STUDY ON PHYSICO-CHEMICAL PARAMETERS IN MULBERRY GROWING SOILS IN ANANTAPUR DISTRICT, ANDHRA PRADESH, INDIA

Madhavi, R*[a]. and Vijaya Kumari, N[b].

[a&b]Department of Biosciences and Sericulture, Sri Padmavati Mahila Visvavidyalayam, Tirupati, Andhra Pradesh, India.
*Corresponding Author: rmadhaviatp@gmail.com

Article History: Received: 23-04-2023 **Revised:** 12-05-2023 **Accepted:** 19-05-2023

Abstract

The present research work was conducted in mulberry growing soil samples collected from twelve different villages of three different mandals (Hindupur, Parigi and Lepakshi) of Anantapur district, Andhra Pradesh during the year 2020. The standard methods were employed for the estimation of various physico-chemical parameters such as pH, organic carbon, electric conductivity, nitrogen, phosphorus and potassium. It is evident from the present study findings that the mean values of pH were ranged from 6.43±0.57 to 6.92±0.40. Almost all soil samples were acidic in condition. The mean values of Electric conductivity were ranged from 0.04±0.005 to 0.06±0.014 and the reported EC values were sufficient in condition. Similarly the organic carbon content ranged from 0.50±0.20 to 0.61±0.09 and the recorded OC values were sufficient in condition. Likewise the available nitrogen ranged from 184.36±11.96 to 203.93±33.91 and the recorded N values were sufficient in condition. The mean values of phosphorus ranged from 113.39±11.76 to 119.12±23.14 and the reported values were high in condition. Finally the mean values of potassium ranged from 161.63±32.61 to 200.67±41.30 and the reported values were sufficient in condition.

Keywords: Physico-chemical parameters, soil fertility, mulberry growing soil.

Introduction

pH is a useful metric for determining the soil's availability of nutrients in balance conditions [1]. Deshmukh [2] reported that compared to alkaline soils, acidic soils have more Fe, Mn, Zn, and Cu. Brady and Weil [3] stated that low pH conditions of the soil favors the solubility of majority of micro nutrients when compared to high pH ranges. Wagh et al. [4] depicted that salinity levels in the soil samples generally measured through electrical conductivity which is measure to assess the concentration of soluble salts in the soils. SOC (Soil's organic matter) involved in the process of water holding and cation absorption from the soil, which determines the optimum output of any cultivable species. Organic matter is an excellent source for the growth of soil microbes which results in optimum crop productivity [5, 6]. Electric conductivity is one of the important parameter which involved in various aspects of soil properties such as texture, ion exchanges, organic matter, and salinity [7]. Optimum levels of electric conductivity of soil should be less than 1 (dS/cm) and more than 1 (dS/cm) of electric conductivity leads to poor production [2].

The use of nitrogen salts has a rapid effect on plants. NO_3 and NH_4 forms of nitrogen that are taken up very efficiently by plant roots [8]. Phosphorus is present in every plant cell. It is one of the most crucial micronutrients that plants need to grow. Phosphorus is a limiting nutrient that stays in the nuclei of plants and stores energy. It aids in energy transfer [9]. Because plants need a lot of phosphorus for growth, phosphorus is an essential element. Plant growth and maturity are accelerated and stimulated by adequate phosphorus availability [7]. Miller and Donahuer [10] stated that plants can absorb more organic phosphorus from soils with more organic matter than from soils with less organic matter. Less soluble soils are known to contain more phosphorus than those with higher runoff [11]. The mineral form of potassium has an impact on plant division, the formation of carbohydrates, the translocation of sugar, the actions of various enzymes, and resistance to particular plant diseases [9]. It is also involved in the regulation of photosynthesis and the production of lignin and cellulose, which usually form the structural components of the cell [7]. In order to assess the soil fertility parameters, in the present study soil samples were collected from mulberry growing areas in twelve villages of three different mandals in the Ananatapur district of Andhra Pradesh and were statistically interpreted using one way ANOVA. The important consideration of this study was to assess the soil fertility status of mulberry growing soil samples. This helps in sericulture farmers to understand the potentiality of the soils before cultivating the mulberry crops.

Material and Methods

Study Area

For the present research work soil samples were collected from twelve sericulture villages from three different mandals in Anantapur district of Andhra Pradesh. The mean value mentioned in table 2 is the average value of four soil samples from each village for each parameter.

Table 1. Sample collection and locations

Sample Id	Villages in Hundupur Mandal	Soil type
S1	Rachepalli	Mulberry growing soil
S2	Chalivendala	Mulberry growing soil
S3	Pulakunta	Mulberry growing soil
S4	Maruvapalli	Mulberry growing soil
Sample Id	**Villages in Parigi Mandal**	
S5	Danapuram	Mulberry growing soil
S6	Jangalapalli	Mulberry growing soil
S7	Kottapalli	Mulberry growing soil
S8	Honnampalli	Mulberry growing soil
Sample Id	**Villages in Lepakshi Mandal**	
S9	Kodipalli	Mulberry growing soil
S10	Basavannapalli	Mulberry growing soil
S11	Vibhudipalli	Mulberry growing soil
S12	Kanchisamudram	Mulberry growing soil

Methodology Used

Standard method of Jackson [12] was employed for the assessment of pH, electric conductivity and for available potassium. For the determination of organic carbon (Walkley and Black [13]

was used. For available nitrogen the Subbiah [14] method was used. Bray and Kurtz [15] was employed for the determination of available phosphorus.

Statistical analysis

One way ANOVA was carried out to check significant difference ($p<0.05$) of soil fertility parameters between mandals of Ananthapur district. Pearson correlation technique was used to check correlations between soil fertility parameters. All values were represented as mean±SD. All tests were analysed by using IBM SPSS Version 22.

Results and Discussion

pH

It is evident from the present study findings that the maximum mean value of pH was recorded in parigi mandal (6.92±0.40), lowest value was recorded in hindupur mandal (6.43±0.57) and moderate value in Lepakshi mandal (6.74±0.30).

Electric conductivity

The maximum mean value of electric conductivity was recorded in parigi (0.06±0.014) and lepakshi mandals (0.06±0.012) and lowest value was recorded in hindupur mandal (0.04±0.005).

Organic carbon

The maximum mean value of organic carbon was recorded in lepakshi mandal (0.61±0.09), lowest value was recorded in parigi mandal (0.50±0.20) and moderate value in hindupur mandal (0.54±0.10).

Nitrogen

The maximum mean value of available nitrogen was recorded in parigi mandal (203.93±33.91), lowest value was recorded in lepakshi mandal (184.36±11.96) and moderate value in hindupur mandal (187.7±14.6).

Phosphorus

The maximum mean value of available phosphorus was recorded in lepakshi mandal (119.12±23.14), lowest value was recorded in hindupur mandal (113.39±11.76) and moderate value in parigi mandal (114.32±16.43).

Potassium

Similarly the maximum mean value of available potassium was recorded in hindupur mandal (200.67±41.30), lowest value was recorded in lepakshi mandal (161.63±32.61) and moderate value in parigi mandal (185.27±49.00).

In order to estimate the correlation between the selected soil parameters the Pearson correlation matrix was employed and the observed values were recorded in tables and figures **(Table 1-3, Figures 1-6).**

Pearson correlation was conducted to check the positive and negative correlation between soil fertility parameters. Based on the observations of current research work the Electric conductivity

had positive correlation with pH (.517). Organic carbon had positive correlation with pH (.211) and electric conductivity (.486). Available nitrogen had positive correlation with pH (.485), electric conductivity (.540) and organic carbon (.146). Available phosphorus had positive correlation with electric conductivity (.056), nitrogen (.287) and negative correlation with pH (-.081) and organic carbon (-.233).Similarly the available potassium had positive correlation with organic carbon (.484) and nitrogen (.236), negative correlation with pH (-.038), electric conductivity (-.062), and available phosphorus (-.562) respectively.

Ghose et al. [16] stated that in Assam, the organic-C status of soils ranged from 0.42-1.30 %, available P_2O_5 ranged from 3.5 -20.5 kg ha^{-1} and K between 30-162 kg ha^{-1}. Range of soil pH varied from 4.2-5.8. Pandey et al. [17] found that the content of available P in Inceptisols of central Uttar Pradesh, ranged from 7.7-55.4 kg ha^{-1}. Available S contents varied from 5.8-53.8 mg kg^{-1} in different soil associations. Similar trends of values were reported in the present study. Majidet al. [18] recorded the pH values in mulberry farms which are ranged from acidic to slightly alkaline in nature. The recorded EC and OC values are in the following proportions as 0.026-0.25(dS/m) and 0.08-1.69(%) respectively. Similar trends of values were reported in the present study. Kothyariet al. [19] recorded slightly alkaline pH, electric conductivity is in the permissible limit. Organic carbon was 0.38%. Likewise N, P values were recorded as 213.70 $kgha^{-1}$and 22.35 $kgha^{-1}$ respectively. More or less similar trends of results were reported in the present investigation. Madhavi et al. [20] recorded slightly alkaline pH. The recorded P, OC, and N values were in the following proportions as 0.009 to 0.033 mg/kg, 0.78% to 0.95% and 0.263% to 0.635% respectively. Similar trends of values were reported in the present study. Naidu et al. [21] recorded the pH values in the soil samples which are ranged from acidic to slightly alkaline in nature. Available nitrogen is low in 13% soil samples, but the values of phosphorus and potassium were in line with the findings of the present study. Sudhakar et al. [22] recorded the average pH value of soil sample is 7.03, OC values ranged from 0.12-1.06%, the average values of available N was 212.3 kg/ha, the P values was fluctuated between 3.69 to 103.9 kg/ha and K values was fluctuated between 181.7 to 905.4 kg/ha. Except potassium remaining parameters are in line with the findings of the present study.

Table 2. Comparative table on soil parameters from three different mandals of Anantapur district (n = 4)

Soil parameters	**Hindupur**	**Parigi**	**Lepakshi**	**Rating***
pH	6.43 ± 0.57^a	6.92 ± 0.40^a	6.74 ± 0.30^a	Acidic soils
EC dSm^{-1}	0.04 ± 0.005^a	0.06 ± 0.014^a	0.06 ± 0.012^a	Normal (Sufficient)
OC (%)	0.54 ± 0.10^a	0.50 ± 0.20^a	0.61 ± 0.09^a	Normal (Sufficient)
N kg/ha	187.6 ± 14.63^a	203.93 ± 33.91^a	184.36 ± 11.96^a	Normal (Sufficient)
P kg/ha	113.39 ± 11.76^a	114.32 ± 16.43^a	119.12 ± 23.14^a	High (Efficient)
K kg/ha	200.67 ± 41.30^a	185.27 ± 49.00^a	161.63 ± 32.61^a	Normal (Sufficient)
Identical alphabetical superscripts along row indicate there is no significant difference. *Except phosphorus the remaining soil fertility parameters are in adequate proportions from three selected mandals of anantapur district.				

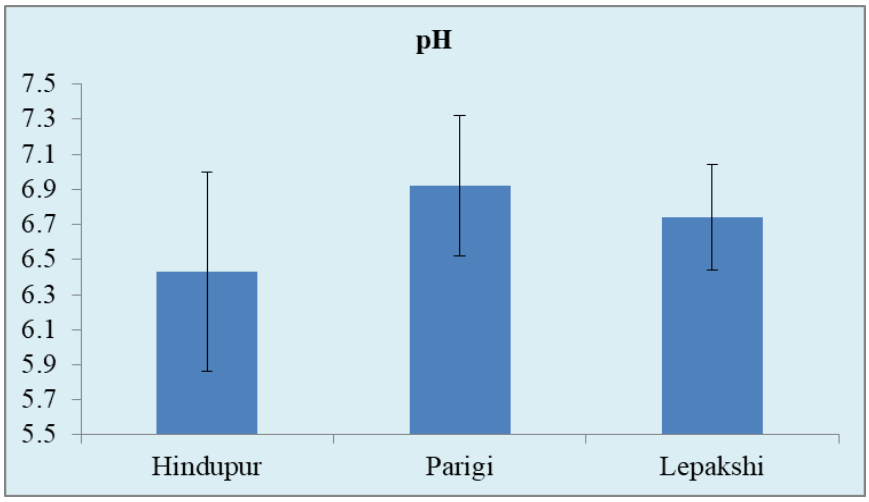

Figure 1. pH

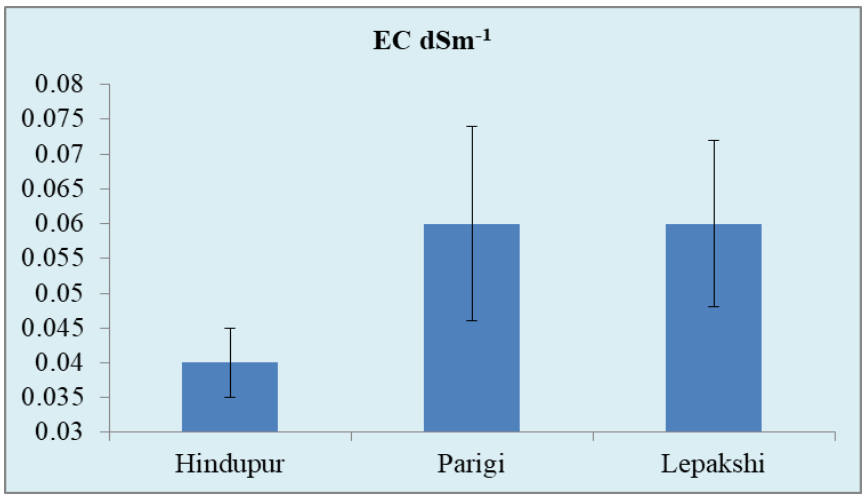

Figure 2. Electric conductivity

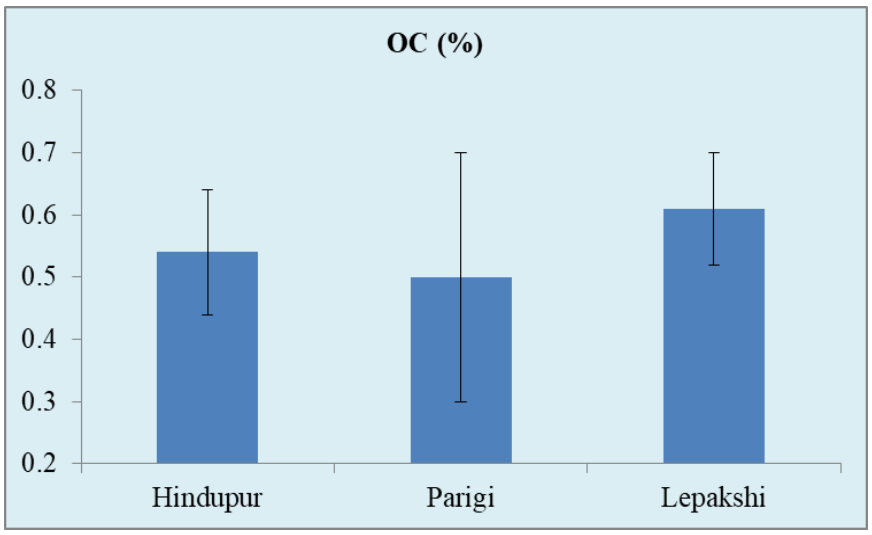

Figure 3. Organic carbon

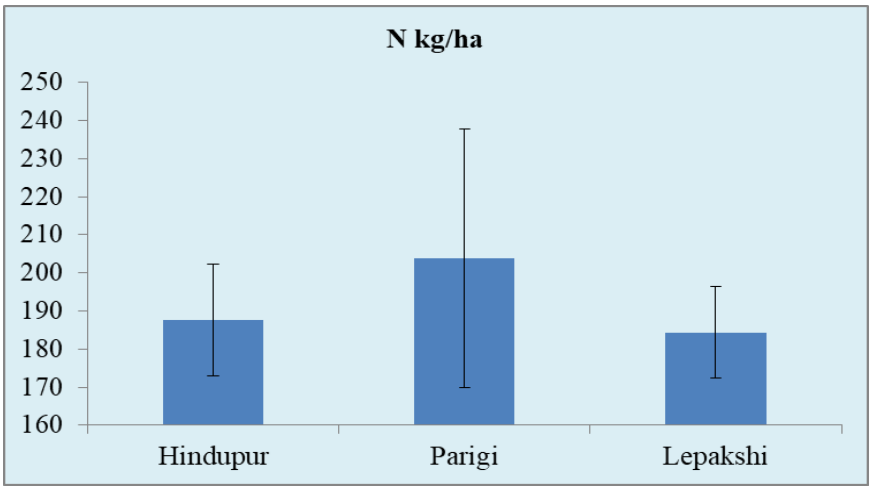

Figure 4. Nitrogen

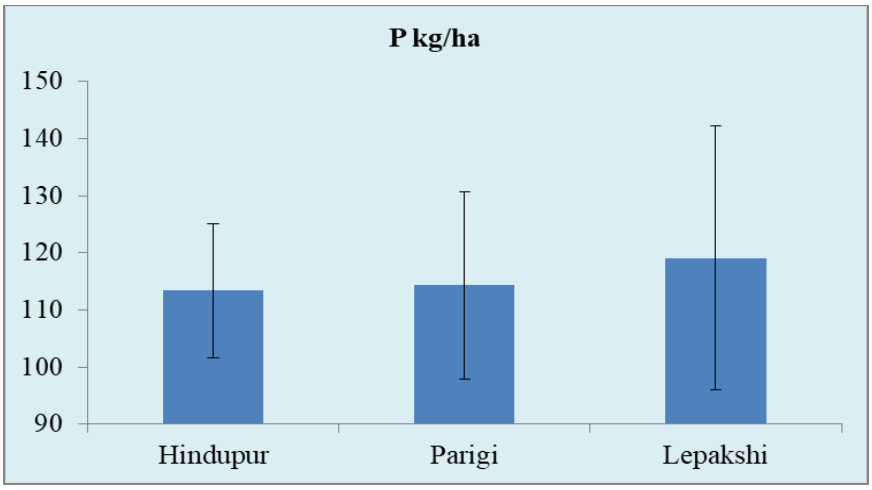

Figure 5. Phosphorus

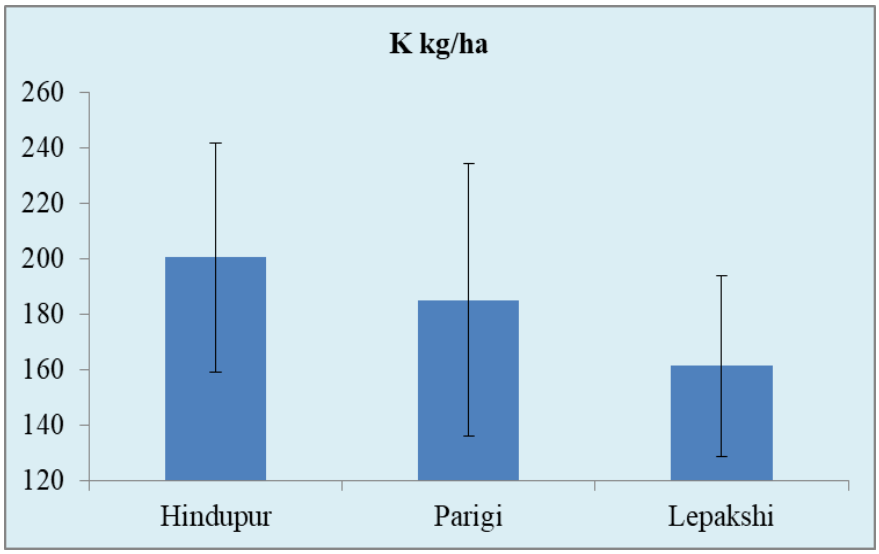

Figure 6. Potassium

Table 3. Pearson correlation for the analysis of physic-chemical parameters

Correlations[a]					
	pH	**EC dSm^{-1}**	**OC (%)**	**N kg/ha**	**P kg/ha**
EC dSm^{-1}	.517				
OC (%)	.211	.486			
N kg/ha	.485	.540	.146		
P kg/ha	-.081	.056	-.233	.287	
K kg/ha	-.038	-.062	.484	.236	-.562
a. Listwise N=12					

Acknowledgments

I would like to thank Acharya N.G. Ranga Agriculture Research Station, Rekulakunta, Anantapur for providing laboratory facilities to carryout soil sample analysis.

References

1. Kinyangi, J. 2007. Soil Health and Soil Quality: A Review. Retrieved from https://ecommons.cornell.edu/bitstream/handle/1813/66582/Soil_Health_Review.pdf
2. Deshmukh, K.K. 2012. Studies on chemical characteristics and classification of soils from Sangamner area, Ahmednagar district, Maharashtra, India. Rasayan Journal of Chemistry, 5(1): 74-85.
3. Brady, C.N. and Weil, R.R. 2002. Nature and properties of soils. 13th Edition, Prentice Hall.
4. Wagh, G.S., Chavhan, D.M. and Sayyed, M.R.G. 2013. Physicochemical Analysis of Soils from Eastern Part of Pune City. Universal Journal of Environmental Research and Technology, 3(1): 93-99.
5. Amos-Tautua, B.M., Onigbinde, A.O. and Ere, D. 2014. Assessment of some heavy metals and physicochemical properties in surface soils of municipal open waste dumpsite in Yenagoa, Nigeria. African Journal of Environmental Science and Technology, 8(1): 41-47.
6. Brady, N.C. 1996. The Nature and Properties of Soils, 11th Edition, McMillan: New York, 1996, 621.
7. Solanki, H.A. and Chavda, N.H. 2012. Physicochemical analysis with reference to seasonal changes in soils of Victoria park reserve forest, Bhavnagar (Gujarat). Life Sciences Leaflets, 8: 62-68.
8. Sumithra, S., Ankalaiah, C., Rao, D. and Yamuna, R.T. 2013. A case study on physicochemical characteristics of soil around industrial and agricultural area of Yerraguntla, Kadapa district, AP, India. International Journal of Geology, Earth and Environmental Sciences, 3(2): 28-34.
9. Jain, S.A., Jagtap, M.S. and Patel, K.P. 2014. Physico-Chemical Characterization of farmland Soil used in some villages of Lunawada Taluka, Dist: Mahisagar (Gujarat) India. International Journal of Scientific and Research Publications, 4(3): 1-5.

10. Miller, R.W. and Donahuer, R.L. 2001. Soils in our environment, 2001, Seventh edition. Prentice Hall, Inc. Upper Saddle River, New Jersey.

11. Ashraf, M., Bhat, G.A., Dar, I.D. and Ali, M. 2012. Physico-Chemical Characteristics of the Grassland Soils of Yusmarg Hill Resort (Kashmir, India), Ecologia Balkanica, 4(1): 31-38.

12. Jackson, M.L. 1973. Soil Chemical Analysis. Prentice Hall of India (Pvt.) Ltd., New Delhi.

13. Walkley, A. and Black, I.A. 1934. An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil Science, 37(1): 29-38.

14. Subbaiah, B.V. 1956. A rapid procedure for estimation of available nitrogen in soil. Current Science, 25: 259-260.

15. Bray, R.H. and Kurtz, L.T. 1945. Determination of total, organic, and available forms of phosphorus in soils. Soil Science, 59(1): 39-46.

16. Ghose, T.J., Saud, R.K., Pathak, A.K., Barkakoty, P.K. and Choudhary, R.K. 2000. Nutrient indexing in kharif rice soils of Upper Assam. Journal of Soils and Crops, 10(1): 1-6.

17. Pandey, S.P., Singh, R.S. and Mishra, S.K. 2000. Availability of phosphorus and sulphur in Inceptisols of central Uttar Pradesh. Journal of the Indian Society of Soil Science, 48(1): 118-121.

18. Majid, N., Ul-Haque, Z. and Mir, M.R. 2022. Physico-chemical properties of soils in different Mulberry farms of Various Districts of Kashmir. Acta Scientific Agriculture, 6(4): 24-27.

19. Kothyari, H.S., Meena, K.C., Meena, B.L. and Meena, R. 2018. Soil Fertility Status in Sawai Madhopur District of Rajasthan. Indian Journal of Pure and Applied Biosciences, 6(4): 587-591.

20. Madhavi, E., Syamkumar, B. and Sekhar, P.R. 2018. Assessment of Soil Quality Under Rice (*Oryza sativa*) Cropping Systems, Yelamanchili Mandal, Visakhapatnam District, Andhra Pradesh, India. Journal of Pharmaceutical, Chemical and Biological Sciences, 6(2): 35-41.

21. Naidu, B.V., Sobhana, V., Sudhakar, P., Sen, S., Obulapathi, N., Sneha, M.V. and Tiwari, P. 2019. Soil nutrient status of mulberry gardens in varied clusters of Andhra Pradesh. Emergent Life Sciences Research, 5: 43-51.

22. Sudhakar, P., Sobhana, V., Gowda, M.S., Sen, S., Sneha, M.V. and Sivaprasad, V. 2020. Fertility Assessment of Soil and Suitable Amelioration for Sustainable Quality Mulberry Leaf and Cocoon Production in Karnataka. Research Biotica, 2(1): 15-19.