Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(1): 1909-1912
Received: 14-11-2018
Accepted: 18-12-2018

Praveen Kumar Y
Research Department of Biotechnology, Marudupandiyar College, Thanjavur, Tamil Nadu, India

Rajakumar R
Research Department of Biotechnology, Marudupandiyar College, Thanjavur, Tamil Nadu, India

Sunil Kumar M
Department of Microbiology, ERF Labs, Hyderabad, Telangana, India

Kalyan Kumar K
Department of Biochemistry, GSM Pharmaceuticals Pvt ltd, Hyderabad, Telangana, India

Correspondence
Praveen Kumar Y
Research Department of Biotechnology, Marudupandiyar College, Thanjavur, India

Assessment of chemical properties of soils from different ecosystems located in Hyderabad

Praveen Kumar Y, Rajakumar R, Sunil Kumar M and Kalyan Kumar K

Abstract
Nutrients present in the soil are most important elements required for the soil fertility and plant growth. These nutrients require plants in adequate proportions. This study was conducted to evaluate the chemical properties of selected soil ecosystems in outer side of Hyderabad – agricultural, organic farming, forest and industrial area. The variables tested included P^H, EC, OC, N, P, K to understand status of soil fertility. The study revealed the PH of the soil samples ranges from 7.01 to 7.41 and was on slightly alkaline side but within the limits 6.5 – 8.5 which is optimum for crops except forest soil shows lower value. The EC values ranged from 0.2 dSm^{-1} to 0.503 dSm^{-1} and were within in the limits of 0.8 dSm^{-1} indicates lower the salinity of soil samples. Organic carbon content showed similar values for all soil samples. Available Nitrogen and Phosphorous content negatively affected all soil samples except organic farming. Potassium levels optimum for organic and forest but lower the values for chemically fertilized and industrial soil samples.

Keywords: Chemical characteristics, soil nutrients, soil health, forest, organic carbon

Introduction
Soil is a natural body developed as a result of pedogenic processes through weathering of rocks, consisting of mineral and organic content, having precise mineralogical, chemical, physical and biological properties as a medium for plant growth (Velayutham and Bhattacharya, 2000). Soil is a critical component in ecosystem and important contributor to human wealth by providing food, water and energy (Gaur, 1997) [9] and supports the life through various processes which include purification of water, increasing biomass production, remediation of pollutants, restoration of ecosystem, and cycling of C, N, S, P and H_2O. It is the most important and natural resource for human beings and animals as these living entities primarily depends upon agriculture and allied areas which are dependent on soil sources. Soil is an organic thin layer of earth crust and contain organic matter, nutrients, water and air which constitute a system that supports the growth of plants is one of the important factor for crop production. In order to achieve higher productivity and profitability, farmer should realize that the fertility levels must be measured as these can be used for determining soil fertility. Currently various techniques are available for measuring the fertility includes indigenous knowledge, Plant/Tissue analysis, Visual observation, remote sensing, soil analysis, green house experiments and biological tests. Of these all techniques soil analysis was mostly employed for measuring soil fertility as this is simple, cost-effective, accurate, universal, and works with all types of soils.

In the present world soil resources were in limit, and easily degrading by various anthrogenic activities in natural systems that leads to conversion of agricultural to non-agricultural uses (Lal, 1998) [13]. Soil degradation is a severe issue and process of degradation can be speedup with soil erosion, decreasing the content in organic matter, changes in soil structure, depletion in plant nutrients and salinization. Intensive agricultural and excessive chemical unbalanced fertilizer farming practises for food production showing adverse effects on soil health. Extensive application of agrochemicals and contaminated irrigation water from industrial waste water led to deterioration soil health (Rayment *et al*., 2002; Kaur *et al*., 2014) [17, 11]. According to the Indian Council of Agricultural Research (2010), out of total geographical area in India 37% affected by various kinds of land degradation that include soil acidity, water erosion, soil salinity, soil alkalinity, mining and industrial waste, which directly effects on crop production across the country. In order to meet the current and future food requirement, the degraded soils and ecosystem must be improve and depleted organic matter should be restored.

The healthy soils are essential for food, fuel, water, fibre, herbal and medicinal products. Soil fertility comprises three main components: physical fertility, chemical fertility and biological fertility (Christopher johns *et al*. 2017) [5].

The physical and chemical properties of the soil play important role in the plants ability to take nutrients water (B.S. Griffith, 2010) [2]. The physical fertility refers to the size, shape, pore spaces, texture, organic material, nutrient composition in the soil. The chemical properties include P^H of the soil, electrical conductivity, organic composition and various mineral composition. Different soil ecosystems have different levels of physical and chemical properties and working with them requires understanding of these properties. The knowledge of physical and chemical properties of the soil helps in soil management procedures while working with that particular soil (N. Brady, 2002) [15].

In other way the forest provide soil ecosystem functions that are fundamental to sustain terrestrial systems (Abson *et al*., 2014: Chazdon *et al*., 2009) [1, 4]. The functions include goods services needed to maintain human populations (Matson, 1997) [14], Fuel and fibre (Rojstaczer *et al*., 2001: Vitousek *et al*., 1986) [16, 20]. They can also regulating pest control (Bale *et al*., 2008) and also supporting pollinating services (Kremen *et al*., 2002) [12]. To improve the productivity from any soil ecosystem the knowledge on different properties of soil is important to update (B.S. Griffith, 2010) [2]. To get better yields, reduce pollution, and achieve sustainable agricultural practices, soil fertility needs to be maintained at optimum level (Diaccono and Montemuroo, 2010) [7]. Hence, soil analysis is the way to know the available major nutrient levels in different land use systems to develop sustainable management strategy to conserve soils. To the best of our knowledge, such study has not been undertaken from this region. Therefore, the aim of present study was to find the differences in the Chemical properties of the soil under different land use systems.

Materials and methods

The study sites are located in city outer part of Hyderabad, in Telangana state, southern part of India. The composite soil samples were collected from four regions - local forest region, paddy soil with chemically fertilized, paddy with organic fertilized soil and industrial area (cherlapally). The principle crop is paddy in this region. The composite soil samples in triplicates were collected (0-15cm) in small sterilized low density polythene bags and were brought to the laboratory. The soil samples were air-dried and passed through 2 mm sieve for further chemical properties. The processed soil samples were used for determining p^H and Electrical conductivity were determined in 1:2 soil: water suspension by potentiometric method (Jackson, M.L. 1977) [10] and conductivity bridge method (Jackson, M.L. 1977) [10] respectively. The Organic carbon was estimated by wet digestion method (Walkley and Black, 1934) [22]. The nutrients level of Total Nitrogen is estimated by alkaline permanganate method (Subbaiah and Asija, 1956) [18]. Available phosphorus estimated in the Olsen's extract by ascorbic acid (Watanabe and Olsen's 1965) [21] and available potassium by Ammonium acetate extract method (Mervin and Peach, 1951).

S. No	Parametres	Methods
1	pH	1:2.0 soil water suspension by Using P^H meter.
2	Electrical conductivity	1:2 soil water suspension by using Conductivity bridge.
3	Organic Carbon	Walkley and Black's oxidation method (Walkely, a and Black, I.A. 1934) [22]
4	Total Nitrogen	Alkaline permanganate method (Subbaiah and Asija, 1956) [18]
5	Available Phosphorus	Olsen's extraction method (Olsen, S.R. 1954)
6	Available Potassium	Ammonium acetate extract method (Mervin and Peach, 1951)

The Chemical analysis of the four soil samples was done in triplicates and the data is presented as Mean ± Standard Error. Statistical analysis was done with the help of Microsoft Excel computer software programs.

Result and Discussion

The Chemical properties of the soils from these systems are summarized in table.1

P^H can be referred to the degree of acidity and alkality in soil. A little change or variation in the P^H of the soils shown to be significant change in the chemical and biological properties. The optimum P^H range required for crops is from 6.5 to 8.5 and the present study shows that P^H of two crop stations was in range. The data also showed in comparison to the paddy crop to the forest and industrial stations which shown to be slightly acidic - 6.12 (forest) and 7.4 (industrial soil) respectively. Among four soils the soil forest site had the lowest value of P^H and the highest average value for was observed in organic soil. The P^H values of the agriculture and organic soil showed similar from the results obtained and this is approximately matched with earlier studies conducted on rhizosphere of paddy soil which showed the P^H about 7.23 (Madhavilatha *et al*., 2015) and (Madhavi *et al*., 2018) [8]. The present findings showed the forest had lower the P^H 6.12. Any variations in the P^H either low or high indicates deficiency of nutrients, less biological activity, less crop production and severe damage to the soil and it's quality (Charman and Murray, 2007) [3].

The soil electrical conductivity (EC) is a major soil indicator of salinity or salt content level. The values of EC observed in the range from 0.2 to 0.5 dS m^{-1} and the highest average value was in agriculture. Soil organic carbon plays important role soil biological function and is a measurable component of organic matter. Most of the Organic matter is from dead or decaying materials. The results showed moderate in all soil samples in considerable concentrations. The low OC can be attributed to continuous cultivation, removal crop residue without return, effects of water and wind erosion which preferentially remove the soil colloids including the organic fractions. The Nitrogen, Phosphorous and Potassium are the major primary macronutrients of the soil and are important plant growth. Nitrogen is important element present in chlorophyll which increases vegetative growth of protein content. The deficiency of nitrogen results in stunted growth of plants and excess present soil is also a problem to the plant which will be reflected by the delayed maturity and most susceptibility to insects and diseases. The fertility is generally reflected by the levels of Nitrogen in the soil and available nitrogen varied from 139.2 kg/acre (organic soil) to 927 kg/acre (Industrial). The use extensive chemical fertilized agriculture practices may leads to the nitrogen content high in agriculture soil which was beyond the limits for this region and similar pattern was observed in forest may due to unavailability of nitrogen source.

Phosphorus (P) in the soil is an important factor which influences the chemical, biochemical characteristics of soil and is important for fertility. Phosphorus is an important factor helps in for cell division, stimulates root growth and formation and also provides the biological energy as ATP which makes the plants more tolerant to drought, cold and diseases. The availability of phosphorous depends on P^H and Organic carbon. The forest soil shows maximum value whereas organic soil given lesser. However, overall all soil samples contains high concentrations in the region. Potassium (K) in the soil is an important macro element which influences various biochemical functions. Potassium deficiency in plants show harmful effects exhibited by leaves turning brown especially in marginal, drying and stunted growth. The agriculture soil and industrial soil contain less content of this element due to chemical and industrial pollution. Medium level concentration this element shown as in case of organic and forest soil ecosystems 72 kg/acre and 56 kg/acre respectively. We can observe various levels of N, P, K present in all soil systems presented in figure.1.

Table 1: Chemical properties of different Soil (Mean ± SE)

SI. No	Parameters	Agriculture	Organic	Forest	Industrial
1	P^H	7.0 ± 0.049	7.1 ± 0.011	6.12 ± 0.011	7.41 ± 0.125
2	EC (dS m^{-1})	0.503 ± 0.017	0.236 ± 0.017	0.206 ± 0.006	0.306 ± 0.063
3	Organic carbon	0.79 ±0.008	0.74 ±0.014	0.76 ±0.008	0.78 ± 0.023
4	Nitrogen kg/acre	875.3 ± 1.45	139.2 ± 0.68	850.6± 1.169	927 ± 3.214
5	Phosphorus kg/acre	68.5 ± 0.435	49.38 ± 0.33	74.16 ± 0.76	57.86 ± 0.20
6	Potassium kg/acre	29.03 ± 0.688	72 ± 0.577	55.86 ± 0.35	43.5 ± 0.692

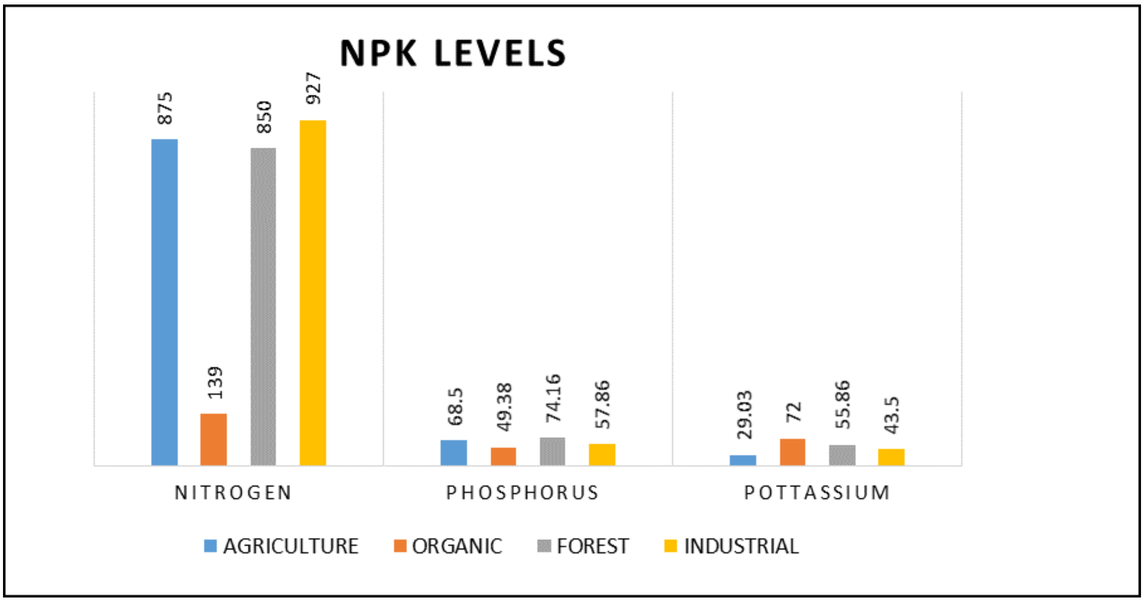

Fig 1: NPK Levels in four soil systems

Conclusion

The study indicates the soil chemical properties such as available Nitrogen content and available Phosphorus content are negatively affects the agriculture, industrial and forest systems except the organic farming soil system where the soil effected only by phosphorus. The high quantities of nitrogen, available phosphorus and organic carbon (forest) content in the soil system indicates that it has considerable impact on nutrient build-up and accumulation by reducing the loss through soil erosion and leaching due to high litter production. The is the first study from outer side region of hyderabad which can be helpful for farmers and measures must be taken to ensure adoption more environment friendly agricultural practices for sustainable production and also maintain soil health by good soil management procedures. Further study is required to know the microbial profiling across all the four soil ecosystems which would give microbial interaction with respect to the soil management practices.

Acknowledgements

The authors thank to Dr. Swapna, Agricultural Officer, for providing necessary laboratory facilities and help in understanding methodology.

References

1. Abson DJ, Wehrden H, Baumgartner S, Fischer J, Hanspach J, Hardtle W *et al*. Ecosystem services as a boundary object for sustainability. Ecol. Econ. 2014; 103:29-37.
2. Griffith BS, Ball BC, Daneill TJ, Hallett PD, Nelson R, Wheatley RE *et al*., Integrating soil quality changes to arable agricultural systems following organic matter addition, or adoption of a ley-arable rotation, Appl. Soil Ecol. 2010; 46:43-53.
3. Charman PEV, Murray BW. Soils and their properties and Management. South Melbourne, Oxford University Press, 2007.
4. Chazdon RL, Harvey CA, Komar O, Griffith DM, Ferguson BG, Martinez-Ramos M *et al*. Beyond Reserves: a research agenda for conserving biodiversity in human modified tropical landscapes. Biotropica. 2009; 41:142-153.
5. Christopher johns, Living soils: The role of Microorganisms in Soil Health – Future Directions International, 2017.
6. Dhavilewarapu, Madhavi Latha. Studies on soil Microflora in Relation to some physico Chemical Factors

from Different Localities of Hyderabad. PhD Thesis, 2015.
7. Diacono M, Montemurro F. Long-term effects of oganic amendments on soil fertility. Agronomy for Sustainable Development, 2010; 30:401.
8. Madhavi E, Shyamkumar B, Raja Sekhar PS. Assessment of Soil Quality under rice (*Oryza sativa*) Cropping systems. J Pharma Chem Biol Sci. 2018; 6(2):35-41.
9. Gaur G. Soil and Soil waste Pollution and its Management. Sarup and Sons, New Delhi, 1997.
10. Jackson ML. Soil Chemical Analysis. Pentice Hall of India. Private Limited-New Delhi, 1977.
11. Kaur M, Soodan RK, Katnoria JK, Bhardwaj R, Pakade YB, Nagpal AV. Analysis of physic-chemical properties, genotoxicity and oxidative stress inducing potential of soils of some agricultural fields under rice cultivation. Tropical plant research. 2014; 1(3):49-61.
12. Kremen, Claire, Williams, Neal M, Thorp, Robbin W. Crop pollination from Native bees at risk from agricultural intensification. Proceedings of the National Academy of Sciences. 2002; 99(26):16812-16816.
13. Lal R. Soil Quality and Agricultural Sustainability. Ann Arbor Press, Michigan, 1998.
14. Matson P. Agricultural intensification and ecosystem properties. Science. 1997; 277(80):504-509.
15. Brady N, Weil R. The Nature and Properties of Soils, 13th ed., Prentice Hall. Upper Saddlle River, New Jersey, 2002, 960.
16. Rojstaczer S, Sterling SM, Moore NJ. Human appropriation of photosynthesis products. Science. 2001; 294(80):2549-2552.
17. Rayment GE, Jeffery AJ, Barry GA. Heavy metals in Australian sugarcane. Communications in soil science and Plant analysis. 2002; 33:15-18, 3203-3212.
18. Subbaiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soils. Current Sci. 1956, 25:259-260.
19. Velayutham M, Bhattacharyya T. Soil resource management. Natural Resource Management for Agricultural Production in India. Edited by Yadav, J.S.P. and Singh, G.B., International Conference on Managing Natural Resources for Sustainable Agricultural Production in the 21st Century.
20. Vitousek PM, Ehrlich PR, Ehrlich AH, Matson PA. Human appropriation of the products of photosynthesis. Bioscience. 1986: 36:368-373.
21. Watanabe FS, Olsen SR. Test of an Ascorbic Acid Method for Determining Phosphorus in Water and NaHCO3 Extracts from the Soil. Soil Science Society of America Journal. 1965: 29:677-678.
22. Walkley A, Black C. A, An examination of digestion methods for determining soil organic matter and a proposed modifications of the chromic acid titration method. Soil Sci. 1934; 37:29-38.