

Effect of K-N-humates on dry matter production and nutrient use efficiency of maize in Sarawak, Malaysia.

ABSTRACT

Agricultural waste, such as sago waste (SW), is one of the sources of pollution to streams and rivers in Sarawak, particularly those situated near sago processing plants. In addition, unbalanced and excessive use of chemical fertilizers can cause soil and water pollution. Humic substances can be used as organic fertilizers, which reduce pollution. The objectives of this study were to produce K- and ammonium-based organic fertilizer from composted SW and to determine the efficiency of the organic-based fertilizer produced. Humic substances were isolated using standard procedures. Liquid fertilizers were formulated except for T2 (NPK fertilizer), which was in solid form. There were six treatments with three replications. Organic fertilizers were applied to soil in pots on the 10th day after sowing (DAS), but on the 28th DAS, only plants of T2 were fertilized. The plant samples were harvested on the 57th DAS during the tassel stage. The dry matter of plant parts (leaves, stems, and roots) were determined and analyzed for N, P, and K using standard procedures. Soil of every treatment was also analyzed for exchangeable K, Ca, Mg, and Na, organic matter, organic carbon, available P, pH, total N, P, nitrate and ammonium contents using standard procedures. Treatments with humin (T5 and T6) showed remarkable results on dry matter production; N, P, and K contents; their uptake; as well as their use efficiency by maize. The inclusion of humin might have loosened the soil and increased the soil porosity, hence the better growth of the plants. Humin plus inorganic fertilizer provided additional nutrients for the plants. The addition of inorganic fertilizer into compost is a combination of quick and slow release sources, which supplies N throughout the crop growth period. Common fertilization by surface application of T2 without any additives (acidic and high CEC materials) causes N and K to be easily lost. High Ca in the soil may have reacted with phosphate from fertilizer to form Ca phosphate, an insoluble compound of phosphate that is generally not available to plants, especially roots. Mixing soil with humin produced from composted SW before application of fertilizers (T5 and T6) significantly increased maize dry matter production and nutrient use efficiency. Additionally, this practice does not only improve N, P, and K use efficiency, but it also helps to reduce the use of N-, P-, and K-based fertilizers by 50%.

Keyword: Sago waste; Humic substances; Humin; Maize; Nitrogen; Potassium.