TO STUDY THE PHYSICO-CHEMICAL PROPERTIES OF SOILS COLLECTED FROM DIFFERENT VILLAGE, MANDAWAR BLOCKS,DAUSA, RAJASTHAN

ABSTRACT

Analysed at the division of soil science and agricultural chemistry, NAI, SHUATS. The soil texture in area varied from sandy loam. In general, the top soils had higher sand fraction then the lower layers. The study revealed that the range of bulk density was 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 2.36-2.49 Mg m^{-3} and the pore space 37.77 to 44.17 %. The water retaining capacity (WRC) of soil ranged between 43.56 to 57.28. The pH of soils ranged between (pH 6.67 - 7.75). The electrical conductivity of soil of entire studied area were less than 1 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 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, OC, 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 surface that has been subjected to and influenced by parent material, climate (including rainfall and temperature), topography and microorganism, all acting over a period of time 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 with respect to their extent, distribution, characteristics and use potential, which is very important for developing an effective land use planning for augmenting agricultural production on sustainable basis (**Pulakeshi*et al.*, 2014**). Although soil provides food, fuel, fodder and fiber the primary essential to sustain life but it is 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 colour. 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 along time, independently on the soil management. **(Prince, 2008).**

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 sod pH, electrical. conductivity, organic carbon, organic matter, Available Nitrogen, Phosphorus and Potassium in sod secondary nutrients such as Sulphur, Calcium and Magnesium and heavy metals content, such as Zinc, Boron, Iron, Manganese and Copper.**(Bennett *et al.,* 2010)**.

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

Rajasthan is located at the north-western part of India is the biggest state in the country and seventh largest by population. It has an area of 3, 42,239 sq.km encompassing 11% of the total geographical area of India. As a matter of fact, 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 on the east while the state of Gujrat is located at the southwest of the state. **(AkronS. G. and Paramasivan, M., 2013)**

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 km^2 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 months of April to June, average daily temperature of around 35^{o}C. May and June are the hottest months in Dausa. Temperature reaches up to 40-45^{o}C in these months. Annually the rainfall is concentrated in the monsoon months between June (Last of June) and September. It receives over 500 mm (approx 20 inch) of rainfall an average. The winter months of November to February are mild and pleasant, with average temperatures in the

15-18^{o}C range and little or no humidity. December and January are the coldest months in Dausa. Temperature varies between 5-10^{o}C in these months. 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 in three different blocks of coastal areas, Ganjam district namely Chatrapur, Rangeilunda, and Chikiti. Samples were collected from three different depths *i.e.,* 0-15cm, 15-30cm and 30-45cm. Soils were collected with the help of Spade and Khurpi from Crop fields making V-shaped method. Those samples were dried in shade place and large clods were broken down by using wooden mallet and separated the larger particle of soils by using 2 mm sieve. After that, Soils were collected in a polythene bag and were labelled properly for Laboratory analysis.

Map 1 :Geographical maps of the State, district and blocks under study

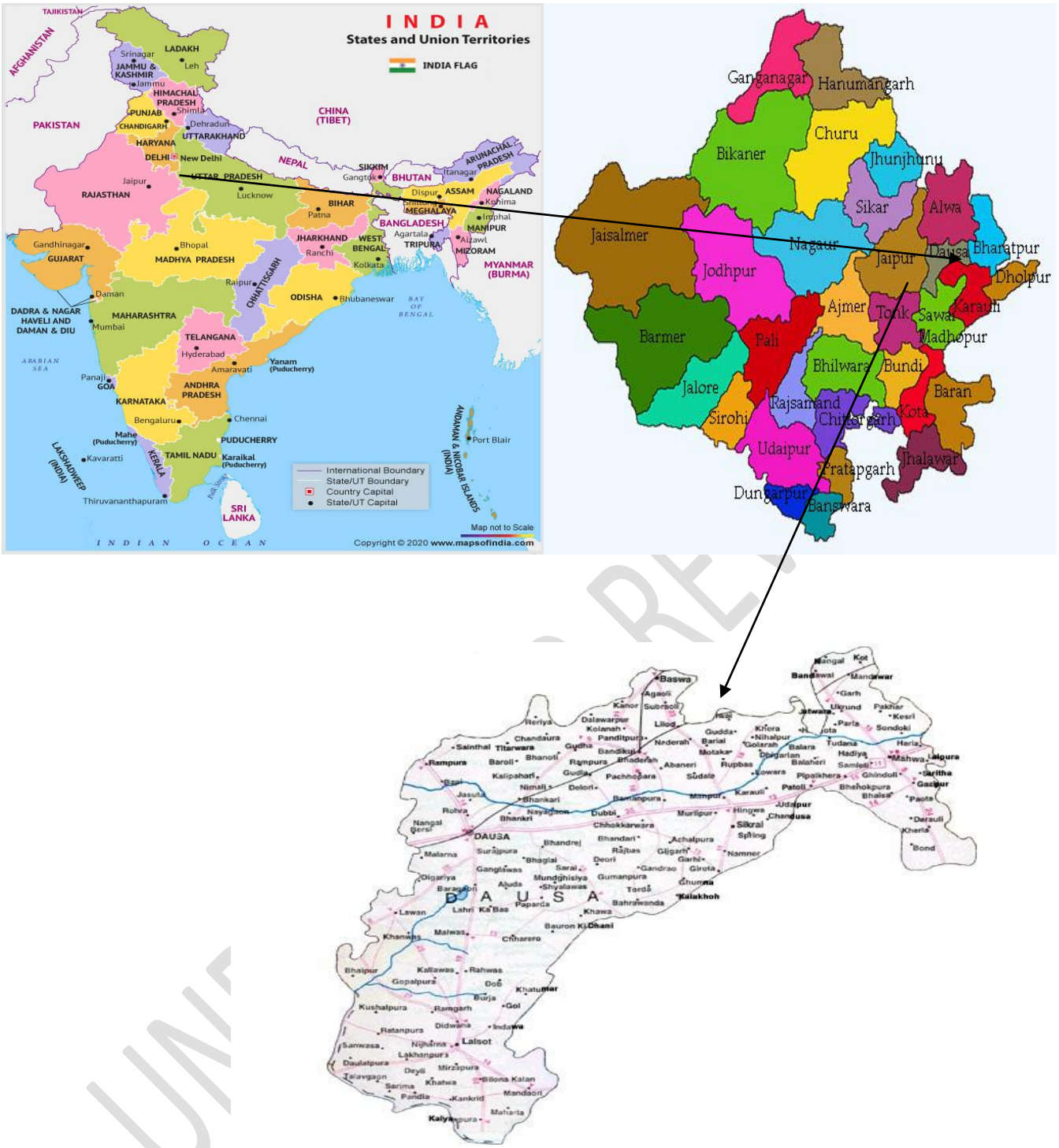

Table 1. The methods of analysis for different soil parameters

S. No.	Particulars	Scientist Name	Methods	Unit

PHYSICAL PROPERTIES				
1.	Bulk density	Black (1965)	Pycnometer	Mg m^{-3}
2.	Particle density	Black (1965)	Pycnometer	Mg m^{-3}
3.	Textural class (Sand, Slit, Clay)	Bouyoucos (1927)	Bouyoucos hydrometer	Percentage (%)
4.	Pore space	Black (1965)	-	Percentage (%)
5.	Water Holding capacity	Muthuval*et al.* (1992)	Graduated measuring cylinder	Percentage (%)
CHEMICAL PROPERTIES				
1.	Soil pH (1:2.5)	Jackson (1958)	Digital pH meter	
2.	Electrical conductivity (1:2.5)	Wilcox (1950)	Digital conductivity meter	dS m^{-1}
3.	Organic carbon	Walkley and Black (1947)	Wet oxidation method	Percentage (%)
4.	Available nitrogen	Subbiah and Asija (1956)	Soil alkaline permanganate method	kg ha^{-1}
5.	Available phosphorus	Olsen *et al.* (1954)	Photometric colorimeter method	kg ha^{-1}
6.	Available potassium	Schollenberger and Simon	Flame photometric method	kg ha^{-1}

RESULT AND DISCUSSION

Physical Properties

The textural classification of soil in different villages of Mandawar block. The texture classification of soil samples was shown Sandy loamin all village.The maximum bulk density recorded was 1.47 Mg m^{-3} in both V_6- Nangal Meo and V_9 -pakher which indicates that the soil is composed of sand and aggregated loams. The minimum bulk density was recorded in V_1- kot which was 1.32 Mg m^3. Similar finding was reported by Sahoo *et al.,* (2015) and Pusty and Panda (2019).Soil particle density ranges from 2.36– 2.49 Mg m^{-3}. V_6– Nangal meo and was reported as highest particle density *i.e.* 2.49 (Mgm^{-3}) followed by V_8 - Reendli*i.e.* 2.49 (Mgm^{-3}), and lowest was found in V_1 - Kot*i.e.* 2.36 (Mgm^{-3}). Similar results were reported by **(Chaudhari *et al.*, 2013)**.Soil porosity in a soil sample ranges from 37.17 – 44.17%. V_6– Kot reportedas highestporosity of 44.17 % followed by V_9 -Pakhar of 44.09%, while v_7 –Nangal meo reported as lowest porosity *i.e.*37.17%. Significant resultswereobserved by**(Ahad*et al.,*2015).** The values of water holding capacity of soil ranges from 36.15– 42.54%. Highestwater holdingcapacitywas observed in the V_9- Phakar which was 42.54 % whereas the lowestwater holdingcapacitywasobserved in V_1 - kot*i.e.* 38.68%.content in the soil sample. Similarresultswerereported by **(Das *et al.,* 2018).**

Table 2: Physical Properties

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
V_1	1.32	1.34	1.38	2.28	2.32	2.36
V_2	1.34	1.36	1.4	2.34	2.38	2.42
V_3	1.35	1.37	1.4	2.39	2.43	2.46
V_4	1.36	1.38	1.41	2.36	2.39	2.44
V_5	1.4	1.43	1.45	2.33	2.37	2.40
V_6	1.42	1.45	1.47	2.40	2.44	2.49
V_7	1.38	1.4	1.43	2.31	2.33	2.38
V_8	1.41	1.43	1.46	2.36	2.39	2.49
V_9	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 %	-	-	-	-	-	-

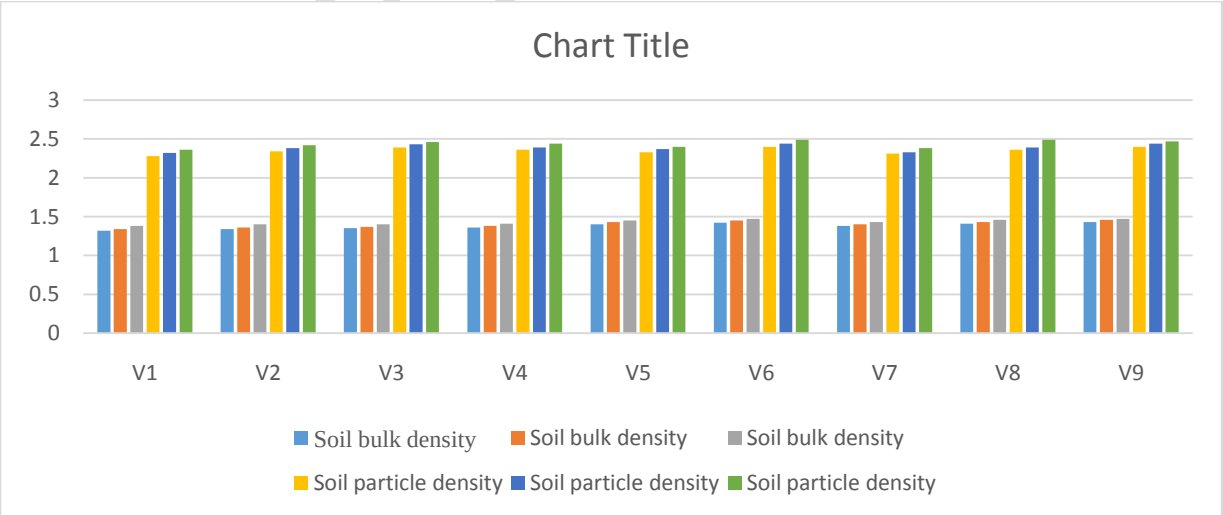

Fig. 1: Bulk density (Mg m-3) & Particle density (Mg m-3)

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
V_1	44.17	41.86	38.52	41.34	39.60	36.88
V_2	42.35	40.55	39.77	40.55	38.54	39.19
V_3	41.42	39.49	38.13	38.88	36.15	39.59
V_4	43.49	41.42	40.04	39.56	38.67	39.72
V_5	43.84	40.36	37.67	40.75	36.87	39.63
V_6	40.52	38.23	36.29	38.65	35.58	40.26
V_7	41.00	37.17	35.23	37.55	34.23	39.45
V_8	43.98	41.52	39.24	41.54	38.38	39.23
V_9	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 3: Physical Properties

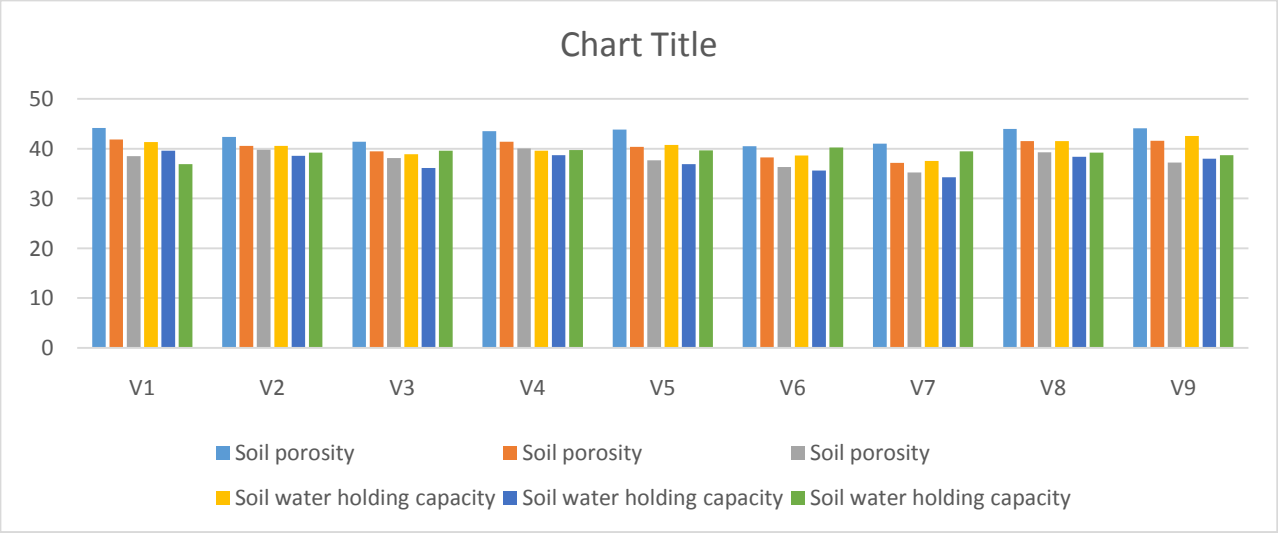

Fig. 2 soil porosity and water holding capacity

Soil Chemical Properties

pH of a soil samples ranges from 6.67 – 7.75. The highest pHvalue was observed in the V_4–Manipura*i.e.* 7.75 followed by V_6 - *i.e.* 7.70 and the lowest pH was found in V_5 – Hadoli*i.e.*6.67. The results shown the pH in neutralrange. The pH is significant and appropriate for the nutrient availability. Similar significantresultswere reported by**(Basavaraja*et al.,*2017).**EC in a soil samples ranged from 0.20 –0.24 dS m^{-1}. The results were found to be significant. Highest EC content was reported in V_1 - Kot*i.e.* 0.65dS m^{-1} followed by V_2– Kolar *i.e.* 0.60dS m^{-1} whereas the lowest EC content was observed in V_9– Phaker*i.e.* 0.20dS m^{-1}. Similar results werereported by**(Basavaraja*etal.,* 2017).**Organic carbon soil samples value ranges from 0.13 – 0.38 % The results were found to be significant. Highest organic carbon reported in V_5 - Hadoli*i.e.* 0.38 %, whereas the lowest organic carbon was observed in V_9– Pakher*i.e.* 0.13%. The organic carbon is low as there is less vegetation is used as residue and due to tropical climate, degradation is quick in whole block. Similar resultswerereported by**(Deshmukh *et al.,* 2012).**Nitrogen content in soil sample ranges from 162 – 310 kg ha^{-1}. The results were found to be significant. Highest nitrogen content in soil was observed in V_7 - Munapura*i.e.,* 310 kg ha^{-1}, the lowest nitrogen content was reported in V_8 - Nangal*i.e.* 162 kg ha^{-1}. Similarresults wereobservedwith**(Sheeba*et al.,*2019).**Phosphorus in soil samples ranged from 15 – 52 kg ha^{-1}. The results were found to be significant. Highest phosphorus was reported in V_1 – Kot*i.e.* 30 kg ha^{-1}, whereas thelowest phosphorus content was observed in V_4 - Munapura*i.e.*15 kg ha^{-1}. . Significant resultswereobserved**(Das *et al.,*2018).**Potassium content in the soil samples ranges from 125 – 255 kg ha^{-1} the results were found to be significant. Highest potassium content was reported in V_3- Banawar*i.e.* 289 kg ha^{-1}, whereas the lowest potassium content was observed in V_8 – Reendli*i.e.* 125 kg ha^{-1}. The status of potassium was found moderate in the whole region due to alluvial soil which is moderate to high in available potassium. Similar results wereobserved with **(Sharma *et al.,* 2014).**

Table 4: Soil Chemical Properties

S. No.	Soil pH			Soil EC (dS m^{-1})			Soil 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
V_1	7.32	7.40	7.44	0.64	0.65	0.65	0.27	0.23	0.20
V_2	7.35	7.48	6.56	0.60	0.58	0.55	0.30	0.27	0.33
V_3	7.64	7.65	7.40	0.32	0.38	0.40	0.30	0.24	0.20
V_4	7.60	7.70	7.75	0.55	0.45	0.56	0.27	0.24	0.21
V_5	7.62	7.65	6.67	0.51	0.52	0.53	0.38	0.33	0.30
V_6	7.70	7.65	7.17	0.46	0.40	0.43	0.23	0.20	0.18
V_7	7.70	6.70	7.32	0.68	0.65	0.70	0.24	0.18	0.15
V_8	7.50	7.55	7.31	0.27	0.30	0.28	0.31	0.25	0.23
V_9	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**

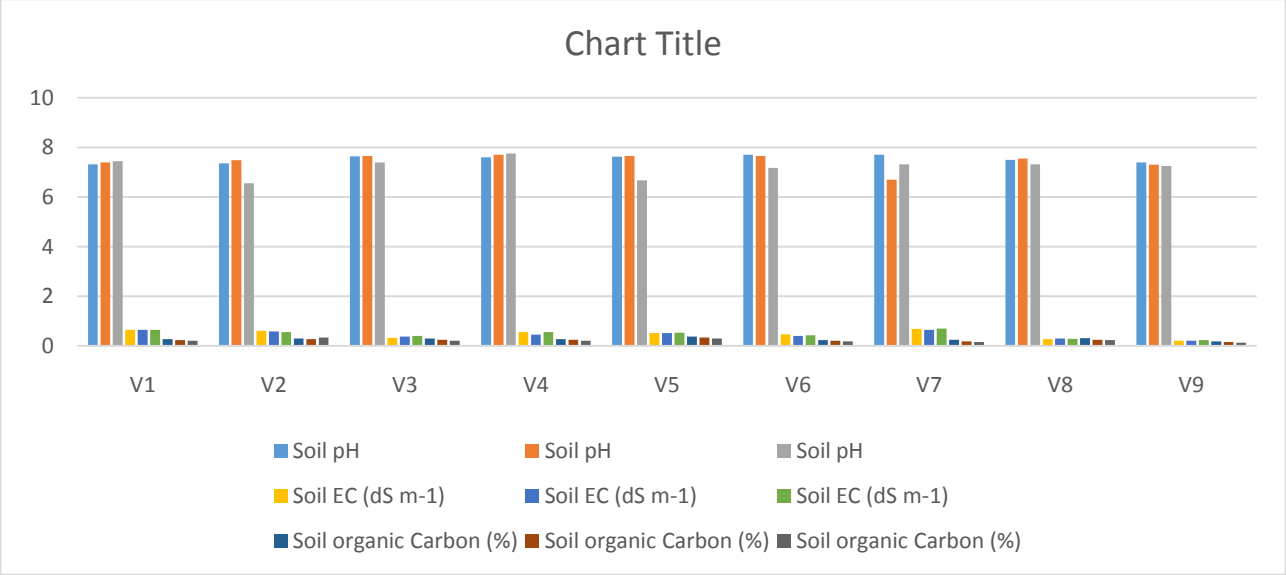

Fig. 3 Soil Ph, Soil EC and Organic carban .

Table 5: Soil Chemical Properties

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
V_1	264	223	196	52	48	44	168	145	140
V_2	290	250	218	50	45	42	144	135	130
V_3	275	225	206	52	50	48	243	235	255
V_4	272	245	212	20	18	15	296	278	250
V_5	255	205	186	37	34	30	188	170	158
V_6	240	198	179	33	30	28	201	185	175
V_7	310	242	221	35	31	27	211	205	180
V_8	234	186	162	24	22	20	145	128	125
V_9	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**

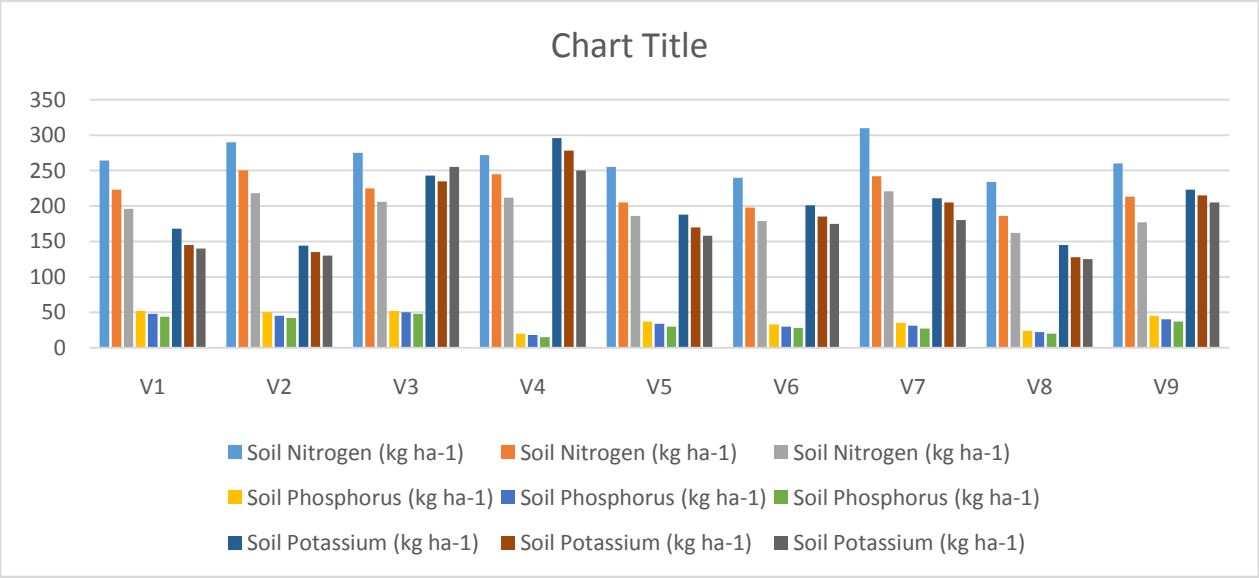

Fig. 4 Nitrogen, phosphorus and potassium

CONCLUSION

It can be concluded that the soils of Mandawar block of Dausa, Rajasthan are in good physical condition which favors the cultivation of most of the crops, especially maize and wheat. Soil texture showed high clay percentage, neutral in pH, very low to low organic carbon content, low to medium in NPK. The deficiency of nutrients can be mitigated by the use of some inorganic fertilizers or organic fertilizers. Tolerant varieties can be used and Integrated Nutrient Management can be adopted.

REFERENCES

Akron, S. G. and Paramasivan, M. (2013) Mapping of Available Nutrient Status of Thirunavalur village, Villupuram district, Tamil Nadu using Geographic Information System. *Madras Agric. J.*, **103(7-9):** 219-222.

Ahad. T., Kanth. T.A. and Nabi. S. (2015) Soil Bulk Density as Related to Texture, Organic Matter Content and Porosity in Kandi Soils of District Kupwara (Kashmir Valley), India. International Journal of Scientific Research, 4(1): 198-200.

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.

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.

Chaudhary, D.R., Ghosh, Arup, Sharma, M.K. and Chikara, J. (2013) Characterization of some salt-affected soils of Amethi, Uttar Pradesh. Agropedology, 16(2): 126-129.

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.

Digal, M., Saren, S., Mishra, A., Dash, P.K., Swain, N. and Acharya, B.P. (2018) Soil fertility status of some villages in Phiringia block of Kandhamal district under North Eastern Ghat agro climatic zone of Odisha, India. *Journal of Pharmacognosy and Phytochemistry*; **7(6):** 658-662.

Deshmukh, M.S., Kachave, T.R and Kanase, P.M. (2020) Evaluation of macro and micronutrient status of pomegranate orchards from Maharashtra region by soil and leaf analysis, *Journal of Pharmacognosy and Phytochemistry*, 9(1): 1378- 1382.

John, M. S, Mohammad, Y., Ullahshah, H. and Bat, J. (2010). Soil health. 42(3): 1909-1922.

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.

Manter, D. K., Delgado, J. A., Blackburn, H. D., Harmel, D., de León, A. A.P., & Honeycutt, C. W. (2017). Opinion: Why we need a national living soil repository. National Academy of Sciences of the USA, 114.

Pulkakeshi, H.B.P, Patil, P.L and Dasog, G.S. (2014) Characterization and classification of soil resources in north transition zone of Karnataka. *Karnataka Journal of Agricultural Sciences*, **27**: 14-21.

Prince, D. G. (2008). Engineering geology principles and practices, *Springller*: 44-65.

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.

Rattan, A.P., Naidu, M.V.S., Ramavatharam, N. and Rao, G.R. (2009) Characterization, classification and evaluation of soils on different land forms in Ramchandra Puram Mandal of Chittoor district in Andhra Pradesh for sustainable land use planning. *Journal of the Indian Society of Soil Science*. **56:** 23–33.

Soil Science Society of America (1970) Glossary of soil science terms, Madison, USA.

Sharma. R., Madhuri. S., Rishi. L.R. and Herojeet. R. (2014) Evaluation of Surface Water Quality for irrigation purposes in Limestone Mining areas of District Solan, Himachal Pradesh, India. International Journal of Innovative Science, Engineering & Technology, 1(8): 369-375.

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.

Tewari, Geeta., Khati, Deepti., Rana, Lata., Yadav, Poonam., Pande, Chitra., Bhatt, Sunita., Kumar, Vinod., Joshi, Neeta. and Joshi, Prasoon K. (2016). Assessment of Physicochemical Properties of Soils from Different Land Use Systems in Uttarakhand, India. *Journal of Chemical Engineering and Chemistry Research.* Vol. 3, No. 11, pp. 1114-1118.