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STUDIES OF SOME SOIL HEALTH PARAMETERS OF DISTRICT BAREILLY, U. P. (INDIA)

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ABSTRACT

To complete the life cycle of plants, organic matter as well as elements or nutrients are very essential. Soil constitutes are most important resource for agriculture. Besides climatic conditions, the texture and depth of the soil, nutrients, salinity and alkalinity, drainage go to determine the crop which would be suitable for an area. Physical characters of soil are related to the arrangement of particles and pores i.e. depth of top soil, porosity, water holding capacity, texture, crusting and aggregation. Each element is specific to plant and cannot replace by any other element. The deficiency of a particular element produces clear symptoms of disease which not appears in absence of any other element. This disease can be cured by the adding of that particular nutrient or element. The element is directly involved in nutrition of the plant. In present study all fifteen blocks of district bareilly has been surveyed from April to August 2018 and soil samples collected from every site and analyzed at U.P State regional soil and culture laboratory, Bilva, Bareilly. pH of all fifteen sites ranges between 6.5-7.8. Soil samples S3, S4, S5, S15 were alkaline and S9, S10, S11 slightly acidic. Organic carbon content was minimum in soil sample S14 and maximum in S9. Other samples from S1 to S15 show medium value. Estimation of phosphorus content ranged from 4.5-13.50 kg ha^{-1}. Amount of potash varied between 134-179 kg ha^{-1} during this study. Higher value of organic sulphur was 15.70 ppm in S15. Medium value of zinc content reported from S3, S7, S8, S9 and rest low value of zinc. Soil samples S7, S14 were subsequently deficient and rich in iron. Soil of entire district was rich in mn content. Copper content in soil ranged from 0.13-0.88 ppm. Electrical value ranged from 0.4 – 0.8 S m^{-1}. Soil of Bareilly district shows imbalance of nutrients in some blocks. It can be reclaimed by adding required amount of particular type of nutrients and manage through control of use of chemical fertilizers in the soil. The use of organic manure in place of chemical fertilizers maintains the soil health and increase nitrogen concentration in the soil in different forms.

(Key words: Soil constituents, water holding capacity, texture)

INTRODUCTION

The District Bareilly forms a part of Rohilkhand division, is located in the north western part of U.P. and lies between latitude 280 01' and 280 54' north and longitude 780 58' and 790 47' east. Its maximum length from north to south is about 96 Km and breadth from east to west is about 75 Km. For the administrative convenience the Bareilly district has been divided into six tehsils and fifteen blocks, which are Tahsil- Baheri (Blocks-Baheri, Damkhoda, Shergarh), Tahsil-Meerganj (Blocks- Meerganj, Fatehgarh West), Tahsil-Bareilly sadar (Blocks- Bhojipura, Kyara , Birthi Chainpur), Tahsil-Aonla (Blocks- Alampur Jafrabad, Ramnagar, Majhgawan), Tahsil- Nawabgan,j (Blocks-Nawabganj, Bhadpura), Tahsil-Faridpur (Blocks- Faridpur , Bhuta). According to the classification followed by the State soil survey organisation, the soil of the district can be classified into three major groups based on its texture and composition characteristics. Bareilly Type-1 (Tarai soils), Bareilly Type-2 (Khadar or low-land soils), Bareilly Type-3 (Upland or Bangar soils). These Soil constituents are most important resource for agriculture. Besides climatic conditions, the texture and depth of the soil, nutrients, salinity and alkalinity, drainage go to determine the crop which would be suitable for an area. Physical characters of soil are related to the arrangement of particles and pores i.e. depth of top soil, porosity, water holding capacity, texture, crusting and aggregation. These characters show the limitations of root growth, seedling development and transfer of water within the soil particles. Various size of particles form mineral portion of soil and mineral component constitutes the soil mass. On the basis of size, the soil particles may be gravels, sands, silts and clays. Separation of soil particles below 2 mm in diameter is known as mechanical analysis. Soil particles as sand, silt and clay determine the physical properties of soil and cultivation.

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Soil texture represents at varying moisture conditions, the degree and kind of cohesion and adhesion of soil material.

To complete the life cycle of plants, organic matter as well as elements or nutrients are very essential. Organic matter in the soil develop from plants and animal remains. Plant tissues are the primary source of organic matter and carbon. Secondary source of organic matter is animal remains. Organic carbon comes from fresh plant tissues added to the soil; they are rich in carbon and poor in nitrogen. This matter binds soil particles into structural units called aggregates and help to maintain granular condition, which require for aeration and permeability of soil. Water holding capacity is increased by organic matter, which increases the amount of available water in sandy and loamy soils. Organic matter serves as a reservoir of chemical elements that are essential for plant growth. Most of the soil nitrogen occurs in organic combination and also considerable quantity of phosphorus and sulphur exists in organic forms.

Each element is specific to plant and cannot replace by any other element. The deficiency of a particular element produces clear symptoms of disease, which not appears in absence of any other element. This disease can be cured by the adding of that particular nutrient or element. The element is directly involved in nutrition of the plant. Plants contain small amounts of 90 or more elements, only 16 of which are known to be essential to plants. Most important nutrients for soil health analysis are phosphate, potash, sulphur, zinc, iron, manganese and copper. Physiological role of nutrient directly affect the plant growth. Phosphorus helps in root formation, cell division and makes plants more drought resistance, increases protein and minerals content in plants while, potassium imparts resistance to diseases and increases the presence of other elements like nitrogen and potash. Potassium also helps in the increase of the size of root and tubers. Sulphur is responsible for chlorophyll formation and stimulates root growth, seed formation and nodule formation. It is a constituent of enzymes and other proteins. Number of enzymes produces by the presence of zinc. It helps in the formation of growth hormones (auxins) and affects the uptake of phosphorus by plants and also acts as a catalyst in chlorophyll formation. The oxygen carrier in oxidation-reduction reaction is iron. It is also responsible for chlorophyll formation and several metabolic reactions. Manganese acts as an activator of many enzymes and also helps in chlorophyll synthesis. Copper is a constituent of certain protein for electron transfer reactions.

MATERIALS AND METHODS

Fifteen soil samples were collected in the depth of 0-20 cm from the surface of soil from all administrative blocks of district in the last four months from April to August of 2018. Sample number 1-3 from block-Majhgawan, Ram nagar and Alampur jafrabad of Tehsil Aonla on 30.04.2018, sample 4-9 from block-Bhojipura of Tahsil Bareilly sadar, block- Damkhoda, Baheri, Shergarh of Tehsil Baheri and block- Meerganj, Fahtehganj west of Tehsil meerganj on 16.07.2018, sample 10 -12 from block-Bithri chainpur of Tehsil Bareilly sadar, block-Bhuta and Faridpur of Tehsil Faridpur on 20.07.2018, sample 13-14 from block-Nawabganj, Bhadpura of Tehsil Nawabganj and sample 15 from block-Kyara of Tehsil Bareilly sadar on 02.08.2018 were collected for estimation.

The collected samples were preserved in polybags for further process. All the chemical analysis conducted at U.P State regional soil and culture laboratory Bilva, Bareilly. pH of samples measured by digital pH meter (Brady and Weil, 2007). Organic carbon content in soil samples estimated through (Walkley-Black,1934) rapid titration method. Phosphorus availability in soil determined by bicarbonate test (Olsen and Cole, 1954). Potash content in soil was tested by flame photometer (Barnes *et al.,* 1945). Electrical conductivity of soil analysed by the help of conductivity meter (McNeal *et al.,* 1970)). Sulphur in samples estimated by colorimetric method using barium chromate (Nemeth 1964). Zinc, Fe, Mn and Cu measured through AAS method (Walsh, 1950).

RESULTS AND DISCUSSION

Results of chemical analysis are indicated in table 1.

When table 1 compared with table 2 and 3, it represents the soil health of Bareilly district as follows: -

pH

One of the most important physicochemical parameter of soil is pH. It mainly affects the growth of soil micro flora and mineral nutrients. Observed pH in all fifteen soil samples ranged between 6.5 -7.8. The samples S3 Block-Bhojipura, S4 Block- Damkhoda, S5 Block- Baheri, and S15 Block- Bhuta were alkaline and S9 Block- Alampur jafrabad, S10 Block-Majhgawan, S11 Block- Ram nagar were slightly acidic. Verma *et al.* (2005) reported that soil pH varied from 8.16 to 9.62 in Mansa district of Punjab.

Organic carbon

It is the indicator of nitrogen content in the soil. The source of organic carbon in the soil contains crop residue, animal manure, green manure and organic fertilizers etc. Organic carbon value ranges from 0.15% - 1.2%. Minimum content of organic carbon estimated in sample S14 of block-Nawabganj, while maximum in S9 of block-Alampur jafrabad. Other samples from S1 to S15 showed medium value of organic carbon. Results of Tewari *et al.* (2016) also resemble with this study. They analyzed organic carbon from 0.07% to 1.64% in different regions of Uttrakhand state.

Phosphorus

It ranged from 4.5 (kg ha^{-1}) – 13.50 (kg ha^{-1}) in all the samples. Out of 15 soil samples S2, S6, S9 had high and rest very low content of phosphorus. Soil of all blocks of Bareilly district except Block-Bithrichaipur, Block- Shergarh, and Block- Alampur jafrabad is deficient in nutrient

Table 1. Chemical analysis of soil samples

Sr. No.	Soil Parameters	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
1	pH	7.30	7.20	7.50	7.70	7.80	7.10	7.20	7.20	6.80	6.50	6.50	7.20	7.30	7.10	7.80
2	Organic carbon (%)	0.45	0.75	0.60	0.60	0.30	0.75	0.75	0.90	1.20	0.97	0.97	0.45	0.30	0.15	0.22
3	Phosphorus (kg ha^{-1})	4.50	13.50	4.50	4.50	4.50	13.50	9.00	9.00	13.50	4.50	9.00	9.00	9.00	9.00	9.00
4	Potash (kg ha^{-1})	179	156	134	156	179	179	156	179	179	134	134	134	134	156	179
5	E.C. (Electrical conductivity) S m^{-1}	0.60	0.50	0.60	0.40	0.50	0.80	0.60	0.70	0.40	0.50	0.50	0.50	0.60	0.80	0.70
6	Organic sulphur (ppm)	13.76	11.55	11.10	12.3	10.96	10.38	14.25	11.75	11.50	14.28	13.00	9.80	9.27	12.76	15.70
7	Zinc (ppm)	0.09	0.14	0.80	0.55	0.50	0.60	0.64	0.61	1.10	0.51	0.42	0.10	0.11	0.07	0.02
8	Fe (ppm)	8.97	10.24	7.59	7.12	6.32	7.33	3.27	7.04	6.95	7.10	7.65	7.57	10.81	11.04	6.04
9	Mn (ppm)	7.17	5.41	6.50	7.32	8.01	9.54	8.85	9.98	7.32	5.64	6.98	4.98	5.66	3.92	4.90
10	Cu (ppm)	0.30	0.27	0.49	0.65	0.88	0.40	0.13	0.14	0.59	0.45	0.22	0.37	0.33	0.27	0.40

S1.Block-Kyara, S2.Block-Bithri Chainpur, S3.Block-Bhojipura (Tahsil- Bareilly Sadar), S4.Block- Damkhoda, S5.Block-Baheri, S6.Block-Shergarh (Tahsil- Baheri), S7.Block-Meerganj (Tahsil- Meerganj), S8.Block- Fahtehganj west (Tahsil-Meerganj), S9.Block- Alampur jafrabad, S10.Block- Majhgawan, S11.Block- Ram nagar (Tahsil- Aonla), S12.Block-Bhuta, S13.Block-Faridpur (Tahsil-Faridpur), S14.Block-Nawabganj, S15.Block- Bhuta (Tahsil-Nawabganj).

Table 2. Fertility categories of primary nutrients

Primary nutrients	Minimum value	Low value	Medium value	High value
Organic carbon (%)	0.20	0.21-0.50	0.51-0.80	>0.80
Phosphorus (kg ha^{-1})	10.0	10.1-20.0	20.1-40.0	>40.0
Potash (kg ha^{-1})	50.0	51-100	101-250	>250

Table 3. Fertility categories of secondary nutrients

Secondary nutrient	Low value	Medium value	High value
Sulphur (ppm)	10.0	10.1-15.0	> 15.0
Zinc (ppm)	0.6	0.61-1.2	> 1.20
Fe (ppm)	4.0	4.10-8.0	> 8.0
Cu (ppm)	0.2	0.21-0.4	> 0.4
Mn (ppm)	2.0	2.10-4.0	> 4.0

phosphorus. These results match with Pathak (2010) and Singh *et al.* (2016), who reported that presence of phosphorus ranged from medium to high category in Kapurthala district of Punjab.

Potash

Amount of potash varied between134 – 179 (kg ha^{-1}) in present study of soil. All the samples have medium content of potash. Similar results were also noted by Ganorkar and Chinchmaiatpure (2013). They compared samples and reported potassium content between 180- 648 kg ha^{-1} from Rajura Bazar, in Warud Tahsil in Amravati District (Maharashtra) India.

Organic sulphur

Higher value of sulphur was 15.70 ppm in S15, which indicates rich quantity of organic sulphur in the soil of Block-Bhuta. All other samples showed medium value. Amara *et al.* (2017) measured same values of sulphur content from 7.5 ppm-12.3 ppm from Mugali and Venkatapur villages of Karnataka district.

Zinc

S3, S7, S8 and S9 had medium value of zinc 0.80 ppm, 0.64 ppm, 0.61 ppm, 1.10 ppm and rest lowered in zinc content. Dave *et al.* (2017) assessed same zinc parameter from villages of Radhanpur Taluka, Patan District of Gujrat. They observed the range of zinc between 0.7 to 0.74 ppm.

Iron

Soil of S7 Block- Meerganj was iron deficient (3.27 ppm) while, S2 Block-Bithri chainpur good, S13 Block-Faridpur was having 10.81ppm iron, S14 Block- Nawabganj (11.04 ppm) was rich in iron. This result is similar with Baishya and Sharma (2007), who estimated 13.68-19.64 ppm iron from Dimoria Development Block of Assam.

Manganese

Soil of entire district was rich in mn content as it showed above the 4 ppm value except S14 block-Nawabganj, which ranged of medium value 3.92 ppm. This estimation matches with Mali *et al.* (2002). They observed 0.2-4.6 ppm from Vasantdada sugarcane research and development farm, Manjari, Pune, Maharastra.

Copper

Copper content in soil samples ranges from 0.13 – 0.88 ppm. Sample S5 Block- Baheri was rich in copper. Shukla and Behera (2017) also estimated copper in the range of 0.20-18.5 ppm from Bhopal.

E.C. (Electrical conductivity)

The measurement of conductivity is used for measure the current that gives an idea of soluble salt present in the soil. Conductivity values ranged from 0.4 Sm^{-1} to 0.8 Sm^{-1}. Conductivity of S4, S9, was less as compared to all other samples. Tele and Ingole (2015) also checked same electrical conductivity. They assessed less than one to more than one from Amaravati, India.

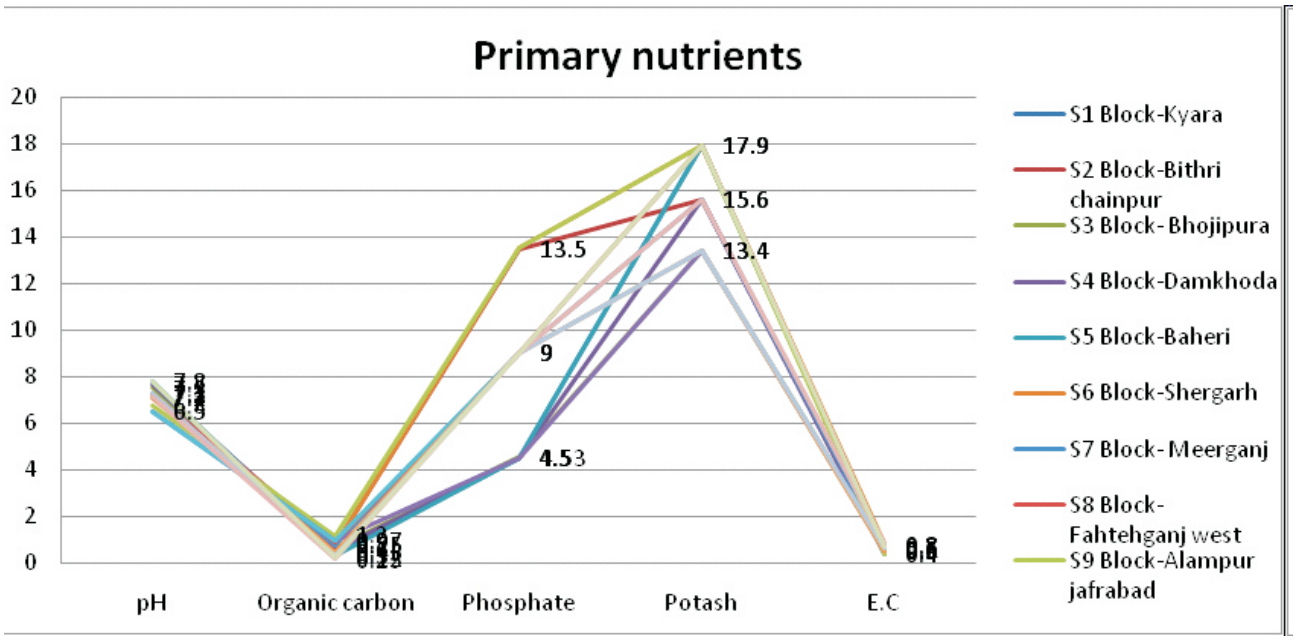

Fig. 1. Primary nutrients comparison

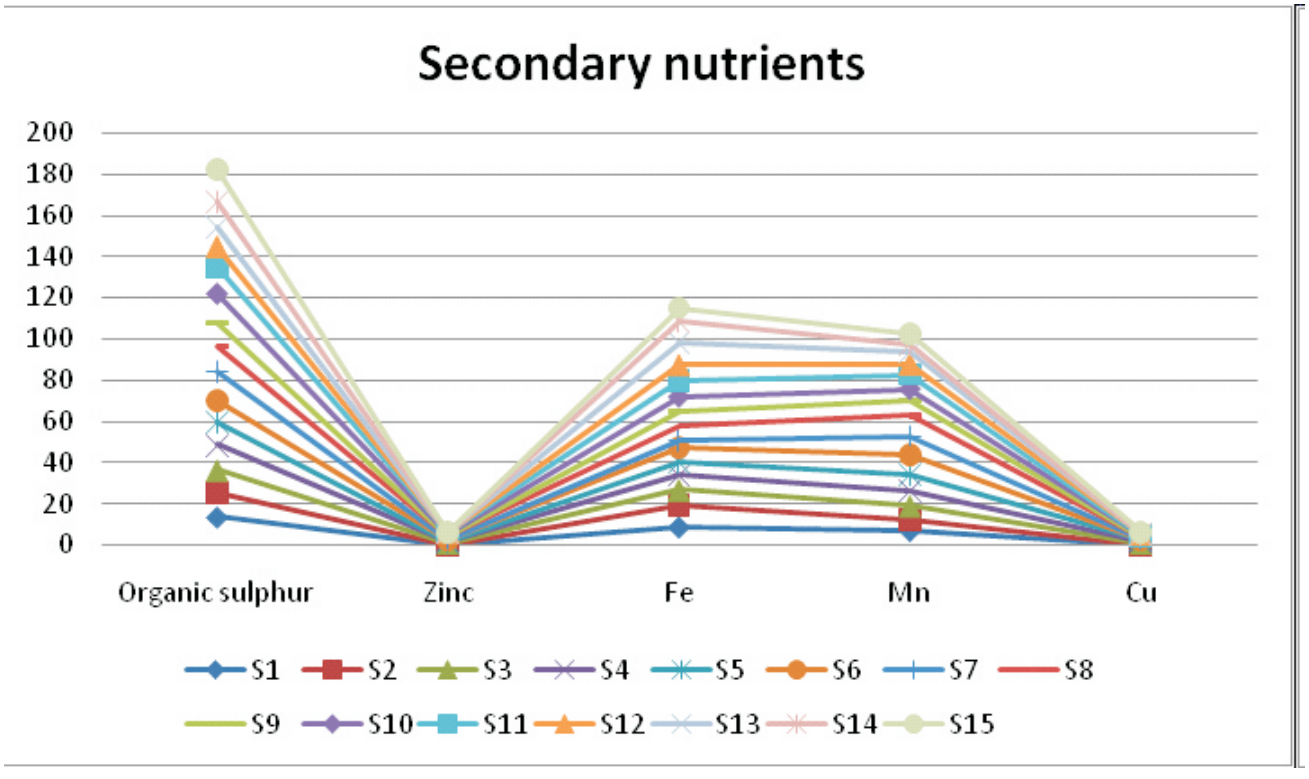

Fig. 2. Secondary nutrients comparison

It is very necessary to study the soil health for plant growth and soil management. Soil of Bareilly district shows imbalance of nutrients in some blocks as discussed in result of this physiochemical analysis. It can be reclaimed by adding required amount of particular type of nutrients and manage through control of use of chemical fertilizers in the soil. The use of organic manure in place of chemical fertilizers maintains the soil health and increases nitrogen concentration in the soil in different forms.

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