International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Studies on Soil Organic Carbon Status of Agastheeswaram Taluk - A Survey

M.P. Jeyasekhar

Associate Professor, Department of Zoology and Research Centre, Scott Christian College (Autonomous), Nagercoil - 629 003, India

Abstract: ***The soil body is the largest terrestrial pool of organic carbon globally. Soil Organic Carbon (SOC) believed to play a crucial role for many soil functions and eco systems services. The changes in SOC are largely determined by how much biomass is grown and retained above and below ground. As indicator for soil health, SOC is important for its contribution to food production mitigation and adaptation to climate change and the achievement of the sustainable development goals. To achieve greater specificity and accuracy, improved methods are required to measure, account, monitor and report on this specific carbon pool. Walkely and Black titration method is used for analyzing the carbon in the soil. The findings of the survey done in this experiment reveals that the organic carbon content varies from field to field even farming the same crops grown.***

Keywords: predosphere, soil fertility, grassland, acronomy

1. Introduction

Soil Organic Matter (SOM) is the primary sink and source of plant nutrients in natural and managed terrestrial ecosystems. It increases the ion exchange, water holding and infiltration capacity, promotes the formation of soil aggregates and is the major energy substrate for the soil fertilizer.

Globally, the upper two meters of the predosphere contain about three times as much organic carbon as is currently in the atmosphere in form of CO_2[1]. In recent years, stability of Organic Matter (OM) has gained increasing attension [2]. Type and length of tillage practice influence the amount of soil organic matter. Conventional tillage mixes result in faster decomposition and loss of organic matter and more or less uniform distribution of organic matter in the plough layer [3], [4].

Kanniyakumari District is endowed with all the types of crops such as cereals, millets, pulses, horticultural crops, plantation crops that about 40, 300 hectares of land is covered by different horticultural and about 21, 7000 hectares of land is covered by plantation crops and 30% of the geographical area of the district is covered by forest crops. Due to climatic factors, it is seen that the production and productivity of the crops are being declined gradually and the farmers are facing lot of problems on soil fertility, its productivity, poor yield and quality of the produce. Diagnosis of the problem correctly and giving remedial solutions rightly will be a great boon to the farming community of kanniyakumari District for maximizing their agricultural production. In the present study the soil carbon status of different areas from Agastheeswaram Taluk was carried out.

Objectives

- To collect soil from areas of Agastheeswaram Taluk.
- To study the carbon level in different soil sample using Walkely and Black titration method.

The rest of the paper is organized as follows: Section 2 deals with materials and methods, Section 3 describes results, Section 4 discusses the performance evaluation and Section 5 concludes the paper.

2. Materials and Methods

Study Area

The Kanniyakumari district lies at the southernmost tip of the Indian peninsula. It extends over a geographical area of 1, 67, 200 Hectares with net sown area of 74, 712 Hectares which accounts for 44.6 percent of the total area.: The soil pH is between 4.5 to 8.0. The district comprises of six taluks; Agasteeswaram, Thovalai, Kalkulam, Vilavancode, Thiruvattar and Killiyoor, The total geographic area of this taluk is 490.8 sq. Km. The latitude location of Agasteeswaram is 8.1009^0 N, 77.5362^0 E.

Collection of soil samples from the field

The soil samples were collected from 10-20 spots in the field depending upon the area where crops have been planted in lines or rows, sampling should be done between the rows except the areas like recently fertilized, spot near trees, composed, heaps, The uniform slice samples were collected from each spot with a thickness of 2 cm.

Walkely and Black titration method

Weigh exactly 0.5 – 1.0 finely ground soil in to a 500 ml conical flask. Pipette out 10 ml of 1N potassium dichromate solution into the flask, shake the flask to mix the dichromate with the soil. Then add 20 ml of conc. Sulphuric acid and shake by gentle rotation for 1 minute to ensure complete contact of the reagents with the soil. Leave the flask to stand for 30 minutes. Then add 200 ml of distilled water, 10 ml of phosphoric acid and 1 ml of diphenyl indicator. Titrate the contents of the flask against 0.5 N ferrous sulphate solution till the contents attain a green colour. This change in colour from blue to green being occurred suddenly.

The following procedure may be adopted to locate the exact end point of the colour change. Titrate with ferrous sulphate solution by addition of 0.5 ml ferrous sulphate each time and when the colour changes to green add 0.5 ml of 1 N dichromate solution and restore the blue colour. Then add the ferrous sulphate solution drop by drop till the colour changes to green.

Calculation

Organic carbon percentage $= \frac{(V_1 - V_2) \times 0.003 \times 100}{W}$

Where

V_1 is the volume of 1N potassium dichromate

V_2 is half the volume of 0.5N Ferroussulphate

W is the weight of the soil taken

3. Results

The samples collected from various fields were subjected to analysis to find out the organic carbon content of the area. The soil colour, texture and quality were analysed and data were recorded (Table 1 to Table 4). The results of the experimental findings were recorded and given below.

In these places, the organic carbon content present in the soil varies from place to place. The organic carbon content varies from< 0.5% to >0.75%. Here, the high range is >0.75%; low range is <0.5% and medium range is 0.5 to 0.75%. In most of the places in Agastheeswaram Taluk such as Ozhukinaseri, Mayiladi, Kottaram, Agastheeswaram, Manakkudi, Parakkai, Soorankudi, Pazhavilai, Peruvilai, Therur having the soil organic carbon content is more than 0.75% (high). Table 2 indicates the high range of organic carbon content.

Asaripallam is having the soil organic carbon content 0.5 - 0.7% (medium). Table 3 indicates the medium range of organic carbon content. Vazhukkamparai is having the soil organic carbon content less than 0.5% (low). Table 4 indicates the low range of organic carbon content.

Table 1: Soil organic carbon content (%)

S. No.	Place Name	Soil Organic Carbon Content (%)
1.	Ozhukinaseri	0.775
2.	Therur	2.585
3.	Vazhukkamparai	0.465
4.	Mylaudy	0.775
5.	Osaravilai	1.034
6.	Potthayadi	0.827
7.	Kottaram	1.240
8.	Agastheeswaram	0.982
9.	Kanniyakumari	0.775
10.	Manakkudi	1.034
11.	Parakkai	1.085
12.	Soorankudi	1.344
13.	Pazhavilai	1.137
14.	Asaripallam	0.682
15.	Peruvilai	1.809

Table 2: High range organic carbon content in soil

S.No.	Place Name	High (>0.75)
1.	Ozhukinaseri	0.775%
2.	Mylaudy	0.775%
3.	Osaravilai	1.034%
4.	Potthayadi	0.827%
5.	Kottaram	1.240%
6.	Agastheeswarm	0.982%
7.	Kanniyakumari	0.775%
8.	Manakkudi	1.034%
9.	Parakkai	1.085%
10.	Soorankudi	1.344%
11.	Pazhavilai	1.137%
12.	Peruvilai	1.809%
13.	Therur	2.585%

Table 3: Mediumrange organic carbon in soil

S.No	Place Name	Medium (0.5 – 0.75%)
1.	Asaripallam	0.682

Table 4: Low range organic carbon content in soil

S.No.	Place Name	Low (<0.5%)
1.	Vazhukkamparai	0.465

4. Discussion

The organic carbon content of the soil is greatly influenced by the physical properties of soil. It is also based upon the agronomic practices. The findings of the survey done in this experiment reveals that the organic carbon content varies from field even farming the same crops grown. Table 1 indicates that soil organic carbon content.

The temperature grasslands exhibit an average root: shoot ratio as high as 3 or 4 whereas the global average from temperate forests is 0.26 [5] [6]. The quality of carbon inputs, often characterized by lignin content, is another important control of decomposition rates and may contribute to observed differences for forests and grasslands [7], [8].

The relative distribution of SOC with depth was slightly correlated with climate, with SOC distribution more deeply as precipitation decreased and temperature increased. The association with precipitation can be largely accounted for by the replacement of vegetation types along precipitation gradients. The mineral soil carbon can play an important role in carbon emissions, especially when considering intensive forest management practices. Such practices are known to cause a high aboveground carbon flux to the atmosphere, but there is evidence that they can also promote comparably high and long-term belowground carbon fluxes [9].

In New Zealand grasslands, the introduction of pine plantations produced shallower SOC profiles after 20 years [10]. The introduction of an exotic grass species in the Savannas of Colombia substantially increased SOC storage [11]. Ecosystem simulations in complex landscapes contacting forests, savannas, and grasslands with an explicit representation of root distributions suggest that SOC pools are particularly sensitive to root distributions of grasses [12].

The soil apparently stores a large pool of carbon below the first meter raises important issues for global carbon budgets and for carbon sequestration strategies. Changes in vegetation type could also play an important role. Shrub encroachment of grasslands or afforestation of areas dedicated to annual crops or pasture. Loss of plant functional types with deeper roots might have the opposite effect. Such changes in vegetation are increasingly common both intentionally and unintentionally, and the contrast between root and SOC profiles supports the idea that the deep soil might act as a carbon reservoir [13]. The fate of new carbon added to added to deep soil, however, can be complex and may not necessarily follow cycling pattern of the total SOC pool.

5. Conclusion

Soil plays a central role for economic and social development by ensuring food, fodder, fiber, and renewable energy supplies to sustain human, animal and plant life. Soil health, an attribute of physical, chemical and biological processes is now showing signs of fatigue due to intensive cultivation, over mining of nutrients by crops with lesser replenishments through organic and inorganic sources of plant nutrients. Organic carbon is an index of good soil health and application of organic manures helps in maintaining high organic carbon content of the soil. Carbon level is determined by rainfall, temperature, vegetation and soil types. Analysis of soil provides a thorough knowledge on the fertility status of soil so as to enable to group soils into various fertility classes for suggesting management practices.

References

[1] Batjes, N.H. 'Total Carbon and Nitrogen in the Soils of the World", "European Journel of. Soil Science", 47, pp.151-163, 1996.
[2] Davidson, E. A. and Janssens, I. A, 'Temperature Sensitivity of Soil Carbon Decomposition and Feedbacks To Climate Change', "Nature', 440, pp.165-173, 2006.
[3] Etana, A., Hakansson, I., Zagal, E. and Bucas, S, 'Effects of Depth on Organic Carbon Content and Physical Properties in Five Swedish Soils", 'Soil & Tillage Research', 52, pp.129 – 139, 1999.
[4] Stickfisch, N. Forstreuter, T. and Ehlers, W. "PloughingEffects on Soil Organic Matter After Twenty Years of Conservation Tillage in Lower Saxony Germany", "Soil & Tillage Research", 52, pp. 91 – 101, 1999.
[5] Riser, P. G., E. C. Birney, H.D. Blocker, S.W. May, W. J. Parton, and J. A. Wiens, 'The True Prairie Ecosystem"., 'US/IBP Synthesis Series", 16, 1981.
[6] Carirns, M.A., S. Brown, E.H. Helmer, and G.A. baumgardener. "Root Biomass Allocation in the World's Uplands Forests". "Oecologia ", 111, pp.. 1-11, 1997.
[7] Melillo J. M., J. D. Aber, and J. F. Muratore. "Nitrogen and Hgninof Hardwood Leaf Litter Decomposition Dynamics", "Ecology", 63, pp. 621-626, 1982.
[8] Austin, A T, and P.M. Vitousek.. 'Nutrient Dynamics, on A Rainfall Gradient in Hawai'I",: Oepologia", 113, pp. 519 ─ 529, 1998..
[9] Thomas Buchholz, Andrew J. Friedland, Claire E. Hornig, William S. Keeton, Giuliana Zanchiand Jared Nunnery, 'Mineral Soil Carbon Fluxes in Forests and Implications for Carbon Balance Assessments", "GCB Bioenergy", 6, pp. 305–311, 2014.
[10] Parfitt. R. L., H. J. Percival, R. A. Dahlgren, and L. F. Hill, "Soil and Solution Chemistry Under Pasture and Radiata Pine in New Zealand", 'Plant and Soil", 191, pp. 279-290, 1997.
[11] Fisher, M. J., I. M. Rao, M. A. Ayarza, C. E. Lascano, J. I, "Introduced Deep – Rooted Grasses in the South American Savannas", Nature, 371, pp. 236 – 238.1994.
[12] Daly, C.D.Bachelet, J.M. Lenihan, R.P Neilson, W. Parton, and D. Ojima, 'Dynamic Simulation of Tree – Grass Interactions for Global Change Studies", 'Ecological Applications', 10, pp. 449 – 469, 2000.
[13] Jackson, R. B., H. J. Schenk, E.G. Jobbagy, J. Canadell, G. D, Colello, R. E. Dickinson, C. B. Field, P. Friedlingstein, M. Heimann, K. Hibbard, D. W. Kicklighter, A. Kleidon, R. P. Neilson, W.J. Parton, O.E. Sala, and M. T. Sykes, "Belowground Consequence of Vegetation Change and Their Treatment in Models", 'Ecological Applocation", 10, pp. 470 – 483, 2000.