ABSTRACT

Study Tolerance Level of Three Pineapple Clones [*Ananas comosus* (L.) Merr.] In the Effect of Lime and Organic Materials for Aluminum Toxicity in Ultisol Soil of PT Great Giant Pineapple

by

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Aluminum (Al) is a metal that is toxic to most plants, inhibits root growth and led to a series influence of metabolic abnornal. PT Great Giant Pineapple (GGP) in Terbanggi Besar, Central Lampung is a plantation and canning pineapple that most of its soil is Ultisol soil types with low soil pH (< 5). Pineapple mostly grown on acid soils with high Al concentration and often poison the roots, especially at the root tip.

This study was conducted to : 1) determine the pineapple clones of PT GGP which tolerant and sensitive to Al toxicity, 2) determine critical limit of Al saturation in Ultisol soil for 3 pineapple clones of PT GGP, 3) study effect of lime and organic matter soil against controlling Al toxicity in soil and plants for effort to improve plant growth and nutrient uptake of pineapple plants.

Study consisted of three experiments, namely: 1) Tolerance test of 3 pineapple clones of PT GGP (GP1, GP3 and F180) in 6 level concentration of $AlCl_3$ (0, 100, 200, 300, 400 and 500 μM) with Completely Randomized Design

for Factorial 3x6 and 5 replications in the greenhouse environment, 2) Evaluation of Al saturation in the Ultisol soil of 3 pineapple clones (GP1, GP3 and F180) in 7 Al saturation level in soil (0% (sand media), < 30%, 30-40%, 40-50%, 50-60%, 60 -70% and > 70%) with Completely Randomized Design for Factorial 3 x 7 and 3 replications in the greenhouse environment, 3) Effect of organic matter and liming on Al toxicity with Completely Randomized Design for Factorial 3x4x3 and 3 replications which consisted of 3 factors: Al saturation in the soil (low < 30%, medium 40-50 % and high > 70%), organic matter dosage (0, 20, 40 and 60 ton / ha), and lime dosage (0, 2 and 4 tons/ha).

Result of the first experiment showed that GP3 and F180 clones have high levels of Al toxicity tolerance which still can produce good shoot and root growth in high Al stress condition (500 μM $AlCl_3$ or equivalent of 24,3 ppm Al). GP3 clone showed the best growth in number of leafs, number of seminal roots, total production of roots sugar, P leaf and root uptake and the lowest Al root uptake compared to other clones. F180 clone produce the best volume water uptake by root, fresh roots weight, plants weight, leaf uptake of N, Ca and Mg and the lowest morphology of Al toxicity in root tips than other clones. While GP1 clone only produce the best of root length, percentage of vertical root weight and K leaf uptake. Thus we can said that the best level Al tolerance owned successively by GP3, F180 and GP1 clones.

Result of the second experiment showed that tolerance limit for controlling Al saturation in the soil which can produce good root growth in GP3 clone reached at Al saturation below 70% (with soil pH 4,1), while the GP1 and F180 clones at Al saturation below 30% (with soil pH 4,3). However, when we viewed

for optimization of soil pH, C organic level in soil, availability of K, Ca and Mg nutrients in the soil for good plant growth and suppress leaching of bases K, Ca and Mg in the soil, the author suggest that Al saturation in soil below 40% is the optimal limit for controlling Al saturation in the soil to reach good pineapple growth.

Result of the third experiment showed that using of organic matter in soils which suffered by Al stress will improve root growth compared to shoot growth in the early stage of pineapple growth (till 4 months after planting) with decreasing of shoot root ratio, increase the number of seminal roots and root water content. While using lime to overcome Al stress in the soil more showed to improve leaf nutrient uptake and available of soil nutrients compared to improve shoot and root growth.

For producing good root growth at early stage of pineapple growth (0-4 months after planting), optimization leaf and root nutrient uptake and availability of soil nutrient, the author suggest for low Al saturation in the soil (< 30%) require using lime 2 tons/ha and without organic matter, for moderate Al saturation (40-50%) require lime 4 tons/ha and organic material 20 tons /ha or without lime and organic matter 40 tons/ha, while for high Al saturation (> 70%) require lime 2 tons/ha and organic materials 60 tons/ha.