

AGRONOMIC EVALUATION OF PRIMARY APATITE CRYSTALS (SELECTIVELY MINED EPPAWALA ROCK PHOSPHATE - SERP)

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In Sri Lanka, imported phosphate fertilizers are applied to most crops. The application of rock phosphate from Eppawala could be an economic alternative to the use of imported fertilizers for certain crops and soils. During the last two decades, many researchers have conducted geological, chemical as well as agronomic studies to evaluate the potential of using Eppawala rock phosphate as a source of P fertilizers. Their results led to the conclusion that although Eppawala rock phosphate is a high grade fertilizer containing more than 30 % P_2O_5 , its low solubility limits its for direct application. Therefore, Eppawala rock phosphate was recommended only for perennial crops such as tea, rubber and coconut.

The Eppawala phosphate deposit consists of SERP loosely embedded in a secondary matrix. In producing commercial rock phosphate fertilizer both SERP and the matrix are ground together. Recent studies have revealed that SERP have a higher P_2O_5 content and a higher citric acid soluble P content than the secondary matrix. It was also shown that the SERP which consist of more than 60 % of the ore could be easily separated from the matrix by sieving. This led to the present investigations to carry out chemical and agronomic studies to evaluate the potential of using the ground apatite crystals (Selectively mined Eppawala Rock Phosphate- SERP) as a directly applied fertilizer.

Laboratory incubation experiments, greenhouse experiments and field experiments were conducted with the following objectives.

1. To compare the citric acid soluble P content of SERP with that of commercially available Eppawala rock phosphate (CERP) fertilizers.
2. To study the effect of mixing peat from Muthurajawela on the solubility of SERP and CERP.
3. To compare the increase in available soil P levels after adding peat treated SERP and peat treated CERP.
4. To evaluate and compare the agronomic effectiveness of SERP (with and without

peat) with CERP (with and without peat) for rice and a short term legume crop in the greenhouse.

5. To evaluate and compare the potential of using SERP and CERP as P fertilizers for rice grown in a peaty soil in the greenhouse.
6. To evaluate the residual effect of SERP and CERP in the greenhouse.
7. To evaluate the potential of substituting part of TSP by SERP for rice and short term vegetables under greenhouse and field conditions.

SERP were hand picked at the deposit and ground to a fine powder and used for chemical analysis, incubation experiments, greenhouse experiments and field experiments.

Chemical analysis

Citric acid soluble P content of SERP and CERP were 5.8% and 3.6% respectively, indicating that SERP is superior to CERP as a phosphorus fertilizer.

Incubation experiments

Incubation experiments conducted to study the effect of mixing peat with rock phosphate indicated that in both SERP and CERP, the citric acid solubility increased due to mixing with peat. The increase in solubility was observed within 2-3 days of incubation indicating that it is mainly a chemical reaction. It was observed that mixing at a ratio of 1:0.8 (rock phosphate: peat) yielded the highest solubility increase. Throughout the incubation period SERP mixed with peat showed a higher citric acid soluble P content than peat mixed CERP.

Available P levels in soils as measured by Olsen method, increased significantly due to the addition of peat mixed SERP as well as peat mixed CERP in the two soils tested, one alfisol and one ultisol. Generally, P levels were much greater in the soil samples treated with peat mixed primary apatite crystal as compared to the samples treated with peat

mixed CERP, again indicating that SERP (with peat) is superior to CERP (with peat) as a P fertilizer.

Greenhouse experiments

A greenhouse experiment was conducted with two soils (one alfisol and one ultisol) using rice (*Oryza sativa*) variety BG-94-1. Treatments were 1) control (No P added) 2) SERP 3) SERP + peat 4) CERP 5) CERP + peat and 6) TSP. Yield parameters were measured and data were statistically analyzed. TSP treatment gave a significantly higher yield compared with rock phosphate treatments and the control. SERP with peat gave the second highest yield, but it was not significantly different from those with other treatments.

Another greenhouse experiment was conducted with an alfisol using cowpea (*Vigna unguiculata*) as the test crop. The treatments used were the same as in the previous experiment. Fresh pod weights were taken after harvesting. None of the fertilizer

treatments had a significant effect on fresh pod yield as compared with the control. TSP gave the highest yield while SERP with peat gave the second highest yield.

A greenhouse experiment using a peaty soil from Bomбуwela (Oxisol) was conducted using rice variety BG-11-11. The treatments were 1) control 2) SERP 3) CERP and 4) TSP. Again, no significant difference was observed in the grain yield between treatments.

Results of these greenhouse experiments, therefore, do not eliminate the potential of SERP as a P fertilizer, at least on certain soils. However, according to our experiments, complete substitution of TSP by rock phosphates from Eppawala does not seem to give promising results. Thus, field experiments were started with the objective of investigating the potential of partially substituting TSP by SERP for short term crops. These field experiments are being continued at two sites in the dry zone.