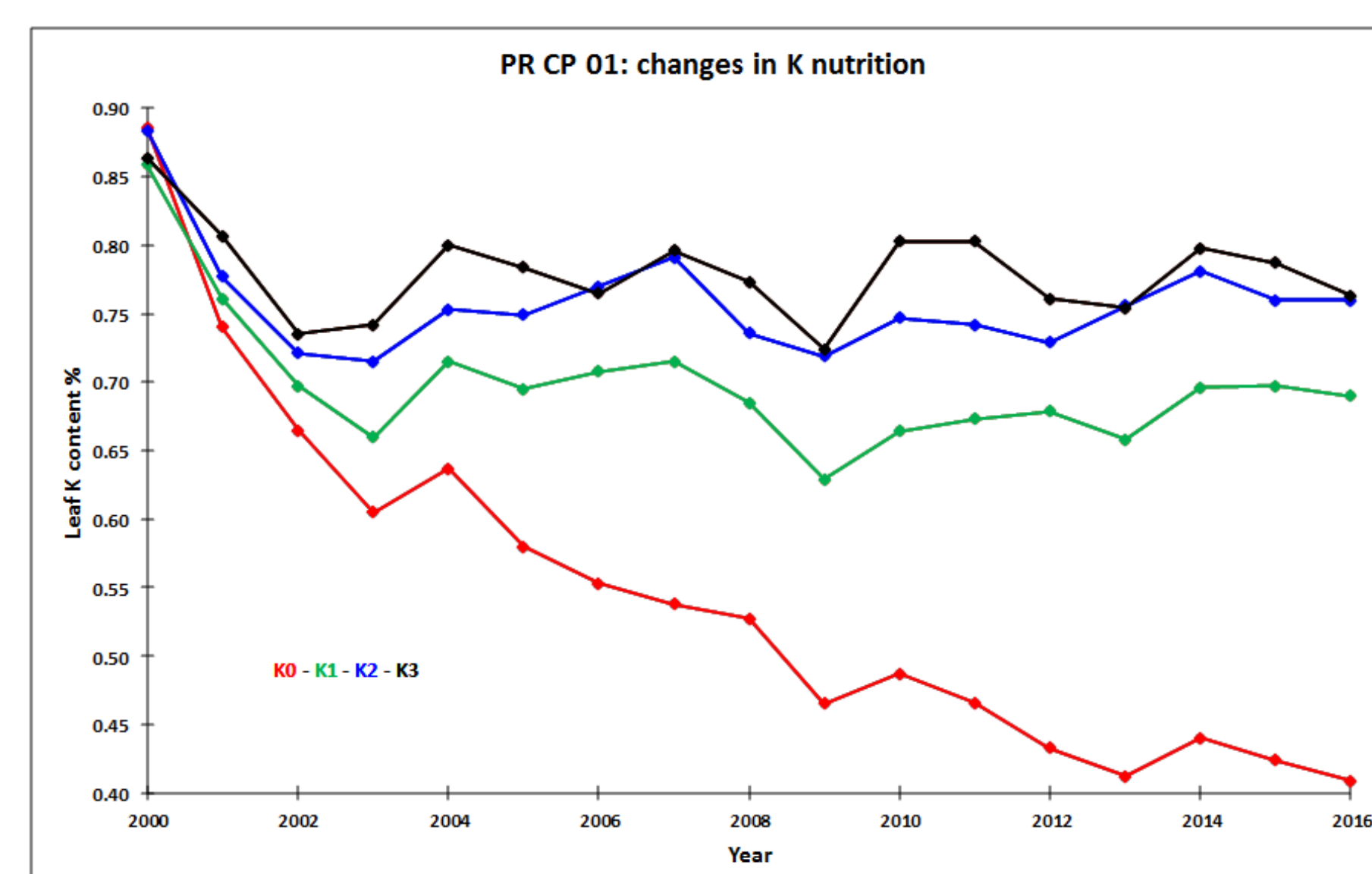


Figure 3: Evolution of the leaf K content for the different K treatments

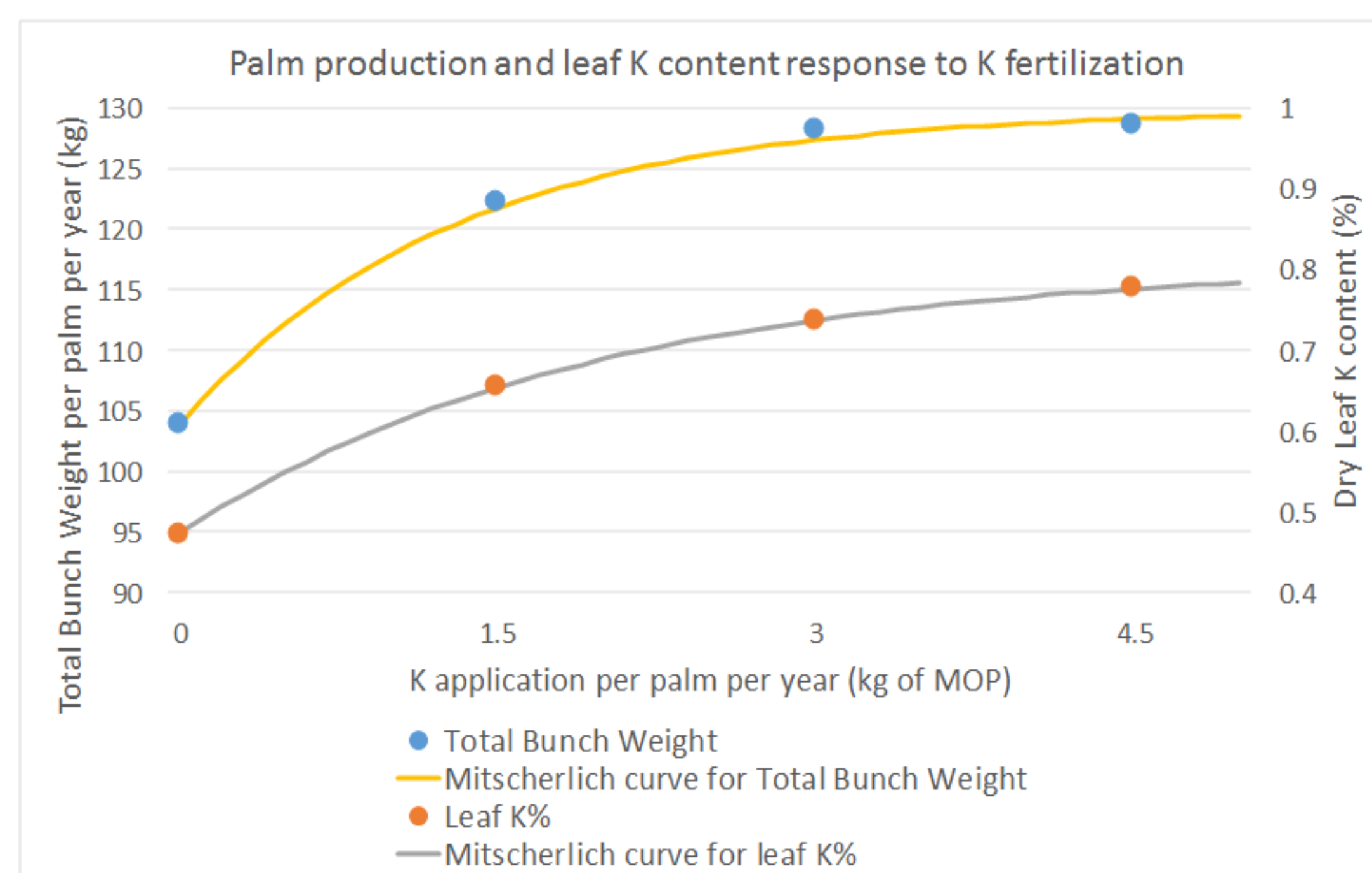


Figure 4: Yield and leaf K content response to K fertilization and Mitscherlich curves (average data from 2009-2012)

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

## References

Ochs, R. (1985). Strategie de mise en oeuvre du controle nutritionnel des plantes perennes. Oleagineux, Vol. 40, n°12

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