ABSTRACT

ANTONIUS SUPARNO. Morpho-physiological Responses of Cacao Seedlings to The Addition of Papuan Ayamaru Phosphate Rock, Humic Acid, and the Inoculation AM Fungi and Phosphate Solubilizing Bacteria. Under direction of SUDIRMAN YAHYA, SUDRADJAT, YADI SETIADI, and KOMARRUDDIN IDRIS

The purposes of the study were to obtain a humic acid dosage, an arbuscular mycorrhizal fungi (AMF) inoculant, and a phosphate solubilizing bacteria (PSB) isolate for improving the response of cacao seedlings to Ayamaru phosphate rock (APR). The study was conducted in the Cikabayan research garden of IPB. F1 UAH cacao seeds from Coffee and Cacao Research Center, Jember, East Java was used and the seedlings were grown on Ultisol, acid soil from Jasinga in 20 cm x 30 cm sized polybag. The seedlings were grown under 60% of shading net for the period of four months.

The study consisted of four trials which were set up in two-factor factorial trials using a Completely Randomized Design. The first factor in Trial I, II and III were APR dosages: 0, 0.5, 1.0, 1.5, and 2.0 g P₂O₅/seeding and 2.0 g P₂O₅ SP36/seeding used as comparison. The second factor in Trial I were AMF inoculation; in Trial II were PSB isolate inoculation; and in Trial III were four levels of humic acid dosages. The first factor in Trial IV was four levels of APR dosages: 0, 1.0, 2.0, and 4.0 g P₂O₅/seeding and 2.0 g P₂O₅ SP36/seeding used as comparison. While the second factor was combination treatments from the best result of Trial I, II, and III.

The best treatments obtained from Trial I, II and III as followed: AMF inoculation using Mycofer inoculant, inoculation with FT.3.2 isolate, and 3.10⁻³ mL of humic acid. Trial IV revealed that stem diameter, leaf number, and shoot/root ratio of the seedling with 2.0 g P₂O₅/seeding of APR was not significantly different than the seedling with 2.0 g P₂O₅ SP36/seeding. The response of most variables of seedlings to APR up to 4.0 g P₂O₅ in all combination treatments of the second factor on the Trial IV was linear. However, the treatments which involved AMF inoculation gave the better result as comparing to seedling without AMF. In term of shoot dry-weight, the effectiveness of Mycofer, humic acid and PSB was 104.29%, 4.38% and 4.24%; in term of P uptake was 191.00%, 33.20% and 18.31%; in term of root colonization was 682.82%, 10.26% and 6.17%; in term of acid phosphatase activity was 30.07%, 7.58%, 7.34%, while in term of APR efficiency was 104.29%, 4.38%, and 4.24% respectively.

Combination treatments in this study were aimed to enhance available P and to lower exchangeable Al content of the media. Combination treatments with the increasing level of APR up to 2.0 g P₂O₅/seeding caused increasing the root colonization and acid phosphatase activity went a long with decreasing exchangeable Al content, but with the increasing level of APR up to 4.0 g P₂O₅/seeding caused decreasing the root colonization and acid phosphatase activity and on the contrary increasing exchangeable Al content of the media.

The response of the growth seedlings and P available content of the media up to 4.0 g P₂O₅ of APR was still increased linearly. The responses were improved by the application of humic acid, AMF and PSB inoculation. The synthesis of organic acids by PSB inoculation and the release of acid phosphatase by AMF to the media indicated that there were the external mechanism of P solubilization of phosphate rock.

Keywords: Theobroma cacao, Gigaspora margarita, Glomus etunicatum, Glomus manihotis, Glomus aggregatum, Acaulospora tuberculata, Acaulospora scrobiculata