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A study of Macronutrients in Soils of different Places around Indore, MP, India

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Abstract

Plants require C, H and O which are extracted from air and water, besides these macronutrients are consumed in large quantities for plant growth and survival. Nitrogen, Phosphorus and Potassium are the primary macronutrients required for plant growth. Nitrogen is Necessary for formation of amino acids, for plants cell division, vital for plant growth, directly involved in photosynthesis, effects energy reactions of the plants. Phosphorus is used for photosynthesis, respiration, energy storage, cell division, early root formation and growth, vital to seed formation. Potassium is required for carbohydrate metabolism, fruit formation, improves quality of seeds and fruit and increases disease resistance. In the last few decades soil analysis and study of macronutrient level has become an important topic of research to determine pH and primary macronutrients. In the present study soil analysis was done around Indore on soil of forest, garden, barren land, farm of wheat and cemented frame making industry. It was observed that these macronutrients levels are comparatively low in cemented industrial areas and the content is comparatively more in the forest area the results obtained are summarized.

Keywords: Soil analysis, pH, macronutrients.

Introduction

Soil is an important component of terrestrial ecosystem because it preserves nutrient reserves, supports many biological process (such as activities linked to nutrient cycles) and filters, keeps and transforms pollutants reducing their toxic effect. Soil quality may be affected by land use type and agriculture management practices because these may cause alteration in land productivity[1-3]. Soil quality is a complex and multifaceted concept defined[4] as "the capacity of a soil to function within ecosystem boundaries to sustain biological productivity, to maintain environmental quality and promote plants and animal health". Nutrients availability depends highly on soil pH[5]. At low pH some metallic elements like zinc and aluminum are overly abundant and highly mobile causing metal toxicity while reducing the availability of elements like calcium and phosphorus which may react to form precipitants[6]. Adversely, at high pH elements such as magnesium and calcium tend to be abundant in the soil solution. Soil quality encompasses many properties and processes as the structural stability of the aggregates[7], water retention capacity of soils[8], and capability of nutrient cycling[9]. Soil quality is as combination of physical, chemical and biological properties that are able to readily change in response to variations in soil conditions[10]. Agronomies practices designed to optimize production in agriculture, including the inter conversion of forest and agricultural land, strongly affect soil quality long term researches[11-14] have shown that cultivation of native soil in additions to climatic factors[15] decreases the soil organic matter content.

The present study was initiated with the objective of ascertaining the land use type and agricultural management practices on the chemical properties of soils.

Material and Methods

Soil Chemical Analysis: Soil pH- Soil pH was determined using a glass electrode pH meter in a 1:2 soil: water suspension at 25°C A 10 g of dry sample was weighed in 100 ml beaker to which 20 ml distilled water was added using a measuring cylinder. The suspension was stirred frequency for 30 minutes. After calibrating the pH meter with buffer solutions at pH 4.0 and 7.0, the pH was read on pH meter (ELICO) LI 120) by immersing the electrode into the upper parts of the suspension.

Soil Nutrient Analysis: Available nitrogen (N): The soil available nitrogen in soil sample was determined by the potassium permagnate method using a Kjeldahi distillation unit.

Available phosphorous (P): The available was extracted with Olsen's reagent (0.5 M sodium bicarbonate, pH 805) in 1: 5 ratio of soil shaken for 30 minutes at 150 rpm as described by Phosphorous in the extract was determined by development of colour by the ascorbic acid reductant method. The absorbance was read at 70 mm using Shimadzu UV/Visible spectrophotometer model UV 1601.

Calculation:

$$\text{Available P (kg/ha)} = \frac{R \; X \; Volume \; of \; extract \; X \; 2.24 \; X \; 10^6}{Volume \; of \; aliquot \; X \; wt \; of \; soil \; 10^6}$$

Where: R = µg in the aliquot. Available Potassiu (K)- Exchangeable K was determined using neutral ammonium acetate extraction (1:5 soil: solution) for 5 min, followed by direct reading by flame photometer.

Calculation: $\text{Available K kg/ha} = \frac{R \, X \, Volume \, of \, Extact \, X \, 2.24 \, 10^4}{Weight \, of \, soil}$

Experimental site description and sampling protocol: the experimental sites are located in Indore district and within a radius of 30 km from National Research Centre for Soyabean, Indore. Under average climatic condition (15 years), the area received around 1020 mm of annual rainfall of which 85-90% occurred between June and September. The rainfall received during these months normally exceeds the water requirement of the crops resulting in sizable runoff and soil loss. The mean minimum and maximum temperature during *Kharif* soyabean (June- October) was 22 and 32°C, respectively. Around 8 soil samples were collected which are under contrasting management practices. The soil samples were collected during the February, 2013 and soil samples were processed for analysis of chemical parameters.

Janapaw Forest ther are trees of palash and there is no supply of fertilizer or external nutrients. Garden of Holkar Science College is usually used for the Botanical study. At the time of soil collection there was pisum sativum grown and urea fertilizer was used. Barren Land has no any tree or grass. In wheat farm at the time of soil collection there were IFCO (Urea Super Phosphate + Potash) is used. Cemented Frame Making Industry is situated on Sanwer Road. The land of these industries is almost cemented. Garden of Agriculture College at the time of soil collection the land is preparing for gardening and tillaging took place there. No any fertilizer used there that time. In home garden there are generally vegetable are grown and there is urea am=nd Cow manure used as a fertilizer. At Farm of Soyabean at the time of soil collection there were harvested and there was urea, IFCO, Super Potash used.

The soil available nitrogen in soil sample was determined by the alkaline potassium permanganate method using a Kjeldahi distillation unit. The available phosphorous was extracted with Olsen's method. Exchangeable K was determined using neutral ammoniumacetate extraction (1:5 soil: solution) for 5 min, followed by direct reading by flame photometer, micronutrients are determined by atomic absorption spectroscope.

Results and Discussion

Result of current research are given in the following table-1 and figures-1 to 4

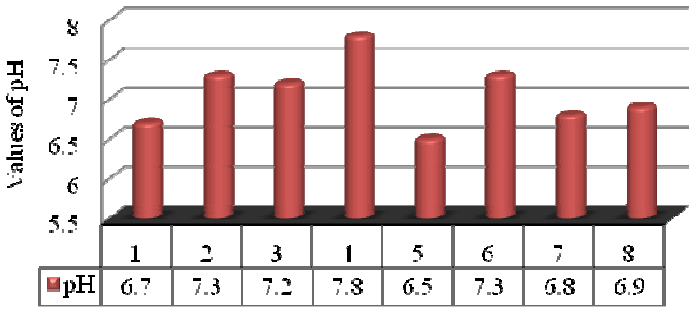

Figure-1
Showing variation of pH into soil of different sites

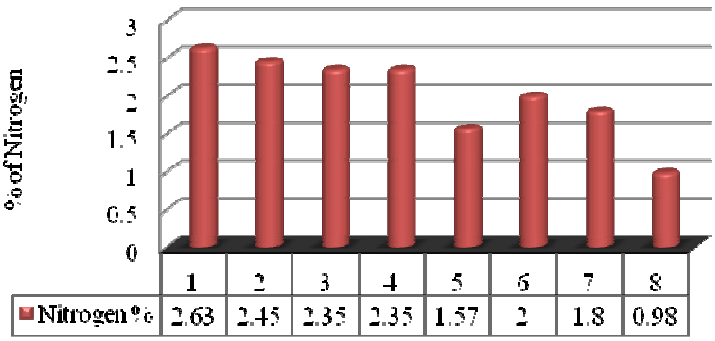

Figure- 2
Showing variation of N into Soil of different Sites

Table-1
Status of pH, and available macronutrients as affected by different land use system

S. No.	Experimental Size	Pertinent Chemical Parameters			
		pH	Nitrogen %	Phosphorus(kg/ha)	Potassium (kg/ha)
1	Soil of Janapaw	6.7	2.63	18	620
2	Soil of Home Garden	7.3	2.45	19	610
3	Soil of Garden of Agriculture College	7.2	2.35	16	560
4	Soil of Garden of Holkar College	7.8	2.35	18	590
5	Soil of Barren Land	6.5	1.57	14	600
6	Soil of Farm of Wheat	7.3	2.00	21	610
7	Soil of Harvested Farm of soyabean	6.8	1.80	16	450
8	Soil of Cemented Frame Making Industry	6.9	0.98	9	350

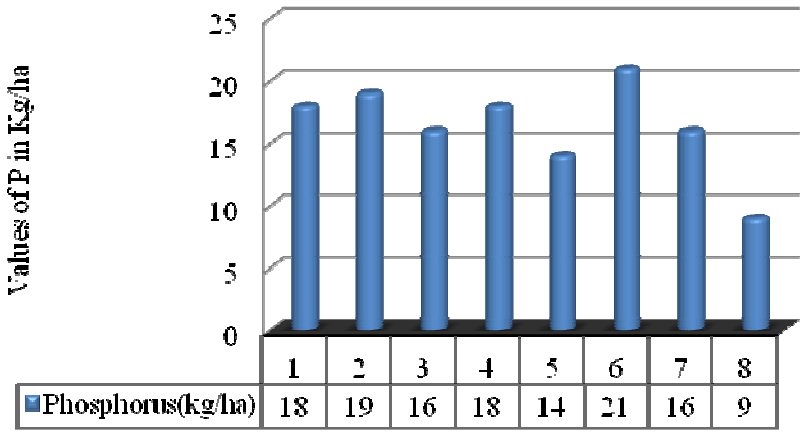

Figure-3
Showing variation of P into Soil of different Sites

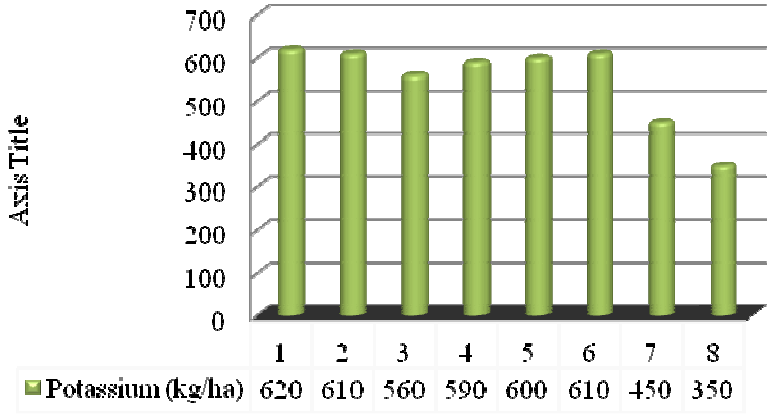

Figure-4
Showing variation of K into Soil of different Sites

Conclusion

The data reveal that the soils under forest, garden land to contain higher available nitrogen content as compared to soils under agricultural and irrigation with industrial effluents. The perusal of the data on available potassium content indicated that the content ranged from 350 to 620 k/ha. The soils under forest and garden land had higher content of available potassium as compared to soils under agricultural and irrigation with industrial effluent.

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