

## Tackling salinity in Indian vertisols for food security

Land degradation is a serious menace to food security. Salinity-related land degradation is becoming a serious challenge to food and nutritional security in developing countries. Order vertisols has problem of salinity throughout the country. The vertisols and their associates cover nearly 257 m ha of the earth's surface, out of which about 72 m ha occurs in India<sup>1</sup>. This shows that nearly 22% of the total geographical area of the country is occupied by vertisols. In the central region of India, known as the Deccan Plateau, the soils are derived from weathered basalts mixed to some extent with detritus from other rocks. In other areas, particularly in the south, soils are also derived from basic metamorphic rocks and calcareous clays. Similarly, in the western region, these are derived from marine alluvium that accounts for nearly 19.6 m ha. Out of this about 1.12 m ha is affected by salinity and waterlogging problems<sup>2</sup>. These soils are generally deep to very deep, heavy-textured with clay content varying from 40% to 70%. Further, these are also low in organic carbon content, high in cation exchange capacity, slight to moderate in soil reaction and are generally calcareous in nature. Vertisols, when kept fallow during kharif season are exposed to soil erosion hazards. Because of their inherent physico-chemical characteristics such as poor hydraulic conductivity, low infiltration rate, and narrow workable moisture range, deep and wide cracks pose serious problems even at low salinity level. However, the vertisols of Baratract, Gujarat, are generally very deep (150–200 cm), fine-textured with clay content ranging from 45% to 68%, with montmorillonite-dominant clay minerals. The soils exhibit high shrink and swell potential and develop wide cracks of 4–6 cm

extending up to 100 cm depth. The soils are calcareous in nature having calcium carbonate ranging from 2% to 12% in the form of nodules, 'kankar' and powder. In general, they exhibit alkaline reaction. In the recent past, the Sardar Sarovar Irrigation Project with a target to providing irrigation for about 1.8 m ha of command in Gujarat has been established. The groundwater quality in this region is highly saline in about 90% of the area<sup>2</sup>. The salinity varies from 2 to 117 dS/m, with a mean of 30.7 dS/m. The use of such high-salinity water either directly or in conjunction with canal water for crop production is thus limited. The salts in the sub-soil are prone to mobilize to the upper surface with rising groundwater table. Conditions are favourable for secondary salinization if irrigation is practised in the traditional way<sup>2</sup>. The major approach for salinity management in this region will need to focus on the prevention of rise in salinity, rather than salinity reduction alone. Rainfed farming systems with *in situ* and *ex situ* rainwater conservation, harvesting, storage, recycling and tapping of perennial flows and augmentation of groundwater for supplemental irrigation are some of the strategies for boosting agricultural productivity of vertisols in arid and semi-arid regions. Another option is biosaline agriculture in these soils. A large number of medicinal, aromatic, oil-yielding and petro crops have been identified which can be cultivated with saline-water irrigation<sup>3,4</sup>. Some of the promising crops include *Salvadora*, *Matricaria*, dill (*Anethum graveolens*) and grasses like *Aeluropus* and *Dichanthium*. More efforts are required to prevent irrigation-induced salinity in the vertisols. Once such soils are salinized, these will require huge investment for reclamation. Vertisols

need special soil and crop management practices for sustainable crop production. Cotton is the dominant crop grown in the *kharif*, followed by sorghum and pearl-millet. Pigeon pea is also grown in some areas. Mostly rainfed *kharif* crops are grown in these area. In the *rabi* season the land is either kept fallow or some fodder sorghum is grown on residual moisture. Alternate ridges and furrows are the commonly used layout in the vertisols and associated soils of India. Managing salinity of such soils is not only helpful for sustainable crop production, but also provides food security and socio-economic development to the farming communities in such areas. Sustainable development in salt-affected vertisols and degraded land areas needs special programmes for improving the productivity and quality potential of crops and cropping systems.

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