ANALYTICAL STUDY OF FERTILITY STATUS OF THE AGRICULTURE SOILS OF NAIGAON (TAL. HAVELI. DIST. PUNE.)(M.S.)WITH RESPECT TO MAJOR NUTRIENTS AVAILABILITY.

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Abstract

Nitrogen (N) Phosphorous (P) and potassium (K) are the most essential elements required by crop plants for the growth and yield. The availability of N P K in the agricultural soil as studied before the rabbi and Kharif season of crops. Soil from four sampling stations of Naigaon of Pune district shown Very high percent availability of Phosphorous more than 35.01 kg/ha and Potassium more than 301 kg/ha and moderate availability of Nitrogen is moderately available in the range 281-420 kg/ha.

Keyword: *Nitrogen, Phosphorous, Potassium, fertility.*

Introduction

Soil analysis has been used as an aid to assessing soil fertility and plant nutrient management from many years. If agricultural land is to remain capable of sustaining crop production at an acceptable level, achieving and maintaining appropriate levels of soil fertility, especially plant nutrient availability, is of paramount importance. The first of three equally important steps in managing the nutrients required by plants is Soil sampling and soil analysis. The second step is the explanation of the analytical data leading to the third step, which is concerned with

recommendations for nutrient additions, as fertilisers or manures, to optimise crop yields while minimising any adverse environmental impact from their application. Currently recommendations for nutrient additions to soil are based on well-tried and tested methods of soil analysis.

Soil analysis is an assist to managing soil nutrients efficiently in maintenance of soil fertility for those nutrients like Nitrogen (N), phosphorus (P), potassium (K) that are retained in soil in plant available forms. If the amount of any of these nutrients in such forms in soil is too small then yield is put in danger, but increasing their reserves in agricultural soils to very high levels is an unnecessary expense. Thus the concept of increasing plant-available N P, K in soil to a critical level in soil has been developed and is discussed here.

For many decades soil scientists have sought ways of indicating the availability to plants of nutrients, like phosphorus, potassium and nitrogen. The total quantities of these which occur in soil can be large although invariably not all is plant available. For consultative purposes analytical procedures for 'plant-available' nutrients have to be quick and reproducible; over time appropriate chemical extract ants have been found and are now widely used. Once a reliable analytical method for assessing the readily plant available status of a nutrient in soil became established, fertiliser recommendations were based on this method of characterising soils.

Soil analysis, however, is of value only if adequate attention is paid to the rules and methodology of good sampling. Among the factors contributing to the chemical properties of soil that can be determined readily by analysis are:

1. Soil acidity (pH), which rarely affects the growth of most crops directly in the range 5.5-7.5 but can influence the availability of other nutrients.

2. The total amount of soil organic matter, which affects soil structure and/or nutrient availability, although it is not yet practical to give critical values for most soils.

3. The readily plant available mineral nutrients, such as N, P, K.

When considering N, P, K in soil in relation to their availability to plants

They can be thought of as existing in a number of pools as shown in Figure 1.
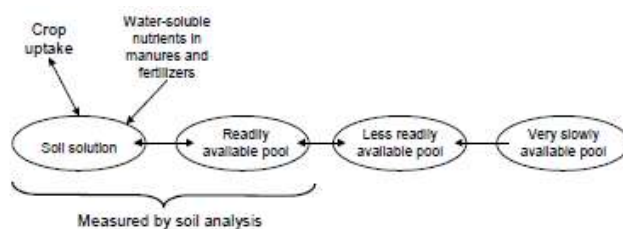
Figure 1: A simple schematic representation of the Nitrogen, potassium

And phosphorus reserves in soil in the pools of differing plant-availability.

Note that in fact the pools are of very different sizes, i.e. they contain very

Different quantities of the nutrient, with these increasing from left to right in

the Figure.

Roots take up both P and K from the soil solution but the amount, especially of P, is very small. However, as P and K are depleted by root uptake they are replenished from reserves in the readily available pool; as this pool becomes depleted of P and K they are replenished, in turn, by reserves in the less readily available pool. The amount of P and K in the readily- and less readily-available pools depends on the past history of fertilizer and manure additions, P and K removals in harvested crops and the soil type. When P and K are added to soil they become distributed between these three pools and the most important feature shown in Figure 1 is the reversible transfer between the pools. The essential feature in crop nutrition is that there must be sufficient N, P, K in the soil solution and readily available pool to meet both maximum daily demand for each nutrient in the early stages of growth and the maximum uptake to achieve optimum yield.

Materials and Methods

For the present investigation, four sampling stations from different locations around Naigaon were selected because of its distinct soil geography and climatologically conditions. The area represents plains with black clayey soil. Hence, four different sites were selected for collection (S1,S2 S3 and S4).

a. Estimation of available nitrogen (N):

Nitrogen of soil mainly present in organic form together with small quantities

of ammonium and nitrate forms. The nitrogen supplying ability of the soil was

determined by distilling soil with alkaline potassium permagnate solution. During the

distillation easily utilizable and amino- N hydrolyzed nitrogen liberated as ammonia

is measured. This serves as an index of nitrogen status of soil. Alkaline potassium

permagnate method (Subhead and Asija, 1956) was followed to estimate available N of soil samples.

In 1000 ml round bottom distillation flask (Kjeldahl flask), 20g soil was taken. To this 20ml distilled water was added. Then 100ml each of 0.32 % potassium permanganate and 100 ml 25% NaOH solution were mixed and immediately connected it to keelhaul assembly. The froth during boiling was prevented by adding liquid paraffin (1ml) and bumping by adding a few glass beads. The contents were distilled in a kjeldahl at a steady rate and liberated ammonia collected in an Erlenmeyer flask (250 ml), containing 20 ml of 2 % boric acid solution with methyl red and bromocresol green indicator. With the absorption of ammonia, the pinkish colour turns to green. After 30 minutes it was titrated with 0.02 N H2SO4 till the colour changed from green to original shade (pink). Blank (without soil) was run simultaneously.

Available nitrogen was calculated from the following formula,

$$\% \text{ Available N} = (A-B) \times (N. \text{ of acid}) \times 0.014 \times \frac{100}{\text{Wt. of soil (g)}}$$

$$\text{Available nitrogen (Kg/hec)} = \% \text{ N} \times \frac{2240000}{100}$$

Where,

1. Wt. of soil sample - Wt.

2. Volume of std. acid required for soil - A ml

3. Volume of std. acid required for blank - B ml.

4. Normality of Sulphuric acid. – N

b. Estimation of available phosphorus (P):

Soil available phosphorus found as orthophosphate in several forms and combinations, but only a small fraction of it may be available to plants. Available phosphorus was estimated by Olsen's method (Olsen, *et al*., 1954) modified by Watanbe (1965). The reagent for Olsen's P was 0.5 M NaHCO3 (pH 8.5) prepared by dissolving 42 g NaHCO3 in distilled water and made up to 1 lit. The pH was adjusted at 8.5 with 20 % NaOH solution. 2.5 g of air dried soil was weighed into 150 ml Erlenmeyer flask, 50 ml of Olsen's reagent (0.5 M NaHCO3 Solution , pH 8.5) and one teaspoonful of activate charcoal were added. The flasks were shaken for 30 minutes on the electrical shaker and contents filtered immediately through Whitman filter paper (No. 41). 5 ml of the filtrate was pipette out into 25 ml of volumetric flask and was neutralized with 1: 4 H2SO4

using paranitrophenol as indicator. The volume was made up by adding distilled water. Colour developed when few crystals of stannous oxalate were added. The solution was shaken well and intensity of blue colour was read in photoelectric calorimeter within 10 min. At wavelength of 730 to 840 μm. A blank was run without soil.

Calculations:

The amount of phosphorus was estimated by using formula,

$$P\text{(ppm in soil)} = \text{ppm P in aliquot} \times \frac{\text{Total volume of extract}}{\text{Aliquot taken (ml)}} \times \frac{1}{\text{Wt. of soil (g)}} \quad (R \times F)$$

$$
\begin{aligned}
P \text{ (Kg/ ha)} &= \text{ppm P in soil} \times 2.24 \\
P_2O_5 \text{(Kg/ ha)} &= P\text{(Kg/ ha)} \times 2.29 \\
\text{Conversion factors} &= P \times 2.29 = P_2O_5 \\
P &= P_2O_5 \times 0.437
\end{aligned}
$$

c. Determination of available potassium (K):

Only small fraction of total K is held in exchangeable form, while the rest remains in fixed or non-exchangeable form. When the crop exhausts the supply of exchangeable K, more K is released from the fixed reserve. Exchangeable K, is therefore, also referred to as 'available K'. The flame photometric method (Jackson, 1958) was employed to estimate available K of samples.

5g of air dried sample was taken in 150 ml Erlenmeyer flask and 25 ml of 1 N ammonium acetate was added to the flask. The contents were shaken for 5 minutes on a mechanical shaker and filtered immediately through a dry filter paper (Whatman No.1). The filtrate was collected in a beaker. 5 ml of filtrate diluted with 25 ml with distilled water. Atomized the above diluted extract to flame photometer to note the reading.

The amount of potassium was estimated by formula:

$$\text{Available K (Kg/ha)} = (R \times F) \times \text{Vol. of extract} \times DF \times \frac{2.24 \times 10^6}{\text{Soil wt.} \times 10^6}$$

$$\text{Available K}_2O \text{ (Kg/ha)} = \text{Available K (Kg/ha)} \times 1.20$$

Where,
$$
\begin{aligned}
R &= \text{reading.} \\
F &= \text{Conc. of K/ corresponding reading.} \\
DF &= \text{dilution factor.}
\end{aligned}
$$

Results and Discussion

Chemical analysis was carried out for the elements like N, P and , K. It is presented in (**Table-1**) the normal range of the elements.

* Available Nitrogen:

In site S3, it was greater i.e 304.64 Kg/ha and 288.96 Kg/ha in site S1 comparatively less i.e. 244.19 Kg/ha in site S4 and 219.52Kg/ha in site S2.(Figure1).

Nitrogen content of soil directly affects soil pH.

* Available Phosphorus:

Phosphorus is one of the key macronutrient required for plant growth and metabolism. Inorganic phosphate supplied to the soil as a fertilizer is rapidly converted into unavailable form. Soluble P converted into insoluble phosphate involves microorganisms. Mycorrhizal plants can take up more phosphorus than non mycorrhizal plants (Kapoor and Mishra, 1931).Comparatively higher P- availability is In site S3,(Figure2) it was greater i.e 49.28 Kg/ha and 47.07 Kg/ha in site S2 comparatively less i.e. 16.8 Kg/ha in site S4 and very less 7.616 Kg/ha in site S1. as shown in the (**Table-2**)

Table No. 1 : The normal values of soil parameters

Parameter	Unit	Normal Range	Remark
Nitrogen (N)	Kg/ha	Less Than 140	Very Low
		140 – 280	Low
		281 - 420	Moderate
		421-560	Moderately
		561-700	High
		More than 701	High
			Very High
Phosphorous (P)	Kg/ha	Less Than 7.00	Very Low
		7.01 –14.00	Low
		14.01 – 21.00	Moderate
		21.01 – 28.00	Moderately
		28.01-35.00	High
		More than 35.01	High
			Very High

Potassium(K)	**Kg/ha**	**Less Than 100**		**Very Low**	
		100 - 150		Low	
		151 - 200		Moderate	
		201-250		Moderately	
		251-300		High	
		More Than 301		High	
				Very High	

Table-2 N P K availability of soil in Naigaon Tal. Haveli Dist. Pune(M.S.)

Parameter	Unit	S1	S2	S3	S4
Nitrogen(N)	Kg/ha	288.96	219.52	304.64	244.19
Phosphorous(P)	Kg/ha	7.616	47.07	49.28	16.8
Potassium(K)	Kg/ha	806.4	448	694.4	403.2

Available Potassium:

Estimated K was recorded in the (**Table-2**)The values were ranging between 806.4 Kg/ha to 403.2 Kg/ha(Figure3). The positive correlation was found by Joshi and Singh (1995).

CONCLUSION

Maximum and minimum values were observed in available micronutrient among different soils sample collected from different locations of four sampling spots of Naigaon of Haveli taluka of Pune district. In sampling spots S1, and S3 nitrogen is moderately available as the values are between 281-420kg/ha, in Soils of sampling spotsS2 and S4 it is available in low quantity(Table1 and Table 2).The phosphorous is deficient in the soils of site S1(Table1 and Table 2), moderately available at S4 and maximum in the soils of sampling sites S2 and S3. The Potassium is available in very high quantity in the soils of all the sampling sites. The farmers are advised to fulfil the requirements of the nutrient elements N and P according the desired crops in Kharif and rabbi season.
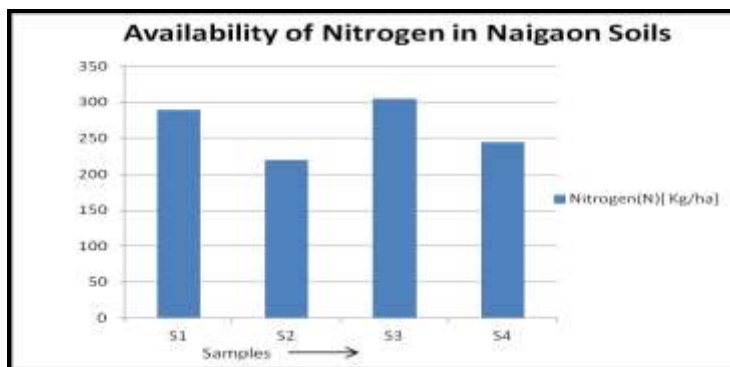
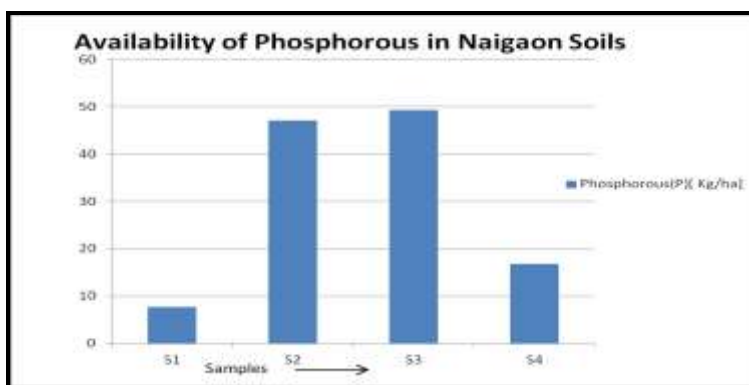**Figure1 - Graph showing availibility of Nitrogen(N)in Naigaon soils**

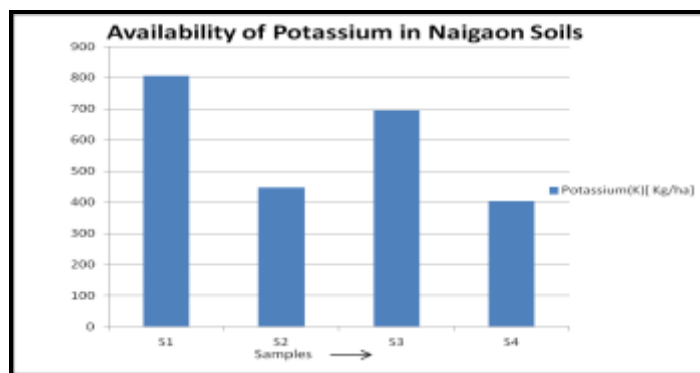**Figure2 - Graph showing availibility of Phosphorous(P)in Naigaon soils**

Figure3 - Graph showing availibility of Potassium(K)in Naigaon soils

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