

## CHANGES IN SOIL PROPERTIES AS INFLUENCED BY *PROSOPIS JULIFLORA* AND CROP COVERS IN SALT AFFECTED SOILS

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Salt affected soils are extensively distributed both on the coastal and inland areas of Gujarat. *Bhal* region located in the vicinity of Gulf of Khambhat consists of an area of 0.54 million hectares having wide ranging salinity and sodicity. *Prosopis juliflora* has been grown in semi-arid regions including the little Rann of Kutch. The plantation is getting momentum in recent years particularly on waste and marginal lands owing to grave energy crisis. Being a salt and drought tolerant tree its cultivation has opened a new horizon in agroforestry for potential utilization of waste and salt affected lands. Therefore a study was undertaken to findout the effect of *Prosopis juliflora* plantation and crops on the reclamation of saline-sodic soils.

*Prosopis juliflora* was planted in four replications in the year 1984 and simultaneously the crop viz cotton (*Gossypium arboreum*) and sorghum (*Sorghum vulgare*) were also separately grown with a bare land having clayey texture and other properties are given in Table 1. The soil samples from *Prosopis* planted plots were collected within 1 meter radial distance from the stem at the depths viz. 0-5, 5-15, 15-30, 30-45, 45-60 and 60-90 cm in absence of shallow saline aquifer whereas soil samples in regions of shallow aquifer was collected from four depths viz. 0-30, 30-60, 60-90 and 90-120 cm. The soil samples from bare land were also collected for comparison. The analysis of soil was carried out as per standard methods described in USDA hand book No. 60 (Richards 1954).

The data presented in Table 2 revealed that the E<sub>c</sub>e and p<sub>h</sub>e increased with the depth of soil and the salinity was higher in upper horizon of soil under *Prosopis* plantation as compared to fallow plot after post monsoon period. Subsequently, the differences in E<sub>c</sub>e and p<sub>h</sub>e between *Prosopis* plantation and fallow plot are completely nil for subsequent layers of profile. The probable mechanism operating in this situation is that the rate of upward movement of soil water is higher under *Prosopis* soil owing to moisture extraction by *Prosopis* lateral shallow roots in comparison to barren land. The soluble salts normally move with water stream. Thus rapid water

Table 1. Physico-chemical characteristics of soil (Typic chromusterts).

Characteristics	Depth of soil, cm			
	0-30	30-60	60-90	90-120
<b>(A) Physical</b>				
(i) Mechanical separates (%)				
Coarse sand	18.8	10.2	13.2	14.8
Fine sand	20.8	8.2	7.5	9.4
Silt	14.4	33.6	30.8	21.9
Clay	45.9	48.0	48.4	53.8
Texture	Clayey	Clayey	Clayey	Clayey
(ii) Infiltration rate, cm/hr	0.19	0.04	0.02	0.02
<b>(B) Chemical</b>				
EC <sub>e</sub> (dSm <sup>-1</sup> )	1.8	2.6	3.9	6.0
pH <sub>e</sub>	8.5	8.1	8.0	8.2
ESP	19.6	28.0	32.5	35.4
Lime (%)	6.2	6.5	7.9	8.0

Water table : 1 to 3 meter

Ground water : a. Salinity : 0.4 to 16 dSm<sup>-1</sup>

b. SAR : 1 to 62

Table 2. Effect of *Prosopis juliflora* plantation on chemical properties of soil in presence of shallow aquifer.

Depth of soil (cm) and date of sampling	Fallow		Under <i>Prosopis</i>	
	EC <sub>e</sub> dSm <sup>-1</sup>	pH <sub>e</sub>	EC <sub>e</sub> dSm <sup>-1</sup>	pH <sub>e</sub>
<b>7.12.84</b>				
0-30	1.83	7.7	1.92	7.7
30-60	2.66	7.8	2.73	7.8
60-90	2.35	7.0	3.29	7.8
90-120	3.98	7.9	4.23	7.9
<b>10.7.85</b>				
0-30	1.98	7.8	1.99	7.8
30-60	2.92	7.9	2.83	7.9
60-90	4.96	7.9	4.90	7.9
90-120	4.90	7.9	4.90	7.9

loss through evapotranspiration under plantation area develops steep upward gradient for water movement through soil capillaries carrying larger quantities of salts in upper horizons as compared to fallow plot for specified period under similar set of atmospheric and soil conditions.

The data on EC<sub>2.5</sub> showed (Table 3) that the total salt concentration decreased under *Prosopis* as compared to fallow and under crops at all the depths. EC<sub>2.5</sub> at surface decreased from 0.60 to 0.22 dSm<sup>-1</sup>. The pH<sub>2.5</sub> of soil also decreased from 8.4 to 7.6 upto 30 cm depth of soil sampling. After 30 cm depth, no decrease in pH<sub>2.5</sub> values were observed (Table 3).

Looking to the ESP values (Table 3) it decreased from 15.0 to 6.5 at 0-5 cm depth while decrease was from 18.5 to 7.0 at 6-15 cm depth.

Shah and Vora (1965) reported that *Prosopis juliflora* plantation decreased the salinity and sodicity considerably in absence of shallow saline aquifer. Similar result was also observed by Aggarwal et al. (1976). Sharma et al. (1990) observed increase in salt concentration while slight decrease in pH under tree cover as compared to bare soil.

The mechanism involved in the removal of salts from upper soil layers in absence of shallow aquifer may be that in summer months due to solar heat, the

Table 3. Effect of *Prosopis juliflora* plantation on EC<sub>2.5</sub> pH<sub>2.5</sub> and ESP of soil in the absence of shallow aquifer.

Sampling	Depth, cm					
	0-5	5-15	15-30	30-45	45-60	60-90
	Electrical conductivity (1 : 2.5)dSm <sup>-1</sup>					
July 87 F	0.60	0.40	0.45	0.52	0.87	2.66
P	0.45	0.29	0.34	0.45	0.94	2.23
Dec. 89 F	0.67	0.60	0.42	0.53	1.20	2.52
P	0.22	0.20	0.25	0.32	0.95	2.12
Oct., 89 S	0.34	0.31	0.60	0.49	0.65	1.70
	pH (1:2.5)					
July 87 F	8.4	8.5	8.5	7.5	7.6	7.3
P	7.7	7.6	7.6	7.5	7.4	7.3
Dec, 89F	8.2	8.2	8.3	8.6	8.6	8.9
P	7.5	7.5	7.6	7.6	7.6	7.8
Oct., 89 S	8.4	8.3	8.6	8.5	8.7	9.1
	Exchangeable sodium percentage (ESP)					
July 87 F	15.0	18.5	24.0	27.3	29.5	32.0
P	10.0	13.5	16.0	18.5	32.9	26.1
Dec. 89 F	9.0	13.0	16.7	20.0	23.2	25.0
P	6.5	7.0	8.5	13.5	16.8	20.5
Oct. 89 S	9.0	12.5	16.8	18.7	21.3	23.0

F — Bare soil

P — Under *Prosopis juliflora*

S — Under sorghum crop

salts generally rise to the ground by capillary fringe and accumulate on the surface. But in the case of soils under *Prosopis juliflora* the plant roots exert a marked influence on soil for their demand of water in dry months. As a result of this, the capillary rise is adversely affected.

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