Thesis Title Improving the Effectiveness of Rock Phosphate in Agriculture

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Abstract

The study was conducted to improve the effectiveness of phosphate rock (PR) for agricultural use by calcination, partially acidulation, and mixing with triple superphosphate. The comparisons of improved PR with fine ground PR in terms of chemical availability and agronomic potential were also included.

It was indicated that the citrate soluble-P of PR from Roi-Et deposite which contained large amount of crandallite mineral [$CaAl_3(PO_4)_2(OH)_6.H_2O$] could be increased by calcination at the temperature

below 800°C while the Kanchanaburi PR [fluorapatite, $3(Ca_3(PO_4)_2).CaF_2$] decreased. However, the soluble-P of partially acidulated phosphate rock (PAPR) from Kanchanaburi deposite appeared to increase with the amount of H_2SO_4 acid used. Rock phosphate which was treated with H_2SO_4 to give 100% acidulation relative to superphosphate could significantly increase its citrate soluble-P to the maximum of 46.2 % of total phosphorus.

The improved Kanchanaburi PR did increase neither growth nor P uptake of corn plant (Zea mays L.) grown in pot containing Korat soil as compared to untreated PR. However,the responses of corn to improved PR were observed on Pakchong soil. Phosphate rock partially acidulated with H_2SO_4 at 80% acidulation (80%PAPR) and complete acidulation (100% PAPR) significantly increase dry matter yield as compared to untreated PR. Phosphorus accumulation in plants which received 30% PAPR or more was higher than those obtained ordinary PR. Improved PR either by calcination or acidulation tended to give more residual available P than untreated PR in both Korat and Pakchong soils. However, the application of 100% acidulation PR caused the maximum residual soil-P to 30 ppm P in case of Pakchong soil.

A field experiment was carried out to test the effects of TSP-PR mixtures on the availability of PR. The availability of Kanchanaburi PR was measured by plant yields and P uptake. It was indicated that the combinations of Kanchanaburi PR with TSP significantly increased yield. Without P fertilizer application, grain

yield of corn was only 703 kg/rai while the maximum grain yield at 830 kg/rai was obtained when P fertilizer at 12 kg P/rai was applied. Phosphate rock was just as effective as TSP when mixed with TSP at the ratio (TSP:PR) of 3:1, and 1:1. Corn plants receiving only PR could produce an average grain yield of 722 kg/rai. The TSP-PR mixtures at different ratio (1:0, 3:1, 1:1, 1:3 and 0:1) had no effect on P uptake of corn. The P availability in soils increased with increasing rate of P fertilizer application. At early stage of plant growth, the available soil-P increased with the proportion of TSP in the mixtures. However, the residual effects of different TSP-PR were not found at the harvest.