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Impact on Soil Properties by the use of Sewage for Irrigation

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Abstract

Objectives: In this study, crops were irrigated with sewage and groundwater. The soil was tested for various characteristics during the growth time of the crop. **Methods/Statistical Analysis**: To investigate the beneficial impacts of domestic waste water on soil properties, groundwater and domestic wastewater samples are discharged into the soil separately. After 10 days, 15 days, 20 days of application of wastewater soil parameters N, P, K & pH of two soil sample containing sewage and groundwater was determined. **Findings**: The use of the sewage improves the physicochemical properties of the soil as compared to the application of groundwater. Sewage leads to increase of crop yield with an improved fertility status of the soil. There is a significant change in the properties of the soils irrigated with sewage and groundwater. Thus, use of sewage for irrigation is a considerable method for the management of wastewater. **Applications:** Farming with wastewater is a potential method to decrease the rise of freshwater demand.

Keywords: Crops, Domestic Wastewater, Soil Parameters (N, P, K, O.C)

1. Introduction

The growth of towns, cities, and development of industries by 19th century leads to problem of disposal of sewage, which encouraged the use of sewage wastewater in irrigation. The practice of use of domestic sewage in farming is becoming prevalent as the demand of water is increasing. In[1] Due to fast industrial development and the growth of population, the availability of water decreases day to day. In[2] this increase in the population has led to increased demand of water and the increased generation of wastewater. The high quality water is preserved and the lower quality is used for agricultural purposes. Irrigation with sewage became a prevalent practice in arid and semiarid regions, where it was readily available and economic to freshwater. In[3] the final aim of sewage management is the protection of the environment which the ultimate goal of wastewater management is the protection of the environment in a manner corresponding with public health and socio-economic concerns. In[4] the use of natural system for infrastructural purposes is a delicate matter which involves lots of stakeholders and parameters who will be affected and hence the adoption of such a system has to be taken up, if and only if all challenges are met and proper solutions for each are arrived. In[5] the benefits of wastewater use in irrigation are numerous but precautions should be taken to avoid short and long-term environmental risks. In[6] due to the increase in the demand of water, we need to adopt recycle and reuse techniques to decrease the load of available resources. In[7] sewage is a major load on water bodies and its incorrect disposal promotes growth of toxic algal blooms which hampers aquatic life. In[8] the practice of reuse is the necessity of the present time. This is the way to meet the demand for fresh water. Sewage has affected adversely both soil health and crop productivity. In[9] sewage has resulted in improved physiochemical

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characteristics of soil. In[10] Domestic wastewater contains essential plant nutrients[11] such as N, P, K and micronutrients which are beneficial for plants growth. In[12] evaluated the changes in soil parameters after discharging domestic wastewater on soil.

2. Materials and Methods

2.1 Soil Sample Collection and Analysis

A laboratory setup was used for performing the work to investigate the impact of application of sewage for irrigation on soil. For this purpose, agricultural soil was collected from Phagwara near Lovely Professional University. Then the soil parameters like N, P, K& pH were determined before applying wastewater.

2.2 Sampling of Water and Analysis

The wastewater was collected from STP at Lovely Professional University, and ground water was collected from irrigation well at Phagwara.

2.3 Methods and Analysis

These two water samples are discharged into the soil separately. After 10 days, 15 days, 20 days of application of wastewater soil parameters N, P, K & pH of two soil sample containing sewage was determined.

2.3.1 Tests Performed

Following tests were performed on soil and waste water:

1. Determining the soil parameters (N, P, K & pH) before applying wastewater.
2. Determining pH, turbidity, chlorine content, total solids, alkalinity, hardness & B.O.D of two sample of waste water.
3. Determining the soil parameters (N, P, K& pH) of two soil sample after 10 days of application of waste water.
4. Determining the soil parameters (N, P, K& pH) of two soil sample after 15 days of application waste water.
5. Determining the soil parameters (N, P, K & pH) of two soil sample after 20 days of application waste water.

3. Result and Discussion

The following tests were performed at Agricultural laboratory of Lovely Professional University.

3.1 Test Results

In this study, first we are analyzed the physiochemical characteristics of groundwater Table 1 and the physico-chemical characteristics of sewage Table 2. The soil parameters were analyzed before applying sewage Table 3. In next stage, Soil was irrigated by applying ground water and sewage and soil parameters were tested after 10 days of applying water and sewage. Table 4 Soil parameters were tested of applying water and sewage after 15 days Table 5 and after 20 days Table 6. It finds both opportunities and problems exist in using sewage and water for irrigation. Using recycled wastewater for irrigation helps in water conservation and nutrient recycling, hence, reducing the demands of freshwater. A change in soil parameters after discharging sewage on soil evaluated. The variation of pH of soil is irrigated with groundwater (Figure 1) and the variation of pH of soil irrigated with sewage (Figure 2). The variations of Organic Carbon (OC) in soil with time are shown in Figure 3 and the variation of Potassium (K) in soil with time shown in Figure 4 and 5 shows the variation of Phosphorous (P) in soil with time and variation of Nitrogen (N) in soil with time are shown in Figure 6.

Table 1. Characteristics of groundwater

BOD	402.6 PPM(mg/lt)
Turbidity	0 NTU
Total Solids	17.82 gms
Hardness	133.5 PPM(mg/lt)
Chloride Content	28.5 PPM(mg/lt)
Alkalinity	76.5 PPM(mg/lt)

Table 2. Characteristics of sewage

Ph	7.61
BOD	758 PPM(mg/lt)
Turbidity	15.67 NTU
Total Solids	62.45 gms
Hardness	300 PPM(mg/lt)
Chloride Content	702.97 PPM(mg/lt)
Alkalinity	13.85 PPM(mg/lt)

Table 3. Soil parameters before applying sewage

pH	Organic Carbon (%)	Nitrogen (%)	Phosphorus (PPM)	Potassium (PPM)

7.62	2.11	7	0.48	100

Table 4. Soil parameters after 10 days of applying water and wastewater

Sample	pH	Nitrogen	Phosphorus	Potassium	Organic Carbon
Groundwater	7.71	46.23	4.80	330	0.65
Waste water	8.02	70.00	3.64	700	1.07

Table 5. Soil parameters after 15 days of applying water and wastewater

Sample	pH	Nitrogen	Phosphorus	Potassium	Organic Carbon
Groundwater	7.64	64.45	0.08	390	1.27
Waste water	8.11	68.65	0.20	750	1.27

Table 6. Soil parameters after 20 days of applying water and wastewater

Sample	pH	Nitrogen	Phosphorus	Potassium	Organic Carbon
Groundwater	7.65	68.65	0.26	280	0.59
Waste water	6.37	46.23	0.76	240	0.65

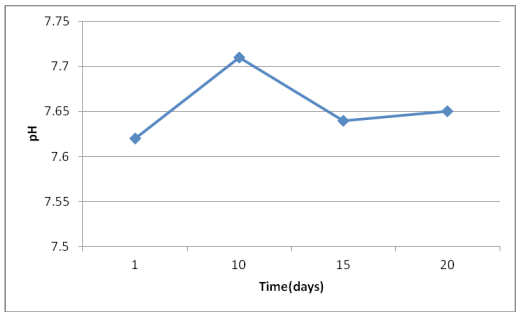

Figure 1. pH variation in groundwater irrigated soil.

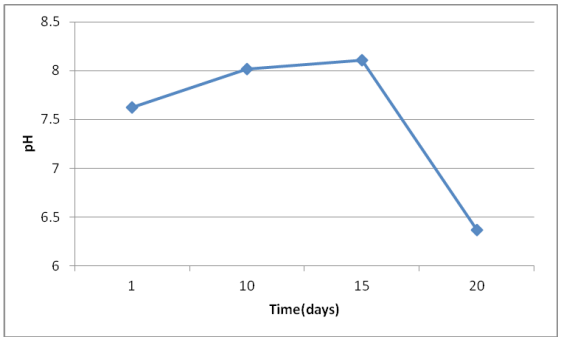

Figure 2. pH variation in sewage irrigated soil.

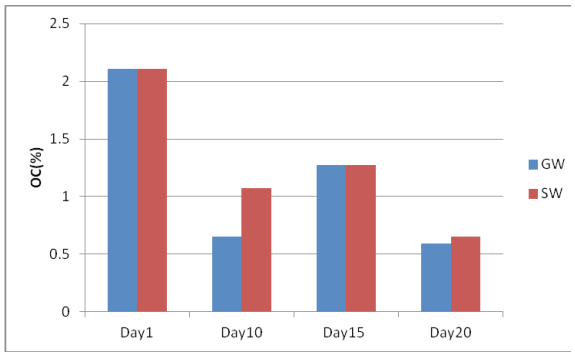

Figure 3. Organic Carbon variation with time.

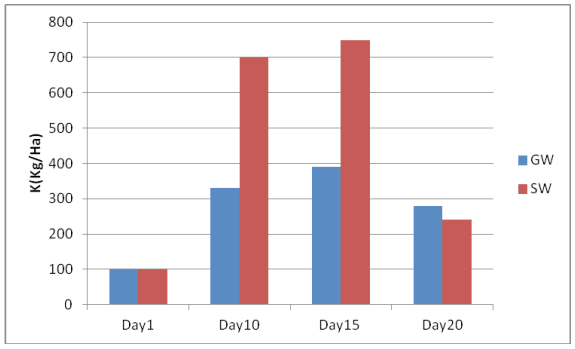

Figure 4. Potassium (K) variation with time.

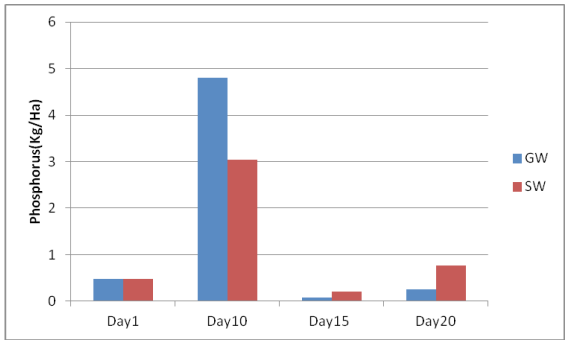

Figure 5. Phosphorus (P) variation with time.

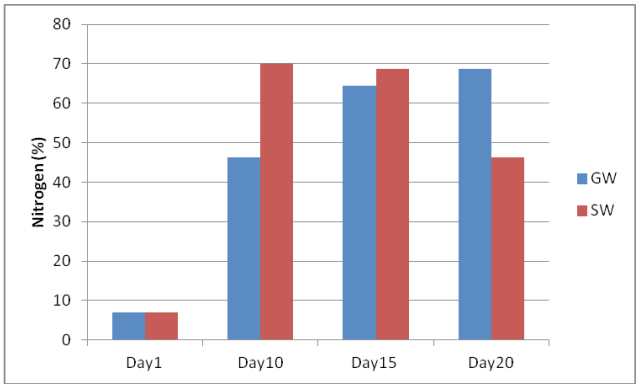

Figure 6. Variation of Nitrogen with time.

4. Conclusion

The value of N and P is increasing till day 10 but decreasing thereafter and value of K is increasing till day 15 and decreased thereafter. OC is decreasing till day 10 but increases from day 10 to day 15 and gradually decreases till day 20. The use of wastewater can prove beneficial for 10 to 15 days in the selected crops. Application of domestic water increased the yield of crops compared to irrigation with ground water; it also increases total N, P, K and organic carbon content of soil. So we can use domestic wastewater for irrigation due to limited availability of water resources and provide an alternative method of wastewater management.

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