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ON INCREASING THE EFFICIENCY OF SUPERPHOSPHATE IN SLIGHTLY ACID SUBMERGED SOILS

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While evaluating the efficiency of different phosphatic fertilizers in different soils it is necessary to bear in mind that the soil acts as a barrier between applied phosphates and plant roots, and before plants can absorbe the nutrient, a large portion of it reacts with different soil components. The more soluble the P fraction in the fertilizer, the higher the proportion of it which reacts with the soil. Therefore the plants absorb P not from the fertilizer directly but from its reaction products. It is therefore necessary to consider pH, Fe, Al, Ca and moisture contents of soils as the deciding factors of the suitability of a phosphatic fertilizer for a particular soil. Experiments conducted in different parts of India since 1948 to evaluate the relative efficiency of water and citrate soluble P fertilizers showed that in general P fertilizers containing citrate soluble P respond better in acid soils whereas these with water soluble P react better in alkaline soils (Motiramani *et al* 1964; Ray Choudhary, 1S65).

The beneficial effects of incorporation of dolomitic lime stone in fertilizer mixtures have been noted since 1937 but information is lacking on the optimum time of mixing a water soluble phosphatic fertilizer like superphosphate with lime so as to make it more efficient in acid soils.

A preliminary pot culture experiment was conducted at Kerala Agricultural University, Vellayani Campus during the Khariff season of 1975-76 using lateritic clay loam soil from Vellayani area of Trivandrum District. Pots of 10 Kg capacity were used in the study. The soil was having a pH of 5.4 and analysed for 0.075% total N, 0.0025% available P and 0.003% of K_2O.

The pots were filled with air dried soil and flooded two days before planting. A basal dose of N, P_2O_5 and K_2O @ 45-45-45 Kg/ha in the form of urea, superposphate and muriate of potash, and lime @ 600 Kg/ha was given. The different treatments consists of mixing lime and super 24 hours before application (Tr_1), immediately before application (Tr_2) and conventional method of adding lime and super separately (Tr_3), lime 2 days before and super at the time of planting. Two 20 day old seedlings of the variety Jaya were planted in each pot on 1-8-1976. Dummy pots of the same treatments were kept for taking samples for soil analysis. Triplicate samples of soil were analysed for avilable P by Bray's method (Bray and Kurtz, 1945) daily for a

period of five days. Results are presented in Plate I. Bray P was comparatively higher in pots receiving super lime mixture prepared immediately before application, which though decreased gradually maintained a higher level when compared to other treatments. Bray P account for mostly iron and aluminium phosphates and for active calcium phosphate (Jackson, 1968).

The crop was harvasted on 11th November 1976. The dry weight of grain and straw were analysed statistically. Super-lime mixture prepared and applied immediately gave significantly higher grain and straw yield at 1% level of significance (Table I). Triplicate composite samples of grain and straw of all the three treatments were analysed for its P content by Amidol method

Table 1

Effect of the time of mixing lime and super on straw and grain yield

Treatments	Tr_1	Tr_2	Tr,	CD
Grain yield in g/pot	26.7	37.1	27.4	7.32 **
Straw yield in g/pot	26.6	30.6	23.1	7.43 **

(Fiske and Subrao, 1925) in the triple acid digestate of the samples. P uptake per pot was also calculated from P concentration and dry weight of grain and straw. The average P uptake values for the three treatments were 58.4, 82.6 and 52.0 mg per pot respectively indicating that, lime super mixture perpared immediately before application supplied more plant available P when comared to other treatments.

In order to investigate the changes in water soluble P of superphosphate in the super-lime mixture for a period of one week after mixing, an incubation study was conducted by mixing superphosphate with lime in 1:2 proportion. Samples of mixture were analysed for citric acid and water soluble P at 24 hours intervals. The results are presented is Plate II. Kinetics of the super-lime mixture for citric acid and water soluble P showed, that immediately on mixing, water soluble P of superphosphate is converted to citric acid soluble and insoluble forms. Citric acid soluble P decreased sharply upto 48 hours after mixing and gradually at the later period. Water soluble P increased gradually from mixing for a period of 48 hours and then decreased gradually. The initial level of citric soluble P was nearly 45 to 50 times as that of water soluble P. After a period of one week of mixing the citric acid soluble fraction was reduced to nearly half of its initial value. The observed increase in water soluble traction coincide with decrease in citric acid soluble fraction.

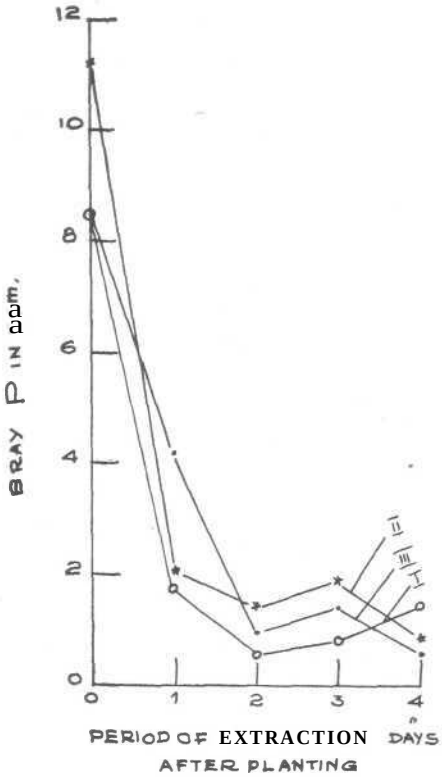

PLATE .J. EFFECT OF THE TIME OF MIXING SUPER & LIME ON AVAILABLE SOIL P

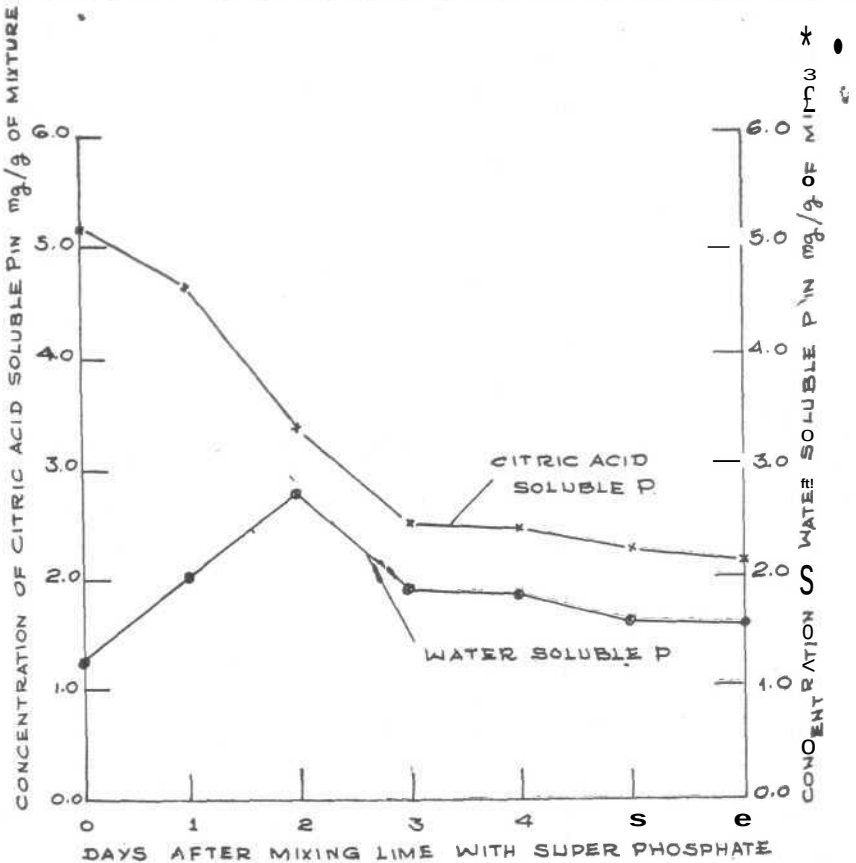

PLATE II. EFFECT OF MIXING LIME WITH SUPER PHOSPHATE ON CITRIC ACID AND WATER SOLUBLE P FRACTIONS

The result of incubation and pot culture study indicates that the observed increase of yield and P uptake in treatment 2, application of lime super mixture prepared immediately before application, might be due to the formation of citrate soluble P in the mixture. Review of P fertilizer trials by Atanalu (1971) pointed out that in tropical and subtropical soils citrate soluble P gave better results than water soluble P for rice.

This preliminary trial clearly indicates that the efficiency of superphosphate can be improved by mixing it with lime just before applcation so as to reduce the reaction of water soluble P with Fe, Al or Mn fractions and consequent reduction in its availability. The recommended doses of lime and superphosphate 300 kg superphosphte and 600 Kg lime for rice in Kerala are found sufficient for the mixture. The results may be further verified by field experiments.

സംഗ്രഹം

സൂപ്പർ ഫോസ്ഫേറും കുമ്മായവുമായി കലർത്തി ഉപയോഗിക്കുന്നതായാൽ അല്പ ഗ്രണമുള്ള മണ്ണുകൾക്കു കൂടുതൽ നല്ലതാണെന്നു തെളിഞ്ഞിട്ടുണ്ട്. എന്നാൽ കുമ്മായം ഏതുപാതത്തിൽ, എപ്പോൾ സൂപ്പർഫോസ്ഫേറുമായി കലർത്തണമെന്നു പരീക്ഷിക്കാനായി കാർഷികസമ്പ്രകലാശാലയിൽ നടത്തിയ ഒരു പ്രാരംഭപരീക്ഷണത്തിൽ നിന്നു, കുമ്മായവും സൂപ്പർഫോസ്ഫേറും 1 : 2 അനുപാതത്തിൽ 300 kg സൂപ്പർഫോസ്ഫേറും 600 kg കുമ്മായവും കലർത്തിയ ഉടനെ, ഞാറു പറിച്ചുനടുന്നതിനു മുൻപായി ചേർക്കുന്നതായാൽ അല്പഗ്രണമുള്ള മണ്ണിൽനിന്നും നെല്ലിനു കൂടുതൽ ഫോസ്ഫേറു ലഭ്യമാകുന്നതാണെന്നു തെളിഞ്ഞിരിക്കുന്നു.

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