Research project of counterparts funded at UNTAD and Universitas Brawijaya (UB)

Name	Counterpart	Title
Sri Rahayu Utami	**A05**	Macronutrient release from oil palm empty fruit bunch

Background and Methods

The oil palm industry produces huge amounts of waste. One of the main waste products is empty fruit bunch (EFB). Every tonne of EFB that goes to the mill produces 20-25% EFB (Abubakar et al., 2011) or 23% on average (Omar et al., 2011). Nevertheless, EFB contains some essential macronutrients such as 0.44% N, 0.144%P, 2.24% K, 0.36% Mg and 0.36% Ca (Menon et al., 2003). Applying EFB as a nutrient source would therefore provide benefits such as improving soil fertility and reducing the use of chemical fertilizer. This research was an attempt to study the mineralization of macronutrients (C, N, P, K, Ca, Mg) from EFB. The EFB was put into litter bags (nylon mesh bags with 2mm mesh), then placed on the soil surface or buried at 10cm in the soil in smallholder oil palm plantations. The EFB from each litter bag was collected every month, rinsed, oven-dried at 60°C to constant weight (at approximately 3 days), and ground so as to pass through a 0.5mm screen. The resultant powder was then analysed for macronutrients.

Results and discussion

Carbon and nitrogen release

The carbon and nitrogen content of EFB declined during the 135 after application (figure 1). During the 140 days, the amount of organic carbon fell to 50% of its original value and that of nitrogen to 75%. The content of the two nutrients in EFB put at 10cm was slightly lower than that for EFB on the soil surface. However, the percentages were similar after 135 days from application. The C/N ratio increased over time, indicating that the proportion of carbon relative to nitrogen decreased, reflecting the maturity of the organic matter applied.

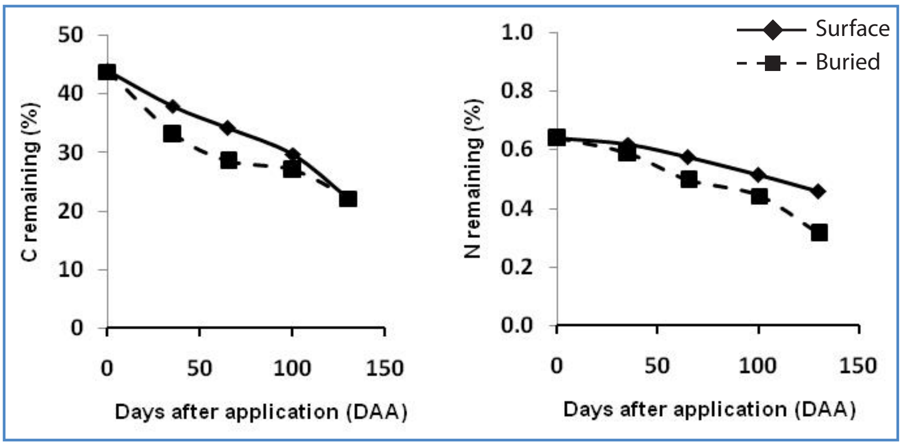

Figure 1. Carbon (left) and nitrogen (right) content in EFB during 140 days after application.

Phosphorus, Potassium, Calcium and Magnesium release

The results showed that P mineralization from EFB was more slowly released into the soil than carbon and nitrogen (figure 2a). After 135 days from application, the P content in EFB still remained about 50% of the initial level. Potassium mineralization, however, was the most rapid, releasing 75% of the initial level. Hence, only 25% remained in EFB after just 35 days from application (figure 2b). Potassium mineralization rate was much

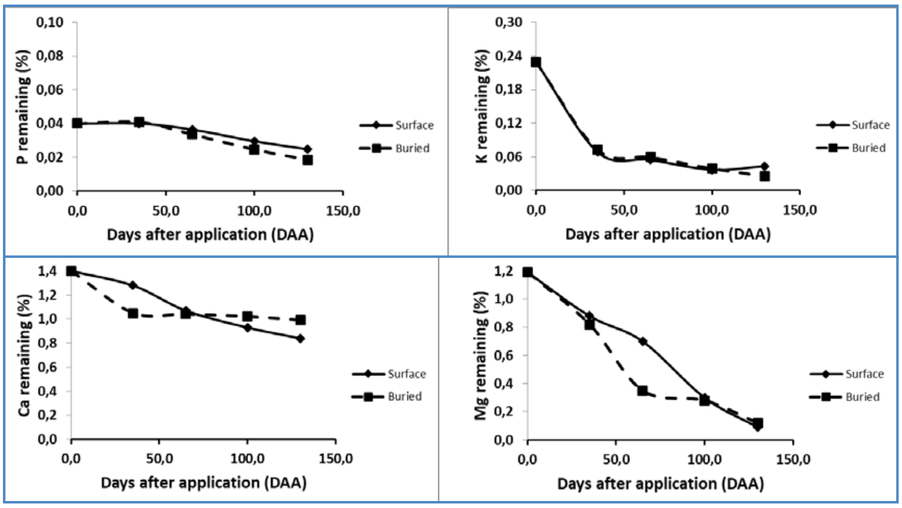

Figure 2. Phosphorus, potassium, magnesium and calcium content of EFB for the 140 days after application.

higher in the 35 days after application, but the rate decreased thereafter. There was no significant difference in the amounts of these minerals between EFB applied on the soil surface and that buried at 10cm.
The pattern of calcium mineralization was similar to that of potassium, rapidly at first and relatively slow from 35 days after application (figure 2c). After 135 days from application EFB applied on the surface still contained 57% compared to 71% for EFB at 10cm. On the contrary, Mg content decreased rapidly between 35 to 135 days after application. In summary, Mg and K would thus be readily available for the period after 35 days from application (figure 2d).

Conclusion

Oil palm EFB is potentially used as a nutrient source in oil palm plantations. However, the rate of mineralization should be taken into account if EFB is to be used as fertilizer. The mineralization rate was rather low, with release of potassium and magnesium as early as 35 days after application. However, carbon, nitrogen, and phosphorous were released at a rather slow rate. An additional source of P is therefore necessary to speed up plant growth. A significant difference between EFB applied at the soil surface and at 10cm depth only existed for N release.

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