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GPS-GIS Based Soil Fertility Status of Mahatma Phule Krishi Vidyapeeth, Rahuri, (M.S.), India

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***Abstract* – The recent database of macro nutrients of block A and B, Central Campus, MPKV, Tehsil Rahuri, Dist. Ahmednagar (M.S.) was developed. Surface soil samples were collected at 0-22.5 cm by using Global Positioning System at 100m grid. The soil samples were analysed for appraisal parameters viz. available N, P and K and depicted on maps by using GIS technique. The results were categorized as per six tier system of rating as low medium and high. The available nitrogen, phosphorus and potassium were ranged from 160.33 to 271.66, 10.26 to 27.45 and 313.6 to 716.8 kg ha-1 in block A and 184.55 to 278.12, 9.98 to 27.45 and 324.8 to 616 kg ha-1 in block B respectively. Both the blocks recorded low in available nitrogen, low to medium in available phosphorus and very high in available potassium.**

***Keywords* – Macronutrients Status, Fertility Maps, GPS.**

I. Introduction

Soils are considered as the integral part of the landscape and their characteristics are largely governed by the landforms in which they are developed. Topographic maps, aerial photographs and remote sensing data provide useful tools for geomorphic analysis of the region and help in the soil survey and mapping [9]. The remote sensing techniques in conjugation with conventional methods have been employed successfully in India and different parts of the world and [11]. The quality of soil needs to be looked into because presently the natural resources are being over exploited. Soils of Maharashtra state are categorized as poor in fertility and vary widely in genetic, morphological, physical, chemical and biological characteristics [2]. The deficiencies started appearing in different areas due to introduction of intensive production systems after green revolution period. It is due to net removal rates of micronutrients by crops being higher under intensive productivity regimes. There are several reports indicated that n, p and k nutrients are not giving as much response as before due to the situation that have been explained to macronutrient deficiency [6]. Intensification of agriculture aimed at obtaining highest yields per unit time per unit area. There are increasing concern of yield stagnation owing to the state of fatigue to the soil which has depleted its nutrients. The emergence of multi nutrient deficiencies in the crop efficient zones of many soils are the consequences of intensive cropping. Global positing system and Geographical information system are advanced tool for studding on site specific nutrient management which can be efficiently used for monitoring soil fertility changes. The geo-referenced nutrient status of soils in A and B block of central campus, MPKV., Rahuri would be useful for ensuring balanced fertilization to crops which demands the systematic study of macronutrients including assessment of status of soils with delineation of nutrient deficiency or sufficiency.

II. Material and Methods

Soil Sampling:

Two hundred and ninety soil samples were collected at 0 -22.5 cm depth with the help of GPS from block A and B, during Kharif 2011-12. The soils were analysed for available N, P and K. The soil available nitrogen was measured by the modified alkaline permanganate method. The available phosphorus was measured by 0.5M $NaHCO_3$ method. The available potassium was measured neutral normal NH_4OAC pH 8.5 method. The analytical data was statistically analysed by using standard methods. The NBSS soil survey manual chart was used for presenting the soil analytical data. The nutrient status was categorised.

Table 1. Categorization of Soils.

Sr. No.	Ratings	Available Nutrients (kg ha^{-1})		
		N	P	K
1.	Very Low	< 140	< 7	< 100
2.	Low	141-280	7.1-14	101-150
3.	Moderate	281-420	14.1-21	151-200
4.	Moderately High	421-560	21.1-28	201-250
5.	High	561-700	28.1-35	251-300
6.	Very High	>700	>35	>300

III. Results and Discussion

Nutrient Status in Soil :

The data pertaining to soil available Nitrogen, Phosphorus and Potassium of Block A and B are presented in Table 2 and 3 and depicted on map fig. 1. The data pertaining to different parameters is categorized as per the six tier rating (Table 1).

Available Nitrogen

Block A: The available nitrogen in soils was ranged from 160.33 to 271.66 kg ha^{-1} with an average of 221.48 kg ha^{-1}. The highest available nitrogen observed was 271.66 kg ha^{-1} (19022 | 26.24N -74039|09.09E) and lowest 160.33 kg ha^{-1} (19022|15.14N-74039|16.46E).

Block B: The available nitrogen in was ranged from 184.55 to 278.12 kg ha^{-1} with an average of 231.29 kg ha^{-1}. The highest available nitrogen was 278.12 kg ha^{-1} (19021| 18.48N-74039|47.83E) and the lowest 184.55 kg ha^{-1} (19021|09.41N-74039|50.36E).

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Table 2. Soil available N, P, K status of block A.

Particulars	Available Nutrients (kg ha^{-1})		
	N	P	K
Mean	221.48	18.51	403.08
Range	160.33-271.66	10.26-27.45	313.6-716.8
Category	Low (100 %)	Low (23.80 %) Medium (76.13%)	Very High (100 %)
SE ±	0.14	2.27	0.21

(No. of soil samples -189)

Table 3. Soil available N, P, K status of block B

Particular	Available Nutrients (kg ha^{-1})		
	N	P	K
Mean	231.29	17.62	383.24
Range	184.55-278.12	9.98-27.45	324.80-616.00
Category	Low (100 %)	Low (32.67 %) Medium (67.32 %)	Very High (100 %)
SE ±	2.53	0.26	5.64

(No. of soil samples -101)

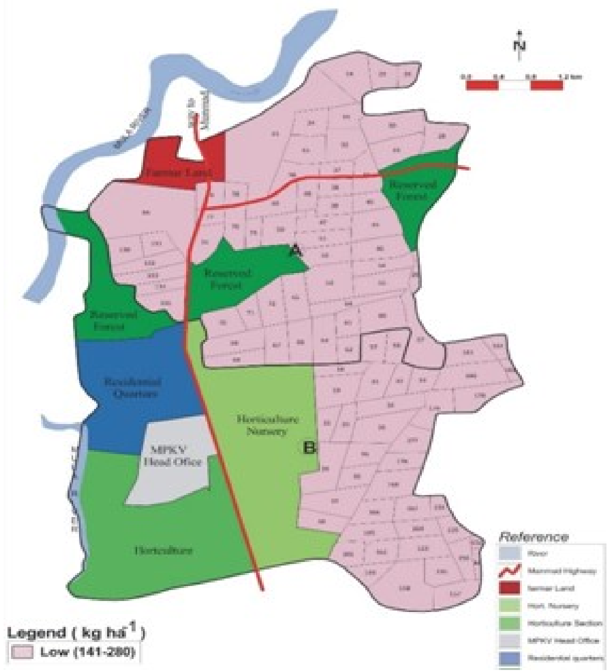

Fig. 1. Map of Available Nitrogen in Block A and B.

All the soil samples collected from block A and B were categorized as low in available nitrogen. It might be due to the higher pH which declined the organic matter status by faster degradation which reflected low status.

Available Phosphorus

Block A: The available phosphorus in soils was ranged from 10.26 to 27.45 kg ha^{-1} with an average of 18.15 kg ha^{-1}. Among the soil samples collected 23.80 per cent samples are in low category whereas 76.13 per cent are in medium category. The highest available phosphorus was 27.45 kg ha^{-1} (19021|51.74N-74038|34.39E) and lowest was 10.26 kg ha^{-1} (19021|35.95N-74039|05.51E).

Block B: The available phosphorus in soils was ranged from 9.98 to 27.45 kg ha^{-1} with an average of 17.62 kg ha^{-1}. Among the soil samples collected 32.67 per cent were in low category and 67.32 per cent were in medium category of available phosphorus. The highest available phosphorus was 27.45 kg ha^{-1} (19021|09.64N-74040|13.57E) and the lowest 9.98 kg ha^{-1} (19020|18.44N-74039|47.76E). Low status of available P in soil might be due to alkaline condition and high content of $CaCO_3$ in the soil.

Fig. 2. Map of Available Phosphorus in Block A and B.

Available Potassium

Block A: The available potassium in soils ranged from 313.6 to .716.8 kg ha^{-1} with an average of 403.08 kg ha^{-1}. The highest available potassium was 716.8 kg ha^{-1} (19022|29.74N-74039|23.31E) and lowest was 313.6kgha^{-1} (19022|19.44N-74038|40.59E).

Block B: The available potassium in soils was ranged from 324.8 to 616 kg ha^{-1} with an average of 383.24 kg ha^{-1}. The highest available potassium observed was 616 kg ha^{-1} (19020|10.20N-74040|02.38E) and the lowest was 324.8 kg ha^{-1} (19021|09.49N-74039|53.69E).

All the soil samples collected were very high in available potassium. The high content of available K in the soil could be attributed to the dissolution and diffusion of K from internal crystal lattice of silicate clay minerals and may be due to high clay content and Montmorillonite clay minerals present (Durgude, 1999). The similar trends of available N, P and K in soil were reported by Katariya (2011) in soils of the Water Management Project-Block A, Meena (2009) in Central Research Farm, Central Campus, MPKV, Rahuri, Waikar et al. (2004).

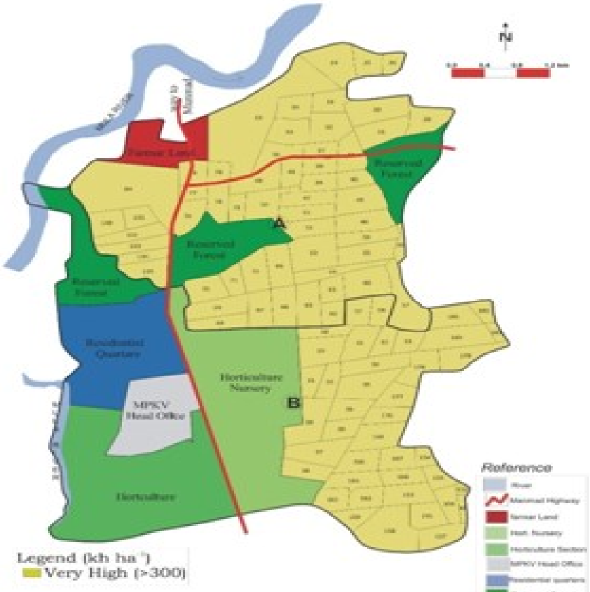

Fig. 3. Map of Available Potassium in Block A and B.

IV. CONCLUSION

This study revealed that all the samples collected from block A and B were low in available nitrogen, low (23.80 per cent), (32.67 per cent) to medium (76.13 per cent) (67.32 per cent) in block A and B in available phosphorus respectively and very high in available potassium.

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