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PHOSPHORUS ANALYSIS OF FARMLAND SOIL IN SOME VILLAGES OF KHANPUR TALUKA DIST.: MAHISAGAR (GUJARAT)

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ABSTRACT

Quality characteristic is based on various parameter like pH, conductivity, total organic carbon, available, nitrogen (N), available phosphorus (P_2O_5) and available potassium (K_2O). This study leads us to the conclusion of the nutrient's quantity of soil of Khanpur taluka, Dist. Mahisagar, Gujarat State. Results show that average all the villages of this taluka have medium and high phosphorus content. The fertility index of phosphorous for both this taluka is 1.89. This information will help farmers to decide the problems to said nutrients amount of fertilizers to be added to said to make the production economic.

Key words: Quality of soil, Fertility index, Khanpur, Gujarat.

INTRODUCTION

Soil is a dynamic natural body developed as a result of pedogenic processes during weathering of rocks. Its in traditional meaning, is the natural medium for the growth of land plants. Soil are all unconsolidated material of the earth's crust, in which land plants can grow, if water and temperature are adequate atleast the minimum nutrients are available and toxic substances are in low concentration. It consists of minerals and organic constituents, exhibits definite physical, chemical and biological properties have variable depth. Over the surface of earth provides a suitable medium for plant growth. Soil mainly consists of 50% pore space (air and water) and 50% solid phase. The soil phase is broadly composed of 45% mineral matter and 5% organic constituents.[1]

Soil analysis can improve crop productivity and minimize wastage of these nutrients, thus minimizing impact an environmental leading to bias through optimum production. Deficiencies of primary, secondary and micronutrients have been observed in intensive cultivated areas. Several state including Andhra Pradesh, Gujarat, Haryana, Karnataka and

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Uttar Pradesh have made commendable progress in soil testing programme in various ways such as expansion of soil testing facilities, popularization of the programme in campaign mode, development of soil fertility maps and use of information technology in delivering soil nutrient status and appropriate recommendation to farmers. This compendium is and effort to put together existing status of soil testing facilities state wise and highlight main issues in soil testing programme compendium on soil health[2,3]. One of the communication deals with quality of soil of Dehegam Taluka. Soil samples were collected from forty different villages of Dehegam Taluka. Quality characteristics of soil such as pH, electrical conductivity (EC), calcium (Ca^{2+}), magnesium (Mg^{2+}), bicarbonate (HCO_3^-), chloride (Cl^-), total organic carbon, available nitrogen (N), available phosphorus (P_2O_5) and potassium (K_2O) were determined as per standard methods. Results show that 20% soils are deficient in available potassium[4].

Another group studied soil samples of 10 different villages of tribal area surrounding Dahod. The physicochemical properties such as moisture content, specific gravity, pH measurement and estimations of Mg^{2+}, Na^+, K^+ and Cl^-, HCO_3^-, PO_4^{3-}, NO_3^- % of soil were well studied. The fertility of the soil depends on the concentration of N, P, K organic and inorganic materials and water. Nitrogen is required for growth of plant and is a constituent of chlorophyll, plant protein and nucleic acid. Phosphorous is most often limiting nutrients remains present in plant nucleic acid act as energy storage. It helps in transfer of energy. Potassium is found in its mineral form and affect plants all division, carbohydrate formation, translocation of sugar, various enzyme action and resistance to certain plant disease, over 60 enzymes are known to require potassium for activation. Amount of nutrients to be added to soil for crop production depend on their present amount in that soil. Fertilizer addition is recommended, now a day an STR (Soil Test Recommendation) basis, in which contents of major nutrients (N, P, K) are determined following standard methods before sowing. Their values suggest quality of soil in terms of its nutrients contents i.e. high, medium, or low nutrients. These nutrients contents are than deduced from required amount of nutrients for following crop and this much amount of nutrients is now recommended for addition to soil[5,6]. One of the communication deals with quality of soil of Kalol and Godhra Taluka soil samples were collected from nineteen different villages of Kalol, Godhra taluka. Physico-chemical study of soil is based on various parameter like pH, conductivity, total organic carbon available nitrogen (N), available phosphorus (P_2O_5) and potassium (K_2O) were determined as per standard methods. Results show that for available phosphorus of soil of the Kalol and Godhra Taluka with their fertility index[7].

There is no intent with this system to make any interpretation as to the potential environment impact of sensitive nutrients, such as phosphorus. This interpretation system is meant strictly for the determination of current soil suitability for agronomic or horticulture crop production. While nutrient availability can be important in the potential for adverse environment effects, it is only one factor in the overall picture. Slope, ground cover, incorporation of nutrient sources, timing of application and other considerations all affect the potential movement of nutrients off-site and their potential for adverse environment impact on surface and ground water[8,9]. In cold climate, rapid root development early in the season is important. To encourage this, a small amount of starter fertilizer may be recommended for some crops even though the available level in the soil may be rated optimum or even excessive. This applies primarily to phosphate (P_2O_5) recommendations, since on adequate available P level is critical in promoting early root growth. Starter fertilizer nutrient quantity is typically less than normal crop removal. Soil fertility testing is really the combination of three discrete but interrelated processes: analysis, interpretation, and recommendation[10]. Stefanic's definition[11] approaches the most the fundamental biologic feature of soil fertility. Fertility is the fundamental feature of the soil that results from the vital activity of micro-population of plant roots of accumulated enzymes and chemical processes, generators of biomass, humus, mineral salts and active biologic substance. The fertility level is related with the potential level of bioaccumulation and mineralization processes, these depending on the programme and conditions of the ecological subsystem evolution and on anthropic influences. This definition has the quality to be analytical. Understanding the definition in detail, the analyses of soil samples can be used for quantifying the level of soil fertility.

Phosphate (P_2O_5) requirement for different crops is calculated by following equation[12].
P_2O_5 requirement = Crop removal + (50 - no. PX's) x Multiplier = Pounds per acre.

The number of PX's is taken from the phosphorus bar graph, which is derived from the pounds per acre Phosphorus test level. Phosphate requirement are also rounded to the nearest 10 pounds per acre. Minimum and maximum limits are also imposed, as with potash requirement. Crop removal values are different for each crop. The multiplier is derived from two factors : (1) The conversion from elemental phosphorus (P) to fertilizer phosphate (P_2O_5) - [roughly a factor of 2] and (2). The average efficiency or effectiveness of added phosphate for each crop. Efficiency is the percentage of fertilizer applied, which is actually taken up or which remains plants available in the soil. Phosphate efficiency is a function of several factors including soil pH, soil organic matter level, whether the fertilizer is banded or broadcast, and how thoroughly the crop rooting system exploits the plow layer.

Present study is an attempt to find out the nutrient's quantity in soil of farmland in Khanpur Taluka Dist.: Mahisagar, Gujarat state. This information will help farmers to decide the amount of fertilizer to be added in soil to make the production economic. The objective of this paper was to analyze the trend in fertility status of soils of farmland in Khanpur taluka

Dist: Mahisagar, Gujarat State.

EXPERIMENTAL

Materials and methods

The soil test data are the best source available to assess soil fertility status. Twenty two villages from Khanpur taluka covering North, South, East and West, were selected for this study. A representative soil sample collected from each village which represent soils of 4 to 10 farm's depending upon area of village. Representative soil samples were collected following standard quadric procedure and taken in polythene bags. In laboratory, these samples were analyzed for different chemical parameters following standard methods[13]. The Olsen phosphorus test was originally developed for use on arid alkaline soils[14,15]. The principle of this method is the heteropolycomplexs are thought to be formed by coordination of molybdate ions, with phosphorus as the central coordinated atom, the oxygen of the molybdate redicals being substituted for that of PO_4^{3-}. This heteropolycomplexs give a faint yellow color due to their water solution, which on reduction with stannous chloride gives a blue colour. The intensity of the colour is read from a spectrophotometer at a wavelength of 660 mm using a red filter.

$$\text{Soil colloid } H_2PO_4^- + HCO_3^- \longrightarrow \text{Soil colloid } HCO_3^- + H_2PO_4^-$$

$$H_2PO_4^- + H_2MoO_4 \longrightarrow \underset{\text{(Faint Yellow)}}{H_2P\,(Mo_3O_{10})_4} + 12\,H_2O$$

$$\underset{\text{(Faint Yellow)}}{H_2P\,(Mo_3O_{10})_4} + SnCl_2 \xrightarrow[\text{Reduction}]{} \underset{\text{(Blue)}}{\text{Phosphomolybdate}}$$

The actual experimental process for phosphorus measurement is : Weigh 5 g of 2 mm sieved soil into 250 mL plastic/glass bottle. Add one teaspoon of activated charcoal and 100 mL 0.5 M $NaHCO_3$ solution. Shake the bottle for 30 mins on mechanical shaker. Filter the shaker through a Whatman No. 1 filter paper. Take 10 mL aliquot in a 50 mL volumetric flask. Add 10 mL ammonium molybdate solution, a little quantity of distilled water and shake well. Add 1 mL working $SnCl_2$ solution in each 50 mL volumetric flask. Make volume upto 50 mL with distilled water and shake well. Take reading on spectrophotometer within 10-15 mins after blue color has been developed, as this color is not stable for more than 15 mins. Use 660 mm wevelength and red filter. Run a blank with all the reagent, except the soil. Determine P concentration in the given soil sample using standard curve.

AR grade reagents and double distilled water were used for soil analysis. Results were compared with standard values[16] to find out low, medium or high nutrient's content essential for STR. The available phosphorus value can be calculated by multiplying a standard factor. Based on the soil test values for different nutrients, soil samples are generally classified into three categories, low, medium, and high (Table 1). Using these fertility classes nutrient/fertility index was calculated.

RESULTS AND DISCUSSION

Table 1 represent the range of low, medium and high phosphorus content as per standard of soil analysis, it is the permissible standard according to Anand Agriculture University. These values are used to determine the category of soil whether the soil sample have low, medium or high content of phosphorus.

Experimental values of quality characteristics especially for available phosphorus of soil of the Khanpur Taluka with their fertility index are presented in the Table 2. This table represents the number of samples lies in low, medium and high phosphorus content. The same table represents the calculated values of fertility index for available phosphorus of the soil for all these 22 villages. Data presented in Table 2 show that soils of few villages contain lower available phosphorus and very few villages have high range of available phosphorus that might be due to poor or excessive use of fertilizer. Wide range of infect average all the samples lies in medium range indicates good quality of soil suggest sufficient amount of presence of available Phosphorus and hence no need of nutrient supplements to this soil. Results are in tune with farming practices followed by farmers of this region. Most of the farmer's are using compost and chemical fertilizers, urea and phosphatic fertilizers only, since last 25 to 30 years which contains concentrated amount of nitrogen and organic carbon, potassium and phosphorus. On the basis of these results farmers are advised to use integrated nutrient management practice to maintain optimum concentration of all the essential nutrients for plants. Farmers are also advised to add biofertilizers containing organic carbon and nitrogen solubilising bacteria. The graphical representation clearly confirms the recent status of all 22 villages for the presence of available phosphorus in their soil. Table 3 represents the taluka wise status of low, medium and high category of samples having phosphorus.

Fig. 1, represents the village wise category for number of sample lies in low, medium and high phosphorus. This clears that how many samples were collected from the village and what is the status of phosphorus level in that sample whether it has low, medium or high nitrogen content. Using these fertility classes nutrient/fertility index was calculated as per the following equation.

$$\text{Fertility index} = (NL \times 1 + NM \times 2 + NH \times 3)/100$$

Where NL, NM and NH are number of sample falling in low, medium and high classes of phosphorus status of samples analyzed for a given are Fig. 2 shows the fertility index for available phosphorus is finally used for recommendation of fertilizers and crop selection.

Table 1: Range of low, medium and high category of available phosphorus in the form of P_2O_5

Category	Total available phosphorus
Low	< 28 Kg P_2O_5/Ha
Medium	28-56 Kg P_2O_5/Ha
High	>56 Kg P_2O_5/Ha

Table 2: Study of presence of phosphorus content in the soil of Khanpur Taluka territory District : Mahisagar

S. No.	Village Name	No. of samples	No. of samples in low phosphorus content	No. of samples in medium phosphorus content	No. of samples in high phosphorus content	Fertility index
1	Babaliya	56	0	56	0	1.12
2	Charanna Degamada	52	7	44	1	0.98
3	Dodavanta	61	1	60	0	1.21
4	Dolariya	139	11	125	3	2.7
5	Dhuleta	222	31	191	0	4.13
6	Fatajina Bhevada	78	7	68	3	1.52
7	Hoseliya Ni Muvadi	47	2	45	0	0.92
8	Khoontelav	391	36	354	1	7.47
9	Lavana	171	0	171	0	3.42
10	Madapur	34	34	0	0	0.34
11	Masiya	65	15	48	2	1.17

Cont…

S. No.	Village Name	No. of samples	No. of samples in low phosphorus content	No. of samples in medium phosphorus content	No. of samples in high phosphorus content	Fertility index
12	Mokamsinh Na Bhevada	82	3	79	0	1.61
13	Naroda	433	133	293	7	7.4
14	Padedi Panapur	19	7	12	0	0.31
15	Pandya Na muvada	52	7	45	0	0.97
16	Sanpadiya	171	4	167	0	3.38
17	Talayan Na Bhevada	121	10	111	0	2.32
18	Tankna Bhevada	51	24	27	0	0.78
19	Umariya	32	0	32	0	0.64
20	Vakta Muvadi	118	17	101	0	2.19
21	Vandarved	107	43	57	7	1.78
22	Virapara Na Muvada	73	0	73	0	1.46
	Total	2575				47.82

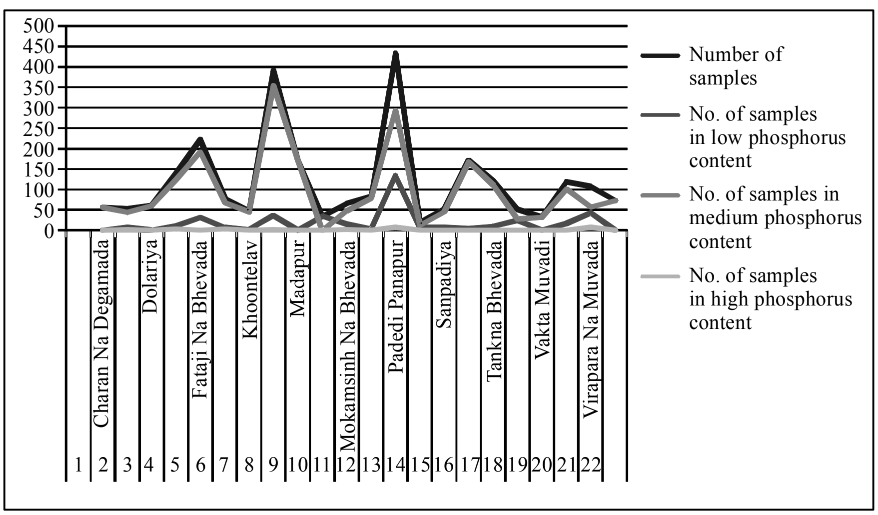

Fig. 1: Number of samples of 22 Khanpur taluka lies in low, medium and high phosphorus content range

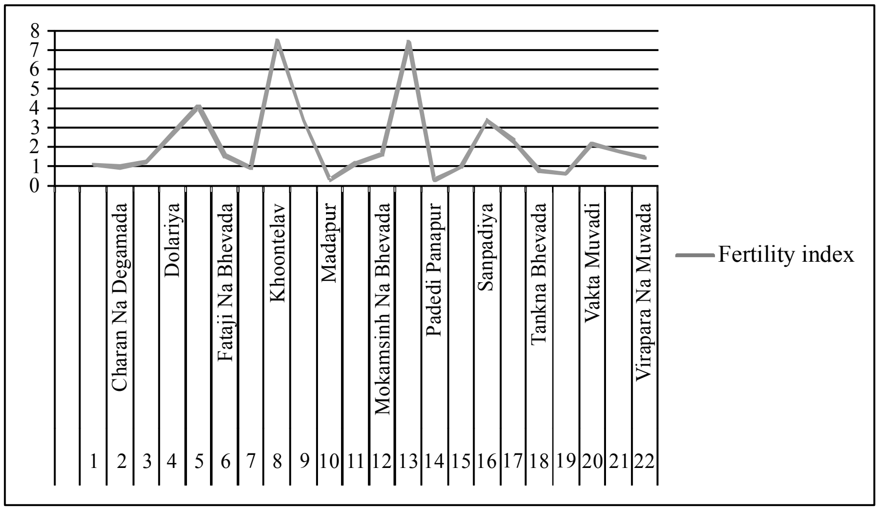

Fig. 2: Fertility index for phosphorus content of Khanpur Taluka territory of Mahisagar District

Table 3: Status of available phosphorus in form of P_2O_5 in the soil of Mahisagar District

S. No.	Taluka	Element	Category of Phosphorus			Total No. of Samples	Fertility Index
			Low	Medium	High		
1	Mahisagar District	Phosphorus	491	4463	46	5000	1.91
2	Khanpur	Phosphorus	392	2159	24	2575	1.89

CONCLUSION

This can be concluded from this study that the available phosphorus deficient soil is recommended for phosphorus rich fertilizer. Average all villages have medium category of available phosphorus and therefore there is no need to add phosphorus contained fertilizers. This study evaluates soil fertility status for making fertilizer recommendations. (i) To classify soil into different types of soil groups, fertility groups for preparing soil maps and soil fertility maps, which are presented in form of graphics. (ii) To predict the probable crop response to applied nutrients. (iii) To identify the type and degree of soil related problems like salinity, alkalinity and acidity etc. (iv) To suggest appropriate reclamation/amelioration measure. (v) To find out suitability for growing crops and orchard. (vi) To find out suitability for irrigation and (vii) To study the soil genesis.

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