Forms of potassium of representative soil series of sub-montane zone of Maharashtra

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ABSTRACT

The representative soil series of order Entisols, Inceptisols and Vertisols collected from agriculture college Kolhapur and different research stations of Sub-montane zone of Maharashtra were assessed for different forms of potassium and its distribution. The water soluble K, Exchangeable K, non-exchangeable K and lattice K contributed 0.23, 2.87, 8.97 and 87.81 per cent of total K, respectively. From the mean values, highest water soluble K, exchangeable K, non-exchangeable K, lattice K and total K were noticed in Vertisols followed by Inceptisols and Entisols. The water soluble k and exchangeable K were found higher in surface layer than sub-surface layer. There was no any specific trend noticed with respect to depth wise distribution of different forms of potassium. These representative soil series of Sub-montane zone of Maharashtra were categorized as medium to high in status for non-exchangeable K and low to moderate in status for total K.

Key words: Water soluble K, exchangeable K, non-exchangeable K, lattice K, total K and Sub-montane zone

Potassium is one of the three major plant nutrient elements. Its importance in Indian agriculture has increased with intensification of agriculture. Potassium is an essential nutrient element for all living organisms including plants and animals. It is a univalent cation found in the largest concentration in the plant cell sap and so it is called a “master cation”. Potassium is ionic (K⁺), free (not bound to any constituent) and mobile in plants. Potassium plays a vital roles in enzyme activation, water relations (osmotic regulation), energy relations, translocation of assimilates, photosynthesis, protein and starch synthesis (Mengel and Krikby, 1987). Over sixty enzymes require K for their activation. In soils, potassium exists in different forms viz. water soluble, exchangeable, and non-exchangeable and lattice potassium. The water soluble and exchangeable together constitutes the plant available potassium. The information on vertical distribution of potassium in agricultural soils is important because it indicates the distribution of potassium with respect to depth of soils. It can indicate the depletion as well as accumulation pattern of potassium, if any within the profile. The present studies were, therefore, undertaken to evaluate the distribution of different forms of K for the representative soil series of Sub-montane zone of Maharashtra.

MATERIALS AND METHODS

Horizon-wise twelve profile samples from representative soil series of order Entisols, Inceptisols and Vertisols from agriculture college, Kolhapur and different research stations of Sub-montane zone of Maharashtra were collected. The collected soil samples were analyzed for different forms of K. Water soluble K was determined in a 1:5 soil: water extract (USSLS, 1954); exchangeable K by Knudsen et.al (1982); non-exchangeable K by boiling 1 N HNO₃ (Wood and De Turk 1941); lattice K was calculated by subtracting 1 N HNO3 extractable K from total K. Total K was determined by extracting soil with H₂SO₄, HClO₄ and HF mixture in platinum crucible at 220-225°C (Jackson 1973). Potassium estimation in the extracts was carried out with the help of a flame photometer.

RESULTS AND DISCUSSION

The horizon wise distribution of different forms of K in different soil series of Entisols, Inceptisols and Vertisols presented in the Table 1, 2 and 3.
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<thead>
<tr>
<th>Sr. No.</th>
<th>Horizon</th>
<th>Depth (cm)</th>
<th>Water soluble K mg kg(^{-1})</th>
<th>% of Total K</th>
<th>Exchangeable K mg kg(^{-1})</th>
<th>% of Total K</th>
<th>Non-Exchangeable K mg kg(^{-1})</th>
<th>% of Total K</th>
<th>Lattice K mg kg(^{-1})</th>
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Table 1: Forms of K of Entisol soil series
Table 2: Forms of K of Inceptisol soil series

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<th>Sr. No.</th>
<th>Horizon</th>
<th>Depth (cm)</th>
<th>Water soluble K mg kg⁻¹</th>
<th>% of Total K</th>
<th>Exchangeable K mg kg⁻¹</th>
<th>% of Total K</th>
<th>Non-Exchangeable K mg kg⁻¹</th>
<th>% of Total K</th>
<th>Lattice K mg kg⁻¹</th>
<th>% of Total K</th>
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<td>% of Total K</td>
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Table 3: Forms of K of Vertisol soil series
The average mean value of water soluble K in different pedons is 11.57 mg kg\(^{-1}\). It contributed 0.23 percent of total K. In general, most of the soil series showed comparatively higher water soluble K in surface horizon than sub-surface horizon. This variation might be due to nature and intensities of cropping pattern, clay content, weathering stages of K bearing minerals and organic matter content in soil. Similar results were reported by Subba Rao et al. (1991) and Raskar and Pharande (1997). The average mean value of exchangeable K in different soil series was 150.47 mg kg\(^{-1}\) and it contributed 2.87 per cent of total K. The exchangeable K status in surface horizon was comparatively higher than sub surface horizons. The higher exchangeable K status of surface layer could be due to application of K fertilizers, crop residue, high organic carbon content and higher biological activities. These findings corroborated with the results observed by Raskar and Pharande (1997) for black soils of Maharashtra. The average mean value of non-exchangeable K in different soil series was 457.63 mg kg\(^{-1}\) and it contributed 8.97 per cent of total K. Most of the soil series showed comparatively low non-exchangeable K status in surface horizon than subsurface horizon. As per the categorization proposed by Subba Rao et al. (1993) for non-exchangeable potassium reserve in all the soil series showed medium to high in non-exchangeable K status. The medium content of non-exchangeable K-status might be due to low content of K bearing minerals such as muscovite, biotite and illite in clay fractions. The higher status of non-exchangeable K in some soil series might be due to higher pedochemical weathering of K bearing minerals in soil and transformation into illite and vermiculite. The values of non-exchangeable K obtained were in agreement with those reported by Bhosale et al. (1992). The average mean value of lattice K in different soil series was 4454.55 mg kg\(^{-1}\) and it contributed 87.81 per cent of total K. The lattice K values of different soil series was low in surface horizon than sub surface horizon. The average mean value of total K in different soil series was 5100 mg kg\(^{-1}\). Surface horizon of most of the soil series showed lower total K than sub surface horizon indicating pedochemical weathering of K bearing in surface horizon than subsurface horizons. On the basis of total K status proposed by Subba Rao et al. (1993), from the mean values, it was observed that the total K content of Vertisols and Inceptisols soil order were medium. Whereas, the soil series of Entisols soil order was low to medium in total K status. The values of total K were in agreement with the values reported by Kadrekar and Kibe (1972), Murthy (1988) and Sharma and Dubey (1988).

**CONCLUSION**

The present study revealed considerable variation in the distribution of different forms of K in the horizons of the different soil samples collected from the representative soil series of sub-montane zone of Maharashtra. The study pointed out the need of integrated use of organic manures and K fertilizers for ensuring steady supply of K to crops to sustain production in the long run.

**REFERENCES**


