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TO STUDY THE EFFECTS OF MUNCIPAL TREATED EFFLUENT ON SOIL IN LEFT PART OF THE SEWAGE TREATMENT PLANT, DAVANAGERE

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ABSTRACT

The project aimed to examine the impact of treated effluent irrigation on soil near a sewage treatment plant at Shivanagara, Davanagere city. The samples of soil are collected at 5 different locations near STP plant. The study assessed the quality of treated wastewater to understand its appropriateness for agricultural use and performance of treatment units are evaluated. The continuous use of treated effluent for irrigation resulted in crop yield reductions due to soil illness, organic matter build up, and nutritional problems. From the collected samples of treated wastewater and soli various parameters such as pH, EC, Colour, TDS, Alkalinity, Hardness, DO, and chlorides were evaluated and the characteristics of soil was examined. The findings indicate that most parameters exceeded acceptable levels for drinking purposes, but the treated wastewater could still be utilized for irrigation.

Keywords: STP, Ground Water, Treated Effluent, Soil.

I. INTRODUCTION

The importance of soil structure in sustaining plant and animal life, as well as environmental quality, is undeniable. However, the increasing demands for food and water, along with the environmental damage caused by population growth, pose significant challenges for humanity. Water scarcity significantly affects the agricultural sector, while urban activities contribute to a substantial rise in sewage effluent generation [1]. The concept of establishing additional water sources has evolved in response, with the viability of using treated municipal wastewater as a reliable water source for cities and densely populated regions being examined [2]. Stressing the significance of wastewater treatment, water recovery, and recycling, it is crucial to consider the harmful effects of discharging untreated sewage into the environment and harming ecosystems. Utilizing treated wastewater in agriculture reduces water usage while enhancing soil's organic and nutrient content, a strategy vital for addressing agricultural water needs, particularly in dry and semi-arid regions [3]. Due to population growth and human activities, critical situations have arisen in areas with limited water supplies, prompting the exploration of alternative sources like wastewater. The study's primary focus is on utilizing municipally treated wastewater in agriculture. The reuse of treated water in agriculture aims to maximize and safeguard water supplies, particularly crucial in arid regions. The utilization of wastewater (WW) in agriculture offers several benefits, including providing an affordable water source, reducing costs related to water treatment, decreasing the reliance on chemical fertilizers, and minimizing environmental impact [4].

II. STUDY AREA

Geographically, Davanagere is situated at 14" 31 N and 75” 58 E and is 602 m above sea level. It is flanked by neighboring districts like Shimoga, Chitradurga, Haveri, and others and is located on the Deccan Plateau's Maidan region. It is situated along National Highway 4, which is a branch of the Golden Quadrilateral's network. According to the 2011 Census, the city has a population of 4,34,971 people and covers an area of 68.63 sq km. Davanagere, a city in the heart of Karnataka, is being developed as portion of the federal government's Smart City initiative. According to the 2023 census, Davanagere City has a population of approximately 5,98,000 people. The municipal STP are effectively constructed to handle the city-generated wastes. One STP with a 40MLD capacity is situated at Shivanagar, Davanagere

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III. MATERIAL AND METHODS

Soil samples collected from the sites contain inherent water content. These samples are first air-dried and then pulverized using a heavy wooden tool, followed by filtration through a 2mm sieve. Any material exceeding the 2mm size is discarded, and the fraction that passes through the sieve (less than 2mm) is referred to as the fine fraction or fine earth. The fine earth is then stored in an airtight container, safeguarded in a chemical odor-free environment with controlled temperature to maintain the soil's original state For black cotton soil, a type of expansive clay soil rich in montmorillonite clay minerals, the following testing methods are recommended:

pH: pH Meter

EC: Electrical Conductivity Meter

NPK: Chemical Analysis

Specific Gravity: Pycnometer Method

Water Content: Gravimetric Method

Dry Unit Mass: Oven-Drying Method

Swell Index: Odometers Test

Permeability: Falling Head Permeameter Method

Void Ratio: Core Cutter Method

Porosity: Measurement of Bulk and Particle Densities

IV. RESULTS

These site locations will be used to compute and analyse soil sample parameters while accounting for the various land uses and possible pollutants associated with each site type.

Table 1- Soil Sample Analysed Characteristics near STP Shivanagar, Davanagere.

Parameters	A (0m)	B (200m)	C (400m)	D (600m)	E (800m)
Soil type	Loam soil.	Silty clay loam.	Silty loam.	Silty loam.	Silty loam.
Sand (%)	19.6	20.6	13.5	20.7	20.5
Silt & clay (%)	78.7	85.3	77.6	77.9	77.9
Gravel (%)	1.57	1.59	1.16	1.63	1.59
Ph	7.95	7.77	7.8	7.7	7.62
EC(ds/m).	0.88	0.82	0.82	0.79	0.8
N(kg/acre).	315	287	270	267	267
P(kg/acre).	21.9	20	20.8	19.9	19.6
K (kg/acre).	187.5	180	170.6	170.2	170
SG	2.6	2.53	2.6	2.58	2.65
Water content (%).	30	27	27	29	30
Dry unit mass (g/cc).	0.062	0.075	0.084	0.07	0.065
Swell index (%).	40	40	50	40	40
Permeability (mm/sec).	0.31	0.38	0.52	0.48	0.45
Void ratio.	0.756	0.53	0.467	0.58	0.722
Porosity.	0.43	0.35	0.32	0.37	0.42

- **A :** Soil sample collected near left part of STP Shivanagar, Davanagere.
- **B :** Soil sample collected 200m from left part of STP Shivanagar, Davanagere.
- **C :** Soil sample collected 400m from left part of STP Shivanagar, Davanagere.
- **D :** Soil sample collected 600m from left part of STP Shivanagar, Davanagere.
- **E :** Soil sample collected 800m from left part of STP Shivanagar, Davanagere.

1) Sand Content :

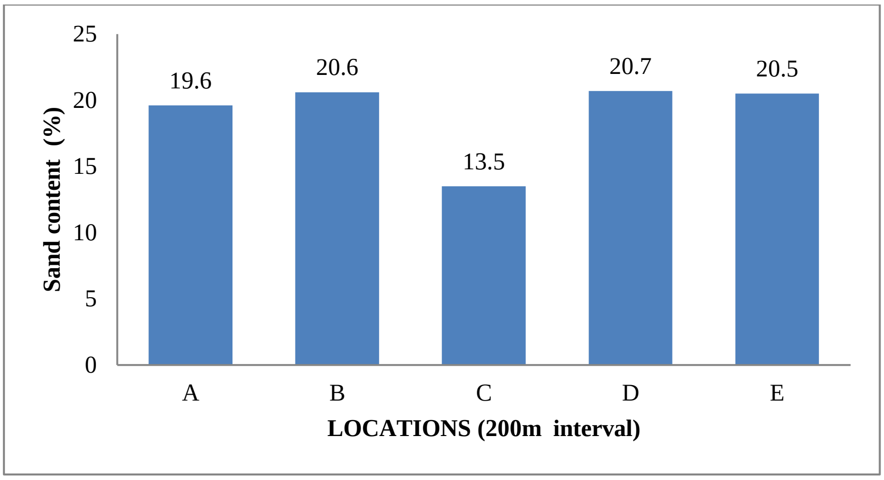

Fig 1- Variation Of Sand Content Near STP Shivanagar, Davanagere.

2) Clay Content :

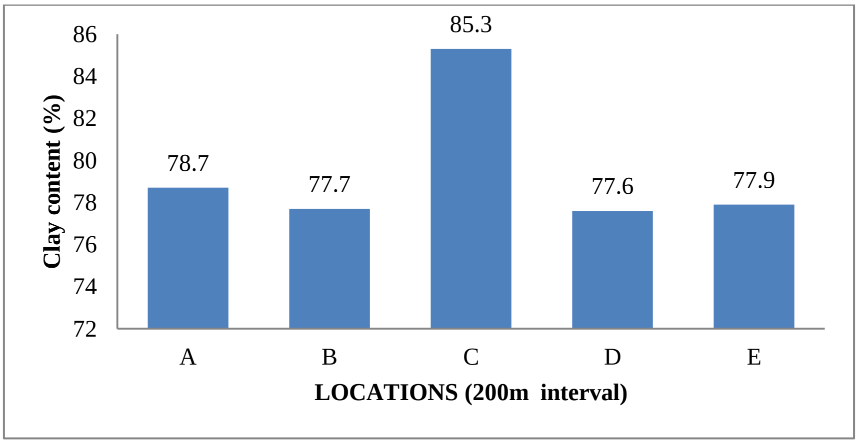

Fig 2- Variation Of Clay Content Near STP Shivanagar, Davanagere.

3) Gravel Content :

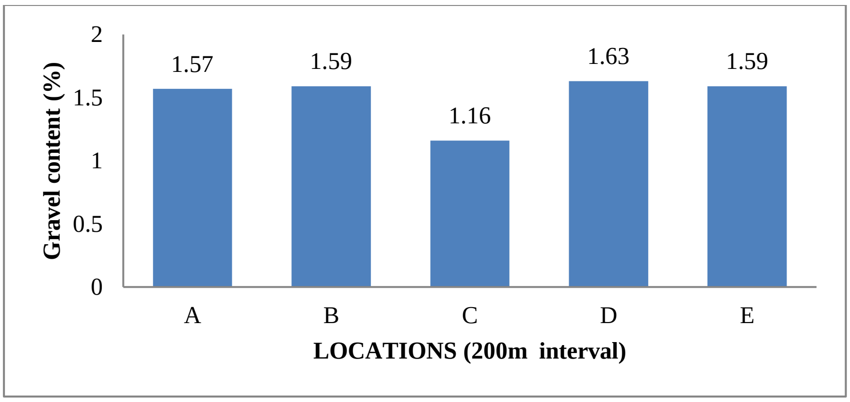

Fig 3- Variation Of Gravel Content Near Stp Shivanagara, Davanagere.

4) pH :

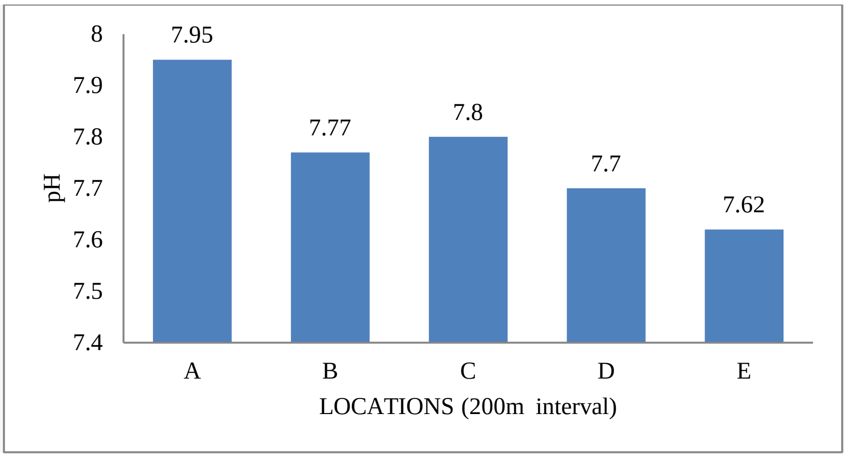

Fig 4- Variation Of Soil pH Near STP Shivanagar, Davanagere.

5) Electrical Conductivity :

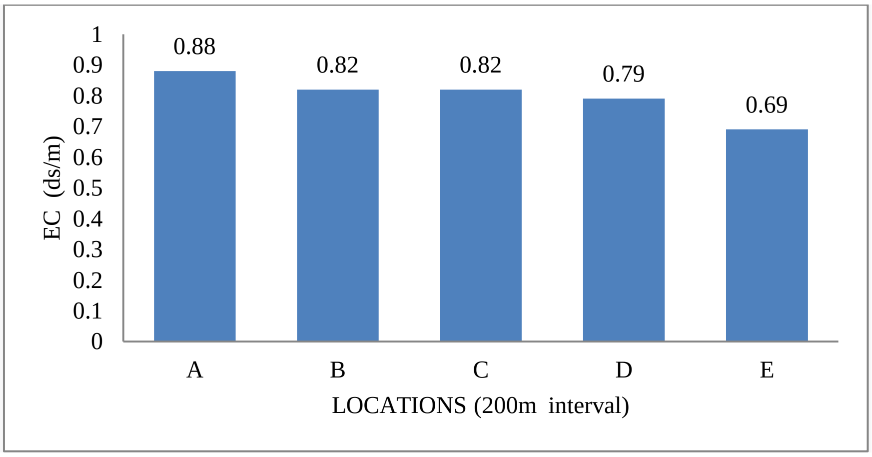

Fig 5- Variation Of Soil EC Near STP Shivanagar, Davanagere.

6) Total Nitrogen :.

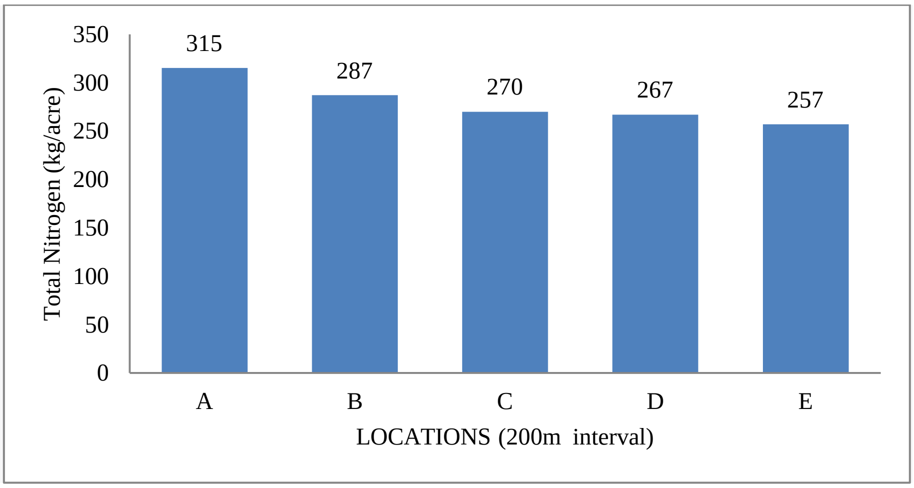

Fig 6- Variation Of Soil Total Nitrogen Near STP Shivanagar, Davanagere.

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7) Total phosphorous :

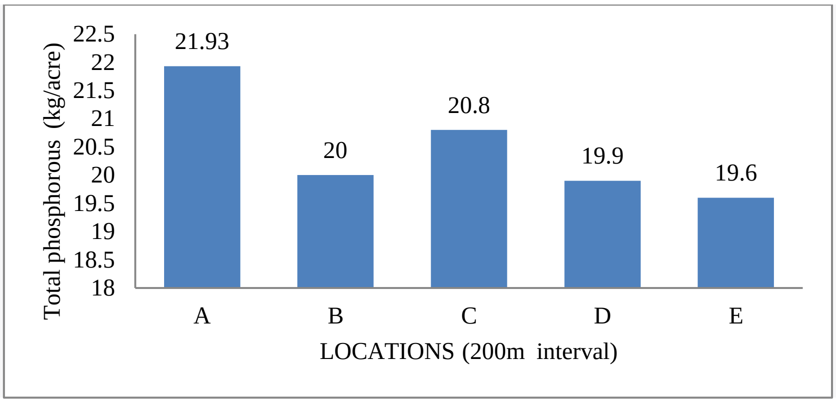

Fig 7- Variation Of Soil Total Phosphorous Near STP Shivanagar, Davanagere.

8) Total potassium :

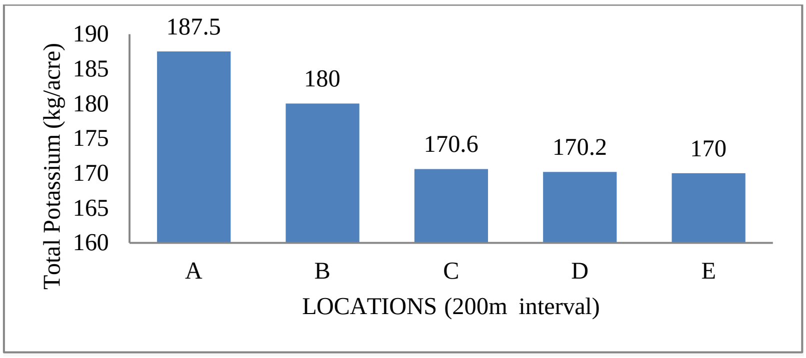

Fig 8- Variation Of Soil Total Potassium Near STP Shivanagar, Davanagere.

9) Specific Gravity :

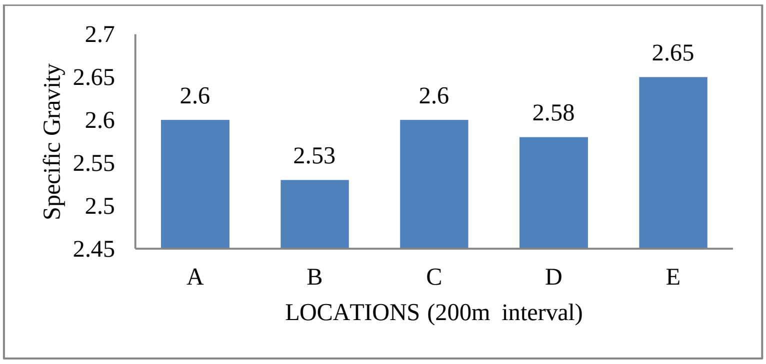

Fig 9- Variation Of Soil Specific Gravity Near STP Shivanagar, Davanagere.

10) Water Content :.

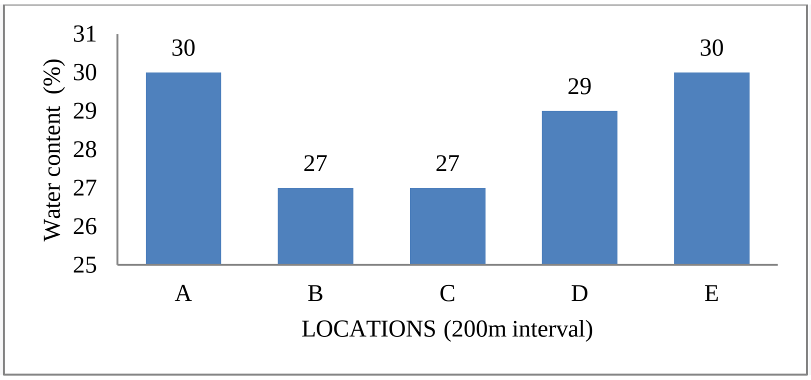

Fig 10- Variation Of Soil Water Content Near STP Shivanagar, Davanagere.

11) Dry Unit Mass :

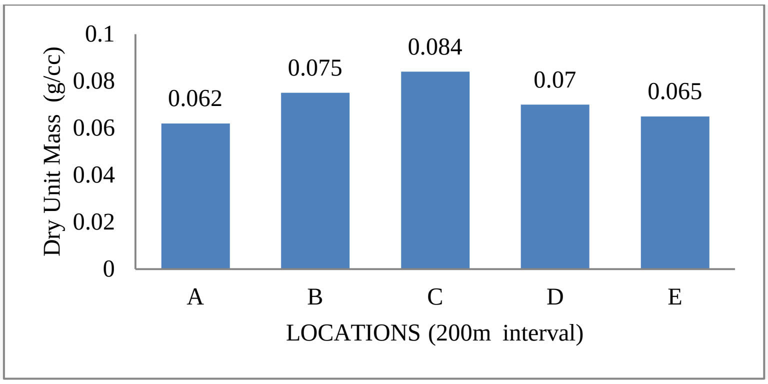

Fig 11- Variation Of Soil Dry Unit Mass Near STP Shivanagar, Davanagere.

12) Swell Index :

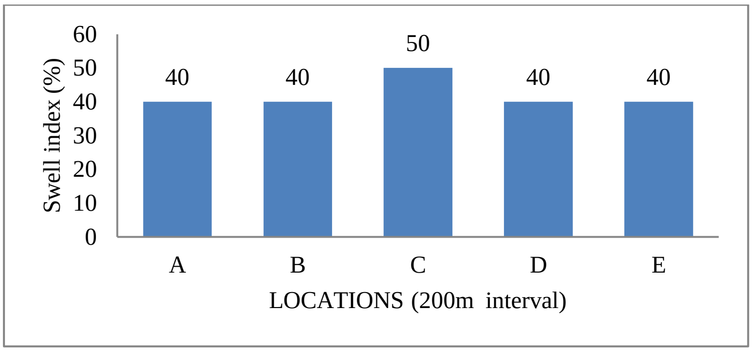

Fig 12- Variation Of Soil Swell Index Near STP Shivanagar, Davanagere.

13) Permeability :

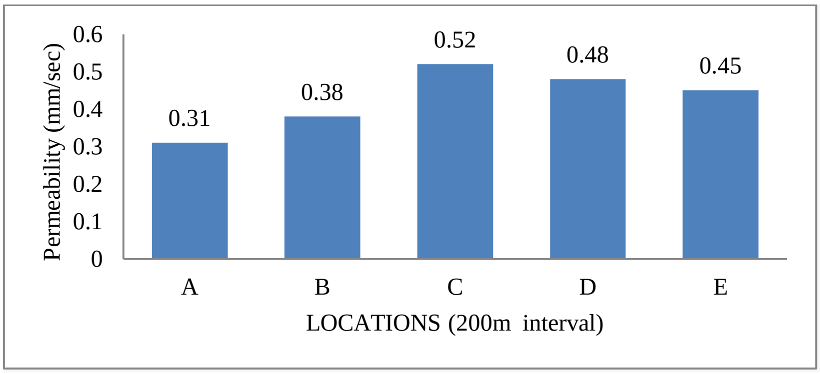

Fig 13- Variation Of Soil Permeability Near STP Shivanagar, Davanagere.

14) Void Ratio :

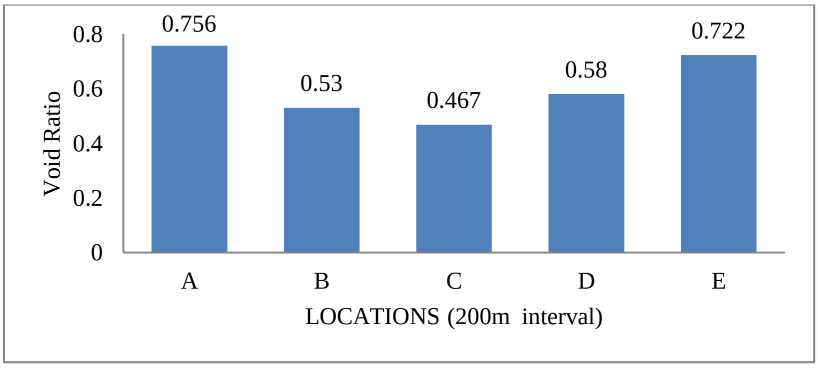

Fig 14- Variation Of Soil Void Ratio Near STP Shivanagar, Davanagere.

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15) Porosity :

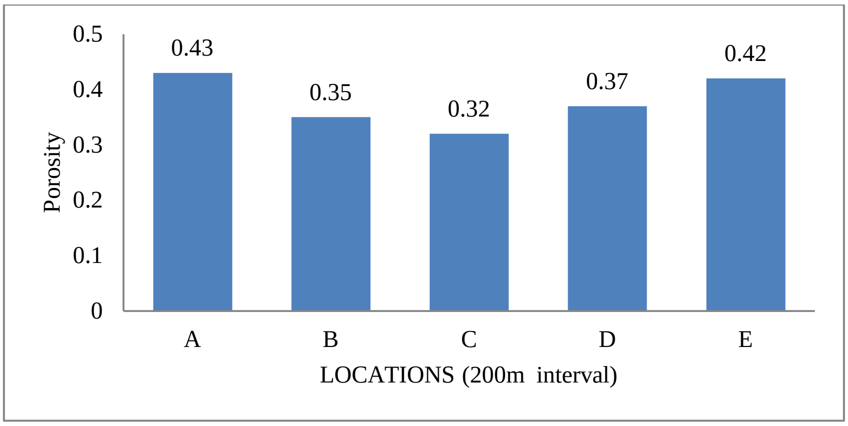

Fig 15- Variation Of Soil Porosity Near STP Shivanagar, Davanagere.

V. CONCLUSION

The conclusion of the study on the effect of treated waste water(ww) effluent irrigation on soil quality, based on experimental analysis, Its best summed up as follows:

- ❖ In some sites, nutrients of soil such as nitrogen and potassium exceeds the limit. This is become of absorption of nutrients and some amount of organic matter present in the treated effluent which is used for irrigation.
- ❖ Treated effluent irrigation have both positive and negative effects on soil quality.
- ❖ Treated effluent can enhance soil fertility due to presence of beneficial nutrients and organic matter for NPK.
- ❖ Excessive irrigation with treated effluent can cause soil salinization and accumulation of trace elements, potentially affecting plant growth and soil health.
- ❖ Careful management, proper irrigation scheduling, and regular monitoring of water and soil quality parameters are crucial to mitigate risks and ensure sustainable irrigation practices.

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