International Journal of Research in Engineering, Science and Management
Volume-1, Issue-11, November-2018
www.ijresm.com | ISSN (Online): 2581-5792

Analysis of Soil Samples from Various Areas of Punjab

Arushi Makkar[1], Anshu Sibbal Chatli[2], Akshita Sharma[3], Parneet Kaur[4], Navdeep Kaur[5], Ekta Goswami[6]

[1,4,5,6]*Student, Department of Bio Technology, Guru Nanak Girls College, Ludhiana, India*
[2]*Assistant Professor, Department of Micro Biology, Guru Nanak Girls College, Ludhiana, India*
[3]*Assistant Professor, Department of Bio Technology, Guru Nanak Girls College, Ludhiana, India*

***Abstract*: Soil harbours various organic and inorganic nutrients on which the yield of crop depends. The physicochemical properties of soils collected from various areas of Punjab were studied viz. soil pH, Electrical Conductivity, Organic Carbon, organic matter and Nitrogen percentage. Most of soils were little alkaline having pH ranged from 7.0-8.2. The value of Electrical Conductivity ranged between 0.21-0.31 mmhos/cm indicating the normal nature of soil. Moreover, the soils were enriched with Organic Carbon ranging between 0.31%-0.80 %. The rhizosphere part of soil was found to be more fertile than non- rhizosphere part due to maximum interaction of microbes and highest humus content.**

***Keywords*: soil, physicochemical properties, fertility**

1. Introduction

Soil is an uppermost layer of earth's crust and is a mixture of organic matter, minerals and organisms that together support life. The soil forms the intermediate zone between the atmosphere and the rock cover of the earth; the lithosphere. It also forms the interface between water bodies and the lithosphere and thus forming the biosphere (Asema et al, 2015). Soil contains diverse community of beneficiary microorganisms required for the growth of plants and to enhance the fertility of soil. These microbes work in cognito to maintain ecological balance by active participation in biogeochemical cycling of nutrients in nature (Talwar and Chatli, 2018). Physicochemical analysis of soil samples determines the quality of soils.

Soil microbes play a vital role in the availability of various plant nutrients in the soil and maintain the soil ecosystem. Microorganisms in soil can participate in genetic as well as in other interactions such as synergism and antagonism (Andreote et al, 2014; Rashid et al, 2016).

In Punjab, soil is generally course textured, alkaline and contains a very little organic matter. Moreover, it has medium to high fertility level.

2. Material and methods

A. Soil sampling

Soil samples (upto 25 cm depth) from various zones viz. rhizosphere (with roots) and non-rhizosphere (roots free soil) were collected from Model Town, Pakhowal Road, Sector-32 Chandigarh Road, Ludhiana, Jagraon (District-Ludhiana), Sahnewal (District-Ludhiana), Ramgarh (District-Ludhiana). Malout (District -Muktsar) and Kharar. Composite soil sample of each class were mixed thoroughly and air dried. These samples were passed through 100-mesh sieve for physicochemical analysis. Sieved soil samples were used for determination of soil pH in 1:2 soil water suspensions, Electrical Conductivity (E.C), Organic Matter (O.M.) and total Nitrogen (N) percentage using standard AOAC (Association of Official Agricultural Chemists) methods.

B. Analysis of Soil Samples

1) Measurement of Electrical Conductivity (Richards, 1954)

The Electrical Conductivity of a soil sample is measured with a conductivity meter known as "Solu Bridge".

Weighed 10 g of soil and 20 ml of distilled water was added to it. The suspension was stirred continuously and left overnight in order to obtain a clear supernatant solution. Connected the Solu Bridge to power supply. Held the conductance cell in a stand and connected it with Solu Bridge. Switched on the Solu Bridge and adjusted it to room temperature with the help of temperature knob. Dipped the conductivity cell into the supernatant solution. Then moved the pointer of the dial so as to get maximum area in shade in the magic eye. Noted the reading on the Solu Bridge and calculated as below:

Cell constant of the conductivity = x
Reading of Solu Bridge = y millimhos
Electrical conductivity = x y millimhos/cm

2) Determination of organic matter (O.M.) (Jackson, 1967)

The Organic Matter (O.M.) in the soil is determined by Wet Digestion Method.

Reagents Required

1. Nitrogen Potassium Dichromate solution: Dissolved 49.04gof K2Cr 4O7 in distilled water and made the volume to 1litre.
2. N/2 Ferrous Ammonium Sulphate i.e. Fe

(NH4)2(SO4)2.6H2O (Mohr's salt): Dissolved 392g of Ferrous Ammonium Sulphate in distilled water. Added 15 ml of Sulphuric acid and made the volume to 2 L in distilled water.

3. Diphenyl Amine Indicator: Dissolved 0.5 g of Diphenyl Amine in a mixture of 1000 ml of concentrated Sulphuric acid and 20ml of distilled water.
4. Concentrated Sulphuric acid (36N)
5. Sodium Fluoride powder

Method

Accurately weighed 2g portion of the soil sample in a conical flask. Added 10 ml 1N potassium dichromate solution and mixed by shaking. Added 20 ml of concentrated Sulphuric acid, swirling the flask during addition. The contents of the flask were cooled for 30mins to complete the reaction. Added 2g of Sodium Fluoride and 100ml of distilled water and mixed vigorously. Then 10 drops of diphenyl amine indicator was added which produced violet coloration in the suspension. Treated the contents of the flasks against N/2 Ferrous Ammonium Sulphate solution till the color changed from violet to bright green. Noted the volume of Ferrous Ammonium Sulphate used. A blank titration was carried out in a similar manner.

The calculations were performed as follows:

Weight of sample taken =8g

Volume of N/2 Ferrous Ammonium Sulphate solution used for blank titration = x ml

Volume of N/2 Ferrous Ammonium Sulphate solution used for titrating the excess nascent oxygen = y ml

Volume of 1N Potassium Dichromate used for the oxidation of carbon (ml of 1N Potassium

Dichromate =0.003g of organic carbon) = (x-y) /2 ml

Percentage of organic carbon in the soil = (x-y)/2 x 0.003 x 100/S = A

Percentage of organic matter = A x 1.724

3.2.3 Estimation of total N (Black, 1965)

Reagents required

Concentrated Sulphuric acid, Hibbard's mixture containing 10 parts of K2SO4, 1 part of Ferrous sulphate and 0.5 parts of Copper sulphate, Salicylic acid, Sodium thiosulphate, 45% Sodium hydroxide, 0.1N Sulphuric acid, 0.1 N Sodium hydroxide solution and Methyl red indicator.

Method

Weighted 10g of soil was transferred to a 300ml Kjeldhal flask and soaked it with water. Added 30ml of concentrated Sulphuric acid and shook by swirling for 15minutes. Added 10g of Hibbard's mixture, 1g of Salicylic acid and 5 g of Sodium thiosulphate in the flask. Heated at low temperature till there was no frothing. Heat was increased and continued digestion until the contents of the flask were changed to transparent grey or greenish yellow. Cooled and added about 100ml of water. Transferred the contents to a flask and made a volume upto the mark. Filtered the contents of this flask for carrying out distillation. Took exactly 20 ml of 0.1N Sulphuric acids into a 150 ml conical flask. 2 drops of methyl red indicator were added and placed under the delivery tube of the condenser in the distillation apparatus. 10 ml of the filtrate was pipetted in the distillation flask. Added 10ml of 45% NaOH solution in this flask through a funnel connected through a tube to the distillation and distilled the filtrate. When the distillate volume reached to 30ml, distillation was complete. Titrate the excess of the acid in the conical flask against 0.1N

Sodium hydroxide until the color changed from pink to yellow. Noted the volume of 0.1N NaOH used. The calculations were performed as follows:

Volume of filtrate taken for distillation = 10 ml

Weight of soil taken = 10 g

Volume of 0.1N NaOH required to neutralize the excess of the acid =20ml (conical flask)

Volume of 0.1N sulphuric acid used for absorption of ammonia = (20-x) ml

1ml of 0.1N sulphuric acid =0.0014g

Percentage of Nitrogen (N) in soil = (20-x) x 0.0014 x 250/V x 100/W

Where V is the volume of the filtrate used for distillation and W is the weight of the soil taken for digestion.

3. Results and discussion

A. *Analysis of soil samples*

All the soil samples collected from various areas viz. Model Town, Pakhowal Road, Sector-32 Chandigarh Road, Ludhiana, Jagraon (District-Ludhiana), Sahnewal (District-Ludhiana), Ramgarh (District-Ludhiana). Malout (District -Muktsar) and Kharar were tested for physicochemical properties. Most of soils under study were neutral to alkaline with pH varying from 7.0 to 8.2. The minimum pH (6.9) was observed in non rhizosphere soil sample of Ramgarh (District-Ludhiana) which indicated that the soil from this area was a little acidic as compared to other areas. The maximum (pH-8.2) was found in soil samples of Model Town, Sector-32 Chandigarh Road, Ludhiana. The Electrical conductivity (E.C.) values from different location indicated that all the soil were normal in nature with E.C. value ranging between 0.25 to 0.31 mmhos/cm. Rhizosphere soil sample of Ramgarh (District-Ludhiana) was found to have least E.C. value (0.21 mmhos/cm) and soil sample from Model Town, Sector-32 Chandigarh Road, Ludhiana and Jagraon (District-Ludhiana) were found to have maximum E.C. value (0.31 mmhos/cm). The soil samples were enriched with organic carbon (O.C.) (0.35 % to 0.80%). The O.C. was higher in rhizosphere than that of non-rhizosphere. The O.C. was maximum in Sector-32 Chandigarh Road, Ludhiana (0.80%) while the minimum in Sahnewal, District-Ludhiana (0.35%).

The total nitrogen percentage (N %) was highest in soil

Table 1
Characterization of soil fertility in Punjab

Area (Punjab)	Soil Sample	Ph	E.C. [Electrical conductivity (mmhos/cm)]	Organic Carbon(O.C.) C%	Organic Matter percentage (O.M. %)	Total Nitrogen percentage (N %)
Model Town, Ludhiana	R	8.2	0.31	0.51	0.87	0.04
	NR	7.8	0.26	0.48	0.82	0.038
Pakhowal Road, Ludhiana	R	7.9	0.27	0.49	0.84	0.03
	NR	7.8	0.25	0.46	0.79	0.026
Kharar	R	7.3	0.26	0.45	0.77	0.03
	NR	7.2	0.25	0.40	0.68	0.024
32,Sector Chandigarh Road,Ludhiana	R	8.2	0.31	0.80	1.38	0.042
	NR	7.8	0.30	0.62	1.07	0.040
Malout, District-Muktsar	R	7.5	0.29	0.51	0.87	0.037
	NR	7.0	0.25	0.42	0.72	0.032
Jagraon, District- Ludhiana	R	7.3	0.31	0.45	0.77	0.033
	NR	7.0	0.28	0.41	0.70	0.028
Sahnewal, District- Ludhiana		7.7	0.30	0.35	0.60	0.023
		7.3	0.29	0.31	0.53	0.021
Ramgarh District- Ludhiana		7.0	0.25	0.42	0.72	0.037
		6.9	0.21	0.39	0.67	0.030

R – Rhizosphere
NR – Non-Rhizosphere

sample Sector-32 Chandigarh Road, Ludhiana (0.042%) while minimum in soil sample of Sahnewal, District-Ludhiana (0.023%) (Table 1).

The above physicochemical properties of soil collected from different areas of Punjab showed that the rhizosphere part of soil is rich in organic matter and nutrients than the non rhizosphere part, which can increase the fertility of soil and lead to the improve yield of crops. Talwar and Chatli (2018) also analysed the soil samples from Ludhiana and reported that the rhizosphere part of soil contains maximum population of microbes than the non- rhizosphere part. Most of soils in Punjab are found to have pH more than 7.

4. Conclusion

The increased organic matter content in soil always results in increase in fertility of soil and hence it is useful for improving the output of plants. Soil bacteria and fungi are the start of the soil food web that supports other organisms. The fertile plains of Punjab boast producing about two-third of the food grains annually in India. The highest fertile soils are important for commercial points of view for farmers resulting in increase in economy of the particular region.

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