

THE PHYSICOCHEMICAL PROPERTIES OF MANDAWAR BLOCK, SOIL DAUSA, RAJASTHAN, INDIA

ABSTRACT

Analysed at the division of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences. The soil texture of the experimental area varied from sandy loam to . In general, the top soil had higher sand fraction than the lower layers. The study revealed that the range of bulk density was varied from 1.32-1.47 Mg m⁻³, the bulk density was increased with increasing the depth as the compaction increases. The range of particle density was from 2.36 to 2.49 Mg m⁻³ and the pore space 37.77 to 44.17 %, respectively. The water retention capacity (WRC) of soil was ranged between 43.56 to 57.28. The pH of soils was in the range between pH 6.67 - 7.75. The electrical conductivity of soil of entire studied area were less than 1.00 dSm⁻¹. The soil organic matter, ranges from 0.13 to 0.38 %. The available nitrogen content of entire studied area was low (162 to 310 kg ha⁻¹). The available phosphorus and potassium content varied in between 15 to 52 kg ha⁻¹ and 125 to 255 kg ha⁻¹. The available zinc, copper, manganese and iron of experimental soil ranged between 0.30 to 0.82 mg kg⁻¹, 0.36 to 1.32 mg kg⁻¹, 1.50 to 6.04 mg kg⁻¹ and 2.36 to 9.62 mg kg⁻¹. The fertility data base would be very useful for extension functionaries, agricultural officers, scientist and above all the farmers for a sustainable crop production.

Key words: pH, EC, Organic carbon, Nitrogen, Potassium, Phosphorus, Dausa district

INTRODUCTION

“Soil is one of the most important natural resources of any country and it is indispensable for our universe. It nourishes the entire plant kingdom and sustenance human life. Soil is the unconsolidated mineral matter on the earth’s surface that has been subjected to and influenced by parent material, climate (including rainfall and temperature), topography, and microorganisms, all acting over a while and producing a product that is soil”. (**Soil Science Society of America, 1970**).

“The growing population of the earth demands a systematic evaluation of soil resources concerning their extent, distribution, characteristics, and use potential, which is very important for developing effective land use planning for augmenting agricultural production on a sustainable basis” (**Nomanet al., 2021**). Although soil provides food, fuel, fodder, and fiber the primary essential to sustain life it is a most neglected and misused natural resource.

“Physical properties analysis generally includes simple, fast, and low-cost methodologies. The physical properties of soil that were assessed were bulk density, particle density, porosity, water holding capacity, specific gravity and soil color. The texture describes the proportion of three sizes of the soil particles and the fineness or coarseness of a soul. Soil texture is an important factor affecting the balance between water and gases, but it is very stable over time, independently of the soil management” (**Kumar et al, 2019**).

“Chemical attributes have been correlated with plant yields and thus the variations of a particular indicator are easily interpreted, and allow a quick improvement of the soil

chemical properties by liming and fertilization Soil chemical parameters have been traditionally used for assessment of potentially available nutrients for crops, and are based on worldwide well-established analytical methodologies. The chemical properties that were analyzed were pH, electrical conductivity, organic carbon, organic matter, Available nitrogen, phosphorus and potassium in secondary nutrients such as sulfur, calcium, and magnesium and heavy metals content, such as zinc, boron, iron, manganese, and copper". (**Barrett et al., 2020**).

"Micronutrient deficiencies were first reported at the end of the 19th century and today it is well known that the extensive areas of our soils are incapable of supplying plants with sufficient amounts of micronutrients. The application of fertilizer in the soil having only major nutrients, the loss of micronutrients through plant uptake and leaching, the decreasing proportion of farm yard manure and other organic manures in comparison with fertilizers and several other factors collectively contribute towards the deficiency of micronutrients in soils". (**Das et al., 2009**).

"Rajasthan is located in North-western India and is the biggest state in the country and the seventh largest by population. It has an area of 3, 42,239 sq. km encompassing 11% of the total geographical area of India. Rajasthan's area is similar to that of Western countries like Italy (3, 01,200 sq. km), Norway (3, 24,200 sq. km), and Poland (3, 12,600 sq. km). The state was formed on 30 March 1949 when Rajputana – the name adopted by the British Raj for its dependencies in the region was merged into the Dominion of India. Important cities are Jaipur, Dausa, Jodhpur, Kota, Bikaner, Ajmer, Alwar and Udaipur. The states of Haryana, Uttar Pradesh and Punjab bound the state of Rajasthan in the north and northeast. Uttar Pradesh, and Madhya Pradesh lie to the east while the state of Gujrat is located in the southwest of the state"(Barrett et al.,2020).

2. MATERIALS AND METHODS

2.1 Study Area

Dausa is located at 27°8' 41" N 76°50'28" E. The city covers an area of 64 km² and lies at an altitude of 467 m (1532 ft.) above sea level. The city lies 54 km west of the state capital, Jaipur. Dausa has a semi-arid climate. Temperatures vary in different seasons. In the summer (April to June), the average daily temperature was 35⁰C, while May and June are the hottest months in Dausa and the temperature reaches up to 40-45⁰C. Annually the rainfall is concentrated in the monsoon months between June (Late June) and September and is estimated over 500 mm (approximately 20 inches). The winter (November to February) is mild and pleasant with average temperatures in the range of 15-18⁰C and little or no humidity. December and January are the coldest months in Dausa with temperatures varying between 5-10⁰C. There are however occasional cold waves that lead to temperatures near freezing.

2.2 Soil Sampling

A total of twenty-seven soil samples were collected from nine different villages of three different blocks of coastal areas, Ganjam district namely Chatrapur, Rangeilunda, and Chikiti. Soil samples were collected from three different depths *i.e.*, 0-15, 15-30, and 30-45cm with the help of spade and khurpi from crop fields. The samples were air dried in shade and large clods were broken down by using wooden mallet, and separated the larger particles by using a 2 mm IS sieve. After that, soils were collected in polythene bags and labeled properly for further laboratory analysis.

UNDER PEER REVIEW

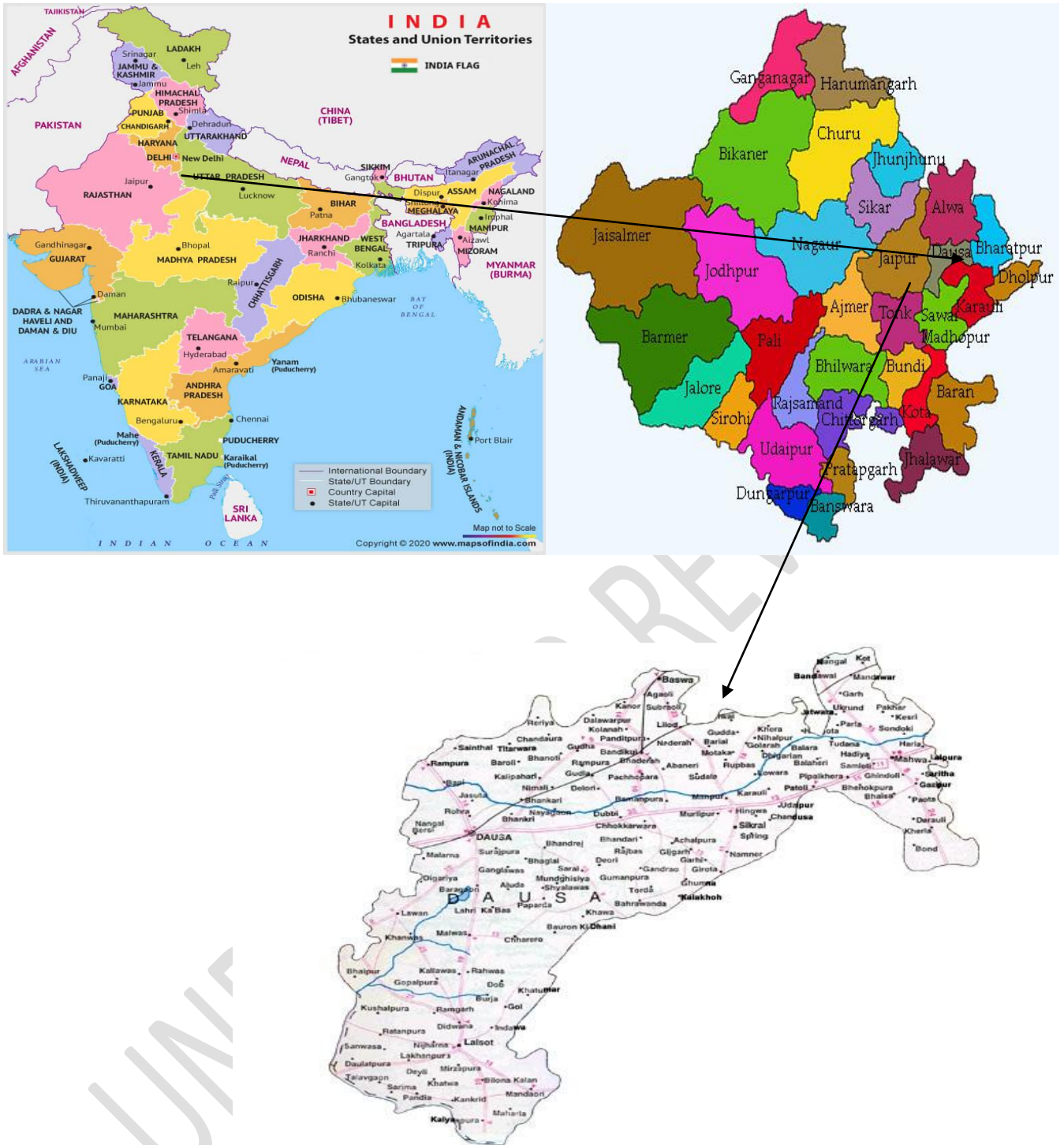


Fig 1: Geographical maps of the india ,state and district

(Soure ;Portial map of india)

RESULT AND DISCUSSION

Physical Properties

The textural classification of soil in different villages of Mandawar block. The texture classification of soil samples was observed as Sandy loam in all villages. The maximum bulk density recorded was in both V₆ - Nangal Meo and V₉ -pakher which indicates that the soil is composed of sand and aggregated loams. The minimum bulk density was recorded in V₁ – kot. A similar finding was reported by Sahoo *et al.*, (2019) and Pusty and Panda (2019). V₆ – Nangal meo was reported as the highest in particle density followed by V₈ – Reendli, and lowest was found in V₁ – Kot. Similar results were reported by (Kumaret *al.*, 2019). V₆ – Kot reported the highest porosity followed by V₉ – Pakhar, while V₇ – Nangal meo reported the lowest porosity. Significant (P<0.05) results were observed by (Nomanet *al.*, 2021). The highest water holding capacity was observed in the V₉ – Phakar, whereas the lowest water holding capacity was observed in V₁ – kot. Similar results were reported by (Mahapatra *et al.*, 2019).

Table 1: Bulk and particle density of the soil samples in different villages of the Mandawar block

S. No.	Soil bulk density			Soil particle density		
	0-15 cm	15-30 cm	15-45 cm	0-15 cm	15-30 cm	15-45 cm
Kot (V₁)	1.32	1.34	1.38	2.28	2.32	2.36
Haldena (V₂)	1.34	1.36	1.4	2.34	2.38	2.42
Banawar (V₃)	1.35	1.37	1.4	2.39	2.43	2.46
Reendli (V₄)	1.36	1.38	1.41	2.36	2.39	2.44
Garh Himmat singh (V₅)	1.4	1.43	1.45	2.33	2.37	2.40
Hadoli (V₆)	1.42	1.45	1.47	2.40	2.44	2.49
Muna pura (V₇)	1.38	1.4	1.43	2.31	2.33	2.38
Nangal meo (V₈)	1.41	1.43	1.46	2.36	2.39	2.49
Pakhar (V₉)	1.43	1.46	1.47	2.40	2.44	2.47
F- test	NS	NS	NS	NS	NS	NS
S.Em.	-	-	-	-	-	-
(±)	-	-	-	-	-	-

C. D. @ 5 %	-	-	-	-	-	-
--------------------	---	---	---	---	---	---

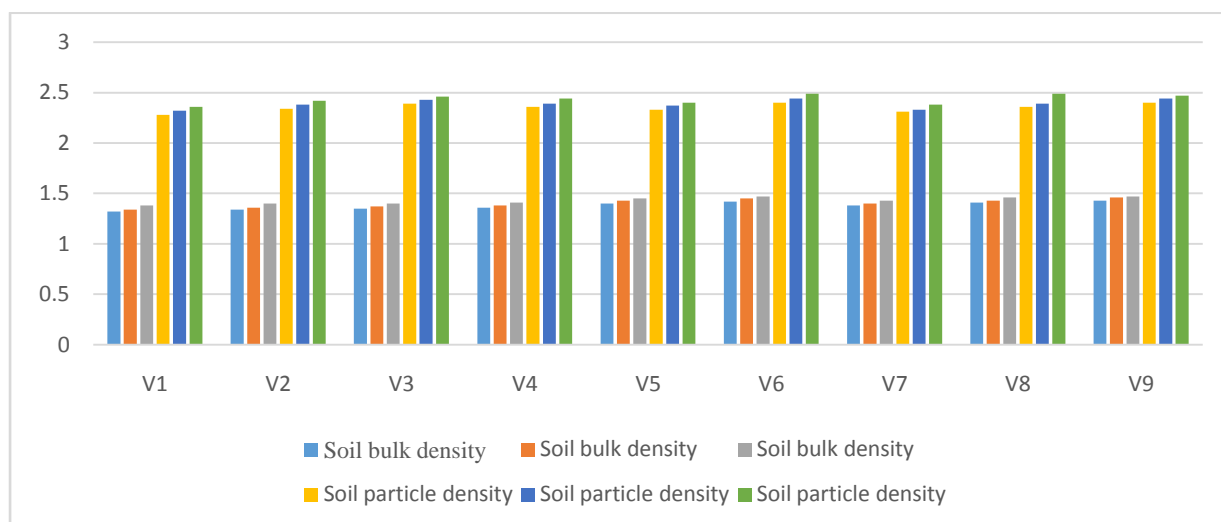


Fig. 2: Bulk density & Particle density of soil samples in different villages of the Mandawar block

S. No.	Soil porosity			Soil water holding capacity		
	0-15 cm	15-30 cm	15-45 cm	0-15 cm	15-30 cm	15-45 cm
Kot (V₁)	44.17	41.86	38.52	41.34	39.60	36.88
Haldena (V₂)	42.35	40.55	39.77	40.55	38.54	39.19
Banawar (V₃)	41.42	39.49	38.13	38.88	36.15	39.59
Reendli (V₄)	43.49	41.42	40.04	39.56	38.67	39.72
Garh Himmat singh (V₅)	43.84	40.36	37.67	40.75	36.87	39.63
Hadoli (V₆)	40.52	38.23	36.29	38.65	35.58	40.26
Muna pura (V₇)	41.00	37.17	35.23	37.55	34.23	39.45
Nangal	43.98	41.52	39.24	41.54	38.38	39.23

meo (V₈)						
Pakhar (V₉)	44.09	41.56	37.23	42.54	37.97	38.68
F- test	S	S	S	S	S	S
S.Em.	0.45	0.62	0.75	0.5	0.59	0.58
(±)						
C. D. @ 5 %	0.092	0.053	0.045	1.5	2.46	2.32

Table 2 Soil porosity and water holding capacity of the soil samples in different villages of the Mandawar block

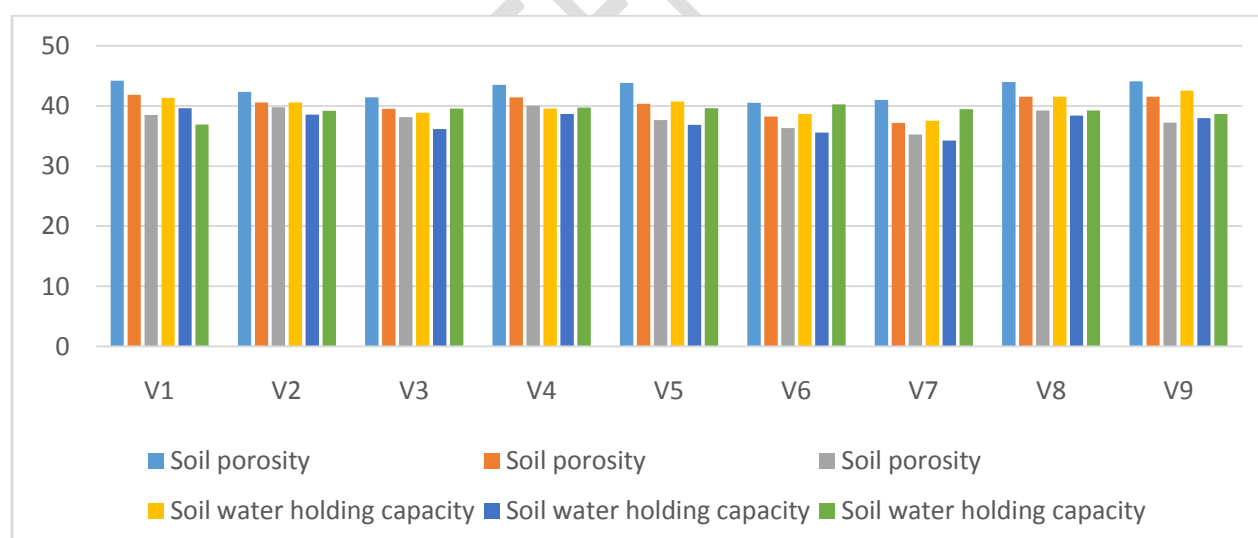


Fig. 3 Soil porosity and water holding capacity of the soil samples in different villages of the Mandawar block

Soil Chemical Properties

The highest pH value was observed in the V₄ – Manipura followed by V₆ – Nangal meo and the lowest pH was found in V₅ – Hadoli. The results revealed that the pH was in the neutral range. The pH is significant and appropriate for nutrient availability. Similar

significant results were reported by (Basavaraja et al., 2017). EC in soil samples was significant. The highest EC content was reported in V₁ – Kot followed by V₂ – Kolar whereas the lowest was observed in V₉ – Phake. Similar results were reported by (Sheeba et al., 2019). Organic carbon in soil samples value was significant and the highest organic carbon was reported in V₅ – Hadoli, whereas the lowest organic carbon was observed in V₉ – Pakher. The organic carbon is low as there is less vegetation used as residue and due to the tropical climate, degradation is quick in whole block. Similar results were reported by (Dash et al., 2019). “Nitrogen content in soil samples was significant and the highest nitrogen content in soil was observed in V₇ - Munapura, the lowest nitrogen content was reported in V₈ – Nangal”. [13] Similar results were observed with (Sheeba et al., 2019). Phosphorus in soil samples was significant. The highest phosphorus was reported in V₁ – Kot, whereas the lowest phosphorus content was observed in V₄ - Munapura. Significant results were observed (Das et al., 2018). “Potassium content in the soil samples was significant. The highest potassium content was reported in V₃ - Banawar, whereas the lowest potassium content was observed in V₈ – Reendli. The status of potassium was found moderate in the whole region due to alluvial soil which is moderate to high in available potassium”. [13] Similar results were observed with (Mahapatra et al., 2019).

Table 3: Soil pH, EC, and Organic carbon of the soil samples in different villages of the Mandawar block

S. No.	pH			EC (dS m ⁻¹)			Organic carbon (%)		
	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
Kot (V₁)	7.32	7.40	7.44	0.64	0.65	0.65	0.27	0.23	0.20
Haldena (V₂)	7.35	7.48	6.56	0.60	0.58	0.55	0.30	0.27	0.33
Banawar (V₃)	7.64	7.65	7.40	0.32	0.38	0.40	0.30	0.24	0.20
Reendli (V₄)	7.60	7.70	7.75	0.55	0.45	0.56	0.27	0.24	0.21
Garh Himmat singh (V₅)	7.62	7.65	6.67	0.51	0.52	0.53	0.38	0.33	0.30
Hadoli (V₆)	7.70	7.65	7.17	0.46	0.40	0.43	0.23	0.20	0.18
Munapura	7.70	6.70	7.32	0.68	0.65	0.70	0.24	0.18	0.15

(V ₇)									
Nangal meo (V₈)	7.50	7.55	7.31	0.27	0.30	0.28	0.31	0.25	0.23
Pakhar (V₉)	7.40	7.30	7.25	0.21	0.20	0.23	0.18	0.15	0.13
F- test	S	S	S	S	S	S	S	S	S
S.Em.	0.13	0.09	0.12	0.005	0.005	0.003	0.003	0.003	0.002
(±)									
C. D. @ 5 %	0.39	0.28	0.37	0.001	0.001	0.001	0.01	0.01	0.006

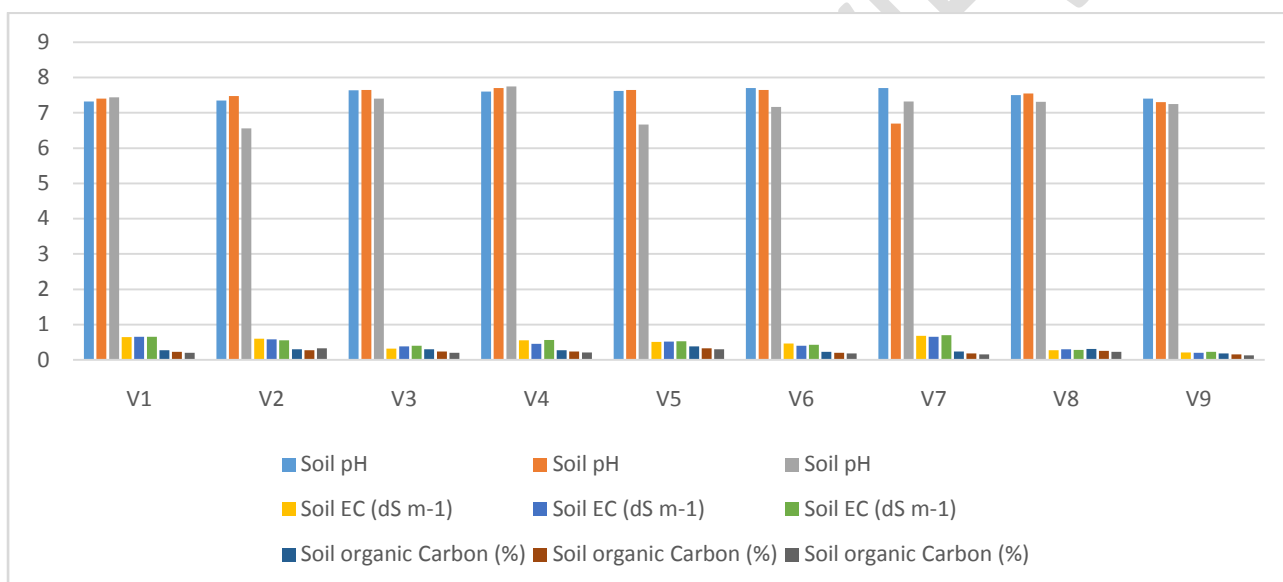


Fig 4 Soil pH, EC, and Organic carbon of the soil samples in different villages of the Mandawar block

Table 4: Available nitrogen, phosphorus, and potassium of the soil samples in different villages of the Mandawar block

S. No.	Soil Nitrogen (kg ha ⁻¹)			Soil Phosphorus (kg ha ⁻¹)			Soil Potassium (kg ha ⁻¹)		
	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
Kot (V₁)	264	223	196	52	48	44	168	145	140
Haldena (V₂)	290	250	218	50	45	42	144	135	130
Banawar (V₃)	275	225	206	52	50	48	243	235	255
Reendli (V₄)	272	245	212	20	18	15	296	278	250
Garh Himmat singh (V₅)	255	205	186	37	34	30	188	170	158
Hadoli (V₆)	240	198	179	33	30	28	201	185	175
Munapura (V₇)	310	242	221	35	31	27	211	205	180
Nangal meo (V₈)	234	186	162	24	22	20	145	128	125
Pakhar (V₉)	260	213	177	45	40	37	223	215	205

F- test	S	S	S	S	S	S	S	S	S
S.Em.	4.08	2.98	2.69	0.29	0.32	0.24	4.05	3.17	2.64
(±)									

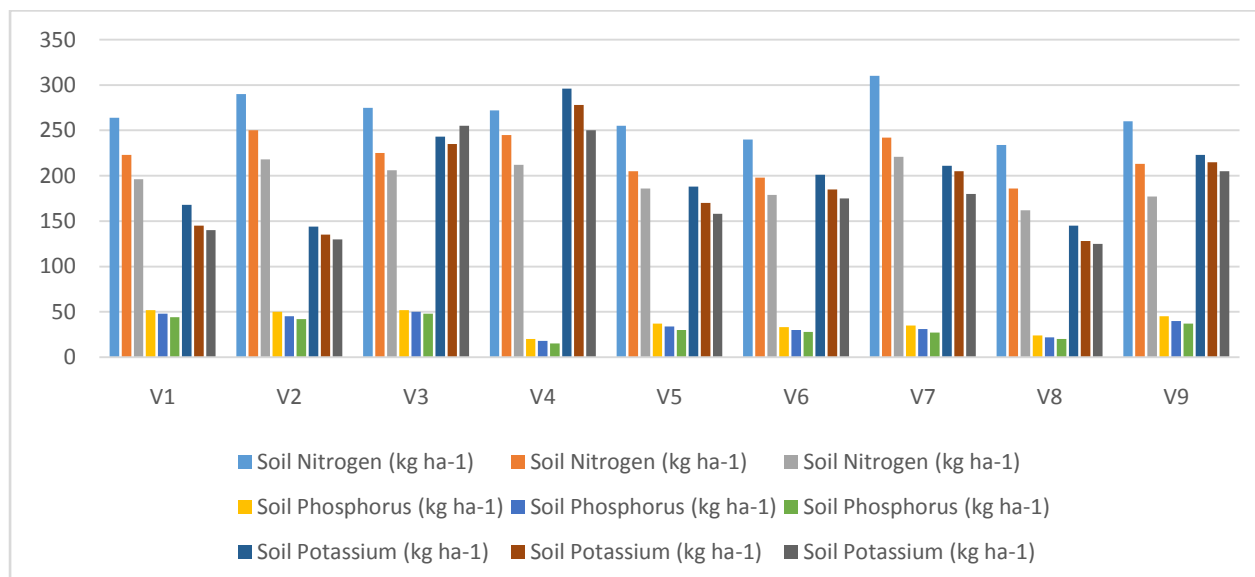


Fig. 5 Available nitrogen, phosphorus, and potassium of the soil samples in different villages of the Mandawar block

CONCLUSION

The majority of crops, particularly wheat and maize, may be grown in the Mandawar block of Dausa, Rajasthan, due to the soils' good physical condition. The soil's texture revealed a high percentage of clay, a pH that was neutral, very little to no organic carbon content, and low to medium levels of NPK. The application of certain inorganic or organic fertilizers can help to lessen the lack of nutrients. It is possible to employ tolerable cultivars and implement integrated nutrient management.

Referenes

1. **Barrett, Thomas and Parkar, C.P. (2020).** Investigation of Soil of Jaipur District of Rajasthan Irrigated with Water of Dravyavati River for its Suitability for Agricultural Purposes. *International Journal for Research in Applied Science & Engineering Technology*, 2779-2781.
2. **Basavaraja P.K., Dey P., Mohamed Saqeebulla H. and Yogendra N.D (2017)** Geo reference-based soil fertility status in Hassan district of Karnataka, India for development of nutrient plan. *Indian Journal of Soil Conservation*, 45 (2): 141-147.
3. **Das. A., David. A.A., Swaroop. N., Thomas. T., Rao. S. and Hasan. A. (2018)** Assessment of Physico-chemical properties of river bank soil of Yamuna in

- Allahabad city, Uttar Pradesh. *International Journal of chemical studies* 6(3): 2412-2417.
4. **Dash, P.K., Mishra, A. and Saren, S. (2019)** Vertical distribution of available nutrients in an Eastern Indian Catena. *Annals of Plant and Soil Research* **21(4)**: 320-325.
 5. **Jackson, M.L. (1958)**. Soil Chemical Analysis. *Prentice Hall of India. Private Ltd., New Delhi* (1973).
 6. **Kumar, A., Mishra, V. N., Srivastav, L. K. and Banwasi, R. (2019)** Evaluations of soil fertility status of available major nutrients (NPK) and micro nutrients (Fe, Mn, Cu & Zn) in vertisol of Kabeerdham District of Chhattisgarh, India. *International Journal of Interdisciplinary and Multidisciplinary Studies*, **10**: 72-79.
 7. **Mohapatra, Kiran Kumar., Pradhan, Chandini. and Saren, Subhashis. (2020)**. Soil fertility status of some villages in Sader block of Balasore district under North Eastern coastal plain agro climatic zone of Odisha, India, *International Journal of Chemical Studies*; 8(2): 381- 386.
 8. **Noman, M., David, A.A., Thomas, T., Swaroop, N. and Hasan, A. (2021)**. Assessment of Physico-chemical Properties of Soil in Dadrol Block, Shahjahanpur District, Uttar Pradesh, India. *International Journal of Current Microbiology and Applied Sciences*.10.
 9. **Pusty, S. K. and Panda, R.B. (2019)** Effect of shifting cultivation on physical & chemical properties of soil in Odisha, India. *International Journal of Recent Scientific Research*, **10(10)**: 35257-35260.
 10. **Sahoo, A.K., Butte, P.S., Nayak, D.C. and Singh, S.K. (2019)** Characterization, classification and evaluation of Lohardaga District, Jharkhand for Agriculture Land Use Planning. *Journal of the Indian Society of Soil Science*. **67**: 9-19.
 11. **Sheeba. S.S., Shalini pillai. P. and Mini. V. (2019)** Assessment and rating of available nutrient status of rice soil in the southern laterites of Kerala. *Journal of Pharmacognosy and Phytochemistry*, 269-272.
 12. **Soil Science Society of America (1970)** *Glossary of soil science terms*, Madison, USA.
 13. Nama P, Swaroop N, Thomas T, Mishra T, Bhinchar S. Assessment of soil health from different villages of Jhadol block, Udaipur, Rajasthan, India. *The Pharma Innovation Journal* 2023; 12(6): 1414-1417

UNDER PEER REVIEW