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AGRONOMIC EVALUATION OF EPPAWALA PHOSPHATE FOR WETLAND RICE

A THESIS PRESENTED BY

Panamulle Arachchige Sunil

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ABSTRACT

Phosphorus is an essential nutrient, for all crops and also critically needed to improve the soil fertility for crop production in large areas of developing countries. This is certainly the case for paddy cultivation, as rice plants need to take up considerable amounts of phosphorus in a relatively short period of time.

In Sri Lanka most of the wet zone paddy soils are deficient in P. Also, plant nutrient removal from rice soils by modern rice varieties is about three times more than that caused by traditional varieties. In view of these factors it is important to use appropriate amounts of P fertilizer in rice cultivation.

The high cost of imported water-soluble P fertilizers such as triple super phosphate (TSP) and single super phosphate (SSP) limits their use by resource-poor farmers. Therefore, substitution of TSP and SSP with a more soluble form of phosphate from Eppawala was considered. Eppawala rock phosphate (ERP) has been used for a long period as a phosphorus fertilizer for plantation crops. Untreated ERP does not appear to be a suitable fertilizer for annual crops because of its low solubility.

A series of field experiments and a pot experiment, Several techniques to increase the solubility of ERP were evaluated. The following techniques were compared:1) Selectively mined apatite crystals (SERP), 2) partial acidulation with H_2SO_4 (level 30% and 50% acidulation),3) Mixing of ERP and TSP at two levels (i.e., 30% ERP and 70% TSP; 50% ERP and 50% TSP).

All experiments showed a significant response to TSP application. The yield of rice grown on TSP-treated plots was significantly higher than that grown on SERP-treated plots in all trials. However, in two of the seven experiments, SERP performed better than the control (which had no P). The most promising results with direct application of ground primary apatite crystals were obtained on acid soils (pH 4 to 5). Absence of any response to SERP application in five of the seven trials is attributed to higher pH and insufficient dose of application. In many fertilizer experiments with rock phosphate, the levels of application are much higher, usually exceeding 100kg of P/ha. Although the response to SERP was significant only in two instances, the yield from all SERP-treated plots was higher than that from the control. The plants treated with PAPR 50% fertilizer (50% acidulation with H_2SO_4) performed equally well as those treated with TSP. The mixture of 50 percent TSP and 50 percent ERP was only marginally inferior to TSP.

Three field experiments were conducted to determine the residual effect of SERP fertilizer. The yields from previous SERP-treated plots were significantly higher than the TSP-treated plots and control in two trials. The available P content of the soils in all plots was monitored during the experiments. P content increased at least three-fold (from 9.5 to 32 ppm) for Maha to Yala seasons for the SERP (25 kg p/ha) treated plots. This trend may continue to strengthen itself in the following seasons, as SERP continues to release phosphate.

Although it is necessary to confirm these data by conducting field experiments in different agro-ecological zones of Sri Lanka, it appears that several ERP-based fertilizers have a good potential to replace or complement TSP.