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Effect of Physico-Chemical analysis on soil in distinct period and areas of Uttarakhand Himalayas (India)

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Abstract *– Soil found in the Himalayas are diverse in character depending upon altitude,vegetation cover, slope, structure and stage. Most of the soils is this region are acidic in nature. The soil of this state is known as mountainous forest soil. The aim of the present investigation is to study physico-chemical properties of the soil samples collected from different sites in Uttarakhand Himalayas. The area under study is located from 77^0 east longitude to 70^0 20′ east longitude and 30^0 North latitude to 30^0 30′ north latitude with the altitude from 330 to 2000 meter from sea-level. The physical and chemical properties of soil were determined on the basis of methods described by Black (1965) and Jackson (1967) in different season at different sites. On the basis of analysis, it was found that physical and chemical attributes of soil differ in season and site wise. The results indicated that the nitrogen content, organic matter and water holding capacity was higher in pre-monsoon season. Calcium and Magnesium concentration was more is post-monsoon season at some sites. There was also a interrelationship between pH and nitrogen, nitrogen is less in post-monsoon season than in pre-monsoon as compared to pH.*

Keyword: *Altitude, Acidic, Mountainous, Vegetation*

I. Introduction:

The soil is one of the most important ecological factor showing its impact on the terrestrial environment either directly or indirectly. It forms the top most layer of earth's crust and is a mixture of many solids, liquid and gaseous substances which differ from place to place. It has both non-living and living matter like mineral particles, decaying plant remains and insects occurring together with countless bacteria on its organic matter. Thus, soil is also the main source of nutrients. (Smaga, I.S., 2016).

A comprehensive information on the physical and chemical nature of the soil, next to climate variables in determining the distribution of natural vegetation, was provided by Waheed and Yadav (1962). According to them soil of a region particularly in a hilly area, often shows marked variation within short distances in many fundamental characteristics such as texture, structure, depth, stratification, permeability drainage, porosity, moisture holding capacity, nutrient availability etc. According to Dhir (1973) the altitude decreases, the percentage of organic carbon also decreased in a profile. Locaby and Dun (1984) pointed out significant changes in soil properties on forest sites which may be used for sustained recreation. Inspite of the reports on dominants influence of the soil, Singh et. al. (1987) claimed clear felling which is accounted for the loss of nutrients both in surface and subsurface soils. It was also observed by them that the mixed plantation with a number of species was found to be beneficial for enriching the soils. Soil profile concentration of P, Ca and Mg which increased depthwise from summer to monsoon and winter (Pandit and Thampan, 1988). The development and type of soil are affected by many factors, of which the parent rock, vegetation and climatic variables are most significant (Skvortsova, et. al. 2015). The characteristics of soil both physical and chemical, undergo changes in response to environmental factor and ultimately affect the growth and yield of plants (Rangasawmey et.al. 1973). Conclusively, a single factor is not responsible for the seasonal variation in soil nutrient status but it is an interaction of several factors viz. among the profile exchangeable cation, climate variables etc. All these factors decide the availability of nutrients in the soil.

II. Material and Methods

Selected areas for study- The area of study is located from 77° east longitude to 78° 20' east longitude and 30° north latitude to 30° 30' north latitude with the altitude ranging from 330 to 2000 m from sea-level. About 60% of the total area is covered with forest and 14% represent cultivated area fields. The vegetation can be broadly divided into three main types a) tropical b) temperate and c) alpine. The number of sites selected for soil samples is five namely, Kaddukhal(S-1), Phakot(S-2), Nagni(S-3), Agrakhal(S-4) and Hindolakhal (S-5) lying in Uttarakhand Himalyas.

Soil samples from the selected sampling sites were collected at different depths (0-20, 20-40 and 40-60 cm) in premonsoon and post monsoon seasons. After air drying, the soil samples were stored in polythene bags. The physical and chemical properties of soil samples viz. colour, pH, water holding capacity, texture, organic

matter, nitrogen, available phosphorous, exchangeable potassium, calcium and magnesium were determined on the basis of the methods described by (Black and Jackson).

III. Results and Discussion

Physico-chemical analysis of the soil was found to alter relating to the depth of soil in both pre and post monsoon season. There was a change in the values of selected parameters at varying depths which reflect the status of soil and its impact on the standing vegetation. (Singh,et.al 1987)

Water holding capacity was found more in pre-monsoon than the post monsoon season as shown in table (A). It is a well known fact that the excess or lack of water in the soil limits growth of vegetation. Water holding capacity may affect the growth directly by alteration in the percentage or indirectly along with other parameters such as soil types, soil temperature etc. (Yadav, 1963)

The nitrogen content varied in both the season of the study period. It was found more in pre-monsoon as compared to the post-monsoon season as shown in table (B). There is an interrelationship between pH and nitrogen content. When an increase in nitrogen content occurs, it results into an increase in pH. This may be due the fact that at low pH, the activity of nitrate is very low and as soon as the nitrogen content increases, the pH also goes up. The alteration in the values of pH can be correlated to the washing of the organic acid layer from the surface layer. (Pandit and Thampan, 1988)

The organic matter was found to be more in pre-monsoon than the post monsoon season as shown in table (A). The organic matter evolves high concentration of carbon monoxide and other acids, due to which the pH of soil can be altered. (NYE 1961)

Concentration of calcium and magnesium was more in post-monsoon than the pre-monsoon season in most of the sites as shown in table (B). Concentration of potassium was totally different from calcium and magnesium. (Patel (1982) and Pal et al. (1985)) rightly pointed out that both calcium and magnesium increased with decrease in pH. Concentration of potassium in the soil was more in post-monsoon than pre-monsoon as shown in table (B). Phosphorus was lower in post-monsoon than the pre-monsoon season. The availability of phosphorus decreases which may be due to formation of insoluble compounds of phosphorus with iron and aluminum ions, as these ions are more soluble in higher acidic condition.

Table (A) : Physico-Chemical Analysis of Soil at selected sampling sites in Pre-Monsoon Season

S. No.	Sampling Sites	Soil Depth (cm)	pH	W.H.C. (%)	Organic Matter (%)	Exchangeable Cations (ppm)			Available P (%)	N (%)
						Ca^{++}	Mg^{++}	K^{+}		
1	S-1	0-20	5.0	70.55	6.82	6.8	8.1	0.6	0.007	0.16
		20-40	5.2	61.59	5.66	5.1	4.5	0.3	0.009	0.13
		40-60	5.4	54.12	4.68	4.3	2.3	0.3	0.011	0.11
2	S-2	0-20	6.5	68.77	2.36	7.8	4.6	0.9	0.004	0.16
		20-40	6.8	60.54	1.19	4.5	3.8	0.7	0.006	0.12
		40-60	7.0	52.33	0.90	2.5	2.6	0.5	0.009	0.09
3	S-3	0-20	6.2	75.19	3.77	10.3	5.1	0.7	0.008	0.19
		20-40	6.5	67.53	2.45	7.8	1.3	0.4	0.009	0.15
		40-60	6.8	60.21	1.26	4.2	0.8	0.2	0.010	0.10
4	S-4	0-20	6.5	80.95	6.87	9.7	6.2	0.6	0.006	0.13
		20-40	6.8	72.63	5.65	10.2	8.5	0.4	0.012	0.16
		40-60	7.2	65.13	2.66	11.5	9.0	0.2	0.013	0.19
5	S-5	0-20	7.0	86.52	6.99	8.4	5.3	0.7	0.005	0.15
		20-40	7.2	77.96	5.32	9.3	7.8	0.5	0.008	0.18
		40-60	7.3	69.88	4.03	10.1	8.5	0.2	.013	0.22

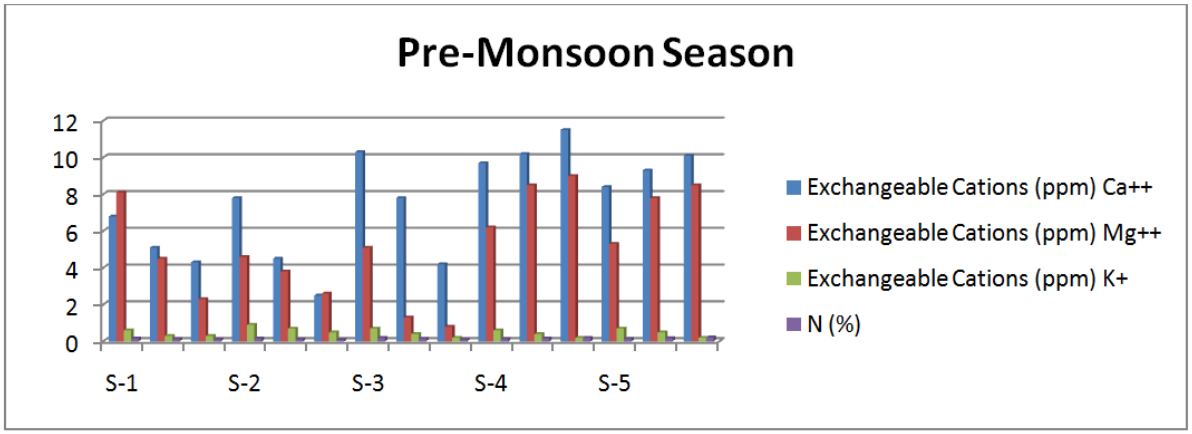
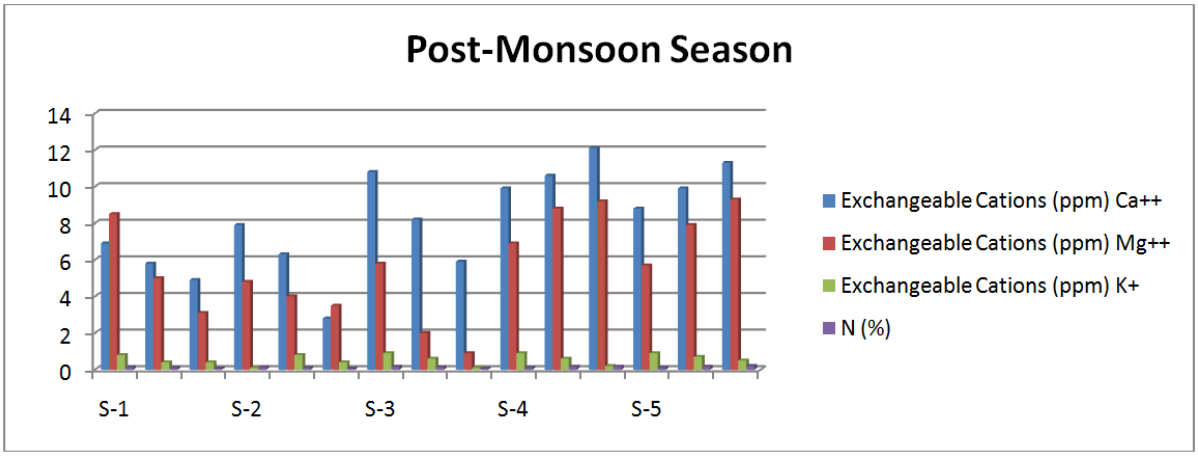


Table (B) : Physico-Chemical Analsysis of Soil at selected sampling sites in Post-Monsoon Season

S. No.	Sampling Sites	Soil Depth (cm)	pH	W.H.C. (%)	Organic Matter (%)	Exchangeable Cations (ppm)			Available P (%)	N (%)
						Ca^{++}	Mg^{++}	K^{+}		
1	S-1	0-20	4.9	61.52	6.05	6.9	8.5	0.8	0.005	0.13
		20-40	5.0	52.64	5.01	5.8	5.0	0.4	0.007	0.11
		40-60	5.2	46.62	4.22	4.9	3.1	0.4	0.009	0.07
2	S-2	0-20	6.3	62.42	2.22	7.9	4.8	0.1	0.002	0.13
		20-40	6.5	54.88	1.11	6.3	4.0	0.8	0.004	0.11
		40-60	6.8	48.59	0.62	2.8	3.5	0.4	0.006	0.07
3	S-3	0-20	6.0	68.24	3.51	10.8	5.8	0.9	0.005	0.17
		20-40	6.2	60.33	2.45	8.2	2.0	0.6	0.007	0.14
		40-60	6.5	55.84	1.13	5.9	0.9	0.1	0.007	0.06
4	S-4	0-20	6.3	70.52	4.33	9.9	6.9	0.9	0.004	0.11
		20-40	6.5	68.29	4.36	10.6	8.8	0.6	0.009	0.17
		40-60	7.0	59.11	2.88	12.1	9.2	0.2	0.011	0.17
5	S-5	0-20	6.8	80.33	5.67	8.8	5.7	0.9	0.004	0.11
		20-40	7.0	70.67	4.52	9.9	7.9	0.7	0.007	0.17
		40-60	7.1	66.52	4.01	11.3	9.3	0.5	0.007	0.20



IV. Conclusion

On the basis of foregoing analysis, the physical and chemical attributes of soil differ greatly sitewise in pre and post monsoon season. There is direct relationship between exchangeable cation occurring at different depths and seasons. Calcium content increases depthwise. Potassium content and organic matter decrease in different sites depthwise both in pre and postmonsoon season. Available Phosphorus increases depthwise in case of each site in both the above different seasons. pH increases as depth of soil increases in both the season. Exchangeable cation content are higher in postmonsoon season than the premonsoon season. Nitrogen % content is found less in postmonsoon season than that of premonsoon season in case of every site.

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