International Journal of Applied Research 2020; 6(7): 241-244

ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2020; 6(7): 241-244
www.allresearchjournal.com
Received: 04-05-2020
Accepted: 06-06-2020

Swati V Thombe
P.G. student, Student, Soil Science and Agricultural Chemistry, College of Agriculture, Nagpur, Maharashtra, India

WP Badole
Professor and Head, Soil Science and Agricultural Chemistry, College of Agriculture, Nagpur, Maharashtra, India

Pranita R Chaure
P.G. student, Student, Soil Science and Agricultural Chemistry, College of Agriculture, Akola, Maharashtra, India

Corresponding Author:
Swati V Thombe
P.G. student, Student, Soil Science and Agricultural Chemistry, College of Agriculture, Nagpur, Maharashtra, India

Study of soil fertility and correlation of soil properties of selected villages under Jalyukt Shivar in Nagpur district

Swati V Thombe, WP Badole and Pranita R Chaure

Abstract
This study was conducted to evaluate the soil fertility status of associated soils of selected villages in Nagpur district of Maharashtra and its relationship with important physico-chemical characteristics, macronutrient and micronutrient content of surface soils. The villages under study were, Shemda and Umtha from Narkhed tahsil and Dhurkheda from Katol tahsil of Nagpur district. Total 150 surface soil samples (0-20 cm) were collected, which includes 50 samples from each village.
The soil of selected villages Shemda, Umtha and Dhurkheda are clayey in texture, having bulk density varied from 1.23 to 1.57 Mg m^{-3} and hydraulic conductivity of soils varies from 0.70 to 1.30 cm hr^{-1}. The soils of study area were neutral to slightly alkaline in reaction with no salinity hazards. The organic carbon content in these soils showed low to moderately high in category (0.20 to 0.79%). The $CaCO_3$ content categorized under slightly to moderately calcareous in nature which ranges from 1.00 to 5.37 per cent.
The soils of Shemda, Umtha and Dhurkheda villages were observed in very low to medium in category for available nitrogen (107.8 to 347.6 kg ha^{-1}), medium to high in category for available phosphorous (13.0 to 35.6 kg ha^{-1}), high to very high for available potassium (254.0 to 394.0 kg ha^{-1}) and low to medium for available sulphur (6.65 to 20.0 mg kg^{-1}). The soils of study area is low to medium in DTPA-extractable iron (2.11 to 9.00 mg kg^{-1}), moderately high to high for copper (0.18 to 1.72 mg kg^{-1}) and manganese (4.02 to 8.46 mg kg^{-1}). The DTPA-extractable zinc was very low to moderately in category (0.20 to 1.86 mg kg^{-1}).
Correlation study revealed that, the yield is positively and significantly correlated with organic carbon (r= 0.545**), hydraulic conductivity (r= 0.521**) and available macronutrients like nitrogen (r= 0.539**), phosphorous (r= 0.501**), potassium (r= 0.289**) and sulphur(r= 0.316**). It also shows positive and significant correlation with DTPA-extractable micronutrients like iron (r= 0.354**), copper (r= 0.423**), manganese (r= 0.451**) and zinc and (r= 0.460**). The increase in organic carbon leads to increase in N, P, K and S.

Keywords: Soil fertility, correlation, micro nutrients, macro nutrients

1. Introduction
Soil is the most precious and natural resources of any nation. To meet the growing demand of food, fiber, fuel and fodder, soils are maintained in an excellent state of health. Soil fertility, compatibility and erodability are the elements of soil quality. Among these, the problem of decline in soil fertility endangers the maximum growth in productivity.
The physico-chemical properties of soil are important for the availability of nutrients in soil and thereby crop production. The crop production is mainly depends on the fertility status of soils. That's why it is important to apply the recommended doses of fertilizer and it is essential to check the fertility status of soils.
Physical indicators are related to the arrangement of solid particles and pores. Such as topsoil depth, bulk density, porosity, aggregates stability, texture, crusting and compaction.
Chemical indicators includes measurements of soil pH, salinity, organic matter, phosphorus concentrations, cation exchange capacity, nutrient recycling and concentration of elements that may be potential contaminants (heavy metals, radio- active compounds etc.) or those that are needed for plant growth and development.
Macronutrients (N, P, K and S) and micronutrients (Zn, Fe, Mn and Cu) are important soil elements that control its fertility. Soil fertility is one of the important factor controlling yield

of the crops. Soil characterization in relation to evaluation of fertility status of the soils of an area or a region is an important aspect in context of sustainable agriculture production.

2. Materials and Methods

The survey was carried out on the soil of Shemda and Umtha villages from Narkhed tahsil and Dhurkheda village from Katol tahsil of Nagpur district. The area is almost uniform plain and topography with medium to deep black soils, formed from parent material basalt. The selected villages of both the tahsil had grown the crops in kharif as well as in rabi season. Orange, cotton and soybean are the important major crops. Other than these crops wheat, jowar, rice, tur, moong, gram also taken by the farmers.

Total 150 surface soil samples (0-20 cm) were collected from the selected villages of Nagpur district which includes 50 surface soil samples from each village after harvest of crops. The collected soil samples were air dried and grind with the help of mortar and pestle and sieve through 2 mm sieve and for the determination of organic carbon, soil samples further passed through 0.5 mm sieve. These soil samples was stored in polythene bags and were subsequently analyzed for mechanical parameters such as bulk density (Blake and Hartz, 1986) [1], hydraulic conductivity (Richard, 1954) [13] and soil texture (Bouyoucos,1936) [2], physico-chemical parameters like pH, EC (Jackson, 1973) [5], organic-C (Walkley and Black, 1934) [1], $CaCO_3$ (Piper, 1966) [12], available nitrogen (Subbiah and Asija, 1956) [16], phosphorous (Olson and Sommer,1982) [11], potassium (Jackson, 1973) [5] and sulphur (Chesin and Yein, 1951) [3] and micronutrients like Fe, Cu, Mn and Zn (Lindsay and Norvell, 1978) [8]. Relationship of crop yield, soil properties, macro and micronutrients with each other.

3. Results and Discussion

The analysis of soil texture was undertaken by analyzing selective 30 surface soil samples (10 samples from each village) from total 150 samples. The soils of study area are clayey in texture. The lowest content of sand was recorded at Shemda village (10.3%) and its highest content at Dhurkheda (22.6%). The lowest content of silt and clay was recorded at village Dhurkheda (21.6 and 48.3%) and its highest content was recorded at Shemda (30.1%) and Umtha (68.6%) respectively.

The bulk density of soils of Shemda (1.27 to 1.52 Mg m^{-3}), Umtha (1.23 to 1.52 Mg m^{-3}) and Dhurkheda (1.25 to 1.57 Mg m^{-3}) indicates the soils have good aeration. The hydraulic conductivity of Shemda, Umtha and Dhurkheda varies from 0.70 to 1.36 cm hr^{-1}, 0.70 to 1.30 cm hr^{-1} and 0.70 to 1.28 cm hr^{-1} respectively.

The pH of soil varied from neutral to slightly alkaline in reaction (6.63-8.90). The pH value of Shemda, Umtha and Dhurkheda ranges from 6.63-8.10, 7.81-8.23 and 7.09-8.50. The electrical conductivity of Shemda, Umtha and Dhurkheda ranges from 0.21 to 0.49, 0.21 to 0.86 and 0.22 to 0.48 dS m^{-1} respectively.

The organic carbon content of Shemda, Umtha and Dhurkheda ranges from 0.22-0.73, 0.20-0.38 and 0.25-0.79 per cent respectively. The organic carbon content of selected villages varied from low to moderately high in category.

The $CaCO_3$ content of Shemda varied from 1.30-4.52 per cent, which indicates that the soils were slightly to moderately calcareous in nature, Umtha ranges from 1.0-5.0 per cent and Dhurkheda 2.12-5.37 per cent.

The available nitrogen was low in major portion having the range 107.8-347.6 kg ha^{-1}. The nitrogen content in Shemda, Umtha and Dhurkheda categorized from 107.8-321.2 kg ha^{-1}, 102.9-299.2 kg ha^{-1} and 122.5-347.6 kg ha^{-1} respectively. The level of phosphorous in study area was medium to high in category (13.0-35.6 kg ha^{-1}) i.e. in Shemda it was 14.3-32.9 kg ha^{-1}, for Umtha 13.0-30.6 kg ha^{-1} and for Dhurkheda it was 16.3-35.6 kg ha^{-1}. The selected village's falls under moderately high to very high in potassium content i.e. in Shemda (266.8-392.0 kg ha^{-1}), Umtha (254.0-380.8 kg ha^{-1}) and Dhurkheda (265.0-394.0 kg ha^{-1}). The sulphur content of Shemda, Umtha and Dhurkheda ranged from 9.67-18.21, 10.08-20.0 and 6.65-16.96 mg kg^{-1} respectively.

The DTPA-extractable iron of selected villages Shemda, Umtha and Dhurkheda was categorized under low to medium in range (2.11-9.00 mg kg^{-1}). The copper content was low to very high as (0.18-1.72 mg kg^{-1}) and the manganese content was moderately high to high (4.02-8.46 mg kg^{-1}). Whereas, the zinc content was in very low to moderately high (0.20-1.86 mg kg^{-1}).

Correlation Study

Correlation of soil properties with available macro nutrients and yield of crops (Cotton, orange and soybean) of selected villages i.e., Shemda, Umtha and Dhurkheda of Katol and Narkhed tahsil of Nagpur district was carried out. The data regarding crop yield of selected farmers from Shemda, Umtha and Dhurkheda villages of Nagpur district.

The result revealed that, the farmers growing their crops by using integrated nutrient management practices received high yield of orange (20 t ha^{-1}), cotton (20.6 q ha^{-1}) and soybean (18 q ha^{-1}) at Shemda, Umtha and Dhurkheda villages respectively.

Relationship of crop yield, soil properties and macronutrients with each other

The crop yield has showed significant and negative correlation with bulk density (r= -0.492**) and had significant and positive correlation with hydraulic conductivity (r= 0.521**), organic carbon (r= 0.545**). The crop yield also had significant and positive correlation with macronutrients like available nitrogen (r= 0.539**), phosphorous (r= 0.501**), potassium (r= 0.289**) sulphur (r= 0.316**).

The bulk density was negatively and significantly correlated with organic carbon (r= -0.924**), available nitrogen (r= -0.907**), phosphorous (r= -0.861**), potassium (r= -0.601**) and sulphur (r= -0.825**).

The hydraulic conductivity was significant and positive correlation with organic carbon (r= 0.923**) and available macronutrients like nitrogen (r= 0.920**), phosphorous (r= 0.903**), potassium (r= 0.479**) and sulphur (r= 0.797**).

The organic carbon showed significant positive correlation with available nitrogen (r= 0.987**), phosphorous (r= 0.959**), potassium (r= 0.581**) and sulphur (r= 0.774**) Most of the soil nitrogen as estimated based on the organic matter present in the soil. There is definite relation of organic carbon with available nitrogen. Hence, organic carbon status of the soil can predict the available nitrogen which shows positive relationship. Similar result was found by Khan *et al.*, (2017) [7] states that, the most of the soil nitrogen is found in organic form, therefore, the available nitrogen is positively correlated with organic carbon in Kanchipur district (Nepal) and Sharma *et al.*, (2006) [15] showed that the organic carbon was positively and significantly correlated with potassium in the soils of Kargil district of cold arid region of Ladakh also Marsonia *et al.*, (1986) [9] studied on the fractions of sulphur in seven soil profiles from dry farming regions of Saurashtra and reported that the significant positive relationship between heat soluble sulphur with organic carbon content of soil. Similar result also found by Kundu and Mukhopadhyay (2005). Calcium carbonate showed that negative and significant correlation with available sulphur (r= -0.216**).

Amongst the macronutrients the nitrogen showed positive and significant correlation with available phosphorous (r= 0.958**), potassium (r= 0.596**) and sulphur (r= 0.769**) and available potassium was also showed positive and significant correlation with nitrogen (r= 0.596**), phosphorous (r= 0.543**) and sulphur (r= 0.444**).

Table 1: Correlation of crop yield, soil properties and macronutrients with other.

Soil properties	Yield	Organic Carbon	Avail. N	Avail. P	Avail. K	Avail. S
Yield	-	0.545**	0.539**	0.501**	0.289**	0.316**
Bulk density	-0.492**	-0.925**	-0.907**	-0.861**	-0.601**	-0.825**
Hydraulic conductivity	0.512**	0.923**	0.920**	0.903**	0.479**	0.797**
pH	-0.091	-0.109	-0.112	-0.052	0.020	-0.162*
Electrical conductivity	-0.088	-0.006	-0.003	-0.021	0.067	0.130
Organic carbon	0.545**	-	0.988**	0.959**	0.581**	0.774**
$CaCO_3$	0.076	0.051	0.049	0.048	0.069	-0.216**
Avail. N	0.539**	0.988**	-	0.958**	0.596**	0.769**
Avail. P	0.501**	0.959**	0.958**	-	0.543**	0.746**
Avail. K	0.289**	0.581**	0.596**	0.543**	-	0.444**
Avail. S	0.316	0.774**	0.769**	0.746**	0.444**	-

*Significant at 5% level (r= 0.159) **Significant at 1% level (r=0.208)

Relationship of crop yield, soil properties, macro and micro nutrients with DTPA-extractable micronutrients.

The pH showed negative and significant correlation with DTPA extractable copper (r= -0.225**). The electrical conductivity and calcium carbonate showed negative and significant correlation with DTPA extractable iron (r= -0.261** and r= -0.336**) respectively.

The organic carbon also showed negative and significant correlation with iron (r= -0.418**).Amongst the macronutrients the available nitrogen, phosphorous, potassium and sulphur showed positive and significant correlation with iron (r= 0.711**, r= 0.690**, r= 0.366** and r= 0.800**), manganese (r= 0.862**, r= 0.872**, r= 0.420** and r= 0.752**) and zinc (r= 0.884**, r= 0.885**, r= 0.501** and r= 0.779**) respectively.

Table 2: Correlation of crop yield and macronutrients with DTPA-extractable micronutrients.

Soil properties	DTPA-extractable micronutrients			
	Fe	Cu	Mn	Zn
Yield	0.354**	0.423**	0.451**	0.460**
pH	-0.153	-0.225**	-0.066	-0.136
Electrical conductivity	-0.261**	-0.029	0.067	0.089
Organic carbon	-0.418**	-0.044	0.079	0.020
$CaCO_3$	-0.336**	0.002	-0.047	0.027
Avail. N	0.711**	-0.847**	0.862**	0.884**
Avail. P	0.690**	-0.795**	0.872**	0.885**
Avail. K	0.366**	-0.570**	0.420**	0.501**
Avail. S	0.800**	-0.726**	0.752**	0.779**
DTPA-Fe	-	-0.713**	0.747**	0.754**
DTPA-Cu	-0.713**	-	-0.749**	-0.791**
DTPA-Mn	0.747**	-0.749**	-	0.833**
DTPA-Zn	0.754**	-0.791**	0.883**	-

Significant at 5% level (r=0.159) **Significant at 1% level (r=0.208)

Amongst the micronutrients iron had negative correlation with copper (r= -0.713**), and had positive correlation with manganese (r= 0.747**) and zinc (r= 0.754**). The content of copper showed negative and significant correlation with DTPA extractable manganese (r= -0.749**) and zinc (r= -0.791**). Further it showed that the manganese had positive and significant correlation with DTPA extractable zinc (r= 0.833**).

As per the study, the yield is positively and significantly correlated with iron (r= 0.354**), copper (r= 0.423**), manganese (r= 0.451**) and zinc (r= 0.460**).

References

1. Blake GR, Hartz KH. Methods of soil analysis, Soil Science Society of America, 1986, 363-382.
2. Bouyoucos GJ. Directions for making mechanical analysis of soils by the hydrometer method. Journal of Soil Science. 1936; 4:225-228.
3. Chesnin L, Yien CH. Turbidimetric determination of available sulphate, Soil Science Society of America proceeding. 1951; 15:149-151.
4. Eswaran H. An assessment of the soil resources of Africa in relation to productivity. 1988; 77(1):1-18.
5. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd. New Delhi. India, 1973.
6. Johnston AE. Soil organic matter, effects on soil and crop. Soil use and management, 2(3), 97-105.
7. Khan AI, Uranw NL, Yadav RN, Singh YV, Durgawati P, Renu Y. Evaluation of soil fertility status from Kanchanpur district, far-western development region of Nepal. International Journal of Current Microbiology and Applied Science. 2017; 6(3):961-968.
8. Lindsay WL, Norvell WA. Development of DTPA soil test for zinc, iron, manganese and copper. Journal of Soil Science Society of America. 1978; 42:421-248.
9. Marsonia PJ, Patel MS, Koria PJ. Status and distribution different forms of sulphur in profiles of calcareous soils of Saurashtra, Gujrat Agriculture University research journal. 1986; 11(2):45-51.
10. Meena HB, Sharma RP, Rawat US. Status of Macro and Micronutrients in some soils of Tonk District of

Rajasthan. Journal of the Indian Society of Soil Science. 2006; 54(4):508-512.
11. Olson SR, Sommer LE. Phosphorous method of soil analysis, chemical and microbiological properties, ed., Agron. 1982; 2(2):403-430.
12. Piper CS. Soil and plant analysis Adelaide, Australia, 1996.
13. Richards LA. Diagnosis and improvement of saline and alkali soils, USDA Handbook no. 60, USDA Washington D.C, 1954.
14. Shalini Kulshrestha HS, Devenda SS, Dhindsa. Studied on causes and remedies of water and soil pollution in Sangamner town of pink city. Indian Journal of environmental sciences. 2003; 7(1):47-52.
15. Sharma VK, Dwivedi SK, Ahmed Z. Status of available major and micronutrients in soils of Kargil district of cold arid region of Ladakh. Annual Plant and Soil Research. 2006; 8(2):175-176.
16. Subbaih BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soil. Current Science. 1956; 25:259-260.
17. Walkley NM, Black AI. Estimation of organic carbon by chromic acid titration method, Soil Science. 1934; 25:259-263.