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# Phosphate Potential as an Index of the Availability of Soil Phosphorus

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The chemical potential of phosphorus in soil solution estimates the free energy or the available energy. The phosphate potential values of the soil samples after flooding for 15 days and 35 days correlated well with the uptake in flooded soils. But the phosphate potential of air dried soils did not correlate with the uptake. Since the phosphate potential values were significantly related to the uptake of P, it may serve as a good index of phosphorus availability in waterlogged soils. However, the ratio between the change in quantity factor and change in intensity known as "differential capacity" or "Q/I relations" would serve as a good index of P availability since the "intensity factor" changes with the "Quantity factor" due to the dynamism of waterlogged soils. Hence the evaluation of "buffering capacity" or the "Q/I relation" is suggested for realistic soil test.

There are many extractants used to test the available phosphorus in soil and all these measure only the quantity factor. The quantity factor is not a good index, because of many interaction of soil factors. Schofield (1955) proposed the concept of "Phosphate potential" to measure the availability of P. He proposed the negative chemical potential of monocalcium phosphate ($\frac{1}{2}$ p Ca + p $H_2PO4$) determined in a 0.01 M $CaCl_2$ soil extract. Larsen (1967) criticised this method by saying that the assumption that this potential is a measure of the partial molar free energy of all the solid phase phosphorus is not valid, as full equilibrium is not achievable. Later Ramamurthy and Subramaniam (1960) have proposed the concept of equilibrium phosphate potential and found that it increase the P availability in paddy soils with considerable success. This paper presents the use of phosphate potential values to predict the phosphate availability in rice soils and the possibility of recommending this method for use.

## MATERIALS AND METHODS

A pot experiment using eleven representative soils of Tamil Nadu was laid out with two moisture treatment viz., field capacity and flooding. The test crop used was "Karuna" (CO. 33) a short duration paddy variety. The pots under flooded condition was irrigated daily and 5 cm depth of water was constantly maintained. The pots under field capacity were added calculated quantity of water (60 per cent water holding capacity). Soon after

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transplanting the pots were weighed and thereafter irrigation was given on alternate days by finding the difference in weights of pots. Soil samples were drawn on 15th and 35th day after transplanting and analysed for availability of phosphorus by phosphate potential method. The phosphate potential was measured by using 0.01 M $CaCl_2$ extractant with 1 : 2.5 soil extractant ratio (Asyling 1954). Twenty grams of soil were added with 50 ml of 0.01 M $CaCl_2$, shaken for one minute and pH recorded. It was then filtered immediately and from 5 ml of the filtrate the concentration of P was estimated by chlorostanous reduced molybdophosphoric acid method in sulphuric acid medium. The amount of calcium present in the filtrate was also estimated by versenate titration. The phosphate potential values were then calculated by using the equation $-\frac{1}{2}$ p Ca + $pH_2PO_4$.

## RESULTS AND DISCUSSION

The chemical potential of phosphorous in soil solution estimates the free energy or the available energy which is the measure of the escaping tendency of the ion. The free energy concept was intoduced to eliminate the soil factors interacting in the solubility of an ion. But the posphate potential varied with the moisture regimes and stages (Table). This factor was hitherto not given importance. Due to changes in environment, phosphate potential also varied, with higher potential under flooded condition.

TABLE. Change of phosphate potential value with stages

| Soils | Air dried soils | Flooding | | Field capacity | |
|---|---|---|---|---|---|
| | | I | II | I | II |
| 1 | 3.62 | 6.08 | 5.38 | 5.51 | 4.21 |
| 2 | 4.38 | 6.44 | 5.62 | 6.28 | 6.42 |
| 3 | 4.88 | 5.89 | 5.17 | 5.53 | 6.01 |
| 4 | 4.56 | 6.29 | 6.21 | 5.71 | 6.47 |
| 5 | 4.44 | 5.25 | 6.32 | 5.76 | 6.48 |
| 6 | 4.26 | 6.40 | 6.36 | 5.81 | 6.46 |
| 7 | 4.18 | 5.58 | 5.70 | 5.82 | 5.98 |
| 8 | 4.00 | 6.21 | 5.02 | 6.19 | 6.48 |
| 9 | 4.49 | 5.42 | 5.74 | 5.92 | 5.76 |
| 10 | 4.51 | 6.22 | 5.44 | 5.98 | 6.42 |
| 11 | 6.00 | 6.61 | 6.11 | 5.98 | 5.98 |

Soils 1, 2, 3 Red soils of Theni, Kappalur and Dindigul
4, 5, 6 Black soils of Thirumangalam, Koilpatti and Dindigul
7, 8, 9 Alluvial soils of Cholavandan, Cumbum and Ambasamudram
10 and 11 Laterite soils of Pannaikkadu and Madurai respectively.

Phosphate potential values of the soil samples after flooding for 15 days and 35 days correlated well with the uptake of phosphorus in fooded soils. But the phosphate potential of air dried soils did not correlate with the uptake. This clearly indicates the change of intensity factor with quantity due to the dynamism of water logged soils. Lamm (1968) and Balasundaram (1971) have reported that even the intensity factor in isolation can not be a good index of nurient availability.

Phosphate potential values were significantly related to the uptake of phosphorus and may serve as a good index of phosphorus availability in soils. However, Barrow (1967) and Lamm (1968) emphasised the ratio between change in quantity factor and change in intensity known as "differential capacity" or "Q/I relations" would serve as a good index of P availability since the "intensity factor" changes with the "Quantity factor" due to the dynamism of water logged soils. Hence, the evaluation of "buffering capacity" or the "Q/I relation" is suggested for realistic soil test.

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