IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

STUDY ON PHYSICAL AND CHEMICAL PROPERTIES OF SOIL ON GROWTH AND MORPHOGENESIS OF PLANT SPECIES OF KUMAUN REGION, UTTARAKHAND.

Nutan Srivastava[1], G.S. Rajwar[2]

[1]Associate Professor, Government PG College Bazpur, Udham Singh Nagar (Uttarakhand) -India

[2]Professor, Government PG College Rishikesh (Uttarakhand)-India

ABSTRACT

Soil is described as a natural body composed of a mixture of organic and mineral materials in which plants grow. The factors responsible for soil formation and development are climate, biological agencies including vegetation and animals, parent rock, topography and time. The first two of these factors are referred to as active factors because it is through their action that soil formation takes place. In recent years, the use of plants products has increased tremendously due to the remarkable variations in chemical and physical properties. Plant requires light, water and nutrients for growth, reproduction and efficient crop production. Plant nutrient are mostly abased by plant roots from soil. The physical, chemical and biological properties of soil lead to a series of physiological, biological and chemical changes along with growth, yield and quality of the plant biomasses.

Soil properties such as soil structure, depth, texture, salinity, acidity, water logging as compaction can limit plant growth even when the soil has adequate nutrients. Better applying fertilizer; consider what is actually limiting plant growth. Soil properties can be observed in the paddock or measured through soil testing. Three groups of soil properties influence plant growth physical or the texture and structure of the soil, chemical, which affects both the fertility of the soil and its physical properties, Biological or the organism in the soil, such as bacteria, fungi, insets and earthworm.

Keywords: - Inorganic, Biological agencies, Topography.

INTRODUCTION

Soil is often defined as the outermost unconsolidated layer of the earth's crusts, ranging from a few centimeters to more than 3 meters in thickness. Soil structure describes the way the sand, silt and clay particles are clumped together. Organic matter (decaying plants and animals) and soil organisms like earthworms and bacteria influence soil structure. Clays, organic matter and materials excreted by soil organisms bind the soil particles together to form aggregates. Soil structure is important for plant growth, regulating the movement of air and water, influencing root development and affecting nutrient availability. Good quality soils are friable (crumbly) and have fine aggregates so the soil breaks up easily if you squeeze it. Poor soil structure has coarse, very firm clods or no structure at all.

Hendrik (1936, 1937) discussing the progress of soil science in the twentieth century distinguished two types of colloid complexes-mineral and organic in soils. The physical, chemical and colloidal theories of early plant ecology considered soil as an independent environmental factor that determined subsequent vegetation (Witkamp, 1971). Hanawalt and Whittaker (1977) stated that soil properties are determined and adjusted to the altitudinal varying climates. Selective absorption of nutrient elements by different tree species and its capacity to return nutrient to the soil bring about changes in soil properties (Singh *et al.*, 1986).

The importance of forest soil acidity was stated by many workers working with forest soil (Small, 1954). There are several evidences from deciduous and coniferous forests of the Eastern and Western United States that are comparatively undisturbed by human indicate that net losses of nutrients in stream water and deep seepage when they occur are counter-balanced by weathering of parent materials or by precipitation (Likens *et al.*, 1967). Several studies have examined soil properties under mature legume plantation (Virginia, 1986). Mature legume trees usually have an intense and deep-rooted system, capable of influencing soil development by altering the physical and chemical properties of the soil they are occupying (Virginia, 1986). Needles, cones, leaves and twigs of surface vegetation gradually decompose and become a part of the soil. Thus, nutrient which returns to the soil exerts a strong feedback on the ecosystem processes (Pastor *et al.*, 1984). Soil properties in relation to forest cover have been investigated by Severson and Armeman (1973) and Peterson and Rolfe (1982) from different part of the world. Banerjee *et al.* (1981, 1989), Singh *et al.* (1983) and Jha *et al.* (1984) etc. are few workers from India in this field. Development of soil layers and humus accumulation take place in natural ecosystems. A part of annual increments of minerals from substrate weathering and atmospheric inputs including N-fixation are immobilized by colloids and biota. This leads to available nutrient element build up in the soil pool which increases the soil fertility. For assessing the soil fertility status and in nutrient cycling studies, the determination of the amount of nutrients in the forest soil is important.

MATERIAL AND METHODS

The physical and chemical properties of soils were analyzed by collecting random samples from three different horizons i.e., horizon A (0-5 cm), horizon B (10-15 cm) and horizon C (20-30 cm) in different seasons (rainy, winter and summer). These soil samples were brought to the laboratory, air- dried and packed in polythene bags for physical and chemical analyses. Physical properties include Soil colour was directly read off with the help of Munsell's soil colour chart. Soil sample is spread uniformly over a cardboard sheet. The soil particles are matched with chips of different colours in the Munsell's soil colour chart. The chip with which the soil colour matches is taken out and the notation indicated on the chart is noted which gives the colour characteristic of that soil.

Soil texture includes soil particles and the fineness which affect plant growth it having water holding capacity also. Three size fractions of soil viz., sand, silt and clay were determined by using sieves of different sizes.

Soil Moisture play important role to uptake water and nutrient. For estimation of moisture content of the soil, the soil samples from three depths were collected in polythene bags, closed rapidly and tightly. About 100 gms of soil from each depth was oven-dried at 105°C till constant weight and dry weight was recorded after cooling the samples using the following formula (Misra, 1968): The water holding capacity was determined by the method adopted by Misra (1968).

Air-dried soil was crushed and passed through a 0.5 mm sieve. A circular what man No. 1 filter paper was placed on the perforated bottom of the brass box and pressed it to the position with a split brass ring. The box and filter paper were weighed (W_1). The brass boxes were filled with the soil uniformly placed on a Petri dish and water was added to about 1 cm height. Chemical Soil pH estimation was carried out by a digital pH meter using 1:5 soil-water suspensions after wetting the soil overnight. The organic carbon per cartage of the soil was determined by Walkey and Black's rapid titration method (Walkley and Black, 1934).

For the determination of available phosphorus 2 gm. soil was transferred to a conical flask of 100 ml capacity. 20 ml baryate solution was added and the flask was shaken for few minutes. The content was filtered in a beaker using filter paper. Five ml of filtrate was transferred to a 25 ml volumetric flask and 5 ml ammonium molybdate solution was added to it. The exchangeable potassium was estimated by flame photometer. Two gm soil was transferred to a conical flask and 10 ml normal ammonium acetate (pH 7) solution was added into it. The flaks were shaken for 5 minutes and content was filtered. A single drop of butyl alcohol was poured into the filtrate. The total nitrogen of soil was determined by Micro-kjeldahl method (Piper, 1944).

RESULTS

The soil texture, colour and other properties represent wide range of variations, depending upon geology, climate, vegetation and biological and chemical interactions. The soil colour of the study area indicates many fold features. Many types of minerals and chemicals present in it reflect the colour of the soil. Any change in soil colour at two different places indicates a difference in their mineral origin or in soil development

The soil of the study area was fairly fertile. Relative proportion of the soil particles of various sizes are important physical parameter, which determines the texture of soil. The large soil particles provide the physical support to the plants, while the smaller particles are significant in determining the capacity of the soil to hold the water and availability of nutrients. The soil texture of both the sites was mostly dominated by clay followed by sand and silt.

The soil moisture varies from season to season and determines the structure of the plant community. Soil moisture diminished with depth on all sites. The maximum moisture content was recorded as 38.7 per cent in rainy season.

On highly disturbed (HD) site of outer region the moisture percentage was maximum in rainy season (38.70 per cent) and minimum was 13.60 per cent in summer season at horizon A. In horizon B maximum moisture was 33.30 per cent, in rainy season and 12.20 per cent in summer, while in horizon C the maximum moisture was 30.20 per cent and the minimum was 10.80 per cent in rainy and summer seasons, respectively.

WHC of the soil decreases with an increase in soil depth. The WHC of the soil was found to be higher at 0-5 cm depth in all the soils, as compared to 10-15 cm and 20-30 cm depths.

Acidity of a soil solution is due to an excess of hydrogen ion (H^+) over hydroxyl ions (OH^-) but if hydroxyl ions are in excess as compared to H^+ ions the solution becomes alkaline.

On highly disturbed site of the outer region the pH ranged from 6.36 to 7.06 and on MD site 6.23 to 7.03 which clearly indicate acidic buffer to slightly alkaline nature of soil and no significant variation in the pH value of different soil samples was observed, except that the overall pH was maximum in rainy season while minimum in summer season.

The nitrogen concentration ranged from 0.150±0.03 to 0.162±0.04, 0.155±0.02 to 0.166±0.04 and 0.158±0.04 to 0.176±0.02 in horizons A, B and C, respectively on HD site of outer region. On MD site it varied from 0.148±0.08 to 0.155±0.03, 0.146±0.03 to 0.155±0.04 and 0.152±0.05 to 0.162±0.08 in horizons A, B and C, respectively.

The phosphorus concentration ranged from 22.50±1.45 to 31.50±1.53, 9.43±0.11 to 18.78±0.88 and 4.50±0.80 to 9.47±0.11 in horizons A, B and C of HD site in outer region.

In case of inner region these values varied from 81.5±2.36 to 90.2±3.20 kg ha^{-1} and 90.5±3.05 to 135.5±2.60 kg ha^{-1} and 104.9±3.00 to 144.3±2.70 kg ha^{-1}, respectively in horizons A, B and C at HD site. The MD site of same region comprised 72.7±3.60 to 95.4±1.25 kg ha^{-1} and 99.5±0.32 to 144.3±2.96 kg ha^{-1} and 108.3±0.71 to 144.5±1.62 kg ha^{-1} in horizons A, B and C, respectively.

Acknowledgement

The Author is very grateful to L.M.S.G.P.G College, Rishikesh Uttarakhand under HNB UNIVERSITY SRINAGAR for providing necessary laboratory facilities.

References

Bhargava, K.S. and Khulbe, R.D. 2007. *Plants Faith and Medicines*. Gyanodaya Prakashan, Nainital.

Badoni, A.K. and Bhatt, B.P. 1992. Aspects and prospects of energy plantation in Himalayan wasteland: A case study of Garhwal Himalaya. In: Mathur *et al*., (Eds.), *Economics of Energy Plantation.* Mimanshu Publication, Daryaganj, New Delhi, pp. 81-88.

Gopalan, C., RamaShastri, B.V. and Balasubramaniam, S.C. 1978. *Nutritive Value of Indian Foods.* National Institute of Nutrition, Hyderabad, India. 204 p.

Gupta, R.K. 1964. Forest types of Garhwal Himalaya in relation to edaphic and geological formations. *J. Soc. Ind. For*. **4:** 147-160.

Maithani, G.P., Mishra, N.N. and Mahendra, A.K. 1986. Socioeconomic factors associated with fuel consumption in rural areas. *Ind. For.*, **112**(9): 753-761.

Maikhuri, R.K., and P.S. Ramakrishnan, 1991. Comparative analysis of the village ecosystem function of different tribes living in Arunachal Pradesh in Northeastern India. *Agricultural Systems*.**35**: 292-299.

Mitchell, R. 1979. *The Analysis of Indian Agroecosystems*. Interprint New Delhi, India. 180 p.

Negi, K.S., Tiwari, J.K., and Gaur, R.D. 1987-88. A contribution to the flora of Khatling glacier in the Garhwal Himalaya (District- Tehri), U.P. *J. Bombay Natl. Hist. Soc.* **84:** 585-598.

Shah, S.A. 1981. Social Forestry - A tool to integrate forestry with agriculture. In: *Proceeding of the Agro Forestry Seminar*. ICAR. pp. 179-182.