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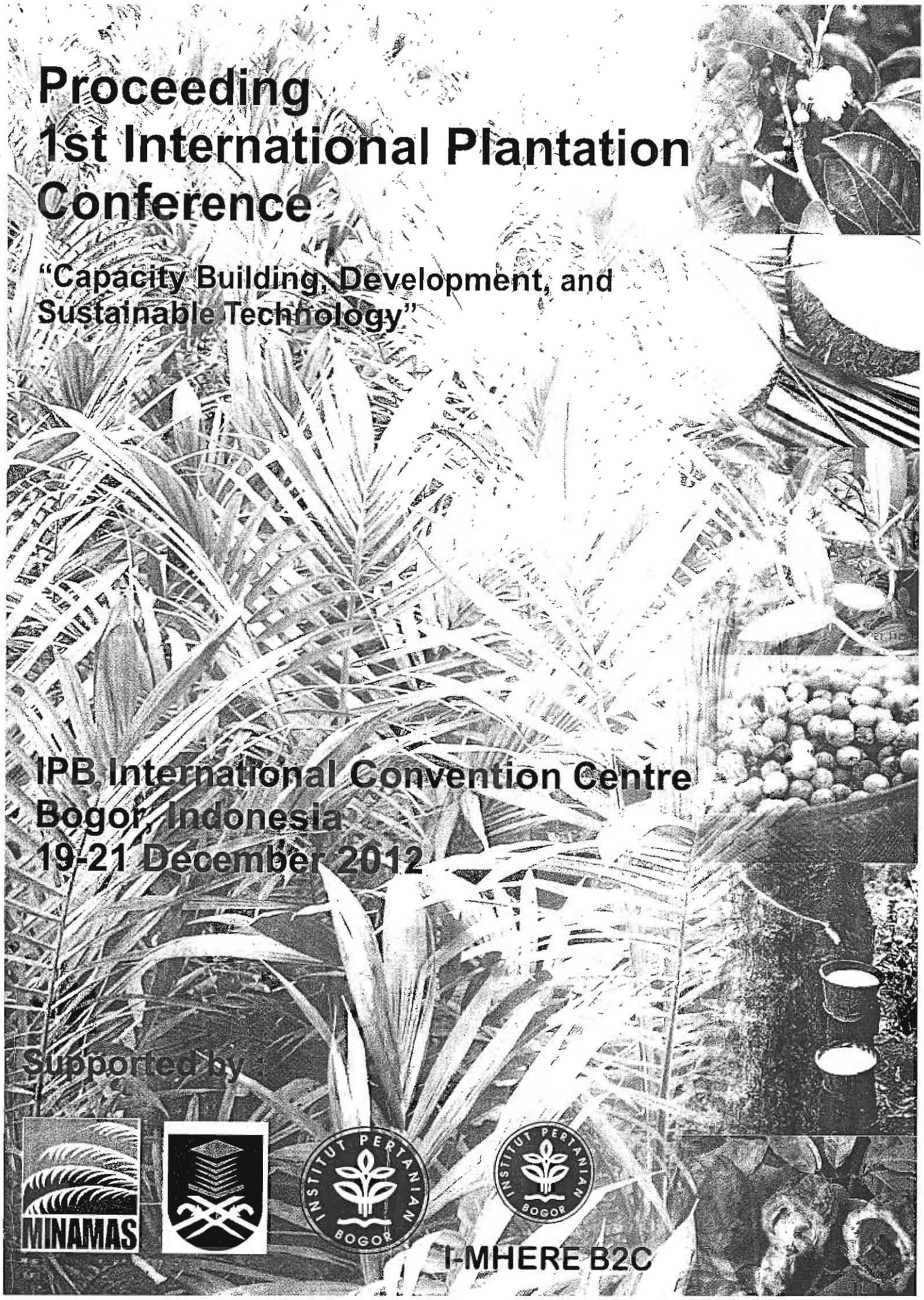

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THE EFFECT OF SLOW RELEASE FERTILIZER TO THE GROWTH AND PRODUCTION OF OIL PALM IN PEAT SOIL

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ABSTRACT

Due to nutrient leaching, application of slow release fertilizers in peat soil is recommended. The effect of slow release fertilizer on the growth and production of oil palm in peat soil was investigated from 2009 to 2012 in PT. Subur Mandiri Lestari, Riau. It was compared with conventional fertilization. The rates of slow fertilizer used was 720 g plant^{-1} semester^{-1} where consisted of N, P_2O_5, K_2O, MgO and B were 101, 42, 138, 29 and 7 g respectively. While the rates of conventional fertilizer were 1.2 kg of urea plant^{-1} semester^{-1}, 1.2 kg of TSP plant^{-1} year^{-1}, 1.2 kg of KCl plant^{-1} semester^{-1} and 75 g $CuSO_4$ and $ZnSO_4$ plant^{-1} year^{-1}. The whole blocks of the treatments were applied 2 kg of dolomite plant^{-1} year^{-1}. Observation were conducted on length of frond, leaf area index, the average weight of fresh fruit bunch (FFB) and FFB in tones ha^{-1} year^{-1}. Nutrient status and nutrient uptake were also evaluated. The results showed that the length of frond, leaf area index and FFB in tones ha^{-1} year^{-1} of slow release fertilizer blocks were comparable with those of conventional fertilization block. Nutrient status varied from 2009 to 2012 except for K were low in slow release fertilizer blocks as well as in conventional block. The nutrient uptake of N, P and K showed that conventional block was higher than that of SRF block. The efficiency showed that efficiency of slow release fertilizer was higher than that of conventional fertilizer. The results suggested that slow release fertilizer was more efficient than conventional fertilizer with comparable results of FFB production.

Key words: efficiency, fertilization, fresh fruit bunch production

INTRODUCTION

Peat soil in Indonesia is now extensively used for oil palm cultivation. This is stimulated by the scarcity of suitable mineral soils, relatively cheap price for such land and the significant advances in peat soil researches.

Water management is the main problem in peat soil cultivation. Drainage ditchs are commonly made to regulate the height of water table and leach the excess of organic acids produced during peat decomposition. As for chemical properties, in general peat soil is very acidic (pH < 4.0), it has very high organic content with high C/N ratio, it has high cation exchange capacity (CEC), it has low base saturation and it is deficient in K, P, Cu, Zn, and B.

Although oil palm is highly tolerant crop and can grow well in wide range of the soils, the above chemical properties can limit the growth and oil palm

production. Therefore fertilization is necessary to increase the peat soil fertility status. Fertilization with conventional fertilizers (urea, TSP, KCl) is very common in oil palm cultivation. However the problem is those fertilizers are relatively easy to leach by flowing water to drainage ditchs due to high solubility. Kløve *et al.* (2010) reported that N leaching in peat soil was about 1-7 mg kg^{-1}. As for P, it was reported that about 5-7 kg P ha^{-1} were leached by 2000-3000 mm percolation water (Kjaergaard *et al.*, 2012). The other report reported that the occurrence and magnitude of P loss also depended on the rate and method of application of the fertilizer and transport factors such as surface runoff which is directly related to hydrological processes and climatic conditions (Renou-Wilson and Farrell, 2007). The efficiency of fertilizers applied is low if nutrient leaching continuously occures in the field. Therefore it is necessary to use slow release fertilizers to increase the efficiency of fertlizers. SRF especially for P fertilizer have long been used as primary fertilizer (Bolan *et al.*, 1993; Niaminen, 1997).

The objectives of this research was to evaluate the effect of slow release fertilizer to the growth, nutrient status, and fresh fruit bunch (FFB) in peat soil.

MATERIALS AND METHODS

The research was conducted in PT. Subur Mandiri Lestari which was situated as presented in Figure 1. All the soil in PT. Subur Mandiri Lestari was peat soil. The research was conducted from 2009 to 2012. The history of fertilization in PT. Subur Mandiri Lestari is presented in Table 1. All block in PT. Subur Mandiri Lestari used Slow Release Fertilizer f (SRF) from 2009 to 2010. Conventional fertiizer was started to use in semester 1 of 2011. The rates of SRF used was 720 g $plant^{-1}$ $semester^{-1}$. It consisted of N, P_2O_5, K_2O, MgO and B were 101, 42, 138, 29 and 7 g respectively. While the rates of conventional fertilizer were 1.2 kg of urea $plant^{-1}$ $semester^{-1}$, 1.2 kg of TSP $plant^{-1}$ $year^{-1}$, 1.2 kg of KCl $plant^{-1}$ $semester^{-1}$ and 75 g $CuSO_4$ $plant^{-1}$ $year^{-1}$ and $ZnSO_4$ $plant^{-1}$ $year^{-1}$. The whole blocks of the treatments were applied 2 kg of dolomite $plant^{-1}$ $year^{-1}$. The weight total in one year fertilization of SRF was 1440 g while the weight total of conventional fertilizer was 6150 g. The total weight of SRF was much lower compare to that of conventional fertilizers.

Length of frond, leaf area index, and FFB in tones ha^{-1} $year^{-1}$ were observed. Soil sampling was conducted in 2009 while the leaf sampling was conducted in each semester from 2009 to 2012. The leaf of number seven teen frond was selected for leaf analyses and the results were used to judge the nutrients status. The number three frond was selected for frond analyses and the results were used to calculate the nutrient uptake of N, P and K in frond.

Soil analyses covered soil pH, organic-C, total-N, available bray 1-P, basic cations (Ca, Mg, K, Na), cation exchange capacity (CEC), exchangeable Al and H and micro nutrients (Fe, Cu, Zn, and Mn). As for leaf it covered total-N, total-P, total basic cations (Ca, Mg, K and Na) and micro nutrients (Cu and Zn) while for frond analyses it covered total-N, total-P and total K.

RESULT AND DISCUSSION

Land and soil characteristics

The depth of the peat in study area was more than 300 cm. The maturity level of peat in top soil was hemic and in subsoil was fibric to hemic. The depth of water table varied form 43 cm to 87 cm. The soil chemical properties is presented in Table 2. In general, this peat soil was low for P, and basic cations (Ca, Mg, K and Na).

The growth and production of fresh fruit bunch

The vegetative growths of of oil palm were identified by the length of frond and area index. The length of frond and leaf area were presented in Figure 2 and 3. The effect of the year of planting relatively affected the length of frond and the leaf area within blocks fertilized by SRF in the year 2010 and 2011. In the year 2012, especially in semester 2 (November 2012) the block H1 which was fertilized by conventional fertilizers showed better length of frond and leaf area compared to other blocks fertilized by SRF. However there were some blocks of SRF namely E, F and G1which showed comparable length of frond and leaf area with those of H1. It suggested that the effect of SRF to the growth of parameters varied widely possibly due to the variation of soil fertility or the quality of genetic of the plant. The growth of some block of SRF were comparable with that of conventional block (H1).

The production of FFB is presented in Figure 4. The production of blocks which were fertilized by SRF with the same the year of planting were comparable with that of H1 which was fertilized by conventional fertilizer. The block which was fertilized by conventional fertilizer was little bit higher than that of block which were fertilized by SRF. However the different of production was not so significant between block which was fertilized by conventional fertilizer and blocks which were fertilized by SRF. By taking into account the amount of fertilizers, it was shown that SRF was more efficient than that of conventional fertilizer. The amount of SRF was 1440 g and conventional fertilizer was 6150 g in one year fertilization. The total weight of SRF was much lower compare to that of conventional fertilizers.

Nutrient status and the uptake of N, P and K

Macro and micro nutrient status of the blocks were presented in Table 3. While the N, P and K uptake were presented in Table 4. Macro and nutrient status between block fertilized by SRF and conventional were not different. Their values fluctuated from 2009 to 2012. K was in general low during observation from 2009 to 2012. K was demanded by oil palm in high amount therefore the rate of K fertilizers in SRF and conventional were not enough (Iren and Amalu, 2012).

The uptake of N, P and K showed that block which was fertilized by conventional fertilizer were higher than those of blocks which were fertilized by SRF. It correlated with the production of FFB in block fertilized by conventional fertilizer where block fertilized by conventional fertilizer was little bit higher than that of blocks fertilized by SRF.

CONCLUSIONS

The effect of SRF and conventional fertilizer to the growth and production of fresh fruit bunch of oil palm were not different. They showed comparable results.

Macro and micro nutrient status of SRF blocks were comparable than those of conventional blocks. K was low status in SRF and in conventional, suggesting the rates of fertilizers were not enough. The uptake of N, P and K showed that block which was fertilized by conventional fertilizer were higher than those of blocks which were fertilized by SRF. Although SRF was lower in some observed parameters than those of conventional fertilizer in the case of efficiency, SRF was more efficient compared to conventional fertilizer due to the amount of fertilizers used in one year fertlization.

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