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Appraisal of Soil Quality Status in Salt Affected Soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan

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ABSTRACT: A field based survey was conducted for appraisal of salinity and sodicity problems of soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan. Fifty seven composite surface soil samples (0-15 cm depth) were collected from the cultivated, irrigated fields during June, 2022 from thirty villages of Dhorimana and Gudhamalani tehsils. Twenty composite surface soil samples (0-15 cm depth) ten from each tehsil were also collected from adjacent cultivated, unirrigated fields on same time. The soil samples were analysed for various parameters by adopting standard methods and procedures. The majority of soils were belongs to sand to loamy sand in texture. Soils of the study area were found normal to alkaline in reaction, non saline and low in dehydrogenase activity. With respect to fertility, the organic carbon, available phosphorous and potassium were obtained low, low to medium and medium to high, respectively.

Keywords: Salt affected soils, Physico-chemical properties of soil, soil quality, Electrical conductivity, pH, Organic carbon, Barmer district etc

INTRODUCTION

The salt content of soil is closely related to salt content of irrigation water (Khandelwal and Lal 1991). Salinity affects almost all aspects of plant development including germination, vegetative growth, and reproductive development due to drought and high soil salinity, and harsh environmental conditions (Machado and Serralheiro 2017). Plants in salt-affected environments experience two types of stress, the osmotic stress and nutrient stress. The osmotic stress is due to low osmotic potential of water in saline soils which adversely affects water absorption by plants. Nutrient stress is due to both toxicity (Na, Cl, B) and deficiency of plant nutrients (N, Ca, K, P, Fe, Zn). It also results in nutritional imbalances. Soil sodicity significantly reduces phosphorus uptake by plants because phosphate ions precipitate with Ca ions (Bano and Fatima 2009). The enhanced Na absorption in sodic soils reduces K absorption which adversely affects the enzymatic activities involved in metabolic processes like photosynthesis and protein synthesis (Hauser and Horie 2010), which is detrimental for plant growth (Agarwal *et al.,* 2005). Reduced leaf area, chlorophyll content and stomatal conductance in salt-affected soils also affect photosynthesis (Netondo *et al.,* 2004).

Soil salinity already covers 20 percentage of the total cultivated and 33 percentage of the irrigated agricultural land worldwide (Srivastava and Kumar 2015). At global level out of the total 810 m ha salt affected soils, 376 m ha area comes under salinity and 434 m ha area comes under sodicity. In India 6.73 m ha and in Rajasthan 1.18 m ha of land is affected by salinity and sodicity (Sharma *et al.,* 2014). Salt affected soils occurs to a lesser or greater extent in all the districts of the state, however, their nature is location specific. The main contributing factors for soil salinization are the highly impregnated salty layer in the soil profile, saline ground water coupled with high water table depth, seepage from canals and other water bodies causing a rise in water table, restricted surface and subsurface drainage and intrusion of sea water into main land. In addition to these, considerable part of cultivated land is subjected to secondary and seasonal salinization due to irrigation with poor quality of ground water.

The periodically diagnosis and subsequent management of salinity and sodicity status of the soil is of vital significance. The detailed systematic information are not yet available about salinity and sodicity indices of the soils of the study area, which is essential for sustainable natural resource. Therefore, an urgent need was feel for extensive and well planned study both in the field and in the laboratory to suggest appropriate management practices for better utilization of soils of the tract.

MATERIALS AND METHODS

Geographically the district Barmer is situated between 24°58' to 26°32' N latitude and 70°05' to 72°52' E longitude. It having total eighteen tehsils, Dhorimana and Gudhamalani tehsils of Barmer district were selected for study area. Fifty seven composite surface soil samples (0-15 cm depth) were collected from the cultivated, irrigated fields during June, 2022 from thirty villages of Dhorimana and Gudhamalani tehsils. Twenty composite surface soil samples (0-15 cm depth) ten from each tehsil were also collected from adjacent cultivated, unirrigated fields on same time. Collected soil samples were subjected to various physical, chemical and biological parameters with adopting standard methods and procedures which were as follows.

Sr. No.	Soil Analysis		
1.	Soil texture	Hydrometer method	Bouyoucos (1962)
2.	pH	Soil pH was determined in 1:2 soil water suspension with the help of glass electrode pH meter	Richards (1954)
3.	EC	Soil EC was determined in 1:2 soil water suspension using standard precision conductivity bridge	Richards (1954)
4.	Organic carbon	Organic carbon was determined by Walkley and Black wet digestion method	Walkley and Black (1934)
5.	Available nutrients		
i.	Available phosphorous	0.5 M $NaHCO_3$ (pH 8.5) extractable P_2O_5	Olsen *et al.* (1956)
ii.	Available potassium	Neutral normal ammonium acetate extractable K using flame photometer	Metson (1956)
6.	Water soluble cations		
i.	Ca^{2+}, Mg^{2+}	Versenate titration method	Richards (1954)
ii.	Na^{+}, K^{+}	Flame photometry method	Richards (1954)
7.	Water soluble anions		
i.	CO_3^{2-}, HCO_3^{-}	Titration with standard H_2SO_4 (Method No. 12)	Richards (1954)
ii.	Cl^{-}	Titration with standard $AgNO_3$ (Method No. 13)	Richards (1954)
iii.	SO_4^{2-}	Using method by precipitation as barium sulphate (Method No.14)	Richards (1954)
8.	Sodium adsorption ratio	Calculated with the help of formula $SAR = \frac{Na^+}{\sqrt{\frac{Ca^{2+}+Mg^{2+}}{2}}}$ All the cations being expressed as me L^{-1}	Moghe *et al.* (1964)
9.	ESP	Calculated with the help of formula $ESP = \frac{100(-0.0126+0.01475\ SAR)}{1+(-0.0126+0.01475\ SAR)}$	Moghe *et al.* (1964)
10.	SSP	Calculated with the help of formula $SSP = \frac{Na^+}{Ca^{2+}+Mg^{2+}+K^{+}+Na^{+}} \times 100$	Richards (1954)
11.	Permeability index	Calculated with the help of formula $PI = \frac{Na^+ + \sqrt{HCO_3^-}}{Ca^{2+}+Mg^{2+}+Na^{+}} \times 100$	Doneen and Headerson (1960)
12.	Dehydrogenase activity	Colorimeteric determination of TPF	Casida *et al.* (1964)
13.	Chloride accumulation in soil	Calculated with the help of formula $Cls = 4.21\left(\frac{Clw.\,Sp}{R}\right)^2$ Where, Cls = Chloride accumulation in soil (me L^{-1}) Clw = Chloride accumulation of water (me L^{-1}) Sp = Saturation per cent of soil R = Mean Annual rainfall of the locality	Kovda *et al.* (1967)

RESULTS AND DISCUSSION

A. Physical parameters

(i) Particle size distribution. Based on sand, silt and clay contents, the soils of the study area have been classified as loamy sand and sand in texture. The sand, silt and clay content of irrigated and un- irrigated soils were ranged between 82.04 to 89.32, 2.02 to 6.06, 8.05 to 11.98 and 83.70 to 88.66, 2.26 to 5.52 and 8.22 to 11.64 per cent in Dhorimana tehsil and 82.95 to 89.94, 2.01 to 5.64, 8.01 to 11.89 and 83.70 to 90.00, 2.00 to 5.52 and 8.00 to 11.69 per cent in Gudhamalani tehsil, respectively. A perusal of data on particle size analysis of soils depicted that these soils have been formed most by from aeolian material and thus characterized as course textured. The results of present study get support from the findings of Bhuyan *et al.* (2014); Dhaka (2021).

Table 1: Physical parameters of irrigated soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

Tehsils	Relative proportion of soil separates (%)			Permeability index
	Sand (2-0.02mm)	Silt (0.02-0.002mm)	Clay (<0.002 mm)	
Dhorimana				
Range	82.04-89.32	2.02-6.06	8.05-11.98	81.67-138.93
Mean	84.38	4.75	10.87	92.44
C.V.	2.53	24.39	10.59	12.18
Gudhamalani				
Range	82.95-89.94	2.01-5.64	8.01-11.89	80.53-103.67
Mean	85.56	4.16	10.28	87.69
C.V.	3.03	28.81	14.86	6.02

Table 2: Physical parameters of unirrigated soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

Tehsils	Relative proportion of soil separates (%)			Permeability index
	Sand (2-0.02mm)	Silt (0.02-0.002mm)	Clay (<0.002 mm)	
Dhorimana				
Range	83.70-88.66	2.26-5.52	8.22-11.64	113.45-138.93
Mean	86.05	3.83	10.12	124.21
C.V.	2.03	24.5	10.84	7.33
Gudhamalani				
Range	83.70-90.00	2.00-5.52	8.00-11.69	99.02-149.07
Mean	86.99	3.45	9.56	115.90
C.V.	2.73	37.4	15.53	13.44

(ii) Permeability index. The permeability index of irrigated and un-irrigated soils were varied from 81.67 to 138.93 and 113.45 to 138.93 in Dhorimana tehsil and 80.53 to 103.67 and 99.02 to 149.07 in Gudhamalani tehsil, respectively. Being light textured soils of the studied area, the percolation loss of water is quite high and thereby irrigation efficiency is less. Therefore, reduction in permeability of soil up to a certain extent can be taken as a benefit in reducing water losses. The similar results were also reported by Singh (2017); Choudhary (2022).

Table 3: Textural classification of soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

Tehsils	Textural classes		Total
	Loamy sand	Sand	
Irrigated soils			
Dhorimana	27	2	29
Gudhamalani	23	5	28
Unirrigated soils			
Dhorimana	9	-	9
Gudhamalani	8	3	11

B. Chemical parameters

(i) Ionic composition. It is evident from the data presented in Table 4 that Ca^{2+}, Mg^{2+}, Na^{+} and K^{+} of irrigated soils ranged between 0.11 to 1.45, 0.17 to 2.18, 0.36 to 5.66 and 0.04 to 0.49 me L^{-1} in Dhorimana tehsil and 0.27 to 1.54, 0.61 to 2.30, 1.28 to 5.42 and 0.12 to 0.75 me L^{-1} in Gudhamalani tehsil, respectively. The mean values of Ca^{2+}, Mg^{2+}, Na^{+} and K^{+} were recorded 0.78, 1.29, 3.23 and 0.26 me L^{-1} in Dhorimana tehsil and 0.82, 1.48, 3.43 and 0.23 me L^{-1} in Gudhamalani tehsil, respectively.

Table 4: Ionic composition of irrigated soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

Tehsils	Ions(meL^{-1})							
	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}
Dhorimana								
Range	0.11-1.45	0.17-2.18	0.36-5.66	0.04-0.49	Trace - 0.25	0.28-3.70	0.35-4.88	0.04-0.62
Mean	0.78	1.29	3.23	0.26	0.08	2.23	2.88	0.35
C.V.	43.28	43.37	43.10	44.32	88.74	41.44	42.65	44.41
Gudhamalani								
Range	0.27-1.54	0.61-2.30	1.28-5.42	0.12-0.75	Trace - 0.35	0.92-3.75	1.20-4.98	0.16-0.58
Mean	0.82	1.48	3.43	0.23	0.12	2.37	3.09	0.38
C.V.	33.62	29.22	30.85	55.77	63.85	29.10	30.28	28.42

The soluble anions namely CO_3^{2-}, HCO_3^{-}, Cl^{-} and SO_4^{2-} affect the electrical conductivity of the soil solution which is directly related to the physico-chemical properties of soils. Data presented in Table 4 indicated that the anions CO_3^{2-}, HCO_3^{-}, Cl^{-} and SO_4^{2-} of irrigated soils were ranged between trace to 0.25, 0.28 to 3.70, 0.35 to 4.88 and 0.04 to 0.62 in Dhorimana tehsil and trace to 0.35, 0.92 to 3.75, 1.20 to 4.98 and 0.16 to 0.58 me L^{-1} in Gudhamalani tehsil, respectively. The mean values of CO_3^{2-}, HCO_3^{-}, Cl^{-} and SO_4^{2-} were found 0.08, 2.23, 2.88 and 0.35 in Dhorimana tehsil and 0.12, 2.37, 3.09 and 0.38 me L^{-1} in Gudhamalani tehsil, respectively. While in case of unirrigated soils Ca^{2+}, Mg^{2+}, Na^{+} and K^{+} values lied between 0.11 to 0.18, 0.16 to 0.33, 0.36 to 0.88 and 0.02 to 0.10 me L^{-1} in Dhorimana tehsil and 0.08 to 0.36, 0.14 to 0.60, 0.33 to 1.46 and 0.03 to 0.15 me L^{-1} in Gudhamalani tehsil, respectively. The average values of Ca^{2+}, Mg^{2+}, Na^{+} and K^{+} were found 0.14, 0.23, 0.56 and 0.05 me L^{-1} in Dhorimana and 0.23, 0.35, 0.84 and 0.08 me L^{-1} in Gudhamalani tehsil, respectively (Table 5).

Further, data indicated that under unirrigated soils soluble anions CO_3^{2-}, HCO_3^{-}, Cl^{-} and SO_4^{2-} varied from trace, 0.28 to 0.47, 0.35 to 0.89 and 0.04 to 0.11me L^{-1} in Dhorimana tehsil and trace to 0.04, 0.24 to 0.84, 0.31 to 1.55 and 0.04 to 0.17 me L^{-1} in Gudhamalani tehsil, respectively. The mean values of CO_3^{2-}, HCO_3^{-}, Cl^{-} and SO_4^{2-} were noticed trace, 0.33, 0.57 and 0.07me L^{-1} in Dhorimana tehsil and 0.01, 0.55, 0.84 and 0.09 me L^{-1} in Gudhamalani tehsil, respectively (Table 5).

(ii) pH and EC. The pH and EC of irrigated and un-irrigated soils (Table 6 and 7) were ranged between 7.91 to 9.02, 0.07 to 0.92 dS m^{-1} and 8.06 to 8.39, 0.07 to 0.15 dS m^{-1} in Dhorimana tehsil and 8.08 to 9.22, 0.23 to 0.94 dS m^{-1} and 8.01 to 9.06, 0.06 to 0.25 dS m^{-1} in Gudhamalani tehsil, respectively. Similar results were also reported by Dhaka (2021); Sharma (2022).

Table 5: Ionic composition of unirrigated soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

Tehsils	Ions(meL^{-1})							
	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}
Dhorimana								
Range	0.11-0.18	0.16-0.33	0.36-0.88	0.02-0.10	Trace	0.28-0.47	0.35-0.89	0.04-0.11
Mean	0.14	0.23	0.56	0.05	Trace	0.33	0.57	0.07
C.V.	20.70	23.27	28.91	46.35	-	19.67	30.23	39.03
Gudhamalani								
Range	0.08-0.36	0.14-0.60	0.33-1.46	0.03-0.15	Trace-0.04	0.24-0.84	0.31-1.55	0.04-0.17
Mean	0.23	0.35	0.84	0.08	0.01	0.55	0.84	0.09
C.V.	39.62	38.70	39.65	53.44	127.13	35.44	43.72	45.57

(iii) SAR, SSP, ESP and Chloride accumulation. The SAR, SSP and ESP of irrigated and un-irrigated soils (Table 6 and 7) were varied from 0.96 to 4.43, 52.94 to 61.59, 0.16 to 5.32 and 0.96 to 1.76, 52.94 to 60.61, 0.16 to 1.35 in Dhorimana tehsil and 1.93 to 4.09, 52.03 to 61.60, 1.60 to 4.81 and 0.99 to 2.13, 52.66 to 58.99 and 0.21 to 1.90 in Gudhamalani tehsil, respectively. The present results get supported from the findings of Dhaker (2018); Choudhary (2022).

The calculated values of chloride accumulation in soils presented in Table 6 revealed that the chloride accumulation values of irrigated soils of Dhorimana and Gudhamalani tehsils was varied from 0.07 to 94.11 and 2.04 to 63.22 me L^{-1} with the mean values of 35.08 and 18.65 me L^{-1} in Dhorimana and Gudhamalani tehsils, respectively. The higher values of chloride accumulation in soils might be due to high evaporative demand of the arid-ecosystem because of high temperature, low rainfall and irrigating the soils with poor quality ground water for irrigation. The results of present study were in close conformity with the findings of Singh (2006); Choudhary (2022).

Table 6: Chemical parameters of irrigated soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

Tehsils	pH	EC (dSm^{-1})	SAR	ESP	SSP	Chloride accumulation (me L^{-1})
Dhorimana						
Range	7.91-9.02	0.07-0.92	0.96-4.43	0.16-5.32	52.94-61.59	0.07-94.11
Mean	8.52	0.56	3.09	3.33	57.89	35.08
C.V.	3.56	42.30	25.46	35.18	3.17	79.32
Gudhamalani						
Range	8.08-9.22	0.23-0.94	1.93-4.09	1.60-4.81	52.03-61.60	2.04-63.22
Mean	8.67	0.60	3.16	3.44	57.38	18.65
C.V.	3.72	29.67	17.57	24.07	3.28	78.20

Table 7: Chemical parameters of unirrigated soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

Tehsils	pH	EC (dSm^{-1})	SAR	ESP	SSP
Dhorimana					
Range	8.06-8.39	0.07-0.15	0.96-1.76	0.16-1.35	52.94-60.61
Mean	8.22	0.10	1.29	0.64	56.84
C.V.	1.47	26.00	19.15	57.01	4.12
Gudhamalani					
Range	8.01-9.06	0.06-0.25	0.99-2.13	0.21-1.90	52.66-58.99
Mean	8.48	0.15	1.54	1.02	56.23
C.V.	4.12	38.00	22.22	49.95	4.10

C. Microbial parameters

(i) Dehydrogenase activity. The dehydrogenase activity of soils of the study area were found to be low and the values of dehydrogenase activity were slightly higher for irrigated soils as compared to un-irrigated soils of both tehsils.

Dehydrogenase activity in the irrigated soils were varied from 8.95 to 13.58 and 5.41 to 13.31 µg TPF g^{-1} soil day^{-1} with the mean values 12.20 and 11.09 µg TPF g^{-1} soil day^{-1} in Dhorimana and Gudhamalani tehsils, respectively (Table 6).

On the other hand, dehydrogenase activity in the unirrigated soils were ranged between 6.00 to 10.45 and 4.05 to 10.31 µg TPF g^{-1} soil day^{-1} with the mean values 7.68 and 7.04 µg TPF g^{-1} soil day^{-1} in Dhorimana and Gudhamalani tehsils, respectively (Table 7). Similar results were also reported by Singh (2006); Dhaker (2018); Sharma (2022).

Table 8: Microbial parameters of soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

Tehsils	Dehydrogenase activity (μgTPFg^{-1} soil day^{-1})	
	Irrigated soils	Unirrigated soils
Dhorimana		
Range	8.95-13.58	6.00-10.45
Mean	12.20	7.68
C.V.	7.79	18.56
Gudhamalani		
Range	5.41-13.31	4.05-10.31
Mean	11.09	7.04
C.V.	19.82	27.14

D. Salinity and sodicity indices of soils

The calculated values of salinity and sodicity indices of Dhorimana and Gudhamalani tehsils were 1.00 and 2.64 for irrigated and 1.00 and 2.35 for un-irrigated soils, respectively. Thus, these soils have no salinity and slight to moderate sodicity problem (Table 9).

Further, on the basis of EC and pH of irrigated and un-irrigated soils of Dhorimana and Gudhamalani tehsils were also classified into three salinity and sodicity groups (Table 10, map 1) as suggested by Sehgal *et al.* (1987). The majority of irrigated soils (70.18 per cent) fells under the V_sM (Very slight salinity and moderate alkalinity) whereas, 21.05 and 8.77 per cent soils fells under the V_sS (Very slight salinity and slight to negligible alkalinity) and V_sSt (Very slight salinity and strong alkalinity) groups, respectively. The majority of un- irrigated soils (45 per cent) fells under the V_sS (Very slight salinity and slight to negligible alkalinity) whereas 45 and 10 per cent soils fell under the V_sM (Very slight salinity and moderate alkalinity) and V_sSt (Very slight salinity and strong alkalinity) groups, respectively.

Table 9: Salinity and sodicity indices of soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

Sr. No.	Soil classes	Number of samples	Percent of samples in each category	Index
Irrigated soils				
A. Salinity (ECdSm^{-1})				
1.	Normal (<1.0)	57	100	1.00 (No salinity problem)
2.	Tending to become saline (1-2)	-	-	
3.	Saline (2-3)	-	-	
4.	High lysaline (>3)	-	-	
Total		57	100	
B. Sodicity (pH)				
1.	Normal (<8)	2	3.51	2.64 (Moderate sodicity problem)
2.	Alkaline (8.0-8.5)	21	36.84	
3.	Very alkaline (8.5-9.0)	29	50.88	
4.	Highly alkaline (>9.0)	5	8.77	
Total		57	100	
Unirrigated soils				
A. Salinity (EC dS m^{-1})				
1.	Normal (<1.0)	20	100	1.00 (No salinity problem)
2.	Tending to become saline (1-2)	-	-	
3.	Saline (2-3)	-	-	
4.	Highly saline (>3)	-	-	
Total		20	100	
B. Sodicity (pH)				
1.	Normal (<8)	-	-	2.35 (Slight sodicity problem)
2.	Alkaline (8.0-8.5)	15	75	
3.	Very alkaline (8.5-9.0)	3	15	
4.	Highly alkaline (>9.0)	2	10	
Total		20	100	

Table 10: Salinity and sodicity hazard groups of soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

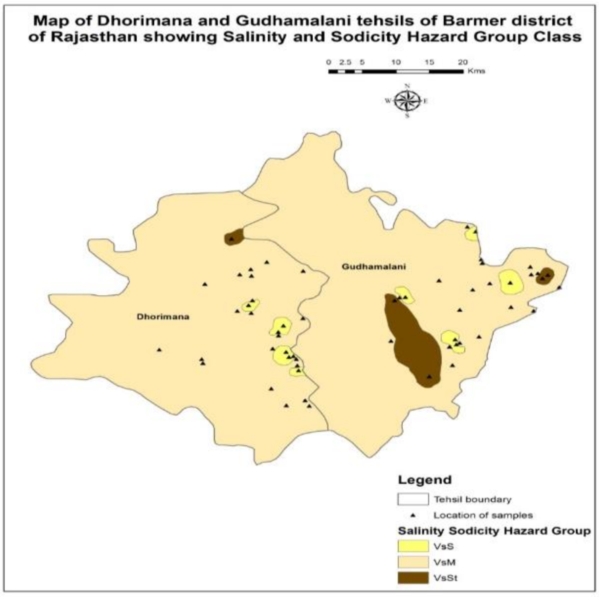
Sr. No.	Salinity sodicity hazard groups	Symbol	Number of samples	Per cent of samples in each category
Irrigated soils				
1.	V_sS	A	12	21.05
2.	V_sM	B	40	70.18
3.	V_sSt	C	5	8.77
Total			57	100
Unirrigated soils				
1.	V_sS	A	9	45
2.	V_sM	B	9	45
3.	V_sSt	C	2	10
Total			20	100

E. Fertility parameters

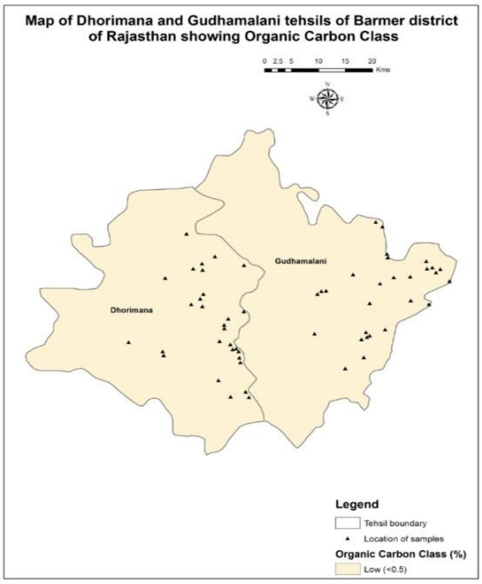
(i) Soil organic carbon. The organic carbon content of irrigated and un-irrigated soils were ranged between 0.06 to 0.39 and 0.15 to 0.26 per cent in Dhorimana tehsil and 0.05 to 0.34 and 0.04 to 0.23 per cent in Gudhamalani tehsil, respectively and soils were classified low in organic carbon [Table 11 (a) & (b) and map 2]. The similar results were also reported by Kumar *et al.* (2017); Sharma (2022).

(ii) Available phosphorous and potassium status of soils. The values of available phosphorous and potassium of irrigated and un-irrigated soils were ranged between 2.89 to 38.41 kg P_2O_5 ha^{-1}, 122.93 to 551.88 kg K_2O ha^{-1} and 16.05 to 26.27 kg P_2O_5 ha^{-1}, 138.62 to 458.92 kg K_2O ha^{-1} in Dhorimana tehsil and 5.30 to 30.95 kg P_2O_5 ha^{-1}, 136.01 to 661.73 kg K_2O ha^{-1} and 8.02 to 29.87 kg P_2O_5 ha^{-1}, 130.78 to 380.47 Kg K_2O ha^{-1} in Gudhamalani tehsil, respectively and soils were classified low to medium in available phosphorous and medium to high in available potassium status (Table 11 (a) & (b) and map 3, 4). The present results were in close conformity with the findings of Kumar *et al.* (2017); Choudhary (2022).

(iii) Fertility index. The calculated values of the fertility index of soils of Dhorimana and Gudhamalani tehsils were 1.00 and 1.00 for organic carbon, 1.63 and 1.55 for available phosphorous and 2.24 and 2.15 for available potassium for irrigated and un-irrigated soils, respectively (Table 12).



Map 1. Showing salinity and sodicity hazard groups of soil.



Map 2. Showing organic carbon status of soil.

Table 11 (a): Fertility parameters of irrigated soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

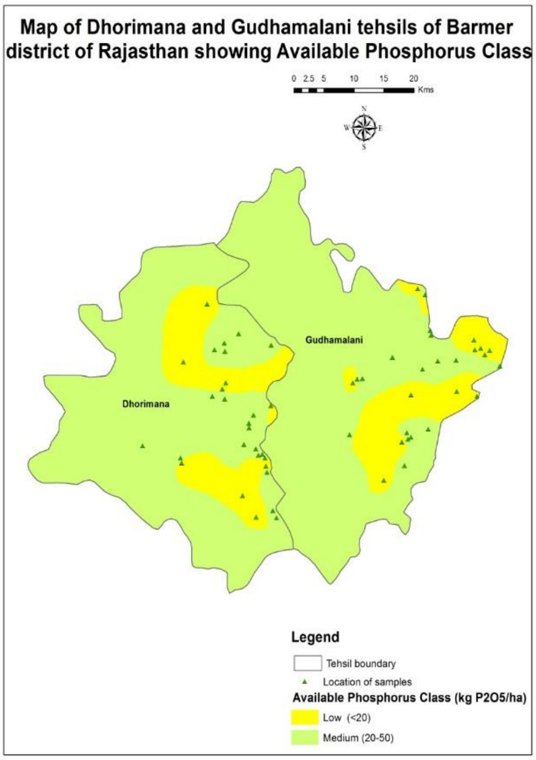
Tehsils	Organic Carbon (%)	Available phosphorus (kg P_2O_5 ha^{-1})	Available potassium (kg K_2O ha^{-1})
Dhorimana			
Range	0.06 - 0.39	2.89 - 38.41	122.93 - 551.88
Mean	0.26	22.67	275.74
C.V.	33.71	39.65	43.44
Gudhamalani			
Range	0.05 - 0.34	5.30 - 30.95	136.01 - 661.73
Mean	0.22	20.10	281.76
C.V.	40.70	37.61	45.68

Table 11 (b): Fertility parameters of unirrigated soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan.

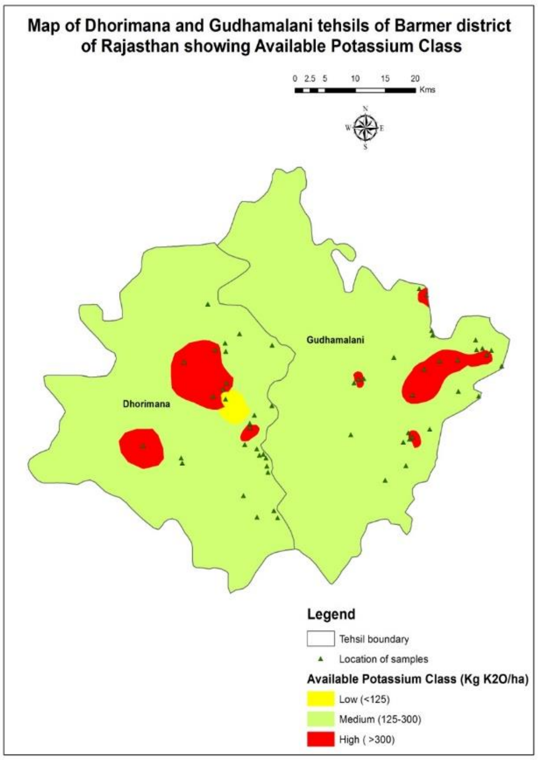
Tehsils	Organic Carbon (%)	Available phosphorus (kg P_2O_5 ha^{-1})	Available potassium (kg K_2O ha^{-1})
Dhorimana			
Range	0.15 -0.26	16.05 - 26.27	138.62 - 458.94
Mean	0.21	21.57	217.81
C.V.	19.70	17.02	43.91
Gudhamalani			
Range	0.04 - 0.23	8.02 - 29.87	130.78 - 380.47
Mean	0.14	17.43	214.11
C.V.	46.30	39.10	37.20

Table 12: Fertility index of soils of Dhorimana and Gudhamalani tehsils of Barmer district of Rajasthan

Sr. No.	Soil classes	Number of samples	Per cent of samples in each category	Index
Irrigated soils				
Organic carbon (%)				
1.	Low	57	100	1.00 (Low)
2.	Medium	-	-	
3.	High	-	-	
Total		57	100	
Available phosphorus (kg P_2O_5 ha^{-1})				
1.	Low	21	36.84	1.63 (Medium)
2.	Medium	36	63.16	
3.	High	-	-	
Total		57	100	
Available potassium (kg K_2O ha^{-1})				
1.	Low	1	1.75	2.24 (High)
2.	Medium	41	71.93	
3.	High	15	26.32	
Total		57	100	
Unirrigated soils				
Organic carbon (%)				
1.	Low	20	100	1.00 (Iow)
2.	Medium	-	-	
3.	High	-	-	
Total		20	100	
Available phosphorus (kg P_2O_5 ha^{-1})				
1.	Low	9	45.00	1.55 (Medium)
2.	Medium	11	55.00	
3.	High	-	-	
Total		20	100	
Available potassium (kg K_2O ha^{-1})				
1.	Low	-	-	2.15 (High)
2.	Medium	17	85.00	
3.	High	3	25.00	
Total		20	100	



Map 3. Showing available phosphorus status of soil.



Map 4. Showing available potassium status of soil.

CONCLUSIONS

The majority of soils were belongs to sand to loamy sand in texture. Soils of the study area were found normal to alkaline in reaction, nonsaline, slight to moderately sodic and low in dehydrogenase activity. With respect to fertility, the soils organic carbon, available phosphorous and potassium were obtained low, low to medium and medium to high, respectively.

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