Excessive salts in the soil removed with gypsum, organic matter

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A new study reports that there is a more affordable way of addressing excessive salts in soil. Credit: Ananth BS (https://commons.wikimedia.org/wiki/File:India_Farming.jpg), CC BY 2.0

Wheat and rice farming on the vast Indo-Gangetic plains, affected by excessive salts in the soil, can be cost-effectively improved by treatment with gypsum and organic manure followed by sowing with salt-tolerant crop varieties, a study says.

Published last month in *Agroecology and Sustainable Food Systems*, the study says that India has 2.8 million hectares of land, mostly in the Indo-Gangetic alluvial plains, that are 'sodic' and that can be recovered by treating it for excess sodium.

Sodic soils restrict the movement of water and air in the soil, affecting the growth of plants. Associated problems include shallow wetting zones, temporary waterlogging and diminished water storage in the root zone, researchers behind the study explain.

Globally, more than 833 million hectares of land have salt-affected soils, especially in the arid or semi-arid environments of Africa, Asia and Latin America, according to the Food and Agriculture Organization (FAO). Between 20 and 50 percent of irrigated soils are too salty, leaving more than 1.5 billion people worldwide to face challenges caused by soil degradation.

Currently, soil remediation of sodic soils in India relies on the addition of 50 percent gypsum followed by cultivating traditional varieties of rice and wheat on the land. But, this is increasingly unaffordable for smallholders who farm on the upper Indo-Gangetic plains which extend over 150,000 square kilometers.

Each hectare of sodic soil requires 12 to 16 tons of gypsum for remediation which, at US$60 per ton, is beyond the reach of small and marginal farmers (those having less than one hectare of land), the study says. The researchers estimated that 60 percent of the total cost of reclamation goes towards gypsum—a mineral which is becoming scarce

because of demand for non-agricultural uses.

According to the study, conducted in the Hardoi district on the Indo-Gangetic plains of Uttar Pradesh state, treatment using 25 percent gypsum, 10 percent magnesium and pressmud (organic fertilizer made from sugar cane residue), followed by sowing with salt-resistant varieties of wheat and rice, doubled crop productivity.

India, a major sugarcane grower, produces about 12 million tons of pressmud annually. Pressmud contains nutrients, organic matter and high amounts of calcium sulfate, which supplies calcium directly to the soil to replace excess sodium.

Vinay Kumar Mishra, an author of the study and director of the Indian Council of Agricultural Research's laboratory complex at Barapani, in Meghalaya state, tells SciDev.Net that accumulation of salts in soils is a major challenge for food production in vast areas and reclamation of soils too expensive for small and marginal farmers.

"Adopting a scientific practice which regains the agricultural potential of sodic soils and improves smallholder food security through integration of gypsum, pressmud and salt-tolerant varieties of rice and wheat is useful and suitable to farmers," Mishra said.

K.C. Jisha, assistant professor in plant physiology at the Muslim Education Society College, in Kodungallur,Kerala and a researcher on soil chemistry, said that sodic soils have higher concentrations of sodium than saline soils which must be treated if they are to support agriculture efficiently.

"Saline soils causes a 'chemical drought' in soils but not sodic soils which can work to cause water-logging. Soil sodicity is easier to correct than high salinity levels in the soil but management of salinity and sodicity

becomes complicated when both occur in the same soil together," Jisha told SciDev.Net.

Out of 584 Indian districts 194 have either saline or sodic soils and a large proportion of affected lands are cultivated by smallholders who rely on marginal farming for their food and feed needs. Alternate wet and dry seasons and the general topography exacerbate problems caused by sodicity and salinity, Jisha said. Salinity is particularly problematic in the deltaic region of the Ganga shared by India and Bangladesh.

Soils turn sodic or saline from natural causes, intensive farming, poor drainage and limited availability of irrigation water. During the wet season, salts accumulate in the low-lying areas and in the dry season they concentrate due to high evaporation of water, resulting in increased sodium ions in the soil.

According to the authors, the benefits of the Hardoi study can be extended immediately to the salt-affected areas of the Ganges mega deltas in India and Bangladesh.

More information: Y.P. Singh et al, Regaining the Agricultural Potential of Sodic Soils and Improved Smallholder Food Security through Integration of Gypsum, Pressmud and Salt Tolerant Varieties, *Agroecology and Sustainable Food Systems* (2021). DOI: 10.1080/21683565.2021.2015735

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