Effect on physico-chemical properties of soil under various land use planning of Kanpur Nagar (U.P.)

Abstract

A research work conducted during 2020-21 at various land use planning of Kanpur Nagar (U.P.) to evaluate the fertility status ofvarious land use planning onsoil physico-chemical characteristics. The 504 representative soil samples with 3 depths viz. 0-15, 15-30,and 30-60 cm soil samples were taken with manually driven post hole auger and processedfor soil analysis from different land use planning of Kanpur Nagar.Results revealedthatphysico-chemical properties*viz*. Bulk density,pH, Electrical Conductivity **(**E.C.), organic carbon (O.C.) varied vertically and horizontally incultivated and fallow lands.Thefrequency distribution of soil bulk density of entire lands ranged 1.14 – 1.43 Mgm^{-3},and soil chemical properties, like,pHranged from 7.1-8.9, the E.C. is found in ranged from 0.33 – 0.97 dSm^{-1}.While organic carbon was ranged from 0.21- 0.68 %.

Keyword: Bulk density, Organic carbon, pH and Standard Deviation.

INTRODUCTION

The Physico-chemical study of soil is very important for proper management of soil and also important for a chemist who is involved in soil analysis, so for sustainable agriculture production property of soil is very important **(Sharma and Chaudhary, 2017)** and the availability of the nutrients is affected by their distribution in soil and other Physico-chemical properties of soils. So, Land use systems play a vital role in governing soil characteristics, nutrient dynamics, and soil fertility. Soils under a particular land-use system may also affect the Physico-chemical properties which may modify fertility status and nutrient availability to plants **(Sharma *et al.*, 2020)**. The physico-chemical properties of soils and their interaction with one another and variation in nutrients supplying capacity is a natural phenomenon. Therefore, different management practices are required at different locations to sustained crop productivity.

Hence, the nutrient status of the soil is very important **(Sireesha *et al.*, 2021)** and the availability of nutrients is affected by their distribution in soil and other Physico-chemical properties of soils. So, Land use systems play a vital role in governing soil characteristics, nutrient dynamics, and soil fertility. Soils under a particular land-use system may affect Physico-chemical properties which may modify fertility status and nutrient availability to plants **(Sharma *et al.*, 2020).**

The soil has an adverse impact that affects the growth and yield of crop plants due to adverse Physico-chemical properties **(Parihar *et al.*, 2013)**. These Physico-chemical characteristics of soils vary in space and time due to variation in topography, climate, weathering processes, vegetation cover, microbial activities, and several other biotic and abiotic factors out of them the vegetation influences the Physico-chemical properties of the soil to a greater extent **(Shrivastava and Kanungo, 2014)**. The study of the Physico-chemical characteristics of soils was measured, also as their interrelationships. The physical properties of the soil depend upon the shape, structure, and size, and pore spaces, amount of organic matter and mineral composition of the soil. The chemical properties of the soil are the interactions of varied chemical constituents among soil particles and the soil solution. Soil properties such as bulk density, porosity, pH value, soil organic carbon (SOC), Electrical Conductivity (EC), P, K, N, S, and moisture content are closely related to soil quality. They choose edaphic properties (physical, chemical, and biochemical properties) to assess soil quality. The combined selected indicators reflect the physical and chemical characteristics of soil **(Chen *et al.*, 2016)**.

MATERIALS AND METHODS

Kanpur Nagar is an agrarian district of the middle gangetic plains zone of U.P. It lies between 80°20’00’’ East longitude and 26°27’ 39’’N North latitude with geographical areas of

1605 km^2.The altitude of Kanpur Nagar 126 meter. Initially district was divided into four sub-divisions and 10 blocks for administrative and development purposes. There are 1011 villages in Kanpur Nagar district. The experiment was conducted in two blocks namely Kalyanpur and Chaubepur of Kanpur Nagar UttarPradesh. Kanpur Nagar is a major industrial town of Uttar Pradesh, the northern state of India. This town is situated on the south bank of river Ganga, located 80 km west of Lucknow, the state capital. It is also known as the industrial capital of the state.

In the present investigation total 504 soil samples were collected from 2 blocks, and 7 different lands uses system to study the Physico-chemical, properties of soil. For this purpose 504 soil samples were collected with GPS system from 3 depth viz. 0-15 cm , 15-30 cm, and 30-60 cm of different land use viz., Fallow land, Crop cultivated land (Rice-Wheat), Horticulture based land use, Grass land use, Barren land, Agro- forestry land use, Vegetable land.

Result and discussion:

Soil bulk density different land use system –

The data related to the bulk density is evident that maximum bulk density was recorded in the depth of 30-60 cm where the land grass use is 1.43 Mg/m^3 and the minimum bulk density was record from the depth of 0–15 cm where the land is crop (wheat – rice) is 1.14 Mg/m^3. The BD results indicate that it increases with increasing the soil depth. In crop based areas B.D. is predominantly occupied by plant roots and micro – organisms whose activity leads to enhance porosity of the soil which ultimately decreases the B.D. in the root zone depth of the soil. In grass based cropping there is no to limited biological activity in subsurface soil depth of causing no alternation in the pore space thus compacting subsurface layers hence resulting in increased bulk density. Similar findings was reported by**Cleik *et al.*, (2005) and Kizilkaya *et al.*, (2010).**

Soil pH, Organic carbon and Electrical conductivity different land use system –

The data for soil pH, E.C. (Electrical conductivity) and O.C. (Organic Carbon) that maximum pH 8.90 was recorded with depth of 30-60 cm where the land is crop (wheat – rice) and minimum pH 7.10 was found with the depth of 0-15 cm where the land is vegetables. The maximum Organic carbon (0.68 %) was recorded from the depth of 0-15 cm and the land is grass based whereas, minimum Organic carbon (0.21 %) was found at the depth of 30-60 cm where the land is barren. As the Electrical Conductivity is concerned, the maximum E.C (0.97 dS m^{-1}) was recorded at 30-60 cm where the land is vegetables, and minimum Electrical Conductivity (0.33 dS m^{-1}) was found at the depth of 0-15 cm where the land is barren.

The pH value ranges of the different land use Systemfrom (7.1-8.9), Organic Carbon (O.C.) ranged from (0.21- 0.68 %), Electrical conductivity (E.C) ranged from (0.33 – 0.97 dS m^{-1}). The higher organic carbon in grass land use followed by agro - forest land may be attributed due to leaves fall and their decomposition. The highest OC was recorded at surface soil in all land use system than sub surface soil. The EC is less at surface soil than sub surface soil due to leaching of salts from upper surface to Lower surface of soil and accumulation of salts in lower surface. The pH considerably increases with increasing the soil depth under all the land use system. The pH value high in crop land and followed by Fallow land has got enough time to replenish the nutrients that were taken earlier during crop growth. Similar findings was reported by **Negassa and Gebrekidan *et al.*, (2000) , Sarkar, *et al.*, (2002)**, **Wankhede *et al.*, (2008), Sahu *et al.*, (2016), Priyanka *et al.*, (2018), Gehlot *et al.*, (2019) and Naphade *et al.*, (2021)**.

TABLE 1 – Bulk Density, pH, Electrical Conductivity and Organic Carbon Status of different land use planning in Kanpur Nagar

Land use system	Soil Depth (cm)	Bulk Density (Mg m^{-3})	pH	Electrical Conductivity (dS/m)	Organic Carbon (%)
Crop cultivated land	0-15	1.14	7.9	0.54	0.53
	15-30	1.18	8.6	0.67	0.45
	30-60	1.23	8.9	0.76	0.44
	Mean	**1.18**	**8.46**	**0.65**	**0.47**
Horticulture land	0-15	1.21	7.6	0.56	0.53
	15-30	1.25	7.8	0.60	0.43
	30-60	1.28	8.3	0.65	0.36
	Mean	**1.24**	**7.9**	**0.60**	**0.44**
Fallow land	0-15	1.30	7.5	0.60	0.66
	15-30	1.35	8.3	0.65	0.32
	30-60	1.38	8.7	0.85	0.27
	Mean	**1.34**	**8.16**	**0.70**	**0.41**
Grass land	0-15	1.31	7.9	0.46	0.68
	15-30	1.38	8.4	0.56	0.45
	30-60	1.43	8.5	0.67	0.47
	Mean	**1.37**	**8.26**	**0.56**	**0.53**
Agroforestry land	0-15	1.35	7.2	0.50	0.68
	15-30	1.36	8.1	0.66	0.56

	30-60	1.38	8.2	0.77	0.35
	Mean	**1.36**	**7.83**	**0.64**	**0.53**
	0-15	1.32	7.1	0.76	0.57
	15-30	1.34	7.8	0.82	0.48
	30-60	1.37	8.2	0.97	0.34
Vegetables land	**Mean**	**1.34**	**7.70**	**0.85**	**0.46**
	0-15	1.16	7.2	0.33	0.53
	15-30	1.19	8.1	0.54	0.46
	30-60	1.22	8.3	0.61	0.21
Barren land	**Mean**	**1.19**	**7.86**	**0.49**	**0.40**
	Total Mean	**1.28**	**8.02**	**0.64**	**0.46**
	Standard Deviation	**0.082**	**0.273**	**0.114**	**0.052**

Conclusion

It may be concluded that the different land use system as well as soil depth affected the soil physico-chemical properties. It may also be concluded that horticulture land (Mango, Aonla , Papaya and Bael), forest land (Shisham, Eucalyptus and Teak) are good for sustainable fertility and soil health whereas crop land use (Rice-Wheat Cropping System) and vegetables land need the addition of organic matter, FYM and some chemical fertilizers to maintain soil productivity, fertility and soil health.

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