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Spatial Analysis of Soil Physical Parameters at Different Depth in Sikrai Tehsil of Dausa, R, India

P. C. Bairwa [a++,#*], K. K. Sharma [a†], Rani Saxena [b++], R. K. Bagdi [c†], R. Verma [a++], A. Tiwari [d], R. Sammauria [b†], R. S., Meena [e†], K.C. Gupta [b†], H. P., Parewa [a‡], C. Kumawat [a++], R. L. Meena [c++], B. S. Dhakad [f++], Shakuntala [g#] and Rajesh [b++]

[a] Department of Soil Science, Sri Karan Narendra Agriculture University, Jobner, District- Jaipur, India.
[b] Department of Agronomy, Sri Karan Narendra Agriculture University, Jobner, District- Jaipur, India.
[c] Department of P. Pathology, Sri Karan Narendra Agriculture University, Jobner, District- Jaipur, India.
[d] Planning Cell, Local Self-Government, Government of Rajasthan, India.
[e] Department of Horticulture, Sri Karan Narendra Agriculture University, Jobner, District- Jaipur, India.
[f] Department of Agricultural Microbiology, Sri Karan Narendra Agriculture University, Jobner, District- Jaipur, India.
[g] Sri Karan Narendra Agriculture, University, Jobner, District- Jaipur, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author PCB designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author KKS who suggest me this topic. Author Rani Saxena help to prepared the fertility maps. Authors RKB and RV help to analyzed the biological properties. Authors R. Sammauria and RSM managed the analyses of the study. Author HPP managed the literature searches. All authors read and approved the final manuscript.

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[++] Assistant Professor and
 # Ph.D. Scholar;
[†] Professor;
[‡] Associate Professor;
**Corresponding author: E-mail: pcdfrs@yahoo.com and pcbairawa.soils.rari@sknau.ac.in;*

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Original Research Article

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ABSTRACT

An investigation, was carried out during year 2021-22. Total 190 soil samples were collected from two depth (i.e., 0 to 15 and 15 to 30 cm). Sand content varied from 73.20 to 82.10 and 71.70 to 80.50 per cent, silt content varies from 9.20 to 14.60 and 10.30 to 15.30 and clay content ranged from 8.20 to 12.80 and 9.20 to 13.20 per cent. The bulk density was ranged from 1.45 to 1.54 and 1.46 to 1.55 Mg m-3, while, particle density was ranged from 2.47 to 2.65 and 2.48 to 2.66 Mgm-3. Porosity of surface and sub-surface soils ranged between 38.87 to 45.08 and 38.71 to 44.91%. Based on sand, silt and clay contents, these soils classified into sandy loam and loamy sand textural classes. Out of 95 surface soil samples 19 (20.00%) fell in loamy sand and 76 (80.00%) samples fell in sandy loam texture class. while, in sub-surface 2 (2.11%) fell in loamy sand and 93 (97.89%) were in sandy loam category. Therefore, the majority of soils were belonged to sandy loam in texture. The depth wise distribution of soil physical properties is valuable to the scientific community for various applications, particularly in agriculture, civil engineering, and efforts to combat environmental degradation and optimum land use plan for maximizing agricultural production.

Keywords: Environmental degradation; sandy loam; soil physical parameters; spatial analysis.

1. INTRODUCTION

Soil is the most vital and precious natural resource that sustains life on the earth. It takes almost 1000 years to produce an inch of topsoil (Chandra and Singh 2009). The most important constituents in soil are organic matter, an appreciable amount of it in soil tremendously increases soil fertility. Decay of organic matter release nitrogen, phosphorus and mineral nutrients in forms available to plants. Soil is a component of the lithosphere and biosphere system. It is a vital natural resource that supports life system and socio-economic development. Soil productivity and sustainability depends on a dynamic equilibrium between its physical and chemical properties. The study of soil use in its spatial context is essential to understand the area of optimum soil use and degraded areas. The comprehensive study of soil use is of immense value to ensure better returns from the soil to meet future requirements for food and industrial raw materials and successful planning of agricultural growth (Alamouti & Navabzadeh, 2007). The natural resources like soil, water and vegetation form an integral part of tropical ecosystem warranting due attention to ensure ecological security and sustainable socio-economic development. Soil is an important component in human's total stock of natural resources which underpins food production. However, the characterization of soil physical, properties is lacking in the studied area. A systematic study of soils is necessary for better utilization of land and water resources to tackle soil and water problems. Understanding the physical properties of soil at various depths is essential for assessing soil health, fertility, and crop suitability and productivity. The findings might be helped farmers and agricultural planners in making informed decisions about crop selection and soil management. It can provide insights into water retention, drainage, and nutrient availability are crucial for sustainable land use. Generally, the research contributes to understanding the effects of land use changes and environmental factors on soil quality, impacting agriculture and policy in the Dausa district and beyond for similar agro - ecological zone.

At this juncture, soil testing along with GPS reading and GIS based mapping would enable to assess the soil fertility status of the particular location. The GPS and GIS helps in collecting a systematic set of georeferenced samples and generating spatial data about the distribution of nutrients (Sharma, et al., 2004).

2. MATERIALS AND METHODS

The soil samples were collected from 95 villages apart from Sikrai tehsil, having variations in slope/topography, colour and cropping pattern and behavior. Two depth-wise samples viz., "0 to

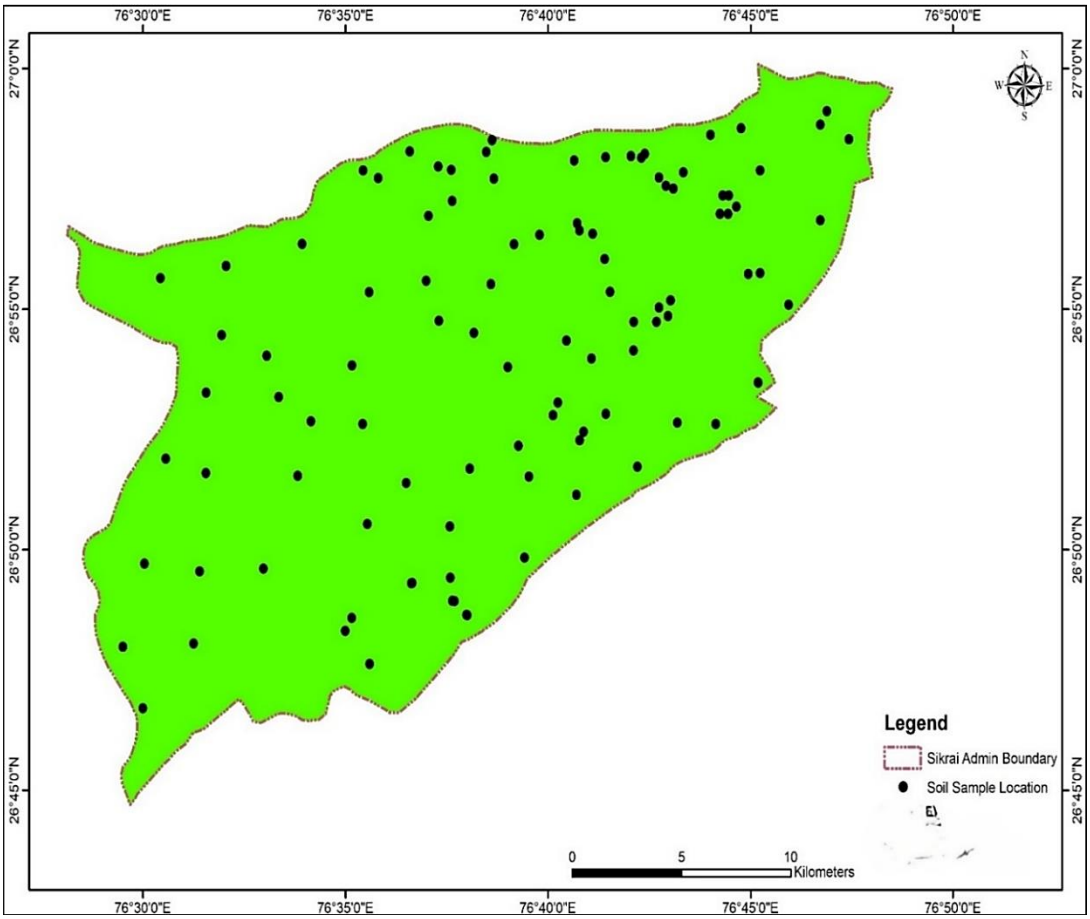
15” cm, “15 to 30” cm was collected and analyzed. Samples were collected only from the open places. The samples were analysed for phsical properties. A sample collection sheet is prepared for proper tagging and packing of the samples on the site. Dausa district lying between latitude 26° 23' and 27° 15’ and longitude 76° 0' and 77° 02'). The area studied lied in the agroclimatic zone IIIA (Semi-arid eastern Plains) of Rajasthan. Sikrai tehsil is located between 76° 69 East Longitude (degrees) and 26° 91 North latitude (degree). The climate of the Dausa is semi-arid. Soil Samples were collected from Two depth viz., “0 to 15” and “15 to 30” cm only from the open places. The samples were analysed for phsical properties. A sample collection sheet is prepared for proper tagging and packing of the samples on the site. Dausa district lying between latitude 26° 23' and 27° 15’ and longitude 76° 0' and 77° 02'). Sikrai tehsil is located between 76° 69 East Longitude (degrees) and 26° 91 North latitude (degree). The climate of the Dausa is semi-arid. In summer, maximum temperature varies from 38 to 45˚C, whereas, in winter generally minimum temperature lies between 5 and 18˚C. The mean annual rainfall of the locality is 450 mm, most of this is received during monsoon season. Main source of irrigation is tube well. A maximum 52 to 58˚C soil temperature has been recorded at surface during summer months.

Table 1. Details of location of soil sampling sites of Sikrai tehsil

S. No.	Sample Code No.	Name of village	Name of Farmers	Longitude	Latitude
1	2	3	4	5	6
1	S_1	Chandera	Ramshai S/O Mulya Ram	76.7765	26.9806
2	S_2	Surer	Nahar Singh S/O Chhotya	76.7814	26.9852
3	S_3	Brihmbad	Malkhan S/O Hari Ram	76.7905	26.9755
4	S_4	Parli	Chet Ram Kajodmal	76.6218	26.9126
5	S_5	Gurjarsimla	Babu Lal S/O Chhaju	76.7591	26.9647
6	S_6	Uaipura	Manoj S/O Ramkhiladi	76.7633	26.9498
7	S_7	meena simla	Omprakash S/O Mallu	76.7787	26.9475
8	S_8	Karodi	Ramkesh S/O Ramkhiladi	76.7461	26.9793
9	S_9	Jopada	Babli S/O Pyare Lal	76.7386	26.9561
10	S_{10}	Khadarpura	Harkesh S/O Jal Singh	76.7335	26.9770
11	S_{11}	Jodhpura	Ram Singh S/O Raghu Nath	76.7065	26.9705
12	S_{12}	Theekariya	Ram Kishan S/O Kishan	76.7539	26.9647
13	S_{13}	Patti Salehsingh	Ranglo S/O Laxman	76.7442	26.9521
14	S_{14}	Darjapura	Mangal S/O Kajodmal	76.7374	26.9497
15	S_{15}	Sultanpura	Ramniwash S/O Kalu Ram	76.7408	26.9497
16	S_{16}	Kheda Pahadpur	Gopal S/O Ghashi Ram	76.7411	26.9561
17	S_{17}	Peelodi	Khiladi S/O Ramhet	76.7183	26.9584
18	S_{18}	Aasatwada	Sita Ram S/O Jagan Singh	76.7051	26.9691
19	S_{19}	Heengi	Chetram S/O Ramphal	76.6900	26.9340
20	S_{20}	Rampura Gujran	Omprakash S/O Kajod	76.7008	26.9697
21	S_{21}	Khedi Ramla	Suwa Lal S/O Dhaturiya	76.7152	26.9594
22	S_{22}	Nikatpuri	Kapuri Devi S/O Hari Singh	76.6904	26.9693
23	S_{23}	Manpur	Ramawtar S/O Mool Chand	76.6774	26.9682
24	S_{24}	Pacholi	Rameshwar S/O Manna	76.6787	26.9464
25	S_{25}	Khedla	Kanhaiya S/O Bhola Ram	76.6796	26.9439
26	S_{26}	Murlipur	Ishwar S/O Ramdhan	76.6851	26.9428
27	S_{27}	Kundera Dungar	Bahadur Singh S/O Kalodmal	76.7018	26.9023
28	S_{28}	Sikrai Dungar	Mishri Lal S/O Rampal	76.7019	26.9123
29	S_{29}	Namner	Ishwar S/O Murlya	76.6905	26.8804
30	S_{30}	Mored	Kanhaiya Lal S/O Ramshai	76.6707	26.8843
31	S_{31}	Moondiyakheda	Chhaju lal S/O Ghudya	76.6846	26.8996
32	S_{32}	Kailai	Sharwan S/O Girdhari Lal	76.6743	26.9058
33	S_{33}	Nandri	Bharosi S/O Devkul	76.7491	26.9289
34	S_{34}	Nyaganv	Ballu S/O Bhajni	76.7539	26.9291
35	S_{35}	Bhalpur	Ramkishore S/O Girdhari	76.7596	26.9325
36	S_{36}	Sikrai	Madan S/O Mool Chand	76.6922	26.9227

S. No.	Sample Code No.	Name of village	Name of Farmers	Longitude	Latitude
1	2	3	4	5	6
37	S_{37}	Piplaki	Todarmal S/O Beerbal	76.6444	26.9619
38	S_{38}	Dhulkot	Ram Singh S/O Dhanna Lal	76.6632	26.9424
39	S_{39}	Seekri	Giriraj S/O Kanwar Pal	76.6527	26.9392
40	S_{40}	Indan	Bhonri Devi W/O Malla Ram	76.7357	26.8769
41	S_{41}	Basedi	Chhote Lal S/O Sonarayan	76.7199	26.8773
42	S_{42}	Bhawgarh	Jagram S/O Muthrya	76.7035	26.8621
43	S_{43}	Garota	Ramesh S/O Khayali Ram	76.6784	26.8523
44	S_{44}	Naharkhohra	Vinod S/O Girdhari Lal	76.7531	26.8913
45	S_{45}	Lakhanpur	Lakhan S/O Surajmal	76.7532	26.8912
46	S_{46}	Hingwa	Ram Singh S/O Giriraj	76.7113	26.9123
47	S_{47}	Girdharipura	Lokesh Bharat Lal	76.7713	26.9159
48	S_{48}	Chandusa	Siya Ram S/O Tholi Ram	76.7123	26.9172
49	S_{49}	Ganipur	Ram Manohar S/O Jagdeesh	76.7171	26.9197
50	S_{50}	Kundela khurd	Indra S/O Mukesh	76.7123	26.9623
51	S_{51}	Chak Ganipur	Ramjilal S/O Chetram	76.7171	26.9197
52	S_{52}	Rameda	Pawan S/O Lallu Ram	76.7161	26.9143
53	S_{53}	Ghumna	Jhamman S/O Mangya	76.6588	26.8586
54	S_{54}	Gadoli	Chhuttan Lal S/O Mool Chand	76.6570	26.8306
55	S_{55}	Jaysinghpura	Malkhan S/O Chhotu Ram	76.6545	26.8693
56	S_{56}	Gadhi	Sugna Devi S/O Somtya Ram	76.6797	26.8712
57	S_{57}	Jagsahaypura	Lokesh S/O Rajendra	76.6687	26.8799
58	S_{58}	Banepura	Mooli Devi S/O Ramkishore	76.6813	26.8742
59	S_{59}	Patan	Dhansi Ram S/O Bhoja Ram	76.6250	26.8576
60	S_{60}	Bujot	Mooli Devi Ramshai	76.6210	26.8464
61	S_{61}	Chainpura	Seela Devi S/O Hanshraj	76.6345	26.8614
62	S_{62}	Kalwan	Prahlad S/O Magan Lal	76.6432	26.9253
63	S_{63}	Giladi	Krishan Lal S/O Ramshai	76.6362	26.9084
64	S_{64}	Geejgarh	Hanuman Shai S/O Laxminarayan	76.6501	26.8597
65	S_{65}	Kalakhon	Balbeer S/O Prahlad	76.6361	26.8092
66	S_{66}	Chak Kalakhon	Sumer S/O Badri	76.6358	26.8093
67	S_{67}	Ambadi	Giriraj S/O Kishori	76.6273	26.8156
68	S_{68}	Jagrampura Patti	Mool Chand S/O Sukhdeva	76.6265	26.8236
69	S_{69}	Gadhora	Jagdeesh S/O Gopi Ram	76.6282	26.8155
70	S_{70}	Johhya	Nawal Kishore S/O Jeeta Ram	76.6095	26.8097
71	S_{71}	Bahrawanda	Mangal Ram S/O Dalla Ram	76.5833	26.8052
72	S_{72}	Divankar	Tara Chand S/O Ramkishore	76.5933	26.7938
73	S_{73}	Bharaw	Kherati S/O Ramsukha	76.5496	26.8268
74	S_{74}	Pharashpura	Ramkishan S/O Dharam Singh	76.5923	26.8422
75	S_{75}	Mohlai	Kalu Ram S/O Somtya	76.6104	26.8217
76	S_{76}	Geroji	Kishan Lal S/O Nathu Lal	76.6108	26.8218
77	S_{77}	Bad Bahranwda	Jag Ram S/O Surjan	76.7224	26.9641
78	S_{78}	Rampura	Ramshai S/O Dhutha	76.6175	26.9490
79	S_{79}	Sikandra	Shanti W/O Kishan Lal	76.5968	26.9621
80	S_{80}	Leekhali	Sadar S/O Banai Singh	76.6436	26.9752
81	S_{81}	Ganwdi	Rameshwar S/O Kanhaiya Lal	76.6413	26.9711
82	S_{82}	Mariyada	Hari Prasad S/O Shri Narayan	76.6269	26.9649
83	S_{83}	Sanwash	Suresh S/O Ramdhan	76.6272	26.9541
84	S_{84}	Bapanpada	Seeta Ram S/O Bhori Lal	76.6098	26.9713
85	S_{85}	Padli Bad	Satyainarayan S/O Badri	76.6215	26.9661
86	S_{86}	Mohchingpura	Vijai Singh S/O Badri	76.4916	26.8063
87	S_{87}	Moroli	Sukh Lal S/O Ghasi Lal	76.4974	26.8048
88	S_{88}	Ranoli	Banwari S/O Mool Chand	76.5207	26.8002
89	S_{89}	Shekpura	Ashok S/O Ramswroop	76.4961	26.8597
90	S_{90}	Gumanpura	Kelash S/O Narayan	76.6504	26.8555

S. No.	Sample Code No.	Name of village	Name of Farmers	Longitude	Latitude
1	2	3	4	5	6
91	S_{91}	Gandrawa	Gyarshi Lal S/O Rewadmal	76.5635	26.8590
92	S_{92}	Gangandwari	Syam Lal S/O Bhagwanshai	76.5691	26.8768
93	S_{93}	Reta	Hariprasad S/o Rmprasad	76.5080	26.9260
94	S_{94}	Dolika	Hariom S/O Ramphool	76.5513	26.8999
95	S_{95}	Dubbi	Jairam S/O Mool Chand	76.5342	26.9317



Map 1. Details of location of sampling sites of Sikrai tehsil of Dausa district

Table 2. Methods used for soil analysis

Sl. No.	Test parameter	Methods	References
A.	Soil analysis		
(i)	Mechanical Analysis		
1.	Soil texture	International Pipette Method	Piper (1950)
(ii)	Physical Properties		
1	Bulk Density	Method No. 38 of USDA Hand Book No. 60	Richards (1954)
2	Particle Density	Method No. 39 of USDA Hand Book No. 60	Richards (1954)
3	Porosity (percent)	Method No. 40 of USDA Hand Book No. 60	Richards (1954)

2.1 Collection of Soil Sample

Geo-referenced surface soil samples at the depth of “0 to15” and “15 to 30” cm were collected from Sikrai tehsils. The latitude and longitude of sampling sites were recorded with the help of different Global Positioning System. Selection of field in village in such a way that it should be representative of whole area of the village and sample was taken from progressive

farmers. Total 190 surface and sub- surface soil samples were collected from the entire selected villages at the depth of “0 to15” and “15 to 30” cm with the help of khurpi and hand- held global positioning system (GPS) over the entire area.

2.2 Process of Soil Sampling

After collecting the soil samples, they were brought to the laboratory. These samples were dried under shade. After that the processing was done as follows: After the air drying under the shade the unwanted materials like roots, stones, and others are should be discarded. The clods in the sample would be broken by using the wooden mallet. After that the samples should be sieved with 2 mm sieve. Sieved samples should be stored in polybags for further estimation of different physical parameters. All the precautions and standard procedures were used to estimate the physical properties of the soil and followed the procedure described by Jackson.

2.3 Statistical Analysis

The data obtained for different parameters of soil analysis were statistically analyzed for correlation using the procedure given by Snedecor and Cochran (1967).

2.4 Methods Used for Soil Analysis

The soil samples were analyzed as per methods given in Table 2.

3. RESULTS AND DISCUSSION

3.1 Physical Properties

3.1.1 Particle size distribution

It was found that most of the soils of villages of Sikrai tehsils having lot of variability in the relative percentage of sand, silt and clay. The data presented in Table 3 revealed that sand content in 190 surface (0-15) and sub-surface (15-30 cm) soil samples of Sikrai tehsil ranged from 73.20 to 82.10 and 71.70 to 80.50 per cent, with mean value of 77.98 and 76.32 percent having, standard deviation 1.93 and 1.92 and coefficient of variation 2.47 and 2.51 per cent. Maximum sand percentage (82.10 and 80.50%) were recorded in Bad Bahranwda (S-77) village while, minimum (73.20 and 71.70%) was recorded in Giladi (S-63) village in both the layers respectively. The silt content ranged from 9.20 to 14.60 and 10.30 to 15.30 per cent, maximum silt percentage (14.60 and 15.30%) was recorded in Giladi village (S-63) in both the layer, minimum (9.20 and 10.30%) was found in Ghumna (S-53) and Bad Bahranwda (S-77) villages with mean value of 11.80 and 12.67 per cent having, standard deviation 1.17 and 1.16 and coefficient of variation 9.90 and 9.17 per cent respectively. As the clay percentage is concerned, the clay content ranged from 8.20 to 12.80 and 9.20 to 13.20 per cent, maximum clay percentage (12.80 and 13.20%) were recorded in Kundela khurd (S-50) village however, minimum (8.20 and 9.20 %) was found in Bapanda (S-84) and Bad Bahranwda (S-77) with mean value of 10.22 and 11.01 per cent having, standard deviation 1.01 and 0.96 and coefficient of variation 9.90 and 8.68 per cent under both the layers respectively. Recorded observations revealed that out of Out of 95 surface soil samples 19 (20.00%) fell in loamy sand and 76 (80.00%) samples fell in sandy loam texture class. while, in sub-surface 2 (2.11%) fell in loamy sand and 93 (97.89%) were in sandy loam texture class. Therefore, the majority of soils were belonged to sandy loam texture class.

per cent sand content is decreased with increased in the depth of soil while, per cent of silt and clay content increased with increased the depth of soil and its vice versa. The clay content was higher in the sub-surface as compared to the surface due to clay illuviation (Chandrakala, et al., 2018). Increase in clay content with depth which might be due to downward translocation of finer particles from the surface layers (Murthy, 1988). Gradual increased in clay content with increasing depth was observed from surface to sub-surface depth (“15 to 30” cm). Thus, increase in clay percentage with depth might be due to attributed to vertical migration or translocation of clay (Mustafa, et al., 2011). Silt content in general also exhibited a regular trend with increasing depth which might be due to variation in parent material, topography or in-situ weathering and translocation of clay (Kumar and Naidu, 2012). On the basis of textural analysis, it is found that most of soils of Sikrai tehsil of Dausa district were sandy loam in texture having lot of variability in relation to proportion of sand, silt and clay. Similar results were observed by Vyas, et al. (1974) in soils of Jaipur district, in soils of Nagaur tehsil of Rajasthan and Mathur, et al. (2006) in soils of North-west plain of Rajasthan. The variation in relative percentage of sand, silt and clay was mainly because of deposition of finer fraction.

Table 3. Physical properties of soils of Sikrai tehsil

S. No.	Sample code No	Sand (%)		Silt (%)		Clay (%)		B D (Mg m^{-3})		P D (Mg m^{-3})		Porosity (%)		Textural Class	
		0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	S_1	79.60	78.20	10.80	11.30	9.60	10.50	1.50	1.52	2.61	2.62	42.53	41.98	Sandy Loam	Sandy Loam
2	S_2	76.10	74.40	13.40	14.30	10.50	11.30	1.47	1.48	2.48	2.49	40.73	40.56	Sandy Loam	Sandy Loam
3	S_3	79.10	76.90	11.70	12.70	9.20	10.40	1.49	1.51	2.63	2.65	43.35	43.02	Sandy Loam	Sandy Loam
4	S_4	79.10	77.20	11.20	12.30	9.70	10.50	1.49	1.51	2.48	2.50	39.92	39.60	Sandy Loam	Sandy Loam
5	S_5	78.40	75.90	11.20	12.50	10.40	11.60	1.48	1.50	2.60	2.61	43.08	42.53	Sandy Loam	Sandy Loam
6	S_6	77.80	75.80	11.30	12.20	10.90	12.00	1.47	1.48	2.63	2.64	44.11	43.94	Sandy Loam	Sandy Loam
7	S_7	76.70	75.30	12.10	12.60	11.20	12.10	1.46	1.48	2.65	2.65	44.91	44.15	Sandy Loam	Sandy Loam
8	S_8	78.90	76.90	11.40	12.30	9.70	10.80	1.49	1.51	2.57	2.58	42.02	41.47	Sandy Loam	Sandy Loam
9	S_9	77.20	75.80	11.90	12.50	10.90	11.70	1.49	1.50	2.59	2.60	42.47	42.31	Sandy Loam	Sandy Loam
10	S_{10}	76.60	74.30	12.10	14.10	11.30	11.60	1.45	1.47	2.64	2.65	45.08	44.53	Sandy Loam	Sandy Loam
11	S_{11}	78.80	77.30	10.90	11.40	10.30	11.30	1.48	1.49	2.49	2.50	40.56	40.40	Sandy Loam	Sandy Loam
12	S_{12}	76.60	74.20	12.30	13.50	11.10	12.30	1.47	1.49	2.62	2.63	43.89	43.35	Sandy Loam	Sandy Loam
13	S_{13}	80.00	78.00	10.40	11.40	9.60	10.60	1.50	1.51	2.63	2.64	42.97	42.80	Loamy Sand	Sandy Loam
14	S_{14}	78.30	76.90	11.10	11.70	10.60	11.40	1.48	1.50	2.61	2.62	43.30	42.75	Sandy Loam	Sandy Loam
15	S_{15}	76.10	74.60	12.80	13.10	11.10	12.30	1.48	1.49	2.62	2.63	43.51	43.35	Sandy Loam	Sandy Loam
16	S_{16}	79.00	77.60	11.50	12.10	9.50	10.30	1.51	1.52	2.61	2.62	42.15	41.98	Sandy Loam	Sandy Loam
17	S_{17}	79.00	77.00	10.70	11.90	10.30	11.10	1.49	1.50	2.61	2.62	42.91	42.75	Sandy Loam	Sandy Loam
18	S_{18}	76.30	74.30	11.90	13.10	11.80	12.60	1.46	1.48	2.64	2.65	44.70	44.15	Sandy Loam	Sandy Loam
19	S_{19}	78.50	76.80	12.60	13.40	8.90	9.80	1.47	1.49	2.58	2.59	43.02	42.47	Sandy Loam	Sandy Loam
20	S_{20}	79.40	77.20	11.50	12.60	9.10	10.20	1.49	1.50	2.50	2.51	40.40	40.24	Loamy Sand	Sandy Loam
21	S_{21}	79.10	77.00	10.80	11.90	10.10	11.10	1.48	1.50	2.63	2.64	43.73	43.18	Sandy Loam	Sandy Loam
22	S_{22}	75.40	74.20	12.90	13.60	11.70	12.20	1.46	1.48	2.64	2.65	44.70	44.15	Sandy Loam	Sandy Loam
23	S_{23}	75.40	73.00	13.10	14.40	11.50	12.60	1.46	1.47	2.64	2.65	44.70	44.53	Sandy Loam	Sandy Loam
24	S_{24}	79.10	77.00	11.20	12.10	9.70	10.90	1.49	1.51	2.59	2.60	42.47	41.92	Sandy Loam	Sandy Loam
25	S_{25}	80.40	78.00	10.70	12.30	8.90	9.70	1.51	1.52	2.60	2.60	41.92	41.54	Loamy Sand	Sandy Loam
26	S_{26}	78.80	77.60	11.90	12.10	9.30	10.30	1.48	1.50	2.57	2.58	42.41	41.86	Sandy Loam	Sandy Loam
27	S_{27}	75.90	74.40	13.50	14.50	10.60	11.10	1.47	1.49	2.58	2.59	43.02	42.47	Sandy Loam	Sandy Loam
28	S_{28}	81.30	79.50	10.10	11.20	8.60	9.30	1.52	1.53	2.60	2.61	41.54	41.38	Loamy Sand	Sandy Loam
29	S_{29}	80.40	79.00	10.40	11.10	9.20	9.90	1.47	1.49	2.63	2.65	44.11	43.77	Loamy Sand	Sandy Loam
30	S_{30}	75.20	73.90	13.60	14.00	11.20	12.10	1.45	1.47	2.63	2.65	44.87	44.53	Sandy Loam	Sandy Loam
31	S_{31}	78.90	77.40	11.00	12.10	10.10	10.50	1.46	1.48	2.59	2.61	43.63	43.30	Sandy Loam	Sandy Loam
32	S_{32}	76.60	75.20	12.20	12.90	11.20	11.90	1.53	1.54	2.60	2.61	41.15	41.00	Sandy Loam	Sandy Loam
33	S_{33}	75.60	73.80	12.60	13.70	11.80	12.50	1.49	1.50	2.58	2.59	42.25	42.08	Sandy Loam	Sandy Loam

S. No.	Sample code No	Sand (%)		Silt (%)		Clay (%)		B D (Mg m^{-3})		P D (Mg m^{-3})		Porosity (%)		Textural Class	
		0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm
34	S_{34}	79.20	77.60	11.70	12.10	9.10	10.30	1.47	1.49	2.61	2.63	43.68	43.35	Loamy Sand	Sandy Loam
35	S_{35}	78.20	77.30	11.30	11.80	10.50	10.90	1.48	1.50	2.61	2.62	43.30	42.75	Sandy Loam	Sandy Loam
36	S_{36}	76.70	75.60	13.60	13.90	9.70	10.50	1.50	1.51	2.51	2.52	40.24	40.08	Sandy Loam	Sandy Loam
37	S_{37}	74.70	73.40	13.20	13.70	12.10	12.90	1.54	1.55	2.63	2.64	41.44	41.29	Sandy Loam	Sandy Loam
38	S_{38}	76.00	74.80	13.80	14.10	10.20	11.10	1.51	1.53	2.59	2.61	41.70	41.38	Sandy Loam	Sandy Loam
39	S_{39}	79.70	78.50	11.20	11.90	9.10	9.60	1.48	1.50	2.65	2.65	44.15	43.40	Loamy Sand	Sandy Loam
40	S_{40}	78.20	77.20	11.00	11.60	10.80	11.20	1.51	1.52	2.59	2.60	41.70	41.54	Sandy Loam	Sandy Loam
41	S_{41}	76.20	74.80	12.90	13.60	10.90	11.60	1.50	1.52	2.62	2.63	42.75	42.21	Sandy Loam	Sandy Loam
42	S_{42}	76.30	75.40	12.60	13.50	11.10	11.10	1.46	1.48	2.62	2.63	44.27	43.73	Sandy Loam	Sandy Loam
43	S_{43}	79.30	77.60	11.20	12.30	9.50	10.10	1.45	1.47	2.52	2.54	42.46	42.13	Sandy Loam	Sandy Loam
44	S_{44}	80.80	79.10	10.30	11.10	8.90	9.80	1.46	1.48	2.64	2.65	44.70	44.15	Loamy Sand	Sandy Loam
45	S_{45}	78.70	77.70	11.80	11.80	9.50	10.50	1.46	1.48	2.64	2.65	44.70	44.15	Sandy Loam	Sandy Loam
46	S_{46}	79.00	77.50	11.60	12.20	9.40	10.30	1.54	1.55	2.61	2.62	41.00	40.84	Sandy Loam	Sandy Loam
47	S_{47}	81.20	79.40	9.50	10.50	9.30	10.10	1.49	1.51	2.65	2.66	43.77	43.23	Loamy Sand	Sandy Loam
48	S_{48}	79.80	78.30	10.30	11.40	9.90	10.30	1.51	1.52	2.47	2.48	38.87	38.71	Sandy Loam	Sandy Loam
49	S_{49}	75.50	73.60	12.70	13.80	11.80	12.60	1.46	1.48	2.52	2.54	42.06	41.73	Sandy Loam	Sandy Loam
50	S_{50}	74.00	72.60	13.20	14.20	12.80	13.20	1.48	1.50	2.63	2.65	43.73	43.40	Sandy Loam	Sandy Loam
51	S_{51}	77.10	75.40	11.60	12.70	11.30	11.90	1.48	1.49	2.49	2.50	40.56	40.40	Sandy Loam	Sandy Loam
52	S_{52}	77.00	75.60	12.90	13.80	10.10	10.60	1.49	1.50	2.63	2.64	43.35	43.18	Sandy Loam	Sandy Loam
53	S_{53}	82.10	80.10	9.20	10.50	8.70	9.40	1.46	1.47	2.62	2.63	44.27	44.11	Loamy Sand	Loamy Sand
54	S_{54}	79.20	77.70	11.70	11.80	9.10	10.50	1.47	1.48	2.62	2.63	43.89	43.73	Loamy Sand	Sandy Loam
55	S_{55}	80.30	78.80	10.30	11.10	9.40	10.10	1.48	1.50	2.63	2.65	43.73	43.40	Loamy Sand	Sandy Loam
56	S_{56}	76.10	75.60	12.60	13.10	11.30	11.30	1.45	1.46	2.64	2.65	45.08	44.91	Sandy Loam	Sandy Loam
57	S_{57}	76.30	74.60	12.00	13.30	11.70	12.10	1.46	1.48	2.59	2.60	43.63	43.08	Sandy Loam	Sandy Loam
58	S_{58}	78.50	76.40	11.90	13.10	9.60	10.50	1.45	1.47	2.52	2.53	42.46	41.90	Sandy Loam	Sandy Loam
59	S_{59}	79.30	76.90	11.40	12.50	9.30	10.60	1.49	1.50	2.64	2.65	43.56	43.40	Sandy Loam	Sandy Loam
60	S_{60}	77.10	74.80	11.60	12.90	11.30	12.30	1.51	1.52	2.58	2.59	41.47	41.31	Sandy Loam	Sandy Loam
61	S_{61}	77.50	76.10	13.10	13.80	9.40	10.10	1.51	1.52	2.62	2.62	42.37	41.98	Sandy Loam	Sandy Loam
62	S_{62}	79.00	77.50	10.90	11.80	10.10	10.70	1.53	1.54	2.56	2.57	40.23	40.08	Sandy Loam	Sandy Loam
63	S_{63}	73.20	71.70	14.60	15.20	12.20	13.10	1.46	1.47	2.58	2.59	43.41	43.24	Sandy Loam	Sandy Loam
64	S_{64}	76.90	75.20	12.20	13.40	10.90	11.40	1.50	1.51	2.60	2.61	42.31	42.15	Sandy Loam	Sandy Loam
65	S_{65}	75.30	72.90	14.10	15.30	10.60	11.80	1.46	1.47	2.61	2.62	44.06	43.89	Sandy Loam	Sandy Loam
66	S_{66}	78.00	76.30	11.50	12.30	10.50	11.40	1.45	1.47	2.52	2.54	42.46	42.13	Sandy Loam	Sandy Loam
67	S_{67}	80.50	79.00	10.50	11.10	9.00	9.90	1.46	1.48	2.59	2.61	43.63	43.30	Loamy Sand	Sandy Loam
68	S_{68}	80.30	78.70	10.40	11.10	9.30	10.20	1.50	1.52	2.58	2.60	41.86	41.54	Loamy Sand	Sandy Loam
69	S_{69}	79.90	78.50	10.20	11.10	9.90	10.40	1.50	1.52	2.64	2.65	43.18	42.64	Sandy Loam	Sandy Loam

S. No.	Sample code No	Sand (%)		Silt (%)		Clay (%)		B D (Mg m^{-3})		P D (Mg m^{-3})		Porosity (%)		Textural Class	
		0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm
70	S_{70}	78.10	77.00	11.30	11.90	10.60	11.10	1.54	1.55	2.57	2.58	40.08	39.92	Sandy Loam	Sandy Loam
71	S_{71}	79.30	77.00	11.20	12.50	9.50	10.50	1.46	1.48	2.60	2.61	43.85	43.30	Sandy Loam	Sandy Loam
72	S_{72}	76.20	74.70	11.90	13.10	11.90	12.20	1.45	1.47	2.62	2.63	44.66	44.11	Sandy Loam	Sandy Loam
73	S_{73}	76.80	74.90	13.10	14.20	10.10	10.90	1.45	1.46	2.62	2.63	44.66	44.49	Sandy Loam	Sandy Loam
74	S_{74}	79.90	78.30	10.80	11.30	9.30	10.40	1.46	1.48	2.59	2.60	43.63	43.08	Loamy Sand	Sandy Loam
75	S_{75}	79.90	78.40	10.10	11.40	10.00	10.20	1.47	1.48	2.54	2.55	42.13	41.96	Sandy Loam	Sandy Loam
76	S_{76}	79.50	78.30	11.20	11.80	9.30	9.90	1.53	1.54	2.54	2.55	39.76	39.61	Loamy Sand	Sandy Loam
77	S_{77}	82.10	80.50	9.60	10.30	8.30	9.20	1.53	1.54	2.62	2.63	41.60	41.44	Loamy Sand	Loamy Sand
78	S_{78}	77.40	75.80	13.20	13.90	9.40	10.30	1.46	1.48	2.61	2.62	44.06	43.51	Sandy Loam	Sandy Loam
79	S_{79}	78.60	76.90	12.10	12.50	9.30	10.60	1.50	1.52	2.58	2.60	41.86	41.54	Sandy Loam	Sandy Loam
80	S_{80}	74.50	72.80	14.20	14.90	11.30	12.30	1.46	1.48	2.54	2.56	42.52	42.19	Sandy Loam	Sandy Loam
81	S_{81}	79.20	77.00	11.10	12.80	9.70	10.20	1.53	1.54	2.61	2.62	41.38	41.22	Sandy Loam	Sandy Loam
82	S_{82}	78.30	76.80	11.60	12.10	10.10	11.10	1.48	1.50	2.64	2.65	43.94	43.40	Sandy Loam	Sandy Loam
83	S_{83}	79.80	78.20	10.60	11.20	9.60	10.60	1.50	1.52	2.59	2.61	42.08	41.76	Loamy Sand	Sandy Loam
84	S_{84}	81.10	79.20	10.70	11.40	8.20	9.40	1.48	1.50	2.62	2.64	43.51	43.18	Loamy Sand	Sandy Loam
85	S_{85}	77.40	76.20	12.80	13.50	9.80	10.30	1.47	1.49	2.59	2.61	43.24	42.91	Sandy Loam	Sandy Loam
86	S86	76.10	75.60	12.60	13.10	11.30	11.30	1.45	1.46	2.64	2.65	45.08	44.91	Sandy Loam	Sandy Loam
87	S87	76.30	74.60	12.00	13.30	11.70	12.10	1.46	1.48	2.59	2.60	43.63	43.08	Sandy Loam	Sandy Loam
88	S88	78.50	76.40	11.90	13.10	9.60	10.50	1.45	1.47	2.52	2.53	42.46	41.90	Sandy Loam	Sandy Loam
89	S89	79.30	76.90	11.40	12.50	9.30	10.60	1.49	1.50	2.64	2.65	43.56	43.40	Sandy Loam	Sandy Loam
90	S90	77.10	74.80	11.60	12.90	11.30	12.30	1.51	1.52	2.58	2.59	41.47	41.31	Sandy Loam	Sandy Loam
91	S91	77.50	76.10	13.10	13.80	9.40	10.10	1.51	1.52	2.62	2.62	42.37	41.98	Sandy Loam	Sandy Loam
92	S92	79.00	77.50	10.90	11.80	10.10	10.70	1.53	1.54	2.56	2.57	40.23	40.08	Sandy Loam	Sandy Loam
93	S93	73.20	71.70	14.60	15.20	12.20	13.10	1.46	1.47	2.58	2.59	43.41	43.24	Sandy Loam	Sandy Loam
94	S94	76.90	75.20	12.20	13.40	10.90	11.40	1.50	1.51	2.60	2.61	42.31	42.15	Sandy Loam	Sandy Loam
95	S95	75.30	72.90	14.20	15.20	10.60	11.80	1.46	1.47	2.61	2.62	44.06	43.89	Sandy Loam	Sandy Loam
Range	Maximum	82.10	80.50	14.60	15.30	12.80	13.20	1.54	1.55	2.65	2.66	45.08	44.91	-	-
	Minimum	73.20	71.70	9.20	10.30	8.20	9.20	1.45	1.46	2.47	2.48	38.87	38.71	-	-
	Mean	77.98	76.32	11.80	12.67	10.22	11.01	1.48	1.50	2.59	2.61	42.82	42.48	-	-
	SD	1.93	1.92	1.17	1.16	1.01	0.96	0.02	0.02	0.04	0.04	1.41	1.34	-	-
	CV	2.47	2.51	9.90	9.17	9.90	8.68	1.68	1.54	1.69	1.65	3.29	3.16	-	-

3.1.2 Bulk density

The data shown in Table 3 indicated that bulk density of surface and sub-surface soils of Sikrai tehsil ranged between 1.45 to 1.54 and 1.46 to 1.55 Mg m^{-3}. The maximum value was 1.54 Mg m^{-3} and 1.55 Mg m^{-3} and minimum value 1.45 Mg m^{-3} and 1.46 Mg m^{-3} was recorded in both the layers respectively. The corresponding mean value of BD were1.48 and 1.50 Mg m^{-3}, standard deviation 0.02 and 0.02 and coefficient of variation 1.68 and 1.54 per cent in surface ("0 to 15" cm) and sub-surface ("15 to 30" cm) soil samples respectively. The bulk density increased with depth which might be due to more compaction, low organic matter, less aggregation and secondary orientation or accumulation of clay in pre-space increased the bulk density or apparent density of sub surface soil. Similar results also reported by Kameriya (1995) in soils Agro-climatic zone – IIA of Rajasthan. These findings are in conformity with the work of Singh and Agrawal (2005).

3.1.3 Particle density

The data shown in Table 3 indicated that particle density of surface and sub-surface soils of Sikrai tahsil ranged between 2.47 to 2.65 and 2.48 to 2.66 Mg m^{-3}. The maximum value of particle density was 2.65 and 2.66 Mg m^{-3} and minimum value of particle density were recorded 2.47 and 2.48 Mg m^{-3} under surface ("0 to 15" cm) and sub- surface ("15 to 30" cm) layers. The corresponding mean value of particle density were 2.59 and 2.61 Mg m^{-3}, standard deviation 0.04 and 0.04 and coefficient of variation 1.69 and 1.65 per cent in surface and sub-surface soil samples respectively. The increase in particle density with depth could be due to a decrease in organic carbon. Minor variation in particle density might be due to changes in mineralogical composition of soil. Similar observation was also made by Kameriya (1995), Vyas, et al. (1974), Naga (1984).

3.1.4 Porosity

The data shown in Table 3 indicated that per cent porosity of surface ("0 to 15" cm) and sub-surface ("15 to 30" cm) soils of Sikrai tehsil ranged between 38.87 to 45.08 and 38.71 to 44.91%. The maximum (45.08 and 44.91%) in Gadhi (S-56) village and minimum (38.87 and 38.71%) were recorded in Chandusa (S-48) and Village in both layers respectively. The corresponding mean value of percent porosity were 42.82 and 42.48%, standard deviation 1.41 and 1.34 and coefficient of variation 3.29 and 3.16 per cent in surface and sub-surface soil samples respectively. The pore space (%) decrease abruptly with increase in depth. Lower porosity under sub-surface ("15 to 30" cm) layer as compare to surface layer ("0 to 15 cm) might be due to compaction and low organic carbon in lower layer and variation in silt and sand fractions and their arrangement. Similar results were reported by Meena et al., (2017).

4. CONCLUSION

Based on soil texture analysis, the soils of studied area have been classified as loamy sand and sandy loam textural classes. In general, majority of soils of the study area were belongs to sandy loam in nature. The almost soils of Sikrai tehsils were found to be dominant as sandy loam in texture.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Alamouti, M. Y., & Navabzadeh, M. (2007). Investigating of plowing depth effect on some soil physical properties. *Pakistan Journal of Biological Sciences*, *10*(24), 4510-4514.

Chandra, R., & Singh, S. K. (2009). Study of macro nutrient and physical status

of soil in a part of Varuna River in Varanasi, India. *International Journal of Environmental Sciences*, *4*(4), 468–471.

Chandrakala, M., Ramesh, M., Sujatha, K., Hegde, R., & Singh, S. K. (2018). Soil fertility evaluation under different land use system in tropical humid region of Kerala, India. *International Journal of Plant & Soil Science*, *24*(4), 1–13.

Kameriya, P. R. (1995). *Characterization of soils of Agro-climatic zone of transitional plain of inland drainage (Zone IIa) of Rajasthan* (Ph.D. Thesis). Rajasthan Agricultural University, Bikaner.

Kumar, Y. S. S., & Naidu, M. V. S. (2012). Characteristics and classification of soils representing major land forms in Vadamalalpeta Mandal of Chittoor District, Andhra Pradesh. *Journal of the Indian Society of Soil Science*, *60*(1), 63–67.

Mathur, G. M., Ramdev, & Yadav, B. S. (2006). Status of zinc in irrigated North-West plain soils of Rajasthan. *Journal of the Indian Society of Soil Science*, *54*, 359–361.

Meena, G. L., Singh, R. S., Singh, R. K., Meena, H. R., Meena, S., & Mina, B. L. (2017). Assessment of productivity potential of some soils of Aravali Hills based on parametric approach. *Indian Journal of Soil Conservation*, 28–39.

Murthy, A. S. P. (1988). Distribution, properties, and management of Vertisols of India. In B. A. Stewart (Ed.), *Advances in Soil Science* (Vol. 8). Springer, New York, NY. https://doi.org/10.1007/978-1-4613-8771-8_4

Mustafa, A. A., Singh, M., Ahmed, N., Sahoo, R. N., Khanna, M., Sarangi, A., & Mishra, A. K. (2011). Characterization and classification of soils of Kheragarh, Agra and their productivity potential. *Journal of Water Management*, *19*(1), 1–19.

Naga, S. R. (1984). *Physico-chemical properties and fertility status of soils of Sambher Panchayat Samiti, Jaipur district (Rajasthan) irrigated with saline ground water* (M.Sc. (Ag.) Thesis). Sukhadia University, Udaipur.

Richards, L. A. (1954). *Diagnosis and improvement of saline and alkaline soils* (USDA Hand Book No. 60). Oxford and IBH Pub. Co., New Delhi.

Sharma, B. D., Arora, H., Kumar, R., & Nayyar, V. K. (2004). Relationships between soil characteristics and total and DTPA-extractable micronutrients in inceptisols of Punjab. *Communications in Soil Science and Plant Analysis*, *35*, 799–818.

Singh, I. S., & Agrawal, H. P. (2005). Characterization, genesis and classification of rice soils of eastern region of Varanasi, Uttar Pradesh. *Agropedology*, *15*, 29–38.

Snedecor, G. W., & Cochran, W. G. (1967). *Statistical methods applied to experiments in agriculture and biology* (5th ed.). Ames, Iowa State University Press.

Vyas, K. S., Marwaha, P. S., & Didal, M. L. (1974). Studies on the saline alkali soils of Jaipur district (Rajasthan) IV. Total exchange capacity and exchangeable cations. *Agriculture Agronomy Industries Journal*, *7*, 3-4.

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