ASSESSMENT OF PHYSICO-CHEMICAL PROPERTIES OF SOIL FROM DIFFERENT BLOCKS OF ADILABAD DISTRICT, TELANGANA

Abstract

An Assessment of Physico-chemical properties of soil from different blocks of Adilabad district, Telangana was carried out in 2022. To determine the availability of macro nutrient in soil of these soil samples and provide the assessment of 9 sampling locations were selected. Soil samples were collected at the depth of 0-15 cm, 15-30 cm and 30-45 cm respectively. Soil textural classes were sandy clay loam. The Water Holding Capacity varies from (36.65 to 45.89%), Bulk Density varies from (1.36 Mg m^{-3} to 1.64 Mg m^{-3}). Particle Density varies from (2.34 Mg m^{-3} to 2.49 Mg m^{-3}). % Pore Space (41.23% to 49.16 %) the physical condition of the soil was found good. The pH of soil is alkaline in nature (7.43 to 8.90) and the Electrical Conductivity (0.17 to 0.49 dSm^{1}) was suitable for all crops. Organic carbon was found low to medium (0.31 to 0.48%). These soils have low Nitrogen (190.00 kg ha^{-1} to 220.00 kg ha^{-1}) in all villages. Phosphorus (16.14 kg ha^{-1} to 25.58 kg ha^{1}) is found medium to high. Potassium (219.87 kg ha^{-1} to 277.51 kg ha^{-1}) is found medium in range. Calcium (3.68 meq $100g^{-1}$ to 5.45 meq $100g^{-1}$) and Magnesium (1.89 meq $100g^{-1}$ to 2.76 meq $100g^{-1}$) are sufficient in this soil. There is an including awareness of the need to pay greater attention in the role of macronutrients enhancement in the soil for good soil health and proper nutrition of plant so as to attain optimum economic yield and soil is suitable for all major tropical and sub-tropical crops.

Key words: Adilabad district, Physico-chemical properties, Soil Health etc.

INTRODUCTION

Soil is the natural medium for the growth of plants. Soil has also been defined as a natural body consisting of layers (soil horizons) that are composed of weathered mineral materials, organic materials, air and water. Soil is the end product of the combined influence of climate, topography, organisms (flora, fauna and human) on parent materials (original rocks and minerals) over time. As a result, soil differs from its parent material in texture, structure, consistency, colour, chemical, biological and physical characteristics. Soil is an essential component of “Land” and “Eco-systems” that both are broader concepts encompassing vegetation, water and climate in the case of land, and in addition to those three aspects, also social and economic considerations in the case of ecosystems. (FAO) profile, texture, composition, or structure. Each soil type is formed differently and can be found inspecific places on the earth’s immediate surface, mid and deep under the surface. Soils on the surface (a few millimetres deep) are usually exposed to direct climatic and environmental factors and easily blown away by the wind, washed away by water, or even broken down by temperature changes, human and animal activity. There are also soils found deep down the earth, often protected from climatic and environmental factors.

Keeping in view of importance of soil's physical and chemical properties, the present study of Physico-chemical properties of soil collected from various locations of district of Adilabad, Telangana undertaken. The soil sample collection is from 3 blocks of Adilabad District in the state of Telangana. Each selecting 3 villages. Samples will be collected randomly from a site of each village using soil auger, Khurpi Knife by composite sampling method at a depth of 0-15cm, 15-30cm, 30-45 cm.

A comparison of the Physico-chemical Properties of some of the soils of different regions of the Telangana state has been undertaken by comparing the results of the present study with the studies done earlier in the other regions of the state. Hence, a detailed study for evaluation of soils is needed to realize the concept of Physico-chemical analysis successfully. With this following objective, a study has been undertaken in soil resources inventory for sustainable land use planning in Adilabad region of Telangana.

MATERIALS AND METHODS

Sampling site and collection

Telangana, state of India, is situated on the Deccan plateau in the central stretch of the eastern seaboard of the Indian Peninsula. it is bordered by the states of Maharashtra to the north, Chhattisgarh to the northern, Karnataka to the west, and Andhra Pradesh to the east and south. The capital of the is Hyderabad.

Soil samples were collected from 3 different Blocks of Adilabad district in Telangana. Three different locations selected from each block. Samples were collected randomly from three site of each block using soil auger, Khurpi, Knife by composite sampling method at depths of 0-15cm,15-30cm, 30-45cm. Twenty-Seven Samples are collected with the help of GPS. All the samples were divided into four parts and then among them two samples are collected and only half kg sample is being taken for the soil analysis by the conning and quartering method.

Methods

Analysis of the soil samples were under the methods, the physical parameters include Soil Colour, Soil Texture, Bulk Density, Particle Density, Pore Space, Water Holding Capacity, whereas chemical parameters include pH, Electrical Conductivity, Organic Carbon, Macronutrients (N, P, K, Ca, Mg,) Soil textural class was determined by using Hydrometer (Bouyoucos, 1927). Bulk density, Particle density, Water holding capacity was determined by using Graduated Measuring Cylinder method (Muthuaval *et al.*, 1992). pH was estimated with the help of Digital pH meter after making 1:2 soil water suspension (Jackson, 1958). Electrical Conductivity was estimated with the help of Digital Conductivity meter (Wilcox, 1950). Percent Organic Carbon was estimated by Wet Oxidation method (Walkley and Black, 1947). Available Nitrogen was estimated by Alkaline Potassium Permanganate method, using Kjeldahl apparatus (Subbiah and Asija, 1956), Available Phosphorus was estimated by Olsen's extraction followed by Spectrophotometric method (Olsen *et al.*, 1954), Available Potassium was estimated by Neutral normal Ammonium Acetate extraction followed by Flame photometric method (Toth and Prince, 1949), Exchangeable Calcium and Magnesium were estimated by EDTA method (Cheng and Bray, 1951).

RESULTS AND DISCUSSION

Physical Properties

The Soil Textural classes identified as Sandy Clay Loam. The sand, silt and clay percentage varied from 46.56 to 60.56 sand, 11.36 to 19.36 silt and 25.08 to 34.08 clay in Sandy Clay Loam. Bulk Density was varied from the 1.36 Mg m^{-3} to 1.64 Mg m^{-3} and the highest Bulk Density was found in S_2 (1.64 Mg m^{-3}) from Jainath Block. The Particle Density varied from 2.34 Mg m^{-3} to 2.49 Mg m^{-3} and the highest Particle Density was found in S_9 (2.49 Mg m^{-3}) from Boath Block. The Pore Space (%) ranged from 41.23% to 49.16 %. The highest Pore Space % was found at S_6 (49.16%) from Ichoda Block. The Water Holding Capacity (%) ranged from 36.65 to 45.89 % and the highest water holding capacity was found at S_6 from Ichoda Block hold the water best at 45.89%.

Table 1: Evaluation of Bulk density and Particle density of Soils of Adilabad District

Block Name & Sites	**Bulk Density (Mg m^{-3})**			**Particle Density (Mg m^{-3})**		
	0-15 cm	**15-30 cm**	**30-45 cm**	**0-15 cm**	**15-30 cm**	**30-45 cm**
Jainath						
S_1	1.40	1.44	1.47	2.38	2.43	2.48
S_2	1.38	1.55	1.84	2.37	2.41	2.44
S_3	1.53	1.56	1.58	2.38	2.42	2.46
Ichoda						
S_4	1.38	1.36	1.38	2.34	2.40	2.44
S_5	1.50	1.45	1.49	2.35	2.41	2.47
S_6	1.53	1.54	1.60	2.37	2.42	2.46
Boath S_7						
	1.53	1.56	1.58	2.38	2.43	2.47
S_8	1.53	1.54	1.60	2.35	2.40	2.46
S_9	1.50	1.56	1.58	2.38	2.43	2.48
	F-Test	**S.Em. ±**	**C.D. @5%**	**F-Test**	**S.Em. ±**	**C.D. @5%**
Depth (0-15 cm)	S	0.024495	0.072779	NS	0.038805	-
Depth (15-30 cm)	S	0.025786	0.076614	NS	0.037809	-
Depth (30-45 cm)	S	0.020413	0.060651	NS	0.044017	-

Table 2: Estimation of Water Holding Capacity, Pore Space (%) of Soils of Adilabad District

Block Name & Sites	Water Holding Capacity (%)			Pore Space (%)		
	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
Jainath						
S_1	42.56	40.09	38.59	47.98	45.67	43.01
S_2	42.20	40.13	38.32	48.73	46.76	43.51
S_3	40.64	38.20	36.65	45.89	43.17	41.23
Ichoda						
S_4	43.40	40.32	38.98	47.16	46.98	43.56
S_5	43.08	40.81	39.87	48.57	46.84	44.21
S_6	45.89	43.45	40.65	49.16	48.34	46.04
Boath						
S_7	44.32	41.89	39.06	48.21	45.46	43.34
S_8	43.12	40.49	38.79	49.09	46.94	43.02
S_9	43.21	41.92	38.13	47.78	45.32	42.78
	F-Test	**S.Em. ±**	**C.D. @5%**	**F-Test**	**S.Em. ±**	**C.D. @5%**
Depth (0-15 cm)	S	0.646975	1.922262	S	0.637188	1.893183
Depth (15-30 cm)	S	0.398562	1.184190	S	0.743546	2.209189
Depth (30-45 cm)	S	0.545969	1.622154	S	0.617412	1.834427

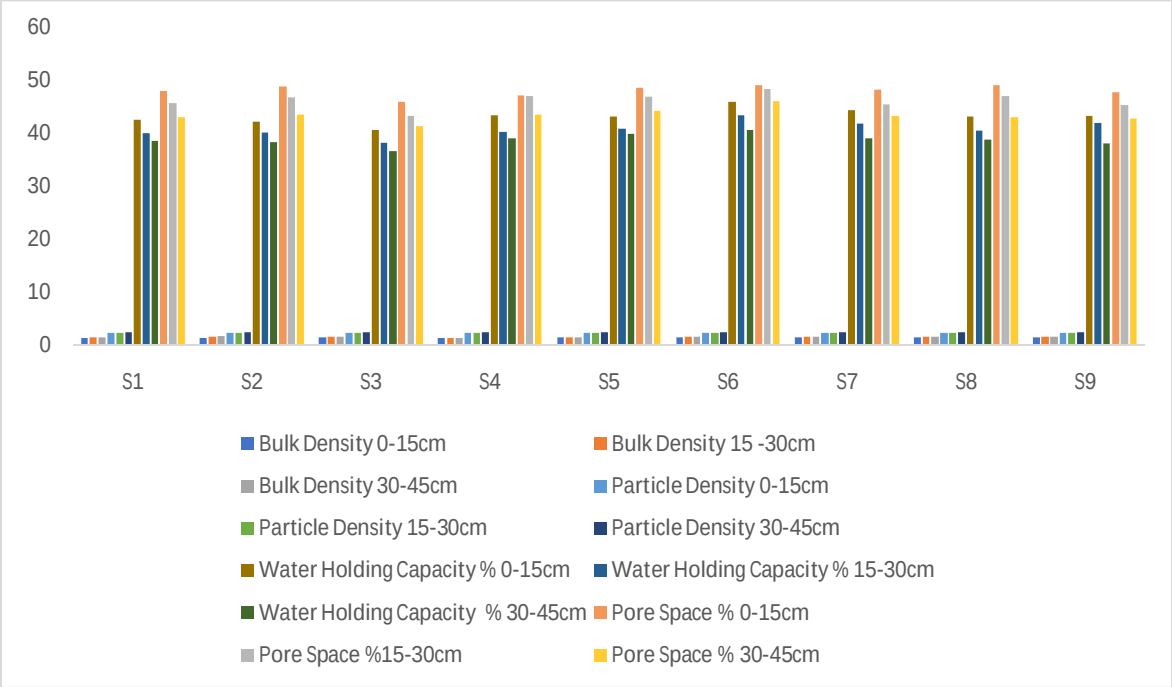

Fig 1: Bulk density, Particle density, Water Holding Capacity and Pore Space

Chemical Properties

The pH value ranged from 7.43 to 8.90 and the highest value was recorded at site S_3 (pH 8.90) from Jainath Block. The Electrical Conductivity ranged from (0.17 to 0.49 dS m^{-1}) and the highest value was recorded at the site S_7 (0.49 dS m^{-1}) from Boath Block and the soil was found to be normal. The value of total Organic Carbon (%) varied from 0.31 to 0.48% and the range of organic carbon content was found low to medium.

Table 3: Estimation of soil pH (1:2), EC (dsm^{-1}) and Organic Carbon (%)

Block Name Sites	**pH**			**EC (ds m^{-1})**			**OC (%)**		
Jainath	**0-15 cm**	**15-30 cm**	**30-45cm**	**0-15 cm**	**15-30 cm**	**30-45 cm**	**0-15 cm**	**15-30 cm**	**30-45 cm**
S_1	8.18	8.25	8.45	0.35	0.34	0.41	0.48	0.45	0.41
S_2	7.45	7.50	7.88	0.31	0.35	0.37	0.45	0.41	0.39
S_3	8.65	8.81	8.90	0.25	0.35	0.41	0.46	0.43	0.41
Ichoda									
S_4	8.24	8.42	8.63	0.38	0.39	0.43	0.45	0.43	0.39
S_5	8.04	8.16	8.48	0.17	0.22	0.27	0.44	0.41	0.39
S_6	7.83	8.03	8.42	0.36	0.41	0.44	0.35	0.33	0.31
Boath									
S_7	8.25	8.51	8.76	0.42	0.45	0.49	0.47	0.43	0.40
S_8	8.15	8.61	8.16	0.41	0.43	0.46	0.43	0.41	0.35
S_9	7.43	7.63	7.76	0.21	0.23	0.33	0.48	0.44	0.41
	F-Test	**S.Em. ±**	**C.D. @5%**	**F-Test**	**S.Em. ±**	**C.D. @5%**	**F-Test**	**S.Em. ±**	**C.D. @5%**
Depth (0-15 cm)	S	0.079147	0.235159	S	0.005140	0.015273	S	0.006054	0.017989
Depth (15-30 cm)	S	0.100188	0.297674	S	0.004122	0.012247	S	0.005681	0.0168795
Depth (30-45 cm)	S	0.098743	0.293338	S	0.006360	0.01889	S	0.003646	0.0108339

Primary Nutrients

The Available Nitrogen content of soil ranged from 198 to 252 kg ha^{-1} and Nitrogen content was low in all villages. The Available Phosphorus content of soil ranged from 16.14 to 25.58 kg ha^{-1}. The phosphorus content was found medium to high. Available Potassium content of soil ranged from 219.87 to 277.51 kg ha^{-1}. The potassium content was found Medium in range in all the villages.

Table 4: Evaluation of Available Nitrogen (Kg ha^{-1}), Available Phosphorous (Kg ha^{-1}) and Available Potassium (Kg ha^{-1})

Block Name Sites	**Nitrogen (Kg ha^{-1})**			**Phosphorous (Kg ha^{-1})**			**Potassium (Kg ha^{-1})**		
Jainath	**0-15 cm**	**15-30 cm**	**30-45cm**	**0-15 cm**	**15-30 cm**	**30-45 cm**	**0-15 cm**	**15-30 cm**	**30-45 cm**
S_1	244.75	232.51	226.71	21.86	18.65	16.94	244.75	232.51	226.71
S_2	256.45	241.19	232.36	24.58	21.12	18.18	256.45	241.19	232.36
S_3	263.10	251.41	245.45	22.19	18.89	16.14	263.10	251.41	245.45
Ichoda									
S_4	235.75	227.32	219.87	23.42	20.38	17.53	235.75	227.32	219.87
S_5	266.01	249.91	235.37	25.58	21.12	19.35	266.01	249.91	235.37
S_6	256.89	242.21	236.21	21.57	19.92	16.34	256.89	242.21	236.21
Boath									
S_7	277.51	269.23	258.61	24.68	21.21	18.86	277.51	269.23	258.61
S_8	266.42	257.51	249.87	25.12	20.67	17.37	266.42	257.51	249.87
S_9	271.56	266.79	256.45	23.35	20.17	16.89	271.56	266.79	256.45
	F-Test	**S.Em. ±**	**C.D. @5%**	**F-Test**	**S.Em. ±**	**C.D. @5%**	**F-Test**	**S.Em. ±**	**C.D. @5%**
Depth (0-15 cm)	S	3.238263	11.8113	S	0.305152	0.90665	S	4.46732	13.27318
Depth (15-30 cm)	S	1.714064	7.87969	S	0.311785	0.92636	S	4.02908	12.74866
Depth (30-45 cm)	S	2.426687	9.38574	S	0.257987	0.76652	S	3.26769	9.708827

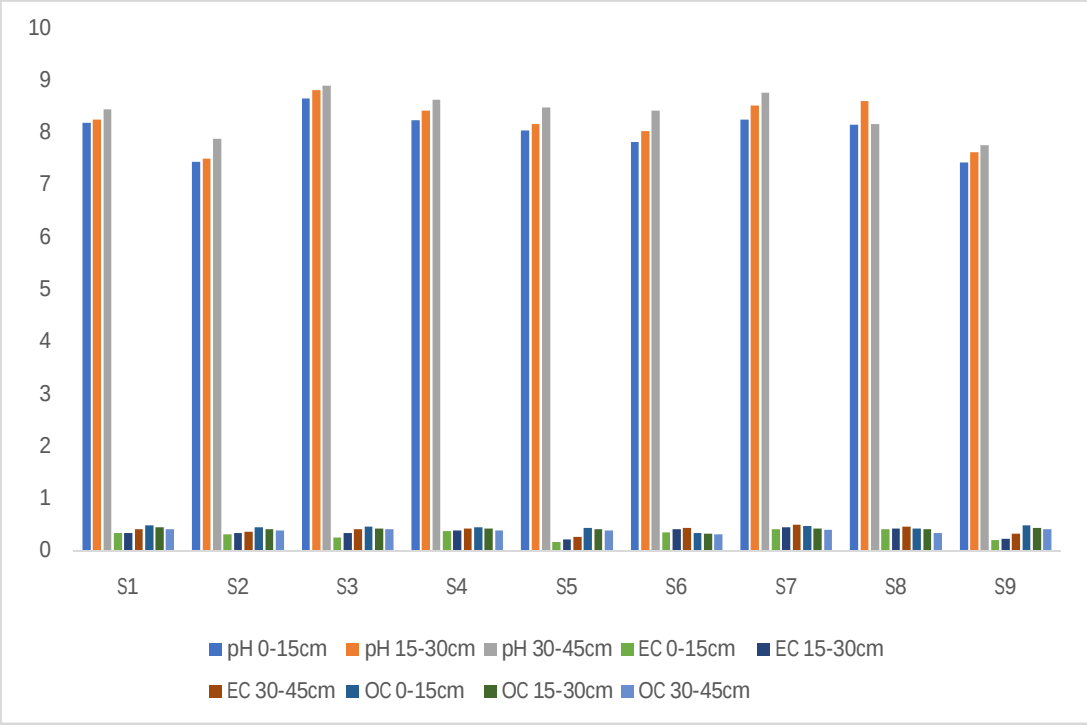

Fig 2: pH, EC and Organic Carbon

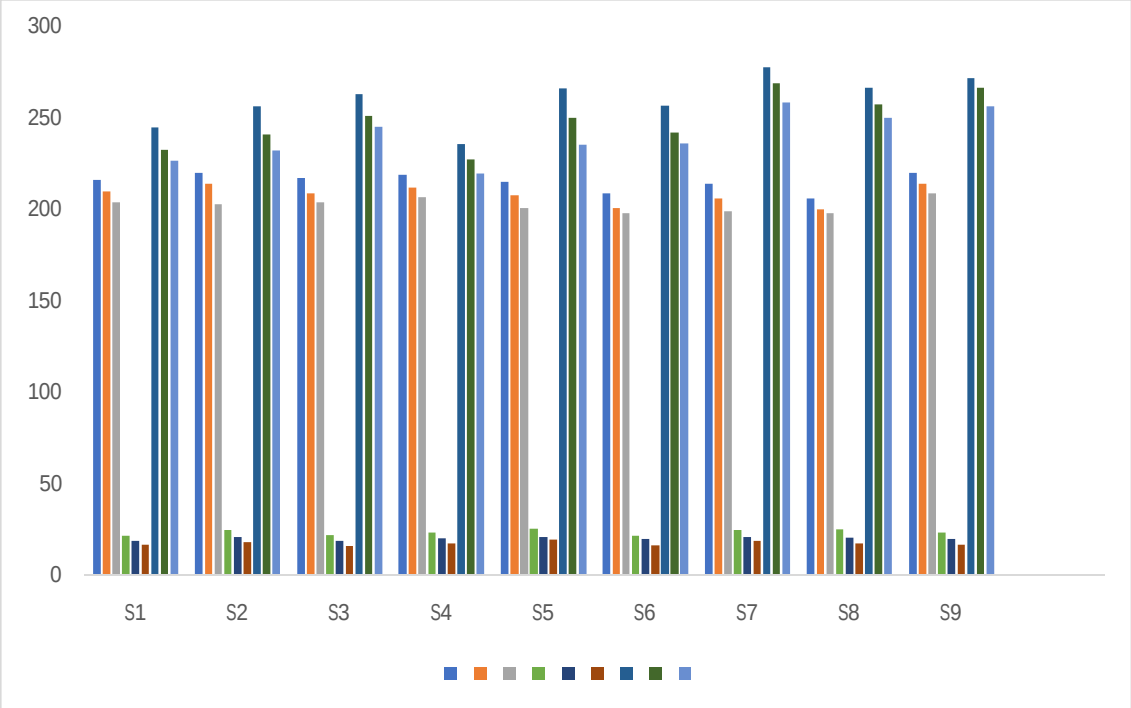

Fig 3: Available Nitrogen, Available Phosphorous and Available Potassium

Secondary Nutrients

Exchangeable Calcium content of soil ranged from 3.68 meq $100g^{-1}$ to 5.45 meq $100g^{-1}$ with the highest value recorded at site S_6 (5.45) meq $100g^{-1}$ from Ichoda Block. Exchangeable Magnesium content of soil ranged from 1.89 meq $100g^{-1}$ to 2.76 meq $100g^{-1}$ with the highest value recorded at S_4 (2.76) meq $100g^{-1}$ from Ichoda Block. Calcium and Magnesium are very sufficient in this soil.

Table 5: Evaluation of Exchangeable Calcium and Magnesium (meq $100g^{-1}$)

Block Name & Sites	**Exchangeable Calcium [meq $100g^{-1}$]**			**Exchangeable Magnesium [meq $100g^{-1}$]**		
	0-15 cm	**15-30 cm**	**30-45 cm**	**0-15 cm**	**15-30 cm**	**30-45 cm**
Jainath						
S_1	4.82	4.66	4.23	2.68	2.42	2.24
S_2	4.25	4.04	3.68	2.76	2.54	2.40
S_3	4.16	4.02	3.74	2.72	2.63	2.44
Ichoda						
S_4	4.66	4.39	4.02	2.76	2.66	2.54
S_5	5.37	5.14	4.96	2.69	2.44	2.18
S_6	5.45	5.11	4.84	2.38	2.18	1.94
Boath						
S_7	5.18	4.93	4.76	2.24	2.14	2.02
S_8	5.04	4.84	4.62	2.14	2.06	1.90
S_9	4.95	4.74	4.41	2.02	1.93	1.89
	F-Test	**S.Em. ±**	**C.D. @5%**	**F-Test**	**S.Em. ±**	**C.D. @5%**
Depth (0-15 cm)	S	0.067288	0.199923	S	0.033628	0.099916
Depth (15-30 cm)	S	0.064924	0.192901	S	0.031174	0.096226
Depth (30-45 cm)	S	0.051665	0.153507	S	0.041628	0.123684

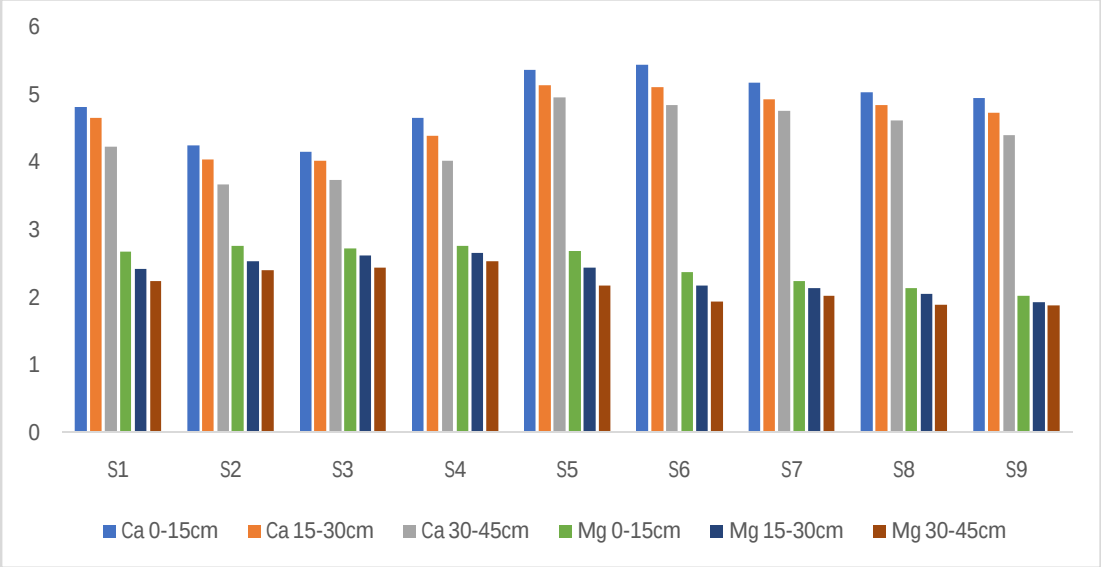

Fig 4: Exchangeable Calcium and Magnesium [meq $100g^{-1}$]

CONCLUSION

It is concluded that the soils of three blocks of the district are sandy clay loam with adequate BD, PD and pore space. It is moderately alkaline in nature, electrical conductivity as favourable for plant growth but with some management practices, organic carbon is low content, and Nitrogen was found to be low and phosphorus are medium to high and potassium is found be medium in range. Secondary nutrients i.e., calcium and magnesium are quite adequate. The deficiency of the nutrients can be mitigated by the use of organic and inorganic fertilizers. It shows that the soils are good for cultivation of Cotton, paddy, red gram, jowar, soya bean, horticulture crops etc. Farmers are required to maintain Soil Health Card according to the guidelines of central and state government for crop cultivation and advise to adopt suitable management practices and provide proper nutrition to soil health. Time to time inventory should be maintained to overcome the pollution effect in their respective soil.

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