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Available Micro Nutrient Status and their Relationship with Soil Properties of Narayanpur Block, District Mirzapur, Uttar Pradesh, India

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A B S T R A C T

In view of scanty information on micronutrient status of soils of Uttar Pradesh the present study was undertaken to study the available micronutrient status and their relationship with physicochemical properties of the soils of Narayanpur block district Mirzapur, having different cropping systems and irrigated by Ganga canal, Dams, Tube well tributaries. Total 75 samples collected from 7 villages of Narayanpur block and analyses in the laboratory using standard laboratory procedures. Results of the study indicate that soils of Narayanpur block have Mn, Fe, and Cu is found at sufficient to high level and Zn found deficient to marginal in soils. These micronutrients need to be added to soils keeping in view of agriculture with high yielding varieties and maintain sufficient status for long duration.

Introduction

Soil is a component of the lithosphere and biosphere system. It is a vital natural resource on which is the supporting life system and socio economic development depends. The crisis of land degradation was mainly related to increasing population pressure. The per capita cultivable land has been declined 0.32 ha in 1950 through 0.14 by the turn of the century to less than 0.1 ha by 2020. The challenge in thus being faced not only of increasing productivity on sustainable basis, but also of the preserving and maintaining of soil resource bases for the posterity (FAO, 1993). Soil is crucial for life on earth and is thus one of the most important natural

resources. It is at the heart of terrestrial ecology, and an understanding of the soil system is a key to successful human use of the land and environmental harmony. Soil is the base of the life, which support all the living organisms of the earth. Plant depends upon the nutritional status of the soil for their growth and completion of the life cycle. The soils of Narayanpur block, Mirzapur district in eastern Uttar Pradesh exhibits catenaries relationship with increasing drainage intensity, change in colour from yellowish brown or reddish brown to reddish gray and texture from loam to clay loam, clay or silt clay and sandy loam. The Narayanpur block,

Mirzapur district, state Utter Pradesh. Geographical area of Mirzapur is 4521 km^2 (latitude 23^0 52″to 25^0 32″N and longitude 82^0 72″to 83^0 33″E). In Mirzapur geography of Narayanpur (latitude 25^0 08″ to 25^0 13″N and longitude 82^0 54″to 82^0 9″E) southeast side is bounded by sonbhadra and Chandauli District. Northeast is bounded by Bihar state and east side is bounded by Jharkhand state, south side is bounded by Chhattisgarh state and the west side is bounded by Madhya Pradesh state. The soil of this region varies considerably but most of the area has alluvial soils, experiences tropical climate with an average annual minimum and maximum temperature 10°C and 47°C respectively. Rainfall is the main source of groundwater recharge in the study area and the region receives an average annual rainfall of ~750 mm. Most of the agricultural activities mainly depend on rainfall, since the availability of groundwater resources is scarce. Present investigation was useful in judging the deficiency of various element and thereby use of fertilizers depending on their status. The present study was conducted for covering study of correlation between physico-chemical properties and available micronutrients in the soils of Narayanpur block district Mirzapur.

Materials and Methods

Study area

Mirzapur is an Eastern most district of Uttar Pradesh state in North India. The town of Mirzapur is the district headquarters and located between Geographical area of Mirzapur is 4521 km2 (latitude 230 52″to 250 32″N and longitude 820 72″to 830 33″E). Mirzapur is situated at the point where the side of Ganga river. Narayanpur block is one of the four tehsil of Mirzapur district, located Eastern-western area. The climate of Narayanpur block is marked by with large variation of temperature, where mean monthly maximum temperature during summer months (May to July) reaches up to 47°C and minimum temperature during winter months (December and January) sometimes goes as low as 0°C or even less The Mean annual rainfall is 750 mm. The region is irrigated by the Ganga River and the Dams. Major crops (Table 1) of the region are Rice, wheat, Groundnut, Soyabean, grams, barely and sugarcane and Horticultural crop like fruits, vegetable, and flowers.

Soil sampling and analysis

Surface soil of the farmer's field from different village of Narayanpur block of Mirzapur district, were sampled randomly to a depth of 0-15 cm in V shape with the help of Khurpi from 7 villages of Narayanpur block was presented in table 1. 10 soil samples were collected from each village. The Soil sample was mixed thoroughly and about a half kilogram of composite samples from farmer's field at different villages was taken for analysis. Collected surface soil sample (0-15 cm depth) were brought into laboratory and dried in shade at room temperature. Air dried soil samples were crushed with the help of wooden roller and sieved through 2 mm sieve. Finally dried soil samples were kept in a polythene bag for further physico-chemical analysis (Table 2).

Statistical analysis

The relationship between different soil characteristics and macronutrient contents in soils were determined using correlation coefficients formula

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

r = Correlation coefficient
SP (xy) = Sum product of x, y variables
SS (x) = Sum of square of x variable
SS (y) = Sum of square of y variable.

Results and Discussion

Status of available micronutrients viz. Fe, Mn, Zn and Cu in soil Deficiency of micronutrients is spreading in soils at faster rate, use of high fertilizer and high yielding crop varieties under intensive cropping system have further accelerated the process of micronutrient deficiency in soil solution. Therefore it has become imperative to monitor soils from Fe, Mn, Zn and Cu. These rating limits are irrespective of crops or soils. Critical limits for soil test (values available Fe, Mn, Zn and Cu) used in India is summarized in table 3.

The data presented in table 4 and its subparts indicates that the available Fe content of these soils was ranged from 1.8 to 17.8 mg kg-1 with an average value of 9.02 mg kg-1. The lowest (1.8 mg kg-1) range was observed in village Bagahi, while highest (17.8 mg kg-1) range was observed in village Jalalpur Maafi with S.D. value of 4.19 and C.V. value of 46.40%. Out of 75 soil samples 18.66% soil samples found deficient, 40% soil samples were marginal in iron content. However it is to note that 31 soil samples have high available iron (Table 3) (Pandey *et al.,* 2013 and Singh *et al.,* 2015).

The available Mn content of these soils was varied from 0.4 to 27 mg/kg with a mean value of 3.44 mg kg-1. The lowest (0.42 mg kg-1) value of Mn was recorded in Bagahi village, while highest (27 mg kg-1) value of Mn content was observed in Kolana village with the S.D. value of 3.62 and C.V. 27.62% (Table 4). Out of 108 soil samples 1.34% soil samples were found deficient, 98% soil samples found marginal in Manganese content (Table 5). However it is to note that 74 soil samples have these results were confirmatory with obtained by Kumar and babel (2011.) Pandey *et al.,* (2013) and Singh *et al.,* (2015).

The data revealed that the available Zn content in soils of Narayanpur block was ranged from 0.8 to 5.8 mg/kg with a mean value of 0.8 mg kg^{-1} The lowest (0.8 mg kg^{-1}) Zn content was recorded in Bagahi. village, while highest (5.8 mg kg^{-1}) Zn content was observed in soil of Kolana with S.D. value of 1.15 and C.V. 50.43 Out of 75 soil samples 1.34% soil samples were found deficient, 16% soil samples were found marginal and 82.66% found high in Zn content. The result are in confirmation with the finding of Yadav (2011).

The available Cu content of Narayanpur block soil was ranged from 0.8 to 4.2 mg kg^{-1}with an average value 2.1 mg kg^{-1}. The result are in conformation with the finding of Pandey *et al.,* (2013) in soils of Dewas district of Madhya Pradesh. The lowest (0.8 mg kg^{-1}) value of Cu content was recorded in Nakhara. Village where as highest (4.2 mg kg^{-1}) value of Cu was recorded in soil of Bagahi. with S.D. value of 0.82 and C.V. value of 39.04%. Out of total 75 soil samples collected from villages' 0% soil samples were found sufficient, 0% soil samples were sufficient,0% soil samples were found marginal and 100% found high in Cu content. The result are in confirmation with the finding of Pandey *et al.,* (2013) and Singh *et al.,* (2015).

Correlation between physico-chemical properties and available nutrients in the soil of Narayanpur block

The data on correlation between soil properties and available nutrients in top soil of Narayanpur block were presented in table 6. The available Cu in this soil negatively significant correlation with Bulk density (r=-.327**).The Cu in soil negatively Non-significant correlation with EC (-.179), Organic Carbon (-.111), Cu is positively correlation with pH (r=.090) and particle density. These results were confirmatory with

results obtained similar were shown by Chaudhary *et al.,* (2013) in soil of Coimbatore.

The available Mn a negatively significant correlation with bulk density (r=-.260*) and negatively Non-significant correlation with EC. Fe in soil positively non-significant correlation pH, particle density and organic carbon. The available Fe content in these soils were positively significant correlated with pH (r=.349**), particle density (r=.321**), and Organic Carbon (r=.532**).The Fe in soil

positively Non-significant correlation with bulk density (r=.174) and Negatively Non-significant correlation with EC (r=-.154). These results were confirmatory with results obtained observed positively correlated with EC (r= -0.126) as reported by Yadav (2010) and Singh *et al.,* (2015). The available zinc content in these soils were negatively Non-significant correlated with EC (r=-.029), bulk density (r=-.034) and particle density (r=-.180). Fe in soil positively Non-significant correlation with pH, and Organic Carbon.

Table.1 Description of sampling sites

S.N.	Village Name	Cropping pattern
1.	Nakahara	Groundnut-Potato, Rice-Potato, Groundnut-Pea
2.	Raipuriya	Groundnut-Wheat, Rice-Wheat, Groundnut-Pea
3.	Jalalpur Maafi	Groundnut-Potatoes, Bajra-Wheat, Soyabean-Potato
4.	Dixitpur	Rice-Wheat-Mustard, Bajra-Sugarcane, Groundnut-Potato
5.	Kailahat	Groundnut-Pea-Mustard, Soyabean-Potato, Rice-Wheat
6.	Bagahi	Groundnut-Potato, Rice-Potato, Groundnut-Pea
7.	Kolana	Rice-Wheat-Mustard, Rice-Sugarcane, Bajra-Wheat

Table.2 Procedure used for physico-chemical analysis of soil

Properties	Applied Method	Reference
1. Physical properties		
2. Bulk density(g cm^{-3})	Pycnometer	Black *et al.,* (1965)
3. Particle density(g cm^{-3})	Pycnometer	Black *et al.,* (1965)
4. Chemical properties		
5. pH	Glass electrode pH meter	Jackson (1973)
6. EC(dsm^{-1})	Electrical conductivity meter	Jackson (1973)
7. Organic carbon (%)	Wet oxidation method	Walkey and Black (1934)
Zn, Fe, Cu and Mn(mg kg^{-1})	DTPA solution method	Lindsay and Norvell (1978)

Table.3 Rating limits for soil test values used in India

S.N. level	Element	Deficient	Sufficient	High
1.	Fe	<4.50	4.50-9.00	>9.00
2.	Mn	<3.5	3.5-7.0	>7.0
3.	Cu	<0.20	0.20-0.40	>0.40
4.	Zn	<0.60	0.60-1.2	>1.2

Table.5 Classification available Micro nutrients status content in soils of Narayanpur block

S.No	Elements	No. of Samples	% of Samples	No. of Samples	% of Samples	No of Samples	% of
1	Fe	14	18.66	30	40	31	41.34
2	Mn	1	1.34	0	0	74	98.66
3	Cu	0	0	0	0	75	100
4	Zn	1	1.34	12	16	62	82.66

Table.6 Correlation between physico-chemical properties and available micronutrients in the soil of Narayanpur block

	Cu	Mn	Fe	Zn
1. pH	.090	.104	.349**	.070
2. EC	-.179	-.149	-.154	-.029
3. BD	-.327**	-.260*	.174	-.034
4. PD	.056	.021	.321**	-.180
5. OC	-.111	.133	.532**	.115

These results were confirmatory with results obtained observed negatively correlated with EC (r= -0.126) as reported by Yadav (2011).

It can be concluded that, the soil from Narayanpur block of Mirzapur district. The soil of studied area found iron out of 75 soil samples 18.66% soil samples found deficient, 40% soil samples were marginal and 41.34% high in iron content. The Mn out of 75 soil samples 1.33% soil samples were found deficient, 0% found in marginal and 98.67% soil samples found High in Manganese content. While Zn out of 75 soil samples 1.34% soil samples were found deficient, 16% soil samples were found marginal and 82.66% found high in Zn content. Out of total 75 soil samples collected from villages' 0% soil samples were found sufficient, 0% soil samples were found marginal and 100 found high in Cu content.

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