Original Research Article

PROPERTIES OF SOILS OF MEDAK DISTRICT IN TELANGANA STATE

ABSTRACT

For the management of soil and plant growth the physicochemical study of parameters are crucial.The objective of this study is to do the physical and chemical analysis of soil samples collected from agricultural fields of Medak district and to provide information to the farmers. Soil samples collected from twenty mandals at three samples per mandal from 0-15 cm depth. Soil parameters like soil texture, pH, EC, organic carbon available nitrogen, phosphorus, potassium and Sulphur tested and recorded. Results shows texture varies from sandy clay loam to sandy loam. pH shows slightly acidic, neutral to slightly alkaline. Electric conductivity remains within the safe limits.The organic carbon recorded maximum low to medium in content, low in nitrogen content, medium to high range in phosphorous, potassium. The available sulphur recorded deficient to sufficient values.The findings suggest that farmers should adopt appropriate soil management techniques, such as crop rotation and conservation tillage which will add to maintain the soil physical characteristics to ensure the sustainability of agricultural practices and the long-term health of the soil.

Keywords: soils, Medak, Physical properties, pH , EC

1. INTRODUCTION

Soil is all unconsolidated material of the earth's crust in which land plants can grow, if water and temperature are adequate at least the minimum nutrients are available and toxic substances are in low concentration. It is a dynamic natural body developed as a result of pedogenic processes during weathering of rocks. It 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. Soil mainly consists of 50% pore space (air and water) and 50% solid phase. The soil phase is broadly composed of 45% mineral matter and 5% organic constituents. (Soils and Plant Nutrients). The physical properties of the soil depend upon the amount, shape, structure, size, pore spaces, organic matter and mineral composition of soil. The chemical properties of the soil are the interactions of various chemical constituents among soil particles and the soil solution

These physical properties are soil texture, bulk density particle density, percent pore space, water holding capacity, soil structure, soil colour. The chemical properties are pH, EC, OC, Nitrogen, Phosphorus, Potassium and Sulphur.

Physicochemical Properties in Soil

pH: Among all the parameters that affect the quality of soil, pH is considered as the most important factor. This is the reason why pH is considered an important entity while carrying out soil analysis. An acidic soil is defined as having a pH of less than six; a normal soil has a pH of between six and eight; and an alkaline soil has a pH of greater than 8.5.

Electrical conductivity: This is another vital characteristic of the soil that is used to assess its quality. The amount of ions in a solution is measured [1]. With an increase in ion concentration, a soil solution becomes more electrically conductive. Electrical conductivity is a quick, simple, and reasonably priced method of evaluating the condition of soils. It represents the amount of ions in a solution. With an increase in ion concentration, a soil solution becomes more electrically conductive.

Organic matter in soil: It is also an essential component of soil. Insufficient organic matter in the soil speeds up the process of soil erosion. Utilising this soil for agricultural purposes can be advantageous if organic matter is found in it. You can add compost, animal manures, and other organic elements to the soil. The soil's higher than normal content of organic matter is another possible reason for the pH drop. From the surface to the subsurface, levelling has caused a decrease in the soil's organic matter content.

Nitrogen: Nitrogen, the most significant element that plants can obtain from the soil, acts as a growth inhibitor [2]. 80% of the atmosphere is made up of nitrogen. Nitrogen gas can be "fixed" into ammonia in water so that blue-green algae can use it. In addition to ammonia, inorganic nitrogen is another kind of nitrogen that can find its way into lakes and streams. Because it can enter aquatic systems through multiple pathways, nitrogen is widely available and easy to get.

Phosphorus: Phosphorus is a necessary element found in all living cells. It's one of the most important macronutrients needed for plant development. Phosphorus primarily acts as an energy reserve reservoir and regulates the amount of nutrients that remain in the plant nucleus.

Potassium: It is one of the key components of plant development and plays a vital part in many different plant physiological functions. It is involved in a variety of plant metabolism processes, such as the production of plant sugars for a range of metabolic needs in plants [3], the control of photosynthesis, and the synthesis of lignin and cellulose, which are structural components of cells.

Sulphur: It is one of the essential plant nutrients plays a vital role in the primary metabolism of higher plants and involved in synthesis of secondary metabolic products in certain groups of plants. It ranks along with nitrogen and phosphorus in importance in the formation of proteins. It not only influences yield but also improves crop quality owing to its influence on protein metabolism and oil synthesis. It is involved in the synthesis of the essential amino acids, like cysteine, cystine and methionine. Role of sulphur in Indian agriculture is now gaining importance because of the recognition of its role in increasing crop production, not only of oil seeds, pulses and forages but also of many cereals

Texture: Agricultural soils are categorized into classes based on their physical texture using the qualitative technique known as soil texture, which is used in both the field and the lab. Particle size is the main factor that determines the texture of soil, and it varies according on location. Soil texture clearly affects aeration and root penetration. It has an impact on the nutritional value of the soil as well. The main determinant of soil texture is electrical conductivity.

The present study is taken upto determine the soil physical, physico-chemical properties in soils of Medak district.

2. MATERIAL AND METHODS

2.1 Location and Study area

Medak district of Telangana state extending over an area of 9,519 km^2. It forms a part of Deccan Plateau under Godavari basin and lies between North Latitudes 170 27' and 180 18' and East longitudes 770 28' and 790 10' falling in topographical sheet nos. 56 F, G, J and K of Survey of India. It is bounded by the Nizamabad district on the north, Karimnagar district on the north and north east, Warangal and Nalgonda district on the east, Hyderabad and Rangareddy district on the south and Bidar district (Karnataka) on the west.

2.2 Sampling and Analysis

Collection of the soil samples

Sixty soil samples were collected randomly from 20 mandals @ three samples per mandal using soil auger, khurpi knife at the depth of 0-15cm. All these samples will be mixed and the mixed sample has been 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 technique.

Processing of soil samples

After sampling the samples were air dried in shade and then these samples were processed for various physical and chemical tests. The processing was done as follows: After drying all the unwanted materials like roots, stones, and others were removed. The clods formed were broken by using wooden pallet. Then the samples were sieved with 2 mm sieve Sieved samples were stored in polybags for further estimation of different physical and chemical parameters.

Analysis of the soil physical and chemical parameters

Soil textural analysis was performed by Hydrometer method (Bouyoucous, 1927). Soil p^H by Digital pH meter (Jackson, 1973), Soil EC by digital EC meter (Jackson, 1973), Organic Carbon by Rapid titration method (Walkley and Black, 1934). Available Nitrogen by Alkaline Permanganate Method by using Kjeldahl Flask (Subbiah and Asija, 1956). Available Phosphorus by using Spectrometric method (Olsen et al., 1956). Available Potassium by Flame Photometer Method using Neutral normal ammonium acetate extraction (Jackson,1973). Available Sulphur by Turbidimetric Method (Chesnin and Yien, 1951).

3.Results and Discussion

As presented in table 1, the Percentage of clay varies from 9.32 % to 40.32% and the sand percentage varies from 38.04 to 85.04.The texture of the soil of the Medak district varied from sandy clay loam to sandy loam.The maximum clay content was noticed in Alladurg mandal and the maximum sand content noticed in Shivampet mandal.

Table 1 : Physical Properties of the Medak district Soils in Telangana state

Sl No	Soil No	Mandal	Village	% clay	% sand	Texture
1	S1	Chilipched	Shilampally	18.32	72.04	sandy clay loam
2	S2		chitkul	21.32	71.04	sandy clay loam
3	S3		Faizabad	18.32	72.04	sandy clay loam
4	S4	Kulcharam	Rampur	28.32	62.04	sandy clay loam
5	S5		Kulcharam	15.32	79.04	sandy loam
6	S6		Pothamsettipalle	20.32	72.04	sandy clay loam
7	S7	Kowdipalle	Kanchanpally	21.32	65.04	sandy clay loam
8	S8		Kanchanpally	28.32	66.04	sandy clay loam
9	S9		Mohammed nagar	34.32	46.04	sandy clay loam
10	S10		Thunki	20.32	66.04	sandy clay loam
11	S11	Yeldurthy	Yeldurthy	10.32	73.04	sandy loam
12	S12		Manepalle	17.32	75.04	sandy clay loam
13	S13		Edulapalle	12.32	79.04	sandy loam
14	S14	Havelighanpur	Havelighanpur	27.32	71.04	sandy clay loam
15	S15		Thimmaipalle	20.32	71.04	sandy clay loam
16	S16		Madulwai	20.32	61.04	Sandy clay loam
17	S17	Medak	Rayalamadugu	11.32	57.04	Sandy loam
18	S18		Ausulpalle	35.32	51.04	sandy clay
19	S19		Medak	28.32	43.04	Sandy clay loam
20	S20	Papannapet	Nampur	17.32	39.04	loam
21	S21		Kothapalle	16.32	76.04	sandy loam
22	S22		Pappannapet	28.32	70.04	sandy clay loam
23	S23	Shankarampet R	Mirzapally	12.32	78.04	sandy loam
24	S24		Shankarampet R	16.32	73.04	sandy clay loam
25	S25	Narsapur	Ramzyathanda	30.32	62.04	sandy clay loam
26	S26		Gollapalle	28.32	67.04	sandy clay loam
27	S27		Madapur	22.32	72.04	sandy clay loam
28	S28	Manoharbad	Konaipalle	20.32	70.04	sandy clay loam
29	S29		Manoharbad	14.32	80.04	sandy loam
30	S30		Chetlagouraram	38.32	52.04	sandy clay
31	S31	shivampet	Chennapur	20.32	70.04	sandy clay loam
32	S32		shivampet	9.32	75.04	sandy loam
33	S33		Gomaram	10.32	85.04	loamy sand
34	S34	Toopran	Toopran	10.32	79.04	loamy sand
35	S35		Gundareddipalle	30.32	62.04	sandy clay loam
36	S36		Ghanpur	16.32	78.04	sandy loam
37	S37	Alladurg	Alladurg	18.32	66.04	sandy loam

38	S38		chilver	40.32	38.04	clay loam
39	S39		Kaidampalli	32.32	52.04	sandy clay loam
40	S40	Chegunta	kistapur	12.32	82.04	sandy loam
41	S41		Ibrahimpur	10.32	84.04	loamy sand
42	S42		Ananthasagar	16.32	72.04	sandy loam
43	S43	Narsingi	Narsampalle	16.32	78.04	sandy loam
44	S44		seripalle	22.32	58.04	sandy clay loam
45	S45		Narsampalle	28.32	64.04	sandy clay loam
46	S46	Nizampet	kalwakunta	27.32	63.04	sandy clay loam
47	S47		Nandigama	19.32	64.04	sandy loam
48	S48		Nizampet	28.32	63.04	sandy clay loam
49	S49	Ramayampet	Rayalapur	20.32	62.04	sandy clay loam
50	S50		Ramayampet	12.32	82.04	sandy loam
51	S51		Thonigandla	18.32	72.04	sandy loam
52	S52	Regode	Pocharam	28.32	52.04	sandy clay loam
53	S53		Regode	10.32	70.04	sandy loam
54	S54		Ritikyal	11.32	66.04	sandy loam
55	S55	Shankarampet(A)	Shankarampet A	16.32	72.04	sandy loam
56	S56		Musapet	28.32	52.04	sandy clay loam
57	S57		cheelapalle	20.32	70.04	sandy clay loam
58	S58	Tekmal	Tekmal	28.32	52.04	sandy clay loam
59	S59		Eklaspur	11.32	80.04	sandy loam
60	S60		kusangi	37.32	44.04	clay loam

S Stands for Soil (S1 to S 60)

Soil Physico -Chemical properties of Medak District in Telangana state The detailed Physico-chemical properties of the study area of Medak district are listed in table 2. The soil pH was ranges from 5.84 to 8.90 i.e., slightly acidic to strongly alkaline in reaction. The highest value of pH was observed in S1 while the lowest pH was found in S 17. The near neutral to very strongly alkaline pH may be attributed to the reaction of applied fertilizer material with soil colloids, which resulted in the retention of basic cations on the exchange complex of the soil.

The electrical conductivity ranged from from 0.02 to 1.07 dSm 1. The lowest electrical conductivity value of 0.03 dsm-1 and while the highest electrical conductivity was observed in the S4 7 indicating non-saline in nature. The results in the present study indicate the non-saline nature of soils. The lower electrical conductivity in soils was due to excess leaching of salts and due to free drainage conditions which favoured the removal of released bases by percolating and drainage water.

The organic carbon content in study area was found to be very low to medium and ranged from 0.003 to 2.05 per cent. The highest Organic carbon content was recorded in S23 whereas the lowest Organic carbon content was recorded in S5.

The available nitrogen was found to be minimum of 78.1 Kg/ha and noticed maximum of 267.1 Kg/ha. The available Phosphorus was found to be minimum of 11.5 Kg/ha and noticed maximum of 583.8 Kg/ha. The available Potassium was found to be minimum of 122..6 Kg/ha and noticed maximum of 568.1 Kg/ha. The available Sulphur was found to be minimum of 4.13 mg/Kg and noticed maximum of 140.6 mg/ Kg.

Table 2 : Physico -chemical Properties of Medak District Soils

Sl No	Soil No	pH	EC	OC %	Available N Kg/ha	P Kg/ha	K Kg/ha	S mg/Kg
1	S1	8.90	0.33	0.25	103.3	113.2	123.8	10.03
2	S2	8.17	0.27	0.39	85.7	145.4	175.5	12.01
3	S3	7.12	0.54	0.18	133.6	48.8	214.9	27.10
4	S4	7.86	1.07	0.23	80.0	583.8	209.3	30.38

5	S5	7.73	0.20	0.003	83.2	15.63	218.3	9.38
6	S6	7.40	0.27	0.16	94.5	64.17	201.4	35.63
7	S7	8.10	0.33	0.42	129.2	45.27	218.3	13.98
8	S8	8.12	0.22	0.15	113.4	40.67	202.5	18.57
9	S9	6.97	0.59	0.34	117.2	82.56	177.8	84.19
10	S10	7.79	0.43	0.17	121.0	108.1	288.0	42.85
11	S11	7.25	0.08	0.03	92.0	59.06	210.4	4.13
12	S12	8.06	0.21	0.12	85.1	59.57	316.1	18.57
13	S13	7.03	0.09	0.15	95.8	52.93	208.1	4.13
14	S14	8.02	0.39	0.71	120.3	139.3	387.0	30.38
15	S15	7.68	0.43	0.32	78.1	97.4	202.5	68.44
16	S16	6.87	0.38	0.51	141.1	116.3	214.9	52.03
17	S17	5.84	0.05	0.39	137.3	27.4	165.4	4.79
18	S18	7.11	0.31	0.19	121.6	65.7	304.9	34.97
19	S19	7.61	0.56	0.83	183.3	543.4	126.0	49.41
20	S20	8.12	0.26	0.21	139.9	123.9	183.4	23.16
21	S21	7.99	0.20	0.60	129.2	54.0	172.1	18.57
22	S22	7.56	0.27	0.44	135.5	21.3	274.5	32.35
23	S23	6.20	0.25	2.05	197.2	19.2	238.5	21.85
24	S24	7.51	0.41	0.05	139.9	14.1	432.0	44.16
25	S25	7.76	0.62	0.96	172.0	146.9	234.0	69.09
26	S26	6.55	0.10	0.17	143.6	40.7	254.3	12.66
27	S27	8.29	0.40	0.45	167.6	51.9	208.1	45.47
28	S28	7.85	0.65	0.83	184.6	102.0	174.4	100.5
29	S29	8.10	0.48	0.46	213.6	224.1	181.1	82.87
30	S30	6.86	0.23	0.50	192.8	113.7	122.6	38.25
31	S31	6.89	0.18	0.57	178.9	41.2	238.5	42.85
32	S32	7.13	0.41	0.15	156.2	63.7	241.9	53.35
33	S33	6.51	0.17	0.15	122.2	66.2	262.1	67.78
34	S34	6.83	0.18	0.24	136.7	63.7	123.8	57.28
35	S35	6.99	0.18	0.53	175.8	112.7	257.6	66.47
36	S36	7.12	0.42	0.19	172.6	33.5	210.4	31.69
37	S37	7.57	0.36	0.16	213.6	82.6	568.1	69.09
38	S38	7.58	0.15	0.17	155.6	35.6	216.0	82.87
39	S39	7.89	0.17	0.12	128.5	38.1	308.3	59.91
40	S40	6.59	0.07	0.15	131.7	55.0	321.8	87.47
41	S41	7.04	0.21	0.05	160.0	108.1	285.8	140.6
42	S42	7.52	0.79	0.90	202.2	93.3	258.8	91.40
43	S43	7.65	0.28	0.55	174.5	67.2	225.0	49.41
44	S44	7.72	0.41	0.58	168.2	82.1	280.1	63.19
45	S45	5.89	0.03	0.50	262.1	34.0	204.8	69.75
46	S46	7.41	0.29	0.16	190.9	64.2	267.8	51.38
47	S47	7.60	0.37	0.28	193.4	72.3	283.5	44.82
48	S48	7.63	0.35	0.22	238.1	40.7	253.1	69.75
49	S49	7.62	0.28	0.40	267.1	37.6	198.0	74.34
50	S50	6.71	0.07	0.28	190.3	120.9	288.0	36.29

51	S51	7.82	0.23	0.25	167.6	71.3	318.4	63.19
52	S52	8.00	0.11	0.06	135.5	54.5	294.8	54.00
53	S53	7.86	0.12	0.08	153.7	27.9	225.0	44.82
54	S54	7.93	0.21	0.12	141.8	47.8	307.1	52.03
55	S55	7.26	0.25	0.47	160.7	81.0	256.5	36.29
56	S56	7.22	0.10	0.33	182.7	11.5	255.4	43.50
57	S57	8.04	0.48	0.17	163.2	78.0	318.4	34.32
58	S58	7.81	0.18	0.09	138.0	32.0	289.1	69.09
59	S59	5.98	0.04	0.40	167.0	42.7	230.6	29.07
60	S60	8.08	0.69	0.04	134.2	93.8	284.6	57.94

Conclusion:

Based on Physical and Physico-chemical properties of Medak district soils texture were sandy clay loam to sandy loam, slightly acidic, neutral to slightly alkaline, non-saline, organic carbon recorded maximum low to medium percent. The available Nitrogen recorded minimum values and phosphorus, potassium recorded medium to high ranges. The available Sulphur recorded deficient to sufficient values.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.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Reference:

1. Bouyoucos GJ. Hydrometer method improved for making particle size analysis of Soils. Agronomy Journal. 1962; 54: 464-465.

2.Bhogal A,Nicholson FA, Chambers BJ. Organic carbon additions: Effects on soil bio-physical and physico-chemical properties. European Journal of Soil Science.2009. *60*(2) : 276-286.

3.Chesnin L, Yien C.H. Turbidimetric determination of available sulphate. Soil Science Society of American Proceedings. 1951;15: 149-151.

4. Gowthamchand, Dhaliwal SS, Sharma V, Verma G, Singh J, Kaur M. Variation of physico-chemical properties among different soil orders under different land use systems of the majha Region in North Region in North-Western India.Sustainability.2023; 15(6): 4779.

5. Jackson ML. Soil chemical analysis. Prentice Hall India Pvt. Ltd., New Delhi. 1973; 498.

6. Karuna KY, Krishna DG, Devi CK. Evaluation of the physical and chemical characteristics of soil in specific natural habitats in and around the Agrara area, Rajanna Sircilla district, Telangana state, India. Journal of Pharmacognosy and Phytochemistry.2023; 12(6):30-34.

7. Mahesh C, Malavath RN, Balaguruvaiah D, Vidyasagar GECH. Evaluation of some sugarcane growing red, red laterite and black soils of Medak district of Telangana..An Asian Journal of Soil Science.2019;14: 1-2.

8.Merugu L, Narayana E. Physico –Chemical Properties of Soil in Forest and Agro Ecosystems in Warangal District,Telangana State. Cahiers Magellane.2024; 6(2): 3964-3975.
9..Narsaiah E, Ramprakash T, Chandinipatnaik M. Soil physical and physico-chemical properties of soils of Jangon district in Telangana state. Journal of Pharmacognosy and Phytochemistry.2018; 7(6):2820-2827.
10. Olsen SR, Cole CV, Watnabe FS, Dean LA. Estimation of available phosphorus in soil by extracting with sodium bicarbonate. USDA Circular. Washington. 1965; 939.
11..Sahu RK, Thomas T, Singh AK, Naga IR. Assessment of Physico-chemical Properties of Soil from Different blocks of Visakhapatnam District, Andhra Pradesh.International Journal of Plant & Soil Science. 35(15): 322-335.
12. Singh PK, Thomas T, Mohanta SR, Thomas A. Assessment of physic-chemical properties of soil from different blocks of Katihar district,Bihar. International Journal of Research in Agronomy.2024; 7(4): 366-372.
13. Subbaiah BV, Asija GL. Rapid Procedure for the Determination of available nitrogen in soil. Current Science. 1956; 25: 226-230.
14.Supriya VV, Swaroop N, David AA, Kumar T. Assessment of physical properties of soil from different blocks of Guntur district, Andhra Pradesh. India.Pharma Innovation Journal.2021; 10(11):2087-2092.
15. Walkley AJ, Black IA. Estimation of soil organic carbon by the chromic acid titration method. Soil Science. 1934 ; 37: 29–38.