International Journal of Science, Strategic Management and Technology
Volume **02** Issue **03** March-**2026** | ISSN: **3108-1762 (Online)** | Impact Factor: 3.8
An International, Peer-Reviewed, Open Access Scholarly Journal Indexed in recognized academic databases

Firdous Ashraf
Scholar, Division of Soil Science,
SKUAST-K, Srinagar, Jammu and Kashmir, India

Subhash Chand
Professor, Division of Soil Science, SKUAST-K,
Srinagar, Jammu and Kashmir, India

Muzaffar Ahmad Malik
Professor & Head, Division of Soil Science,
SKUAST-K, Srinagar, Jammu and Kashmir, India

Rehana Rasool
Associate Professor, Division of Soil Science and
Agricultural Chemistry FoA, SKUAST-K,
Srinagar, Jammu and Kashmir, India

Amit Kumar
Associate Professor, Division of Fruit Science,
SKUAST-K, Srinagar, Jammu and Kashmir, India

Bhagyashree Dheklae
Assistant Professor, Statistics, Division of AGB,
Faculty of FVSc & AH, SKUAST-Kashmir,
Srinagar, Jammu and Kashmir, India

Shaheen Kauser Jan
Professor & Ex-Head, Division of Plant
Pathology, SKUAST-K, Srinagar, Jammu and
Kashmir, India

Corresponding Author:
Firdous Ashraf
Scholar, Division of Soil Science, SKUAST-K,
Srinagar, Jammu and Kashmir, India
Email Address: firdous11hort@gmail,com

Depth Wise Assessment of Soil Chemical Indicators under different land uses in District Pulwama of Kashmir valley

Firdous Ashraf, Subhash Chand, Muzaffar Ahmad Malik, Rehana Rasool, Amit Kumar, Bhagyashree Dheklae, Shaheen Kauser Jan

Abstract
The present investigation entitled "Depth Wise Assessment of Soil Chemical Indicators under different land uses in District Pulwama of Kashmir valley" was carried out with a view to ascertain the chemical indicators of soils under different land uses viz. Horticulture, Agriculture and Forestry. Purposive sampling method was followed, and composite soil samples were collected from fifteen locations in each land use at two depths: surface (0-15cm) and sub-surface (15-30 cm). The soil samples processed and analyzed for chemical indicators (pH, EC, OC, macronutrients and micronutrients like Zn, Cu, Fe & Mn) by using standard techniques. Soil pH varied from slightly acidic to slightly alkaline under examined land uses and it showed an increasing trend in all the land uses with soil depth. The electrical conductivity values of different land uses was less than 1 dSm^{-1} indicating no salinity hazard All the macro and micronutrients showed a decreasing trend with the increase in soil depth except calcium and magnesium. It was concluded that chemical indicators assessed for different land uses were found higher in forestry as compared to horticulture and agriculture and decreased with increase in depth.

Keywords: Chemical indicators, Land uses, Macronutrients, Purposive sampling method

Introduction

Soil quality, antonym for soil degradation, has deteriorated due to natural and anthropogenic activities particularly with the advent of the intensive management practices. Land use is characterized by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it (Abad *et al.,* 2014). Land use systems significantly affected the clay, the silt and the sand fractions and affect the distribution and supply of soil nutrients by directly altering soil properties like exchangeable basic and acidic cations. Land use and soil management practices influence the soil nutrients and related soil processes, such as erosion, oxidation, mineralization, and leaching, etc (Liu *et al.,* 2010). As a result, it can modify the processes of transport and re distribution of nutrients. A systematic characterization of soil is of prime importance for evolving suitable agronomic practices and predicting their ability in relation to the different land use systems. Soil quality is more focused on dynamic soil properties which can be strongly influenced by management and are mainly monitored in the of a specific soil due to land use and management practices and it is measured by using physical, chemical and biological indicators. The use of indicators made the soil quality a complex functional concept which cannot be measured directly in the field or laboratory but can only be measured from soil characteristics (Diack and Stott, 2001). The most popular indicators used to assess soil quality are soil organic carbon, total nitrogen and soil acidity. Soil organic carbon is fundamental to soil fertility and is a strong indicator of a soil's biological health as well as its chemical, biological, and physical processes. The total nitrogen is the main nutrient used for vegetation growth and is also used as a key soil quality assessment (Ren *et al.,* 2014). With the help of pedotransfer functions, indices also allow the assessment of soil quality of different soil classes. Furthermore, appropriate indices can assess soil quality in time, indicating its improvement, stability or degradation. (Mukherjee and Lal, 2014). The studies on chemical indicators of soil are essential to generate information regarding efficiency of top 15-30 cm of the soil. The dynamic nature of soil describes the condition

Soil chemical indicators play a vital role in the growth, development and yield of plant and the information on the fertility status of an area can go a long way in planning judicious fertilizers and soil management practices to develop economically viable alternatives for the farming community. Keeping in view the above-mentioned facts, present investigation was carried out in district Pulwama of Kashmir valley.

Materials and Methods

The present investigation entitled, "Depth Wise Assessment of Soil Chemical Indicators under different land uses in District Pulwama of Kashmir valley", was carried out at, Faculty of Horticulture, Shalimar, SKUAST-K during 2022-2024. The selected study area Pulwama district of Kashmir valley which is centrally located in the valley of Kashmir, is located at Latitude of 33 degrees, 54.1 minutes North and Longitude of 74 degrees, 53.8 minutes east. It has an average elevation of 1630 meters (5347 feet) above sea level. It is bounded by Srinagar in the North side, Budgam and Poonch in the West side and Anantnag in the South side. The total geographical area of the district is 1090 sq km an area of 2,379 sq km (Fig. 1). The study area was by actual traversing across the various land forms before the selection of representative sites. Keeping in view surface features like, physiographic changes, altitude and present land use, fifteen representative soil samples (surface: 0-15cm & sub surface: 15-30cm) at different locations were selected from each land use for studying the soil chemical indicators (Table 1).

Design of survey

No. of land use systems used: 03 (Horticulture, Agriculture, Forestry)
No. of locations per land use system: 15
No. of depths: 02 (surface: 0-15cm & sub-surface: 15-30cm)
No. of replications per sample: 03
Sampling method: Purposive method of Sampling

Preparation of soil samples

The soil samples were air-dried and ground using a wooden pestle and mortar and passed through a 2 mm sieve and kept in labeled nutrient availability of soils in order to improve yield and maintain soil health.

Soil Chemical Indicators

Soil reaction (pH)

A soil suspension was prepared with distilled water keeping 1:2.5 soil to water ratio and the concentration of hydrogen ions in soil (pH) of suspension was measured by digital glass electrode pH meter (Jackson, 1973).

Electrical conductivity (EC)

The soil suspension (1:2.5 soil to water ratio) used for pH determination was used to measure soluble salts after keeping them overnight to obtain a clear supernatant solution. The soluble salts in the soil were measured with a Solu bridge conductivity meter at 25ºC. The conductivity of electric current through soil suspension is proportional to the concentration of soluble salts present in it (Jackson, 1973). The electrical conductivity was expressed as deci-siemens per meter (dSm^{-1})

Organic Carbon (OC)

Rapid titration method (wet digestion method) was used for organic carbon determination (Walkley and Black, 1934). In this determination 2 gm of dried soil was treated with 10 ml of 1N potassium dichromate ($K_2Cr_2O_7$) solution in a 250 ml conical flask. 20 ml of concentrated sulphuric acid (H_2SO_4) was slowly added to the flask. After 30 minutes, about 0.5 gm of NaF, 100 ml of distilled water. The excess of potassium dichromate not reduced by the organic matter of the soil was determined by titration using 0.5N ferrous ammonium sulphate (FAS) solution using diphenylamine as an indicator. The change from violent to bright green through blue colour was the end point. The value of FAS used for titration was adopted for calculating organic carbon and was expressed as percentage. 10 ml of 1N $K_2Cr_2O_7$ solution in another flask was titrated without soil against 0.5N FAS solution to determine blank. The organic carbon in the soil was calculated as:

Organic carbon (gKg^{-1}) = [(X-Y) * 0.003 * 100 * N]/W

Where X = volume of 0.5 N FAS used for blank titration
Y = volume of 0.5 N FAS used for soil sample
N = Normality of FAS used
W= Weight of soil sample

polythene bags for laboratory analysis. For organic carbon determination, the samples were passed through 0.2 mm sieve and again transferred to air tight bags for further laboratory investigations. Then the processed soil samples were subjected to analysis for various soil chemical indicators.

ions using neutral normal ammonium acetate. The sodium concentration was measured flame photo metrically and serves the measure of total CEC of the soil (Baruah & Barthakur, 1998).

Available Nitrogen

The available nitrogen content in the collected soil samples was determined by alkaline permanganate oxidation method through Kjeldahl distillation unit (Subbiah and Asija, 1956), which is based on the extraction of inorganic and readily oxidizable N from organic compounds. The N was extracted with 0.32 per cent $KMnO_4$ and distilled by 2.5 per cent NaOH. The distillation process was carried out by nitrogen analyzer and manual titration was done. The liberated ammonia was absorbed in 2 per cent boric acid, containing bromocresol green and methyl red mixed indicator. The amount of ammonia absorbed was determined titrimetrically using standard H_2SO_4 (0.02 N) till the colour flashed from green to pink.

Available Phosphorus

Available phosphorus in soil samples was determined by the method described by Olsen *et al.* (1954). One gm soil sample was extracted with 20 ml of 0.5M $NaHCO_3$ solution at pH 8.5 (Olsen's Extractant). The soil sample was shaken for 30 minutes on an end-to-end shear. 5ml of filtrate was taken in 25 ml volumetric flask and add 5ml ammonium molybedate + 1ml stannous chloride and final volume was made. The intensity of blue colour developed by stannous chloride was proportional to the concentration of phosphate ions was read on spectrophotometer at wavelength of 760 nm.

Available Potassium

The available potassium was extracted by 1N ammonium acetate at pH 7 and then determined with the help of flame photometer using K-filter. 5g soil was taken in a 150 ml conical flask and extracted with 25 ml of neutral 1N ammonium acetate solution. The filtrate was aspirated into the automizer of the calibrated flame photometer

Cation Exchange Capacity (CEC)

It was determined by the centrifuge method using sodium acetate solution (pH 8.2) for leaching and then sodium ions were replaced by ammonium

saturated paste by same method described earlier and then filtered it with a vacuum filtration system using a Buchner funnel fitted with Whatman No.42 filter paper. Then collected filterate in small bottle and kept it for subsequent measurements. It was determined by taking 10 ml of clear soil extracts in a conical flask was and then 8-10 drops of buffer solution (NH_4Cl-NH_4OH) and 3-4 drops of Eriochrome black-T (EBT) indicator were added and titrated against ETDA (versanate) solution till colour changed from wine red to bluish green.

Available Sulphur

Available sulphur was determined with 0.15% $CaCl_2$ solution and the Sulphur in the extract was estimated turbidmetrically (Black, 1965). Weigh 5g soil sample add 25ml calcium chloride, shake the solution half an hour then filter it. Finally take 10ml filiterate add 1ml gum acacia + 0.5g finely ground barium chloride and make volume 25ml with distilled water. Then the extent of turbidity developed was estimated on spectrophotometer at 420 nm wave length.

Available micronutrients (Zn, Cu, Fe and Mn)

The available micronutrients (Zn, Fe, Mn, and Cu) content in soil were estimated by extracting soil with DTPA solution (Lindsay and Norvell, 1978) and determined with the help of atomic absorption spectrophotometer. About 10 grams of processed soil sample was shaken for 2 hours with 20 ml of extractant (0.005 M DTPA, 0.01 M $CaCl_2$ and 0.1 N TEA buffered at 7.3 pH) on electrical shaker and then filtrate was analyzed for zinc (Zn) copper (Cu), manganese (Mn) and Iron (Fe) using atomic absorption spectrophotometer (AAS).

Results and Discussion

Chemical properties of soils

Soil reaction (pH)

Soil pH varied from slightly acidic to slightly alkaline under examined land uses with highest pH of 7.18 recorded in agriculture land uses and lowest of 6.17 in forestry land uses (Table 2).

and reading was noted. The concentration of potassium in the solution was proportional to the galvanometer reading (Jackson, 1973).

Exchangeable Calcium and Magnesium

Exchangeable calcium and magnesium were determined by versanate titration method after extraction with ammonium acetate solution (Page *et al*., 1982). Prepared soil extract after weighed 200 g air dry soil in a crucible dish and made its

The lower pH in upper layer is attributed to the presence of excessive organic matter which leads to the release of organic acids and vice versa in lower depths. The results are in agreement with the experimental findings of Pal *et al.* (2013), Ramzan *et al.* (2014) and Bashir *et al.* (2016).

Electrical conductivity (EC)

The electrical conductivity of the soil samples found highest in agriculture land uses 0.22 dSm^{-1} and lowest of 0.13 dSm^{-1} in forestry land uses which could be attributed to high rainfall in forest areas resulting in more leaching of salts (Table 2). All the examined land uses have electrical conductivity values below 1 dSm^{-1} indicating that there is no salinity hazard. Electrical conductivity showed increasing pattern with the soil depth (Fig. 3) which might be attributed to leaching out of alkali and alkaline bases. These findings were supported by Pal *et al.* (2013), Abad *et al.* (2014), Bashir *et al.* (2016), Rehman (2019) and Roheela (2019).

Organic Carbon (OC)

The soil organic carbon of surface soils was found highest (22.04 gkg^{-1}) under forestry land use and lowest (11.72 gkg^{-1}) in agriculture land use with decreasing trend along the depth (Table 2). The higher organic carbon in forestry land use might be attributed to return of higher quantity and quality of plant litter, high altitude, low temperature which impedes the degree of decomposition and results in the accumulation of more organic carbon. Higher organic carbon in surface soils of forests have also been recorded by Yimer *et al.* (2007), Jamala and Oke (2013), Yihenew *et al.* (2015). Lowest organic carbon in agriculture land use may be due to long-term cultivation under submerged conditions and application of mineral fertilizers resulting in degradation of soil quality such as breakdown of

The low pH observed in forestry land uses might be attributed to relatively higher rainfall which increases the leaching of salts and higher content of organic matter which brings down pH by releasing organic acids (Fig. 2). With the increment in soil depth the pH showed an increasing trend owing to leaching of exchangeable bases along soil profile (Mohammed *et al.,* 2005).

highest (21.28 $cmol(+)kg^{-1}$) in forestry land use and lowest (15.05 $cmol(+)kg^{-1}$) in agriculture land use (Table 2). The highest CEC in forestry land use could be related to the existence of the maximum organic matter content (Selassie and Ayanna, 2013) and Roheela (2019). The cation exchange capacity of soils among various land uses showed a declining pattern similar to organic carbon content with soil depth (Fig. 4&5) which might be attributed to difference of organic carbon content and clay content at all the depths. Organic carbon plays a substantial role and is closely correlated compared to clay content. These findings corroborate with the results of Wani *et al.* (2010), Pal *et al*. (2013), Sharma *et al.* (2013), Ramzan *et al.* (2014) and Bashir *et al.* (2016).

Available Macronutrient Status

The data regarding the available Macronutrient status of the soils in study area is presented in table 3

Available Nitrogen

The mean value of nitrogen was found highest in forestry land use (417.54 N $kgha^{-1}$) at depth 0-15 cm and minimum amount was found in agriculture land use (237.06 N $kgha^{-1}$) at depth 15-30 cm (Table 3). This could be related to the influence of higher OM as well as enhanced enzymatic activities, mineralization and mobilization of nitrogen and greater amount of humus in natural forests in comparison to cultivated soils. "There is a positive correlation between soil organic matter and nitrogen content" (Chauhan *et al.,* 2014). Low SOM results in the less amounts of N content in agriculture and horticulture land uses and conversion of organic nitrogen into mineral N, CO_2 and nitrogenous gases which enters into the atmosphere and are lost from the soil. These reports are aligned with Yihenew *et al.* (2015), Maqbool *et al.* (2017) and Roheela (2019). The nitrogen concentration has shown a declining stable aggregates and deterioration of soil organic matter. The reports are further supported by the results of Chemeda *et al.* (2017), Kaur and Bhat (2017). With an increment in soil depth the organic carbon showed a consistent decline among all the studied land use systems which might be attributed to lesser content of organic matter and plant residues in sub-surface horizons (Fig. 4&5). These are further aligned with the observations of Liding *et al.* (2011), Mojiri *et al.*, (2012), Rehman (2019) and Roheela (2019).

Cation Exchange Capacity (CEC)

The cation exchange capacity of surface soils was

forestry land use might be attributed to the enhanced OM content that increases the availability of phosphorus by the synthesis of organo-phosphate complexes which are more readily absorbed by plant species, substitution of anion H_2PO^{4-} from adsorption sites, decline fixation of P by the synthesis of protective film of Fe/Al oxides by humus. In addition, the degradation of OM produces acids that maximize the solubilization of calcium phosphates. These observations are supported by Yihenew *et al.* (2015), Maqbool *et al.* (2017), Rehman (2019) and Roheela (2019). The phosphorus content reduced with soil depth (Fig. 6&7). These findings are supported by Liding (2011), Chemeda *et al.* (2017), Rehman (2019) and Roheela (2019).

Available Potassium

The maximum average value was found in forestry land use (319.14 $kgha^{-1}$) and lowest in agriculture land use (286.28 $kgha^{-1}$). The highest potassium content in forestry land use might be because of higher OM content, formation of organic complexes with clay and organic matter in forests and lowest potassium content in agriculture might be due to intensive cultivation that leads to the removal of potassium and also leaching of potassium. The high status of potassium among studied land uses might be due to the presence of illite type of minerals in Kashmir soils. The potassium content reduced with soil depth which is attributed to obvious reason of decline in OM in the lower horizons (Fig. 6&7). These observations are aligned with the reports of Singh *et al.* (2012), Sharma *et al.* (2013), Chandan *et al.* (2016), Rehman (2019) and Roheela (2019).

pattern with soil depth which might be attributed to decline in OM in the lower depths (Fig. 6&7). These observations are closely linked with the observations of Anjum (2012), Pal *et al.* (2013) and Roheela (2019).

Available Phosphorus

The findings reported in the Table 3 revealed that the highest mean values were recorded in forestry land use (35.63 P_2O_5 $kgha^{-1}$) at depth 0-15 cm. The minimum amount of phosphorus was found agriculture land use (18.91 P_2O_5 $kgha^{-1}$) at depth 15-30cm. The highest content of phosphorus in

in forestry land use (2.21 $cmol(p^+)kg^{-1}$). Magnesium depicted an inconsistent pattern with soil depth (Fig. 9). Similar results were observed by Verma *et al.* (1990), Dar (2009). High magnesium content might be because of existence of illite type of minerals in Kashmir as reported by Najar (2002). These observations are further related by Dar *et al.* (2015), Masrat (2015) and Wani *et al.* (2017) who did not observe any definite relationship of exchangeable magnesium with soil depth.

Available Sulphur

The investigated land uses showed the available sulphur (Table 3) followed a similar trend in both depths, The highest mean values were found in forest land use and lowest in agriculture land use which could be because of high OM in forest land, indicating organic carbon is the regulating factor for sulphur availability. There is a strong association between available sulphur and organic carbon. These observations are supported by Basumatary *et al.* (2010), Javed *et al.* (2014), Rehman (2019) and Roheela (2019). The sulphur content decreased with the soil depth (Fig. 6&7) . These reports are in agreement with Sharma *et al.* (2013), Habtamu *et al.* (2014), Padhan *et al.* (2016), Rehman (2019) and Roheela (2019).

Available micronutrients (Zn, Cu, Fe and Mn)

The highest mean values for micronutrients were found in forestry land use and lowest in agriculture land use (Table 4). This might be because of more OM content that acted as a chelating agent thereby preventing leaching losses of micronutrients. Furthermore organic matter acts as a good source of micronutrients

Exchangeable Calcium and Magnesium

The maximum calcium content was observed under Horticulture land use (5.66 cmol(p^+)kg^{-1}) & lowest in forestry land use (4.42 cmol(p^+)kg^{-1}). The variation of calcium content among studied land uses might be because of presence of calcium bearing minerals, difference in pH of soils and difference in elevation and slope (Table 3). In general, calcium content of sub-surface (15-30cm) was higher than the surface (0-15 cm) layers which might be due to loss of calcium from upper to lower soil depths (Fig. 8). These findings are in agreement with those of Ahmad (2003), Dar (2009) and Wani *et al.* (2017). The maximum magnesium content was observed under horticulture land use (2.85 cmol(p^+)kg^{-1}) & lowest

(Habtamu *et al.,* 2014). The low micronutrient concentration in agricultural land uses can be attributed to low OM concentration. These observations are in agreement with Dar *et al.* (2012), Yitbarek *et al.* (2013), Habtamu *et al.* (2014), Maqbool *et al.* (2017) and Roheela (2019). The micronutrients decreased with soil depth which could be due to their strong association with OC of soils (Fig. 10 & 11). Same observations were reported by Anjum (2012), Kiflu and Beyene (2013) and Roheela (2019).

Table 1: Description of soil sampling sites under different land uses of district Pulwama

Latitude	Longitude	Altitude	Sample Code	Land use
33°56'14.64"N	75°6'25.92"E	2039	HS1	Horticulture
33°55'8.04"N	75°7'19.20"E	1593	HS2	
33°57'3.60"N	75°3'15.48"E	1584	HS3	
33°59'32.28"N	74°56'57.48"E	1588	HS4	
33°56'18.96"N	74°55'12.72"E	1593	HS5	
33°57'14.04"N	74°56'30.84"E	1688	HS6	
33°55'31.44"N	74°56'6.00"E	1715	HS7	
33°51'34.56"N	74°52'39.36"E	1675	HS8	
33°50'44.88"N	74°52'41.88"E	1638	HS9	
33°50'53.88"N	74°54'30.96"E	1634	HS10	
33°52'46.92"N	74°53'38.40"E	1597	HS11	
33°54'41.76"N	75°5'8.52"E	1635	HS12	
33°53'25.44"N	75°3'41.76"E	1667	HS13	
33°59'22.92"N	74°59'29.76"E	2039	HS14	
33°54'57.60"N	75°3'31.32"E	1593	HS15	
33°56'52.44"N	75°7'19.20"E	1760	AS1	Agriculture
33°55'59.52"N	75°8'7.08"E	1751	AS2	
33°59'53.88"N	74°54'20.52"E	1587	AS3	
34°0'56.16"N	74°56'38.04"E	1610	AS4	
33°57'59.76"N	74°55'57.36"E	1637	AS5	
33°58'8.40"N	74°53'39.48"E	1589	AS6	
33°56'21.48"N	74°55'47.28"E	1587	AS7	
33°57'10.44"N	74°54'47.52"E	1586	AS8	
33°55'28.56"N	74°54'50.76"E	1590	AS9	
33°52'39.00"N	74°54'58.32"E	1626	AS10	
33°53'25.44"N	74°57'33.84"E	1652	AS11	
33°55'31.44"N	74°59'0.60"E	1588	AS12	

33°51'3.60"N	74°58'52.68"E	1645	AS13	
33°51'21.96"N	75°1'35.76"E	1590	AS14	
33°51'29.88"N	74°56'44.16"E	1668	AS15	
33°53'51.36"N	74°52'49.44"E	1618	FS1	**Forestry**
33°54'15.48"N	74°54'25.20"E	1599	FS2	
33°57'9.00"N	75°5'29.76"E	1718	FS3	
33°52'43.32"N	75°6'29.88"E	1898	FS4	
33°55'18.48"N	75°8'59.64"E	2040	FS5	
33°58'3.00"N	75°1'24.96"E	2509	FS6	
33°58'29.64"N	75°0'39.24"E	2137	FS7	
33°58'38.28"N	75°3'57.60"E	2279	FS8	
33°55'57.36"N	75°2'9.60"E	1915	FS9	
33°57'32.40"N	75°0'6.48"E	1842	FS10	
33°59'46.32"N	75°1'22.44"E	1820	FS11	
33°58'48.72"N	75°8'2.04"E	2524	FS12	
33°56'14.64"N	75°0'32.40"E	1691	FS13	
33°56'47.76"N	75°1'59.52"E	2138	FS14	
33°59'25.44"N	75°7'6.96"E	2596	FS15	

Fig. 1: Study soil map of district Pulwama

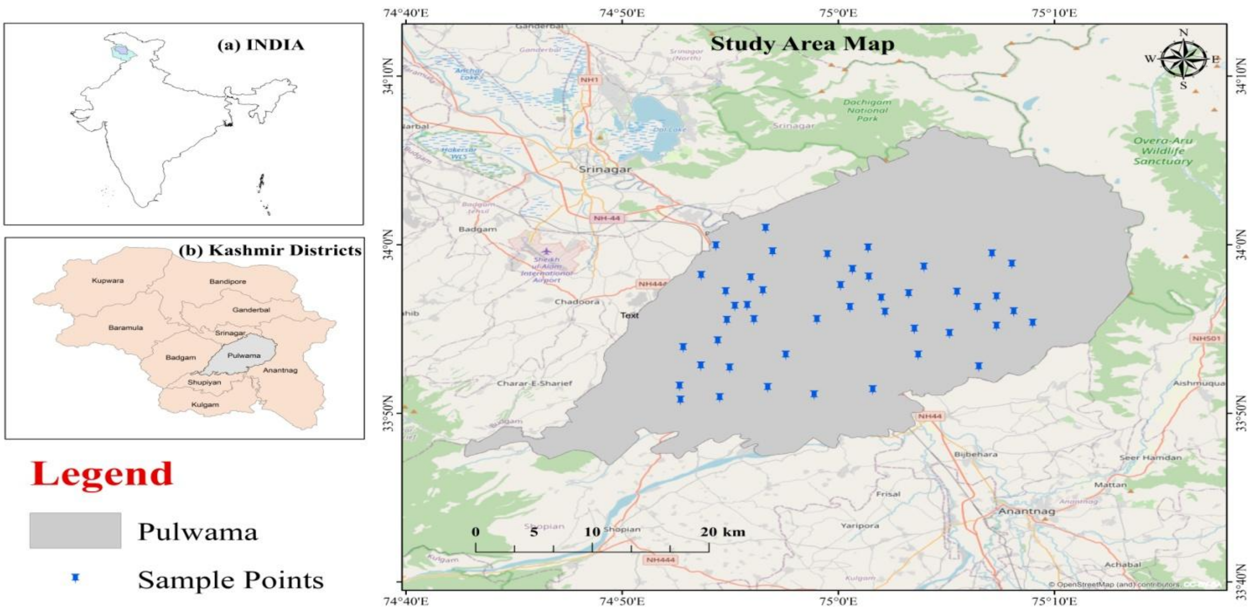


Table 2: Chemical properties of soils under different land uses of district Pulwama

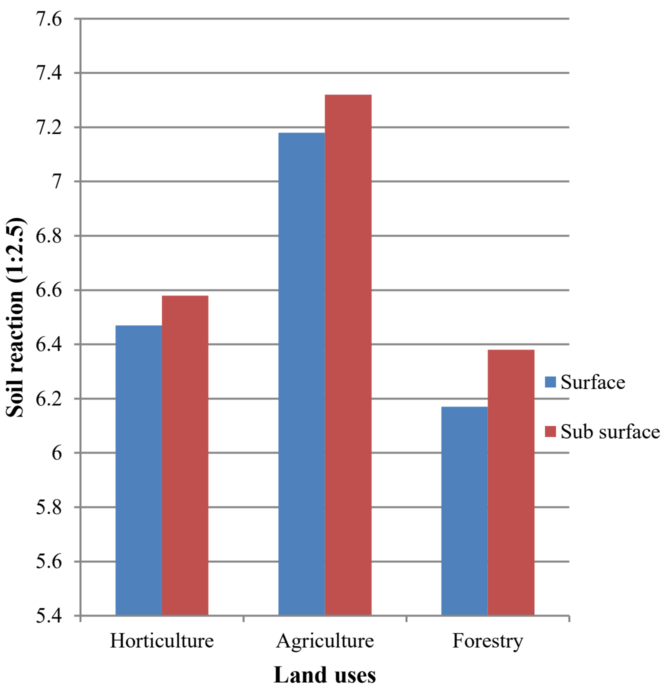
Land Use	Depth (cm)			pH (1:2.5)	EC (dSm^{-1})	OC (gkg^{-1})	CEC ($cmol(p+)kg^{-1}$)
Horticulture	0-15	95% C.I	LL	6.07	0.14	16.61	17.35
			UL	6.83	0.22	17.16	20.27
			Mean	**6.47**	**0.20**	**16.90**	**18.83**
		95%	LL	7.04	0.19	10.73	13.55

International Journal of Science, Strategic Management and Technology
Volume 02 Issue 03 March-2026 | ISSN: 3108-1762 (Online) | Impact Factor: 3.8
An International, Peer-Reviewed, Open Access Scholarly Journal Indexed in recognized academic databases

Agriculture	0-15	CI	UL	7.33	0.28	12.71	16.56
			Mean	**7.18**	**0.22**	**11.72**	**15.05**
Forestry	0-15	95% C.I	LL	5.63	0.05	21.52	16.27
			UL	6.67	0.17	22.51	26.25
			Mean	**6.17**	**0.13**	**22.04**	**21.28**
CV(%)				**6.59**	**30.37**	**24.27**	**12.86**
Horticulture	15-30	95% C.I	LL	6.44	0.15	10.22	15.15
			UL	6.73	0.24	17.75	18.87
			Mean	**6.58**	**0.22**	**13.98**	**17.01**
Agriculture	15-30	95% C.I	LL	6.42	0.20	10.07	12.05
			UL	8.21	0.29	12.89	16.02
			Mean	**7.32**	**0.25**	**11.48**	**14.04**
Forestry	15-30	95% C.I	LL	6.01	0.05	16.63	15.25
			UL	6.77	0.23	21.14	23.90
			Mean	**6.38**	**0.15**	**18.88**	**19.58**
CV(%)				**6.47**	**23.69**	**20.70**	**12.80**

C.I=Confidence interval, LL=Lower limit, UL=Upper limit, CV=Coefficient of variance, EC =Electrical conductivity, OC = Organic carbon

Fig. 2 Soil reaction (pH) of surface (0-15cm) & sub surface (15-30cm) soils under different land uses



International Journal of Science, Strategic Management and Technology
Volume 02 Issue 03 March-2026 | ISSN: 3108-1762 (Online) | Impact Factor: 3.8
An International, Peer-Reviewed, Open Access Scholarly Journal Indexed in recognized academic databases

Fig. 3 Electrical conductivity (EC) of surface (0-15cm) & sub surface (15-30cm) soils under different land uses

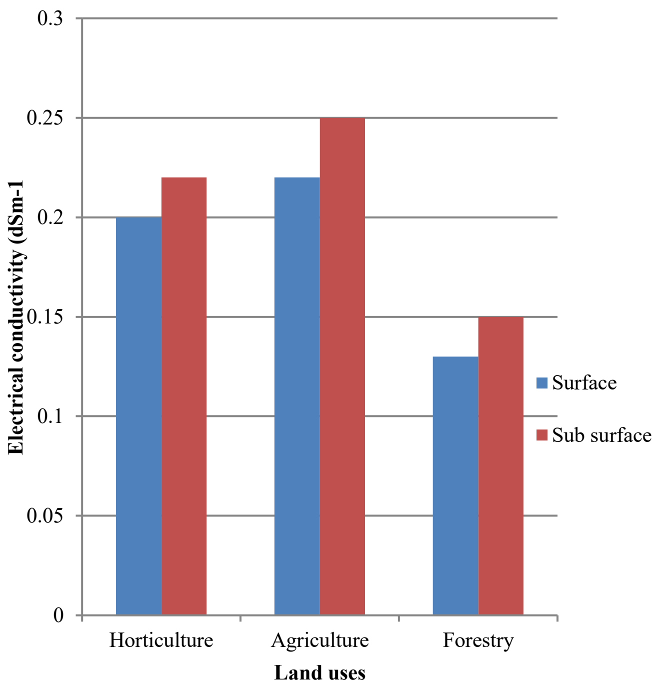
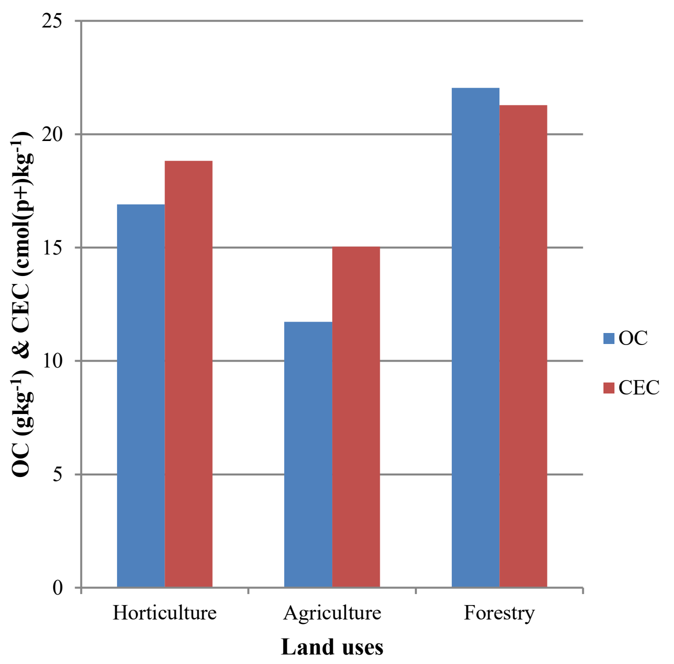


Fig. 4 Oragnic carbon (OC) and Cation exchange capacity (CEC) of surface (0-15cm) soils under different land uses



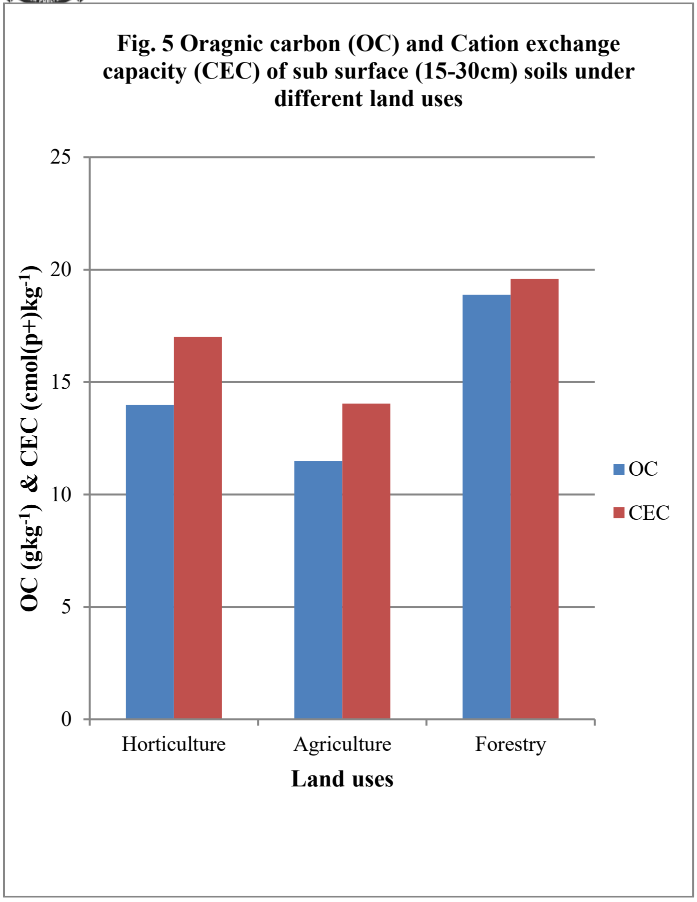


Table 3: Available macronutrient status of soils under different land uses of district Pulwama

Land Use	Depth (cm)			Nitrogen (kgha^{-1})	Phosphorus (kgha^{-1})	Potassium (kgha^{-1})	Calcium (cmol(p$^+$)kg^{-1})	Magnesium (cmol(p$^+$)kg^{-1})	Sulphur (kgha^{-1})
Horticulture	0-15	95%C.I	LL	272.88	24.76	241.82	4.97	2.54	19.62
			UL	447.82	37.73	353.22	6.36	3.16	31.50
		Mean		**360.35**	**31.25**	**297.52**	**5.66**	**2.85**	**20.56**
Agriculture	0-15	95%C.I	LL	233.82	24.69	264.75	4.75	2.34	12.58
			UL	324.70	30.36	307.82	5.62	2.81	23.42
		Mean		**279.32**	**27.53**	**286.28**	**5.19**	**2.58**	**18.01**
Forestry	0-15	95%C.I	LL	370.42	30.38	275.02	3.40	1.67	20.50
			UL	464.65	40.87	363.26	5.43	2.75	55.10
		Mean		**417.54**	**35.63**	**319.14**	**4.42**	**2.21**	**37.80**
CV(%)				**15.65**	**11.67**	**5.76**	**12.75**	**13.12**	**31.55**
Horticulture	15-30	95%C.I	LL	248.05	16.48	211.36	4.55	2.21	11.89
			UL	336.37	26.37	269.35	6.35	3.27	21.53
		Mean		**292.21**	**21.43**	**240.35**	**5.45**	**2.74**	**16.71**
Agriculture	15-30	95%C.I	LL	214.56	13.57	174.48	5.13	2.38	12.36
			UL	259.56	24.24	254.28	5.60	2.99	16.16
		Mean		**237.06**	**18.91**	**214.38**	**5.36**	**2.69**	**14.26**
Forestry	15-30	95%C.I	LL	277.18	18.79	263.30	4.02	1.39	17.51
			UL	350.54	34.07	300.97	5.05	2.80	42.49
		Mean		**313.87**	**26.43**	**282.14**	**4.54**	**2.10**	**30.01**
CV(%)				**11.18**	**14.87**	**12.05**	**11.84**	**15.19**	**31.11**

C.I=Confidence interval, LL=Lower limit, UL=Upper limit, CV=Coefficient of variance

International Journal of Science, Strategic Management and Technology
Volume 02 Issue 03 March-2026 | ISSN: 3108-1762 (Online) | Impact Factor: 3.8
An International, Peer-Reviewed, Open Access Scholarly Journal Indexed in recognized academic databases

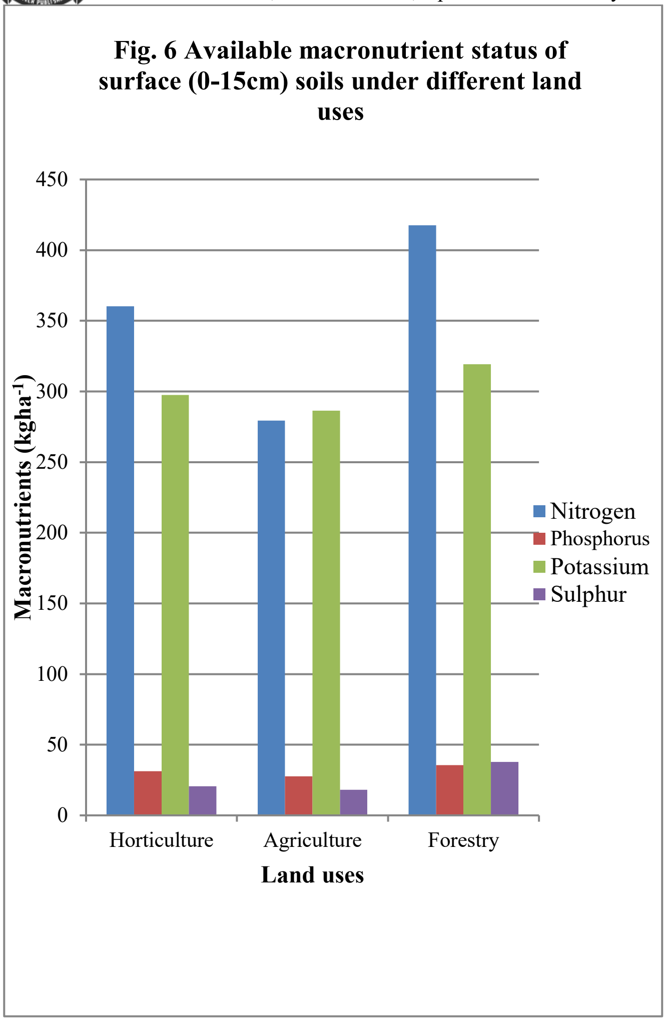


Fig. 7 Available macronutrient status of sub surface (15-30cm) soils under different land uses

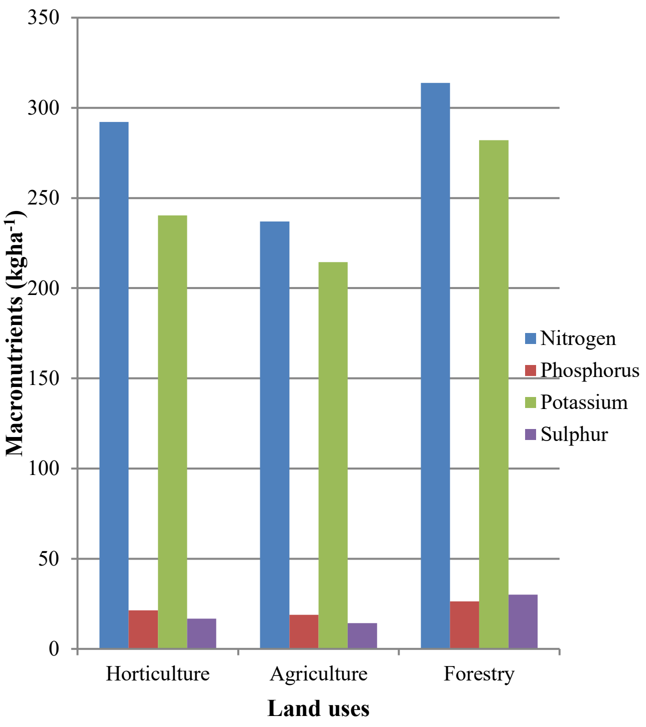


Fig. 8 Exchangeable Calcium (Ca) of surface (0-15cm) & sub surface (15-30cm) soils under different land uses

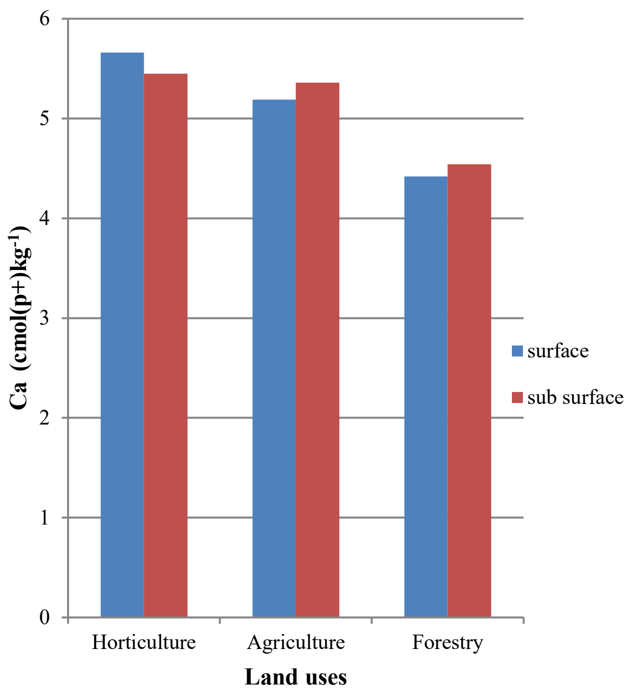


Fig. 9 Exchangeable Magnesium (Mg) of surface (0-15cm) & sub surface (15-30cm) soils under different land uses

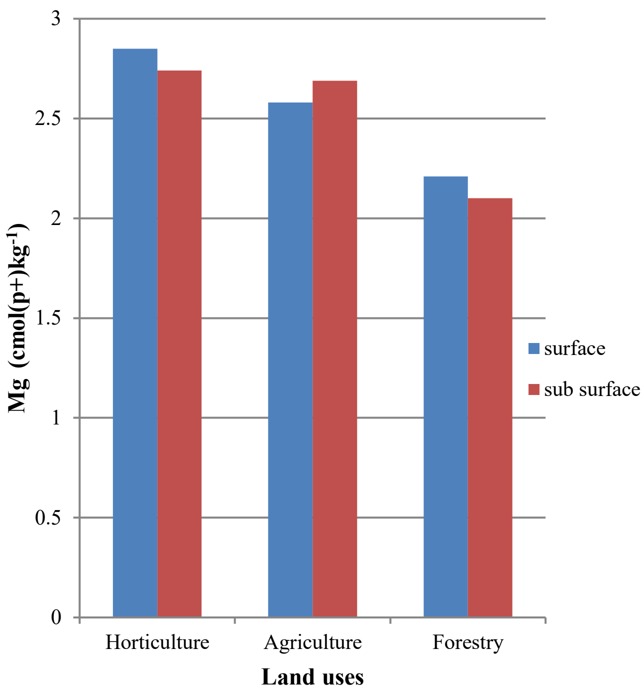
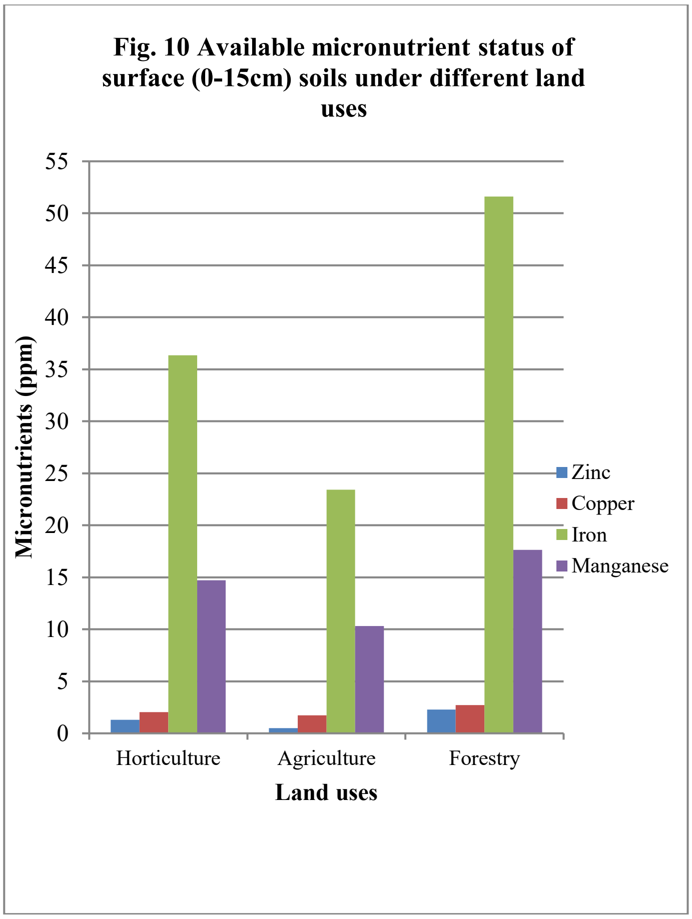
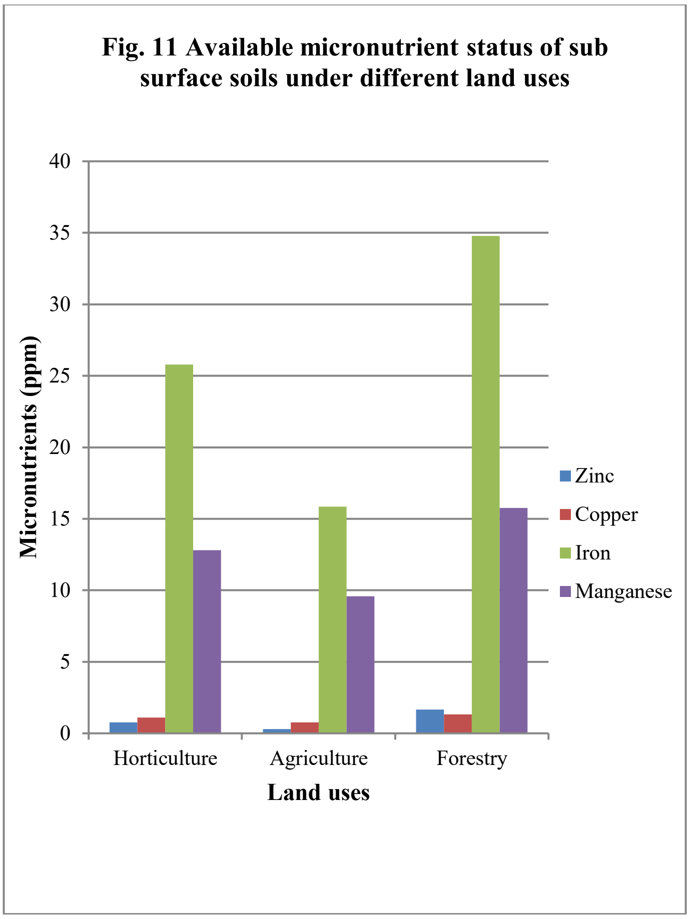


Table 4: Micronutrient status of soils under different land uses

Land Use	Depth (cm)			Zn (ppm)	Cu (ppm)	Fe (ppm)	Mn (ppm)
Horticulture	0-15	95% C.I	LL	0.89	1.85	29.97	12.98
			UL	1.71	2.25	42.74	16.48
		Mean		**1.30**	**2.05**	**36.35**	**14.73**
Agriculture	0-15	95% C.I	LL	0.36	0.84	20.86	9.20
			UL	0.63	2.61	25.95	11.44
		Mean		**0.50**	**1.73**	**23.41**	**10.32**
Forestry	0-15	95% C.I	LL	1.04	2.22	42.74	15.93
			UL	3.49	3.21	60.50	19.35
		Mean		**2.27**	**2.72**	**51.62**	**17.64**
CV(%)				**46.83**	**18.20**	**28.73**	**19.17**
Horticulture	15-30	95% C.I	LL	0.51	0.81	24.64	10.17
			UL	1.01	1.39	26.93	15.43
		Mean		**0.76**	**1.10**	**25.78**	**12.80**
Agriculture	15-30	95% C.I	LL	0.20	0.55	13.51	8.64
			UL	0.40	0.98	18.19	10.51
		Mean		**0.30**	**0.77**	**15.85**	**9.58**
Forestry	15-30	95% C.I	LL	0.98	1.08	28.56	13.13
			UL	2.34	1.58	41.03	18.37
		Mean		**1.66**	**1.33**	**34.79**	**15.75**
CV(%)				**57.71**	**20.32**	**26.41**	**19.27**

C.I=Confidence interval, LL= Lower limit, UL= Upper limit, CV=Coefficient of variance, Zn= Zinc, Cu= Copper, Fe=Iron, Mn=Manganese





Conclusion

Forests were found to accumulate higher organic carbon content than horticulture and agriculture land uses, indicating that further extension and conversion of natural forests into agriculture will lead to a great loss of stored carbon from soils. The presence of higher organic matter in forest reflects its good soil chemical indicators and hence good soil quality. A wide variation in chemical indicators with respect to studied land uses was observed. The undisturbed soil i.e. Forestry land use exhibited better properties than cultivated ones i.e Horticulture and Agriculture land use.

References

Abad, J. R. S., Khosravi, H. and Alamdarlou, E. S. 2014. Assessment the effects of land use changes on soil physicochemical properties in Jafarabad of Golestan province, *Iran. Bulletin of Environment, Pharmacology and Life Sciences* **3**(3): 296-300.

Ahmad, Z. 2003. Characterization and nutrient indexing of apple (*Malus domestica* Borkh) orchard soils of Bangil area of Baramulla Evaluation of Soil Resources in Dara Microwatershed. Ph.D thesis submitted to Sher-e Kashmir university of Agricultural Sciences and Technology of Kashmir Shalimar, Srinagar, 48-111.

Barauah, T. C. and Barthakulh, H. P. 1998, A textbook of soil analysis. *Viskas Publishing House. New Delhi (India)* pp.334. Physical and mineralogical properties. *American Society of Agronomy* **2:** 573-590

Black, C. A. 1965. Methods of soil analysis. Part 1 Physical and mineralogical properties. *American Society of Agronomy* **2:** 573-590

Chandan, S., Sradhanjali, B., Rudra, P. P. and Sanjat, K. S. 2016. Physicochemical properties of soil under different land use practices located near Bhawanipatna town in Odisha, India. *International Journal of Environmental Sciences* **6**: 941-953.

Chauhan, R. P., Pande, K. R. and Thakur, S. 2014. Soil properties affected by land use systems in western Chitwan, Nepal. *International Journal of Applied Sciences and Biotechnology* **2**(3): 265-269.

Chemeda, M., Kibret, K. and Fite, T. 2017. Influence of different land use types and soil depths on

District. M.Sc Thesis submitted to SKUAST-Kashmir Srinagar, 1-104.

Anjum, R. 2012. Characterization, Classification and *Journal of Environmental Sciences and Natural Resources* **4**(2): 1-11.

Dar, M. A. 2009. Effect of altitude on nutritional status of pear orchard soils of Kashmir valley. Ph.D. thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, 225.

Dar, M. A., Wani, J. A., Raina, S. K., Bhat, M. Y. and Malik, M. A. 2015. Relationship of leaf nutrient content with fruit yield and quality of pear. *Journal of Environmental Biology* 36: 649-653.

Diack M and Stott D E. 2001. Development of soil quality index for the chalmers silt clay loam from the mid west USA. In: Stott D E, Mohtar R H and Steinhardt G C (editors). Sustaining the global farm. Selected papers from the 10th ternational Soil Conservation Organization Meeting, May 24-29, 1999, Purdue University and the USDA-ARS National Soil Erosion Laboratory. pp. 550-555.

Habtamu, T. K., Tegenu, A. E., Amy, S. C., Husien, A. O., Haimanote, K. B., Tigist, Y. T. and Anteneh, A. 2014. Fertility status of soils under different land uses at Wujiraba watershed, North-western highlands of Ethiopia. *Agriculture, Forestry and Fisheries* **3**(5): 410-419.

Jackson M. C. 1973. Soil chemical analysis. *Prentice Hall, India, Pvt. Ltd. New Delhi* pp.22-25.

Jamala, G. Y. and Oke, D. O. 2013. Soil organic carbon fractions as affected by land use in the southern guinea sawanna ecosystem of Adamawa state, Nigeria. *Journal of Soil Science and Environmental Management* **4**(61): 16-22.

Javed, A., Sandeep, S. and Katitar, D. K. 2014. Forms of sulphur in wheat growing soils of Agra district of Uttar Pradesh. *Annals of Plant and Soil Research* **16**(2): 148-150.

Kaur, R. and Bhat, Z. A. 2017. Effect of different agricultural land use systems on physico-chemical properties of soil in sub-mountainous districts of Punjab, north-west India. *Journal of Pharmacognosy and Phytochemistry* **6**(3): 226 233.

Kiflu, A. and Beyene, S. 2013. Effects of different land use systems on selected soil properties in south ethopia. *Journal of Soil Science and Environmental Management* **4**(5): 100-107.

Liding, C., Xin, Q., Xinyu, Z., Qi, L. and Yanyan, Z. 2011. Effect of agricultural land use changes on soil nutrient use efficiency in an agricultural area, Beijing, China. *China* selected soil properties related to soil fertility in Warandhab Area, Horo Guduru Wallaga Zone, Oromiya, Ethiopia. *International*

Li, C. L., Zhou, J. and Zhang, Z. Y. 2010. Impact of land use and soil fertility on distributions of soil aggregate fractions and some nutrients. *Pedosphere* **20**(5):666 673.

Maqbool, M., Rasool, R. and Ramzan, S. 2017. Soil physico-chemical properties as impacted by different land use systems in district Ganderbal, Jammu and Kashmir: India. *International Journal of Chemical Studies* **5**(4): 832-840.

Masrat, M. 2015. Effect of different land use systems (LUS) on physico-chemical properties and nutrient status of soil in district Ganderbal. M.Sc. (Agri.) thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, 63-88.

Mohammed, A. P., Roux, A. L., Barker, C. H. and Heluf, G. 2005. Soils of Jelo Micro-Catchment in the Chercher highlands of eastern Ethiopia: I. Morphological and physicochemical properties. *Ethiopian Journal of Natural Resources* **7**: 55-81.

Mojiri, A., Aziz, H. A. and Ramaji, A. 2012. Potential decline in soil quality attributes as a result of land use change in a hill slope in Lordegan, Western Iran. *African Journal of Agricultural Research* **7**(4): 577-582.

Mukherjee, A. and Lal, R. 2014. Comparison of soil quality index using three methods. *PLoS ONE* **9**(8): e105981.

Najar, G. R. 2002. Studies on pedogenesis and nutrient indexing of apple (Red Delicious) growing soils of Kashmir Thesis submitted to SKUAST Kashmir Srinagar, pp. 1-204.

Olsen, S. R., Cole, C. V., Wantanabe, F. S. and Dean, L. 1954. Estimation of available phosphorus in soil by extraction with sodium carbonate. *US Department of Agriculture, Circular No. 939. Washington, DC.*

Padhan, D., Pradhan, A. K., Chakraborty, M. and Sen, A. 2016. Assessment of effects of land use pattern on distribution of sulphur fractions in soil. *Journal of Applied and Natural Science* **8**(3): 1685-1691.

Page, A. L., Miller, R. H. and Keeney, D. R. 1982, Methods of soil Analysis, Part 2–Chemical and microbiological properties, Publ. By *American Society of Agronomy, INC. Soil Scientists of America, INC, Madison, USA,* pp.5 & 650-654.

Pal, S., Panwar, P. and Bhardwaj, D.R.2013. Soil quality under forest compared to other land uses in acid soil of North Western Himalaya, India. *Annals of Forest Research* **561:** 187-198.

Geographical Science **21**(4): 392-402.

Lindsay, W. L and Norvell, W. A. 1978. Development of DTPA soil test for zinc, copper, iron and manganese. *Soil Science Society of American Journal* **42:** 421-428

Liu, X. L., He, Y. Q., Zhang, H. L., Schroder, J. K., **2**(8): 132-142.

Rehman, R. 2019. Influence of land conversion on soil properties and organic carbon pools in hilly areas of of Shopian. M.Sc thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, 84.

Ren, T., Wang, J., Chen, Q., Zhang, F. and Lu, S. 2014. The effects of manure and nitrogen fertilizer applications on soil organic carbon and nitrogen in a high input cropping system. *PLoS One* **9**(5).

Roheela, A. 2019. Soil quality assessment under different land uses in district Bandipora. M.Sc thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, pp. 132

Selassie, Y. G. and Ayanna, G. 2013. Effects of different Land use systems on selected physico-chemical properties of soils in North western-Ethiopia. *Journal of Agricultural Science* **5**(4): 112-120.

Sharma, Y. K., Sharma, A. and Sharma, S. K. 2013. An appraisal of physico chemical characteristics and soil fertility status of forest and rice land use systems in Mokokchung district of Nagaland. *Journal of the Indian Society of Soil Science* **61**(1): 38-43.

Singh, R. P. and Mishra, S. K. 2012. Available macronutrients (N, P, K and S) in the oils of Chiraigaon Block of District Varanasi (U.P) in relation to soil characteristics. *Indian Journal of Science and Research* **3**(1): 97-100.

Subbiah, B. V. and Asija, G. L. 1956. A rapid procedure for assessment of available nitrogen in rice soils. *Current Science.* **25**: 259-260.

Verma, K. S., Shyampura, R. L. and Jain, S. P. 1990. Characterization of soils under forest of Kashmir valley. *Journal of Indian Society of Soil Science* **38**: 107-115.

Walkley A J and Black C A. 1934. Estimation of soil organic carbon by the chromic acid titration method. *Soil Science* **37:** 259-266

Wani, M. A., Mushtaq, Z. and Nazir, S. 2010. Mapping of micronutrients of the submerged rice soils of Kashmir. *Research Journal of Agricultural Sciences* **1**(4): 458-462.

Wani, S. A., Najar, G. R. and Padder, B. A. 2017. Altitudinal and Depth-wise Variation of Soil

Ramzan S, Bhat, M. A, Kirmani, N. A. and Rasool, R. (2014). Fractionation of Zinc and their Properties Himalayas. Association in Soils International with of Soil Kashmir Invention. *Journal of Agricultural and Soil Science* Vol.

nitrogen contents in three adjacent land use types in the Bale Mountains, southeastern highlands of Ethiopia. *Forest Ecology Management* **242**: 337-342.

Yitbarek, T., Gebrekidan, H., Kibret, K. and Beyene, S. 2013. Impacts of land use on selected physicochemical properties of soils of Abobo area, Western Ethiopia. *Agriculture, Forestry and Fisheries* **2**(5): 177-183.

Physico-chemical Properties and Available Nutrients of Pear Orchards in Jammu & Kashmir, India. *Chemical Sciences Review and Letters* **6**(23): 1638-1645.

Yihenew, G. S., Fentanesh, A. and Solomon, A. 2015. Effects of land use types, management practices and slope classes on selected soil physico-chemical properties in Zikre Watershed, North-Western Ethiopia. *Environmental Systems Research* **4**: 1-3.

Yimer, F., Ledin, S. and Abdulakdir, A. 2007. Changes in soil organic carbon and total