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EVALUATION OF POTASSIUM REQUIREMENT OF OIL PALM BY DESORPTION ISOTHERM

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Abstract: The Desorption Equilibrium Model (DEM) was prepared to recommend the potssium requirement of oil palm with the aid of simple basic soil tests in the oil palm growing laterite soil of Palode, Thiruvanathapuram. Based on DEM ready reckoner to guide the level of K_2O to be applied per palm to raise the available potassium to any desired level was proposed.

1. Introduction

According to Hartley (1988), potassium could be the most commonly required element in the oil palm nutrition. In general, potassium requirement of oil palm could only be decided through long term field experiments. However, using Desorption Equilibrium Model (DEM) as shown by Srinivasan and Biddappa (1990) for cardamom, it could be assessed based on simple soil test results. This approach, if successfully standardised for the soil in the oil palm growing areas may have great significance in scheduling fertilizer application.

2. Materials and Methods

Soil samples (0-100cm), collected from the oil palm growing tracts of CPCRI Research Centre, Palode were used in the study. The potassium DEM was constructed using the procedure of Biddappa and Sarkunan (1981) as under. 5g of soil was incubated with graded levels of potassium (0,50,100,150 and 200ug/g) for 96 hours. At the end of incubation period the soil was extracted with IN neutral ammonium acetate and the desorbed potassium was estimated. The DEM was constructed by plotting the desorbed potassium (β µg/g) against the added potassium (Ψ µg/g). From the isotherm the potassium buffering capacity (β^0/Ψ^0) was computed.

The TKR (Total Potassium Requirement) model. was decuced from the buffering capacity as follows.

Deficit Postassium = (n -x)µg/g

where n= optimum potassium requirement

x= soil test value in ppm

$$TKR = \frac{(n-x)}{\text{Buffereing capacity}}$$

$$= \frac{(n-x)}{(\beta^0/\Psi^0)}$$

$$= \frac{(n-x) \times \Psi^0 \times 17.6}{\beta^0} \text{ g Potassium/palm}$$

Where 17.6 is a factor derived from the soil volume in the basin of the oil palm with a radius of two metres and depth of one metre. The bulk density of the soil (1.4g/cc) was used in calculating the mass of the soil in that volume.

$$\text{(i.e., } = \frac{22 \times 2 \times 2 \times 100 \times 100 \times 1.4 \times 100}{7 \times 1000 \times 1000} = 17.6\text{)}$$

$$\text{Therefore TKR} = \frac{(n-x) \times \Psi^0 \times 22.2}{\beta^0} \text{ g } k2_0\text{/palm}$$

Based on the TKR model, ready reckoner table was prepared to deduce the dose of K_2O to be applied per palm to raise the soil available potassium to any pre-determined level.

3. Results and Discussion

Fig I depicts the potassium DEM and the regression equation of the plot was found to be y = -4 + 0.80 x with a significant (1% level) value of correlation coefficient (r = 0.99). The value of inverse of buffering capacity (β^0/Ψ^0) deduced from the DEM was 1.25 and this value was further used to develop the TKR model (Table 1). According to the Table, the potassium requirement varied depending upon the desired level of available potassium from 10 to 80 ppm. for e.g., if the soil test value (available potassium) is found to be 20 ppm and to raise this value to 80 ppm, one must apply 1655 g K_2O/palm.

Table 1. Total potassium requirement (TKR) for raising the available potassium to the desired level in the oil palm growing laterite soils of Southern Kerala.

Soil test value (avallable potassium.) ppm	Dose required to raise the available Potassium (g K_2O/palm) <—— Desired level of available Potassium (ppm) ——>							
	10	20	30	40	50	60	70	80
0	278	555	833	1110	1388	1665	1973	2220
10	—	278	555	833	1110	1388	1665	1943
20	—	—	278	555	833	1110	1388	1665
30	—	—	—	278	555	833	1110	1388
40	—	—	—	—	278	555	833	1110
50	—	—	—	—	—	278	555	833
60	—	—	—	—	—	—	278	555
70	—	—	—	—	—	—	—	278
80	—	—	—	—	—	—	—	—

Similar DEM model was also developed for evaluating phosphorus requirement of oil plam (Muralidharan and Biddappa, 1992). This approach appears to be simple and less time consuming rather than conducting field experiments. which would take otherwise such a long period to arrive the potassium requirement of the crop. Apart from that the increasing cost of fertilizers warrants their judicious application and usually the application of the arbitrarily recommended dose of fertilisers would not be in accordance with the requirement of the palm. The proposed model aims at maintaining the soil potassium fertility level at 80 ppm of available potassium. Although in the oil palm, this has not been established either through field experimentation or through exhaustion, this was established for the coconut through long term field experimentation at CPCRI. Kasaragod (CPCRI. 1985). These results of the coconut have been utilised for the oil palm, since the nutrient requirements of these two perennial oil palnts are closely comparable (Ochs, 1977).

The DEM for potassium was plotted for evaluating the buffering capacity (β^0/Ψ^0). Srinivasan and Biddappa (1990) also used nutrient buffering capacity for evaluating the nutrient requirement in cardomom soils. Since the buffering capacity was closely related to the rate of potassium diffusion and other availability parameters, it could be used in the computation of potassium requirement. It may be stated that this factor would be a constant for a given soil under standard conditions. The model was based on the recovery of added potassium, which was 80 per cent in the present study. The fertilizer experiment (Nair and Sreedharan, 1982) conducted so far in the oil palm growing tracts of southern Kerala have not given any conclusive evidence so as to evolve critical limits for major nutrients. In the absence of computer models and adequate data from field experiments, this model, which has taken into account the response and reaction of the soil to the added fertilizer may be considered most suitable for potassium scheduling for oil palm on the basis of soil test data. Thus, the present arbitrary recommendations of 1200g K_2O per palm per year for the oil palm grown in south India can be modified by using this model.

4. Conclusion

The TKR model computed based on the DEM would find applications among the oil palm cultivators. Thus, depending upon the purchasing power of the oil palm cultivators the soil available potassium status can be maintained to any desired level by supplying the indicated amounts of K_2O in the table.

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