Agricultural Reviews, 39(1) 2018 : 86-88
Print ISSN:0253-1496 / Online ISSN:0976-0539

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com

Coastal saline Soils of India: A review

V. Sabareshwari*[1] and A. Ramya

Department of Environmental Science,
Tamil Nadu Agricultural University, Coimbatore-641 003, Tamil Nadu, India.
Received: 24-10-2017 Accepted: 02-12-2017 DOI: 10.18805/ag.R-1768

ABSTRACT

Coastal region covers a long strip along the east coast (West Bengal, Orissa, Andhra Pradesh, Pondicherry and Tamil Nadu) and west coast (Gujarat, Maharashtra, Karnataka and Kerala). Salinity is mainly due to the presence of saline ground water at shallow depth and frequent sea water inundation in the low lying areas. Sea water intrusion into the aquifers may be direct, but also range of complex geochemical processes like, inter-aquifer mixing, mobilization of brines, water-rock interaction and anthropogenic contamination. NaCl and Na_2SO_4 are the dominant salts, with abundance of soluble cations in the order of Na>Mg>Ca>K. The salt reaches the soil surface through capillary rise during dry season and makes the soil saline and unproductive for agriculture. Salinity ranges 0.5 dSm^{-1} in monsoon and 50 dSm^{-1} in summer. Proper understanding about the nature, properties and prevailing constraints related to diverse group of coastal soils is necessary to undertake better management practices to improve the productivity and quality of such low productive salty soils.

Key words: Coastal salinity, Sea water intrusion, Soluble salts, Technologies adopted.

INTRODUCTION

Soils which contain excess soluble salts that affect plant growth adversely are called as salt affected soils. All soils contain some of amount of soluble salts. If the soil dominated by NaCl and Na_2SO_4 , the soil is said to be saline soil. Salinity range of coastal area (EC) ranges from 0.5 dSm^{-1} in monsoon to 50 dSm^{-1} in summer. If the quantity of soluble salts in a soil exceeds a particular value, the growth and yield of the crops was affected adversely, the extent depending on the kind and amount of salts present. The salt reaches the soil surface through capillary rise during dry season and makes the soil saline and unproductive for agriculture (Prasenjit Ray *et al.,* 2014). Mostly NaCl followed by Na_2SO_4 are the dominant soluble salts, with abundance of soluble cations in the order of Na>Mg>Ca>K.

In coastal areas, salinisation can be associated with the over exploitation of groundwater caused by the demands of growing urbanization, industry and agriculture. Over extraction of groundwater can lower the normal water table and lead to the intrusion of marine water. Natural disasters in coastal areas, such as tsunamis, can cause severe salinisation problems. Originating from geological weathering, the salts are transported and accumulated in the profile as result of water movement. There are several mechanisms by which water trapped in sedimentary rocks can be altered into saline water. In many areas, saline and fresh subsurface waters exist in close proximity. When fresh groundwater is pumped from aquifers that are in hydraulic connection with seawater, the change in gradients as a result of pumping may result in a flow of salt water from the sea towards the well.

Development of salinity not only deteriorates the quality and quantity of produce and limits the choice of cultivable crops, many a times there may be land which may go out of cultivation, so the management technology adopted must be beneficial, cost effective and sustainable manner (Dhanushkodi *et al.,* 2012). Salt tolerant conventional and non-conventional tree, shrubs and herbs are also adopted called Bio-saline agriculture.

Upconing: Upconing refers to a situation where a well, located close enough to saline water underlying freshwater, is pumped at a rate sufficient to cause the salt water to be drawn into the well in an upward shaped cone or mound. It has been estimated that in the USA over two-thirds of the continental area are underlain by saline groundwater that could intrude on freshwater supplies as a result of up coning.

Effect of soil salinity: In general salinity causes stunted growth of plants. There are several reports that salinity increased the concentration of N, P, Ca, Mg and Na and decreased the concentration of K in shoot. In grains the salinity increases the concentration of Na and decreases the concentration of P but did not affect the concentration of N, K, Ca and Mg. Water and nutrient uptake by plants gets interrupted. Due to high concentration of salt on soil, the microbial growth gets limited, since higher salt concentration

*Corresponding author's e-mail: sabareeshwaris99@gmail.com
[1]Department of Soil Science, TamilNadu Agricultural University, Coimbatore-641 003, Tamil Nadu, India.

in soil solution the osmotic irregularity was observed, finally the plants get wilted and dried. Spikelet sterility in rice was noticed in saline soil.

MANAGEMENT TECHNOLOGIES

Drainage: Drainage is the primary method of controlling soil salinity. The system should permit a small fraction of the irrigation water (about 10 to 20 percent, the drainage or leaching fraction) to be drained and discharged out of the irrigation project. In irrigated areas where salinity is stable, the salt concentration of the drainage water is normally 5 to 10 times higher than that of the irrigation water. Salt export matches salt import and salt will not accumulate.

Subsurface drainage: Continuous line of tiles (pipes) laid at a specific depth. The tiles are buried conduits with open joints or perforations which collect and convey drainage water to sub mains and mains. These mains further convey the water to an outlet of a collector from where water is pumped out for irrigation.

Leaching : As a hydro-technical method of reclamation, leaching is the removal of soluble salts beyond the root zone, especially in shallow rooted crops. The amount of water used for reclamation of saline soils depends on degree of soil salinity, quality of irrigation water, the soil depth to be reclaimed and the water application techniques. The process of leaching was successful in the depth of 0-10 cm by means of maximum leaching of salts by Mahendran, (2007). The other management technologies are,

1. Selection of tolerant varieties
2. Use of organic matter
3. Use of mulch
4. Foliar application of fertilizers
5. Fertilizer management
6. Integrated nutrient management
7. Phytoremediation
8. Green manures & green leaf manure
9. Strip cropping (Manjunath, 2016, Naik, 2014 and Quadir, 2005)

Saline tolerant varieties released by CSSRI, Karnal

Crop	Variety
Rice	Saline Soil: CSR-49, CSR 36, CSR 30 (basmati type), CSR 27, CSR 23, CSR 13 and CSR 10. Coastal saline soil: Butnath (CSRC(S) 5-2-2-5) and Sumati- CSRC
Wheat	KRL 213, KRL 210, KRL 19 and KRL 1-4
Indian Mustard	CS 56, CS 54 and CS 52
Chick pea (gram)	Karnal Chana 1
Dhaincha (sesbania)	CSD 137 and CSD-123

Other management stratergies

1.Protective embankment 2. Provision of sluice gate on the embankment 3. Levelling of land 4. Storing of excess rainwater for irrigation 5. Keeping land covered in winter and summer months 6. Sand Dune

Skimming well technology: Traditional 'doruvu'**:** Shallow depth fresh water being collected in dug out conical pits locally called 'doruvus'. The seeped water is usually collected in pitchers and then splashed on vegetables flower plants, groundnut and nurseries of paddy, vegetables tobacco and casuarina etc. The water collected from a doruvu, that occupies an area of about 200 sq.m is just sufficient for irrigating an area of 800 sq.m. Maintenance of 10-12 such doruvus is a common practice for each hectare of land.

Radial skimming well (Improved doruvu technology): To overcome these constraints, the skimming well technology has been evolved by the All India Coordinated Research Project on Management of Salt affected Soils and Use of Saline water in Agriculture, Bapatla Centre of Acharya N. G. Ranga Agricultural University, popularly known as 'Improved Doruvu Technology' to skim the shallow depth fresh water in coastal aquifer without disturbing the hydro-dynamic conditions (Raghu Babu, 2004). The system consists of a collector well with lateral collector lines installed at shallow depth.

The collector lines are connected to the sump on either side and imbedded for the collection of lateral flow by digging a trench. Depending on the water table head above the collector pipes, the collectors are continuously charged with subsurface fresh waters throughout their length and water flow into the well under gravity. The recharge occurs due to precipitation, upstream canal seepage and also by recycling of irrigation water. As a result of this recharge, flow lines are sustained. The advantages of skimming well over the traditional doruvus is as follow: Over exploitation of ground water beyond the collector line depth is not possible, and it serves as control of saline ground water upconing problem (or) against sea water intrusion as commonly observed in lanka lands, the land wastage and water evaporation is avoided and can be used for productive purposes.

This technology effectively facilitates the adoption of modern irrigation systems like drips and sprinklers and helps in improving upon the water use efficiency. If properly planned and installed, the systems can be used to create irrigation source as well as to control watertable in the cultivable areas in the periods of submergence. With this system, sufficient water expected to be made available to rabi and plantation crops and effective usage of water through sprinkler and drip irrigation methods possible. The system also replaces the existing traditional 'doruvus'.

CONCLUSION

In India, Central Soil Salinity Research Institute (CSSRI) and several State Agricultural Universities have made significant contribution in the field of salinity research in agriculture but still many problems remains unanswered.

In order to answer all the challenges faced by the developing population, we the soil scientists must continuously contribute our energy for converting salty land to productive land with new innovations. Technology evaluation, transfer and impact assessment are the pivot on the success of any technological development, the same with better idea may be the thrust of future to achieve higher yield in sustainable agriculture.

REFERENCES

Dhanushkodi, V. and Subrahmaniyan, K. (2012). Soil management to increase rice yield in salt affected coastal soil. *Int. J. Res. Chem. Environ*., **2**(4): 1-5.

Mahendran, S. (2007). Technology development for saline water irrigation to increase the crop production in the coastal saline soils of Ramanathapuram district. CSRC. TNAU.

Manjunath, B.L., Gopal, R., Maharajan, R., Ramesh, R., and Singh, N. P. (2016). Effect of improved nutrient management on grain yield of rice and soil health under organic management. *Indian J. Agron*., **61** (1):25-32.

Naik, V.R., Patel, P.B., and Patel, B.K. (2014). Study on effect of different organics on yield and quality of organically grown onion. The Bioscan. **9** (4): 1499-1503.

Prasenjit Ray, Babu Lal Meena and Nath, C. P. (2014). Management of coastal soils for improving soil quality and productivity. *Pop. kheti*, **2**(1): 95-99.

Quadir, M., Noble, A.D., and Oster. (2005). Driving force for sodium removal during phytoremediation of calcareous sodic and saline sodic soil. *Soil Use and Management*. **21**:173-180.

Raghu Babu, M., Rajendra Prasad, B., and Srikanth, I. (2004). Subsurface skimming techniques for coastal sandy soils, Bulletin No. 1/04: 18pp., A I C R P Saline Water Scheme, Bapatla.

Vanathi, D. and Mohamed Amanullah, M. (2007). *Internat. J. Agric. Sci*., **3**(1): 39-42.