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# Status of Micronutrients of the Different Villages in Raipur Karchulian Block of Rewa District of M.P.

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**ABSTRACT:**

The current study was conducted at the different villages of theto evaluate the status of nutrients in Raipur Karchulianblock of Rewa district (Madhya Pradesh). The district is spread between Latitude –$24^0$21′59.9″ N to $24^0$48′40.9″ N and Longitude - $81^0$09′21.8″ E to $82^0$02′02.2″ E. The random sampling technique was used to collect 36 soil samples at different locations (villages Raura, Patauna&Khira) with the help of GPS at 0–15 cm depth. The collected soil samples were air-dried in shade at room temperature, passed through a 2 mm filter paper, and analyzed for different physico-chemical properties. The result revealed that the mean value of pH, electrical conductivity and organic carbon in soil were 6.78, 0.31 $dSm^{-1}$ and 4.05 g $kg^{-1}$, respectively. The average macronutrient like available N,P,K,S and micronutrient like Zn, Cu, Fe, Mn and B contents were observed as 246,14.96,370,12.4 and 0.59, 1.82, 6.89, 5.57 and 1.27 mg $kg^{-1}$, respectively. The findings indicated that the studied soils were slightly acidic to Nutral and free from salinity hazards; 50% of the soil samples were low in organic carbon, 30% were medium in organic carbon, and 100% of the soil samples were low in available N and medium in available P, K, and S. The results of the study indicate that zinc (Zn: 72.2%), iron (Fe: 8.3%) and (S: 16.6%) deficiency are the major disorders in study soils of different villages in Raipur Karchulianblock of Rewa district Madhya Pradesh. The findings of this research could help in crop nutrient management, fertilizer recommendation, and decision-making for increasing agricultural production and farmer profitability.

**KEYWORDS :** Micro nutrients , Soil properties, Organic Carbon, Decision Making

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|---|---|---|

**INTRODUCTION :**

Soil is a vital, natural, and dynamic body that sustains all living things on Earth (Jones, 2012). It is a complex mixture comprising minerals, organic materials, countless microorganisms, and variable proportions of air and water, all crucial for sustaining life (Wilding and Lin, 2006). Fertile and productive soils proliferate life, whereas unfertile and unproductive soils bring hunger and famine (Khadka et al., 2019). By weathering and soil-forming processes, organic matter, fertilizer, and parent material give macro and micronutrients to the soil (Haby et al., 1991). Among the nutrients, macronutrients are nitrogen (N), phosphorus (P), potassium (K), sulphur (S), calcium (Ca) and magnesium (Mg) (Thaker et al., 2023). These are essential for plant growth, which is important to preserve ecosystems and high crop yields (Qiu et al., 2005). In soil science, the term “soil fertility” is frequently employed to describe the role played by various soil properties such as nutrients, moisture, minerals, and organic matter in supporting plant growth (Desbiez et al., 2004). Soil fertility refers to the interactions of the physical, chemical and biological properties of soil and is directly related to agricultural production (Rakesh et al., 2012). Various regions exhibit distinct limiting factors affecting soil fertility; for instance, tropical areas face challenges like moisture stress, elevated phosphorus fixation, and increased acidity (Cardoso and Kuyper, 2006). Consequently, soil fertility proves to be a multifaceted concept, not directly quantifiable but assessable through other soil properties as indicated by (Bautista-Cruz et al., 2007). The soil fertility evaluation is the most basic decision-making tool in order to make an efficient plan for a particular land use system (Havlin et al., 2010).

The word micronutrient represents some essential plant nutrients that are required in very small quantities for the growth, development and reproduction of plant as major nutrients. Green revolution has significantly increased the food crop production in India, accomplished through growing of high yielding varieties; use of high analysis NPK fertilizers, increase in irrigated areas and increase in cropping intensity catalyzed the depletion of the finite reserve micronutrients in soil. Indiscriminate use of high analysis chemical fertilizers results in the deficiency of secondary and micronutrients in soils (Singh 2007). Variability in micronutrient contents of the soils is a mirror of the diversity in parent materials from which these have originated (Rattan et al. 2008). Information about the extent of macro and micronutrient deficient area is necessary for the scientists, administrators, farmers and fertilizer manufacturers to determine the kind and quantity of fertilizer required for the particular region.It is an important factor that determines the growth of plants. It has identified levels of macronutrient and micronutrient concentrations in the soil that are sufficient for field crop production without further additions. There are several techniques for the evaluation of soil fertility status; soil testing is the most important method. Soil testing provides information regarding nutrient availability in soils, which forms the basis for fertilizer recommendations for the economic production of crops (Panda, 2010).Soil testing is perhaps the most regularly used method for determining soil fertility (Havlin et al., 2010) and increasing agricultural production through fertility management (Goovaerts, 1998). This paper reports on the soil fertility status of different villages in Raipur Karchulianblock of Rewa district Madhya Pradesh during 2023–24. It can be useful in recommending optimum soil management practices, crops, and cropping systems for ensuring sustained yields in the region.

## MATERIALS AND METHODS :

### Site description:

The current investigations were to assess the soil fertility status of Three villages (villages Raura, Patauna&Khira) in the in Raipur Karchulianblock of Rewa district (Madhya Pradesh) during November, 2023–June, 2024. The coordinates of the location are Latitude – $24^0$ 21′59.9″Nto $24^0$48′40.9″N and Longitudes - $81^0$09′21.8″E to $82^0$02′02.2″E and the elevation is 365.7 m . Most of the land in these villages is cultivable. The soils of these villages are mostly sandy loam or lightly textured. The farmers in this village are progressive and creative. Farmers become aware of their soil's health.

### Climate:

The climate of the Rewa district is congenial to successful cultivation of cereals, oilseeds, pulses, horticultural crops, fisheries, and poultry farming. The temperature rises up to 47°C or more during the summer and drops to 4°C during December and January. The average rainfall is 1080 mm mm, of which 90% is received by the south-west monsoon. The normal period of onset of the monsoon in the region is the first week of July, which lasts up to the end of September. About 90% of the annual rainfall is received during themonsoon season, but it is highly erratic and unpredictable, at times causing drought spells of varying degree and duration.

**Soil sampling and analysis :**

A total of 36 surface soil samples were collected from the undisturbed land of the Three villages (villages Raura, Patauna&Khira) in the in Raipur Karchulian block of Rewa district in 2023. A sample was randomly collected from a depth of 0–15 cm (plough layer) in a 'V' shape with the help of a spade. The soil samples were mixed systematically, and about 500 g of composite samples were collected in polythene bags from the farmer's field for analysis. The collected soil samples were air dried in shade at room temperature, crushed, powdered, and grinded with a wooden roller before sieving with a 2.0 mm sieve and being transported to the laboratory. Finally, a 500 g soil sample was preserved in a labeled polythene bag for further laboratory analysis..pH measurement employed a pH meter with a 1:2.5 soil-water suspension, while electrical conductivity was gauged using an EC bridge, following method given by (Jackson, 1973). Organic carbon content was assessed through the Walkley and Black method proposed by (Walkley and Black, 1934). Available nitrogen was quantified using the alkalinepotassium permanganate method by (Subbiah and Asija, 1956), employing a Kjeldahl apparatus. Olsen's method, utilizing a spectrophotometer, was employed for estimating available phosphorus, as described by (Olsen et al., 1954). Available potassium was determined by flame photometer, with neutral normal ammonium acetate method, suggested by (Hanway and Heidal, 1952). Exchangeable calcium and magnesium were assessed through the EDTA method introduced by (Cheng and Bray, 1951). Available sulphur was estimated using the Calcium chloride method with a spectrophotometer, following the procedure outlined by (Chesnin and Yien, 1950). Basic

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soil parameters were estimated using standard laboratory methods. Soil available Zn, Fe, Mn and Cu were extracted with DTPA as outlined by Lindsay and Norvell (1978) and estimated by using atomic absorption spectrophotometer, where as available B (hot water soluble B) content in soil was determined by azomethine-H method (Berger and Truog 1939) and estimated by using spectrophotometer

Further, data were processed and calculated by using standard statistical methodsstatistically to obtain the proposed objectives. The limits of micronutrients (mg $kg^{-1}$) were used for various categories (low, medium and high) as suggested by Singh *et. al.* (2007) are given as under :

**Table: 1 various categories (low, medium and high) of soil**

| **Parameters** | **Low** | **Medium** | **High** |
|---|---|---|---|
| OC % | <0.50 | 0.51-1.00 | >1.00 |
| N Kg/ha | <250 | 251-400 | >400 |
| P Kg/ha | <10 | 11-20 | >20 |
| K Kg/ha | <250 | 251-400 | >400 |
| S mg/Kg | <10 | 11-20 | >20 |

| **Micronutrients** | **Low** | **Medium** | **High** |
|---|---|---|---|
| Zn mg/Kg | <0.6 | 0.6-1.2 | >1.2 |
| Cu mg/Kg | <0.2 | 0.2-0.4 | > 0.4 |
| Fe mg/Kg | < 4.5 | 4.5-9.0 | >9.0 |
| Mn mg/Kg | <2.0 | 2.0-4.0 | >4.0 |
| B mg/Kg | <0.1 | 0.1-0.60 | >0.60 |

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## RESULTS AND DISCUSSIONS :

### Basic properties of soil :

The results of present study on soil properties are presented in Table 2. It is indicated that the soil pH varied from 6.2 to 7.9 with mean value of 6.7 in Rewa district. Thus, the soil samples of Rewa district were found to be neutral. Electrical conductivity ranged from 0.20 to 0.40 with mean value of 0.31 $dSm^{-1}$ hence, soils of Rewa districts were found to be low in soluble salts. Organic carbon content in soils was found to vary from 1.80 to 6.20 g $kg^{-1}$ with mean value 4.05 g $ka^{-1}$ in Rewa district. It is indicating that the soil of Rewa districts were low in organic carbon content . . A similar result was observed by Pandey et al. (2020) in the Mirzapur district of eastern Uttar Pradesh

**Table 1: Study of Physiochemical properties and available NPK and S in soil**

| Sample No | pH | EC dSm/m | OC g/Kg | N Kg/ha | P Kg/ha | K Kg/ha | S mg/Kg |
|---|---|---|---|---|---|---|---|
| 1 | 6.5 | 0.30 | 4.5 | 234.1 | 18.0 | 314.0 | 10.6 |
| 2 | 6.7 | 0.30 | 5.0 | 220.3 | 12.6 | 322.3 | 11.5 |
| 3 | 6.3 | 0.35 | 4.1 | 250.3 | 10.9 | 321.2 | 12.3 |
| 4 | 6.5 | 0.35 | 5.2 | 300.8 | 16.2 | 35.02 | 14.6 |
| 5 | 6.4 | 0.30 | 4.7 | 235.6 | 20.5 | 36.08 | 11.5 |
| 6 | 7.2 | 0.25 | 4.3 | 210.2 | 18.6 | 315.6 | 13.2 |
| 7 | 7.1 | 0.35 | 3.9 | 212.3 | 15.2 | 410.2 | 7.25 |
| 8 | 7.5 | 0.30 | 3.7 | 195.2 | 13.8 | 455.3 | 7.08 |
| 9 | 7.9 | 0.30 | 4.5 | 212.3 | 14.2 | 457.5 | 7.9 |
| 10 | 7.0 | 0.25 | 5.1 | 214.3 | 13.2 | 480.2 | 8.25 |
| 11 | 6.8 | 0.35 | 4.5 | 220.9 | 16.2 | 450.3 | 8.6 |
| 12 | 6.9 | 0.35 | 5.0 | 218.3 | 11.3 | 455.2 | 9.25 |
| 13 | 6.2 | 0.35 | 3.4 | 260.8 | 11.9 | 380.2 | 9.7 |
| 14 | 6.5 | 0.30 | 4.7 | 275.3 | 11.7 | 390.2 | 10.3 |
| 15 | 6.7 | 0.25 | 3.0 | 260.3 | 15.6 | 356.1 | 15.2 |
| 16 | 6.2 | 0.30 | 3.7 | 240.9 | 15.2 | 385.2 | 16.7 |
| 17 | 7.1 | 0.30 | 2.7 | 236.8 | 15.9 | 401.2 | 13.2 |
| 18 | 7.3 | 0.25 | 3.1 | 261.0 | 15.7 | 408.3 | 13.6 |
| 19 | 7.4 | 0.25 | 6.1 | 275.3 | 14.3 | 425.3 | 14.5 |
| 20 | 7.5 | 0.30 | 3.7 | 295.4 | 16.3 | 385.2 | 17.3 |
| 21 | 7.0 | 0.35 | 3.3 | 246.3 | 13.1 | 366.2 | 12.2 |
| 22 | 7.6 | 0.40 | 2.7 | 277.2 | 17.2 | 368.5 | 13.6 |
| 23 | 6.3 | 0.35 | 4.7 | 244.3 | 16.3 | 456.2 | 14.2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | 6.5 | 0.40 | 3.1 | 265.3 | 14.2 | 409.1 | 14.7 |
| 25 | 6.6 | 0.30 | 4.3 | 296.2 | 16.3 | 407.9 | 13.2 |
| 26 | 6.7 | 0.35 | 6.2 | 201.8 | 16.8 | 410.4 | 15.3 |
| 27 | 6.8 | 0.30 | 4.2 | 208.7 | 16.9 | 385.2 | 14.2 |
| 28 | 6.6 | 0.35 | 4.7 | 255.3 | 15.3 | 359.2 | 13.6 |
| 29 | 6.4 | 0.35 | 2.6 | 260.3 | 14.2 | 388.5 | 15.2 |
| 30 | 6.5 | 0.25 | 1.8 | 250.1 | 14.0 | 302.2 | 18.1 |
| 31 | 6.5 | 0.20 | 5.4 | 235.6 | 13.2 | 309.8 | 17.3 |
| 32 | 6.7 | 0.35 | 2.0 | 260.3 | 14.5 | 325.6 | 16.3 |
| 33 | 6.8 | 0.30 | 2.7 | 255.3 | 14.2 | 410.2 | 11.2 |
| 34 | 6.2 | 0.30 | 3.3 | 265.2 | 14.3 | 425.6 | 8.25 |
| 35 | 6.5 | 0.35 | 4.9 | 266.7 | 13.6 | 412.3 | 8.3 |
| 36 | 6.5 | 0.35 | 5.0 | 256.3 | 17.2 | 413.7 | 9.5 |
| Maximum | 7.90 | 0.40 | 6.20 | 300.80 | 20.50 | 480.20 | 18.10 |
| Minimum | 6.20 | 0.20 | 1.80 | 195.20 | 10.90 | 350.02 | 7.08 |
| Average | 6.78 | 0.31 | 4.05 | 246.54 | 14.96 | 370.42 | 12.44 |
| PSD | 0.00 | 0.00 | 77.78 | 47.22 | 0.00 | 5.56 | 27.78 |

**Status of macro nutrients in soils:**

The data presented in Table 2 indicate that the available N content in soils was found to vary from 195 to 300 kgha$^{-1}$ with a mean value of 246 kgha$^{-1}$. For the soil as a whole 47 per cent samples were tested low in available N content in soils. The available P content in soils was found to vary from 10.9 to 20.5 kgha$^{-1}$ with a mean value of 14.9 kgha$^{-1}$. For the soil as a whole none of the samples were tested low in P in soils. The available K content in soils was found to vary from 350 to 480 kgha$^{-1}$ with a mean value of 370 kgha$^{-1}$. For the soil as a whole none of the samples were tested low in K in soils. The available S content in soils was found to vary from 7.1 to 18.1 mg kg$^{-1}$ with a mean value of 12.4 mg kg$^{-1}$. For the soil as a whole 28 per cent samples were tested low in available S content in soils A similar result was observed by Bharteey et al. (2023) in the Dhemaji district of Assa

**Table :3 Status of Micronutrients content in soil**

| Sample No | Zn mg/Kg | Cu mg/Kg | Fe mg/Kg | Mn mg/Kg | B mg/Kg |
|---|---|---|---|---|---|
| 1 | 0.55 | 1.80 | 10.4 | 9.8 | 1.31 |
| 2 | 0.44 | 1.58 | 10.0 | 5.6 | 1.25 |
| 3 | 0.40 | 1.68 | 10.2 | 6.7 | 1.06 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | 0.24 | 1.40 | 6.6 | 5.1 | 1.56 |
| 5 | 0.50 | 4.06 | 9.8 | 6.6 | 1.64 |
| 6 | 3.00 | 4.16 | 8.4 | 9.8 | 1.48 |
| 7 | 2.18 | 3.22 | 9.4 | 8.7 | 1.35 |
| 8 | 1.60 | 2.76 | 10.8 | 7.4 | 1.34 |
| 9 | 0.32 | 1.98 | 6.6 | 7.2 | 1.31 |
| 10 | 0.36 | 1.56 | 8.0 | 3.8 | 1.25 |
| 11 | 0.08 | 0.84 | 2.4 | 1.8 | 1.06 |
| 12 | 0.06 | 0.68 | 4.6 | 3.6 | 1.56 |
| 13 | 0.18 | 1.50 | 7.0 | 3.0 | 1.64 |
| 14 | 0.94 | 1.45 | 5.8 | 2.0 | 1.48 |
| 15 | 0.68 | 1.28 | 8.4 | 3.2 | 1.35 |
| 16 | 0.72 | 1.42 | 7.4 | 5.4 | 0.13 |
| 17 | 1.66 | 1.90 | 6.8 | 5.9 | 0.92 |
| 18 | 0.16 | 2.02 | 10.2 | 5.9 | 1.16 |
| 19 | 0.44 | 2.04 | 6.8 | 7.4 | 1.23 |
| 20 | 0.76 | 2.06 | 5.8 | 4.9 | 1.34 |
| 21 | 0.32 | 1.30 | 4.6 | 4.3 | 1.37 |
| 22 | 0.48 | 1.72 | 6.4 | 4.6 | 2.72 |
| 23 | 0.12 | 1.64 | 5.4 | 6.7 | 0.13 |
| 24 | 0.14 | 1.48 | 4.6 | 4.0 | 0.92 |
| 25 | 0.14 | 1.90 | 7.0 | 4.6 | 1.21 |
| 26 | 0.36 | 1.40 | 7.0 | 4.0 | 1.40 |
| 27 | 0.14 | 1.96 | 4.0 | 5.1 | 1.27 |
| 28 | 0.20 | 1.86 | 6.2 | 6.1 | 1.56 |
| 29 | 0.36 | 2.14 | 5.2 | 3.8 | 1.21 |
| 30 | 1.12 | 2.34 | 6.8 | 5.9 | 1.32 |
| 31 | 1.46 | 2.42 | 7.8 | 8.2 | 1.42 |
| 32 | 0.16 | 1.48 | 5.0 | 6.4 | 0.81 |
| 33 | 0.18 | 1.58 | 6.4 | 4.6 | 1.32 |
| 34 | 0.10 | 0.86 | 4.6 | 4.9 | 1.36 |
| 35 | 0.28 | 0.76 | 3.6 | 5.5 | 0.84 |
| 36 | 0.36 | 1.12 | 8.0 | 7.9 | 1.32 |

| | | | | | |
|---|---|---|---|---|---|
| Maximum | 3.00 | 4.16 | 10.80 | 9.80 | 2.72 |
| Minimum | 0.06 | 0.68 | 2.40 | 1.80 | 0.13 |
| Average | 0.59 | 1.82 | 6.89 | 5.57 | 1.27 |
| PSD | 72.22 | 0.00 | 8.33 | 2.78 | 16.67 |

**Status of micro nutrients in soils:**

The data presented in Table 3 indicate that the available Zn content in soils was found to vary from 0.06 to 3.00 mg kg-1 with a mean value of 0.59 mg kg-1 in soil. Considering 0.6 mg kg-1 DTPA extractable Zn as the critical limit, below which response of crops to the application of Zn may be expected 72.09 percent samples were found deficient. For the soil as a whole 72.09 per cent samples were tested low in available Zn content in soils.The available Cu content in soils was found to vary from 0.68 to 4.16 mg kg-1 with a mean value of 1.82 mg kg-1 in soil. None of the samples were tested low in Cu. The available Fe content in soils was found to vary from 2.40 to 10.80 mg kg-1 with a mean value of 6.89 mg kg-1 of soil. Only 8.0% samples were tested low in Fe. As reveled by the data given in the Table 3 the available Mn content in soils was found to vary from 1.80 to 9.80 mg kg-1 with a mean value of 5.57 mg kg-1 in of soil. Only 3 percent of the samples were tested low in Mn. As evident from the data presented in Table 3 the available B content in soils was found to vary from 0.13 to 2.72 mg kg-1 with a mean value of 1.27 mg kg-1 in of soil. 17 percent of the samples were tested low in Boron. Similar work has been carried out by Dwivedi *et al*. (2005), Mehra *et al*. (2005) and Singh *et al*. (2008) in different soil types.

**CONCLUSION:**

The study area, ranging distribution with slightly acidic to neutral soil. Soil in the area had low OC, N and S levels were low, while P was in the medium range. Available K was considered sufficient. It is apparent from study that the deficiencies of Zn, Fe and B were found in 72, 8.0 and 17% samples, however, none of the soils samples were deficient in available Cu and Mn. The studies suggested that higher organic carbon content in soil leads to protection of crops from micronutrient (Zn and B) deficiencies. Examining the chemical and physical properties of soil was advantageous for enhancing optimized soil fertility. The collection of valuable soil data established a connection between soil composition and plant growth, assisting farmers in the implementation of sustainable agricultural practices.

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