

Original Research Article

PHYSICAL AND PHYSICO-CHEMICAL 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 @ 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.

Keywords: soil physical, physico-chemical 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 km². It forms a part of Deccan Plateau under Godavari basin and lies between North Latitudes 17° 27' and 18° 18' and East longitudes 77° 28' and 79° 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 coning 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 (Bouyoucos, 1927). Soil pH 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 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.

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