Name	Counterpart	Title
Bambang Irawan, Gindo Tampubolon, Hasbi Hasibuan (PT. Humusindo)	**B11**	Effects of fertilizer regime and time of planting in the biodiversity enrichment experiment (BEE) in the oil palm landscape

Background and Methods

After four years of the Biodiversity Enrichment Experiment (BEE), part of the EFForTS Project, it is possible to draw some initial conclusions. Biodiversity enrichment in oil palm plantations is able, under certain conditions, to generate synergies between economic and ecological functions. In the initial phase, EFForTS-BEE significantly increased yield per oil palm which, at the plot scale, compensated for the yield loss created by removing from oil palms to create the enrichment. In our analysis of net yield changes, we found an overall neutral effect on yield for small plots and a very variable, but overall significantly positive effect for large plots (Gerard *et al*. 2017). Moreover, Teuscher et al. (2016) concluded that the initial positive responses of birds and invertebrates to the biodiversity enrichment treatments are promising and suggest that tree islands are suitable technique for enhancing biodiversity in impoverished landscapes. Our BEE project also revealed important knowledge of the best trees species for integration with the monoculture oil palm landscape. These species are sungkai (*Peronema canescens*), petai (*Parkia speciosa*) and jengkol (*Archidendron pauciflorum*) as they had the greatest survival rate and best growth in both diameter and height.

The research was conducted in PT. Mekar Agro Sawit, located in Aur Gading, Jambi. We applied a split plot randomized design with oil palm age as the main plots and fertilizer regime as the sub plots. Oil palm age was the number of years since the trees had been planted and had three levels. These were: a1; one year old; a3; three years old and a5; five years old. The fertilizer regime had two levels: f0; no additional fertilizer and f1; additional fertilizer calculated on the basis of soil nutrient content. There were therefore six treatment combinations and each combination was replicated five times giving 30 plots in total.
Four different tree species were selected based on ecological and economic considerations. The economic considerations were mainly the economic value of their products. Two of the four selected tree species were the fruit trees petai (*Parkia speciosa*) and jengkol (Archidendron pauciflorum). The other two species were the timber producers bulian (*Eusideroxlyon zwageri*) and sungkai (*Peronema canescens*). On December 12, 2017 we planted 150 trees of each species giving 600 in total. Each tree was planted equidistant from four oil palm trees.

Objectives

The overall objective of this research was to study whether BEE is still feasible from both an ecological and economic view point when the number of oil palm trees and the planting interval is the same as normal for oil palm plantations. The specific objectives were: (1) to study the interaction between oil palm age at the time the enrichment trees were planted and the fertilizer regime; (2) to study the impact of oil palm age on the growth and survival rate of the trees and production of palm oil and; (3) to study the impact of fertilizer on the growth of trees and on the production of palm oil.

Results

A. Soil Properties

The soils of the research sites were mostly poor. Acidity was moderately high at pH<4.0. The surface of the colloid was dominated by acid cations such as H, Al, and Fe. This was also indicated by the low degree of base saturation. The organic content was also low with at between 1.3 and 1.5%. The cation exchange capacity (CEC) was also low or very low. Those conditions lead to low availability of macronutrients such as nitrogen, phosphate and potassium. Soils not under oil palm had higher CEC than soils growing oil palm of the three ages. The soil was dominated by the clay fraction with 1:1 kaolinite and Al and Fe oxide. The soil was fine to moderately coarse in texture (clay to sandy clay). The soil for the three and five year old oil palms was clay but that for the one-year old oil palms was sandy clay.

B. Tree Growth

Oil palm age had a significant effect on diameter and height growth of petai (*Parkia speciosa*). Otherwise, neither fertilizer regime nor the interaction between oil palm age and fertilizer were not significantly different for any of the other species or parameters. Only the diameter of petai and sungkai, and petai height, were significantly different between oil palm age classes. The highest diameter value for petai and sungkai belonged to trees planted among one-year old oil palms. The same was also true for petai height. The petai planted among one-year old oil palm trees grew significantly faster than petai planted among three and five-year old oil palms. The results for sungkai were similar. Sungkai planted among one-year old oil palm trees grew significantly faster, especially in diameter, than sungkai planted among five year old oil palm trees. But they were not significantly different from sungkai planted among three year old oil palm trees.

The effects of fertilizer on the growth of trees planted among oil palm were closely similar. There was a clear indication that giving additional fertilizer increased the growth rate of both tree diameter and tree height. But only petai diameter was significantly different between fertilizer treatments under Duncan's multiple range test.

C. Production of Oil Palm

There was no significant difference between oil palm production in enriched plots and that in control plots (plot with no trees) for either three or five-year old oil palm (using t test). The same result obtained between fertilizer treatments. However, there was a small indication that both three and five year old oil palms produced slightly more in fertilized than in unfertilized plots.

Figure 1.
Performance of trees planted under oil palm at One year after planting: (a) Sungkai (Peronema canescens); (b) Jengkol(Archidendron pauciflorum); (c) Bulian/Ironwood (Eusideroxlon zwageri) and (d) Petai(Parkia speciosa)

References

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