International Journal of Current Research in Multidisciplinary (IJCRM) *ISSN: 2456-0979*
Vol. 5, No. 4, (April'20), pp. 28-34

COMPARATIVE STUDY ON THE IMPROVEMENT IN SELECTED SOIL PARAMETERS BY THE PLOTTED LAND TREES IN BENGALURU, KARNATAKA

Lasitha K. & Dr. Sr. M Arul Sheeba Rani
Department of Botany, Nirmala College for Women, Coimbatore-18

ABSTRACT

Soil is the foundation and essential for tree growth. This is the storage place for all the essential micro, macronutrients and soil organic matters but its contaminated by human activities. Recently, many crop and cultivated lands are converted to plotted land projects in urban area. Consequence, the soils are disrupted and highly diverse, that is, does not exist with their natural characteristics, which directly affects the density of tree canopy. Trees with their large leaf area provide abundant benefits for improving air, water and land scape quality, reduction in ultraviolet radiation, building energy conservation etc. Recently, urban area focuses on planting many trees in streets, road side, layouts and gardens to overcome the problems. The present study focuses on analyzing the improvement in soil fertility by planting the trees in the layout. Barren soil and five tree species soil profiles are used for this study in a particular plotted layout.

KEYWORDS :- *Urbanization, Soil, Tree canopy, pH, Moisture, Electrical Conductivity.*

INTRODUCTION

Earth is a terrain that encompasses all the factors and resources. Particularly, the contribution of agricultural land for human living and well-being has been enormous. But recently, the land is heavily affected by human induced environmental transformation and Industrial revolution, globalization, expansion of population and technologies. The fastest growing environmental degradation is, forests and crop lands have been converted to plotted lands for the purpose to establish building habitats and industries. Global demand for the products of the land is likely to continue growing in the future due to increasing population and the urbanization of the city. Urbanization means unavoidable expansion of cities occupying cultivated land. In India, year 1900, only 14% of the population was migrated to urban areas, it is expected to be 53% in 2050.In 2020, Indian population reached 1,341.0 million (CEIC data). Therefore, population growth and urbanization are destroying land mother. It is a socio-economic change which is created by the concentration of population and by the industrial development in urban areas. However, on one hand, urbanization leads to environmental degradation and other side helps to improve our national economy.

The highlighting environment problem in all over the world is air pollution, contamination of water and land. The rate of CO_2 emission increasing temperature on the earth at fast rate. It was411.85ppm in 2019 and year beginning of 2020 reached 412.96ppm.The main source of air pollution by the anthropogenic activates of energy generation, industries and transportation that use large amount of energy sources. Another demonstrable impact on urban area are hydrological pollutant. Increasing thermal properties and other particulate matter from urban areas affects the natural rain fall. One of the primary environmental problem is waste generation in land due to decomposition of huge amount of waste material into frequent accumulation of nutrient chemicals. Urbanization is an expanded landscape that includes urban forest and urban greening. Which are associated with sustainable urban development. The urban greening and forestry improve the quality of life through reducing pollution, improving physical activity, recreational and aesthetic value of urban area.

Trees plays an important role in urban environment. It absorbs 70-90% of radiation in summer and 20-90% in winter. Shaded trees reduce maximum surface temperature by 11^oC to 25^oC. The tree canopies reduce CO_2 emission by cooling energy. It reduced by roughly 1.5-5%(EPA,2008). Gill *et al*., (2007) reported that10 % green cover (grass and shrubs) can keep the surface temperature below even under the high CO_2 emissions. It reduced 7% of runoff and reduce the need for erosion control (HAUFC, 1986).Soil is an essential storage nutrient unit for trees growth, which is contaminated by human activities. Hence, good soil promotes good

vegetative growth such as increase in size and height of trees, numbers of stem, leaves and roots. Though, trees have response to environment and genetically, Environmental factors can inhibit physiological processes of tree growth. Some of the trees has specific genotypes which can adapt to grow in any conditions. Hence selecting the right tree for the right place will enhance growth and longevity of trees in turn its litter will enhance the soil fertility. The aim of the study focuses on soil physical parameter of plotted layout trees. Five different tree species soil were collected to identify soil's pH, moisture, temperature, EC to understand the litters effect on the fertility of soil.

MATERIALS AND METHODS

Study area

Bengaluru is located south eastern part of Karnataka, surrounding area of 741km^2.Bengaluruencompasses lush green cover with parks, gardens, institutions, defense campus, plots and apartments. It comes under tropical savanna region. The average lowest temperature is 15^{o}C and highest 35^{o}C.Champion and seth, (1968) reported Bengaluru was classified dry deciduous forest type of vegetation, which had 979 species in 542 genera and 133 families. Ramaswamy and Razi, (1973)) reported that, there are 142 species introduced in Bengaluru over the period of last 150 years for gardening and floriculture in urban area. These species have been adapted to Bengaluru's environment and become heritage trees. All these have enhanced beauty to the landscape and the quality of life. Hence, it is called garden city of India.

Shriram Malhaar, a 30 acre plotted gated community land located in Sarjapura, south-east Bengaluru. Before the layout formation the land was having only 19 trees (10 coconut trees, 5 fruit trees and 4 decorative trees while layout making 821 trees (60 fruit trees, 180 flowering trees and 580 decorative trees) are planted and covered with grass and weeds. Ground water is the source of water for the layout and its just 200 meters away from the Sarjapura lake. The layout is built with all amenities like parks, playgrounds, amphitheater, tar roads, underground electricity and drainage system. In order to conserve the scarce availability of water in and around Bengaluru, the layout has been provided with a state-of-the-art rain water harvesting system. A well designed storm water system has been laid along both sides of the road to collect the rain water and use it for recharging the recharge pits located all over the site. This will recharge the first aquifer and will strengthen the underground water source. The human occupancy of the layout is zero as of now and its home for birds and fauna (Plate 1&2).

Plate 1: Location Map

Plate 2: Study Area

Sample collection

For the present study five different trees of different genera such as *Thespesiapopulena(L) Sol.ex Correa, Filliciumdecipens (Wight&Arn.)Thwaites, Acacia auriculiformis A. Cunn. exBenth., Markhamialutea (Benth.) K.Schum. and Tabebuiarosea (Bertol.) Dc*were selected from the project land to find out the physical parameter of soil (pH, moisture, temperature, EC). The tree canopy soilwas collected during the year 2019 (Plate 3,4,5,6 &7)Soil samples were collected separately from the depth of 0-50 cm.Barren land soil is taken from the same plot was kept as control.soil samples were packed in sterile bags,and as soonas possible returned to the laboratory and processed within 2 days.The minerals were analyzed in the standard

laboratory by employing Atomic Absorption Spectrophotometer and the results were represented in Table and Charts.

Sample 1: Plate 3*Thespesia populena (L) Sol.ex Correa*

Sample 2: Plate 4*Fillicium decipens (Wight&Arn.)Thwaites*

Sample 3: Plate 5*Acacia auriculiformis A. Cunn.ex Benth*

Sample 4: Plate 6*Markhamia lutea (Benth.)K.Schum*

Sample 5: Plate 7*Tabebuia rosea(Bertol.)Dc*

RESULTS AND DISCUSSION

Table 1 Physical parameters of the selected tree canopy soil.

Parameters	Barren soil	*Thespesia populena*	*Fillicium decipens*	*Acacia auriculiformis*	*Markhamia lutea*	*Tabebuia rosea*
pH@25^{o}C	6.08	6.04	5.04	6.11	5.85	5.90
Soil Moisture	3.12%	6.48%	7.64%	6.04%	10.41%	6.14%
EC	44.19μs/cm	46.70μs/cm	111.20 s/cm	41.2μs/cm	48.70μs/cm	57μs/cm
Soil temperature	27^{o}C	27^{o}C	27^{o}C	25^{o}C	22^{o}C	25^{o}C

Soil pH

Soil pH is a factor, that affects growth and survival of the tree because it directly affects the protoplasm of root cell. The optimal soil pH for most of the plants prefer acidic range (5.5-6.5) in which more mineral nutrients are available for plant growth.The result of all five selected tree canopy soil samples was found in the range between (5.04-6.11) respectively, which indicates strong to moderate acidic condition. Among the samples, *Acacia auriculiformis*A.*Cunn.exBenth.*, tree soil observed higher value (6.11).Theless value (5.04) is observed in *Filliciumdecipens*tree soil indicates strongly acidic. Provin et al (2001) observed that the solubility of salts and moisture content affected by soil pH. That means, low soil pH value, have high soluble salt content and thereby high electrical conductivity. Similar results found in *Filliciumdecipens (Wight&Arn.) Thwaites.*Strongly acidic soils, have strong aggregation, good internal drainage and water-holding characteristics (Peter et al 2016). Decrease in soil pH causes an increase biomass allocation to roots. The remaining soil sample shows moderate acidic condition (Table 1& Chart 1). The barren soil (control) shows 6.08 moderately acidic. Comparing tree canopy soil with barren soil has significant similarity.

However, the present result shows slight points variations among the acidic range (very strong acidic to slightly acidic). This may be due to the solubility of salts and soil moisture. Porębska, *et al* (2008) reported that changes in soil pH depends on soil properties, vegetation, deposition of acidifying materials and weather conditions (temperature and moisture). The average range of soil pH is from 4-8. But, each tree species has specific range for optimal growth. It can vary during the growth season. pH USDA (1998) reported that temperature is one of the reason for change in the chemical activity of the soil, at the standard temperature of 25^{o}C, most of the pH measurements correction may happen.It may also vary based on the soil depth.

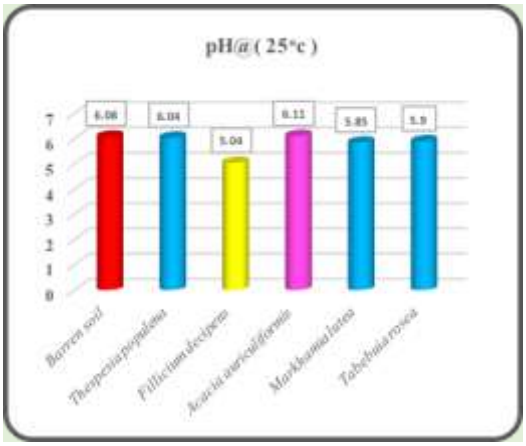

Chart 1: Physical parameter of soil pH

Soil moisture

Trees attain most of their water from the soil. Which is held in the soil pores in liquid, solid and vapour state (Scott and Maitre, 1998). The physiological processes of germination,photosynthesis,respiration and nutrition are ultimately bound up with moisture. Generally, soil moisture ranges from 10%-45%. Soil water dissolve salts and make up soil solution, which is important medium for supply of nutrients to growing plants. soil moisture regulates temperature. A lack of soil water will also diminish nutrient availability by reducing microbial activity, which is responsible for the liberation of nitrogen, phosphorus and sulfur from soil organic matter. Decreasing water uptake reduce the rate of photosynthesis. Tree plays important role in water stress detection and irrigation management. The Results showed that the soil moisture was the lowest for barren soil (3.12%), and highest for *Markhamialutea(Benth.)K.Schum*. (10.41%). (Table 1 & Chart 2). There are many reasons for the higher to lower level of soil moisture. It depends on availability of organic carbon obtained from the annual return of leaf litter. Therefore, as the level of organic matter increases in a soil, the water holding capacity also increases, due to the affinity of organic matter for water. Therefore, soil moisture helps to identify the adequate amount of water needed for tree growth. When the Plant get optimum soil moisture, it can readily absorb the water which is an important medium for supply of nutrients to growing plants.

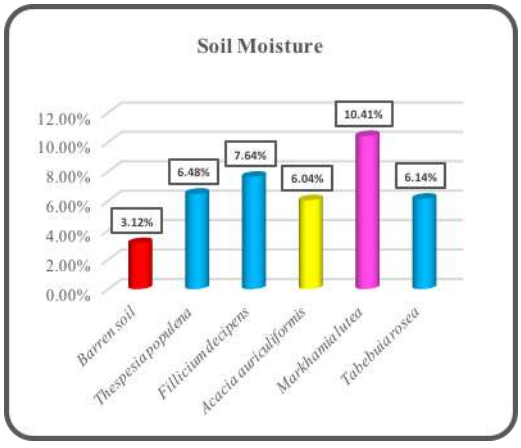

Chart 2: Physical parameter of soil moisture

Soil electrical conductivity

Soil EC is assist to measure the amount of salinity in the soil. It is important to identify, all the influencing factors affecting the soil. EC increases with increasing moisture content in the soil. Increase in Temperature increases the EC due to ions agitation. Increase in temperature by 1^{o}C will increase the electrical conductive by 2.02% (Campbell, Bower and Richards, 1948). Low soil pH value has high soluble salt content and thereby it has high electrical conductivity.The metal minerals such as Manganese, zinc etc. conduct current through electronic conduction through the movement of ions in the fluid. The highest value of EC among the tree species is *Filliciumdecipens(Wight&Arn.) Thwaites*shows 111.20 μs/cm which has high temperature, low soil pH and moderate moisture. The lowest is *Acacia auriculiformis A. Cunn.exBenth*41.2 μs/cm.The barren soil shows 44.19μs/cm. (Table 1 & Chart 3)The quality and quantity of water and texture of the soil has a significant effect on electrical conductivity.

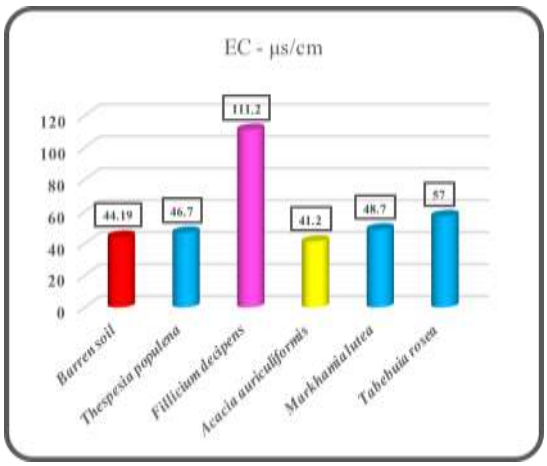

Chart 3: Physical parameter of soil EC

Soil temperature

Soil temperature plays key role in all biochemical process and regulates trees shoot growth, root growth, respiration, nutrient uptake, microbial activity, decomposition, etc., It helps to determinesoil surface temperature and water balance. It directly or indirectly affects soil moisture, aeration, nutrients and governs soil properties etc.As per the present study, the range is between (22^{o}-27^{o}c)(Table 1 & Chart 4).*Markhamialutea(Benth.) K.Schum*. soil has low temperature (22^{o}C), and *Thespesiapopulena(L) Sol.ex Correa*, *Filliciumdecipens (Wight&Arn.) Thwaites*, showed highest temperature(27^{o}C). The control (Barren soil) shows 27^{o}C. At lower temperature, there is a decrease in microbial activities and biochemical process due to which, organic matter decomposes slowly. On the other hand, increase in soil temperature increases the microbial activities and bio chemical process which in turn increases the organic matter decomposition and the value of soil pH. (Fang, 2005;Menzies et al,2003).The same observation found in our result for *Thespesiapopulena(L) Sol.ex Correa*soil. Balakrishnansandikar (2013) reported that the maximum metabolic activities and absorption of water take place between 20^{o}C -30^{o}C. As our result shows the same range which means all the samples are in optimal temperature for the maximum metabolic activities. However, the optimal changes may vary species to species and changes may occur based on physical and chemical factors.

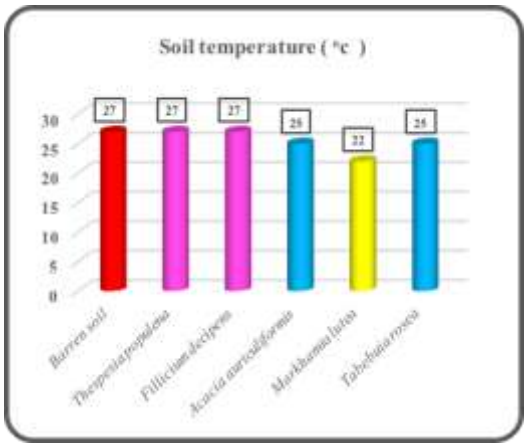

Chart 4: Physical parameter of soil temperature

CONCLUSION

Over the recent decades, soil has been contaminated due to various urban activities.The only solution to overcome these problems is to plant many trees. As our result shows, compared to barren soil there is a significant improvement in pH, Moisture and Electrical conductivity of the soil under the tree canopies. This observation shows that the fertility of the soil improved by microbial activity on the tree litters. Trees helps to control soil erosion, improves water holding capacity, reduces Co2, reduces atmospheric temperature, helps arboreal species, adds beauty to the soring environment. Urbanization is unavoidable but urban greening can improve urban lifestyle. As the quote says "We have not inherited the earth from our ancestors. We have merely borrowed it from our children". We have to take care of our mother nature for our children.

REFERENCE:

[1] Balkrishna, M Sandikar (2013). Applied Microbiology, Himalaya Publishing House pvt.Ltd.,pp.4-14. ISBN: 978-93-5097-577-0.

[2] Campbell, R. B., Bower, C.A, & Richards, L.A. (1948). Change of electrical conductivity with temperature and the relation of osmotic pressure of electrical conductivity and ion concentration for soil extracts. *Soil science society of America Proceedings*,13, 66-69.

[3] Csonka, L. N.1989. Physiological and genetic responses of bacteria to os- motic stress. *Microbiol. Rev*. **53:**121–147.

[4] Fang CM, Smith P, MonorieffJB,et al. Similar response of cabile and resistant soil organic matter pools to changes in temperature. *Nature*.2005;436:881-883.

[5] Killham K Amato M Ladd JN (1993). Effect of substrate location in soil and soil pore-water regime on carbon turnover. *Soil BiolBiochem* 25: 57–62.

[6] Mensies N, Gillman G. Plant growth limitation and nutrient loss following piled burning in slash and burn agriculture. *NutrCycl A groecosyst*, 2003;65(1):23-33.

[7] Ochsnor TE, Horton R, Ren T.A new prespective on soil thermal properties. *Soil science society of American journal*.2001;65(6):1641-1647.

[8] Porębska G, ApoloniaOstrowska A, Borzyszkowski J. Changes in the soil sorption complex of forest soils in Poland over the past 27 years. *Sci Total Environ*. 2008; 399: 105–112. pmid:18485449

[9] Ramaswamy S.V. and Razi B.A. (1973). Flora of Bangalore District, Bangalore Press.

[10] Schneider S.H. (1989). The changing climate. *Scientific American*, 120:70-79.

[11] Scott, and Maitre. 1998. Interaction between vegetation and groundwater Research priorities for South Africa 730/1/98.

[12] Stark JM Firestone MK (1995) Mechanisms for soil moisture effects on activity of nitrifying bacteria. *Appl Environ Microbiol*61: 218–221.

[13] Susannah Gill,J.F.Handley, Roland Ennos, Stephan pauleit. Adapting cities for climate change: the role of the green infrastructure.2007.33(1):115-133.

[14] Zhou J Xia B Treves DS Wu LY Marsh TL O'Neill RV Palumb AV TiedjeJM(2002) Spatial and resource factors influencing high microbial diversity in soil. *Appl Environ Microbiol*68: 326–334.

[15] "Benefits of Tree" Factsheet(website), Houston Area urban forestry control council, hppt://www.hgas.com/community/livable/forestry/documents/benefits_of trees.pdf
[16] http:forestsforwatersheds.org/reduce-stromwater/
[17] Indian population [1951-2020] (Date&Charts-CEIC ,www.ceidata.com)
[18] UN World Urbanization Prospects (2018). Available at:https://esa.un.org/unpd/wup/download/
[19] https:/urbanforestrysouth.org/about/contact/organizations/houstan-area-urban-forestry-council

