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Characterization and explanation of the soil fertility state of Sakaldiha block in the Chandauli District of Uttar Pradesh's industrial area

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Abstract

"Characterization and Comparative Study on Soil Fertility Status of Sakaldiha Block in Chandauli District of Uttar Pradesh" is the name of the study that was just completed. 2019 saw the investigation's completion. Winter. Soil samples were gathered from three different places (0–15 cm) in the Sakaldiha block. The gathered soil samples were processed and tested in the lab for various Physicochemical traits and easily available nutrients in accordance with the established protocols. To compare variations in nutrient status around industrial regions and conduct research on the relationship between relevant soil properties and relevant nutrients (NH-2). The soluble salt level of the soil in the Sakaldiha block of the Chandauli district is within a safe limit and has no effect on crop germination. The soil is categorised as neutral to slightly acidic in reaction. The research area's soils have a small range of organic carbon. The research area's soils have phosphorus levels that range from low to medium. Nitrogen ranged from low to high, whereas potassium was revealed to be in the middle to high range. The amounts of calcium and magnesium in the soils of the Sakaldiha block were suitable. Fe levels were adequate in all the soils studied, but Mn, Cu, and Zn contents ranged from insufficient to sufficient. Areas near industry had slightly higher B.D., P.D. macro- and micronutrient values, with the exception of Zn and Cu.

Keywords: Soil properties; Soil Fertility; Nutrient status; Calcium; Magnesium Industrial Area.

1 Introduction

A crucial component of an ecosystem, soil depends on a number of systems for maintaining life and on socioeconomic development. However, today's soils have less capacity to produce, and several innate characteristics and agro-ecological factors place restrictions on how much may be produced. One of the most important natural resources is soil, which is necessary for life on this planet. Therefore, the secret to efficient land use and environmental harmony knows the soil system. According to [1], soil quality degradation processes for fertility include physical, chemical, and biological degradation processes. The only option to meet the demand for agricultural output in emerging countries like India, where the land-person ratio is rapidly dropping, is to increase agricultural productivity with little to no impact to the environment and sustainability. The characterization of soils for the evaluation of fertility status for a particular locale or region is crucial to sustainable farming. Nitrogen, phosphorus, potassium, sulphur, calcium, and magnesium are the main soil constituents that regulate fertility and agricultural productivity. Recent years have seen a significant decline in the reaction efficiency of chemical fertilizer nutrients under intensive agriculture as a result of uneven and inadequate fertilizer use coupled with low reaction effectiveness of other inputs. Variation in the availability of nutrients is a normal phenomenon; certain nutrients are insufficient while the others are present in sufficient amounts. According to physical, soil quality is degraded in terms of productivity or fertility by chemical and biological

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processes. We cannot increase agricultural output without the application of macro nutrient fertilizers to correct current imbalances [2].

According to its physical area, Uttar Pradesh, which makes up 10.41% of the country's territory and has a 3, 42, 239 square km, is the fourth-largest state in the country. It is located in the south-eastern part of the country (Census, 2012 Provisional information) [3]. The country's projected agricultural output largely depends on the monsoon's quick arrival. The State received 650 mm of rainfall from the southwest monsoon and 1000 mm from the northeast monsoon, compared to the typical rainfall of 741 mm, according to the current monsoon season rainfall pattern. Due to little precipitation, there is insufficient groundwater supply. Due to the increased wind speed and temperature, plants are suffering. In heavier soils, the capacity to hold water is insufficient. In general, there is little to moderate availability of organic carbon and soil nitrogen status. Potassium is abundant in soil. Some areas of this region also showed micro-elemental deficits, primarily zinc. The results of the current investigation were useful in determining which micronutrient components were lacking and, consequently, how effectively fertilizers might be used given their availability. From Varanasi, District Chandauli was built in 1997. Following this procedure, the trend toward urbanization slowly increases over time. The study is required to measure these changes since the urban sprawl of the main city (Chandauli) and regional service center (Block headquarters) has been changing the land use and cropping pattern. The project's goals are to identify the causes of the shift in land use and cropping patterns in the study area as well as to look at how they have changed in the Chandauli district [4].

1.1 Research area

With a total area of 2441 square kilometers, District Chandauli is in eastern Uttar Pradesh and is a part of the middle Ganga plain. It is located between latitudes 24.42 and 25.35 north and 83.00 and 83.24 east. The research region is limited by both political and natural limits, including Sonbhadra district in the south, Bihar state in the northeast to southeast, the Ganga River in the north-west to north, and Mirzapur district in the west. According to Koppen's classification of climates, this area has a humid subtropical monsoon climate with a harsh summer and a mild winter. The majority of the yearly rainfall falls between June and September, with the remainder amount falling during the winter from western disturbances [5]. The district is separated into low-lying paddy land, hilly terrain, irrigated upland, and rain-fed land [6].

2 Materials and methods

2.1 Location

The town of Sakaldiha is situated in the Sakaldiha tehsil of the Chandauli district of the Indian state of Uttar Pradesh. It is 19.8 kilometres to the Pt. Deen Dayal Upadhyay station in Chandauli. The Chandauli district is located between latitudes 81°14′ and 84°24′ to the east and latitudes 24°56′ and 25°35′ to the north. It is around 30 km east-southeast of Varanasi. The location of the research area is marked on the Uttar Pradesh state map.

2.2 Analysis of soil sample

The soil forms the intermediate zone between the atmosphere and the rock cover of the earth, the lithosphere. It also forms the interface between water bodies (Hydrosphere) and the Lithosphere and thus, forming a part of Biosphere. The soil may be defined as the uppermost weathered layer of the earth’s crust in which are mixed organisms and products of their death and decay. It may also be defined as the part of the earth’s crust in which plants are anchored. The soil is a complex organization being made up of some six constituents’ namely inorganic matter, organic matter, soil organisms, soil moisture, soil solution and soil air. Roughly, the soil contains 50-60% mineral matter, 25-35% water, 15-25% air and little percentage of organic matter.

The soil pollution due to sewage is also very high. Several diseases are inflicted in human beings due to pathogenic forms present in the soil. It is the need of time that we have to study the physicochemical parameters of soil to know its quality. Twenty representative samples were collected from various parts of the Kadi taluka and its physicochemical analysis have been performed to know its different parameters like pH, Electrical Conductivity, Phosphorus, Potassium, Sulfur, Carbon and Boron [7]. The Physicochemical characteristics of the soil, including its mechanical examination, soil pH, electrical conductivity, organic carbon content, and availability of nutrients (N, P, K, S, Ca, Mg, Fe, Cu, Zn, and Mn), as well as its need for lime, were all examined.

2.3 Soil pH and electrical conductivity

The pH of the soil or the soil response is used to express the soil's acidity or alkalinity. Because it affects capacity, the pH of the soil is a crucial component. The pH readings varied by no more than 8.5. The pH number that acidic soil cannot exceed. Alkaline 6.5, Neutral 6.5-7.8 Alkali = 7.5–8.5 > 8.5. The total amount of soluble salts in the soil is determined using the electrical conductivity (EC) of aqueous soil. Extracts. Normal EC in soil is 0.8 dsm^{-1}, which is crucial for salt-sensitive crops and non-critical for salt-tolerant crops. 1.6 -2.5 dsm^{-1}, Injurious to most crops > 2.5 dsm^{-1}. (0.4 -1.8 dsm^{-1}) is the EC value.

2.4 Bulk density and Particle density

On an electric balance, the clean, dry pycnometer was taken and weighed. A spatula was used to fully fill the pycnometer with soil. The pycnometer's weight in the soil was then measured. The soil was then taken out of the pycnometer. The same pycnometer was filled with water in a burette, and water was then dripped into the pycnometer from the burette until the pycnometer was fully submerged in water. The real volume of the pycnometer will be determined by the burette reading. The pycnometer was removed and weighed. It was clean and dry. The pycnometer was filled with water and weighed. Take a beaker, fill it with 10 g of oven-dried soil, 10 cc of water, and heat it to drive out the air. By flushing water, this soil is conveyed to the pycnometer. Using a pipette, the soil clinging to the inside side of the neck of the bottle was rinsed. Placed the stopper in, cleaned the pycnometer's surface, let it dry, then weighed it.

2.5 Water holding capacity of soil

The piper method was used to determine the soil's ability to hold water (1996). Filter paper with the same diameter as the keen box was placed on the inner base of the box, and then it was weighed. In the box over the filter paper, earth was added. Twenty taps on the box filled the soil. With the aid of a knife, the upper surface was made nearly horizontal after dirt filling. The soil-filled box was next placed in a water-filled Petridis for an hour, after which the wet soil-filled box was kept in an oven to dry, the weight of the dry soil-filled box was taken, and finally a filter paper the same size as the soil-filled box was also submerged in water for an hour and weighed before and after wetting.

2.6 Organic carbon

By using chromic acid wet digestion to determine the amount of unreacted dichromate with ferrous ammonium sulphate, organic carbon in the soil was estimated.

2.7 Available Macronutrients

Using the alkaline $KMNO_4$ technique, which was described by excess alkaline $KMNO_4$ and a distillation apparatus were used to remediate 5g of soil. The soil's organic matter (amino acid) was oxidized by nascent oxygen produced by $KMNO_4$ in the presence of NaOH, resulting in the release of NH_3. This NH_3 was then distilled and absorbed in a known volume of standard acid (H_2SO4), with the surplus being titrated with standard alkali (NaOH). Available Phosphorus in the soil was extracted using 0.5M $NaHCO_3$ (pH 8.5). (1954) was determined using the Watanabe ascorbic acid method and the Kurtz method (0.03 $NH4F^+$ 0.025 HCL (pH 3.5)-prepared by combining 1.11 g of NH_4F with 2.1 ml of concentrated HCL in 1 liter). Soil potassium was extracted by shaking with neutral normal ammonium acetate for five minutes at a constant temperature (25°C), and the amount of K in the extract was then calculated using a flame Photometer [8].

2.8 Available Sulphur

A 0.15 percent calcium chloride solution was used to remove soil. Barium chloride was used to assess the amount of soluble sulphate in an extract sample while gum acacia solution was present. At a wavelength of 420 nm, the barium sulphate-induced turbidity was detected.

2.9 Available calcium and magnesium

The soil was extracted using neutral, aqueous ammonium acetate solution, which was shaken for a short period of time to extract the calcium and magnesium, and the calcium and magnesium extract was then filtered. A sample of extract (typically 5 ml) was titrated against a standard EDTA solution to see if the color of the extract changed from wine red to blue in the presence of ammonium chloride, ammonium hydroxide buffer solution, and Eri chrome black T indicator.

2.10 Available micronutrients

Utilizing 0.005M diethylene triamine Penta acetic acid (DTPA), 0.01M calcium chloride dehydrate, and 0.1M Tri ethanol amine buffered at pH 7.3, the micronutrients Zn, Cu, Fe, and Mn were extracted. A 100 ml conical flask containing 20 g of dirt was filled with a 20 ml DTPA solution. It was shaken horizontally for two hours. It was filtered via Whatman No. 42 filter paper, and atomic absorption Spectrophotometer measurements of concentrations were made.

2.11 Methodology for Soil nutrients status evaluation

The classifying of the soils of the various blocks as a whole in to the three fertility classes was done according to the nutrient index value computed from the soil test summaries giving there % distribution into low, medium and high categories. The formula for the nutritional index is: Nutrient index= [percent in high category *3+ percent in medium category *2+ percent in low category *1] / 100. A nutritional index of less than 1.5 indicates a poor category in this % assessment, and one between 1.5 and 2.5 indicates a medium fertility class. A value of 2.5 and above (up to 3.00) denotes a high fertility class for the specific nutrient.

2.12 Statistical Analysis

All of the observations' data were statistically analysed. Range, Mean, Standard deviation, and coefficient of variation for every parameter in soil were computed along with correlations between other values.

3 Result and discussion

3.1 Physicochemical properties of soil.

Information on pH, EC, B.D., P.D., W.H.C., and organic carbon can be found in Table 4. The information shows that the pH range of these soils was 6.1 to 7.9, with an average of 6.6. The lowest pH (6.1) was found in the soils of Dhaus Khas village, and the highest pH (7.52) was found in soils with S.D. values of 0.541614 and 7.72 percent (7.9).

13 percent of the communities (out of 60) had a moderate acidic pH, while 87 percent had a reactive neutral pH. The soils were reacting from slightly acidic to neutral. A similar result was observed in the lower Shivaliks in the Solan region of the North West Himalayas. The electrical conductivity of the Sakaldiha blocks was (0.8 -2.0) dsm^{-1} on average. The villages of Alampur (EC = 0.8) and Akabalpur (EC = 2.0), both with S.D. values of 0.317438 and C.V. values of 20.21896 percent, had the lowest and greatest respective ecs. Since the vast majority of soil tests fall within a tolerable range, salt is not harmful to seed germination. Out of 60 villages, 13% were somewhat acidic, whereas 87% were reactively neutral. The soils were transitioning from a moderate acidic state to a neutral state. In the lower Shivalik's in the Solan region of the North West Himalaya reported a similar conclusion. The electrical conductivity of the Sakaldiha blocks ranged from 0.8 to 2.0 dsm^{-1}, with an average value of 1.03 dsm^{-1}. With S.D. values of 0.317438 and C.V. values of 20.21896 percent, Akabalpur village had the greatest EC (2.0), while Alampur village had the lowest EC (0.8). Salt does not prevent seed germination because the vast majority of soil samples fall within a safe range. Rahmatnagar's sample had the lowest water retention capacity (23%) while Reusa's sample had the highest (43%).

The range of the data on the percentage of organic carbon was 0.2 to 1.2, with a mean value of 0.558. The soils of Awati village showed the maximum value (1.00), while Bahadurpur village had the lowest value (0.20), with the S.D. value of organic carbon being 0.182 and the C.V. value of organic carbon being 32.597 percent, respectively.

3.2 Status of available N, P, K of Sakaldiha block in soil.

In and its subparts, the state of N, P, and K have been displayed. These soils had an available N concentration that ranged from 150.52 to 188.16 kg ha^{-1}, with a mean of 155.12 kg ha^{-1}. The soils in Alampur villages had the lowest nitrogen content (150.52 kg ha^{-1}), whereas the soils in Basani had the highest nitrogen content (188.16 kg ha^{-1}) and the highest S.D. and C.V. values, respectively.

Out of 60 soil samples taken from 60 communities in the Sakaldiha block, 25% of the samples were found to be low quality, while 58% of the samples were found to be medium quality. The majority of soil samples were in the medium group, which may be related to the usage of bio fertilizer, green manures, or nitrogen fertilizer. Climate has a significant impact on the availability of nitrogen.

With a mean value of 14.19 kg ha^{-1}, the available phosphorus level in these soils ranged from 4.61 to 22.5 kg ha^{-1}. The village of Dhoos khus had the lowest amount of phosphorus (4.6 kg ha^{-1}), whereas Adampur had the largest amount (22.5 kg ha^{-1}), with a S.D. value of 3.41 and a C.V. value of 24.03 percent.

Out of the 60 soil samples that were obtained, 11.6% of the soil samples were found to be low in phosphorus content, while 88.4% of the soil samples were found to be in the medium range. These results concur with findings made public in relation to soils in the Baloda block of the Janjgir district, as well as some soils in Rajasthan [9].

With an average value of 308.65 kg ha^{-1} K, the potassium concentration in these soils ranged from 258.5 to 348.75 kg ha^{-1}. The soils of Patina had the lowest value of K (226.5 kg ha^{-1}) whereas Avahi village had the highest value of K (348.75 kg ha^{-1}) with S.D. value 26.35 and C.V. 8.53 percent.

Out of 60 soil samples, none fell into the low range, 81.7 percent were found to be medium, and 18.3 percent had high potassium contents. The greater value for K may be caused by the presence of elite, mineral rich in potassium, in these soils or by intense weathering that released K to the mineral exchange site in these soils.

3.3 Status of Available secondary macronutrient viz. S, Ca, Mg in soil of Sakaldiha block.

Table 1. and its sub-parts contain information on the availability of S exchangeable Ca^{2+}, Mg^{2+}, and soils in block of Chandauli district. The soils of the Sakaldiha block had accessible sulphur concentrations that ranged from 3.6 to 19.18 kg ha^{-1}, with an average value of 10.91 kg ha^{-1}. Adampur's soils had the lowest value of sulphur (3.16 kg ha^{-1}), while Katsila village's soils had the highest value (19.18), with a S.D. value of 4.87 and a C.V. value of 44.61 percent out of all soil samples, 40% were found to have low Sulphur level, while 60% were found to have medium Sulphur content in the soils of Sakaldiha Block. These soils have medium levels of sulphur, which may be because sulphur-rich complex fertilizers were used. The information showed that these soils had an average exchangeable Ca^{2+} concentration of 6.38 Cmol (P^+) kg^{-1}, with a range of 3.2 to 8 Cmol (P^+) kg^{-1}. The soils in Braga village had the lowest range of exchangeable Ca^{2+} (3.2 Cmol (P^+) kg ha^{-1}) while the soils in Ajagra village had the highest range (8 Cmol (P^+) kg ha^{-1}) with S.D. values of 1.81 and 33.94%. All soil samples were determined to have enough calcium that was readily available. It can be as a result of applying lime to the soil in the study region or using fertilizer high in calcium. With a mean value of 2.74 Cmol (P^+) kg^{-1}, the exchangeable Mg^{2+} concentration in the soils of the Sakaldiha block ranged from 0.75- 4.2 Cmol (P^+) kg^{-1}. Faguia village had the lowest amount of exchangeable Mg^{2+} (0.75 Cmol (P^+) kg^{-1}) whereas Braga village had the highest amount (4.2 Cmol (P^+) kg-^{1}) with a S.D. value of 0.93 and a C.V. value of 33.94%. One hundred percent of the soil samples taken from the sixty communities are confirmed to have enough magnesium.

3.4 Status of micronutrients viz. Fe, Zn, Mn and Cu in Soil of Sakaldiha block.

Micronutrient deficiencies are becoming more prevalent in soils at a faster rate, and the use of high fertilizer and high yielding crop types under intensive cropping systems has further sped up this trend. Therefore, monitoring soils for Fe, Zn, Mn, and Cu has become crucial.

The accessible Fe content of these soils ranged from (55.87-149.6 mg kg^{-1}), with an average value of 31.47 mg kg^{-1}, according to the data shown in table 4 and its subparts. Concur with these findings (2012) [9]. The village Amara had the lowest value (55.87 mg kg^{-1}), while the village Jagdishpur had the highest value (149.6 mg kg^{-1}), with a S.D. value of 43.08 and a C.V. value of 136.89%. Out of 60 soil samples, 80 percent were judged to be sufficient, while 20 percent had excessive iron contents. Because of its Topography, Sakaldiha block's soil has a lot of iron. The majority of soils do not lack iron because iron-bearing minerals in these soils release the iron that crops need. The availability of Fe content in the soil was negatively impacted by pH.

With a mean value of 63.77 mg kg^{-1}, the Available Mn concentration of these soils ranged from 42.46 to 88.02 mg kg^{-1}. The outcome is consistent with a possible explanation for the higher Mn content in the soil of the Sakaldiha block is the existence of manganese-bearing minerals. Amawal village had the lowest value of Mn (42.46 mg kg^{-1}), while Lauda village had the greatest value of content (88.02 mg kg^{-1}), with a S.D. of 13.42 mg kg^{-1} and a C.V. of 21.05 percent. Out of 60 soil samples, 23.33 percent were found to be inadequate, 28.34 percent to have high manganese contents, and 48.33 percent to be sufficient in their range [10].

With an average value of 5.25 mg kg^{-1}, the accessible Cu levels of the Sakaldiha block soil ranged from 0.24 to 11.94 mg kg^{-1}. The outcomes are consistent with the lowest (0.24 mg kg^{-1}) value of Cu content was reported in village Barahauli whereas highest (11.94 mg kg^{-1}) value of Cu was found in village Balipur with S.D. value of 2.21 and C.V. value of 42.15 per cent. Out of the total soil samples taken from 60 villages, 15% were deemed sufficient, 81.67% were determined to be high in copper, and 3.33 percent were deemed to be deficient in copper [9].

The findings showed that Saakaldiha's soils had an accessible Zn concentration that ranged from 0.338 to 7.546 mg kg^{-1}, with a mean value of 2.16 mg kg^{-1}.Reported results that were similar. When organic matter increased, the Zn shortage lessened and pH climbed. Bansipur had the lowest Zn content (0.338 mg kg^{-1}), while Jalsapur village had the highest (7.456 mg kg^{-1}) with a S.D. value of 1.59 and a C.V. value of 73.58 percent. 60 soil samples were examined, and 58.33 percent of the samples were determined to be insufficient, 33.33 percent to be sufficient, and 8.34 percent to have high Zn contents [9].

3.5 Nutrient Index of Soils of Sakaldiha block.

Table 5. below lists the nutrient index values of the accessible macronutrients (N, P, and K), secondary nutrients (S, Ca, and Mg), and micronutrient cations (Fe, Zn, Cu, and Cu) in the Sakaldiha block of the Chandauli district.

The soil in the Sakaldiha block had a "nutrient value index" rating of "Medium" for N, P, and K and "Low" for S. According to the nutrient index, the values for nitrogen, Phosphorus, potassium, and sulphur are 1.98, 1.78, 2.18, and 1.20, respectively, while the values for fertility status are 1.5 for low, 1.5 to 2.5 for medium, and >2.5 for high. Calcium, magnesium, iron, manganese, and copper each had a nutritional index value of 1.0, 6.16, 1.81, 0.92, and 2.75, respectively. Zinc's nutrient index has moved up to the "High" category. Zn has a calculated nutritional index value of 2.75.

3.6 On the analysis various parameters of Industrial Area following difference were seen.

Industrial area land contains pH value approx. to 7.28, respectively. The usage of fertilizer and continuous cropping may be responsible for the higher pH of the soil, whereas industrial raw materials may be to blame for the lower pH. Industrial area mean EC values is of 1.7, respectively. There is no discernible variance 1.24 Mg m^{-3} of soil from industrial area, respectively, were measured. The particle density fluctuates between 2.23Mg m^{-3}, 2.32 Mg m^{-3}, and 2.29 Mg m^{-3}. 31.63 percent, 32.10 percent, and 33.75 percent were the results for the WHC. It's virtually comparable. The recorded values for OC, Industrial area is of 0.42. Due to agricultural cultivation, OC in Industrial area. S, Ca, and Mg showing change due to cultivation and industries in 308.25, 302.06, and 320.66 kg ha^{-1}, respectively. All sample locations were recorded at 4.76.5.91 and 13.42 Cmol $(P)^{+}$ kg^{-1}, 6.51, 6.59, and 5.48, respectively, 2.49, 2.24, and 3.48. Due to industrial waste deposition, S, Ca, and Mg levels are high. Fe, Mn, Zn, and Cu were detected in concentrations of 76.76, 64.16, 2.51, and 6.16 in 89.61, 66.14, 1.74, and 7.76 in industrial land. Due to the accumulation of industrial waste on the soil, almost all metrics are high in industrial areas.

Table 1 Physical properties and characteristics of soil of Sakaldiha Block

Soil characteristics	Range	Mean	S.D	C.V. (%)
PH (1:2.5, soil water)	6.1 – 7.9	7.00	0.5416	7.726488
E.C. (ds m^{-1})	0.8 – 2.0	1.57	0.3174	20.21896
B.D (Mg m^{-3})	1.12- 1.42	1.4	0.0236	4.067498
P.D (Mg m^{-3})	2.00 – 2.89	2.23	0.1290	116.0092
W.H.C (%)	23 – 43	32.49	3.9984	12.30478
O.C. (%)	0.2 – 1.02	0.558	0.182000893	32.59728

Table 2 Status of available primary macronutrients in soil of Skaldiha block.

Soil characteristics	Range	Mean	S.D.	C.V.
Available N (kg ha^{-1})	150.528 - 188.16	155.1213	15.70	10.12
Available P (kg ha^{-1})	4.6 - 22.5	14.19	3.41	24.03
Available K (kg ha^{-1})	258.5 - 348.75	308.65	26.35	8.539

Table 3 Status of available secondary macronutrient viz. S, Ca, Mg in soils of Sakaldiha block

Soil Characteristics	Range	Mean	S. D	C.V
Available S (kg ha^{-1})	3.6 - 19.18	10.91	4.87	44.61
Available Ca(Cmol(P^{+})kg^{-1})	3.2 – 8.0	6.38	1.81	28.37
Available Mg (Cmol (P^{+})kg^{-1})	0.75 - 4.25	2.74	0.932757	33.94

Table 4 Status of available micronutrient viz. Fe, Zn, Mn, Cu in soils of Sakaldiha

Soil Characteristics	Range	Mean	S.D.	C.V.
Available Fe (mg kg^{-1})	55.87 - 149.6	31.47	43.08	136.89
Available Mn (mg kg^{-1})	42.46 - 88.02	63.77	13.42	21.05
Available Cu (mg kg^{-1})	0.24 - 11.94	5.25	2.215	42.15
Available Zn (mg kg^{-1})	0.338 - 7.546	2.16	1.59	73.58

Table 5 Nutrient Index value of recorded nutrients showing soil fertility analysis present in Sakaldiha block of Chandauli district

S.No.	Available Nutrient	NIV	Category
1	Nitrogen	1.89	Medium
2	Phosphorus	1.78	Medium
3	Potassium	2.18	Medium
4	Sulphur	1.20	Low
5	Calcium	1.0	Low
6	Magnesium	1.0	Low
7	Iron	6.16	Medium
8	Manganese	1.81	Low
9	Copper	0.92	High
10	Zinc	2.75	High

Table 6 Physiochemical recorded data of soil present in Industrial area of Sakaldiha block in Chandauli district.

S. No	Parameter	Industrial Area
1	PH	6.62
2	EC (dsm^{-1})	1.71
3	BD (Mg m^{-3})	1.24
4	PD (Mg m^{-3})	2.29
5	WHC (%)	33.75
6	OC (%)	0.42
7	N (kg ha^{-1})	159.30

8	P (kg ha^{-1})	17.50
9	K (kg ha^{-1})	320.62
10	S (kg ha^{-1})	13.42
11	Ca (C mol P^{+} kg^{-1})	5.48
12	Mg (C mol P^{+} kg^{-1})	3.48
13	Fe (mg kg^{-1})	89.61
14	Mn (mg kg^{-1})	66.14
15	Zn (mg kg^{-1})	1.71
16	Cu (mg kg^{-1})	4.76

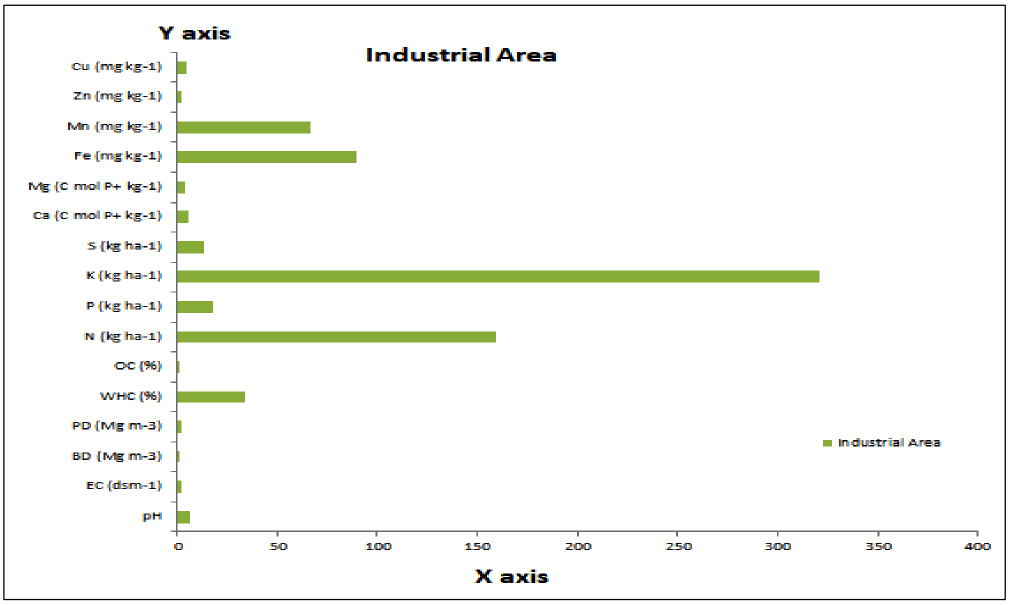

Figure 1 Industrial area of Sakaldiha block in Chandauli district

Physiochemical index value of some elements used in Industrial areas of soil.

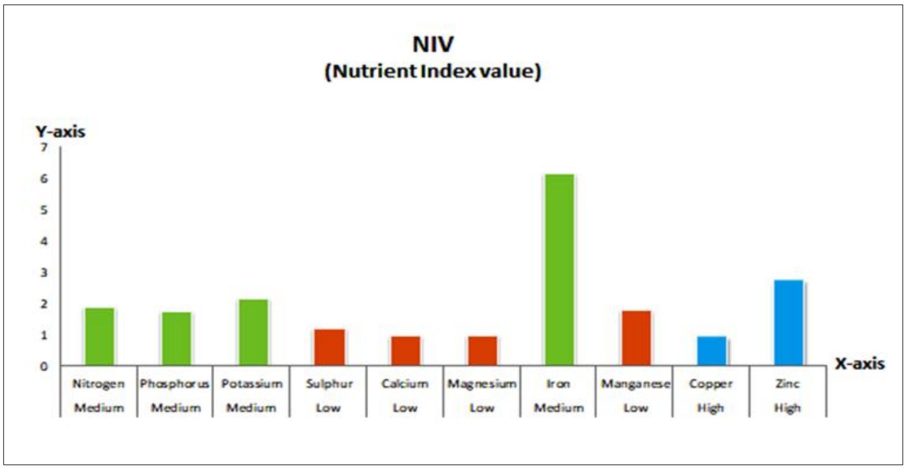

Figure 2 Nutrient Index value of Sakaldiha block of Chandauli district.

4 Conclusion

The soil in the Sakaldiha block of the Chandauli district is classified as slightly acidic to neutral in reaction, and its soluble salt content is within a safe range that has no impact on crop germination. The soil in the study area has a middle range of organic carbon. The Phosphorus content of the soil in the study area ranges from low to medium. While potassium was discovered in the medium to high range, nitrogen varied from low to high. The soil of the Sakaldiha block contained an adequate amount of calcium and magnesium. Mn, Cu, and Zn content in the soil of the study region ranged from inadequate to sufficient, but Fe level was adequate across the soil. The B.D., P.D., macronutrient, and micronutrient values are slightly greater in areas close to industries. According to our research, farmers who live close to factories and industries and who depend only on farming can guarantee the germination of their seeds and the cropping of their crops to prevent illness and field destruction. In our research, we examined the significant macronutrients and micronutrients found in the soils of industrial areas, which will help the human food supply as well as reveal the potentially deadly effects of fatal diseases brought on by factories and industries on our life.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare there is no conflict of interest in this study.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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