INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 12, No. 2, p. 326-330, 2018

RESEARCH PAPER OPEN ACCESS

Physical characterization of soil of Sardar Bahadur Khan Womens University and its ability for plant growth

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Key words: University campus, Oasis of roses, Physical properties of soil, Plant growth

http://dx.doi.org/10.12692/ijb/12.2.326-330 Article published on February 28, 2018

Abstract

Soil is a natural surface layer that is capable of supporting plants. Soil contains different kinds of texture in it which are distributed according to their particle size like clay, silt, sand, loam and gravel. The focus of research in recent studies has been based on the effect of physical properties of soil on the normal plant growth in the university campus and whether the soil is capable for plant growth or not. The result showed that soil texture affects the plant growth more, over all the campus soil is fine textured and good for normal plant growth, except of some other plants. It is concluded that all four types of soil are suitable for vegetation. But the oasis of rose soil is comparatively best for the plant growth, because it contains an excess amount of clay along with nutrients. Fine arts soil is poorest in its texture in comparison to all of the four types because of an excess of gravel. While the soil of the other two areas is normal in their textures.

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Introduction

Soil is a natural surface layer that is capable of supporting plants. Soil forms the uppermost layer of the earth's crust and is made up of inorganic and organic matter. The world consists of 71% water and 29% land. Of the 29%, 5, 8% are dry, cold ice deserts; 8, 7% are warm sand and rock deserts and 5, 8% are too steep to cultivate. This leaves us with only 8,7% of land with an approximately 1m deep layer of soil to feed, house and sustain all the people on earth (Harmse, 1987). Physical properties of a soil type depend on the size of particles present in it. Particles above 2.0 mm are generally classified as gravel or stones and others as sand (between 0.05 and 2.0 mm), it (0.002 to 0.05 mm) and clay (less than 0.002 mm). The texture of a soil depends on the percentage of sand, silt and clay in it. On the bases of this, soils are designated as clay, sandy clay, clay loam, silty clay, silty clay loam, sandy loam, silty loam, loamy sand, sand and silt. Soil particles occupy more than half the space in the soil. The remaining space between the particles, called the pore space, is occupied by water and air.Sample collection so that the sample is 'representative 'Interpretation of results that includes consideration of factors that influence how soil nutrients are utilized such as moisture, temperature, pH, soil quality and physical structure, interactions between nutrients, rootstock (John Turner).

This research is based on the physical analysis of the soil of the SBK Women University by different physical analysis parameters, to investigate the type of soil, its texture, structure, porosity, water holding capacity, etc. This research will help us to understand the nature of soil and weather which type of vegetation is suitable for growth, and how we can improve the quality of soil.

Materials and methods

Physical analysis of soil

The research work was conducted at SBK women's university at 2. 9. 2010. By the physical analysis the properties of soil like-Soil texture, structure, color, moisture, porosity, etc. are tested. There are different soil tests which are used for analysis of soil, in which nutrient contents and composition are measured. Physical analysis determines the soil original texture, structure, color and amount of moisture present in it.

Sample collection

A survey of the university campus was done at 2.9.2010, and samples were collected from four different areas within the campus. Physical analysis of soil was carried in a lab of the university. The four selected areas were-

1. Fine arts area (sample A)
2. Bus stands area sample (sample B)
3. Chemistry department area (sample C)
4. Sample D (sample D)

Methods for sample collection

In every selected area a thin and vertical section of soil piece was dug (in a square shape) about 6cm in depth with the help of swine or spade and about 1kg of soil sample is taken from every area in separate polythene bags, and every bag is labeled with permanent marker.

Lab work

After collecting samples from different areas, lab work was started on 3. 9. 2010. The lab work for physical analysis of soil was done by doing different experiments.

Soil texture

Different Parameters were used for the analysis of soil texture, which were as follows-

Sieve method

Different types of sieves were used for separating the different sizes of the soil particles.

- Clay less than 0.002mm in particle size.
- Silt 0.002-0.05mm in particle size.
- Sand 0.05-2.0mm in particle size.
- Loam larger than 2.0mm in particle size.

Feel method

Feel method is another method to analyze the soil texture, in which soil is tested by touching it and pressing with the help of fingers.

Wet method

Took each type of soil in small amount in china dish and add water to make a band while rolling wet soil between palms of two hands, then check the soil is either making ribbon shaped or not.

Soil profile

Four beakers of 1000 ml were taken, 500 gm from every soil sample was added in separate beaker, and then add water by making the level up to 1000ml. These beakers were kept overnight to check the layers or horizons of soil for soil profile analysis.

Soil moisture

Four Petri plates are taken and then weight them (while empty) with the help of digital balance. Then add different soil samples in separate Petri plates and again (Petri plates along with the samples) are weighted. Transfer these Petri plates in oven at 100 degree centy grades for 24 hours to check the moisture content present in soil.

Formula: dry wt. _ wet wt. / dry wt. 100

Soil colour

Mensal color chart is used for the determination of soil color.

Soil structure

Shapes of soil structure are as follows-

1. Platy 2. Blocky

3. Granular 4. Prismatic

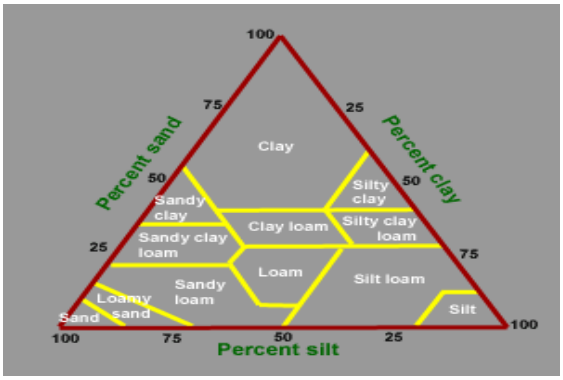

Fig. 1. Physical properties of soil

Results

The moisture content of different soil samples were increased from 0.03, 0.10, 0.12, 0.47% in (table 3) for bus stand, chem. Dept., fine arts and oasis of roses soil respectively. The moisture content of oasis of roses was greater in comparison to other three soil sample. Oasis of roses soil contains an excess amount of clay in comparison with fine arts soil, an excess amount of silt in comparison with chem. Dept. soil, an excess amount of loam in comparison with bus stand soil, and an excess amount of sand in comparison with chem. Dept. soil. Bus stands, soil contains an excess amount of sand in comparison to oasis of roses soil, an excess amount of silt in comparison to chem. Dept. soil, an excess amount of loam in comparison to fine arts area soil, and an excess amount of clay in comparison to chem. Dept. soil. Fine arts area soil contains a huge amount of gravel in comparison to oasis of roses soil an excess amount of loam in comparison to chem. Dept. soil, and bus stand soil, and an excess amount of humus in comparison to other three areas. Chem. Dept soil contains an excess amount of loam in comparison to fine arts area soil, an excess amount of clay in comparison to bus stand soil, and an excess amount of loam in comparison to oasis of roses soil.

The soil samples of four different areas i.e. oasis of roses, bus stand, fine arts area and chem. Dept. having soil types flour like, powder like, sandy type and powder like respectively in comparison with each other. Oasis of roses, bus stand and chem. Dept. soil form very good ribbon shaped band in comparison to fine arts area soil which do not form a ribbon shaped band. Fine arts area soil was good porous in comparison to other three areas like bus stand, oasis of roses and chem. Dept soil, which soil was less porous. The soil samples of four different areas i.e. oasis of roses, bus stand, fine arts area, and chem. Dept having different soil colors grey, pale brown, light brown, grey and brown respectively in comparison with each other.

Fig. 2. Different soil samples collected from different part of campus for physical analysis.

Table 1. Showing soil profile data.

S.No	Samples	1	2	3	4	5
1.	Oasis of roses	Gravel	Loam	Sand	Clay	Humus
2.	Bus stand	Gravel	Loam	Silt	Clay	Humus
3.	Chemistry dept.	Gravel	Loam	sand	Clay	Humus
4.	Fine arts area	Gravel	Loam	Sand	Clay	Humus

Table 2. Porosity status of different soil samples/volume.

S. No	Samples	Observations
1	Oasis of roses	Good porous
2	Bus stand	Porous
3	Chem. Dept	Porous
4	Fine arts area	Less porous

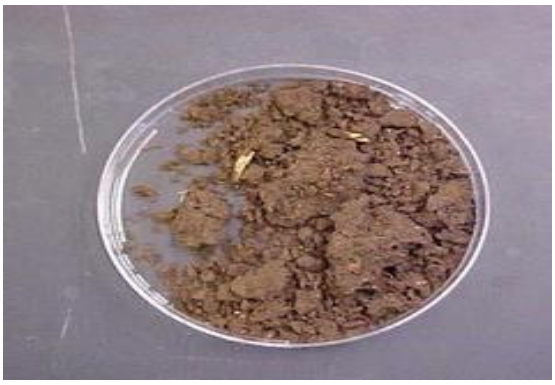

Table 3. Showing soil moisture content.

Samples	Wt. of empty Petri dish	Wt. of soil +Petri dish	Soil wt. _ Petri dish wt.	Oven dry wt.	Oven dry wt. _ initial wt.
Oasis of roses	96.92g	141.11g	44.19g	140.44g	0.67g
Bus stand	96.57g	176.67g	80.1g	176.60g	0.07g
Chemistry dept.	94.76g	179.38g	84.62g	179.20g	0.18g
Fine arts area	99.85g	166.91g	66.06g	166.70g	0.21g

Calculations

Sample D

Soil moisture= wet wt. – dry wt. / dry wt. × 100

= 141.11 – 140.44 /140.44 ×100 = 0.47%

Sample B

Soil moisture = wet wt. – dry wt. /dry wt. × 100

= 176.67 – 176.60 / 176.60 × 100 = 0.03%

Sample C

Soil moisture= wet wt. – dry wt. /dry wt ×100

= 179.38 – 179.20 / 179.20 ×100 = 0.10%

Sample A

Soil moisture = wet wt – dry wt. / dry wt. × 100

= 166.91 – 166.70 /166.70 × 100 = 0.12%

Table 4. Showing feel Methods for all soil samples.

S.No.	Samples	Observation
1.	Sample D	Ribbon shaped
2.	Sample B	Very good band
3.	Sample A	No band
4.	Sample C	Very good band

Table 5. Showing Results for Feel Method of soil analysis.

S.No.	Samples	Observation
1	Sample D	Flour like
2	Sample B	Powder like
3	Sample A	Sand type
4	Sample C	Powder like

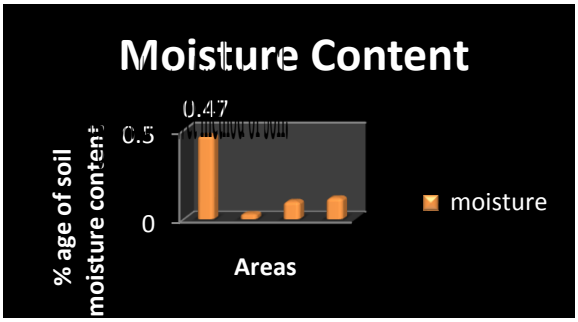

Fig. 3. Graph showing soil moisture content of 4 different areas of campus

(X- Axis: Soils of 4 different areas. Y- Axis:%Age of soil moisture content)

Discussion

The study was based on the physical analysis of soil of the four different areas of the SBK women's university campus i.e. oasis of roses, bus stand area, fine arts side and chem. Dept area. The soil samples of all these areas were studied to check the physical parameters of soil for the normal growth of plants during the summer season of 2010 under natural environmental conditions of university. The data presented in the table (3) revealed that oasis of roses

soil is suitable for the growth of plants in which amount of clay was high as compared to other three areas. Because clay soil holds moisture content and nutrients sufficiently this in return is good for plant's growth. The amount of humus is also very high in that area which acts as a fertilizer and improves soil quality for plant growth. The result was opposite in fine arts area, because fine arts area contains small amount of clay and soil surface was covered with gravel, so the plant growth was less in that area. Similar results have been reported by Wilde 1958, Pritchett and Fisher 1987. The data in the table (2) showed that the pore volume was greater in oasis of roses due the presence of clay soil in which water holding capacity is high as compared to others. The moisture content in other areas was low in comparison with oasis of roses. These results are in agreement with Ekwue 1990, Islam and Weil 2000, Min *et al* 2003, Scot *et al* 1994. The data in the table (1) and (2) showed that oasis of roses soil was rich in its organic matter content and probably associated with increase in total porosity of soil which in return is responsible for the loosening of soil by root action. These results were confirmed by Hayness 2000, Lampurlanes and Cantero-Martinez 2003. The data presented in the table (1) showed that oasis of roses soil contains all horizons in the soil profile and suitable for plant's growth. Fine arts, chem. Dept and bus stand soil have a negative effect on the growth of plants. Same results were reported by Lhotsky 1991. The data presented in the table (1) showed that soil samples of all areas consists on variety of textures i.e. clay, silt, sand, loam and gravel which are responsible for plant's growth these results were observed by Tornes and others in 2000.

Conclusion

Plants play very important role in our life but they demand good environment, soil quality, air and water which are free of pollution. It is observed that if any soil has different textures like clay, slit, sand, loam, gravel are sufficient in amount along with its necessary nutrients and then the soil is considered best for the growth of plants. Soil texture, structure, profile and its moisture content, all are necessary for the normal growth of plants. Clay is considered best for growth of plant because of having capacity to hold water and nutrients which are absorbed by plant's roots. In short this research gives the best description about the soil physical condition and its effect on the growth of plants. It will give guidance to the students who wish to carry out soil physical analysis in any other part of Balochistan. If the physical quality of soil is improved then it can be used for cropping desired plants as well.

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