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Characteristics and genesis of sodic soils of Indo-Gangetic plains and vertisols of Purna valley, Maharastra

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ABSTRACT

This study was conducted to establish a relation between depth distribution pattern of total Na-content of soil/soil separates with exchangeable sodium percentage and its relevance in formation of sodic soils of Indo-Gangetic Plains (IGP) and Vertisols of Purna Valley. Experimental study on the release of alkali and alkaline earth cations indicates that in both the soils cumulative amount of Ca release was more than Na. The elemental analysis of both soils showed that Na_2O content of soil separates increased down the depth, likewise CaO and MgO content in general indicating weathering of minerals was maximum at the surface of the soils. The released cations move downward in the profile where ca and Mg get precipitated as carbonates which increases the concentration of Na and ultimately the ESP in the subsurface horizons which impairs the hydraulic conductivity of sub-surface horizons. Due to poor hydraulic conductivity the leaching become restricted and as a result ESP increases up in the profile. The depth distribution of ESP with depth in sodic alluvial and black soils indicates sodiumisation is at the initial stage in black soils while it is at its peak in soils of IGP.

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Key words : Sodic soils, ESP, Vertisols, Indo-Gangetic Plains

INTRODUCTION

The vertisols and associated soils constitute a major soil group in India. Despite the high potential these soil pose the problem of poor internal drainage, which is caused due to high clay content, ESP, EMP and Pedogenic carbonate. According to estimate of Abrol and Bhumbla (1971) there are about 7 m ha area are salt affected of which 2.5 m.ha represents alkali soils in north-western part of India in the states of Punjab, Haryana and Uttar Pradesh forming a part of Indo-Gangetic Plains.

A recent study by Pal *et al.* (2001) indicates that the semiarid climate is the prime factor responsible for starting the pedogenic process which results in the depletion of Ca^{2+} ions from the soil solution in the form of $CaCO_3$ and also in the simultaneous increase of both SAR and ESP with depth in Vertisols of the Purna Valley Maharashtra. The depth distribution of ESP in sodic soils of IGP indicates that the process of sodiumisation begins at the surface of the profile. Sodiumisation of deeper horizons remains relatively low and is most likely brought about by the illuviation of sodium saturated and highly deflocculated clay particles as well as limited leaching of alkali salt solutions. This contrasting depth distribution apparently suggests that the weathering of minerals is maximum at the surface of the Indo-Gangetic plain while it is in the downstairs in Vertisols of the purna valley. In both the soils sodicity developed through a process other than ground-water and reduction of sulphate ions under anaerobic conditions (Bhargava and Bhattacharjee, 1982). Under these conditions the only possibility would be the release potential of Na ions of the minerals.

In view of above, the present study was undertaken to establish a relation between depth distribution pattern of total Na content of soil/soilseparates with exchangeable sodium percentage and to assess the role of minerals in formation of sodic soils.

MATERIALS AND METHODS

Two deep black soils (=100cm) from Purna valley Maharashtra and two pedons of alluvial soils from Indo-

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