The Pharma Innovation Journal 2022; 11(3): 1216-1220

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 1216-1220

www.thepharmajournal.com
Received: 17-12-2021
Accepted: 23-02-2022

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Assessment of Physico-chemical parameters and nutrient index of soil in different blocks of Meerut district, Uttar Pradesh (West)

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Abstract
The objective of this research was to study the soil fertility of Meerut district and guide the farmers about the problems related and provide Soil. In the present study Physico-chemical analysis of soil in Meerut district was analysed by selecting nine different villages. Accordingly, it is found that the pH of the soil samples was found to be neutral to slightly alkaline in nature with a mean value 7.89. The electrical conductivity of soils was recorded with mean value 0.27 dS m-1. 74.07% of the soil samples showed low-medium Organic Carbon content this is due to low and high temperature and less decomposition of organic matter in the soil. The soil nutrient index Nitrogen (1.25), Phosphorus (1.48), Potassium (1.48), Sulphur (1.25), Zinc (1.08) and Iron (1.41) has showed low range of nutrient index whereas Organic carbon (1.74), and Manganese (1.70) are showed medium range. The results strongly recommend that still improving cropping pattern, decomposition of organic waste, mulching and tillage practices.

Keywords: Brassica juncea, correlation, Indian mustard, path coefficient analysis

Introduction
Soil is a thin layer of earth's crust and is a living media, which is one of the important factors of crop production and serves as a natural nutrient source for the growth of plants. The components of the soils are mineral material, organic matter, water and air, the proportions of which vary and which together form a system for plant growth. Macronutrients (N, P, K) and micronutrient (Zn, Fe, Cu, Mn) are important soil elements that control its fertility. Soil fertility is one of the important factors controlling yield of the crops (Kumar, 2016). Farmers apply inadequate and imbalanced fertilizer due to which the inherent capacity of soil *i.e.*, soil fertility is affected adversely. Many secondary (S, Ca, Mg) as well as micronutrients (Zn, Fe, B, Mo) deficiency are experienced and become limiting factor for crop production. In such condition, sustainability of crop production cannot be assured (Kumar, 2017). Soil structure and soil organic matter are two of the most dynamic properties that are extremely sensitive to crop and soil management. Soil organic matter is closely related to soil organic carbon dynamics in the soil because it constitutes the largest terrestrial reservoir of soil organic carbon (Srinidhi *et al*., 2020) [14]. Soil fertility deterioration mostly occurs due to increased population density, land use, adverse climatic conditions, over grazing, increased land fragmentation and deforestation etc. Continuous and intensive cropping without adequate use of nutrients and improper soil management practices may decline soil fertility (Reddy *et al*., 2021) [13]. The soil's native ability to supply sufficient nutrients has decreased with higher plant productivity level associated with increased human demand for food. Therefore, one of the greatest challenges today is to develop and implement soil, crop and nutrients management technologies that enhance the plant productivity and quality of soil, water and air (Singh., 2016) [12]. There is no doubt that soil test-based fertilizer recommendation is essential in farming systems of Asia and beyond to uphold productivity and maintain farm soil fertility. In some developing countries, there are soil fertility maps, which are meant for highlighting and interpreting the nutrient statuses as well as plant nutrients requirement assumption decisions (Singh, 2019). A productive soil would ensure proper retention and release of water and nutrients, promote and sustain root growth, maintain soil biotic habitat, respond to management and resist degradation. Soil-test based fertility management is an effective tool for increasing productivity of agricultural soils that have high degree of spatial variability resulting from the combined effects of physical, chemical or biological processes.

The present study deals with the assessment of physico-chemical parameters of different blocks of Meerut district, UP (west), India.

Materials and Methods

Meerut is situated on the vast plains that are bounded by river Ganga on the east and river Hindan on the west of Uttar Pradesh in the northern part of India. The alluvial soil grains deposited from both the rivers is what makes this whole region most suitable for agriculture. In area Meerut district covers 2,522 km^2 (974 sq mi). It is located at 28° 59' 4.7184" N latitude and 77° 42' 21.4416" E longitude. Meerut district consists of 667 villages, 12 blocks. It comes under western plain agro-climatic zone. The place shows humid sub-tropical climate with temperature variation from 21°C to 45°C in summers and 5°C to 23°C. Meerut receives an average rainfall of 800-1000 mm per year. Soil samples were collected from three different blocks of Meerut district Uttar Pradesh (west). They are Sardhana, Mawana and Kharkhoda. In each block three villages were selected for sampling and samples were obtained from three different depths 0-15 cm, 15-30 cm, and 30-45 cm with the help of GPS totally twenty-seven soil sample were collected which were first air dried at room temperature, then crushed using wooden mallet and then sieved (2mm) for further analysis. The samples were analyzed for different physico-chemical properties such as soil color, texture, pH, EC, OC and available macro and micro-nutrients. Bulk and particle density was measured by pycnometer suggested by Black (1965) [1]. Colour of the soil was judged by visually comparing a soil sample with the chips of standard Munsell Soil Colour Charts (hue, value and chroma indices) (1971) to describe colors. The soil texture was judged by Bouyoucos hydrometer suggested by Bouyoucos (1927) [2]. Soil pH was measured by digital pH meter suggested by Jackson (1958) and Electrical Conductivity by digital conductivity meter given by Wilcox (1950). Organic carbon was determined by Walkley and Black (1934) [17] Wet Oxidation Method. Available macronutrients *i.e.*, available Nitrogen (N), Phosphorus (P) and potassium (K) were estimated by the methods suggested by (Subbiah and Asija, 1956) [15] with alkaline potassium permanganate, (Olsen *et al.*, 1954) [9] using photo electric colorimeter and Toth and Prince (1949) with flame photometer respectively. Sulphur was obtained by Chesnin and Yein (1951) by turbid metrical method.

Table 1: Procedures used for Physico-chemical analysis.

Particulars	Methods	Scientist (years)
Texture	Bouyoucos Hydrometer	Bouyoucos, (1927) [2]
Soil Colour	Munsell Colour Chart	Munsell, (1971)
Particle Density (Mg m^{-3})	Graduated measuring cylinder	Muthuaval *et al.*, (1992) [8]
Bulk Density (Mg m^{-3})	Graduated measuring cylinder	Muthuaval *et al.*, (1992) [8]
Pore Space (%)	Graduated measuring cylinder	Muthuaval *et al.*, (1992) [8]
Water Retaining Capacity (%)	Graduated measuring cylinder	Muthuaval *et al.*, (1992) [8]
Soil pH	Digital pH meter	Jackson, (1958)
Electrical Conductivity	Digital EC meter	Wilcox, (1950)
Organic Carbon (%)	Rapid Titration Method	Walkley and Black, (1947)
Available Nitrogen (kg ha^{-1})	Kjeldahl Method	Subbiah and Asija, (1956) [15]
Available Phosphorous (kg ha^{-1})	Calorimetric Method	Olsen *et al.*, (1954) [9]
Available Potassium (kg ha^{-1})	Flame photometer method	Toth and Prince, (1949)
Calcium and Magnesium (meq $100g^{-1}$)	EDTA method	Jackson, (1961)
Sulphur (mg kg^{-1})	Turbid Metric method	Chesnin and Yein, (1951)
Zinc, Iron and Copper (mg ha^{-1})	DTPA method	Lindsay and Norvell, (1978) [5]

Soil nutrient index

In order to compare the levels of soil fertility of one area with those of another it was necessary to obtain a single value for each nutrient. The Organic carbon, Nitrogen, Phosphorus, Potassium, Sulphur, Zinc, Iron, Manganese and Copper Index calculated value is given in the Table:1. The nutrient index is calculated by using the formula as given by (Muhr *et al*., 1963).

$$\text{Nutrient Index (N.I.)} = \frac{NL \times 1 + NM \times 2 + NH \times 3}{NT}$$

Where, NL: Indicates number of samples falling in low class of nutrient status

NM: Indicates number of samples falling in medium class of nutrient status

NH: Indicates number of samples falling in high class of nutrient status

NT: Indicates total number of samples analyzed for a given area.

The nutrient index value of less than 1.5 is rated as low, 1.5 to 2.5 is rated as medium and more than 2.5 is rated as high fertility status as suggested by (Ramamoorthy and Bajaj 1969) [10].

Results and Discussion

The Soil Colour (Dry method) of soil samples are shown Light yellowish brown, Pale yellow, Olive and Olive yellow and In Wet method color of soil samples were shown Olive brown, Olive, Yellowish brown, Greyish and Dark grayish brown. The Textural classification of sand, slit and clay percentage in soil samples are varied from 60.20-68.93% in sand, 12.94-20.81% in silt and 10.25-13.27% in clay all soil samples come under sandy loam textural class. The Bulk density value ranged from 1.00 to 1.33 Mg m^{-3} with an Overall Mean value 1.16 Mg m^{-3}. V_4 (Akbarpur Garhi) 15-30 cm depth soil has shown highest bulk density and V_9 (Kharkhoda Ward No.-3) 30-45 cm depth soil has shown lowest bulk density. The statistical analysis of bulk density has shown significant value and it comes under fine textured soils. The Particle density value ranged from 1.66 to 2.50 Mg m^{-3} with an Overall Mean value 2.07 Mg m^{-3}. V_2 (Dabathuwa Garhi) 0-15 cm and 15-30 cm, V_7 (Kharkhoda Ward No.-1) 0-

15 cm, V_9 (Kharkhoda Ward No.-3) 0-15cm and 15-30 cm depth soil has shown highest particle density and V_3 (Dabathuwa) 30-45 cm depth soil has shown lowest particle density. The statistical analysis of particle density has shown significant value. The Porosity of the soil particle ranged value ranged from 31.25 to 55.55% with an Overall Mean value 41.50%. In V_2 (Dabathuwa Garhi) 0-15 cm and V_9 (Kharkhoda Ward No.-3) 0-15 cm depth soil has shown highest pore space and V_4 (Akbarpur Garhi) and V_7 (Kharkhoda Ward No.-1) 30-45 cm depth soil has shown lowest pore space. The statistical analysis of porosity has shown significant value. Water Holding Capacity of the soil varied from 39.47 to 65.65% with an Overall Mean value 53.07%. In V_5 (Jarauda) 30-45 cm depth soil has shown highest water holding capacity and V_9 (Kharkhoda Ward No.-3) 0-15 cm depth soil has shown lowest water holding capacity. The statistical analysis of Water Holding Capacity has shown significant value. pH of the soil samples ranged from 7.1 to 9.2 with an Overall Mean value 7.89. In V_2 (Dabathuwa Garhi) 15-30 cm and 30-45 cm depth soil has shown highest pH and V_4 (Akbarpur Garhi) 0-15 cm depth soil has shown lowest pH. The statistical analysis of pH has shown significant value. EC of the soil varied from 0.21 to 0.37 dS m^{-1} with an Overall Mean value (0.28 dS m^{-1}). In V_6 (Jataula) and V_9 (Kharkhoda Ward No.-3) 30-45 cm depth soil has shown highest EC and V_8 (Kharkhoda Ward No.-2) 0-15 cm depth soil has shown lowest EC. The statistical analysis of EC has shown significant value. Organic Carbon of the soil samples ranged from 0.3 to 0.77% with an Overall Mean value (0.46%). In V_3 (Dabathuwa) 30-45 cm depth soil has shown highest Organic Carbon and V_8 (Kharkhoda Ward No.-2) 30-45 cm depth soil has shown lowest Organic Carbon. The statistical analysis of Organic Carbon has shown significant value. The Nitrogen of the samples varied from 141 to 597 kg ha^{-1} with an Overall Mean value (219.33 kg ha^{-1}). In V_3 (Dabathuwa) 30-45 cm depth soil has shown highest available nitrogen and V_8 (Kharkhoda Ward No.-2) 15-30 cm depth soil has shown lowest available nitrogen. The statistical analysis of Nitrogen gas shown significant value. Phosphorus of the soil samples ranged from 11 to 27 kg ha^{-1} with an Overall Mean value (16.59 kg ha^{-1}) In V_6 (Jataula) 0-15 cm depth soil has shown highest available phosphorus and V_4 (Akbarpur Garhi) 0-15 cm, V_3 (Dabathuwa) 0-15 cm and 30-45 cm, V_5 (Jarauda) 15-20 cm depth soil has shown lowest available Phosphorus. The statistical analysis of Phosphorus has shown significant value. Potassium of the soil samples varied from 108 to 244 kg ha^{-1} with an Overall Mean value (162.64 kg ha^{-1}). In V_8 (Kharkhoda Ward No.-2) 0-15 cm depth soil has shown highest available Potassium and V_4 (Akbarpur Garhi) 0-15 cm and V_7 (Kharkhoda Ward No.-2) 30-45 cm depth soil has shown lowest available Potassium. The statistical analysis of Potassium has shown significant value. The Calcium of the soil samples ranged from 3.8 to 9.8 meq 100 g^{-1} with an Overall Mean value 7.55 meq 100 g^{-1}**.** In V_5 (Jarauda) 0-15 cm depth soil has shown highest available Calcium and V_6 (Jataula) 0-15 cm depth soil has shown lowest available Calcium content. The statistical analysis of Calcium has shown significant value. The Magnesium of the soil samples varied from 6 to 6.8 Mg kg^{-1} with an Overall Mean value (6.26 Mg kg^{-1}). In V_8 (Kharkhoda Ward No.-2) 30-45 cm depth soil has shown highest available magnesium and V_3 (Dabathuwa) 0-15 cm soil depth has shown lowest available magnesium. The statistical analysis of Magnesium has shown significant value. The Sulphur of the soil samples varied from 20 to 28 Mg kg^{-1} with an Overall Mean value 23.61 Mg kg^{-1}**.** In V_7 (Kharkhoda Ward No.-1) 30-45 depth soil has shown highest available Sulphur and V_1 (Daurala) 0-15 cm soil depth has shown lowest available Sulphur. The statistical analysis of Sulphur has shown significant value. Zinc of the soil samples ranged from 0.51 to 0.85 Mg kg^{-1} with an Overall Mean value 0.64 Mg kg^{-1}**.** In V_7 (Kharkhoda Ward No.-1) 15-30 cm depth soil has shown highest available Zinc and V_6 (Jataula) 30-45 cm soil depth has shown lowest available Zinc. The statistical analysis of Zinc has shown significant value. Iron of the soil samples varied from 3.84 to 8.39 Mg kg^{-1} with an Overall Mean value 5.44 Mg kg^{-1}**.** In V_4 (Akbarpur Garhi) 0-15 cm depth soil has shown highest available Iron and V_2 (Dabathuwa Garhi) 15-30 cm soil depth has shown lowest available Iron. The statistical analysis of Iron has shown significant value. Copper of the soil samples varied from 0.24 to 0.87 Mg kg^{-1} with an Overall Mean value 0.43 Mg kg^{-1}. In V_1 (Daurala) 0-15 cm depth soil has shown highest available Copper

Table 2: Nutrient Index values of Chaka lock in Prayagraj district of Uttar Pradesh

Sl. No	Available nutrients	Nutrient index values	Category
1	Organic carbon	1.74	Medium
2	Nitrogen	1.25	Low
3	Phosphorus	1.48	Low
4	Potassium	1.48	Low
5	Sulphur	1.25	Low
6	Zinc	1.08	Low
7	Manganese	1.70	Medium
8	Iron	1.41	Low
9	Copper	2.66	High

Table 3: Soil quality parameters of overall mean in different villages of Meerut district, Uttar Pradesh (west)

Village No	Name of the Village	pH	EC (d S m^{-1})	OC (%)	N (Kg ha^1)	P (Kg ha^1)	K (Kg ha^1)
1	Daurala	8.4	0.26	0.56	355.66	16.66	162.33
2	Dabathuwa Garhi	7.33	0.33	0.13	171.66	17.00	161.00
3	Dabathuwa	9.03	0.25	0.47	288.00	11.33	196.00
4	Akbarpur Garhi	7.33	0.26	0.19	164.66	13.00	145.66
5	Jarauda	7.7	0.25	0.39	178.00	14.66	138.00
6	Jataula	7.76	0.34	0.24	170.66	24.33	157.33
7	Kharkhoda Ward No. -1	7.66	0.26	0.49	305.00	17.00	140.00
8	Kharkhoda Ward No. - 2	7.83	0.22	0.34	164.66	19.66	186.00
9	Kharkhoda Ward No. - 3	7.96	0.35	0.2	175.66	15.66	173.00

Table 4: Soil quality parameters of overall mean in different villages of Meerut district, Uttar Pradesh (west)

Village No	Name of the Village	Ca (Kg ha^{1})	Mg (Kg ha^{1})	S (Kg ha^{1})	Zn (Kg ha^{1})	Mn (Kg ha^{1})	Fe (Kg ha^{1})	Cu (Kg ha^{1})
1	Daurala	9.0	6.4	8.66	0.63	0.64	16.72	0.63
2	Dabathuwa Garhi	7.5	6.3	6.33	0.66	0.66	14.39	0.66
3	Dabathuwa	6.5	6.2	3.00	0.58	0.60	13.95	0.58
4	Akbarpur Garhi	7.8	6.4	8.00	0.6	0.59	16.93	0.60
5	Jarauda	9.0	6.0	6.33	0.65	0.64	18.91	0.65
6	Jataula	4.4	6.2	6.33	0.64	0.51	18.58	0.64
7	Kharkhoda Ward No. -1	8.6	6.0	23.00	0.50	0.66	15.39	0.50
8	Kharkhoda Ward No. - 2	7.2	6.6	4.60	0.66	0.64	15.64	0.66
9	Kharkhoda Ward No. - 3	7.6	6.1	4.60	0.61	0.63	16.24	0.61

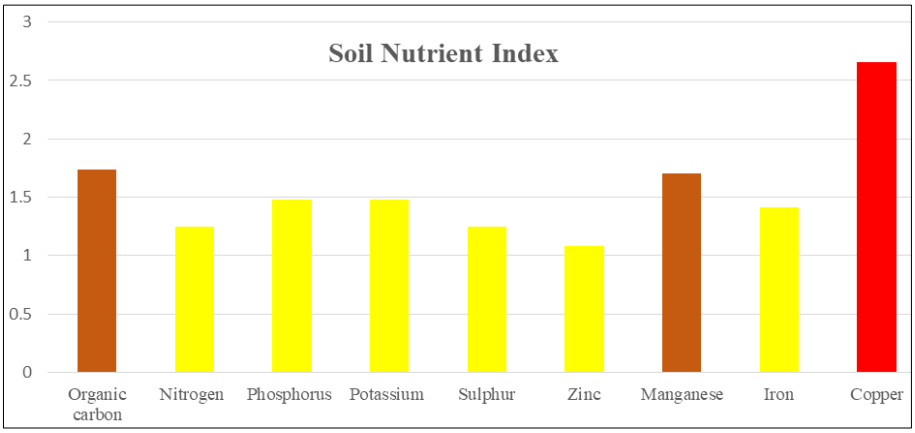

Fig 1: Graphical representation of the nutrient index of soil

Conclusion

It was concluded that soil parameters were studied during the course of investigation responded good chemical properties pH is neutral to alkaline, EC, Nitrogen, Organic Carbon, Potassium and Phosphorus is adequate range having good amount of Ca+Mg. These studies give information about nature of Soil, present nutrient content in soil based on this analysis. According to the soil nutrient index nitrogen, phosphorus, potassium, sulphur, zinc and iron has showed low range of nutrient index whereas organic carbon, and manganese are showed medium range. These analyses may help farmers to maintain proper nutrient management to obtain high yield with quality products. Still improvement can be done by improving cropping pattern, decomposition of organic waste, mulching and tillage practices.

Acknowledgements

The authors would like to thank the Hon'ble Vice Chancellor, SHUATS and HoD, Department of Soil Science and Agricultural Chemistry, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences for the support. The thankfulness is also extended to all professors, friends and technicians for their continuous help and support.

References

1. Black CA. Methods of Soil Analysis. Part I and II. American Society of Agronomy, Inc., Madison, Wisconsin, U. S. A. 1965;1-2:1572.
2. Bouyoucos GJ. The hydrometer as a new method for the mechanical analysis of soils. Soil Science 1927:343- 353.
3. Chesnin L, Yien CH. Turbidimetric determination of available sulphur. Proceeding of Soil Science. American. 1950;14:149-151.
4. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi. 1973.
5. Lindsay WL, Norvell WA. Development of a EDTA micronutrients soil test for Zn, Fe, Mn, and Cu. Soil Science Society of America Journal. 1978;42(3):421- 428
6. Muhr GR, Datta NP, Shankara Subraney N, Dever F, Lecy VK, Donahue RR. Soil Testing in India, USAID Mission to India. 1965.
7. Munsell AH. Munsell Soil Colour Charts. First edition. Munsell Color Company Inc., Baltimore. 1954.
8. Muthuvell P, Udayasoorian C, Natesan R, Ramaswami PR. Introduction to Soil Analysis. First edition. Tamil Nadu Agricultural University, Coimbatore. 1992.
9. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of Available Phosphorus in Soils by Extraction with Sodium Bicarbonate. U. S. Department of Agriculture, Circular No. 1954;939.
10. Ramamurthy B, Bajaj JC. Nitrogen, Phosphorus and Potash status of Indian soils. Fertilizer News. 1969;14:25-28.
11. Schollenberger CJ. Simon RH. Determination of Exchange Capacity and Exchangeable Bases in Soil-Ammonium Acetate Method. Soil Science. 1945;59:13-24.
12. Singh YV, Singh SK, Sahi SK, Verma SK, Yadav RN, Singh PK. Evaluation of soil fertility status from Milkipur village, Arajiline Block, Varanasi district, Uttar Pradesh, in relation to soil characteristics. Journal of pure and applied microbiology. 2016;10(2):1455-1461.
13. Srinath Reddy I, David AA, Srinidhi P. Anatomization of soil fertility status of Chaka Block, Yamuna River bank, Prayagraj, Uttar Pradesh, India. International Journal of Plant and Soil Science. 2021;33(14):27-34.
14. Srinidhi P, Singh YV, Sharma PK, Singh RK, Latare AM, Srinath I, *et al*. Physico-chemical analysis of Madanapalle block, Chittor district of Andhra Pradesh.

International Journal of Chemical Sciences. 2020;8(3):154-158.
15. Subbiah BV, Asija GL. A rapid procedure for the determination of available nitrogen in soils. Current Science. 1956;25:259-260.
16. USDA U.S. Salinity Laboratory Staff, Diagnosis and Improvement of Saline and Alkali Soils. Handbook 60. Washington, D.C. 1954.
17. Walkley A, Black TA. An examination of the Degt. Jarett method for determination of soil organic matter and a proposed modification of chromic acid titration. Soil Science. 1934;37:29-38.