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Assessment of Physico-chemical Properties on Soil from Different Blocks of Komaram Bheem, Asifabad District, Telangana, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The objectives of this study were to examine the results of 12 sampling locations and determine the availability of macronutrients in the soil of these soil samples. Soil samples were collected at the depth of 0-15 cm and 15-30 cm respectively. Soil textural classes were Sandy clay loam. The Water Holding Capacity varies from (38.24 to 45.84%), Bulk Density varies from (1.32 Mg m^{-3} to 1.48 Mg m^{-3}). Particle Density varies from (2.31 Mg m^{-3} to 2.45 Mg m^{-3}). The soil was reported to be in good physical condition, with % Pore Space (43.49% to 49.16%). The pH of soil is alkaline in nature (7.25 to 8.92) and the Electrical Conductivity (0.18 to 0.48 dSm^{1}) was suitable for all crops. Organic carbon was found low to medium (0.33 to 0.48%) these soils had low nitrogen levels (200.00 kg ha-1 to 220.00 kg ha-1). Phosphorus (16.24 kg ha^{-1} to 26.58 kg ha^{1}) is found medium to high. Potassium (225.24 kg ha^{-1} to 277.51 kg ha^{-1}) is found medium in range. Calcium (4.02 to 5.45

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meq $100g^{-1}$) and Magnesium (1.92 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.

Keywords: Komaram Bheem Asifabad district; physico-chemical properties; soil health; nutrient availability.

1. INTRODUCTION

Soil is a precious and irreplaceable resource that could be described as the "soul of infinite life". Its crop producing capacity is the essence of life in the soil, and its productivity is greatly influenced by soil fertility, management practices, and climate [1]. The term "soil" represents one of the most dynamic and intricate natural systems on the surface of the earth. It is crucial for the survival of various life forms and serves as a medium for plant growth, providing them with the nutrients they need [2]. Thus, without prior knowledge on status of soil fertility might have been resulted adverse effects on soils as well as crops both in terms of nutrient deficiency and toxicity either by adequate or over usage of fertilizers (Madhavi et al., 2018). Soil analysis is a process that involves testing soil samples to determine their physical, chemical, and biological properties. The results of a soil analysis can help farmers and gardeners make informed decisions about how to manage their soil for optimal crop yields and also used to make recommendations for fertilization [3]. The knowledge about the physical and chemical properties helps in managing the resources while working with a particular soil. The aim is to set appropriate guidelines for sustainable productivity for better utilization and management of the soil for particular land use (Pradhan et al.,2020)

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 Komaram Bheem, Asifabad, Telangana undertaken. The soil sample collection is from 3 blocks of Komaram Bheem Asifabad District in the state of Telangana. Each selecting 4 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. 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 Komaram Bheem region of Telangana.

2. METHODOLOGY

2.1 Sampling Site and Collection

Telangana is situated on the Deccan plateau in the central stretch of the eastern seaboard of the Indian Peninsula. It covers 112,077 square kilometres (43,273 sq. mi). The region is drained by two major rivers, with about 79% of the Godavari River catchment area and about 69% of the Krishna River catchment area, but most of the land is arid. Telangana is also drained by several minor rivers such as the Bhima, the Maner the Manjira the Musi, and the Tungabhadra. Soil samples were collected from 3 different Blocks of Komaram Bheem Asifabad district in Telangana. Four different locations selected from each block. The samples are collected from all 4 directions from one village with 0-15cm and 15-30cm depth. Twenty-four Samples are collected with the help of GPS.

2.2 Methods

The procedures for analyzing the soil samples were followed, the physical parameters include Soil Texture, Bulk Density, Particle Density, Water Holding Capacity, whereas chemical parameters include pH, Electrical Conductivity, Organic Carbon, Macro-Nutrients (N, P, K) Soil textural class was determined by using Bouyoucos Hydrometer [4]. 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 [5]. Electrical Conductivity was estimated with the help of Digital Conductivity meter [6]. Percent Organic Carbon was estimated by Wet Oxidation

method [7]. Available Nitrogen was estimated by Alkaline Potassium Permanganate method, using Kjeldahl apparatus [8], Available Phosphorus was estimated by Olsen's extraction followed by Spectrophotometric method [9], available Potassium was estimated by Neutral normal Ammonium Acetate extraction followed by Flame photometric method [10-14].

3. RESULTS AND DUSCUSSION

3.1 Physico-chemical Characteristics

The Soil Textural classes identified as Sandy clay loam. The sand, silt and clay percentage varied from 46.56 to 60.56 sand, 12.36 to 16.36 silt and 25.08 to 37.72 clay. Bulk Density was varied from the 1.32 Mg m^{-3} to 1.48 Mg m^{-3} and the highest Bulk Density was found in Shivapur V_2 (1.48 Mg m^{-3}) from Sirpur (t) Block [15-18]. The Particle Density varied from 2.31 Mg m^{-3} to 2.45 Mg m^{-3} and the highest Particle Density was found in Vempelli V_3 (2.45 Mg m^{-3}) from the Kaghaznagar Block. The Pore Space (%) ranged from 43.22% to 49.16 %. The highest Pore Space % was found at Tonkini V_3 (49.16%) from the Sirpur (t) Block. The Water Holding Capacity (%) ranged from 38.24 to 45.84 % and the highest Water Holding Capacity was found at Tonkini V_3 from

Table 1. Bulk density and particle density of soils of Komaram Bheem Asifabad district

Blocks	Villages	Bulk Density (Mg m^{-3})		Particle Density (Mg m^{-3})	
		0-15cm	15-30cm	0-15cm	15-30cm
Kaghaznagar(B1)	Kosini (V_1)	1.35	1.38	2.31	2.42
	Regulaguda (V_2)	1.43	1.45	2.35	2.41
	Vempelli (V_3)	1.35	1.40	2.38	2.45
	Charigaon (V_4)	1.32	1.38	2.32	2.40
Sirpur (t) (B2)	Rudraram (V_1)	1.36	1.38	2.35	2.41
	Shivapur (V_2)	1.45	1.48	2.37	2.43
	Tonkini (V_3)	1.42	1.44	2.34	2.42
	Parigaon (V_4)	1.34	1.38	2.38	2.44
Kouthala (B3)	Talodi (V_1)	1.38	1.42	2.35	2.41
	Kanki (V_2)	1.33	1.37	2.37	2.43
	Chandaram (V_3)	1.43	1.45	2.33	2.42
	Muthampet (V_4)	1.36	1.40	2.34	2.40
	F-Test	S	S	NS	NS
	S. Em. ±	0.021338	0.021338	0.034396	0.034396
	C.D @5%	0.06228	0.06228	-	-

Table 2. Percent pore space (%) and water holding capacity of soils of Komaram Bheem Asifabad district

Blocks	Villages	Pore Space (%)		Water Holding Capacity (%)	
		0-15cm	15-30cm	0-15cm	15-30cm
Kaghaznagar(B1)	Kosini (V_1)	45.75	43.58	40.21	38.59
	Regulaguda (V_2)	47.73	45.67	42.25	40.41
	Vempelli (V_3)	46.55	44.57	40.64	38.24
	Charigaon (V_4)	47.15	45.35	43.42	40.48
Sirpur (t) (B2)	Rudraram (V_1)	48.45	46.65	43.08	40.81
	Shivapur (V_2)	46.95	43.49	42.25	40.13
	Tonkini (V_3)	49.16	46.94	45.84	43.25
	Parigaon (V_4)	48.25	45.46	44.32	41.89
Kouthala (B3)	Talodi (V_1)	47.28	45.33	43.52	40.49
	Kanki (V_2)	47.66	45.60	43.21	40.66
	Chandaram (V_3)	45.92	43.22	40.92	38.65
	Muthampet (V_4)	48.86	46.84	42.25	40.25
	F-Test	S	S	S	S
	S. Em. ±	0.576390	0.576390	0.692018	0.692018
	C.D @5%	1.68236	1.68236	2.019858	2.019858

Table 3. Soil pH, EC (dS m^{-1}) and percent organic carbon (%) of soils of Komaram Bheem, Asifabad district

Blocks	Villages	pH		EC (dS m^{-1})		OC (%)	
		0-15cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm
Kaghaznagar(B1)	Kosini (V_1)	8.18	8.25	0.32	0.36	0.48	0.45
	Regulaguda (V_2)	7.45	7.50	0.31	0.35	0.46	0.40
	Vempelli (V_3)	8.85	8.92	0.28	0.33	0.47	0.41
	Charigaon (V_4)	7.34	7.61	0.38	0.41	0.48	0.46
Sirpur (t) (B2)	Rudraram (V_1)	8.24	8.42	0.18	0.23	0.41	0.35
	Shivapur (V_2)	7.25	7.65	0.38	0.42	0.37	0.33
	Tonkini (V_3)	8.33	8.41	0.43	0.48	0.46	0.43
	Parigaon (V_4)	7.45	7.54	0.42	0.45	0.35	0.34
Kouthala (B3)	Talodi (V_1)	8.25	8.51	0.35	0.42	0.47	0.43
	Kanki (V_2)	7.63	7.86	0.31	0.37	0.46	0.42
	Chandaram (V_3)	8.25	8.89	0.33	0.37	0.42	0.40
	Muthampet (V_4)	7.81	7.98	0.35	0.41	0.44	0.41
	F-Test	S	S	S	S	S	S
	S. Em. ±	0.136	0.136	0.005	0.005	0.006	0.006
	C.D @5%	0.395	0.395	0.015	0.015	0.0196	0.0196

Table 4. Available nitrogen, phosphorous and available potassium (Kg ha^{-1}) of soils of Komaram Bheem Asifabad district

Blocks	Villages	Nitrogen (Kg ha^{-1})		Phosphorous (Kg ha^{-1})		Potassium (Kg ha^{-1})	
		0-15cm	15-30cm	0-15cm	15-30cm	0-15cm	15-30cm
Kaghaznagar(B1)	Kosini (V_1)	215.00	210.00	21.55	18.65	246.54	225.24
	Regulaguda (V_2)	217.00	212.00	26.58	22.12	256.45	241.18
	Vempelli (V_3)	220.00	214.00	22.19	16.38	235.50	227.32
	Charigaon (V_4)	218.00	215.00	24.58	21.21	266.01	249.91
Sirpur (t) (B2)	Rudraram (V_1)	215.00	208.00	25.32	23.64	268.1	251.19
	Shivapur (V_2)	217.00	212.00	20.57	16.24	244.75	232.51
	Tonkini (V_3)	214.00	206.00	24.68	21.12	263.11	251.42
	Parigaon (V_4)	212.00	205.00	25.12	22.67	271.56	266.78
Kouthala (B3)	Talodi (V_1)	215.00	211.00	23.35	20.17	235.75	227.32
	Kanki (V_2)	216.00	208.00	25.14	22.64	254.36	236.59
	Chandaram (V_3)	206.00	200.00	22.33	19.26	265.41	257.51
	Muthampet (V_4)	210.00	205.00	21.84	18.45	277.51	269.23
	F-Test	S	S	S	S	S	S
	S. Em. ±	3.897	3.897	0.364	0.364	4.07	4.07
	C.D @5%	11.8	11.8	1.06	1.06	11.890	11.890

Table 5. Exchangeable calcium and magnesium [meq $100g^{-1}$] of soils of Komaram Bheem, Asifabad district

Blocks	Villages	Exchangeable calcium [meq $100g^{-1}$]		Exchangeable Magnesium [meq $100g^{-1}$]	
		0-15cm	**15-30cm**	**0-15cm**	**15-30cm**
Kaghaznagar(B1)	Kosini (V_1)	4.82	4.63	2.68	2.42
	Regulaguda (V_2)	4.25	4.03	2.73	2.55
	Vempelli (V_3)	4.15	4.02	2.64	2.45
	Charigaon (V_4)	4.67	4.38	2.76	2.54
Sirpur (t) (B2)	Rudraram (V_1)	5.38	5.14	2.68	2.47
	Shivapur (V_2)	4.46	4.39	2.37	2.18
	Tonkini (V_3)	5.45	5.13	2.25	2.15
	Parigaon (V_4)	5.19	4.94	2.28	2.19
Kouthala (B3)	Talodi (V_1)	5.04	4.85	2.15	2.06
	Kanki (V_2)	4.85	4.74	2.03	1.92
	Chandaram (V_3)	4.66	4.37	2.10	1.98
	Muthampet (V_4)	4.95	4.84	2.14	2.05
	F-Test	S	S	S	S
	S. Em. ±	0.0677	0.0677	0.0373	0.0373
	C.D @5%	0.1976	0.1976	0.1089	0.1089

Sirpur (t) Block. The pH value ranged from 7.25 to 8.92 and the highest value was recorded at Vempelli V_3 (pH 8.92) from the Kaghaznagar Block. The Electrical Conductivity ranged from (0.18 to 0.48 dS m^{-1}) and the highest value was recorded at Tonkini V_3 (0.48 dS m^{-1}) from the Sirpur (t) Block and the soil was found to be normal. The value of total Organic Carbon (%) varied from 0.33 to 0.48% and the range of organic carbon content was found low to medium. The Available Nitrogen content of soil ranged from 200 to 220 kg ha^{-1} and Nitrogen content was low in all villages. The Available Phosphorus content of soil ranged from 16.24 to 26.58 kg ha^{-1} [19-21]. The phosphorus content was found medium to high. Available Potassium content of soil ranged from 225.24 to 277.51 kg ha^{-1}. The potassium content was found Medium in range in all the villages. Exchangeable Calcium content of soil ranged from 4.02 to 5.45 [meq $100g^{-1}$] with the highest value recorded at Tonkini V_3 (5.45) [meq $100g^{-1}$] from the Sirpur (t) Block. Exchangeable Magnesium content of soil ranged from 1.92 to 2.76 [meq $100g^{-1}$] with the highest value recorded at Charigaon V_4 (2.76) [meq $100g^{-1}$] from the Kaghaznagar Block. Calcium and Magnesium are very sufficient in this soil.

4. CONCLUSION

The results of experiment are concluded as soil colour, soil texture, bulk density, percent pore space, water holding capacity and specific gravity of soil of Komaram Bheem Asifabad Block was found significantly good for plant growth. The soils of Komaram Bheem Asifabad District were found alkaline in nature which is suitable for crop growth. The percent Organic Carbon, N, P, K, content of the soil significantly varied from Low to Medium. Calcium and Magnesium are sufficient in the soil.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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