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Screening of Primary Soil Nutrients (NPK) in Tarai and Hill Region Uttarakhand, India

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Abstract:

Primary soil nutrients (NPK) play a very important role in improving the yield and quality of crops. A screening was carried out to study and distribution of NPK in different selective sites in Tarai and Hill region,Uttarakhand, India.Three main elements nitrogen, phosphorus, and potassium (NPK), readily available through fertilizer/ natural fertilizer.It is a proper plant nutrition and essential for successful production of crops. Primary soil nutrients (NPK)has own specific properties therefore they play vital role different metabolic process of plant life.

The soil primary nutrients (NPK) mean value of some selective sites of Tarai region (2006),Uttarakhand (India) was found 0.121%, 0.003%, 0.013%,respectively. Similarly, the mean value of NPK of Hill region (2010), Uttarakhand (India) was found, 0.212%, 0.001%, 0.015%.This result shows that the NPK percentage inTarai and Hill region are very less as per Indian standards. So, this shows the poor soil health.

Correlation among the NPK(macronutrients) of the of Tarai and Hill region shows that, the total nitrogen of Tarai region is negatively correlated with nitrogen % of Hill region, ($r = -0.74955$, $P \leq 0.01$),percentage of phosphorus is negatively correlated in Tarai and Hill region ($r = -0.38145$, $P \leq 0.05$), and Potassium also negatively correlated i.e. ($r = -0.71750 \leq 0.01$).

Keywords: Primary soil nutrients, Soil, Nitrogen, Phosphorus, Potassium.

INTRODUCTION:

Humans are dependent on plants as their food source and soil is the primary medium for plant growth. It is the source of nutrient element to the plants. Soil, being the source of infinite life is the most crucial and precious natural resource, and not a renewable in short period (1).Soil is a dynamic resource that provides several essential functions to support plant, animal and human life. Soil quality is the capacity of a specific kind of soil

to function within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation (2).

The soil properties indicate the health of a particular land area such as forests. The use of soil properties as indicators of soil quality focused on soil nutrient availability for plant growth especially N, P, and K provide the evidence of limiting factors for forest plants growing on relatively fertile soil in the lowland tropics (3).The soil macronutrients, such as nitrogen, phosphorus, and potassium together make up the trio known as NPK have agronomic importance. They are known to govern the fertility of the soil and control the yield of the crop (4). Without proper management, continuous crop production can reduce nutrient reserves in the soil. As reserves get depleted, crop growth and productivity can be compromised. Techniques to conserve and add nutrients to the soil through the application of organic and inorganic fertilizers can help to maintain and increase the nutrient reserves of the soil (5). Nitrogen is primarily responsible for vegetative growth. Nitrogen assimilation into amino acids, is the building block for protein in the plant. It is a component of chlorophyll and is required for several enzymatic reactions. Phosphorus is a major component in plant DNA and RNA (6). Today, the most applied fertilizer of plants is nitrogen (N).Phosphorus (P) is also one of the essential elements for plant development. Phosphorus is an essential element for metabolic functions and vital structures in plants. It playsimportant role in early root development, photosynthesis, cell division, energy transfer, and early maturity (7). There are many factors which affect the soil properties.Soil erosion is perhaps the most familiar process with respect to potential for radical change to soil conditions over small (hillslope) or large spatial scales. Intense water or wind erosion events can almost-instantaneously transport up to tens of millimeters of soil depth. Such erosion rates may result in the truncation of the upper portion of a soil profile and will represent a significant loss of fertile topsoil(8). Soil productivity directly depending on soil fertility, most studies on soil productivity can be categorized into two main areas: (i) evaluation of soil productivity, and (ii) studying the influential factors in productivity. Soil fertility is a common term in agricultural sustainable development and can be defined as the ability of the soil to supply plants with the nutrients required in accurate quantities and correct proportions (9).

Soil quality is the ability of a soil to function within an ecosystem boundaries to sustain biological productivity, maintain air and water quality, and support human habitation and health [4]. Soil quality has two parts: the intrinsic part covering the inherent capacity of the soil for crop growth, and the dynamic part influenced by the soil user or manager(10). The poor soil management practice in cultivated lands has led to a higher rate of soil erosion,decreased crop production and productivity, and declined soil quality.Changes in land use can also disrupt carbon and nitrogen dynamics and organic matter content in soil(11).

The Kumaun Himalayan forests have variation in the topography, climate, soil condition and biodiversity, which form a complex ecosystem (12). To the best of our knowledge, such study has not been undertaken from the Uttarakhand region of India. Therefore, the study was aimed to find out the properties ofprimary soil nutrients (NPK) under different land-use systems in Tarai and Hill region Uttarakhand, India**.**

OBSERVATION TABLE:

Primary soil nutrients (NPK) of Tarai region (2006) and Hill region (2010) Uttarakhand, India

Table 1 Primary soil nutrients (NPK) of Tarai region (2006)

	Tarai region (2006)				Mean value
	Khatima	**Sitarganj**	**Rudrapur**	**Pantnager**	
Percentage of Nitrogen (N)	0.1026	0.1725	0.1075	0.102	0.121
Percentage ofPhosphorus (P)	0.0013	0.0032	0.0032	0.0041	0.003
Percentage of Potassium (K)	0.0098	0.0.0013	0.015	0.014	0.0133

Table 2 Primary soil nutrients (NPK) of Hill region (2010)

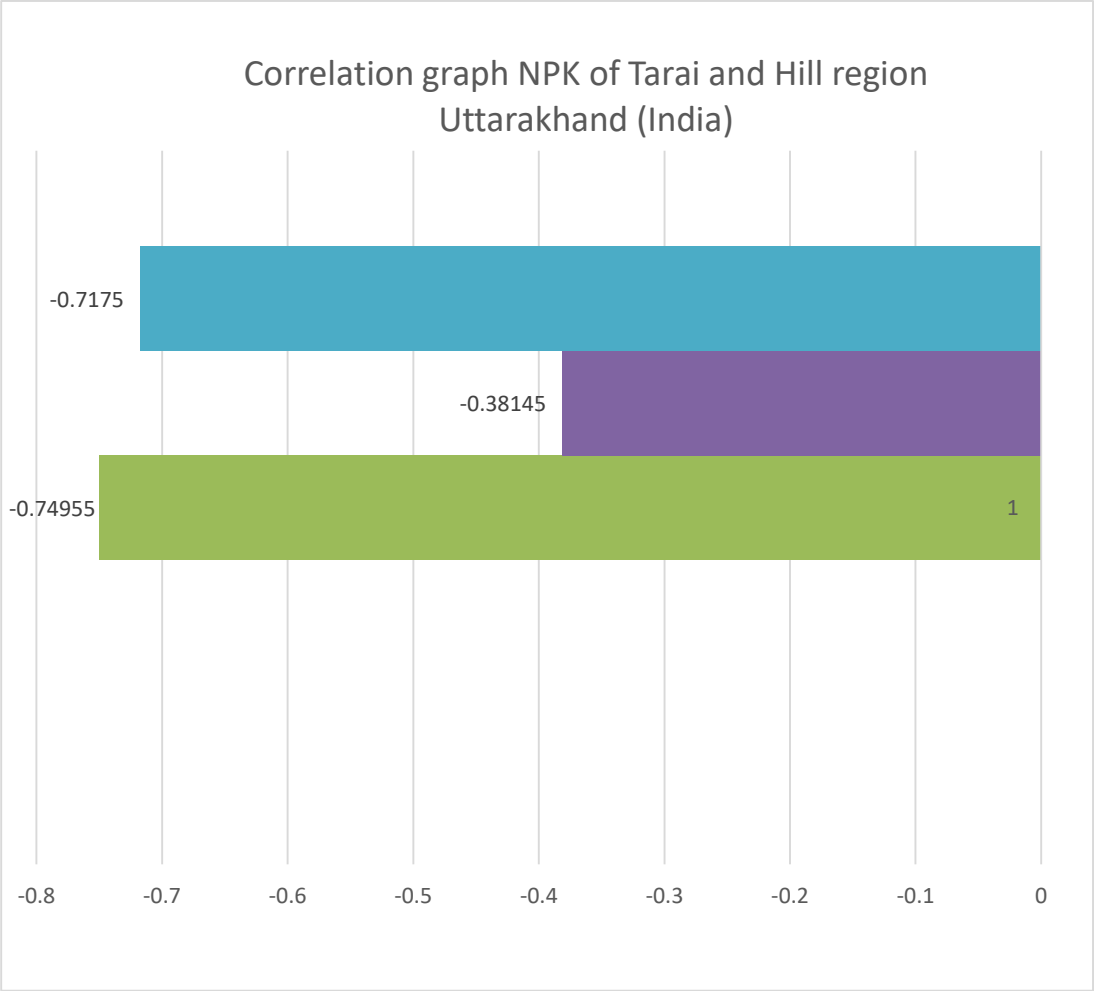
	Hill region (2010)				Mean value
	Nainital	**Bhowali**	**Muktaswer**	**Ramgarh**	
Percentage of Nitrogen (N)	0.18	0.13	0.24	0.30	0.2125
Percentage of Phosphorus (P)	0.0019	0.0006	0.0007	0.0033	0.0016
Percentage of Potassium (K)	0.0132	0.024	0.0046	0.0193	0.0152

Co-relation between Tarai and Hill variables:

Tarai and Hill region	**N**	**P**	**K**
Co-relation (r)	**-0.74955**	**-0.38145**	**-0.71750**

*** Correlation is significant at the 0.05 level.**

**** Correlation is significant at the 0.01 level.**



RESULT AND DISCUSSION:

Soil nitrogen exists in three general forms, organic nitrogen compounds, ammonium (NH_4^+) ions and nitrate (NO_3^-) ions. The majority of plant available nitrogen is in inorganic form i.e., NH_4^+ ion and NO_3^- ion. In hill region the percentage of nitrogen is almost high in compared to Tarai region Uttarakhand, (India), because nitrogen is the major component of chlorophyll by which plant use sunlight to produce food and carbon dioxide by photosynthesis process. In Tarai region excessive irrigation, heavy rainfall and overwatering may be the cause of lower percentage of nitrogen in the soil.

In organic farming system phosphorus is supplied mainly through recycling of farm organic materials such as compost, green manures, and animal manures. These organic materials contain phosphorus mineralized by soil organism, making the macronutrients easier for plants to use. Immobilization adsorption, precipitation run of and erosion decreases the phosphorus availability.

The mean value (percentage) of NPK of Tarai region (2006), Uttarakhand (India) was found 0.121%, 0.003%, 0.013%, respectively. Similarly, the mean value of NPK of Hill region (2010), Uttarakhand (India) was found, 0.212%, 0.001%, 0.015%.

The result of correlation among the NPK of the of selective sites of Tarai and Hillregion, Uttarakhand, India shows that, the total nitrogen of Tarai region is negatively correlated with nitrogen (percentage) of Hill region, ($r = -0.74955$, $P \leq 0.01$), percentage of phosphorus is negatively correlated in Tarai and Hill region ($r = -0.38145$, $P \leq 0.05$), and Potassium also negatively correlated i.e. ($r = -0.71750 \leq 0.01$).

CONCLUSION:

From the above it may be concluded that the NPK percentage in Tarai and Hill region are very less as per Indian standards.So, this shows the poor soil health. Apart of this, the percentage of nitrogen was found more in Hill region while the percentage of phosphorus and potassium were almost same.This study also reveals uneven distribution of nutrients in widespread in Hill soil of Uttarakhand.It is observed that farmers require attention regarding soil management practices for optimum agricultural production.Besides heavy application of farmyard manure deficiencies of many nutrients has also occurred in most of the soil samples.

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