Lecture 4
Chemical Problem soils

Salt - affected soils

The salt-affected soils occur in the arid and semiarid regions where evapo-transpiration greatly exceeds precipitation. The accumulated ions causing salinity or alkalinity include sodium, potassium, magnesium, calcium, chlorides, carbonates and bicarbonates. The salt- affected soils can be primarily classified as saline soil and sodic soil. The state-wise distribution of salt affected soils in India is presented in the following table.

Saline soils

Saline soils defined as soils having a conductivity of the saturation extract greater than 4 dS m^{-1} and an exchangeable sodium percentage

Table - Extent and distribution of salt affected soils in India

(Area x1000ha)

States	Water logged		Salt affected area			Total
	Canal command	Total	Canal command	Outside canal	Coastal	
Andhra Pradesh	266	339	139	391	283	813
Bihar	363	363	224	176	Nil	400
Gujarat	173	484	540	327	302	1214
Haryana	230	275	455	Nil	Nil	455
Karnataka	36	36	51	267	86	404
Kerala	12	12	NA	NA	26	26
Madhya Pradesh	57	57	220	22	Nil	242
Maharashtra & Goa	6	111	446	NA	88	534
Orissa	196	196	NA	NA	400	400
Punjab	199	199	393	127	Nil	519
Rajasthan	180	348	138	984	Nil	1122
Tamil Nadu	18	128	257	NA	84	340
Uttar Pradesh	455	1980	606	689	Nil	1295
West Bengal	NA	NA	Nil	NA	800	800
Total	2190	4528	3469	3027	2069	8565

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less than 15 Saline soils defined as soils having a conductivity of the saturation extract greater than 4 dS m^{-1} and an exchangeable sodium percentage less than 15. The pH is usually less than 8.5. Formerly these soils were called *white alkali* soils because of surface crust of whitesalts.

Formation

The process by which the saline soil formed is called Salinization.Saline soils occur mostly in arid or semi arid regions. In arid regions saline soils occur not only because there is less rainfall available

to leach and transport the salts but also because of high evaporation rates,which tend further to concentrate the salts in soils and in surface

waters.

Major production constraints

Presence of salts leads to alteration of osmotic potential of the soil solution. Consequently water intake by plants restricted and thereby nutrients uptake by plants are also reduced. In this soil due to high salt levels microbial activity is reduced. Specific ion effects on plants are also seen due to toxicity of ions like chloride, sulphate, *etc.*

Management of saline soils

The reclamation of saline soils involves basically the removal of salts from the saline soil through the processes of leaching with water and drainage. Provision of lateral and main drainage channels of 60 cm deep and 45 cm wide and leaching of salts could reclaim the soils. Sub-surface drainage is an effective tool for lowering the water table, removal of excess salts and prevention of secondary salinisation. of ions like chloride, sulphate, *etc.*

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Irrigation management

Proportional mixing of good quality (if available) water with saline water and then using for irrigation reduces the effect of salinity. Alternate furrow irrigation favours growth of plant than flooding. Drip, sprinkler and pitcher irrigation have been found to be more efficient than the conventional flood irrigation method since relatively lesser amount ofwater is used under these improved methods.

Fertilizer management

Addition of extra dose of nitrogen to the tune of 20-25% of recommended level will compensate the low availability of N in these soils. Addition of organic manures like, FYM, compost, etc helps in reducing the ill effect of salinity due to release of organic acids produced during decomposition. Green manuring (Sunhemp, Daincha, Kolingi) and

or green leaf manuring also counteracts the effects of salinity.

Crop choice / Crop management

Crops are to be chosen based on the soil salinity level. The relative salt tolerance of different crops is as follows:

Relative tolerance of crops to salinity

Plant species	Threshold salinity (dS m^{-1})	Plant species	Threshold salinity (dS m^{-1})
Field crops		**Vegetables**	
Cotton	7.7	Tomato	2.5
Sugarbeet	7.0	Cabbage	1.8
Sorghum	6.8	Potato	1.7
Wheat	6.0	Onion	1.2
Soybean	5.0	Carrot	1.0
Groundnut	3.2	**Fruits**	
Rice	3.0	Citrus	1.7
Maize	1.7	-	-
Sugarcane	1.7	-	-

Soil / cultural management

Planting the seed in the centre of the raised bed / ridge may affect the germination as it is the spot of greatest salt accumulation. A better salinity control can be achieved by using sloping beds with seeds planted

on the sloping side just above the water line. Alternate furrow irrigation is advantageous as the salts can be displaced beyond the single seed row. Application of straw mulch had been found to curtail the evaporation from soil surface resulting in the reduced salt concentration in the root zone profile within 30 days.