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RESEARCH ARTICLE

CHARACTERIZATION OF SOIL FROM SEMI-ARID REGIONS

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ABSTRACT

During the present investigation, soil from different villages of Jaipur district in Rajasthan was tested. Soils of two depths viz 0-15 cm and 15-30 cm were tested. Surface soil samples (0-15 cm) showed the pH ranging from 8.2 to 10.2 and sub-surface soil samples (15-30cm) showed pH ranging from 8.0 to 10.0 showing characteristic of alkali soils. The EC of 9 soil samples was less than 1 mmhos/cm. One soil sample showed EC more than 1 mmhos/cm. Organic carbon percentage was low in all the 10 soil samples. Available Phosphorus and potash ranged from medium to high in these soil samples.

INTRODUCTION

Salinity is one of the most severe environmental factors limiting the productivity of agricultural crops. Most crops are sensitive to salinity caused by high concentration of salts in the soil. The cost of salinity to agriculture is estimated conservatively to be about US$ 12 billion a year, and is expected to increase as soils are further affected (Ghassemi *et al.,* 1995). Secondary salinization of agricultural lands is particularly widespread in arid and semi-arid environment where crop production requires irrigation schemes. At least 20% of all irrigated lands are salt affected with some estimates being as high as 50%. On the basis of both quantity and nature of salts present in the surface horizons, the salt affected soils have been grouped under two broad classes, viz. Saline and Alkali (Abrol and Bhumbla, 1978; Bhumbla and Abrol, 1979; Abrol and Gupta, 1990). Saline soils contain excess or neutral soluble salts, chiefly chlorides and sulphates of sodium, magnesium and calcium, in quantities sufficient to affect plant growth adversely. While alkali soils contain sufficient exchangeable sodium to affect the plant growth.

In India, around 90 million hectare of land is waste land out of which around 9 million ha is affected due to saline conditions (Singh, 1992). A large portion of this area is in Rajasthan under arid and semi-arid conditions. In Rajasthan, out of geographical area of 342 lac ha., salt affected lands occupy about 11.83 lac ha. out of which 3.42 lac ha. are non-culturable which needs special attention and situation specific technology for rehabilitation. Rajasthan soils have a calcareous hard pan approximately one to two meter below.

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The salt affected soils fall under 3 distinct classes - saline, saline - alkali and alkali soils. The salt problem is predominant in district Ajmer, Bhilwara, Chittorgarh, Jodhpur, Jaipur, Pali, Tonk, Bundi, Kota and Bharatpur etc. Salt affected lands are literally known as Lavania Bhumi. The word lavania is derived from "lavan" meaning salty. In Rajasthan these lands are called Usar or Kharda while the low lying areas having high concentration of salts as Rann. The soils of these lands are known as Khari, Luni or Rehi and if black in tone Telia (oily). Depending upon their genesis these have been classified as natural and secondary salt affected.

Natural salt affected

Basically most of the soils are mildly weathered and these contain reserves of water soluble salts, leading to primary salinization of soils as potential evapotranspiration is greater than precipitation.

Secondary Salt affected

Secondary salinization is caused due to irrigation with saline water (Anonymous, 1970). In the arid tract of Rajasthan, soils have limited potential for crop production. The most common features of the areas having saline or alkaline soils are the appearance of white or greyish white salt depositions on the upper crust during summers, the sterile and barren look with hard rock like surface devoid of any natural vegetation and poor drainage with muddy water standing for long periods. In semi-arid and arid conditions where precipitation is less than potential evapotranspiration salts formed during the weathering of soil minerals are not fully leached down. During the periods of higher rainfall the soluble salts are washed

Table 1: Analysis of soil samples collected from villages of Jaipur District

S. No.	Name of Village	Sample No.	Depth (cm)	pH	Conductivity	Carbon %	Phosphate kg/ha	Potash kg/ha
1.	Beelwa	1	0-15	10.2	0.48	0.12	H*	H*
		2	15-30	10.0	0.81	0.12	H*	H*
2.	Manpur Nangal	3	0-15	9.9	0.45	0.25	30	240
		4	15-30	9.8	0.60	0.21	37	160
3.	Malwa (A)	5	0-15	9.3	0.28	0.32	H*	270
		6	15-30	8.7	0.40	0.32	26	190
4.	Malwa (B)	7	0-15	8.2	0.59	0.34	H*	140
		8	15-30	8.0	0.60	0.27	H*	150
5.	Barkhera	9	0-15	8.4	0.64	0.09	H*	260
		10	15-30	8.6	0.85	0.25	34	H*
6.	Padampura	11	0-15	9.6	0.76	0.025	28	H*
		12	15-30	7.8	0.82	0.09	26	H*
7.	Baada Muksandpura	13	0-15	9.5	1.07	0.025	H*	210
	(A)	14	15-30	9.5	1.02	0.025	45	180
8.	Baada Muksandpura	15	0-15	9.5	0.56	0.12	38	220
	(B)	16	15-30	9.6	0.65	0.025	H*	190
9.	Baada Muksandpura	17	0-15	9.6	0.53	0.025	30	170
	(C)	18	15-30	9.3	0.50	0.09	H*	180
10.	Shivdaspura	19	0-15	8.9	0.40	0.23	H*	H*
		20	15-30	8.3	0.46	0.12	H*	280

H*- High

The fertility status of the above table has been categorized on the basis of following range of available nutrients in the soil

Fertility Status	NP_2O_5 (Kg/ha) (Organic Carbon)	K_2O (Kg/ha)
L	< 0.50%< 23	< 143

down from higher lying areas to the lower lying areas. Repetition of this process results in high salinity due to secondary salinization (Johari, 2002).

MATERIALS AND METHODS

Soil was collected up to the desired depth (0-15 cm and 15-30 cm) by means of spade or khurpi from 8 to 10 spots. The soil collected in this manner was thoroughly mixed by hand on polythene sheet and bulk reduced by quartering and about 400 g of composite sample retained. The soil was air dried and put in polythene bags with identification mark. The air-dry soil was passed through 2 mm sieve for analysis.

Soil test methodology

Chemical tests such as determination of pH (soil reaction), electrical conductivity, organic carbon and available phosphorus and potassium were conducted in the laboratory, which are known to have direct impact on the productivity of soil as well as fertility status.

RESULTS AND DISCUSSION

On testing the soil of depth 0-15 cm of 10 fields, maximum pH was found at Beelwa : 10.2, highest conductivity at Baada Muksandpura : 1.07, highest carbon percentage at Malwa (B) : 0.34, highest Phosphate (kg/ha) at Beelwa, Malwa (A), (B), Barkhera, Baada Muksandpura (A), Shivdaspura and highest Potash (kg/ha) at Beelwa Padampura and Shivdaspura. Minimum pH was recorded at Malwa (B) : 8.2, conductivity at Malwa (A) : 0.28, carbon percentage at Padampura, Baada Muksandpura (A&C) : 0.025, Phosphate (kg/ha) at Padampura : 28, Potash (kg/ha) at Malwa (B) : 140. Soils of depth 15-30 cm showed maximum pH at Beelwa : 10.0, conductivity at Baada Muksandpura (A) : 1.02 mmhos/cm, carbon percentage at Malwa (A), Phosphate at Beelwa, Malwa (B), Baada Muksandpura (B & C) and Shivdaspura. Minimum pH was recorded at Padampura-7.8, conductivity at Malwa (A) : 0.40 mmhos/cm, carbon percentage at Baada Muksandpura (A & B) : 0.025, Phosphate (kg/ha) at Malwa (A), and Padampura : 26 and Potash (kg/ha) at Malwa (B). (Table 1 & Fig. 1 & 2).

The depth of the soil indicated variation in the pH, conductivity, carbon, Phosphate & Potash. In all the cases, a decrease in pH indicated surface accumulation of salts due to high evapo - transpiration. An increase in conductivity from 0 - 15 cm to 15 - 30 cm depth at Beelwa, Manpur Nangal, Malwa (A), (B), Barkhera, Padampura, Baada Muksundpura (B) and Shivdaspura indicated that due to rain or irrigation water there was downward movement of the salts. Such movement was relatively poor or negligient in areas which had poor irrigation facilities. Surface layers showed greater carbon accumulation at Malwa (A) & (B) as compared to Barkhera. The sandy soils of Rajasthan are very poor in carbon. The Phosphate also increased in the lower profile at Manpur Nangal and Malwa (B) but it decreased at Barkhera, Malwa

(A), Padampura & Baada Muksandpura (A). No direct correlation of potassium could be established in soil although in general the decrease was recorded from Manpur Nangal, Malwa (A) & Baada Muksandpura (A &B). Apparently the variation in the distribution of minerals from pH and EC could be correlated with the availability of irrigation facilities from rainfall condition & cropping pattern. The toxic effects of salts in depressing plant growth come from two different sources, first rise in concentration of soil solution, as a result of which the flow of water into the plants by osmosis is reduced or reversed and physiological drought condition may occur even though the soil is moist and second, direct chemical effects of salts in disturbing nutrition and metabolism of plants and toxicity caused by specific ions. Growth retardation due to salinity may be related directly to the osmotic pressure to the soil solution and it was found to be largely independent of the kinds of salts present. The osmotic pressure rise with rise in concentration of soil solution with the result that the growth of plants was inhibited by non-availability of water. The proper characterization of soil suggests that Rajasthan soils are already high in phosphate and potash & there is no need to provide phosphate and potash in some villages. The nature of soil varies from alkaline to saline alkaline which affects the yield. We should use the tolerant crops in these regions. The present investigation suggests that there is a need for change in cropping pattern so that optimal utilization of agriculture resource could be made for a given climatic conditon.

REFERENCES

Abrol, I.P. and Bhumbla, D.R. 1978 : Some comments on terminology relating to salt-affectedd soils. Proc. Meeting of the sub-commission on Salt-affected Dryland Saline Seep Control, 11th Intern. Soil Sci. congre. Edmonton, 19-25.

Abrol, I.P. and Gupta, R.K. 1990 : Alkali soils and their management. In: Technologies for Wasteland Development. ICAR, New Delhi, pp 317-334.

Anonymous, 1970. Reclamation of Potential Water Table and Salinity Problems, Rajasthan Canal Soil and water Study Project, United Nations Development Project, Technical Report 36, 119 pp.

Bhumbla, D.R. and Abrol, I.P. 1979. Saline and Sodic Soils. pp. 719-38. (In) Soil and Rice Symposium, IRRI, Los Banos, Laguna, Phillipines, 20-23 Septemeber, 1977.

Ghassemi, F., Jakeman, A.J., and Nix, H.A. (1995) Salinization of Land and Water Resources. University of New South Wales Press Ltd., Canberra, Australia.

Johari, S.N. 2002. Problem of Salinity Alkalinity in the Indian Desert, Advances in Resource Management of the Indian Desert, 99-112.

Singh, N.T. 1992. Salt affected soils in India. Land and Soils, Har-Anand Publication, New Delhi, pp. 65-102.

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