FACULTY OF BIOSCIENCE ENGINEERING

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LET THERE BE LIGHT: LIGHT INTERCEPTION METHOD UPDATE FOR OIL PALM (*ELAEIS GUINEENSIS* JACQ.) CANOPIES

Introduction

Research context

Light interception, which is the fraction of absorbed photosynthetically radiation (PAR) by the crop canopy, is linked with planting density. Planting density of oil palm (*Elaeis guineensis* Jacq.) plantations is in turn strongly related to fresh fruit bunch yield. However, light interception experiments in oil palm plantations are scarce and often performed decennia ago, in Southeast Asia and without a clear methodology: a great opportunity for a light interception experiment with recent planting material in West-African growing conditions.

Research objectives

1. Revealing light interception distribution.
2. Recommending best light interception sampling method.

Methodology

Light interception was monitored in five different planting densities (128, 143, 160, 180 and 205 palms/ha), eleven years after planting (Figure 1).

Figure 1 Left: device for measuring PAR above canopy. **Middle:** sensor measuring PAR below canopy for the fixed method. **Right:** quantum sensor on mobile levelling device for mobile sampling.

The trial consists of four replicates. During fixed sampling, PAR was measured on sixteen equidistant locations below canopy with a quantum sensor (QS5 Quantum Sensor, Delta-T Devices). During mobile sampling, measurements were carried out by walking along two regular paths while holding the quantum sensor by hand. PAR above canopy was measured simultaneously during sampling below canopy (Figure 2 and Figure 3).

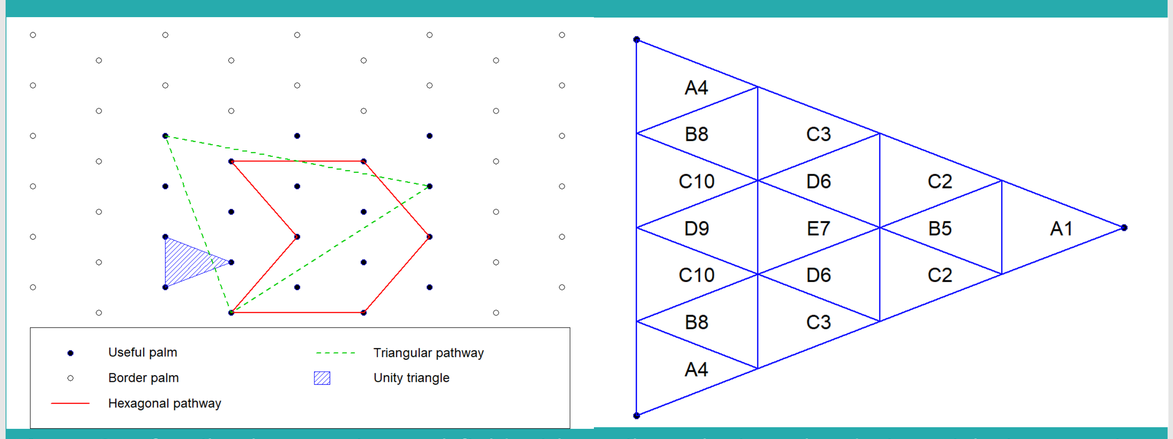

Figure 2 Left: oil palm experimental field with equilateral triangular design. Light interception experiment was carried out with the fixed method in the unity triangle, and with the mobile method along the two pathways. **Right:** detail of the unity triangle with sixteen fixed measuring points.

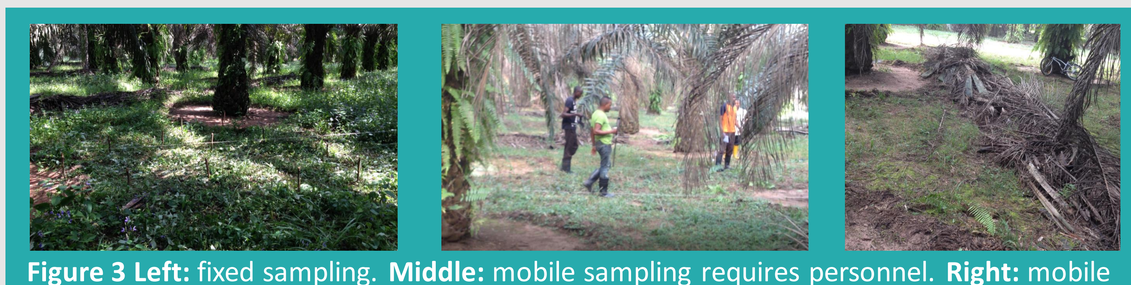

Figure 3 Left: fixed sampling. **Middle:** mobile sampling requires personnel. **Right:** mobile sampling in an oil palm field is not without obstacles.

Results and discussion

Light interception distribution

The hypothesis of high light interception near the trunk is rejected. The light interception pattern is rather irregular or random (Figure 4, left). The light interception in R3-160 is a good example of this randomness: low light interception where high light interception is expected and vice versa. This means a grid method is suited for fixed light interception sampling. Furthermore, it was calculated that the number of sensors could be reduced to four.

Fixed vs mobile sampling method

It is also clear that there is no difference ($p = 0.99$) between the fixed and the mobile method for light interception sampling (Figure 4, right). This means researchers can choose the method freely. Furthermore, it is clear from these data that mobile sampling can be reduced to one segment of the triangular or hexagonal pathway; there are no differences between all segments ($p = 0.98$). The main advantage of the mobile sampling method is its speed. However, there are several disadvantages: the sensor is not designed for mobile use, there is no standardised levelling device and walking speed and sensor height are prone to error.

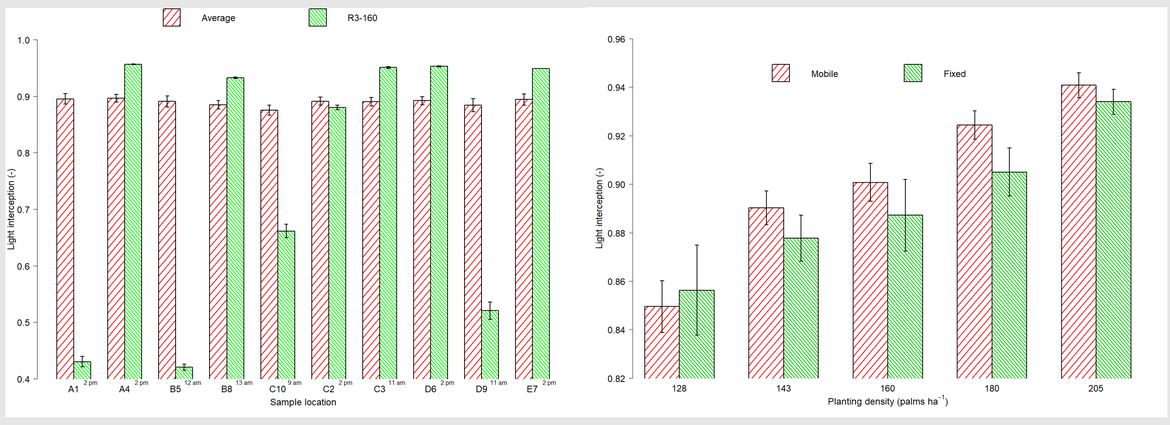

Figure 4 Left: bar graphs of light interception at the fixed sampling locations, average of all planting densities, replicates and hours compared to the example of replicate 3 (R3-160,160 palms/ha). **Right:** comparison between mobile and fixed sampling of light interception.

Conclusion and recommendation

1. Light interception is randomly distributed below the oil palm canopy.
2. It is recommended to use a fixed light interception sampling design, with four sampling locations.

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