

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.907.211>

Analysis of Physico-Chemical Properties and Available Macro Nutrient Status of Soil Blocks of Alwar District Rajasthan, India

Priyanka Yadav*, Narendra Swaroop and Tarence Thomas

Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, SHUATS, Prayagraj, UttarPradesh, India

*Corresponding author

ABSTRACT

Keywords

Physico-chemical properties, Alwar district, Soil and macronutrient status

Article Info

Accepted:

17 June 2020

Available Online:

10 July 2020

The present study was conducted to assess the physico-chemical properties and available N, P, K status of soil of Alwar district, Rajasthan using standard laboratory procedure. Soil samples were collected from three blocks (Mundawar, Behror, Neemarana) of the Alwar district from two depth viz. 0-15 cm and 15-30 cm. Nine sampling points in different villages were selected for the analysis of pH, electrical conductivity (EC), Nitrogen, Phosphorus, Potassium, Soil texture i.e sand, silt and clay % in soil, Water holding capacity, Percent pore space in soil. Results of the study indicated that pH ranges from 7.6 to 8.4. The EC ranges from 0.22 to 0.98 dSm^{-1} . The Nitrogen ranges from 87.5 to 184.1 Kg ha^{-1} . The Phosphorus ranges from 25 to 39 Kg ha^{-1} . The Potassium ranges from 169 to 298 Kg ha^{-1} . The sand, silt and clay ranges were from 85.2 - 94.6 %, 1.3 - 8.3 % and 4.1-9.0 % respectively. The soil texture varied from Fine sand to Loamy sand. Range of water holding capacity from 42.42 % to 62.5 % and percent pore space 37.86 to 58.9 including mean highest percent pore space 55.87 % and the lowest percent space 42.35 %

Introduction

Soil consists of minerals and organic constituents, exhibits definite physical, chemical and biological properties of variable depth. Over the surface of earth provides a suitable medium for plant growth. The chemical properties of the soil are the interactions of various chemical constituents among soil particles and the soil solution. These physical and chemical properties are soil texture, bulk density particle density water holding capacity, soil structure, soil colour, pH, electrical conductivity, cation

exchange capacity, organic carbon, organic matter and soil nutrients (i.e divided as macro and micro nutrient). (Nautiyal and Kumar, 2004) Soil testing makes complete nutrient control a possibility, Fertilizer experiments are being patterned to determine economically optimum rates of nutrients application high yields with low production costs per unit are a must in modern farming.

Farmers of today are different in the failure is more certain and sooner unless they are obtaining reasonably high yields, improved drainage, many improved Cultural practices,

better varieties, and control of insects and disease have helped to set the stage for high yields. As a result, the demand on the soil has gradually increased. Soil testing lets farmers know how much and what kind of fertilizer they must apply to be sure of returns from their investments in other improved practices (Joshi, *et al.*, 2013).

The quality of soil is rather dynamic and can affect the sustainability and productivity of land use. It is the end product of soil degradative or conserving processes and is controlled by chemical, physical and biological components of a soil and their interactions (Papendick and Parr, 1992).

Limited studies are available so far on the changes in soil nutrient status over time in the drylands in general, and arid regions in particular where the sandy soils mostly suffer from several nutrient deficiencies. It has been documented (Wani 2008) that dryland soils are not only thirsty but also hungry.

In order to maintain and enhance the productivity of land, one needs to take-up not only proper soil and water management activities, but also appropriate knowledge-based soil nutrient management. In the arid sandy tract of western Rajasthan, the soils are usually deficient in several macro- and micronutrients, and there is large spatial variability in the plant-available nutrient content of the soils (Gupta *et al.*, 2000; Praveen-Kumar *et al.*, 2009; Mahesh Kumar *et al.*, 2011a).

Also, the soils of the region do not receive adequate nutrient replenishment through flood, *etc.* as the region is devoid of any major perennial stream, and the rainfall is low. Consequently, productivity of the soils in arid region is also relatively low. The district Alwar of Rajasthan is considered as the driest part of country.

Materials and Methods

Study area

The district is located in the south-eastern part of Rajasthan. Geographically, the district lies at 25°43'N latitude and 75°65'E longitude and 268 m altitude. Geographical Area of Alwar district is 5,776 sq km. It is approximately at a distance of 164 km from the state capital Jaipur. The climate of district is extremely hot in the summers and fairly cold in the winters. The prevailing climate in Alwar is known as local steppe climate. The climate here is classified as BSh by the Koppen-Geiger classification system. The average annual is 637 mm.

Sample collection and Analysis

Soil samples were collected from three different blocks of Alwar district Rajasthan. They are Behror, Neemrana and Mundawar. Soil samples were collected with the help of Khurpi, spade and meter scale. In each block three village selected for sampling and samples obtained from two different depths 0-15cm and 15-30cm, totally eighteen soil sample were collected then further were first air dried at room temperature, then crushed using wooden mallet and then sieved (2mm) for further analysis. Water holding capacity (%) was estimated by volume basis (Muthuvel 1992). The relative proportions of the various soil separates in a soil. Analysis of soil texture was done by Bouyoucos Hydrometer method (Bouyoucos, 1927). The pore space % was calculated from the 100ml graduated measuring cylinder (Black, 1965). The soil was distilled with alkaline potassium permanganate as suggested by (Subbiah and Asija 1956) and the ammonia evolved was determined. P in the soil extract is determined colorimetrically using a Photoelectric Colorimeter after developing molybdenum blue colour (Olsen *et al.*, 1954). The procedure was based on extraction with 1N NH₄OAC

(pH 7.0) and K was determined by Flame Photometer (Toth and Prince, 1949). The same procedure used for the estimation of K. The pH was determined in 1:2 soil water suspensions using digital pH meter (Jackson, 1958). The EC was determined in 1:2 soil water suspensions using digital EC meter (Wilcox, 1950).

Results and Discussion

The Table.1 and 2 depicted the soil texture in different blocks of Alwar district from depth (0-15 and 15-30). The Sand, Silt and Clay % ranges from 85.2 - 94.6 %, 1.3 – 8.3 % and 4.1-9.0 % respectively. The Table 1 and Figure 1.1 shows the variation in water holding capacity at different depths (0-15cm and 15-30 cm) in Alwar district soils which are collected from few villages those are located nearby coastal areas. Water holding capacity of soil at 0-15cm varies between 42.85 - 62.5 %. Depth of 15-30 cm of soil showing 42.42 - 59.35% of water holding capacity. In this situation water holding capacity of soil high at 0-15cm depth. The

Table1 and Figure 1.2 depicted the statistical accumulation on percent pore space of various farmers field and depths of 0-15 and 15-30. %Pore space varies between 37.86 - 56.15 at the depth of 0-15cm of soil and 37.9 – 58.95 % at the depth of 15-30cm depth of the soil. It means increasing the depth results increasing % pore space of soils. The mean highest percent pore space 55.87 % and the lowest percent space 42.35%. The Table 1 and Figure 1.3 depicted the statistical accumulation on pH of various farmers field and depths. The pH ranges from 7.6 - 8.4 at 0-15cm depth and 7.7 - 8.2 at 15-30 cm depth. The highest mean value is recorded 8.25 and the least mean value 7.65. When depth wise values were considered, 0-15cm samples show lower pH when compared to 15-30cm depth (deeper) soil samples. It means alkaline in nature these depth is having high amount of exchangeable sodium ions. it shows that higher amount of pH is present in 15-30 cm compared to 0-15cm depth of soil. It occurs because of downward movement of water accumulation of cations in lower layers of soils.

Table.1 Physico-chemical parameter 9 sampling sites at depth (0-15) selected from three blocks of alwar district

Parameters	V1 0-15	V2 0-15	V3 0-15	V4 0-15	V5 0-15	V6 0-15	V7 0-15	V8 0-15	V9 0-15
pH	8.2	8.0	7.9	8.3	7.8	7.8	8.4	7.6	7.8
EC	0.27	0.22	0.37	0.89	0.94	0.89	0.91	0.78	0.96
% Pore space	46.8	45.2	37.86	51.66	56.15	46.8	53.1	50	46.8
Water holding capacity	62.5	51.42	55.8	45.94	42.85	47.22	51.42	44.11	56.6
Sand%	86.0	88.5	89.5	94.6	94.0	94.0	85.2	85.2	86.2
Silt%	8.3	4.5	4.5	1.3	1.9	1.9	5.8	5.8	7.6
Clay%	5.7	7.0	6.0	4.1	4.2	4.2	9.0	9.0	6.2
Soil texture	Fine sand	Fine sand	Loamy sand	Fine sand	Fine sand	Fine sand	Loamy sand	Loamy sand	Loamy sand
Avai N	151.2	98.3	117.2	91.2	162.7	103.4	109.3	127.2	117.2
Avai P	39	36	36	31	27	26	30	33	36
K	223	197	186	223	181	169	298	284	230

Table.2 Physico-chemical parameter 9 sampling sites at depth (15-30) selected from three blocks of alwar district

Parameters	V1 15-30	V2 15-30	V3 15-30	V4 15-30	V5 15-30	V6 15-30	V7 15-30	V8 15-30	V9 15-30
pH	7.9	7.9	8.0	8.2	7.7	7.8	8.0	7.7	7.7
EC	0.30	0.32	0.45	0.94	0.96	0.98	0.79	0.70	0.94
%Pore space	53.1	44.5	56.9	53.4	55.6	37.9	41.2	58.95	45.18
Water holding capacity	57.57	57.14	59.35	47.2	42.4	43.2	48.48	48.57	58.06
Sand%	86.0	88.5	89.5	94.6	94.0	94.0	85.2	85.2	86.2
Silt%	8.3	4.5	4.5	1.3	1.9	1.9	5.8	5.8	7.6
Clay%	5.7	7.0	6.0	4.1	4.2	4.2	9.0	9.0	6.2
Soil texture	Fine sand	Fine sand	Loamy sand	Fine sand	Fine sand	Fine sand	Loamy sand	Loamy sand	Loamy sand
Avai N	138.7	102.1	87.5	99.4	170.2	134.2	129.4	139.2	184.1
Avai P	38	33	38	33	25	27	32	34	38
K	229	174	187	259	194	173	283	188	202

Fig.1 Water holding capacity (%) of farmer’s field at 0-15 and 15-30 cm depths

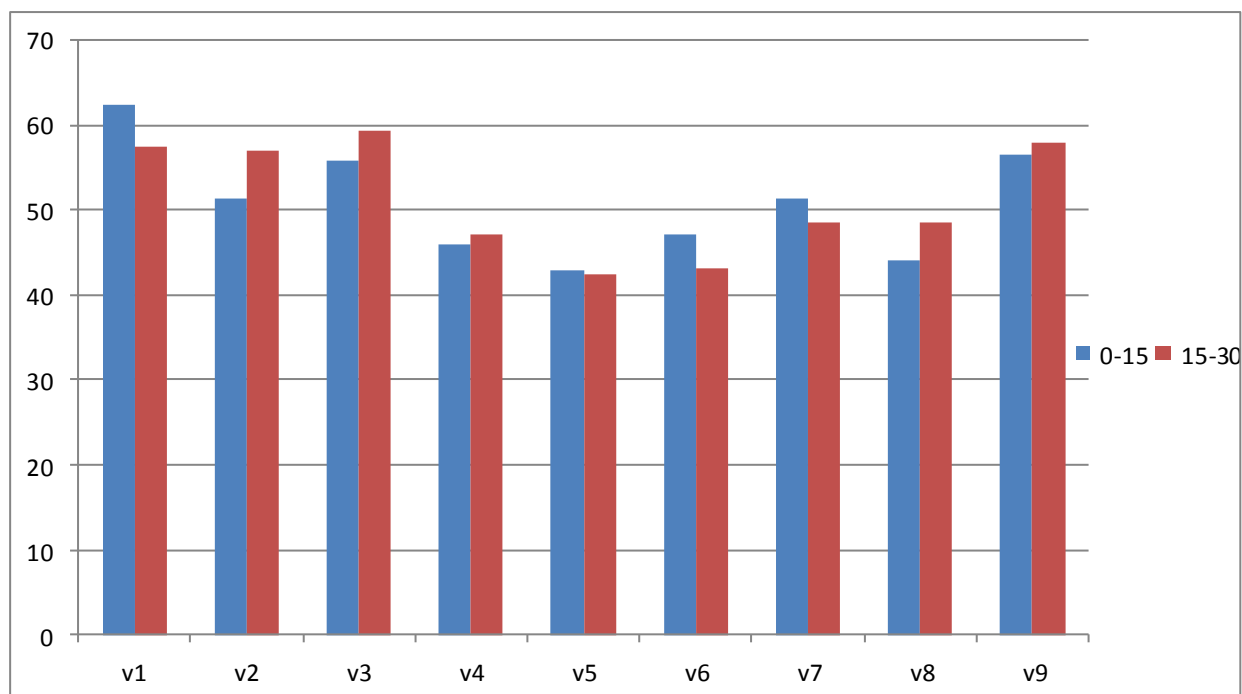


Fig.2 Percent Pore Space of farmer's field at 0-15 and 15-30 cm depths

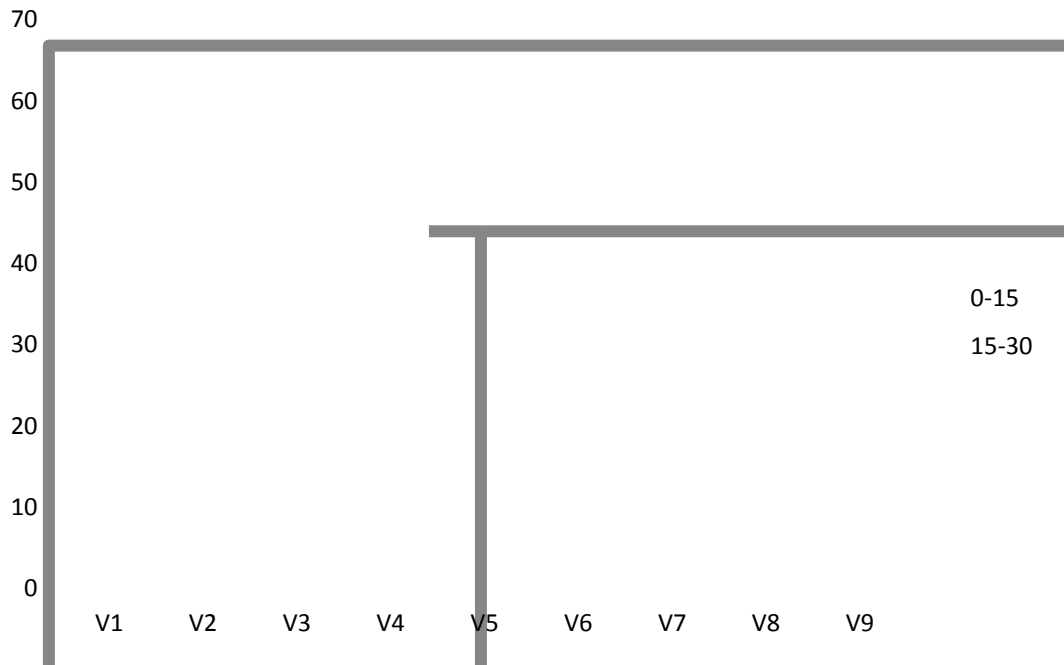


Fig.3 pH value of farmer's field at 0-15 and 15-30 cm depths

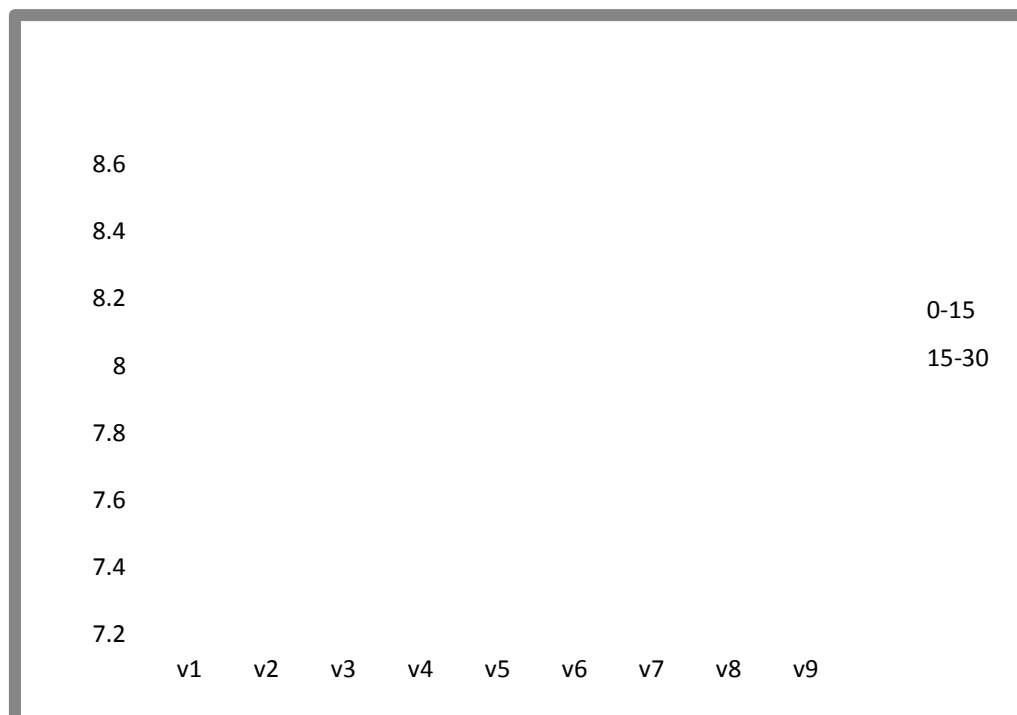


Fig.4 EC (dS m^{-1}) of farmer's field at 0-15 and 15-30 cm depths

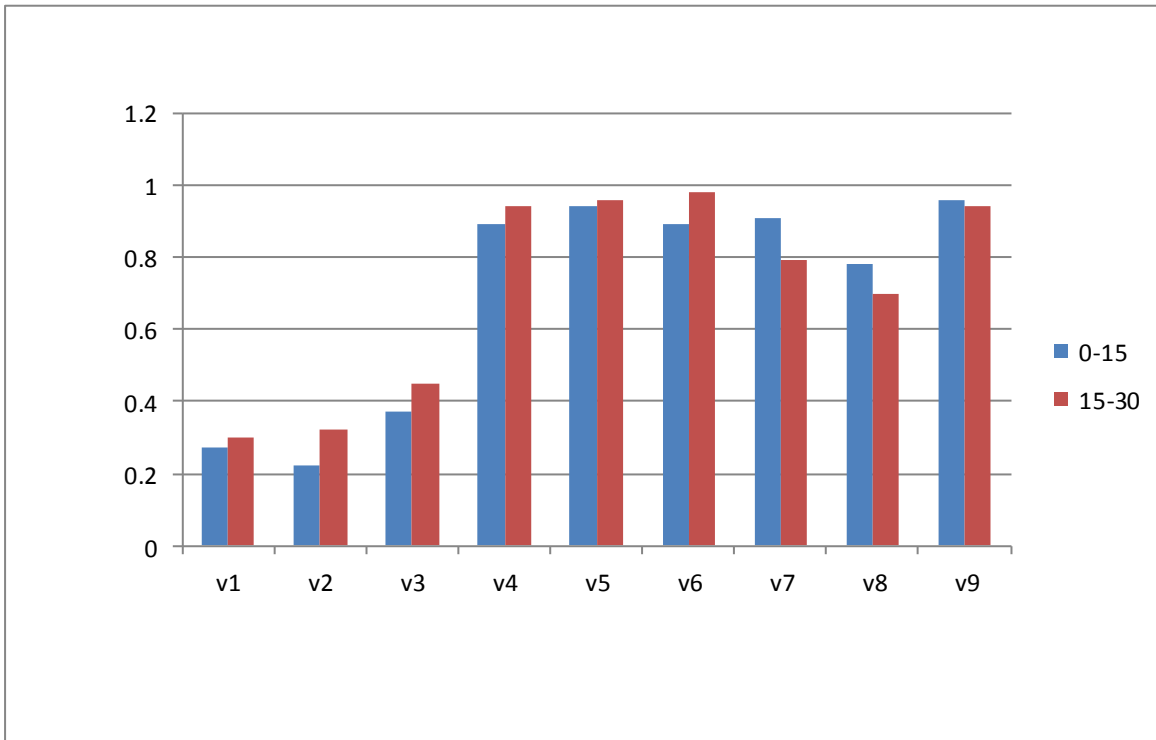


Fig.5 Available Nitrogen (kg ha^{-1}) of farmer's field at 0-15 and 15-30 cm depths

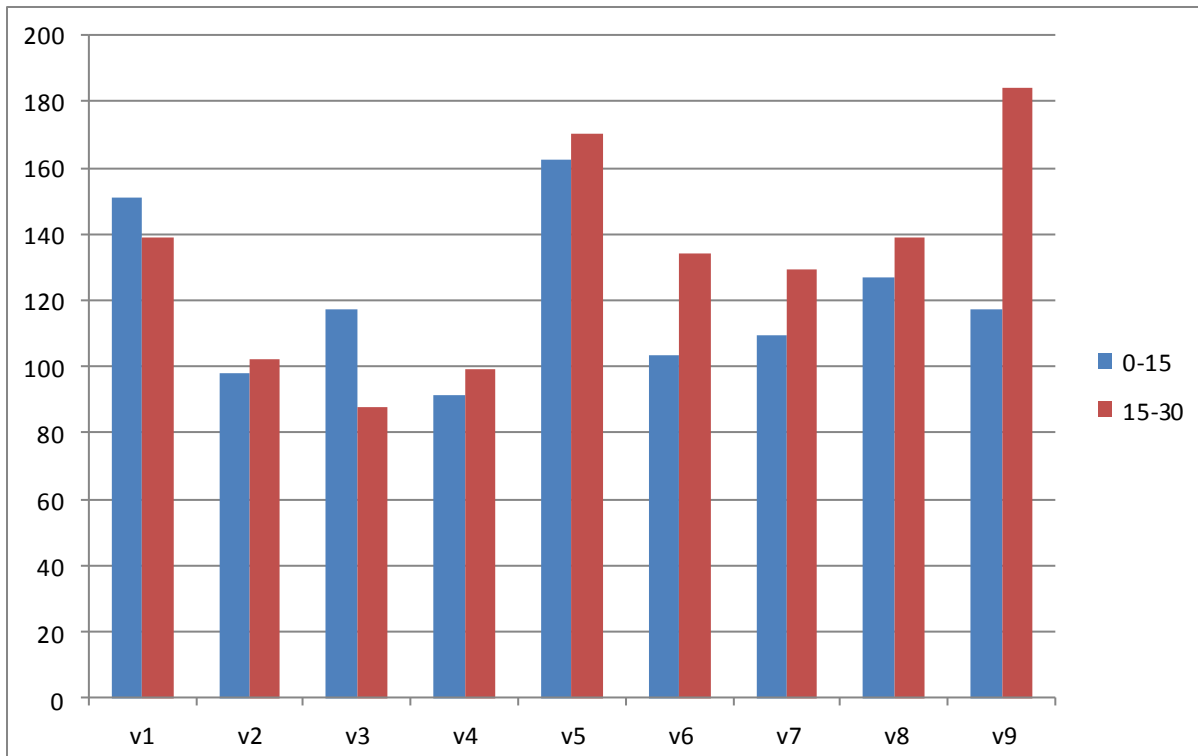


Fig.6 Available phosphorus (kg ha^{-1}) of farmer's field at 0-15 and 15-30 cm depths

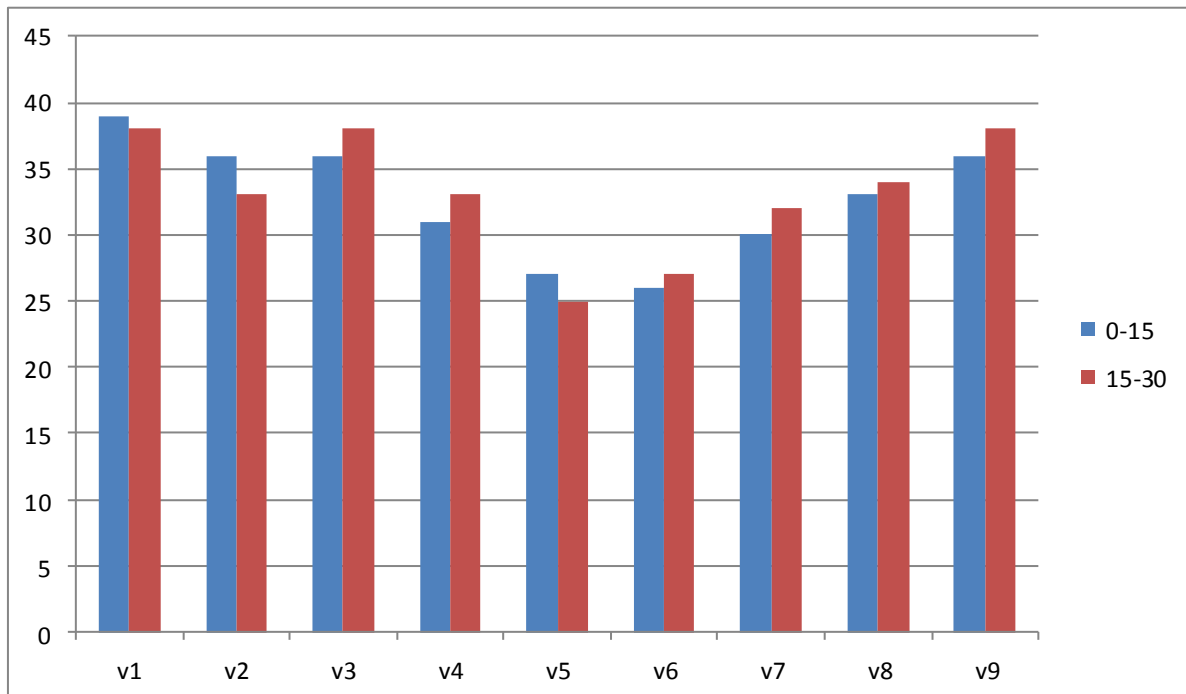
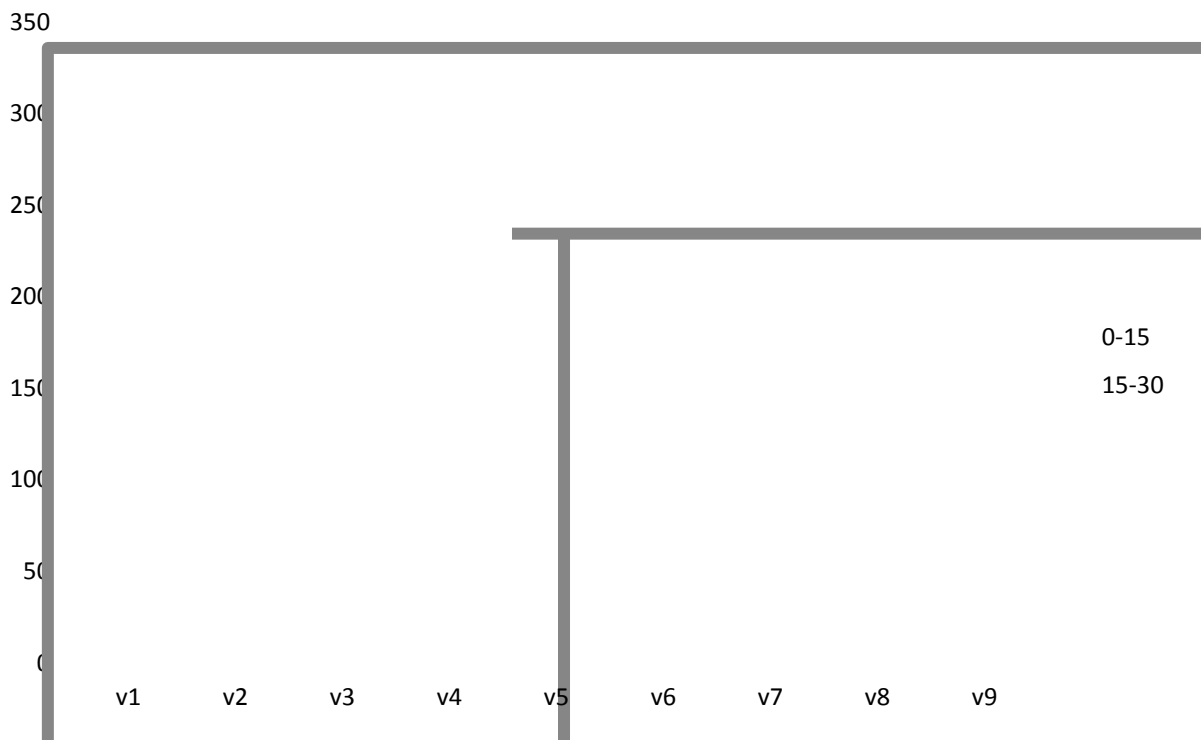


Fig.7 Available potassium (kg ha^{-1}) of farmer's field at 0-15 and 15-30 cm depths



The Table.1 and Figure.4 depicted the statistical accumulation on EC of various farmers field and depths. The highest mean value is recorded 0.95 dS m⁻¹ and the least mean value 0.27 dS m⁻¹.EC of this region soils 0-15 cm depth is various in between 0.22 – 0.96 dS m⁻¹.At the depth of 15-30 cm of soils showing 0.30 – 0.98 dS m⁻¹. Comparatively 0-15cm depth is showing fewer amounts EC than 15-30cm depth.. The Table 1 and Figure 1.5 depicted the statistical accumulation on Nitrogen (kg ha⁻¹) of various farmers field and depths which was found to be non significant. The N ranges from 98.3 - 162.75kg ha⁻¹ at 0-15 cm and 87.5 – 184.1 kg ha⁻¹ at 15-30 cm. The highest mean value is recorded is 166.47 kg ha⁻¹ and the least mean value 95.3 kg ha⁻¹.The Table 1 and Figure 1.6 depicted the statistical accumulation on available phosphorus (kg ha⁻¹) of various farmers field and depths. The P ranges from 26 - 36kg ha⁻¹ at 0-15 cm and 25-38 kg ha⁻¹ at 15-30 cm depth. The highest mean value is recorded 38.5 and the least mean value 26kg ha⁻¹.

The Table.1 and Figure.7 depicted the statistical accumulation on potassium (kg ha⁻¹) of various farmers field and depths. The K ranges from 169-298 kg ha⁻¹ at 0-15 cm and 173-283 kg ha⁻¹ at 15-30 cm The highest mean value is recorded 290.5 kg ha⁻¹ and the least mean value 171 kg ha⁻¹.

References

- Adikua, S. G. K. , G. Osei a , T. A. Adjadeh a & G. N. Dowuona (2007) Simplifying the Analysis of Soil Particle Sizes. I. Testof the Sur and Kukal's Modified Hydrometer Method Communications in Soil Science and Plant Analysis, 35:13-14, 1995-2003
- ArshiIram and TI Khan (2018)Analysis of Soil Quality Using Physico-Chemical Parameters with Special Emphasis on Fluoride from Selected Sites of Sawai Madhopur Tehsil, Rajasthan. *Int J Environ Sci Nat Res* 12(5) (125-132
- Gurjar, O.P., RamawatarMeena and Achinkumar and Surya Kant (2017) Soil Fertility Status of Mandal Block in Bhilwara District of Rajasthan,India. *International Journal of Current Microbiology and Applied Sciences* ISSN: 2319-7706 Volume 6 Number 9 1154-1158
- Hukam Singh Kothiyari, K. C. Meena, B. L. Meena and RamkishanMeena (2018)Soil Fertility Statusin SawaiMadhopur District of Rajasthan *Int. J. Pure App. Biosci.* 6 (4): 587-591
- Mahesh Kumar, S.K. Singh1 and B.K. Sharma (2009) Characterization, Classification and Evaluation of Soils of Churu District, Rajasthan *Journal of the Indian Society of Soil Science*, Vol. 57, No. 3, pp 253-261
- Pravin R. Chaudhari, Dodha V. Ahire, Vidya D. Ahire, Manab Chkravarty and Saroj Maity Soil Bulk Density as related to Soil Texture, Organic Matter Content and available total Nutrients *International Journal of Scientific and Research Publications*, Volume 3, Issue 2, 2250-3153
- Rakesh Gothwal, Govind Kumar Gupta. (2018). Physico-Chemical Analysis of Soil during Summer Season in Lentic Fresh Water Ecosystem: Nakki Lake-Mount Abu *WSN* 115 (2019) 117-127
- Ramana1, Y.V. Singh, L. K. Jat, Santosh K. Meena Lakhapati Singh, H.S. Jatav and AlpanaPaul. (2015). Available Macro Nutrient Status and their Relationship with Soil Physico-Chemical Properties of Sri Ganganagar. *Journal of Pure and Applied Microbiology*, Vol. 9(4), p. 2887-2894
- Sanjay Kumarbhati. (2017). Chemical Analysis of soil fertility parameters in

- Sri ganganagar and Hanumangarh District of Rajasthan. *IJIRMP* 5 (4).
- Singh, Y.V., Shashi Kant, S.K. Singh, P.K. Sharma, L.K. Jat, M. Kumar, S.K. Shahi, H.S. Jatav and R.N. Yadav. 2017. Assessment of Physico-Chemical Characteristics of the Soil of Lahar Block in Bhind District of Madhya Pradesh (India). *Int.J.Curr.Microbiol.App.Sci.* 6(2). 511-519.
- Subbaiah, B.V. and Asija, G.K (1956) A rapid procedure for utilization of available nitrogen in *Soil.Curr.Sci.* 26: 258-260.
- Tan (1945) Observed the procedure of soil sampling.
- Toth and Prince, (1949) Estimation of available potassium.
- VarshaPandey, PoonamGautam and AP Singh (2018) Assessment of physical properties of soil under different land use systems in a Mollisol *Journal of Pharmacognosy and Phytochemistry* ; 7(6): 2645-2648
- Vikram Kumar^{1*}, Jahangeer², PadmNabh Tripathi³ and Shaktibala Comparative study of soil physical characteristics of Jaipur district, Rajasthan (2017) *African Journal of Environmental Science and Technology* Vol. 11(1), pp. 45-55
- Walkley, A. and Black, I.A (1934) Estimation of Degtjareft method for determining soil organic matter, and a proposed modification of chromic acid titration method. *Soil Science* 37,29-38

How to cite this article:

Priyanka Yadav, Narendra Swaroop and Tarence Thomas. 2020. Analysis of Physico – Chemical Properties and Available Macro Nutrient Status of Soil Blocks of Alwar District Rajasthan, India. *Int.J.Curr.Microbiol.App.Sci.* 9(07): 1834-1842.
doi: <https://doi.org/10.20546/ijcmas.2020.907.211>