Anatomization of Soil Fertility Status of Chaka Block, Yamuna River Bank, Prayagraj, Uttar Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author ISR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors AAD and PS managed the analyses of the study. Author PS managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was carried at Sam Higginbottom university of Agriculture Technology and Sciences in the department of Soil Science and Agricultural Chemistry lab. In this study, a total of 24 soil samples were collected from eight different villages on 01 November 2020 in Chaka block of Prayagraj district and from each village 3 soil samples were collected and analyzed for their Physico-chemical parameters by using standard laboratory techniques. According to the critical limits of soil nutrients the results observed, 70 to 80% soil samples were in low to medium range for Nitrogen (N) (51-648 kg ha⁻¹), Phosphorus (P) (0 – 48 kg ha⁻¹) and Potassium (K) (78.4 – 392 kg ha⁻¹). The micro-nutrients (Zn, Fe, Mn, Cu) of soil samples are observed deficiency range due to inverse relationship with pH i.e., increase in pH causes reduction in availability of Zn, Fe, Mn, Cu. According to the Nutrient Index Values, Chaka block was found to be medium category for Organic carbon (2.25), Nitrogen (1.70), Phosphorous (2.29), and Manganese (1.70). Low
1. INTRODUCTION

Soil is the natural resources which need to be scientifically utilized for improving the productivity and economic condition of the country. Soil is the thin layer on earth surface which is formed before the drawn of human civilization and it regulates the nutritional status by that means reach the socio-economic condition of any biosphere. The capacity of soil to function as living ecosystem to sustain plants, animals and humans referred as soil health. The healthy soil gives us clean air and water, crops and forest, grazing lands, diverse wildlife and magnificent landscape and it perform major five functions such as regulating water, snowmelt and irrigation water movement, sustain living organism’s life and buffering potential pollutants, cycling nutrients- nitrogen, phosphorous, carbon and other nutrients are stored and transformed (USDA U.S. Salinity Laboratory Staff) [1].

Soil fertility management is effective tools for increasing productivity of agricultural soil that has high degree of spatial viability from the combined effects of physical, chemical and biological processes [2]. The Fertility status of the soils of an area or region is an important aspect for sustainable agricultural production whereas Nitrogen, Phosphorus and Potassium are major soil nutrient elements that control its fertility and yields of crops. There are 16 essential elements for plant growth absence of any one nutrient it will render the crop production. The essential plants nutrients are classified into Macro and Micro nutrients such as N, P, K, Ca, Mg, S and Cu, Fe, Mn, B, Zn…etc. Soil consists Nitrogen in forms of N2O, NO, NO2, and NH3. It is the essential constituent of all living matter like chlorophyll, protoplasm, protein and nucleic acids and it also found in other compounds of plant metabolism like: Nucleotides, Phosphatides, alkaloids, enzymes, hormones, vitamins etc. Phosphorus is a limiting nutrient in the soil which goes for fixation and it plays vital role in photosynthesis, respiration, energy storage, cell division, cell elongation, promotes early root formation and growth. Calcium plays a major role in neutralizing the charges on the acidic molecules of phosphoric acid and organic acid which are injurious to plants. Magnesium is a component part of chromosomes and polyribosomes and it is a mineral constituent for chlorophyll. Sulphur plays major role for formation of plant protein because it is a part of certain amino-acids which acts as building blocks of proteins.

In Uttar Pradesh most of area is covered by deep layer of alluvial soil spread by rivers of ganga system. The fertility range of alluvial soil from sandy to clayey loam where southern part of Uttar Pradesh soil is mixed red and black or red-to-yellow. The distribution of total geographical area of Uttar Pradesh is 29,441 ha in that soil are categorized in different soil orders were 415 ha belongs to vertosols, 83 ha Mollisols, 1,793 ha Alfisols, 21,490 Inceptisols, 4,813 Entisols and 848 ha are other soil orders [3]. Rivers are precious elements of nature its play’s major role in integrating and organizing the landscape [4]. Yamuna originated from Yamunotri glacier of Uttar kashi it is second largest tributary river ganga and important river of India It flows through the states of Delhi, Haryana, and Uttar Pradesh were merges with ganga at Triveni Sangam, Prayagraj. The total length of river is around 1,370 kilometers with a total drainage of 366,220 Sq kilometers. Approximately, 57 million people are depending on the river for their basic need in entire Yamuna basin 12.3 million hectares are irrigated and 49% of land is irrigated from surface water [5].

2. MATERIALS AND METHODS

2.1 Study Area

Chaka is a block in Prayagraj district of the Indian state in the Southern part of Uttar Pradesh at an elevation of 98 meters (322 ft). Prayagraj is also a metropolis city in the Indian state of Uttar Pradesh. It is located at 25.45°N and 81.84°E and lies 102m above the mean sea level. The geographical area of the district is 5437.2 Sq.kms (as per 1991 data). Prayagraj comes under three agro-climates zones are Agro-climate zone-IV, Middle Gangetic plains region

Keywords: Nutrient index; soil nutrients; soil fertility; quality and Yamuna river.
Agro-climate Zone-V and Upper Gangetic Plains region and Agro-climate Zone-VIII. Prayagraj district consists of 7 Tehsils, 20 locks, 218 Nyaya panchayats, and 1472 Gram panchayats. The place shows a humid subtropical climate with temperature varies from 10°C to 28°C in winters and 23°C to 42°C in summer and annual rainfall is 981mm. The major crops grown are Paddy, wheat, Barley and jowar.

2.2 Analysis of Physico-chemical Parameters

Total 24 surface soil composite samples were collected from eight different villages, and each village 3 surface soil samples were collected in different sites in chaka block. Prayagraj district, Uttar Pradesh. At first stones litter and twigs were removed from sampling place and with the help of soil auger the soil was dugged up to 15cm depth. From each field 4-6 representative sub-samples were collected in the form of zigzag manner. Approximately about 3-4 kg of soil sample was collected and spread on the large sheet and mixed it order to make soil homogenous once the mixing was done left over root twigs were removed and the samples was reduced to 1kg by quadratic method. Then the soil was packed in poly bag and sample number, sample location, area, farmer details, crop details, and date of sampling were noted on the bags and brought to the laboratory. In laboratory the soil samples were shade dried and crushed manually with the help of mallet and sieved through 2mm size sieve mash. About 500 g of soil sample was obtained after sieving and thus obtained soil sample was stored in a clean jute bag. The collected samples were analysed for Chemical, macro nutrients and micro nutrients parameters. The pH was determined by potentiometric method by making 1:2.5 soil water suspension where as EC was measured by digital EC meter. Organic carbon was determined by wet-oxidation method [6]. Available Nitrogen was determined by alkaline potassium permanganate method [7] by 800ml Kjeldhal flask. Phosphorous was determined by Colorimetric method by using spectrophotometer [8]. Available K was determined by Flame photometer using neutral ammonium acetate solution [9]. Exchangeable calcium and magnesium were estimated by Versanate titration method [10]. Available S was determined by using spectrophotometer [11]. Available micronutrients Fe, Cu, Zn, and Mn were determined by using DTPA extraction by using Atomic absorption spectrophotometer [12].

3. RESULTS AND DISCUSSIONS

The results of the chemical properties, macro and micronutrients of soil samples, from different villages of chaka block in Prayagraj district are given in Table: - 2.

The available Nitrogen content of soil samples range from 51 to 648 kg ha\(^{-1}\) with a mean value of 289.9, standard deviation of 184.7 and co-efficient of variation of 63.7% . Based on the limits suggested by Muhr et al. [13], out of total soil samples, 41.6% of the samples were in low nitrogen content, 45.8% of the samples were in medium range and 12.5% of the samples were in high range. Similar results were observed with Patel et al. [14]. Phosphorus content of soil samples were ranged from 6 to 48 kg ha\(^{-1}\) with a mean of 23.08, standard deviation of 11.47 and co-efficient of variation of 49.7%. out of total soil samples, 4.16% of the samples were in low phosphorus range, 62.5% of the samples were in medium range and 33.3% were in high range. Similar results were observed with Yurembam et al., [15]. Potassium content of soil samples ranges from 78.4 to 392 kg ha\(^{-1}\) with a mean value of 144.6. Based on the limits suggested by Muhr et al.[13], out of total soil samples, 66.6% of the samples were in low potassium range, the reason may be due to absence of elite rich potassium minerals in these soils, 29.1% of the soil samples were in medium range and 4.1% of the soil samples were in low potassium range. Similar results were observed with [16].

The exchangeable calcium content of soil samples ranges from 1.44 to 31.68 Meq/100g with a mean value of 8.49, standard deviation of 6.28 and co-efficient of variation of 73.98% . Based on the limits suggested by Ramamoorthy and Bajaj [17], out of total soil samples, 4.1% of the samples were in low range whereas 95.8% of the samples were in high range. Exchangeable magnesium content of soil samples ranges from 0 to 14.35 Meq/100g with a mean value of 4.77, standard deviation of 2.21 and co-efficient of variation of89.1% . Based on the limits suggested by Ramamoorthy and Bajaj, [17], out of total soil samples, 29.1% of the samples were in low range whereas 70.8% of the samples were in high range. Available sulphur content in soil samples ranges from 3 to 43 mg kg\(^{-1}\) with a mean value of 8.25, 9.34 as a standard deviation and 113.3% as co-efficient of variation. Based on the limits suggested by Awanish et al. (2014). Out of total soil samples, 83.3% of samples were in low sulphur content, 4.8% of samples were in...
medium and 12.5% were in high range. Similar results were observed [18].

The content of zinc in soil sample were shown from 0.121 to 0.845 mg Kg$^{-1}$ with a 0.394 as mean value, 0.175 as a standard deviation and 44.5% as a co-efficient of variation. Based on the limits suggested by Awanish et al., (2014) for micro-nutrients. Out of total samples 91.6% of samples shown deficiency of zinc. The content of manganese in soil samples were shown 2.16 to 9.75 mg Kg$^{-1}$ with 4.553 as a mean value. The availability of iron has inverse relationship with pH i.e., increase in pH causes reduction in availability of iron. Iron content in soil samples were shown 3.88 to 6.42 mg Kg$^{-1}$ where 58.3% of soil samples are shown deficiency of iron and 41.6% are shown sufficient of iron. The pH and Organic matter are inversely relationship with availability of copper. The copper content in soil samples ranged from 0.25 to 1.32 mg Kg$^{-1}$ with a 0.634 as a mean value. 66.6% of soil samples shown excess content of copper in soil. Based on limits similar results by Awanish et al. (2014).

3.1 Soil Nutrient Index

In order to compare the levels of soil fertility of one area with those of another it was necessary to obtain a single value for each nutrient. The Organic carbon, Nitrogen, Phosphorus, Potassium, Sulphur, Zinc, Iron, Manganese and Copper Index calculated values are given in the Table:1. The nutrient index is calculated by using the formula as given by Muhr et al., [13]1963).

**Nutrient Index (N.I.)** = \( \frac{NL \times 1 + NM \times 2 + NH \times 3}{NT} \)

Where, NL: Indicates number of samples falling in low class of nutrient status  
NM: Indicates number of samples falling in medium class of nutrient status  
NH: Indicates number of samples falling in high class of nutrient status  
NT: Indicates total number of samples analyzed for a given area.

The nutrient index value of less than 1.5 is rated as low, 1.5 to 2.5 is rated as medium and more than 2.5 is rated as high fertility status as suggested by Ramamoorthy and Bajaj [17].

3.2 Correlation Matrix between Physico-chemical Parameters of Soil in Chaka Block, Prayagraj, Uttar Pradesh

The data on correlation matrix between physico-chemical properties of soil of different villages in Chaka block of Prayagraj, Uttar Pradesh is given in Table:3. The bulk density of the soil in negatively non-significantly correlated with water holding capacity (\( r = -0.070 \)), Phosphorus (\( r = -0.082 \)), Iron (\( r = -0.169 \)), copper (\( r = -0.043 \)), negatively significantly correlated with organic carbon (\( r = -0.538 \)), nitrogen (\( r = -0.546 \)), sulphur (\( r = -0.390 \)) and positively non-significantly correlated with particle density (\( r = 0.342 \)), porosity (\( r = 0.001 \)), pH (\( r = 0.366 \)), EC (\( r = 0.166 \)), potassium (\( r = 0.106 \)), calcium (\( r = 0.037 \)), magnesium (\( r = 0.379 \)), zinc (\( r = 0.010 \)), manganese (\( r = 0.172 \)). The particle density of the soil is negatively non-significantly correlated with water holding capacity (\( r = -0.289 \)), pH (\( r = -0.130 \)), EC (\( r = -0.133 \)), organic carbon (\( r = -0.317 \)), nitrogen (\( r = -0.199 \)), potassium (\( r = -0.360 \)), calcium (\( r = -0.035 \)), magnesium (\( r = -0.082 \)), zinc (\( r = -0.095 \)), manganese (\( r = -0.225 \)) and positively non-significantly correlated with porosity (\( r = 0.942 \)), phosphorus (\( r = 0.277 \)), sulphur (\( r = 0.044 \)), copper (\( r = 0.055 \)). The porosity of the soil is positively significantly correlated with phosphorus (\( r = 0.259 \), positively non-significantly correlated with sulphur (\( r = 0.185 \)), iron (\( r = 0.065 \)), copper (\( r = 0.053 \)) and negatively non-significantly correlated with water holding capacity (\( r = -0.302 \)), pH (\( r = -0.252 \)), EC (\( r = -0.219 \)), organic carbon (\( r = -0.189 \)), nitrogen (\( r = -0.036 \)), potassium (\( r = -0.449 \)), calcium (\( r = -0.046 \)), magnesium (\( r = -0.214 \)), zinc (\( r = -0.109 \)), manganese (\( r = -0.281 \)). The water holding capacity of the soil is positively non-significantly correlated with pH (\( r = 0.145 \)), EC (\( r = 0.359 \)), organic carbon (\( r = 0.304 \)), nitrogen (\( r = 0.200 \)), phosphorus (\( r = 0.176 \)), potassium (\( r = 0.308 \)), calcium (\( r = 0.216 \)), manganese (\( r = 0.294 \)) and negatively non-significantly correlated with magnesium (\( r = -0.023 \)), sulphur (\( r = -0.027 \)), zinc (\( r = -0.023 \)), iron (\( r = -0.137 \)), copper (\( r = -0.078 \)). The pH of the soil is negatively significantly correlated with potassium (\( r = -0.038 \), negatively non-significantly correlated with EC (\( r = -0.016 \)), organic carbon (\( r = -0.207 \)), nitrogen (\( r = -0.154 \)), phosphorus (\( r = -0.436 \)), sulphur (\( r = -0.190 \)), zinc (\( r = -0.190 \)), iron (\( r = -0.197 \)), manganese (\( r = -0.081 \)), copper (\( r = -0.241 \)) and positively correlated with calcium (\( r = 0.037 \)), magnesium (\( r = 0.034 \)). The EC of the soil positively significantly correlated with manganese (\( r = 0.607 \)), positively non-significantly correlated with phosphorus (\( r = 0.370 \)), potassium (\( r = 0.797 \)), calcium (\( r = 0.359 \)), zinc (\( r = 0.271 \)), iron (\( r = 0.254 \)) and negatively non-significantly correlated with organic carbon (\( r = -0.030 \)), nitrogen (\( r = -0.187 \)), magnesium (\( r = -0.223 \)), sulphur (\( r = -0.136 \)), copper (\( r = -0.112 \)).
Table 1. Nutrient Index values of Chaka lock in Prayagraj district of Uttar Pradesh

| Sl. No | Available nutrients | Nutrient index values | Category |
|--------|---------------------|-----------------------|----------|
| 1      | Organic carbon      | 2.25                  | Medium   |
| 2      | Nitrogen            | 1.708                 | Medium   |
| 3      | Phosphorus          | 2.291                 | Medium   |
| 4      | Potassium           | 1.375                 | Low      |
| 5      | Sulphur             | 1.29                  | Low      |
| 6      | Zinc                | 1.08                  | Low      |
| 7      | Manganese           | 1.708                 | Medium   |
| 8      | Iron                | 1.416                 | Low      |
| 9      | Copper              | 2.66                  | High     |

Table 2. Soil quality parameters of different villages of Chaka block, Prayagraj, Uttar Pradesh

| Sample No | Name of the Village | pH | EC (d S m⁻¹) | OC (%) | N (Kg ha⁻¹) | P (Kg ha⁻¹) | K (Kg ha⁻¹) | Ca (Kg ha⁻¹) | Mg (Kg ha⁻¹) | S (Kg ha⁻¹) | Zn (Kg ha⁻¹) | Mn (Kg ha⁻¹) | Fe (Kg ha⁻¹) | Cu (Kg ha⁻¹) |
|-----------|---------------------|----|--------------|--------|-------------|-------------|-------------|--------------|--------------|-------------|--------------|--------------|--------------|--------------|
| S₁        | Arail               | 7.51 | 0.20     | 0.81  | 381         | 17          | 156.8       | 08           | 0.4          | 03          | 0.528        | 3.432        | 4.618        | 0.928        |
| S₂        | Arail               | 7.47 | 0.21     | 0.41  | 165         | 27          | 179.2       | 10.2         | 0.6          | 03          | 0.536        | 9.756        | 4.623        | 0.536        |
| S₃        | Arail               | 7.33 | 0.31     | 0.72  | 406         | 48          | 257.6       | 13.8         | 0.2          | 08          | 0.667        | 7.532        | 6.291        | 0.864        |
| S₄        | Dewrakh             | 7.45 | 0.22     | 0.56  | 125         | 18          | 224.0       | 10.0         | 0.4          | 03          | 0.502        | 5.499        | 3.998        | 0.689        |
| S₅        | Dewrakh             | 7.72 | 0.24     | 0.48  | 178         | 25          | 392.0       | 12.0         | 2.6          | 03          | 0.542        | 5.784        | 4.014        | 0.815        |
| S₆        | Dewrakh             | 7.65 | 0.25     | 0.00  | 76          | 27          | 280.0       | 8.2          | 5.4          | 03          | 0.468        | 5.648        | 3.925        | 0.425        |
| S₇        | Mawaiya             | 7.65 | 0.16     | 0.31  | 114         | 21          | 89.6        | 06           | 7.4          | 03          | 0.568        | 6.421        | 4.825        | 0.625        |
| S₈        | Mawaiya             | 7.75 | 0.12     | 0.60  | 394         | 27          | 78.4        | 06           | 7.4          | 03          | 0.382        | 2.485        | 4.263        | 0.819        |
| S₉        | Mawaiya             | 7.60 | 0.12     | 0.50  | 292         | 17          | 100.8       | 7.2          | 1.2          | 03          | 0.562        | 2.814        | 3.888        | 0.935        |
| S₁₀       | Lawayan             | 7.80 | 0.15     | 0.65  | 584         | 17          | 100.8       | 7.6          | 02           | 03          | 0.344        | 3.485        | 4.349        | 0.523        |
| S₁₁       | Lawayan             | 7.31 | 0.14     | 0.50  | 483         | 17          | 112.0       | 7.8          | 1.4          | 03          | 0.326        | 2.165        | 3.897        | 1.215        |
| S₁₂       | Lawayan             | 7.40 | 0.13     | 0.50  | 305         | 13          | 89.6        | 8.2          | 1.6          | 03          | 0.374        | 2.356        | 4.023        | 1.325        |
| S₁₃       | Chat Kalana         | 8.33 | 0.19     | 0.10  | 51          | 06          | 89.6        | 9.8          | 00           | 03          | 0.253        | 3.145        | 4.125        | 0.425        |
| S₁₄       | Chat Kalana         | 7.60 | 0.17     | 0.52  | 318         | 17          | 112.0       | 9.4          | 02           | 03          | 0.253        | 4.685        | 4.325        | 0.254        |
| S₁₅       | Chat Kalana         | 7.54 | 0.15     | 0.02  | 51          | 13          | 100.8       | 7.8          | 1.8          | 13          | 0.845        | 4.263        | 6.425        | 0.567        |
| S₁₆       | Newada Samogar      | 7.44 | 0.17     | 0.60  | 330         | 13          | 156.8       | 3.8          | 06           | 8           | 0.164        | 2.841        | 3.984        | 0.426        |
| S₁₇       | Newada Samogar      | 7.53 | 0.15     | 0.02  | 51          | 13          | 89.6        | 17.8         | 02           | 8           | 0.274        | 4.625        | 4.265        | 0.615        |
Table 3. Correlation between Physico-chemical properties of soil in different villages of Chaka block

| Parameters | Bd | Pd | Porosity | WHC | pH | EC | OC | N | P | K | Ca | Mg | S | Zn | Mn | Fe | Cu |
|------------|----|----|----------|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|            |    |    |          |     |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Bd         | 1  |    |          |     |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Pd         | 0.341 | 1 |          |     |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Porosity   | 0.001 | 0.942*** | 1 |          |     |    |    |    |    |    |    |    |    |    |    |    |    |
| WHC        | -0.070 | -0.249 | -0.302 | 1 |          |     |    |    |    |    |    |    |    |    |    |    |    |
| pH         | 0.366 | -0.130 | -0.252 | 0.145 | 1 |          |     |    |    |    |    |    |    |    |    |    |    |
| EC         | 0.166 | -0.133 | -0.219 | 0.359 | -0.016 | 1 |          |     |    |    |    |    |    |    |    |    |    |
| OC         | -0.538* | -0.317 | -0.189 | 0.304 | -0.207 | -0.030 | 1 |          |     |    |    |    |    |    |    |    |    |
| N          | -0.546 | -0.199 | -0.036 | 0.200 | -0.154 | -0.187 | 0.871 | 1 |          |     |    |    |    |    |    |    |    |
| P          | -0.082 | 0.277 | 0.259 | 0.176 | -0.436 | 0.370 | 0.379 | 0.276 | 1 |          |     |    |    |    |    |    |    |
| K          | 0.106 | -0.360 | -0.449 | 0.308 | -0.038* | 0.797 | -0.002 | -0.172 | 0.227 | 1 |          |     |    |    |    |    |    |
| Ca         | 0.037 | -0.035 | -0.046 | 0.216 | 0.037 | 0.359 | -0.234 | -0.222 | 0.041 | 0.255 | 1 |          |     |    |    |    |
| Mg         | 0.10 | -0.082 | -0.214 | -0.231 | 0.034 | -0.223 | -0.159 | -0.101 | 0.071 | -0.021 | -0.019 | 1 |          |     |    |    |
| S          | 0.037 | 0.044 | 0.185 | -0.027 | -0.190 | -0.136 | 0.157 | 0.319 | 0.262 | -0.154 | -0.049 | -0.038 | 1 |          |     |    |
| Zn         | -0.390* | -0.095 | -0.109 | -0.023 | -0.003 | 0.271 | -0.037 | -0.167 | 0.128 | 0.320 | 0.104 | -0.081 | -0.152 | 1 |          |     |
| Fe         | 0.010 | 0.008 | 0.065 | -0.137 | -0.197 | 0.254 | -0.010 | 0.034 | 0.226 | -0.059 | 0.041 | -0.106 | 0.180 | 0.284 | 1 |    |
| Mn         | 0.172 | -0.225 | -0.281 | 0.294 | -0.081 | 0.607* | -0.086 | -0.163 | 0.226 | 0.459* | 0.310 | -0.009 | 0.093 | 0.300 | 0.415* | 1 |
| Cu         | -0.043 | 0.055 | 0.053 | -0.078 | -0.241 | -0.112 | 0.102 | 0.122 | -0.071 | 0.015 | 0.046 | -0.153 | -0.241 | 0.295 | -0.109 | -0.241 | 1 |

Note: (*) represents significant at 0.05 level, ** = ***, = 1

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organic carbon of the soil is negatively non-
significantly correlated with potassium (r = -
0.002), calcium (r = -0.234), magnesium (r = -
0.159), zinc (r = -0.037), iron (r = -0.010),
manganese (r = -0.086) and positively non-
significantly correlated with nitrogen (r = 0.871),
phosphorus (r = 0.379), sulphur (r = 0.157),
copper (r = 0.102). The macronutrients of the soil i.e.,
nitrogen status of the soil negatively non-
significantly correlated with potassium (r = -0.172), calcium (r =
-0.22), magnesium (r = -0.101), zinc (r = -
0.167), manganese (r = -0.163) and positively non-
significantly correlated with phosphorus (r =
0.276), sulphur (r = 0.319), iron (r = 0.034),
copper (r = 0.122). Phosphorus of the soil
negatively non-significantly correlated with
copper (r = -0.071) and positively non-
significantly correlated with potassium (r =
0.227), calcium (r = 0.041), magnesium (r =
0.071), sulphur (r = 0.262), zinc (r = 0.128), iron
(r = 0.226), manganese (r = 0.226) and
potassium of the soil positively significantly
correlated with manganese (r = 0.459), positively
non-significantly correlated with calcium (r =
0.255), zinc (r = 0.320), copper (r = 0.015) and
negatively non-significantly correlated with
manganese (r = -0.021), sulphur (r = -0.154), iron
(r = -0.059). The secondary macro-nutrients i.e.,
calcium of the soil negatively non-significantly
correlated with magnesium (r = -0.011), sulphur
(r = -0.049) and positively non-significantly
correlated with zinc (r = 0.104), iron (r = 0.041),
manganese (r = 0.310), copper (r = 0.046),
magnesium of the soil negatively non-
significantly correlated with sulphur (r = -0.038),
zinc (r =-0.081), iron (r = -0.106), manganese (r =
-0.009), copper (r = -0.153) and sulphur of the
soil positively non-significantly correlated with
iron (r = 0.180), manganese (r = 0.093) and
negatively non-significantly correlated with zinc (r
= -0.152), copper (r = -0.241).

Micro-nutrients of the soil i.e., zinc of the soil is
positively non-significantly correlated with iron
(r = 0.284), manganese (r = 0.300), copper (r =
0.295). Iron of the soil is positively significantly
correlated with manganese (r = 0.415) and
negatively non-significantly correlated with
copper (r = -0.109) and Manganese of the soil
negatively non-significantly correlated with
copper (r = -0.241).

4. CONCLUSION

The present investigation in chaka block,
Prayagraj district, Uttar Pradesh clearly states
that soil is neutral to alkaline in condition. 100%
of soil samples are in permissible limit of EC
suitable for most of crops. 58.3% of the soil
samples showed medium-high organic carbon
content this is due to low and high temperature
and less decomposition of organic matter in the
soil. More than 50% soil samples are in medium
range of nitrogen, phosphorus whereas
potassium and sulphur are in low. Zinc,
manganese and iron are in deficiency due to
inverse relationship with pH i.e., increase in pH
causes reduction in availability whereas copper
in sufficient range. According to the soil nutrient
index potassium, sulphur, zinc and iron has
showed low range of nutrient index whereas
organic carbon, nitrogen, potassium and
manganese are showed medium range. These
analyses may help farmers to maintain proper
nutrient management to obtain high yield with
quality products. Still improvement can be done
by improving cropping pattern, decomposition of
organic waste, mulching and tillage practices.

COMPETING INTERESTS

Authors have declared that no competing
interests exist.

REFERENCES

1. USDA U.S. Salinity Laboratory Staff,
Diagnosis and Improvement of Saline and
Alkali Soils. Handbook 60. Washington,
D.C; 1954.
2. Goovaerts P. Geostatistical tools for
characterizing the spatial variability of
microbiological and physico-chemical soil
properties. Biology and Fertility of Soils.
1998;27:315-334.
3. Bhattacharyya Ak, Nanda SK, Mishra BK.
Soil classification and soil and land
suitability for irrigation in Kuanria irrigation
project. Journal of the Indian Society of
Soil Science. 1997;45(2):333-338.
4. Das A, David AA, Swaroop N, Thomas T,
Rao S, Hasan A. Assessment of Physico-
chemical properties of river bank soil of
Yamuna in Allahabad city, Uttar Pradesh.
International Journal of chemical studies.
2018;6(3):2412-2417.
5. CPCB. Water Quality Status of Yamuna
River. 1999-2005: Central Pollution control
Board, Ministry of environment and
Forests. Assessment and Development of
River Basin Series: ADSORBS/41/2006-
2007
6. Walkley A, Black TA. An examination of the Deft. Jarett method for determination of soil organic matter and a proposed modification of chromic acid titration. Soil Science. 1934;37:29-38.
7. Subbiah BV, Asija GL. A rapid procedure for the determination of available nitrogen in soils. Current Science. 1956; 25:259-260.
8. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of Available Phosphorus in Soils by Extraction with Sodium Bicarbonate. U. S. Department of Agriculture, Circular No. 939; 1954.
9. Schollenberger CJ, Simon RH. Determination of Exchange Capacity and Exchangeable Bases in Soil-Ammonium Acetate Method. Soil Science. 1945;59:13-24.
10. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi; 1973.
11. Chesnin L, Yien CH. Turbidimetric determination of available sulphur. Proceeding of Soil Science. American. 1950;14:149-151.
12. Lindsay WL, Norvell WA. Development of a EDTA micronutrients soil test for Zn, Fe, Mn, and Cu. Soil Science Society of America Journal. 1978;42(3):421-428.
13. Muhr GR, Datta NP, Shankara Subraney N, Dever F, Lecy VK, Donahue RR. Soil Testing in India, USAID Mission to India; 1965.
14. Alok Patel, Varma S, Singh SK, Singh RK. Soil Fertility status of Jaunpur District in Eastern Uttar Pradesh. Journal of Pharmacognosy and Phytochemistry. 2017;SP1:949-952.
15. Yurembam. GS, Harish Chandra, Vinod Kumar. Status of Available Macro and Micro nutrients in the soils of Someshwar watershed in Almora district of Uttarakhand. An International Quarterly Journal of Environmental Sciences. 2015;9(3&4):725-730.
16. Dinesh K, Sushil L, Shahabuddin K, Sushila J, Buddh Bahadur Pant. Assessment of soil fertility status of Agriculture Research Station, Belachapi, Dhanusha, Nepal. Journal of Mazie Research and Development. 2016;2(1):43-57.
17. Ramamurthy B, Bajaj JC. Nitrogen, Phosphorus and Potash status of Indian soils. Fertilizer News. 1969;14:25-28.
18. Sheeba SS, Shalini Pillai P, Mini V. Assessment and rating of available nutrient status of rice soil in the southern laterites of Kerala. Journal of Pharmacognosy and Phytochemistry. 2019;269-272.