Appraisal of Macro and Micronutrient Status of Soils of Washim Road Farm of Dr.PDKV Akola, Maharashtra, using GPS

Abstract

The present study was conducted during the year 2018 and 2019 at Department of Soil Science and Agricultural Chemistry, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra with an aim to know the **macro and micronutrient status of soils of Washim road farm, Dr. PDKV Akola**. Grid based (GPS) forty four (44) surface (0-20 cm depth) soil samples were collected by grid survey method at 200m distance from Washim road farm and analyzed as per standard procedure for judging chemical properties and available nutrient status of soil. The results indicate that all the soils pH under study were slightly alkaline to moderately alkaline in reaction and it ranged from 7.5 to 8.6 and soils were free from soluble salt hazard (EC 0.13 to 0.38 dSm^{-1}). Organic carbon content were ranged from 2.34-8.97 g kg^{-1}, soils of Washim road farm was moderately calcareous to calcareous due to presence of $CaCO_3$ in soil. The available major nutrient content in these soils showed very low status for N (100.35-175.61 kg ha^{-1}), available P (13.25-22.4 kg ha^{-1}), and very high for available K (340.14-539.04 kg ha^{-1}). While the available S, it ranges from 7.58-16.4 mg kg^{-1}. The available micronutrient content in these soils showed very low to moderate status for available Fe (2.05-5.96 mg kg^{-1}), available Mn (0.82-4.47mg kg^{-1}) and available Zn (0.12-0.88 mg kg^{-1}) indicates very low to medium and high for available Cu (0.73-3.12mg kg^{-1}).

Keywords: nutrient status, grid survey, GPS, chemical property, macronutrients, micronutrient

Introduction:

Soils are inherently heterogeneous in nature, diverse and dynamic system and its properties change in time and space continuously. Heterogeneity in soil properties with depth and across landscapes can be accounted for by several interacting factors that operate with different intensities and at different scales and acting simultaneously. Soil is a medium for plant growth and development that leads to crop productivity. Crop productivity depends on many factors and soil fertility is major branch amongst all. Soil fertility has direct relation with crop yields, provided other factors are in optimum level. Soil fertility must be periodically estimated as there is continuous removal of macro

and micronutrients by crop intensively grown in every crop season. The availability of soil nutrients for plant growth and yield production is a function of different parameters, including soil pH, soil organic matter and texture, and soil biological activities. Hence, determination of such parameters is important for evaluating nutrient behavior in the soil and for suggesting appropriate methods of enhancing nutrient availability to plant.(Shazia et al. 2017)

All researches in soil fertility have one common goal that is to assess nutrient supplying capacity of the soil, deficiencies of nutrient if any and to supply nutrient based on crop needs. Thus, in the game of crop production, there are three dependent and yet interdependent players the soil, the plant and fertilizers, each one of them key players (Goswami, 1999).The challenge during the next millennium is to achieve and sustain growth rates high enough to feed the swelling population without degrading the environment (NAAS, 1997).

The micronutrient deficiencies, even with minor symptoms can lower crop-yields or quality; and low production in animals. From this, it is apparent that hidden trace elements deficiencies are far more widespread in crop lands than are generally estimated. The soils of Washim road farm of the university have been assessed for nutrient status. This will helps to research workers to manage the farm by making efficient use of available resources and to provide base for conducting research experiments.

Materials and Methods:

The Washim road farm is situated about 6 km west of Akola town, lies between longitude 76°59’42.7” to 76°59’34”E, Latitude 20°40’42” to 20°40’58”N and covers 99.9 hectares. Total 44 surface soil samples with (0-20 cm depth) from cultivated area of the washim road farm Dr. PDKV, Akola were collected using Global Positioning System (GPS) at grid interval of 200 m. The grid wise sample were collected , the sample were labeled, air dried and sieve through 2 mm sieve for analysis of soil fertility parameter.

Soil pH and electrical conductivity at 1:2.5 soil water suspensions (Jackson 1973). Organic carbon was measured by Chromic acid wet digestion method (Walkley and Black 1934). And $CaCO_3$ was determined by rapid titration method (Piper 1966). Available N was determined by alkaline permanganate method as described by Subbiah and Asija (1956) , the available P was extracted with Olsen’s reagent 0.5 M $NaHCO_3$ of pH 8.5 and was estimated colorimetrically as per Jackson (1973), the available K was estimated by extracting the soil with 1 N NH_4OAC (pH 7.0) by using flame

photometer (Jackson, 1973) and Available Sulphur was estimated by 0.15% $CaCl_2$ extractable method (Piper, 1966). While the available micronutrient cation (Fe, Mn, Zn and Cu) were extracted by DTPA-$CaCl_2$ extractant at pH 7.3 (Lindasay and Norvell,1978).

Results and Discussion:

Chemical properties of soil:

The results presented in (Table 1 and Fig.1) revealed that the pH of the soils of Washim road farm, were ranged from 7.50 to 8.60 indicating slightly to moderately alkaline in reaction. The alkaline reaction of soil is probably due to presence of sufficient free lime content in these soils (Jibhkate *et al.* 2009).The EC ranged from 0.13 to 0.38 dSm^{-1} in Washim road farm, As regards, the variation observed in respect of electrical conductivity of surface soils no definite trend was observed. This range of EC value shows that all the soils were non-saline in nature and suitable for healthy plant growth. (Padole and Mahajan, 2003) The EC value <1.0 indicate that these soils are free from hazard of soluble salts as prescribed by Richards (1954).The organic carbon in soils ranged from 2.34 to 8.97 g kg^{-1}. The soils were low to moderately high in organic carbon content. The surface of any soil normally received continuous fresh addition of organic matter due to residues as well as this layer also receives addition of organic matter in the form of FYM, it might be due to the higher content of organic carbon in surface layer. The low content of organic carbon might be due to slow rate of decomposition and continuous utilization by plants for the uptake of nutrients. Similar results were reported by Patil et al. (2008) in the soils of Agriculture college farm, Pune. The data in relation to $CaCO_3$ revealed that all the soils under study contain free lime and this might be due to soils are moderately alkaline in reaction. The magnitude of free lime content ranged from 4.25 to 10.0 %. It indicates that these soils are moderately calcareous (18%) to calcareous (82%) in nature

Table 1. Status of soil pH, EC, OC, $CaCO_3$for Washim road farm of the University

No. of sample analysed	Parameters	Range (g kg^{-1})	Mean	Ratings					
				VL	L	M	Mod. H	H	VH
44	pH	7.5-8.6	7.95	-	-	-	-	-	-
	EC (dSm^{-1})	0.13 - 0.38	0.25	-	-	-	-	-	-
	OC (g kg^{-1})	2.34- 8.97	5.88	0	3 (7%)	17 (39%)	23 (52%)	1 (2%)	0
	$CaCO_3$	4.25- 10.0	6.98	0	0	8 (18%)	36 (82%)	0	0

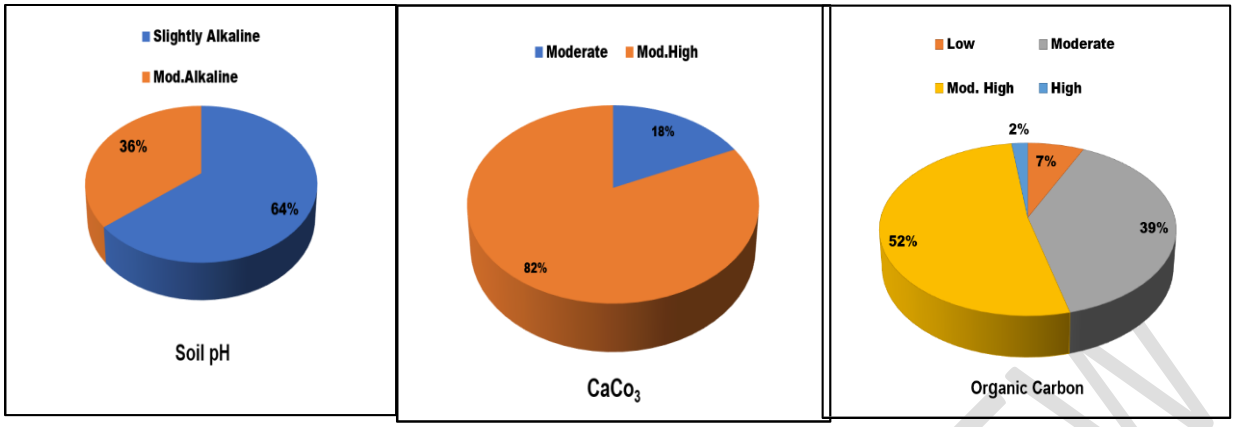

Fig 1: Categorization of soil pH, $CaCO_3$, Organic Carbon from Washim road farm

Macronutrient status:

The data presented in (Table 2 and Fig.2) revealed that the available nitrogen in Washim road farm ranged from 100.35 - 175.61 kg ha^{-1}.The available N content of soils depends on the mineralization of organic matter and management practices including cropping pattern. Similar observations were also recorded by Dhale and Prasad (2009). As per rating standard, soil containing less than 280 kg nitrogen ha^{-1} are normally rated as low in available nitrogen content. The soils thus need judicious application of both organic manure and nitrogenous fertilizers to meet the N requirement of crops grown in them.

The available phosphorus ranged from 13.25 to 22.4 kg ha^{-1} in Washim road farm. Low available P might be because of less mobility of phosphorus in the soil as it get easily adsorbed and fixed in upper layer. The variation in the availability of phosphorus might be due to variation in $CaCO_3$ content of the soil, different soil properties and agronomic practices. The result closely point by Bharambe *et al.* 2001.

No. of sample analysed	Parameter	Range (kg ha^{-1})	Mean	Ratings					
				VL	L	M	Mod. H	H	VH
44	N	100.35- 175.61	139.72	22 (50%)	22 (50%)	0	0	0	0
	P	13.25-22.4	18.01	0	2 (5%)	33 (75%)	9 (20%)	0	0
	K	340.14- 539.05	420.77	0	0	0	0	0	44 (100%)
	S	7.58- 16.4	11.51	0	12 (27%)	28 (64%)	4 (9%)	0	0

Table 2: Soil available nutrient status in Washim road farm

The magnitude of available potassium for Washim road farm soil ranged from 340.14 to 539.05 kg ha^{-1}. As per ratings, soils containing available potassium more than 300 kg ha^{-1} categorized as very high in available potassium content. The data on the basis of available potassium content indicates that the soils have no problem of K deficiency. The high potassium content may be attributed to presence of potassium supplying minerals in parent rock of the area. Similar results were also reported by Kashikar (1983)for black soils.

The magnitude of available Sulphur ranged from 7.58 to 16.4 mg kg^{-1}. As per ratings, soils containing available Sulphur more than 20 mg kg^{-1} categorized as very high in available Sulphur content. Low available Sulphur in these soils may be due to the less supply of Sulphur containing fertilizers. The results closely confirmative with (Wagh *et al*. 2008)

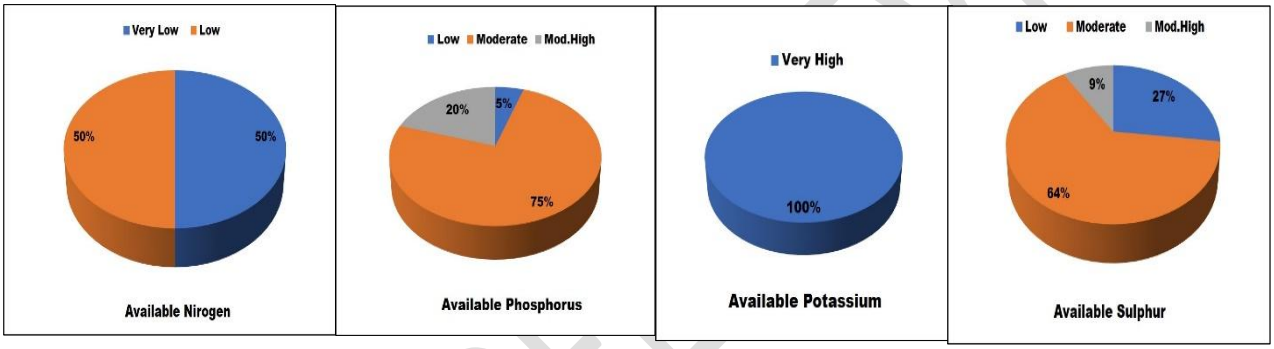

Fig 2: Categorization of soil available N, P, K, S from Washim road farm

Micronutrient status:

The DTPA extractable Fe content in soils of Washim road farm ranged between 2.05 to 5.96 mg kg^{-1}, considering critical limit for DTPA –Fe 2.5-4.5 mg kg^{-1} as given by Katyal and Rattan(2003) these soils are found to be sufficient in available Fe content it is due to the increased in $CaCO_3$ and clay content in the soils. Similar observation was reported by Jibhkate *et al*. (2009).Magnitude of available manganese content in soils ranged from 0.82 to 4.47 mg kg^{-1} indicates very low to medium status.

The available zinc extracted by DTPA varied from 0.12 to 0.88 mg kg^{-1} for Washim road farm. the soils under study are categorized as a medium in available zinc status. Similar observation was recorded by Gajbhiye *et al*. (1993), The Washim road farm showed high to very high availability of Copper. The available copper extracted by DTPA ranged between 0.73 to 3.12 mg kg^{-1}. Considering

critical limit of 0.2 mg kg^{-1} as suggested by Katyal and Rattan (2003), these soils are categorized as high in available copper content. Similar results were reported by Jibhkate *et al*. (2009).

No. of sample analysed	Parameter	Range (mg kg^{-1})	Mean	Ratings					
				VL	L	M	Mod. H	H	VH
44	Fe	2.05- 5.96	4.06	4 (9%)	25 (57%)	15 (34%)	0	0	0
	Mn	0.82- 4.47	2.63	7(16%)	8(18%)	20(46%)	9(20%)	0	0
	Zn	0.12- 0.88	0.46	11(25%)	18(41%)	15(34%)	0	0	0
	Cu	0.73- 3.12	1.78	0	0	0	1(2%)	6(14%)	37(84%)

Table 3: available micronutrient status in soils of Washim road farm

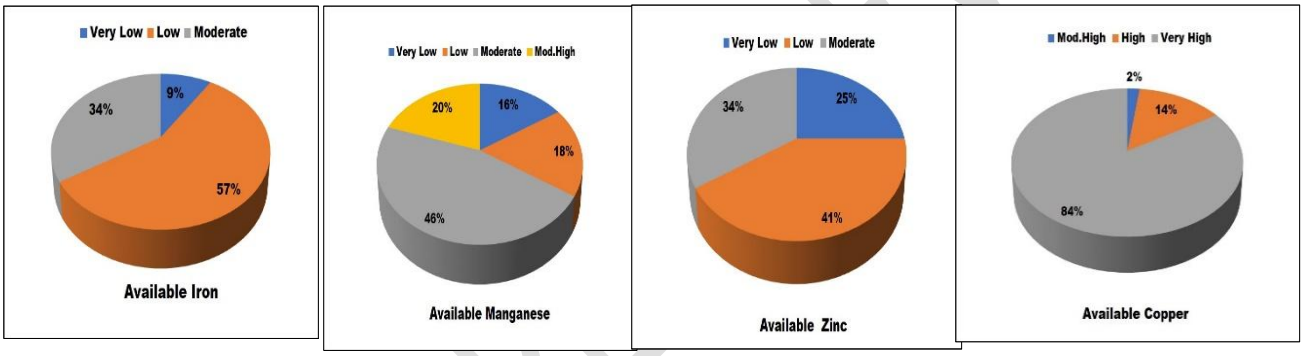

Fig 3: Categorization of soil available Fe, Mn, Zn, Cu from Washim road farm

Conclusion:

The study has revealed that pH of soils were slightly to moderately alkaline in reaction having EC within the safe limit for crop cultivation. The soil organic carbon content was low to moderately high and was moderately calcareous to calcareous in nature. The available macronutrient status (N,P,K) very low to low in available nitrogen and moderate to moderately high in phosphorus and very high in available potassium status while low to medium in available Sulphur. In the soils of Washim road farm the availability of nitrogen, phosphorus increased with increase in organic carbon content. Availability of Sulphur increased with increase in available nitrogen. Data showed that available N status of Washim road farm soils was categorized under very low fertility. The soils of research farm were high in available Cu and low in available Fe, Mn, Zn. Fe, Mn, Zn categorized as low nutrient status. The situation therefore demands the adoption of appropriate management practices in order to boost soil fertility status. The practice may include such practices as site specific

nutrient management, increased use of organic nutrient sources, sustainable land used and cropping system and appropriate agronomic practices.

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