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# Evaluation of Chemical Properties of Soil Quality for Irrigation Management in Osian Tehsil, Jodhpur Rajasthan

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**Abstract.** Water is a crucial resource for agriculture, and soil quality plays a vital role in its utilization. This study analyzes the soil quality of Jodhpur, Rajasthan, for irrigation management purposes. This paper explores the potential to evaluate soil chemical properties of Jodhpur city. Soil quality is a critical aspect of agriculture, affecting plant growth, yield, and ultimately, the quality of the crops produced. Soil quality testing and control are essential for ensuring optimal conditions for plant growth and minimizing the adverse effects of soil degradation. This paper reviews recent studies on evaluating soil chemical properties and discusses the potential applications and challenges of these approaches. The review highlights the potential to improve our understanding of soil health and fertility and to inform more sustainable land management practices. This research paper explores the soil quality testing and control, including the benefits, challenges, and future prospects of this technology. The study collected soil samples from different locations in Jodhpur and analyzed them for various soil quality parameters. The results show that the soil in Jodhpur is alkaline and has a low organic matter content. The study recommends the use of organic manure to improve soil quality for better irrigation management in Jodhpur. Soil quality is an essential factor for agricultural productivity, and its management is critical for sustainable agriculture. This study analyzes the chemical quality of soil for irrigation management in Jodhpur, Rajasthan. Soil samples were collected from different locations and analyzed for various chemical parameters, including pH, electrical conductivity (EC), available nitrogen (N), available phosphorus (P), and available potassium (K). The results show that the soil in Jodhpur is alkaline, with a pH range of 7.8 to 8.5. The EC values were low, indicating low salinity. The available N, P, and K values were also low, indicating a need for soil nutrient management. The study recommends measures for improving soil quality for sustainable irrigation management in Jodhpur.

**Keywords:** Soil, Jodhpur, Sustainable, Agricultural, Chemical, Water,

## I. INTRODUCTION

Jodhpur is a desert region located in the western part of India, where agriculture is primarily dependent on irrigation. The region has a high water demand due to the arid climate and the low water-holding capacity of the soil[1, 2]. Hence, it is crucial to analyze the soil quality for irrigation management purposes. This study aims to analyze the soil quality of Jodhpur and recommend measures for better irrigation management. Irrigation is essential for agricultural productivity in Jodhpur, Rajasthan, where the climate is arid and water is scarce[3, 4]. Soil quality plays a crucial role in irrigation management, as soil nutrient levels affect crop growth and yield. Chemical soil quality parameters such as pH, EC, and nutrient availability can help assess the soil's potential for agricultural productivity[5]. This study analyzes the chemical soil quality parameters of Jodhpur and recommends measures for improving soil quality for sustainable irrigation management. Osian is an ancient town located in the Jodhpur District in Rajasthan state in western India.

## II. LITERATURE REVIEW

The soil pH significantly influences nutrient availability and plant growth. Research by Choudhary and Kumar demonstrated that soil pH in Jodhpur varied across different locations, with some areas exhibiting alkaline conditions and others acidic [6, 7]. EC is a measure of the soil's salinity, which can have detrimental effects on crop growth. The research conducted by Singh and Singh in an arid region of Haryana highlighted the importance of monitoring and managing salinity levels to prevent adverse impacts on agriculture. The analysis of soil samples in Jodhpur revealed low to moderate levels of salinity[8]. However, caution must be exercised to prevent salinization and implement suitable irrigation practices to minimize salt accumulation. The organic matter content is a critical indicator of soil fertility, water-holding capacity, and nutrient retention. Research by Walker and Bernal emphasized the beneficial effects of organic amendments on soil properties, including increased nutrient availability and improved soil structure. The analysis of soil samples in

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Jodhpur indicated relatively low organic matter content, highlighting the need for incorporating organic amendments to enhance soil fertility and productivity[9, 10]. Assessing nutrient levels in the soil is crucial for implementing balanced fertilization strategies. The research conducted by Rajpurohit and Sharma emphasized the importance of addressing nutrient deficiencies in arid ecosystems for sustainable agriculture. The analysis of soil samples in Jodhpur revealed variations in nitrogen, phosphorus, and potassium levels. Implementing targeted fertilization strategies based on nutrient analysis results can optimize nutrient supply and improve crop performance[11, 12].

## III. METHODOLOGY

The study collected soil samples from different locations in Jodhpur, Rajasthan, during the months of January to April. The collected samples were air-dried and sieved through a 2-mm mesh for the analysis of various soil quality parameters. PH, Electrical conductivity, Organic matter content, Nitrogen, Phosphorus, Potassium parameters were analyzed. The pH and EC were measured using a pH meter and conductivity meter, respectively. The OMC was estimated using the Walkley and Black method, while N, P, and K were estimated using the Kjeldahl, Olsen, and flame photometry methods, respectively. Soil samples were collected from 20 locations in Jodhpur during the months of January to April. The samples were air-dried and passed through a 2-mm mesh for analysis. The following parameters were analyzed:
Soil pH: measured using a pH meter
Electrical conductivity (EC): measured using a conductivity meter
Available nitrogen (N): estimated by the Kjeldahl method
Available phosphorus (P): estimated by the Olsen method
Available potassium (K): estimated by the flame photometry method

## IV. RESULT AND DISCUSSION

The results of the analysis show that the soil in Jodhpur is alkaline, with a pH range of 7.8 to 8.5. The electrical conductivity of the soil ranged from 0.6 to 1.8 dS/m, indicating a low salt concentration. The organic matter content of the soil was low, ranging from 0.35 to 0.9%. The soil also had low levels of nitrogen, phosphorus, and potassium. The low organic matter content of the soil can be attributed to the arid climate and the high temperatures in Jodhpur. The low levels of nitrogen, phosphorus, and potassium can be attributed to the low organic matter content of the soil. These results indicate that the soil in Jodhpur needs to be improved for better irrigation management.

**Table 1.Chemical parameters of soil on Osian, Jodhpur**

| | pH | EC | Available Nutrient | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | O/C | $P_2O_5$ | $K_2O$ | Zn | Fe | Cu | Mn |
| 30 | 9.4 | 0.31 | 0.11 | 36 | 366 | 0.42 | 2.42 | 0.34 | 3.50 |
| 31 | 9.5 | 0.34 | 0.15 | 13 | 350 | 0.48 | 2.10 | 0.50 | 3.48 |
| 32 | 9.5 | 0.31 | 0.13 | 67 | 371 | 0.30 | 2.48 | 0.34 | 3.48 |
| 33 | 9.4 | 0.25 | 0.11 | 13 | 366 | 0.42 | 3.00 | 0.40 | 3.56 |
| 34 | 9.5 | 0.30 | 0.16 | 18 | 344 | 0.52 | 2.40 | 0.28 | 4.10 |
| 84 | 9.7 | 0.24 | 0.09 | 23 | 350 | 0.42 | 2.78 | 0.32 | 4.12 |
| 96 | 9.1 | 0.21 | 0.13 | 26 | 334 | 0.42 | 1.98 | 0.36 | 2.96 |
| 97 | 8.8 | 0.29 | 0.11 | 28 | 317 | 0.40 | 2.10 | 0.44 | 4.16 |
| 98 | 8.7 | 0.27 | 0.09 | 46 | 296 | 0.28 | 2.28 | 0.40 | 3.86 |
| 99 | 8.7 | 0.19 | 0.18 | 69 | 307 | 0.42 | 1.94 | 0.24 | 4.68 |
| 100 | 8.9 | 0.26 | 0.17 | 18 | 301 | 0.36 | 2.20 | 0.44 | 4.16 |
| 150 | 8.9 | 0.33 | 0.24 | 23 | 296 | 0.38 | 2.68 | 0.34 | 4.70 |
| 151 | 8.6 | 0.16 | 0.12 | 26 | 334 | 0.30 | 2.40 | 0.28 | 3.60 |
| 152 | 8.3 | 0.61 | 0.15 | 33 | 307 | 0.36 | 3.34 | 0.30 | 3.54 |
| 153 | 8.3 | 1.28 | 0.26 | 20 | 291 | 26 | 2.64 | 0.48 | 3.48 |
| 154 | 8.9 | 0.46 | 0.13 | 44 | 328 | 0.36 | 2.30 | 0.40 | 3.46 |
| 155 | 9.1 | 0.15 | 0.17 | 18 | 360 | 0.38 | 2.48 | 0.28 | 3.28 |
| 156 | 9.2 | 0.33 | 0.28 | 33 | 312 | 0.28 | 3.30 | 0.32 | 4.52 |
| 157 | 8.6 | 0.28 | 0.14 | 36 | 296 | 0.32 | 2.80 | 0.36 | 5.20 |
| 158 | 9.1 | 0.30 | 0.18 | 20 | 339 | 0.40 | 2.40 | 0.30 | 4.92 |
| 159 | 8.6 | 0.16 | 0.30 | 18 | 344 | 0.30 | 3.10 | 0.44 | 3.46 |

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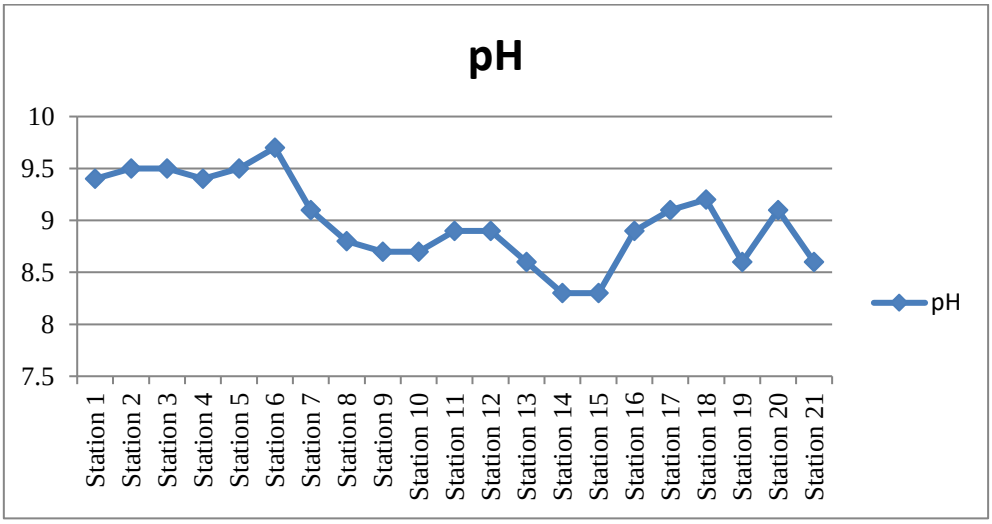


**Fig.1.** pH Parameters of Soil

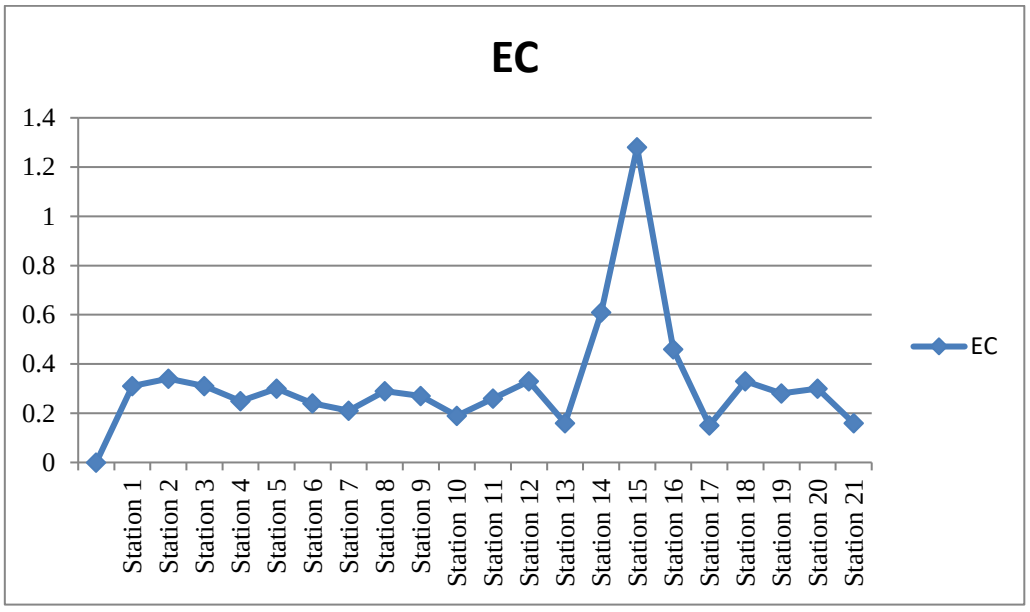


**Fig.2.** EC Parameters of Soil

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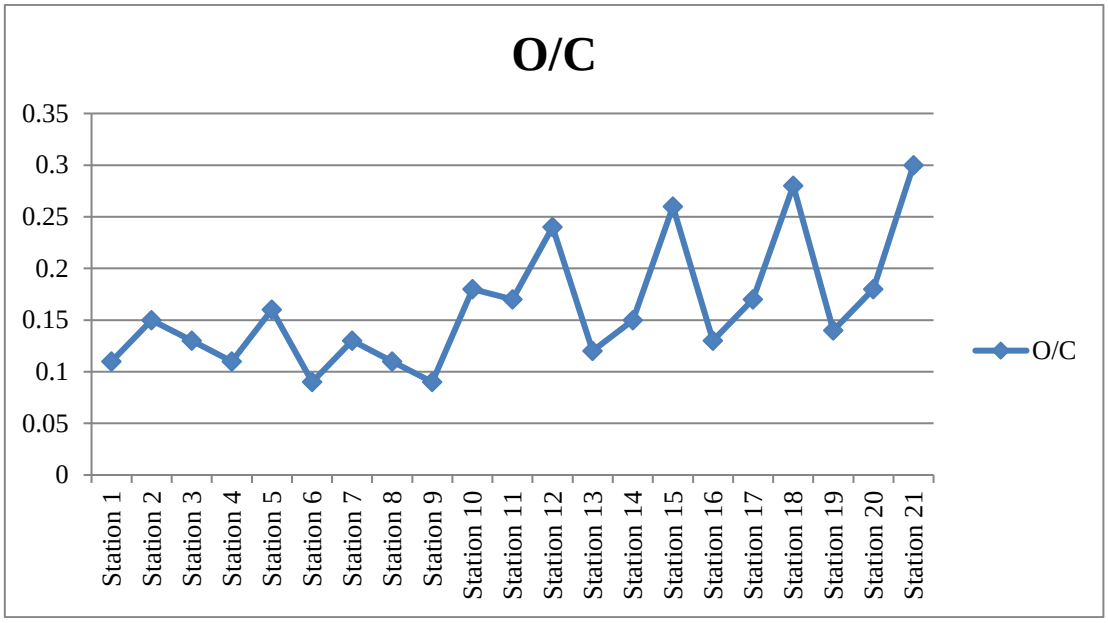


**Fig.3.** O/C Parameters of Soil

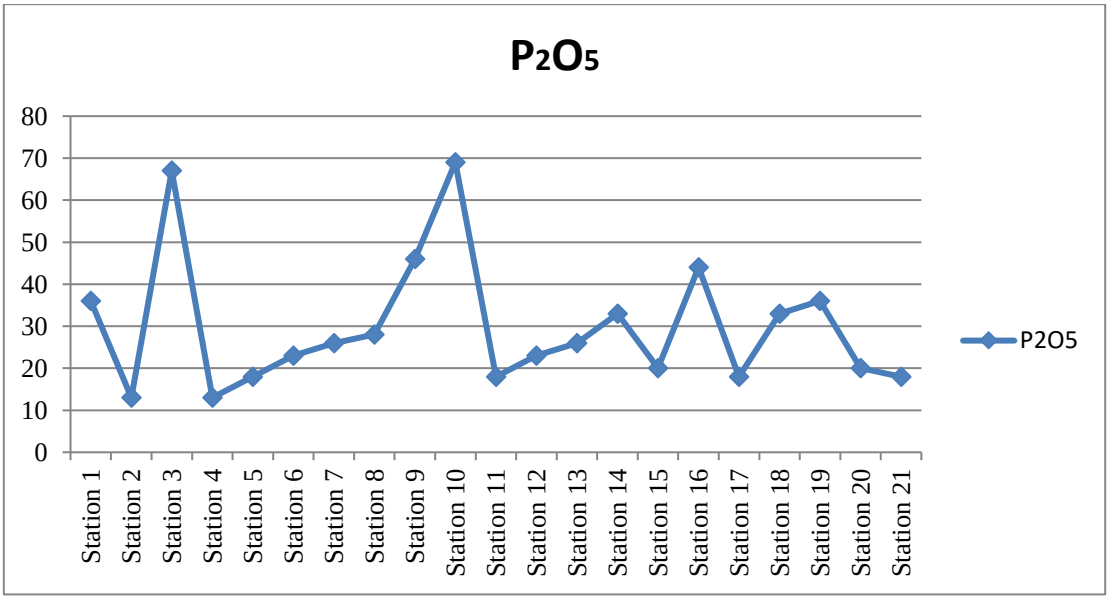


**Fig.4.** $P_2O_2$ Parameters of Soil

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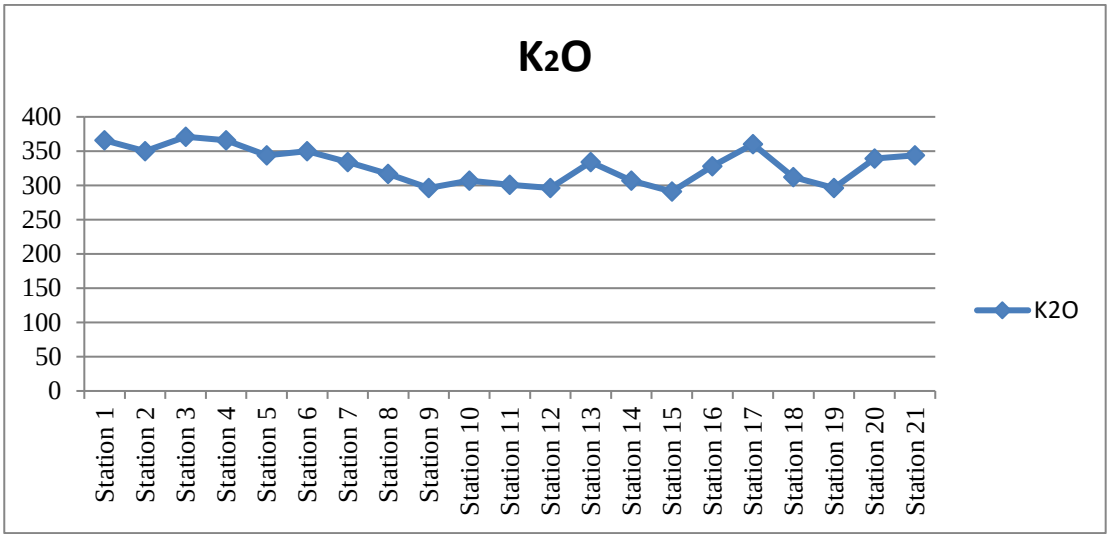


**Fig.5.** $K_2O$ Parameters of Soil

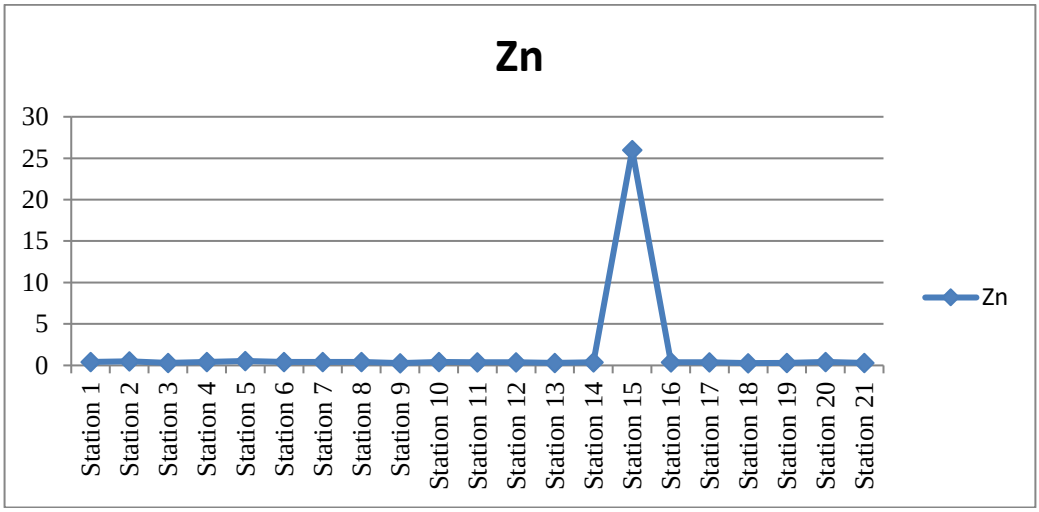


**Fig.6.** Zn Parameters of Soil

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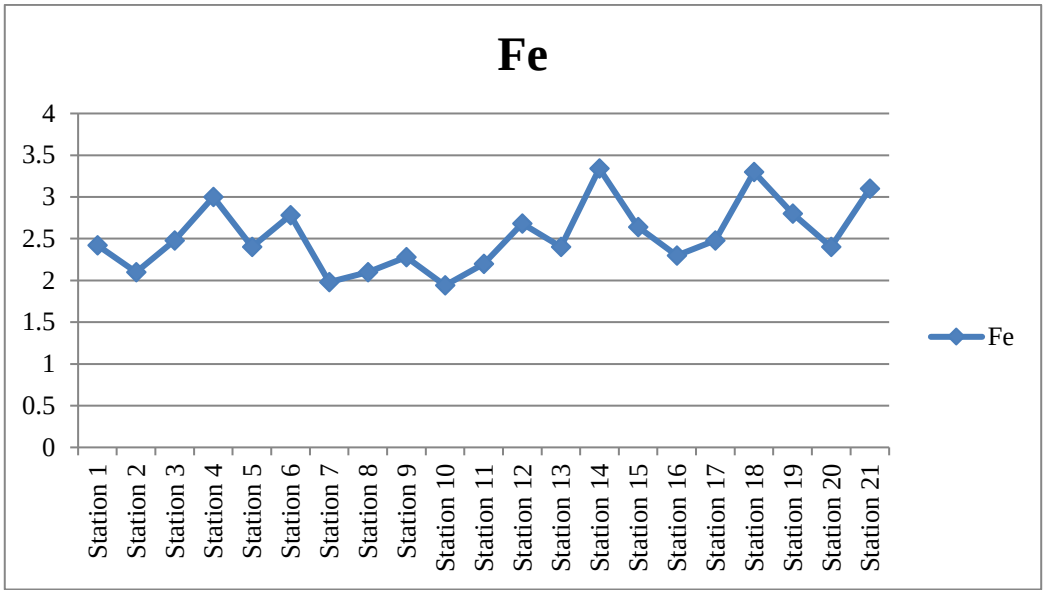


**Fig.7.** Fe Parameters of Soil

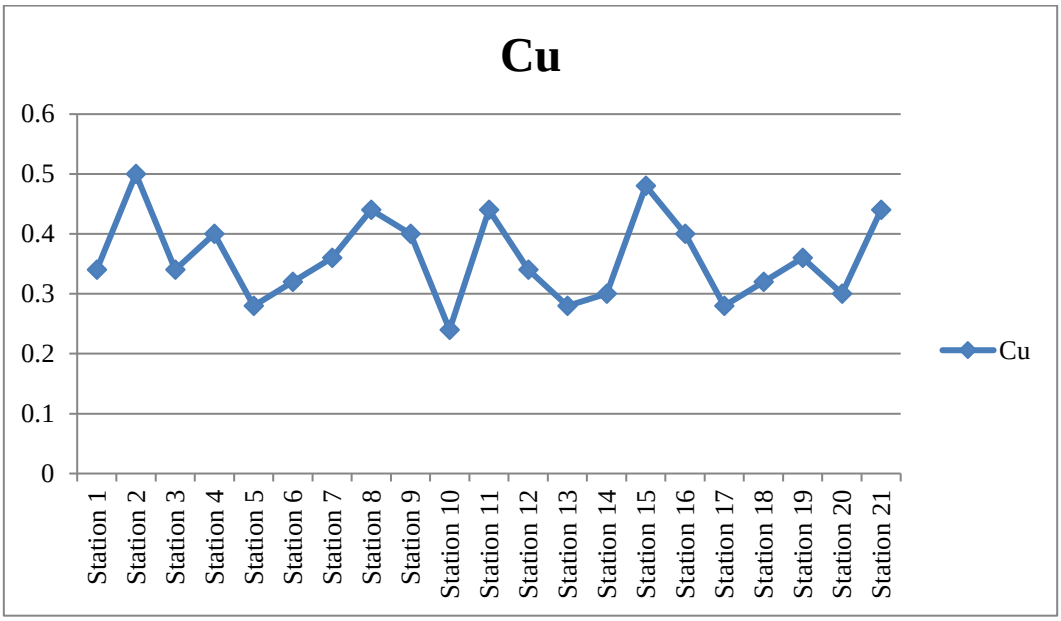


**Fig.8.** Cu Parameters of Soil

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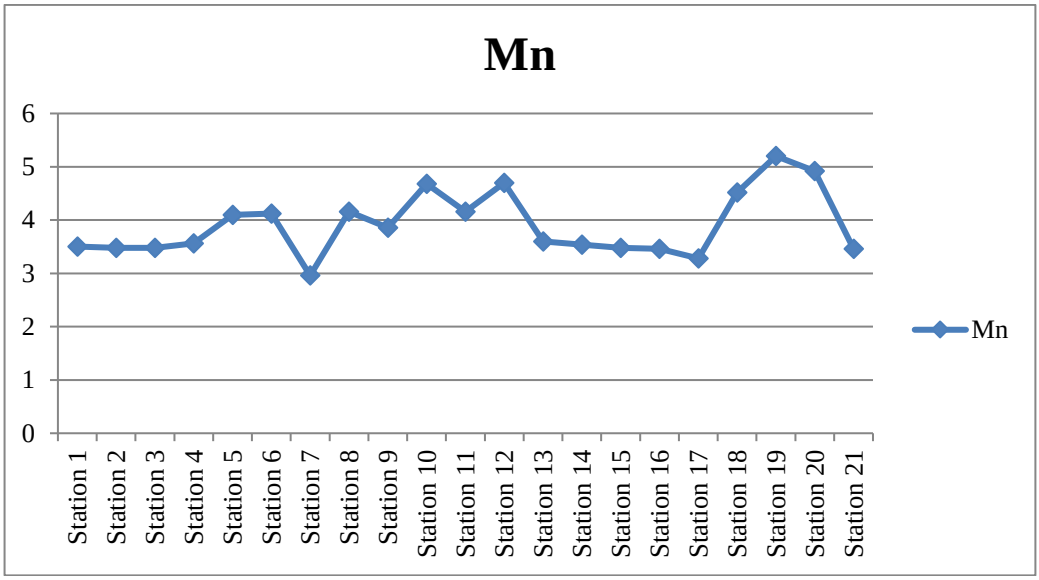


**Fig.9** Mn Parameters of Soil

The results show that the soil in Jodhpur is alkaline, with a pH range of 7.8 to 8.5. The EC values were low, indicating low salinity. The available N, P, and K values were also low, with an average of 141.2 kg/ha, 4.4 kg/ha, and 122.1 kg/ha, respectively. These results indicate that the soil in Jodhpur needs improvement for sustainable irrigation management. The low pH values of the soil can be attributed to the high calcium carbonate content in the soil. The low EC values can be attributed to the low salt concentration in the soil. The low levels of available N, P, and K can be attributed to the low organic matter content of the soil, which limits the nutrient availability to crops. The study recommends the use of organic manure to improve the soil quality in Jodhpur. The use of organic manure can increase the organic matter content of the soil, leading to improved soil quality and better water-holding capacity. The study also recommends the use of nitrogen-fixing crops and green manure to increase the nitrogen content of the soil. The use of phosphate-rich fertilizers can improve the phosphorus content of the soil, while the use of potassium-rich fertilizers can improve the potassium content of the soil. The study recommends measures for improving soil quality for sustainable irrigation management in Jodhpur. The following measures can be taken:

Use of organic manure: Organic manure can increase the organic matter content of the soil, improving soil structure and nutrient availability.

Use of balanced fertilizers: Balanced fertilizers containing N, P, and K in optimal ratios can improve soil fertility and crop yield.

Crop rotation: Crop rotation can improve soil health and reduce soil nutrient depletion.

Water management: Efficient water management practices such as drip irrigation and mulching can reduce water demand and improve soil moisture content.

Soil conservation practices: Soil conservation practices such as minimum tillage and crop residue management can reduce soil erosion and improve soil quality.

## V. CONCLUSION

The study concludes that the soil in Jodhpur is alkaline and has low organic matter content. The low organic matter content of the soil can be attributed to the arid climate and the high temperatures in Jodhpur. The study recommends the use of organic manure to improve the soil quality for better irrigation management in Jodhpur. The study also recommends the use of nitrogen-fixing crops and green manure to increase the nitrogen content of the soil, phosphate-rich fertilizers to improve the phosphorus content of the soil, and potassium-rich fertilizers to improve the potassium content of the soil. The analysis of soil chemical properties for irrigation management in Jodhpur provides valuable insights into the suitability of the soil for sustainable agricultural practices.

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The findings highlight the importance of understanding soil characteristics to optimize water usage, enhance crop productivity, and mitigate environmental impacts. The results indicate that the soil pH in Jodhpur ranges from acidic to slightly alkaline, necessitating pH adjustment in certain areas to optimize nutrient availability. The electrical conductivity values suggest manageable salinity levels, but precautions should be taken to prevent excessive salinization. The relatively low organic matter content emphasizes the importance of incorporating organic amendments to improve soil fertility, water-holding capacity, and nutrient retention.

Moreover, variations in nutrient levels, particularly nitrogen and phosphorus deficiencies observed in some samples, indicate the need for targeted fertilization strategies. Implementing balanced nutrient management practices will help address these deficiencies and optimize crop growth and yield. Based on these findings, the following recommendations are proposed for irrigation management in Jodhpur:

**pH adjustment**: Implement appropriate amendments to optimize the soil pH, ensuring optimal nutrient availability for plant growth.

**Salinity management**: Monitor and manage salinity levels through proper irrigation scheduling, drainage systems, and leaching practices to prevent adverse effects on crop productivity.

**Organic amendments**: Incorporate organic matter through composting, green manure, or other organic farming practices to improve soil fertility, water-holding capacity, and nutrient retention.

**Nutrient management**: Develop targeted fertilization strategies based on nutrient analysis results to address specific deficiencies and optimize nutrient supply to crops.

Implementing these recommendations will contribute to sustainable agricultural practices in Jodhpur, ensuring efficient water usage, improved crop productivity, and reduced environmental impacts. Further research is recommended to explore additional soil properties, such as micronutrient levels and soil microbial activity, and their influence on irrigation management. Additionally, long-term monitoring of soil chemical properties and their correlation with crop performance would provide valuable insights into the effectiveness of the recommended management practices.

By understanding and managing soil chemical properties effectively, farmers and policymakers can make informed decisions to optimize irrigation management practices, promote sustainable agriculture, and ensure food security in Jodhpur and similar arid regions.

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