Ghana Darwin Initiative Yield Policy & Practice Brief

No. 1: Identifying the main drivers of yields in Ghanaian oil palm smallholdings

Key Message

The key factors impacting yields positively in Ghanaian smallholdings are contouring, decreased number and size of large trees, increased rate of harvesting and proper soil management

Summary

- Oil palm expansion into High Conservation Value Areas has increased in recent times, leading to a need for sustainable intensification strategies that promote Best Agricultural Practices (BAPs) to increase yields while conserving biodiversity.
- In Ghana, smallholder farmers play a major role in the oil palm industry, but are faced with challenges of low yields and limited uptake of BAPs.
- This study examined the socio-economic factors that affect crop management practices and then explored relationships between crop management, soil nutrients and fruit yields.
- The results showed that farms with an increased number of large shade trees had lower yields, and that smallholders who applied soil contours around their palms had higher yields, possibly due to reductions in water stress.
- Increasing management intensity largely resulted in increased yields, but farmers' harvesting rates were low and thus farmers were often unable to realise an increased income from increased management intensity.
- Most smallholdings lacked sufficient soil nitrogen and phosphorus for sustained high productivity.

Background

Oil palm is a valued global commodity but there are increasing concerns over its expansion into High Conservation Value Areas (HCVAs). In an effort to address this problem, the Round-table for Sustainable Palm Oil (RSPO) is promoting the adoption of Best Agricultural Practices (BAPs) in order to increase production whilst conserving nature. In Ghana, oil palm smallholders play a major role in the industry but produce low yields, with a current yield gap of about ~19 t ha^{-1} $year^{-1}$. Hence, smallholders are encouraged to boost their yields through the adoption of BAPs.

To better understand the smallholder yield gap, this project; supported by the UK Darwin Initiative, collected data from 2016-2018 from two smallholder oil palm communities in the vicinity of Kakum National Park in the Central Region of Ghana. We interviewed 100 oil palm smallholders using structured questionnaires including questions about the socio-economic characteristics of each smallholder, their farms and crop management practices. At 31 of these farms, we next made measurements relating to management activities and environment (numbers and sizes of trees and shrubs growing in addition to oil palm, understory temperature, herb-layer height, ground cover, soil nutrients). We then measured oil palm fresh fruit bunch yields by weighing all harvested fruit over a period of five months at each farm.

The aim of this policy brief is to summarise our results, focusing on three main questions:

- Do social characteristics of oil palm farmers influence their crop management?
- What are the social, environmental and management factors that affect fruit yields in oil palm smallholdings?
- What is the soil nutrient status of oil palm smallholdings?

Do social characteristics of oil palm farmers influence their crop management?

We found that none of the social characteristics we studied, including gender, age, household size and educational status, affected crop management. We also found that most farmers obtained little to no help from other household members in terms of farm labour. Hence increasing oil palm management intensity and adoption of BAPs may be difficult to achieve without financial support or neglect of other crops and responsibilities, especially because the cost of hiring labour is high.

What are the factors that affect yields in oil palm smallholdings?

In an analysis of management, social and environmental factors (Fig 1), oil palm smallholders attained an average yield of 5.7 t ha^{-1} yr^{-1}, similar to the average for smallholders in Ghana (5.8 t ha^{-1} yr^{-1}). The highest yield (~17 t ha^{-1} yr^{-1}) was, however, much lower than the Ghana potential of 25 t ha^{-1} yr^{-1}.

Management factors - Removal of woody perennials and undergrowth**,** round weeding, pruning of old fronds**,** contouring of soil**,** applying empty fruit bunches and pruned fronds beneath palms

Social factors - educational status, age, household size, gender

Environmental factors – plantation age, soil nutrients, temperature beneath canopy

Figure 1: Factors considered in our study

FFB yields were significantly higher on farms that had **a lower density of large trees** shading the canopy of the palms**.** In addition, smallholders who applied **soil contours** around palms had higher yields than those who did not. Farms with higher **soil phosphorus and nitrogen** also had higher FFB yields, whilst yield was lower on farms with higher **soil calcium** (Fig 2).

Our results suggest that FFBs yields could be increased by managing farms more intensively, in line with recommended Best Agricultural Practices. However, most smallholders were not realising their potential yields, in part due to a low frequency of harvests. In the current system, it appears that the cost of labour is a limiting factor and thus the level of management is inefficient and insufficient among the smallholders to realize higher yields.

What is the soil nutrient status in oil palm smallholdings?

The soils in the smallholdings had the recommended pH, and levels of magnesium, soil organic carbon and organic matter for productivity, but levels for nitrogen (N) and phosphorous (P) were low. Our study indicated that increasing N and P levels in the soil would be likely to increase yields.

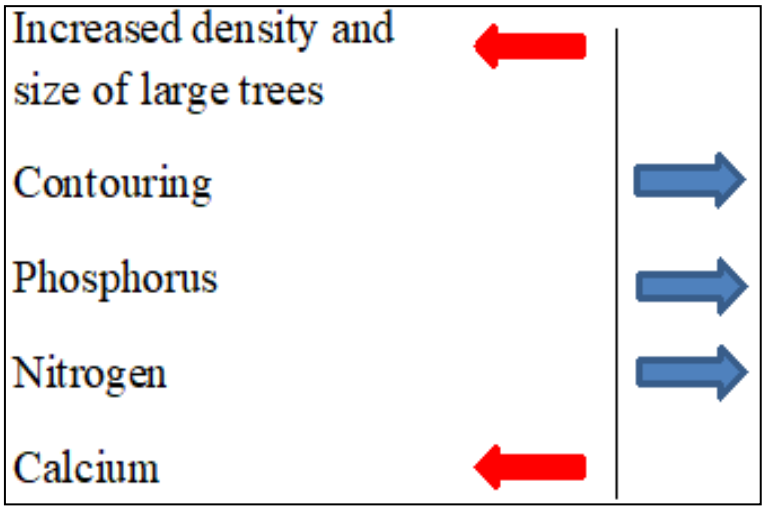

Figure 2: Main drivers of oil palm yields

As seen in Figure 3, most smallholdings had lower levels of soil nitrogen than that considered most suitable to support oil palm growth and productivity (0.12%). As shown in Figure 4, all smallholdings had much lower levels of soil phosphorus than the minimum considered suitable to support fruit production (15 mg kg^{-1}).

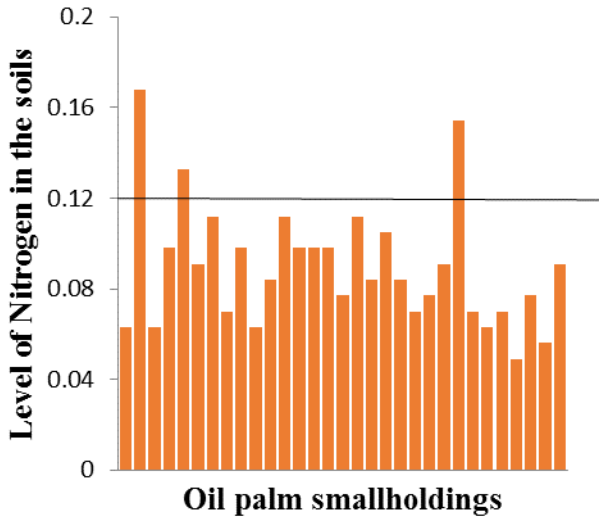

Figure 3: Soil nitrogen levels in 31 smallholdings

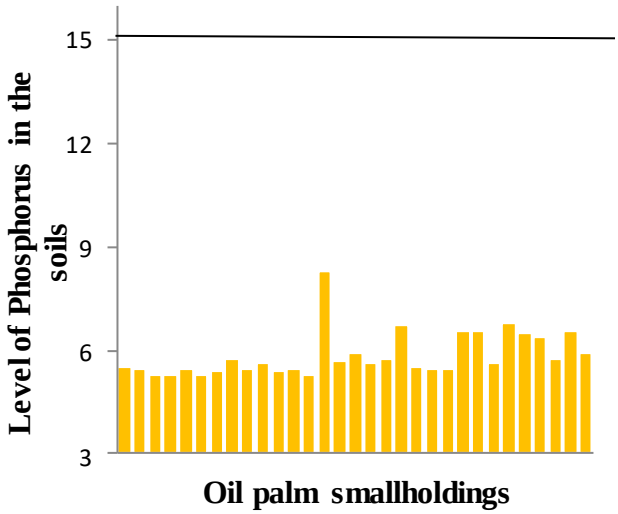

Figure 4: Soil phosphorus levels in smallholdings

Recommendations

We recommend that farmers could most effectively boost their fruit yields and improve their livelihoods by adopting the following practices:

1. **Soil contouring -** Smallholders could increase fruit yields by applying soil contours around their oil palms to reduce runoff of rain water, potentially making water more available for the palms as well as reducing rates of soil erosion and nutrient loss.
2. **Increasing harvesting frequency -** Farmers are encouraged to harvest every 14 days in keeping with BAP recommendations in order to more fully realise their potential yields. A major constraint on harvesting rates during this study was access to a mill to process harvested fruit sufficiently quickly to maintain quality. A new mill is now fully operational, providing much greater opportunities for farmers to market their produce.
3. **Soil nutrient management –** In the absence of industrial fertilizers, farmers could potentially increase soil nitrogen and phosphorous by applying empty fruit bunches and pruned fronds beneath palms in addition to regular weeding, mulching and soil contouring.
4. **Thinning of woody perennial species -** Smallholders could potentially increase yields by reducing shading of palms by large trees emerging above the canopy. This might be achieved by thinning of species that are not of social importance (e.g. edible or of value in construction). However, retention of some large trees is recommended to provide support for biodiversity and associated ecosystem services.

Additional Future Opportunities

- ✓ **Strengthening BAP Associations:** Stakeholder assistance in strengthening smallholder group associations would provide farmers with greater bargaining power on farm inputs such as fertilizers.

- ✓ **Access to extension services and capital:** Greater access to extension services would enable smallholder farmers to adopt BAPs more effectively. Government could facilitate farmers' access to loans to enable them to cater for labour costs for more effective implementation of BAPs.

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