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Studies on the Efficiency of Laccadive Phosphate Deposits as a Phosphatic Fertiliser in the Acid Soils of Kuttanad

by

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Introduction: A detailed soil survey of the Laccadive Islands, a group of nineteen islands off the West Coast in the Arabian Sea, brought to light the presence of large deposits of phosphorus. These deposits have a high content of calcium carbonate and are low in organic matter. Phosphorus is present in the citric soluble form and in spite of the high content of calcium carbonate present in the deposits, reversion of phosphorus to insoluble forms does not take place. The absence of ammoniacal nitrogen must be due to the presence of calcium carbonate and the nitrate nitrogen, if any, must have been washed off.

The origin of the phosphate deposits in the Laccadives is not definitely established. It is presumed that the accumulation of birds' guano through centuries must have enriched the soil with phosphorus and calcium. If the Laccadive phosphate could be used as a substitute to the ordinary phosphatic fertilisers, it will go a long way to ease the current fertiliser shortage threatening the country's agricultural production plans. Hence it was felt feasible to compare its efficiency as a 'fertiliser' with one of the commonly used chemical fertilisers.

Review of Literature: Gopalaswamy (1961) reported that iron and aluminium oxides account for about 42% in the top four inches layer of the Moncompu soil. Koshy and Brito Muthunayagam (1961) after a detailed study on the problem of phosphate fixation in the Kuttanad soil concluded that upto 94.5 % of the water soluble phosphorus in superphosphate gets fixed within one day of application into the soil. Fixation of citric soluble phosphorus, however, was found to be only 90.5% during the same interval. Combire (1965) opined that owing to the high sorption power of tropical soils, the strong leaching and intense fixation of P by the iron and aluminium salts, it is sometimes advantageous not to use water soluble phosphates in acid soils, as they get fixed in a few hours of application, but to use less easily soluble phosphates which do not react as quickly with the soil particles. Subramony (1965) reported that major portion of the P in the Laccadive phosphates is in the citric soluble form and also that the availability of the element increases with decreased particle size.

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Material and Methods: The trial was laid out in the experimental farm of the Regional Rice Research Station, Moncompu during the *punja* season (October to February) for three years from 1964-65 to 1966-67. The soil is acidic and alluvial clay. The chemical and mechanical composition of the top nine inches soil are as follows:

(a) *Chemical composition of the soil:* Loss on ignition-25.9%, K_2O-0.17%, CaO-0.14%, N-0.29%, Chloride-0.12%, P_2O_5-0.12%, Sulphate-Trace, pH-5.2%.

Mechanical composition of the soil: Coarse sand-8.4%, Clay-30.35%, Fine sand-34.75%, Organic matter-5.26%, Silt-20 35%.

Phosphorus deposits collected from the Kalpeni Island ground to a size of 60 to 80 mesh was used in the trial. The chemical analysis of the material is as under:

N-Trace, P_2O_5-8%, K_2O-Trace, $CaCO_3$-75% and MgO-0.1%.

The trial included three treatments: T1-control. with no P, T2-super phosphate and T3-Laccadive phosphate. Phosphorus was given at the rate of 44 9 kg/ha (40 lbs/acre) in the form of P_2O_5. The treatments were replicated three times in the first year and seven times each in the second and third years.

PTB 10, one of the popular short duration rice varieties was used in the trial in all the three years. The entire P and K_2O were applied basally at the last puddling. N was applied in two doses, one at the time of planting and the other at the tillering phase. The doses of N and K_2O were kept constant for all the treatments. Irrigations and plant protection operations were attended to as and when found necessary.

Results: *Grain Yield:* A combined analysis of the data for all the three years indicated that the treatment effects were significantly different from the control at the 1% level. Super phosphate stood first in rank closely followed by the Laccadive phosphate. The difference between the two P treatments was found to be markedly superior over the control. (Vide Table 1).

TABLE 1. *Comparison of the mean grain yields*

Treatments	Years			Mean	SE_D	CD (P=0.05)
	1964—65	1965—66	1966—67			
T1	9.20	11.98	15.01	12.06		
T2	10.80	12.03	15.83	12.89	0.23	0.47
T3	9 45	12.20	15.64	12.43		

Conclusion: $\overline{T_2\ T_3}\ \underline{T_3\ T_1}$

Straw yield: The yield of straw did not show any marked effect in the first year of the trial. But in the second and third years, the treatments were significantly superior over the control (Table 2). The combined analysis of the three years data confirmed the appreciable influence of the treatments on this character (Table 3).

TABLE 2. *Comparison of the mean straw yield per plot*

Seasons	Treatments			SE_D	CD (P=0.05)
	T_1	T_2	T^3		
1965—66	36.21	41.43	36.71	1.68	3.43
1966—67	38.29	46.14	42.71	1.78	3.64

Conclusions:	Seasons	Treatments
	1965—66	T_2 T_3 T_1
	1966—67	T_2 T_3 T_1

TABLE 3. *Comparison of the mean yields of straw taken over three years*

Treatments	Seasons			Mean	SE_D	CD (P=0.05)
	1964—65	1965—66	1966—67			
T_1	32.73	36.21	38.29	35.74		
T_2	34.03	41.43	46.24	40.53	1.04	2.12
T_3	30.73	36.71	42.71	36.72		

Conclusions: T_2 T_3 T_1

Discussion: The results of the trial indicate that the water soluble P does not have any marked beneficial effects on the grain yield of the crop. When the yield of straw is considered, there is significant effect with the application of water soluble P. In both the characters studied, the treatments maintain the same trend in production. Due to the high acidity and clay content of the soil, a common feature of the entire Kuttanad tract, a major portion of the water soluble form of P applied gets absorbed in the clay colloids, precipitated with the iron and aluminium ions or fixed with their hydrous oxides making it unavailable to the crop. A part of the P thus immobilised is again made available through anion exchange that takes place during the top growth. Since P in the Lacadive soil is not water soluble, the amount of such undesirable changes in the soil will be comparatively less immediately after application.

In spite of the fact that P in the citric soluble form is fixed only less rapidly in ordinary soils, Koshy and Brito Muthunayagam (1961) found that in the long run both the water soluble and the insoluble phosphates reach an equilibrium in the Kuttanad soil. At this stage, the availability of the element from both the forms is almost equal. The numerical increase in the grain yield and the significant increase in the straw yield by the application of superphosphate are attributed to the absence of lime in the fertiliser. The high calcium carbonate in the Laccadive soil has helped to reduce the yield of straw in the treatment. When the yields of grain and straw are considered, it is concluded that the Laccadive soil can be used as an effective substitute to superphosphate in the Kuttanad tract.

The harmful residual effects of ord
nated by the Laccadive phosphate due to the presence of high proportions of calcium carbonate which will have favourable effects on the soil in the long run. The cost of the Laccadive phosphate is also much less compared to superphosphate.

Summary and Conclusion: The effect of Laccadive Phosphate deposits was compared with the ordinary superphosphate in the acid soils of Kuttanad. Phosphorus was given basally at 44.9 kg/ha in the form of P_2O_5. The trial was conducted during the *punja* season for three years. Grain and straw yields were analysed statistically and the conclusions are: (1) There was no marked increase in the yield of grain due to the different phosphates tried. (2) The yield of straw showed significant increase with superphosphate. (3) Considering the cost of the material, high content of lime, favourable residual effects and its efficiency on the yield of grain, Laccadive phosphate can be effectively used as a substitute to superphosphate in the acid soils of Kuttanad.

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