

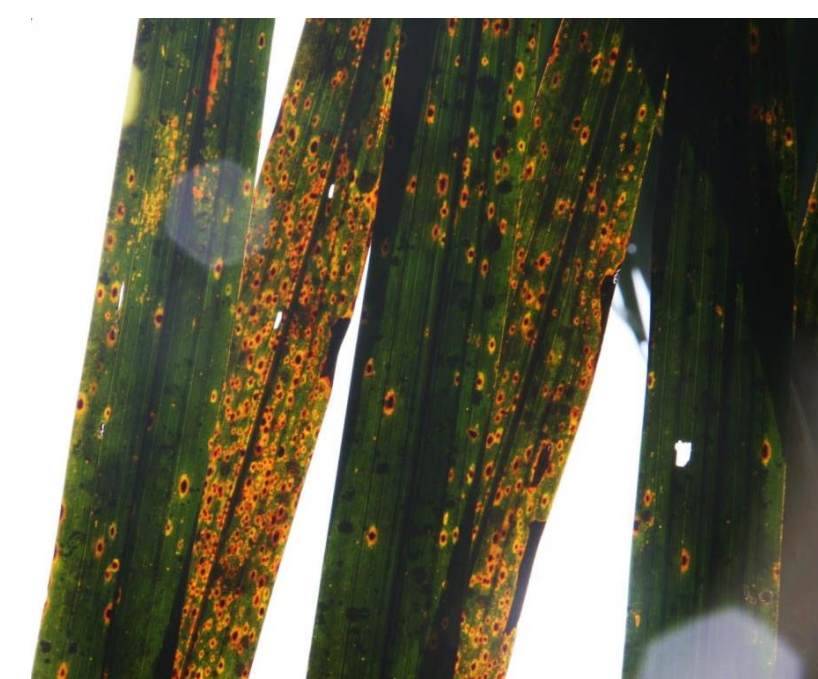
CLOSING THE YIELD GAP IN SMALLHOLDER OIL PALM PLANTATIONS IN INDONESIA



Nitrogen deficiency: chlorotic leaves



Phosphorus deficiency: tapered trunk



Potassium deficiency: yellow spots



Magnesium deficiency: yellow/orange leaves



Boron deficiency: deformed leaves



Copper deficiency: necrotic leaf tips



Figure 2: Effect of improved fertilisation on vegetative growth in a very neglected plantation. Top panel: before fertilisation; bottom panel: eight months after fertilisation



Figure 3: Farmer in Sintang shows a very large fruit he found in his BMP plot



Figure 4: Rock phosphate application to increase soil phosphorus and relieve soil acidity

There are 13 million hectares of oil palm plantations in Indonesia, of which around 6 million are owned by smallholders. Smallholders typically achieve yields of 16 ton fruit bunches per hectare, while the potential is more than 35 ton per hectare. Poor nutrition is a key cause of this yield gap.

We work with smallholders in two locations in Indonesia to close yield gaps and improve the management and the sustainability in the plantations. In the field we experiment with better management practices including fertiliser use. After one year, farmers reported clear improvements in bunch quality and vegetative growth. Trends of increasing yield, bunch size and leaf area have been observed, starting after six months. A full yield response is expected to unfold over the coming year(s).

In the graphs we present the result from Kumpeh (6 paired plots) where we have collected data for more than one year, starting in June 2014.

Within a few months farmers observed:

- Shinier bunches
- Larger bunches
- Greener leaves

What we measured and observed after half a year (November 2014):

- No change in yield (Figure 1A)
- No change in bunch size (Figure 1B)
- Probably greener leaves (Figure 2)

What we measured and observed after one year (June 2015):

- Trend of increasing yield in Kumpeh but no significant change (Figure 1A)
- Trend of increasing bunch size in Kumpeh, sometimes significant (Figure 1B)
- Trend of improving yields in Sintang (data not shown) (Figure 3)
- Strong reductions in leaf yellowing and senescence (Figure 2)

Concluding remarks:

- Rolling yields of 22-27 ton per hectare per year have been measured in Jambi, compared with farmer estimates of 18-20 tonnes in previous years
- Yield improvements started within half a year, probably due to better harvesting and maintenance
- Differences between BMP and reference plots are suppressed because all farmers have learned and copied BMP practices in their reference plots

Methods

We implemented 14 one-hectare demonstration plots paired with one-hectare 'business as usual' reference plots in mature plantations (12-15 years after planting) in two locations in Indonesia: Jambi in Sumatra, and Sintang in West-Kalimantan. In the demonstration plots the farmers implemented basic 'better management practices' (BMPs). These include better weeding, pruning, soil conservation, harvesting, and fertiliser use. We applied the following fertilisers per tree per year: 1.5-2.5 kg urea, 1.0-2.0 kg rock phosphate (Figure 4), 2.0-3.0 kg KCl or equivalent, 0.5-1.0 kg kieserite (Sintang only), and 100 g borax. In the demonstration and the reference plots, we measure vegetative growth and collect tissue samples every year, and we keep yield records at every harvest. In two plantations, we measure and sample every four months to follow closely the effects of improved fertilisation over time.

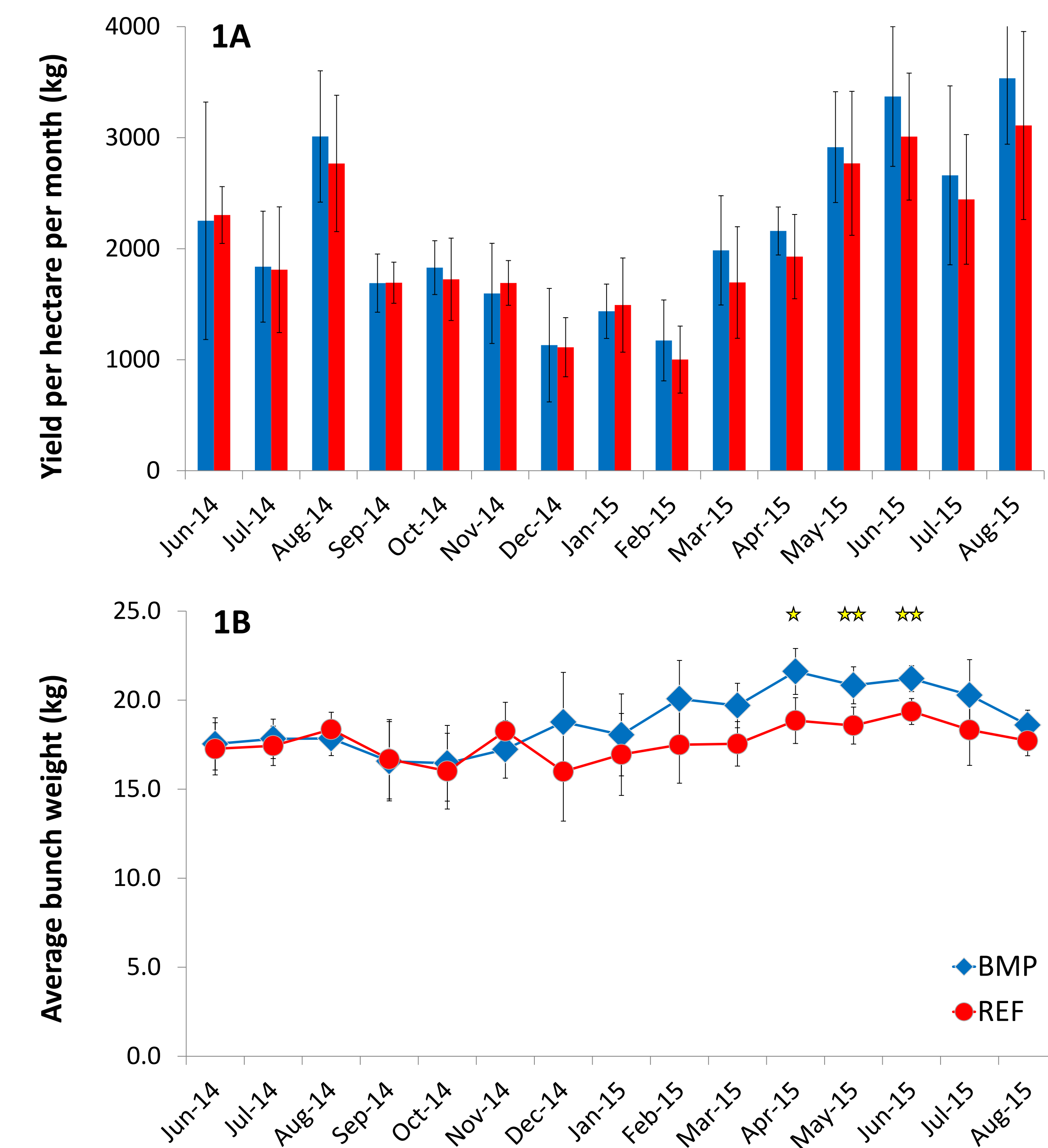


Figure 1: Plot yield (1A) and bunch size (1B) in the BMP (blue) and the reference (red) plots in Jambi. Error bars show the standard deviation ($n=6$ or $n=5$). Significant differences are indicated with a star (* $p<0.05$, ** $p<0.01$). Note: the dip in bunch weight in August 2015 is probably caused by the combined effects of haze and drought.

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