International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(3): 2112-2116

Received: 14-03-2018
Accepted: 17-04-2018

Mohit Sen
Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences- Allahabad, Uttar Pradesh, India

Tarence Thomas
Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences- Allahabad, Uttar Pradesh, India

P Smriti Rao
Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences- Allahaba, Uttar Pradesh, India

Ajay Pratap Singh
Assistant Chemist, Directorate of Geology & Mining, Lucknow, Utter Pradesh, India

Correspondence
Mohit Sen
Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences- Allahabad, Uttar Pradesh, India

Assessment of macronutrients in soils of robertsganj block in Sonbhadra district, Uttar Pradesh, India

Mohit Sen, Tarence Thomas, P Smriti Rao and Ajay Pratap Singh

Abstract
A survey of chemical properties of soil of 'Robertsganj' block in 'Sonbhadra' district in subtropical area of Uttar Pradesh was carried out in 2017-18. The main objective of this study is to collect information on soil pH, electrical conductivity, organic carbon, N, P, and K. For this 20 sampling points were selected from different location. Soil samples collected at a depth of 0-15 cm. with the help of this study we found the value of pH in varied from 4.02 to 7.95. It is acidic to alkaline in nature. The EC value is varied from 0.393 to 4.009 dS m^{-1} and it is normal to highly salinity soil. The value of OC% found is varied from 0.13% to 0.78% and this is very low to medium high level. The value of available nitrogen (kg ha^{-1}) found is varied from 172.89 kg ha^{-1} to 468.39 kg ha^{-1} and this is low to medium level. The value of available phosphorus (P_2O_5 in kg ha^{-1}) found is varied from 85.2 kg ha^{-1} to 1.29 kg ha^{-1} and this is high level to low level. The value of available potassium (K_2O in kg ha^{-1}) found is varied from 53.76 kg ha^{-1} to 282.24 kg ha^{-1} and this is low level to high level.

Keywords: sonbhadra district, chemical properties, Block, Village, Soil depth, Introduction, etc.

Introduction
"The thin layer of soil covering the earth's surface represents the difference between survival extinction for most terrestrial life." (John W. Doran and Timothy B. Parkin). Soil survey is the only tool for making the inventory of soils (Upadhyay *et al.,* 2014) [15]. Soil is the basic resource for agriculture and its proper management is essential to sustain agricultural production and maintain soil productivity. Soil testing is one of the best available tools, to ascertain the physical characteristics and nutrient status of a field so as to assess the fertilizer requirements for a crop or a cropping system or for knowing the reclamation requirements if the soil is saline/sodic in nature.

Fertilizer application based on soil tests is the best available approach for harvesting the economically viable potential yields of crops by increasing input use efficiency and maintaining soil health (Singh and Brar, 2005) [12]. The production of sugarcane crop is more in the north-central part of India. Wheat is the state's principal food crop and sugarcane is the main commercial crop. About 70% of India's sugar comes from Uttar Pradesh. Uttar Pradesh is the state of India whose capital is Lucknow. At present 75 districts are there in Uttar Pradesh. The total geographical area of the state is 243,290 sq. km.

Uttar Pradesh can be divided into three distinct hypsographical regions

1. The Shivalik foothills and Terai in the North
2. The Gangetic Plain in the centre
3. The Vindhya Hills and plateau in the south plateau

Uttar Pradesh is bounded Uttarakhand on the north-west, Haryana and Delhi on the west, Rajasthan on the south west, Madhya Pradesh on the south, Chhattisgarh and Jharkhand on south-east and Bihar on the east. Situated between 23°52'N and 31°28'N latitudes and 77°3' and 84°39'E longitudes, this is the fourth largest state in the country in terms of area, and the first in terms of population. The major soil type found in Uttar Pradesh is alluvial soil. All 3 types of alluvial soil such as riverine, coastal and deltaic alluvial soil are found in Uttar Pradesh. The state receives annual rainfall ranging from less than 710 mm to greater than 1750 mm in different areas. The percolation/water retention capacity, as well as the productive capacity of different soils, varies. Much of the area of Uttar Pradesh is covered by a deep layer of alluvium spread by the slow-moving rivers of the Ganges system.

Those extremely fertile alluvial soils range from sandy to clayey loam. The soils in the southern part of the state are generally mixed red and black or red-to-yellow.

Sonbhadra district or Sonebhadra is the 2nd largest district of Uttar Pradesh, India. Sonbhadra is the only district in India which borders four states namely Madhya Pradesh, Chhattisgarh Jharkhand and Bihar. Sonbhadra district is an industrial zone and it has lots of minerals like bauxite, limestone, coal, gold etc. Sonbhadra is called as Energy Capital of India because there are so many power plants. Sonbhadra lies between vindhya and kaimur hills, and its topology and environment prompted First Prime minister of India Pt. Jawahar Lal Nehru to refer to Sonbhadra as 'The Switzerland of India'. Sonbhadra has a relatively subtropical climate with high variation between summer and winter temperatures. The average temperature is 30 °C-46 °C in the summer and 2 °C-15 °C in the winter. The weather is pleasant in rainy season from July to October.

Materials and Methods

The present study was conducted in three stages *i.e.* soil survey and collection of samples and their analysis for different soil parameters. The details of materials used and technique adopted during the course of study are explained in this chapter. Robertsganj is a Block located in Sonbhadra district in Uttar Pradesh. Placed in rural region of Uttar Pradesh, it is one among the 3 blocks of Sonbhadra district. The block has 796 villages. Robertsganj is located at 24.7°N 83.07°E. It has an average elevation of 330 meters (1080 feet) from ground level. Robertsganj is located in the south-eastern ranges of the Vindhyanchal Mountain, from where the soil has been taken for analysis. The soil samples were collected from Robertsganj blocks viz., Lori and Gordiha village of Sonbhadra district (U.P.) (Fig. 1 and 2). 20 samples were collected with depths (0-15 cm). Statistical analysis was done using standard analysis of variance.

Fig 1: Map of Uttar Pradesh Study Area

Fig 2: Map of Sonbhadra District Study Area

The pH was determined in 1:2 soil water suspensions using Digital pH Meter (Jackson 1958) [6]. The EC was determined in 1:2 soil water suspensions using Digital Conductivity Meter (Wilcox 1950) [19]. The organic carbon was determined by Rapid Titration Method (Walkley, 1947) [17]. Available nitrogen is a term used to describe the fertilizers. The available N <250 kg ha^{-1} may be interpreted as low, 250-500 kg ha^{-1} as medium and >500 kg ha^{-1} as high. The soil was distilled with alkaline potassium permanganate as suggested by (Subbiah and Asija, 1956) [13] and the ammonia evolved was determined. The available phosphorous was extracted from soil by 0.5 M $NaHCO_3$ (pH 8.5) solution. Phosphorous in the soil extract is determined colorimetrically using a Photoelectric Colorimeter after developing molybdenum blue colour (Olsen *et al*., 1954) [8]. The exchangeable potassium is extracted from 1N NH_4OAC (pH 7.0) and K was determined by Flame Photometer **(**Toth and Prince, 1949) [14].

Results and Discussion

The observations regarding pH, EC, Organic Carbon, Nitrogen, Phosphorus, and Potassium extracted from soil are given in figures 3 to 5 and table No. 1. The figure 3 depicts the statistical accumulation of pH on villages and depth which was found to be significant at both levels. The highest value of pH is found in Gordiha village area at depth (0-15 cm) 7.95 and lowest pH value is found in Lori area at depth (0-15 cm) 4.02. Similar results were reported (Upadhyay and Chawla, 2014) [15].

The figure 4 depicts the statistical accumulation of EC on villages and depth which was found to be significant at both levels. The highest value of EC is found in Gordiha village at depth (0-15 cm) 4.009 dS m^{-1} and the lowest value of EC is found in Lori area at depth (0-15 cm) 0.393 dS m^{-1}. Similar results were reported (Upadhyay *et al.* 2014) [15].

The figure 5 depicts the statistical accumulation of organic carbon (%) on villages and depth which was found to be significant at both levels. The lowest to highest value of organic carbon is found in Gordiha village at depth (0-15 cm) 0.13% to 0.78% and similar results of Lori area. Similar results were observed by (Rao *et al.* 2016) [10].

The accumulation of available nitrogen on villages and the depth which was found are to be significant at both levels. The highest value of nitrogen is found in Gordiha village at depth (0-15 cm) 468.39 kg ha^{-1} and the lowest value of Nitrogen is found in Lori area at depth (0-15 cm) 172.89 kg ha^{-1}. Similar results were reported by (Upadhyay *et al.* 2014) [15].

The accumulation of available phosphorus on villages and the depth which was found to be significant at both levels. The highest value of phosphorus is found in Lori area at depth (0-15 cm) 85.2 kg ha^{-1} and, lowest value at depth (0-15 cm) 1.79 kg ha^{-1}. Similar results were reported by (Rao *et al.* 2016) [10].

The accumulation of available potassium on villages and depth which was found to be significant at both levels. The highest value of potassium is found in Lori area at depth (0-15 cm) 282.24 kg ha^{-1} and, lowest value at depth (0-15 cm) 53.76 kg ha^{-1} in same area. Similar results were reported by (Upadhyay *et al.* 2014) [15].

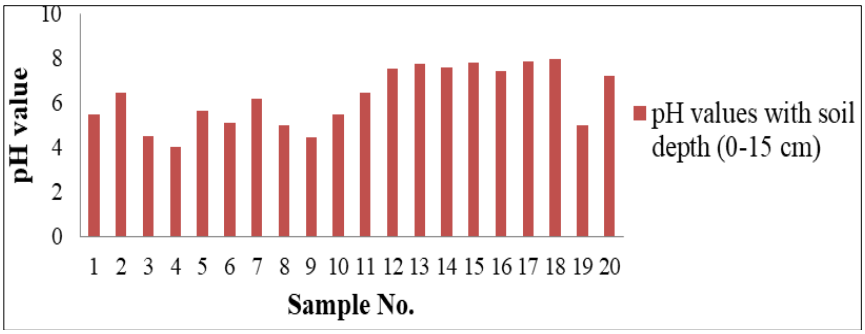

Fig 3: pH values of soil Robertsganj block regions, Uttar Pradesh at 0-15 cm depth, 2017-18.

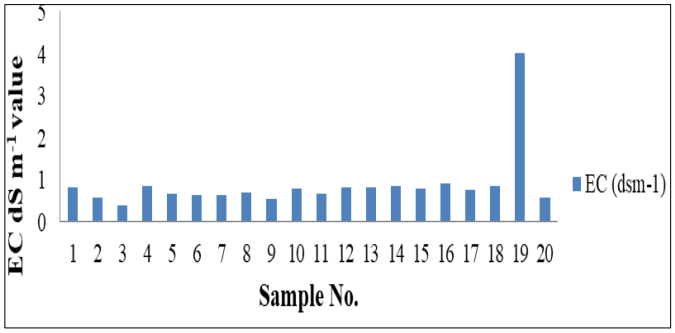

Fig 3: EC values of soils of Robertsganj block regions, Uttar Pradesh at 0-15 cm depth, 2017-18.

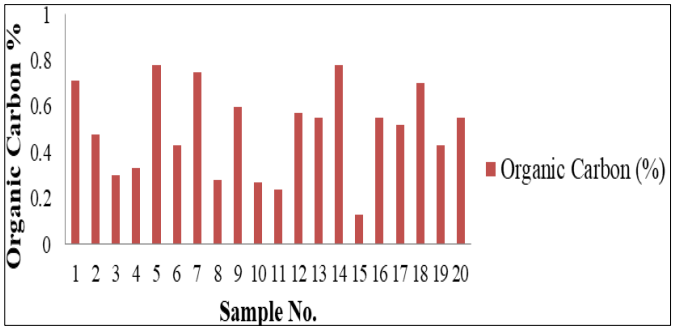

Fig 4: Organic Carbon values of soils of Robertsganj block regions, Uttar Pradesh at 0-15 cm depth, 2017-18.

Table 1: Available Nitrogen (kg ha^{-1}), Phosphorus (P_2O_5 in kg ha^{-1}), Potassium (K_2O in kg ha^{-1}) of soil of Robertsganj block regions, Uttar Pradesh at 0-15 cm depth, 2017-18

Sr. No.	Sample No. (0-15 cm)	Available Nitrogen (kg ha^{-1})	Available Phosphorus P_2O_5 (kg ha^{-1})	Available Potassium K_2O (kg ha^{-1})
1	1	172.8	11.51	80.64
2	2	194.9	18.30	94.08
3	3	289.2	3.42	67.2
4	4	223.1	10.86	134.4
5	5	279.7	52.6	282.24
6	6	298.6	78.6	120.96
7	7	270.3	1.79	188.16
8	8	226.3	70.40	67.2
9	9	213.7	85.2	53.76
10	10	204.3	75.61	94.08
11	11	289.2	16.36	67.2
12	12	257.7	19.42	67.2
13	13	392.9	11.29	80.64
14	14	396.09	9.13	147.8
15	15	298.64	12.99	188.1
16	16	468.3	6.10	67.2
17	17	282.9	14.74	107.5
18	18	399.2	1.29	67.2
19	19	433.8	24.81	80.64
20	20	424.3	8.72	107.5

Note: - Sampling Site Area; Soil Depth (0-15 cm)
Lori (Sample No. 1 to 10).
Gordiha (Sample No. 11 to 20).

Conclusions

Based on the present study, it can be concluded that the soils of study area were slightly alkaline in reaction and highly calcareous in nature. The highest value of nitrogen is found in gordiha village at depth (0-15 cm) 468.39 kg ha^{-1} and the lowest value of Nitrogen is found in Lori area at depth (0-15 cm) 172.89 kg ha^{-1}. Similar results were reported by (Upadhyay *et al.* 2014) [15]. It concluded that optimum nitrogen are found in gordiha village area. The application of FYM and fertigation significantly increased in crop production. The increase in crop yield with FYM was accompanied by the increase in total N, P and K uptake. The value of OC% found is varied from 0.13% to 0.78% and this is very low to medium high level. Addition of FYM significantly improved the soil organic carbon, available P, available K and microbial population.

Acknowledgement

Authors are sincerely thankful to Dr. A. A. David, Associate Professor, Dr. N. Swaroop, Associate Professor, Dr. (Ms.), Amreen Hasan, Assistant Professor, Department of Soil Science and Agricultural Chemistry of Naini agricultural institute, SHUATS, Allahabad, (UP).

References

1. Anonymous. Harmonization of wasteland/degraded lands datasets of India. Wasteland News. 2008; 23(4):50-53.
2. Anonymous. Munsell Soil Colour Chart. Munsell Colour Company Inc. 2441 N, Calvert Street, Baltimore, Maryland 21212, USA, 1971.
3. Black CA. Methods of soil analysis Vol.1. American Society of Agronomy, Madison, Wisconsin USA, 1965.
4. Brady NC, Weil RR. the nature and properties of soils (11th ed.). Prentice Hall, New York, 1996.
5. Chibba IM, Sekkhon GS. Effect of pH and organic carbon on – availability of nutrients in acid soils. Journal of the Indian Society of Soil Science. 1985; 3(3):409-411.
6. Jackson ML. Soil Chemical Analysis, Prentice Hall of India Private Limited, New Delhi, 1958.
7. Jain P, Singh D. Analysis the Physico-Chemical and Microbial Diversity of Different Variety of Soil Collected From Madhya Pradesh, India. Scholarly Journal of Agricultural Science. 2014; 4(2):103-108.
8. Olsen SR, Cole CVFS, Dean LA. Estimation of available phosphorous in soil by extraction with sodium bicarbonate U.S. Dept. Agr. Cric, 1954, 939.
9. Pandey A, Laxmi R, Tiwari J, Sharma RP. Distribution of available macro and micronutrients in soils of Dewas

District of Madhya Pradesh, India. Journal of multidisciplinary advance research. 2013; 2(2):108-114.
10. Rao PS, Thomas T, Singh Z. Assessment of macronutrients in soils of Bastar Plateau Region, Chhattisgarh, India. International journal of multidisciplinary research and development. 2016; 3(7):34-38.
11. Shaw E. Dean LA. the use of dithizone as an extractant to estimation the nutrient status of soil. Soil Sci. 1952; 73:341-344.
12. Singh M, Brar JS. The physico- chemical characteristics and fertility status of soil of Amritsar district of Punjab. J Res. Punjab agric. University. 2005; 42(1):19-27.
13. Subbiah BV, Asija CL. A rapid procedure for the estimation of available nitrogen in soil, Current Science. 1956; 25:259-260.
14. Toth SJ, Prince AL. Use of the Flame photometer technique in rapid soil tests for K and Ca. J Soil Sci. 1949; 41:445-446.
15. Upadhyay M, Chawla JK. Chemical characteristics of soil in parts of Dhamtari District of Chhattisgarh. IJMCA. 2014; 4(13):146-149.
16. Wagh GS, Chavhan DM, Sayyed, MRG. Physicochemical analysis of soils from Eastern part of Pune city. Universal Journal of Environmental Research and Technology. 2013; 3(1):93-99.
17. Walkley A. Critical examination of rapid method for determining organic carbon in soil, effect of variation in digestion condition and of inorganic soil constitutes. Soil Sci. 1947, 632-251.
18. Wang Y, Huang T, Lin Z, Li S, Wang R, Ce Y. Soil pH value, organic matter and macronutrients contents prediction using optical diffuse reflectance spectroscopy. Computers and Electronics in Agriculture. 2015; 1(11):69-77.
19. Wilcox LV. Electrical conductivity, Amer. water works Assoc. J. 1950; 42:775-776.