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Relative efficacy of soil test methods to measure changes in K status due to uptake, addition and release of potassium in calcareous soil under continuous cropping

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ABSTRACT

The relative efficacy of the extractants used to measure the status of available K in the calcareous soils of Junagadh was in the decreasing order; 1 N boiling HNO_3 > neutral normal NH_4OAc > Morgan's reagent > 0.01 M $CaCl_2$ solution. The 1N ammonium acetate, Morgan's reagent and 0.01 N $CaCl_2$ methods were not sensitive enough to reflect the changes taking place in the K status of the soil due to continuous cropping and application of potassium. But the 1N boiling HNO_3 which extracted the non-exchangeable K released in the form of available K from reserve pool during crop growth can be recommended for use on medium black calcareous soils where there is appreciable release and utilization of K from non-exchangeable forms under continuous cropping.

Key words : Available K, Non-exch. K, Release of K, Potassium application, Continuous cropping.

Several methods in vogue in laboratories measure the available potassium in soils at the time of extraction. So the usefulness of these methods is limited when applied to different soils of varying capacities to release K from non-exchangeable sources, especially when high amount of K is removed because of continuous cropping. From literature it is seen that large amount of K is released when continuous cropping is followed without K fertilizer. In such situation soil test method, which can give correct picture of the changes in the K status in soil, only will be helpful for formulating a sound fertilizer recommendation. That is the objective of the work reported here.

MATERIALS AND METHODS

Four different levels of native lime containing soils used in pot culture experiment were collected from college farms, Junagadh. The soils were clay loam in texture, with pH ranging from 8.0 to 8.2, EC from 0.32 to 0.55 dSm^{-1}, and CEC from 32.4 to 48.3 Cmol (P^+) kg^{-1}. Native lime contents of these soils were 4.3, 17.8, 30.5 and 40.5 per cent. The organic carbon content of all the four soils ranged from 0.68 to 0.96 per cent, while available P_2O_5 and K_2O ranged from 12 to 37 mg kg^{-1} and 87.1 to 105 mg kg^{-1}, respectively.

Pots were filled with 12 kg soil and crops of groundnut, wheat and maize were grown in sequence with different levels of potassium application @ 0, 300, 600 and 1200 mg pot^{-1} added through muriate of potash. Recommended doses of N and P were given through DAP and urea. Irrigation was given using distilled water. The groundnut and wheat were harvested at maturity and maize after 60 days. The plant and soil samples were collected for chemical analysis.

Available K content of the soil was determined using different extractants viz., neutral normal ammonium acetate, Morgan's reagent, 0.01 M $CaCl_2$ and 1N boiling HNO_3 and the potassium was estimated using a flame photometer. On the basis of lime content, exact quality of 1N HNO_3 required to neutralize the lime was calculated and added in all soil samples, to avoid under estimation of available K by 1N boiling HNO_3 method.

RESULTS AND DISCUSSION

Data on the available K estimated by different methods are presented in Table 1. In comparison with other extractants, efficiency of $CaCl_2$ solution was the least while 1N boiling HNO_3 extracted comparatively large amounts of potassium. The methods can be arranged in the following order in respect of their ability to extract available K from the soil; 1N HNO_3>1N N_4OAc>Morgan's Reagent>0.01M $CaCl_2$. In all these methods, it was found that after cropping with groundnut more potassium was mobilized to the available form in the soil, but after maize, the available K status decreased. The amount of K utilized by groundnut, wheat and maize differed vary much, as much as the uptake by groundnut