Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(4): 532-535
Received: 13-05-2019
Accepted: 15-06-2019

Dipanjali Mishra
Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

YV Singh
Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Sukirtee
Department of Soil Science and Agricultural Chemistry, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Correspondence
YV Singh
Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Macro nutrients status and their relationship with soil physicochemical properties of Naugarh block, Chandauli district, Uttar Pradesh, India

Dipanjali Mishra, YV Singh and Sukirtee

Abstract
An area's evaluation of soil fertility is crucial for sustainable agricultural manufacturing. The macro nutrients direct soil fertility and regulate crop development and yield. Naugarh block in Chandauli district of Eastern Uttar Pradesh was chosen in the current inquiry and the status of accessible soil macronutrients and their connection to physicochemical characteristics were researched. The district of Chandauli has distinct crop systems and are irrigated by the Ganga Canal and the Bhakhra Canal. Five different villages were selected from the Naugarh block, several samples of surface soil (0-15 cm) were taken from each of the identified locations and the standard laboratory procedures were used for the analysis of physicochemical properties and also status of available nutrients such as N, P, K, S, Ca and Mg. Study results indicate that Naugarh block soils in organic carbon content are medium to high. Of the 52 samples collected, 100% of the samples were found to be low in available nitrogen status and found low to medium in available phosphorus, potassium and sulphur, but Ca and Mg were found to be adequate.

Keywords: Macro nutrient status, physico-chemical properties and soil etc.

Introduction
In developing nations like India where the land-person ratio is quickly declining, increasing agricultural productivity with minimum or no harm to the environment and sustainability is the only way to meet the requirements of agricultural produce. An important aspect in sustainable farming is the characterization of soils for the assessment of fertility status for a specific locality or region. The primary components of the soil that control their fertility and crop yield are nitrogen, phosphorus, potassium, sulfur, calcium and magnesium. In latest years, the reaction effectiveness of chemical fertilizer nutrients has greatly decreased under intensive agriculture due to imbalanced and insufficient fertilizer use combined with low effectiveness of other inputs. Variation in the supply of nutrients is a natural phenomenon, their is deficiency of some others while the others are available in sufficient quantity According to (Lal and Singh 1998) [7], physical, chemical and biological degradation involves the soil quality degradation process with regard to productivity or fertility. Without the use of macro nutrient fertilizers in order to overcome existing imbalances, we cannot improve crop productivity. There is inadequate data on the study area's nutrient accessibility. The current research was therefore conducted to understand the status of macro nutrient of Naugarh block soils and an effort has also been made to correlate the soil's macro nutrient content with other soil properties.

Uttar Pradesh, which is located in the north-eastern part of the nation is the fourth largest state in India. The state covers an area of about 3, 42, 239 sq. km representing 10.41 % of area of the nation and 5.67 % of the population of the nation (Census, 2012 Provisional data). The largest state which mainly relies on agriculture depends largely on the timely arrival of monsoon. At present the rainfall pattern in the state has shown 650mm of rainfall from the southwest monsoon during this present monsoon season and 1000 mm from the south-east monsoon against the standard 741 mm rainfall where the soils have medium infiltration rate, low to medium fertility, low depth and medium water holding capacity in some fields (Mathur *et al.*, 2006) [8]. Groundwater availability is restricted or less due to precipitation scarcity. The plants are suffering from moderate to elevated temperatures. The ability to hold water in lighter soils is insufficient. In particular, the soil's nitrogen and organic carbon status is small to medium. The soils have a good potassium supply.

In the present study, various macronutrients were assessed and according to their fertility status appropriate fertilizers were recommended. This research was carried out to cover the

status of macronutrients in the Naugarh block soils of Chandauli district and its correlation with physicochemical properties.

Materials and Methods

Soil sampling and analysis

A Khurpi was used to randomly sample the surface soil of the farmer's field from five different villages of the Chandauli district's Naugarh block to a depth of 0-15 cm in V shape. The soil sample was carefully blended and approximately half a kilogram of composite samples were taken for assessment from the farmer's field. Soil's physical characteristics viz. bulk density, particle density (Black *et al*., 1965) [2] and porosity were measured. Soil pH was determined with glass electrode in (1:2.5) of soil: water suspension. Electrical conductivity in (1:2) of soil: water suspension was determined. (Jackson, 1973) [5]. The organic carbon in soil samples were analyzed (Walkley and Black, 1934) [16], available N by alkaline permanganate method (Subbiah and Asija, 1956) [15], available P by calorimetric method (Olsen *et al*., 1954) [13], available K by ammonium acetate (Hanyway and Heidal, 1952) [4], available S by turbidimetric method (Chesnin and Yien, 1950) [3] and available Ca and Mg determined (Jackson, 1973) [5].

Statistical analysis

A Statistical analysis of relationship between different soil characteristics and macronutrients present in soil and plant were determined using correlation coefficients:

$$r = \sqrt{\frac{SP\ (xy)}{SS(x), SS\ (y)}}$$

Where:
r = Correlation coefficient
SP (x y) = Sum of product of x, y variables
SS (x) = Sum of square of x no. of variable
SS (y) = Sum of square of y variable

Results and Discussion

Soil physicochemical characteristics

The pH, electrical conductivity, bulk density and organic carbon are discussed at Table 1. The soil pH of the soils varied between 5.5 and 7.9 with a mean value of 6.80. Of the five villages, 86.53% of soil specimens were neutral (7.0 to 7.4), 13.46% of soil specimens were in nature mildly saline (pH 8.0 to 8.8). Naugarh block soils were neutral to moderately alkaline in response. The neutral to alkaline pH may be due to medium to high base saturation of the soils. Similar result was also reported by Yadav (2011) [16] in arid region of Rajasthan.

Naugarh block's electrical conductivity ranged from 0.04 to 0.20 dSm-1 with an average of 0.08 dSm-1. The smallest EC (0.04) was reported in Persiya village, while Persiya also recorded the largest EC (0.20). These values show that in these soils, salinity is not a issue. Mathur *et al.* (2006) [9] also noted similar results in Rajasthan's Northwest plain soils.

Bulk density and Particle density of the soils varied from 1.09-1.45 and 2.04-2.70 Mg m^{-3}, respectively with the average values of 1.30 and 2.42 Mg m^{-3}. Porosity of soil ranged from 34.44 to 50.0%, with a mean of 45.43%.

Organic carbon estimates are used to evaluate the quantity of organic matter present in soil. The percentage of organic carbon content of the soil varied between 0.11 and 1.80 with the average value of 0.78 (Table 1). This clearly shows that the soils of Naugarh block in their organic carbon status is medium to high. These findings are in accordance with the results supported by Singh *et al.* (2015) [13].

Status of available N, P and K in soil

Table 2 and its subparts showed the status of N, P and K. Naugarh's available nitrogen content varied between 109.76 and 260.28 kg ha^{-1} with a mean value of 163.83 kg ha^{-1}. The smallest nitrogen content (109.76 kg ha^{-1}) was noted in Persiya village soils where the largest nitrogen content (260.28 kg ha^{-1}) was reported in Bataoba village soils. Of 52 soil specimens from 5 Naugarh block villages, 100% of soil specimens were discovered to be low in nitrogen. Climate has a major effect on nitrogen supply, peak soil samples were in low category resulted due to low organic carbon in soil and precipitation uncertainty. The same pattern of result was also observed by Jatav and Mishra. (2012) [6] in soils of Janjgir district of chattisgarh, India.

The accessible phosphorus content of the soil varied between 9.01 and 42.96 kg ha^{-1} with a mean value of 18.61 kg ha^{-1} in these soils. The smallest P content (9.01 kg ha^{-1}) was discovered in Majhganwa village whereas the largest P content (42.96 kg ha^{-1}) was discovered in Bataoba village. Of the 52 soil specimens gathered, 65.38% of soil specimens were found to be medium, 19.23% of soil specimens were discovered to be small, and 15.38% were discovered to be high in P. A fixed phosphorus pool comprising inorganic phosphate compounds that are insoluble and organic compounds resistant to soil microbes can cause greater accessibility of phosphorus. These results also support the conclusions in the Rajasthan district of Tonk soil reported by Meena *et al.* (2006) [10].

The available potassium content in these soils varied between 87.36 and 364 kg ha^{-1} with a mean value of 194.35 kg ha^{-1} K. K's smallest value (87.36 kg ha^{-1}) was discovered in Majhganwa village soils whereas K's largest value (364 kg ha^{-1}) was discovered in Persiya village. Of the 52 soil specimens gathered, 53.84% of soil specimens were found to be medium, 36.53% of soil specimens discovered to be small in potassium. Singh *et al.* (2015) [13] also noted similar outcomes.

Status of available secondary macronutrient in soils of Naugarh

Tables 2, 3, 4 provided the status of available S in Chandauli district, Naugarh block soils. The available sulphur content of the soils of Naugarh block varied between 5.10 and 28.16 kg ha^{-1} with a mean of 8.11 kg ha^{-1}. The smallest (5.10 kg ha^{-1}) sulphur value discovered in Majhganwa village soils and the largest S content (28.16 kg ha^{-1}) was also discovered in this village. Of the complete soil samples gathered, 86.53 percent of the soil samples were found to be small, 11.53 percent were discovered to be medium and 1.92 percent were found to be high in sulphur content in Naugarh block soils. So Naugarh's soils have been discovered to react well to S fertilization. These results also agree with Basavaraja *et al.* (2017) [1] in the soils of eight taluks of Hassan district, Karnataka.

Table 1: Physico-chemical properties of soils of Naugarh block

Soil characteristics	Range	Mean	S.D.
pH (1:2.5)	5.5-7.9	6.8	0.67
E.C. (dSm^{-1})	0.04-0.20	0.08	0.03
B.D. (Mg m^{-3})	1.09	1.45	0.08
P.D. (Mg m^{-3})	2.04	2.70	0.14
OC (%)	0.11	1.80	0.32

Table 2: Status of available macronutrients in soils of Naugarh block

Soil characteristics	Range	Mean	S.D
Available N (kg ha^{-1})	109.76-260.28	163.83	46.25
Available P (kg ha^{-1})	9.01-42.96	18.61	7.46
Available K (kg ha^{-1})	87.36-364.0	194.35	93.37
Available S (kg ha^{-1})	5.10-28.16	8.11	3.19

Table 3: Status of available macronutrients in soils of Naugarh block

Soil characteristics	Range	Mean	S.D
Available N (kg ha^{-1})	109.76-260.28	163.83	46.25
Available P (kg ha^{-1})	9.01-42.96	18.61	7.46
Available K (kg ha^{-1})	87.36-364.0	194.35	93.37
Available S (kg ha^{-1})	5.10-28.16	8.11	3.19

Table 4: Classification of OC% and available macronutrients status in soils of Naugarh block

S. N.	Elements	No. of samples	% of samples	No. of samples	% of samples	No. of samples	% of samples
		Low		Medium		High	
1	OC%	10	19.23	15	28.84	27	51.92
2	N	52	100	0	0	0	0
3	P	10	19.23	34	65.38	8	15.38
4	K	19	36.53	28	53.84	5	9.61
5	S	45	86.53	6	11.53	1	1.92

Correlation between physicochemical properties and available macro nutrients in the soils of Naugarh block

Data on the correlation between accessible macronutrients and soil properties in the Naugarh block's top soils were shown in Table 5 showing that no soil parameter was found to be favorably correlated with available nitrogen. The close connection between available N and organic carbon may be due to the combination of nitrogen with organic matter, N adsorption with organic matter, and soil humus complicated adsorption of Ammoniacal N. PH, organic carbon, bulk density, particle density, EC, porosity, however, have a adverse connection with nitrogen that is not significant. Mathur *et al.* (2006) [9] recorded a similar relationship that the DTPA-extractable zinc was non-significantly and negatively correlated with pH and with organic carbon negatively.

There is no significant positive correlation between the available phosphorus and organic carbon (r=0.111), pH(r=0.149), EC(r=0.169), porosity(r=0.053). Bulk density(r=-0.057) and particle density(r=-0.017) are related to phosphorus in a negative way. This suggests that the existence of organic matter improves phosphorus accessibility. Jadav and Mishra (2012) [6] also noted similar outcomes in soils in the Mewar area of Rajasthan and Chhattisgarh district of Janjgir.

There was a non-significant and positive correlation between K and organic carbon (r=0.092) accessible. This could be due to the development in the presence of organic matter of a favourable setting. There is also a non-significant positive relationship between K and pH (r=0.185), EC(r=0.046) and non-significant negative correlation with bulk density(r=-0.111), particle density (r=-0.104) and porosity (r=-0.011). Yadav (2001) [16] also observed a similar connection.

Available sulphur in these soils exhibits a non-significant adverse connection with pH (r=-0.125) and porosity (r=-0.053). Sulphur in these soils exhibits a non-significant positive correlation with organic carbon (r=0.052), bulk density (r=0.080), particle density (r=0.024) and EC (r=0.049). These findings were found similar with the findings of Meena *et al.* (2006) [10] that organic carbon and accessible sulphur have a favorable correlation (r=0.051). This connection existed due to the association of most of the sulphur status with organic matter.

Table 5: Correlation between physicochemical properties and available macro nutrients in the soil of Naugarh block

	N	P	K	S
pH	-0.080	0.149	0.185	-0.125
EC	-0.043	0.169	0.046	0.049
OC	-0.052	0.111	0.092	0.052
BD	-0.149	-0.057	-0.111	0.080
PD	-0.112	-0.017	-0.104	0.024
POROSITY	-0.010	0.053	-0.011	-0.053

* Significant at 5%, ** Significant at 1%

Conclusion

It can be concluded that the soils of Naugarh block are classified under neutral to mildly saline soils in nature. The organic carbon spectrum in these soils under research are medium to elevated. Of the 52 soil specimens gathered, 100% discovered low in nitrogen, available phosphorus discovered low to medium (65.38%) and available potassium also reported in comparable patterns. Available secondary macronutrient S is in range of small to medium.

Acknowledgement

The authors are highly grateful to the Head of the Department of soil Science and Agricultural Chemistry for providing necessary facilities to run this work.

References

1. Basavaraja PK, Dey P, Saqeebulla HM, Yogendra ND. Geo-reference based soil fertility status in Hassan district of Karnataka, India for development of nutrient plan. Indian Journal of Soil Conservation. 2017; 45(2):141-147.
2. Black CA. Soil Plant relationship 2nd edition New York., Pub. USA, 1965, 515-516.
3. Chesnin L, Yien CH. (Turbidimetric determination of available sulphate. Soil Science Society of America Proceedings. 1951; 15:149-151.
4. Hanway J, Heidal H. Soil analysis methods as used in Iowa State, College and Soil Testing Laboratory. Iowa Agriculture. 1952; 57:1-31.
5. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi, 1973.

6. Jatav GK, Mishra VN. Evaluation of soil fertility status of available N, P & K in inceptisol of Baloda block of Janjgir district of Chhattisgarh, Journal of Progressive Agriculture. 2012; 3(1):24-29.
7. Klute A, Dirksen C. Hydraulic conductivity of saturated soils. In method of soil Analysis, ed. A. Klute. American Society of Agronomy and Soil Science Society of America, Madison United States. 1986, 694-700.
8. Lal R, Singh BR. Effect of soil degradation on crop productivity in East Africa. Journal of Sustainable Agriculture. 1998; 13(1):15-41.
9. Mathur GM, Deo R, Yadav BS. Status of zinc in irrigated North-West Plain soils of Rajasthan. Journal of the Indian Society of Soil Science. 2006; 54(3):359-361.
10. Meena HB, Sharma PR, Rawat US. Status of macro-micronutrients in some soils of Tonk district of Rajasthan. Journal of the Indian Society of Soil Science. 2006; 54:508-512.
11. Muhr GR, Datta NP, Subramany NS, Dever F, Lecy VK, Donahue RR. Soil testing in India, USDA, Publication, 1965, 120.
12. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soil by extraction with sodium by carbonate. Circular 939. U.S. department of Agriculture: Washington DC. 1954, 1-19
13. Singh YV, Jat LK, Santosh K. Meena Available Macro Nutrient Status and their Relationship with Soil Physico-Chemical Properties of Sri Ganganagar District of Rajasthan, India Journal of Pure and Applied Microbiology. 2015; 9(4):2887-2894.
14. Subbiah BV, Asija GL. A rapid procedure for estimation of available nitrogen in soil. Currant Science. 1956; 25:259-260.
15. Walkey A, Black I. Armstrong. An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Science. 1934; 37(1):29-38.
16. Yadav BK. Micronutrient status of soils under legume crops in arid region of Western Rajasthan, India. Academic Journal of Plant Sciences. 2011; 4(3):94-97.