



Amelioration of salt affected soils

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Received: May, 2023; Revised: May, 2023 Accepted: May, 2023

Abstract

Soil amelioration is the part of the overall land amelioration. It is usually labour and cost intensive and thus in many cases uneconomical. Salinization of the soil is one of the most constrains to food security. Salt deposition in the soil is a natural process however anthropogenic activities such as improper agricultural practices, poor drainage system and ineffective water management have accelerated the process

of salinization. For the reclamation of saline and alkaline soils such as leaching, growing green manure crops, subsurface drainage, use of gypsum, use of pyrite and other organic materials such as FYM etc. are used. Salt affected soils are carry poor physical properties and fertility problems that adversely affect the yield and growth of crops.

Introduction

Saline – alkaline soils are characterized by a important amount of soluble salts and sodium in the soil solution and CEC (cation exchange capacity), high pH due to the soluble carbonates. Soil salinity can be measured by the Ec (Electrical conductivity) of soil solution and sodicity by the ESP (Exchangeable sodium percentage) and the SAR (Sodium absorption ratio) is used to determine the presence of Na^+ in soil solution and in irrigation water. Alkaline soils are developed due to excess NaCO_3 and

NaHCO_3 ions in soil. Alkaline soils have toxicity of boron, Mo and sodium nutrients. Alkaline soils have pH of greater than 8.5 and Ec is less than 4 dS/m. ESP (exchangeable sodium percentage) of alkaline soil is greater than 15. In alkaline soils we should use calcium ammonium nitrate (CAN) or DAP fertilizers instead of urea. Saline soils have pH less than 8.5. Saline soils having a electrical conductivity of saturation extract more than 4 dS/m and ESP is less than 15. Saline soils are called white alkali soils or solon chalk.

Identification of saline and alkali soils

Saline soil- Saline soils can be identified in the field by the uneven growth of crops and the presence of white salts crusts on the soil surface. In cereals or forage crops grown in saline soils barren spots and stunted plants may appear .In saline soils occur accumulation of soluble salt i.e. Cl and SO_4 ions of sodium, calcium and magnesium in root zone. Sensitive crops lose vigor in saline soils, generally most crops suffer from saline soils and in highly saline soils only salinity tolerant crops can survive. The white crust layer formed on the soil surface due to salts. The saline soils are also known as white alkali or solan chalk. The soluble salt concentration present in saline soils is more than or equal to 0.1 percentage.

Alkali soil - The alkaline soils are also known as solonetz. They are also called black alkali soils, it is mainly due to higher pH, NaCO_3 and NaHCO_3 ions in soil. The finely decomposed organic matter is dissolved along with the water or soil solution that impart a dark black colour to the soil. In arid and semi-arid areas salt formed during weathering process are not completely leached. High exchangeable Na refuses the availability of calcium, magnesium to plants. Mostly Barley, Sugarcane, Mustard, Rice, Maize, Bajra, Sorghum, Tomato, Cabbage Banana, guava etc. crops are suitable for cultivation in alkaline soils.

Management of Saline soils

Leaching: Leaching is done with good quality of water through irrigation or rain is the practical way to remove excess salts from the saline soils. Leaching is effective if drainage facilities are available, as this will reduce the water table and remove the

salts by draining the salt rich effluent. The concentration of soluble salts in saline soils increases with evaporation and may also lead to salt precipitation. The goal of salt leaching is to remove the solutes from the upper layers of the soil.

Addition of organic amendments

The application of organic amendments (FYM) to saline soils is promising for soil chemical amelioration such as Na^+ leaching, which decreases the ESP and EC of the soil. Application of crop residues and other organic materials have got a tremendous effect on maintaining soil physical, chemical and biological properties of saline soils. Amendments derive from agriculture such as farm yard

Management of alkaline soils

Reclamation of alkaline soil needs removal of most of the exchangeable sodium, development of the soil physical structure and lowering of the soil pH. To replace exchangeable Na^+ by Ca^{++} and thus released Na^+ salt be leached out of root zone.

Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$): It is a sedimentary mineral. It is very important for the management of alkaline soil. Gypsum is slightly soluble in water. So gypsum should be applied well in advance. Gypsum is a good source of sulphur, calcium for plant nutrition and it replaces Na and leached downward and out of reach of plant roots. 8 qt. of gypsum per hectare is sufficient enough to reclaim one hectare soil. For every 1 m. e. of exchangeable sodium per 100 gm of soil @ 1.7 tons of

Conclusion

There are different types to reclaim salt-affected soil, which include leaching, application of organic amendments, gypsum, pyrite and salt scraping. Salt leaching is the most significant method among the above strategies. However, its

manure, green manure crops are used for the reclamation of Saline soils.

Salt scraping: Saline soils can be ameliorated by salt scraping to remove the salt crust so that plants can re germinate. Salt scraping must be followed by leaching to remove salts including Na^+ from the root zone, and in moderate saline-sodic conditions, applying Ca^{++} amendments to replace exchangeable Na^+ .

gypsum /acre is to be applied. About 25% less gypsum may be applied 10-15 t/ha FYM (farm yard manure) along with gypsum, salt tolerant rice variety and salt tolerant wheat variety can also be grown successfully by using gypsum @ 25% gypsum requirement.

Pyrite (FeS_2): Application of pyrite as an amendment is a modern development in the chemical reclamation in alkaline soil. Pyrite @12 Qt/ha Used for the reclamation of alkaline soil.

Green manure: Crops such as Dhaincha (*Sesbania acqualata*) can be grown up to flowering stage and incorporated into the soil it helps to the amelioration of alkaline soil. For the amelioration of alkaline soils paddy straw can be used.

potency depends on soil physico-chemical conditions and climatic conditions of the site. Use of gypsum, pyrite and Green manure is the most significant amendments for the reclamation of alkaline soil.



Saline soil



Alkali soil