PHYSICO-CHEMICAL PROPERTIES OF SOIL OF DIFFERENT AREAS OF JAJPUR DISTRICT

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This is to certify that the thesis entitled, "**PHYSICO-CHEMICAL PROPERTIES OF SOIL OF DIFFERENT AREAS OF JAJPUR DISTRICT**" submitted in partial fulfillment of the requirements for award of degree of Master of Science in Chemistry to the Odisha University of Agriculture and Technology, Bhubaneswar, is a faithful record of bonafide research work carried out by **RAJESH KUMAR SWAIN** under the guidance and supervision and that no part of thesis has been submitted for any degree or diploma or published in any form.

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ABBREVIATIONS

NPK-Nitrogen-Phosphorus-Potassium

Ca - Calcium

Mg - Magnesium

BD - Bulk Density

EC - Electrical Conductivity

WHC – Water holding capacity

EDTA – Ethylenediaminetetraacetic acid

PD -Particle density

BD-Bulk density

OC -Organic Carbon

ABSTRACT

A crucial component of habitat is soil. It contains different types of minerals, microbial communities, and organic materials. Soil is an essential component for the healthy growth of plants since it contains nutrients. The true rank of the soil can be determined by knowing the soil fertility. The ability of the soil to provide plants with sufficient amounts of nutrients in a very good ratio is known as soil fertility. From the Jajpur district, soil samples were taken from Chandikhole, Jarka, Mirzapur, Raghunathpur, and Dhanmandal, representing five separate locations. The aforementioned locations' soil samples were used in experiments to test for physical characteristics like WHC and texture as well as chemical characteristics like PH, EC, and OC. It was found from the experiment that the PH of the soil is least in Raghunathpur (4.3), Highest in Chandikhole (5.7), Jarka has the second highest (5.1). Also, the EC highest in Dhanmandal (0.41) and the lowest in Raghunathpur (0.12). The OC was found to be highest in Raghunathpur (7.89) and the lowest in Dhanmandal (3.04).

From these results we can find out which type of crop is suitable for these soils and will give a sober yield.

INTRODUCTION

One of the most crucial natural resources is soil. The most important component that satisfies all of the fundamental requirements of living things is soil. It offers a growing environment for plants and feeds nutrients to the organism, all of which are necessary for the existence of many forms of life. Therefore, the importance of soil to survival is enormous. The physical and chemical characteristics of the soil greatly influence how much water and nutrients the plants take in. The physiochemical characteristics of the soil that is utilized for agriculture determine all agricultural production and forest growth. The quantity, shape, size, structure, pore spaces, organic matter content, and mineral makeup of the soil all affect its physical composition of soil. The chemical properties of soil are the interactions of discrete chemical particles with soil particles. Water retention, carbon sequestration, plant productivity, best remediation, and other functions are examples of functions that fall within the category of soil quality. It can also be defined more specifically when dealing with a particular soil type. Here, an effort is made to examine specific qualities and provide a pertinent approach that aids in the efficient use of resources and increases productivity.

The goal of this study was about the inspection of the status and properties of soil in Chandikhole, Jarka, Dhanmandal, Mirzapur, Raghunathpur.

REVIEW OF LITERATURE

For the realization of the topic of research, material information was collected from different literature from textbooks, Environmental progress reports from various agencies,websites, reports by government agencies,considerable knowledge was collected and a review of what other scientists have stated on issues concurring with the research topic is done.

In fluorotic areas of the Agastheeswaram Union, South India, Anita Joshi Raj and V UmayoruBhagan [1] investigated the fluoride content with physicochemical characteristics of 51 surface soil samples and 51 subsurface water samples. In all the fluorotic locations, the surface soil samples had fluoride levels higher than the subterranean water samples. The range of fluoride concentrations in the soil and water samples was 2 to 3.5 ppm and 1.3 to 2.7 ppm, respectively. We also looked at other variables like pH, alkalinity, and salt.In all of the soil and water samples taken at various times of the year, alkalinity and pH levels were found to be higher than allowed. Finally, it was predicted that the leaching of minerals from the soil is what causes the high fluoride content in water samples.

DilipBillore and Saroj Mahajan [2] from July 2008 to June 2009, work was done on the investigation of physico chemical factors including pH, specific conductivity, sulphate, phosphate sodium, and potassium. Variations in the variables occurred during the study year. The findings of the investigation indicated that the soli was alkaline throughout the research year. The soil's quality affects an ecosystem's productivity. The quality and productivity of pond soil are impacted by several factors being above and below acceptable limits.

Anu, Upadhya S.K and Avinash Bajpai [3] conducted research on how waste dumps might contaminate soil. Solid waste is defined as trash, sludge, refuse, and other materials that have been abandoned (including solids, liquids, and enclosed gases) as a result of operations in the industrial, commercial, mining, and agricultural sectors as well as community activities. To evaluate the soil quality, samples were gathered from Shahpur Lake in Bhopal. Physical and chemical characteristics of the soil, including pH, moisture content, bulk density, and chloride, were evaluated during the study period using the accepted techniques. High chloride values suggest soil sediment pollution as a result of urbanization, industrialization, and agricultural system modernization, which leads to excessive use of chemical fertilizers and pesticides.

SA, Osakwe [4] In a study, the physicochemical characteristics of soils from parts of the Isoko Region of Delta State, Nigeria, damaged by a natural flood disaster were examined. The findings showed a general decrease in soil pH (5.425 0.313), phosphorus (7.47 +- 6.34mgkg-1), and nitrate (0.34 +-0.07mgkg-1), as well as exchangeable calcium (1.97 0.31mgkg-1 potassium (0.090.01mgkg-1), and effective cation exchange capacity (5.0761.532 (cmolkg-1) and related parameters with 3.87 +- 0.21, 77.57+- 5.83 . The values of exchangeable magnesium (1.50 +-0.25mgkg-1), exchangeable sodium (0.28 +-0.004mgkg-1) and exchangeable acidity, with values of 0.43+0.08 and 0.42+-1.02mgkg-1 for Hydrogen and Aluminum, respectively.

The overall findings showed that the flood lowered soil metal adsorption capacity and increased soil acidity, but had little to no impact on biodegradable and compostable components. Government should take the initiative and develop strategies to stop the country from experiencing more flooding disasters.

According to research by Kiran G. Chaudhari [5], the physical-chemical analysis of soil depends on a number of factors, including total organic carbon, nitrogen (N), phosphorus (P2O5), potassium (K2O), pH, and conductivity. We draw a conclusion on the amount of nutrients available in the soil of Bhusawal, District Jalgaon, based on this study (Maharashtra). According to the findings, all eight of the Bhusawal locations that were chosen contain medium to high mineral contents. in order to research how applying nitrogen and phosphorus fertilizer might boost crop production by percentage. This knowledge will assist farmers in resolving issues with soil nutrients, including how much fertilizer should be applied to maximize crop yield.

Work on soils with physical properties, chemical properties, and micro nutrients of soils has been done by Rajesh P. Ganorkar and P.G. Chinchmalatpure [6]. Six different areas around Rajura Bazar in Warud Tahsil of Amravati District (Maharashtra), India, were used to collect soil samples. In the month of February 2013, the soil's moisture content, pH, EC, carbon, calcium carbonate, TDS, magnesium, calcium, nitrogen, copper, potassium, and phosphorus contents were examined. The soil sample pH values showed that all samples were alkaline and contained a moderate amount of readily available micronutrients.

Joel O.F. and Amajuoyi C.A. [7] investigated a few heavy metals and selected physicochemical characteristics at a drilling cutting dump site. According to test results, the majority of the plots in the research region had a high degree of contamination for various heavy metals as copper, iron, and calcium. Copper was at 84 mg/kg, calcium was at 12560 mg/kg, and iron was at 880 mg/kg. These readings exceeded the regulatory body's established goal values, the Department of Petroleum Resources (DPR). Additionally, the oil and

grease showed significant contamination, with one plot having a concentration of up to 840 mg/kg. This was demonstrated by the absence of plant development that was observed in the research region due to the NPK values running out below what was required to meet USDA standards for plant growth. The project's highest level of heavy metal and physicochemical parameter pollution demonstrates the importance of exercising caution when handling drilling cutting discharges.

Researchers AbdulmajeedMlitan, Abdullah Abofalga, and Abdelaziz Swalem [8] looked into how treated wastewater affected the chemical and physical characteristics of soil. Wastewater treatment was the subject of a field experiment in the Misurata region in central Libya. Industrial waste water is treated using soil physicochemical characteristics such pH, water content, total soluble salts, and the addition of cadmium, zinc, lead, copper, and iron. The findings show that several test sites were contaminated by industrial waste water. The percentage of water in the soil varied from 7.68 to 19.56. With no discernible variations between places, soil pH ranged from 7.7 to 8.0 and total soluble salts ranged from 272.6 to 300 ppm. With the exception of iron, all of the tested metals increased from the first to the third location.

Work on impacted and non-impacted soil was done by SanjoliMobar, Pallavi Kaushik, and Pradeep Bhatnagar [9] in Sanganer and Durgapura, two locations in the Jaipur district. By estimating physicochemical parameters like pH, electrical conductivity (EC), water holding capacity, texture analysis, organic carbon, organic matter, total hardness, sodium, and potassium concentrations, as well as sodium adsorption ratios (SAR) and cation exchange capacities (CEC), the soil quality was analyzed. The findings indicated a substantial difference in both soil's pH, EC, water holding capacity,

total hardness, SAR, and CEC, indicating the influence of industrial effluent on soil quality. Control of this industrial contamination, which can be ensured by planned development, therefore assumes more significance to maintain the declining soil quality.

In Western India's Gujarat state, Prakash L. Patel, Nirmal P. Patel, Prakash H. Patel, and Anita Gharekhan [10] compared the chemical characteristics of agricultural soil in several villages throughout Kutch district. Their main goal was to investigate the mung bean crop using 30 samples of medium dark soil that were randomly chosen. Soil samples were taken by authorized farmers who had received local training under the Gujarati government's Soil Health Card Program and brought to the Soil Test Laboratory in Bhuj for analysis. The analysis of the soil quality employed standard methodologies. By employing correlation analysis, this work aims to investigate and assess the relationship between soil characteristics and macronutrients (P, K, C, and S).

The Tiptur Taluk's Eachanur, V. Mallenahalli, and Halkurke lakes' designated command regions were the subject of research by A.M. Shivanna and G. Nagendrappa [11]. The following factors were examined: pH, EC, OC, N, P, and K. According to the study, the pH of the soil samples ranged from 7.07 to 7.87, was somewhat alkaline but still within the range of 6.5-8.5 that is best for crops. The soils' low salinity status was indicated by EC values that ranged from 0.26 dSm-1 to 0.485 dSm-1 and were below the threshold of 0.8 dSm-1. The OC content of the samples ranged from 0.50 to 0.67 percent, and they were all rated as medium.

MATERIALS AND METHODS

Five soil samples were collected from five various locations of Jajpur district. Physical and chemical characteristics were measured three times each for each parameter.

pH

We measured the pH of the soil water solution using a systronic pH meter with a combined glass rod and calomel electrode. 40mLdistilled water was combined with a 20gm soil sample. in a 1:2 ratio. The suspension was left for an hour after being stirred sporadically for 30 minutes with a glass rod.

The pH value was measured after inserting the combined electrode into the supernatant. The soil's acidity or alkalinity is determined by the pH value, which measures the hydrogen ion activity of the soil-water system.

ELECTRICAL CONDUCTANCE (EC)

A systronic conductivity meter was used to calculate the EC of the soil-water suspension. 40mL of distilled water and 20g of soil were combined in a 1:2 ratio. The suspension was held for 30 minutes while being agitated sporadically. After allowing the soil to settle, a conductivity cell was placed in the solution to take a reading and record the EC values.

ORGANIC CARBON (OC)

The Walkley and Black Method was used to determine the soil's OC (organic carbon). 2 g of finely ground soil were added to a 500 mL conical flask after passing through a mesh filter, where they were then mixed with 20 mL of concentrated H_2SO_4 and cc of 1N $K_2Cr_2O_7$. After shaking the flask for a minute, it was left to stand for 30 minutes. 10mL of concentrated H_3PO_4 was added after 200mL of distilled water. After adding 1cc of biphenyl amine indicator, the solution became a deep violet color. The mixture was titrated against a 0.5N ferrous ammonium sulphate solution until the solution's color turned parrot green. Following all of the aforementioned procedures, a blank titration was performed without using soil.

Determination of bulk density, particle density and percent pore space

A 100-cc measuring cylinder was filled with 40–50 g of soil after being weighed and measured. The amount of soil was measured after the cylinder was struck six times on the tabletop from a height of four inches. The soil was moved to a sheet of paper, and water (from a burette) was added to the cylinder until the soil was completely submerged. A glass rod was used to mix the soil after it had been added to the cylinder. Glass rod was removed after being rinsed with water from the burette. It was noted how much water the burette added in total. The total amount of soil water did not fill the cylinder to its maximum capacity.

Calculation

Weight of soil(g) = w

Volume of soil (cc) = v1

Volume of water(cc) = v2

Volume of soil water suspension = v3

Bulk density (g/cc) = W/V1

Particle density(g/cc) =W/V3-V2

% PORE SPACE = (1-BD/PD) x 100

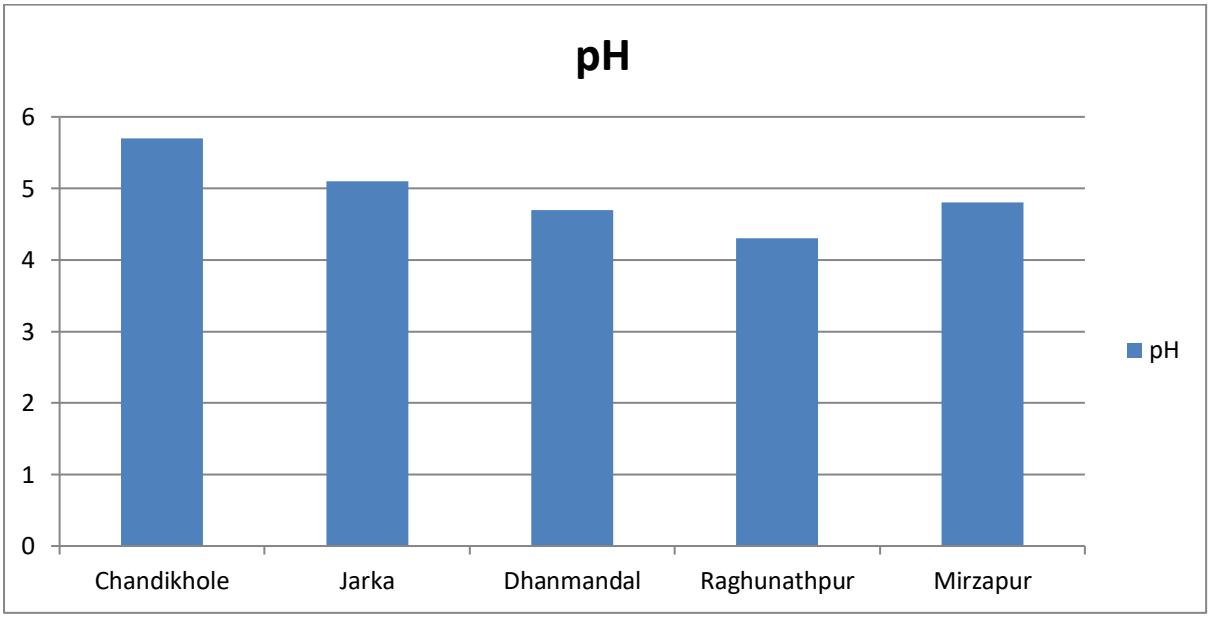
RESULTS AND DISCUSSION

pH, Electrical conductivity, Organic carbons, Bulk density, Particle density and Percentage of pore space of different areas of Jajpur district are listed in table-1.

AREA	pH	EC	OC	BD	PD	% OF PORE SPACE
CHANDIKHOLE	5.7	0.21	6.41	1.94	3.60	48
JARKA	5.1	0.18	4.32	2.27	4.81	53
DHANMANDAL	4.7	0.41	3.04	2.09	3.70	44
RAGHUNATHPUR	4.3	0.12	7.89	1.80	3.07	42
MIRJAPUR	4.8	0.23	5.92	2.05	3.60	44

pH :

Soil samples are collected from different areas of Jajpur district lies in acidic range (4.3 to 5.7). The highest soil pH (5.7) was found in Chandikhole followed by Jarka, Mirzapur, Dhanmandal with their respective mean value of 5.1,4.8,4.7. The lowest soil pH was found in Raghunathpur (4.3), which is more acidic.



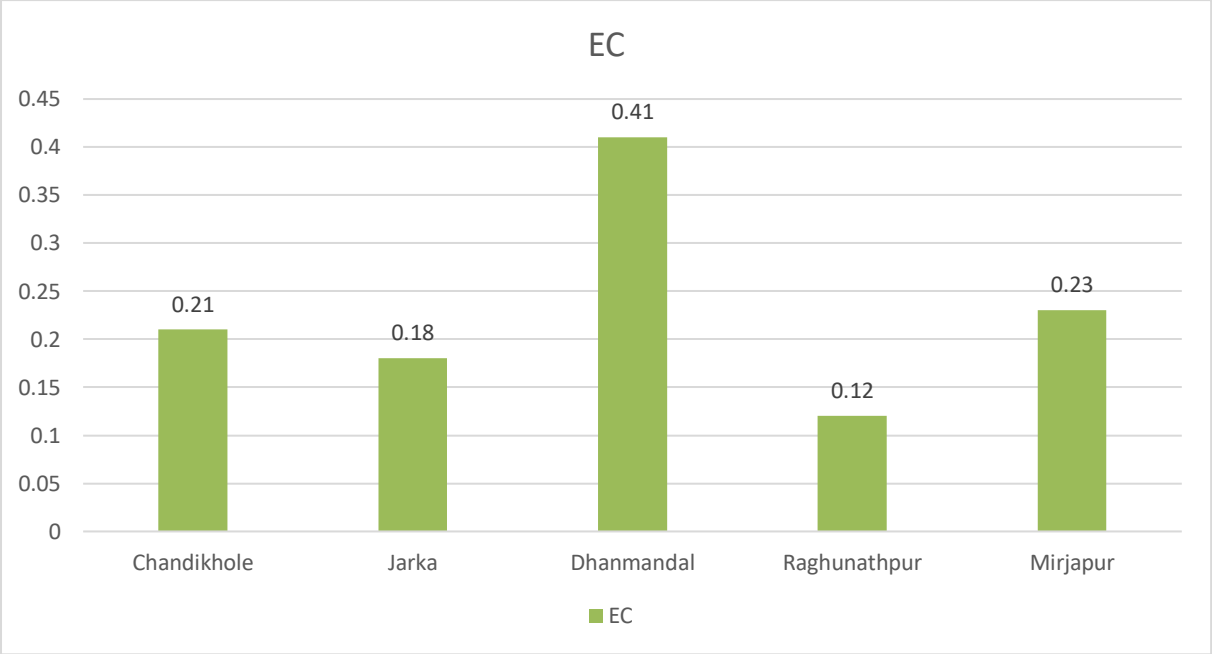
[Figure 1]

[PH of soils of different areas of Jajpur district]

EC:

The soils of Chandikhole, Jarka, Dhanmandal, Raghunathpur, and Mirzapur had electrical conductivities (1:2) that ranged from 0.12 to

0.41 dsm-1. Dhanmandal had the highest mean EC value (0.41 dsm-1), followed by Mirzapur (0.23 dsm-1), and Raghunathpur had the lowest EC value (0.12 dsm-1).

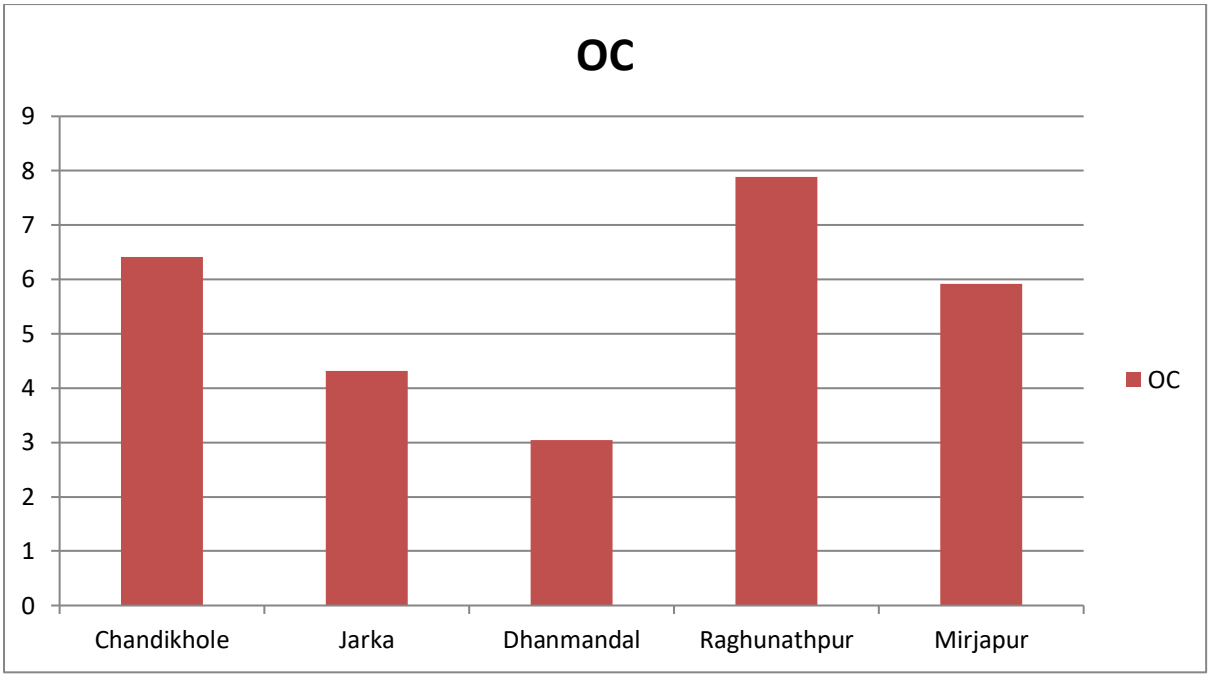


[Figure 2]

[EC of soils of different areas of Jajpur district]

OC:

The range of oxidizable organic carbon is 3.04 to 7.89 g kg-1. The information showed that Dhanmandal had the lowest (3.04 g kg-1) and Raghunathpur had the greatest (7.89 g kg-1) soil organic carbon content. Some regions of the Jajpur district have a high OC concentration since there are farms and forests nearby.

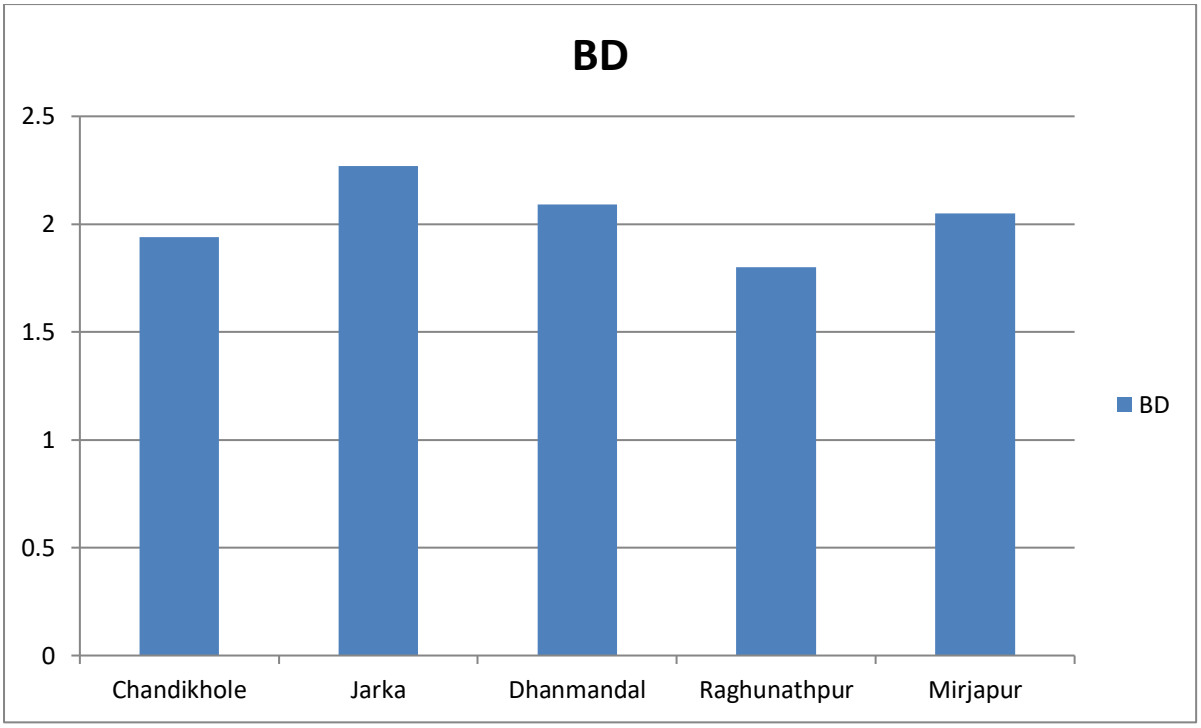


[Figure 3]

[OC of soils of different areas of Jajpur district]

BD:

Raghunathpur, Chandikhole, Mirzapur, Dhanmandal, and Jarka soils ranged in bulk density (BD) from 1.80 to 2.27. The highest mean BD value was reported in Jarka (2.27) and was followed by Dhanmandal (2.09). Raghunathpur recorded the lowest BD value (1.80).

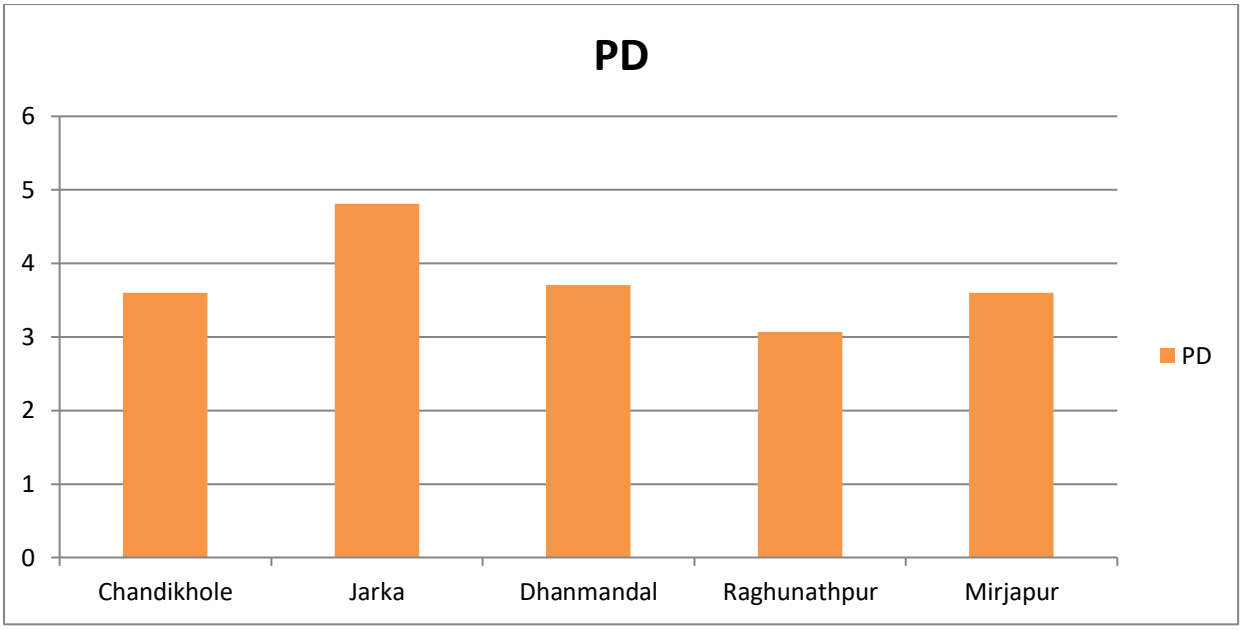


[Figure 4]

[BD of soils of different areas of Jajpur district]

PD:

All of the samples of soil taken from the Jajpur district's areas have pd values that fall within the following range: (3.07 to 4.81). Jarka had the highest particle density (PD) (4.81) followed by Dhanmandal, Chandikhole, and Mirzapur with mean values of 3.70, 3.60, and 3.60 respectively. Raghunathpur had the lowest particle density (PD) (3.07).

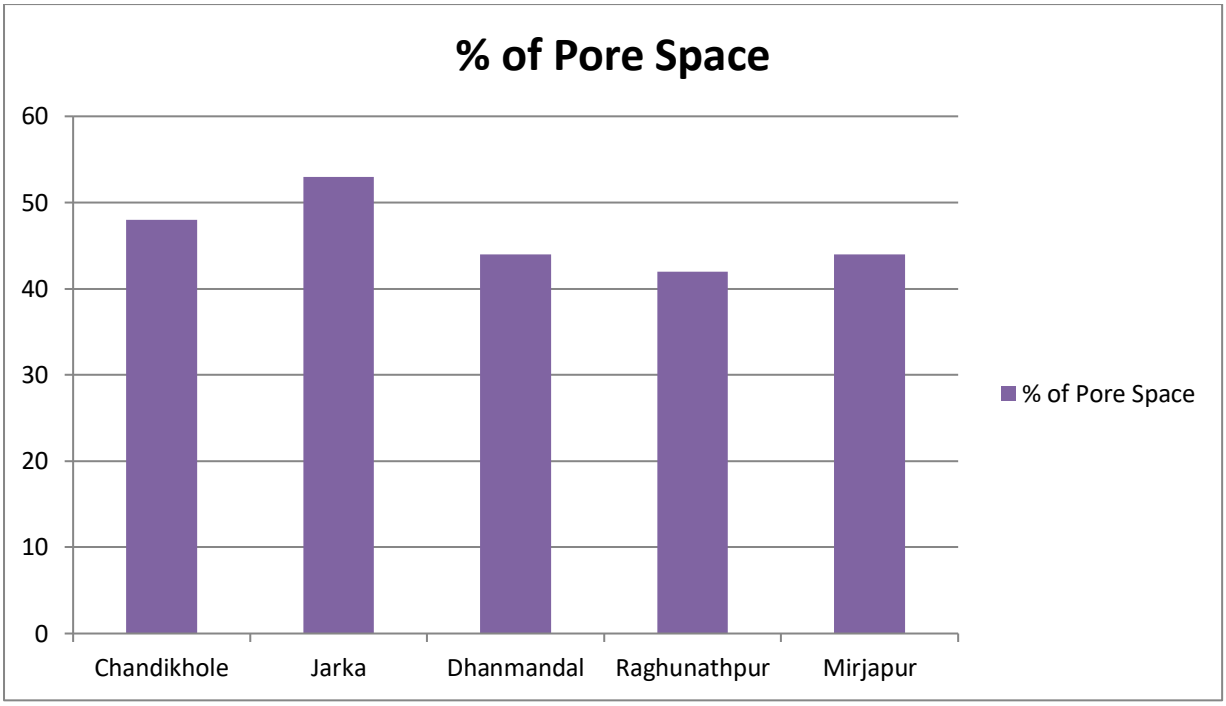


[Figure 5]

[PD of soils of different areas of Jajpur]

PORE SPACE:

Raghunathpur, Dhanmandal, Mirzapur, Chandikhole, and Jarka soils ranged in pore space percentage from 42 to 53 percent. The information showed that Jarka (53 percent) has the largest pore space, followed by Chandikhole (48 percent). It has been noted that Dhanmandal and Mirzapur's soils possess the same percentage of pore space (44 percent). In Raghunathpur, the lowest pore space was found (42 percent).



[Figure 6]

[Pore space of soils of different areas of Jajpur district]

CONCLUSION

To compare the properties of soils of different parts of the Jajpur district, five distinct soil samples were taken and their physical, chemical, and biological characteristics was recorded. It was determined that Chandikhole and Dhanmandal have the highest PH and EC. The area around Raghunathpur has the largest concentration of OC, followed by Chandikhole and Mirzapur. Compared to other chosen areas in the Jajpur district, Dhanmandal has the lowest OC.

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