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Assessment of effect of treated sewage effluenton irrigation fields: A case study of Jodhpur

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ABSTRACT:- *Mankind is currently confronted with one of the greatest challenges in its history, thus how to adequately use its limited freshwater resources. In this context, the challenge is the shortage of water sources, which led to the use of wastewater for agriculture purposes. The reuse of treated wastewater for irrigation is a practical solution to overcome water scarcity, especially in arid and semiarid regions. However, there are several potential environmental and health risks associated with this practices. Many cities and districts are struggling to balance water use among municipal, industrial, agricultural, and recreational users. The population increase has not only increased the fresh water demand but also increased the volume of waste water generated. Sewage, often untreated, is used to irrigate 10% of the world's crops, according to the first ever global survey of waste water irrigation. However, many farmers, especially those in urban areas, use sewage because it is free and abundant, even during droughts, and, being full of nitrates and phosphates, acts as an effective fertilizer. In addition, wastewater is a valuable source for plant nutrients and organic matter needed for maintaining fertility and productivity of arid soils. Domestic wastewater contains essential plant nutrients such as N, P, K and micronutrients which are beneficial for plants growth. The objectives of this study were to evaluate the changes in soil parameters after discharging domestic wastewater on soil.*

The paper aims to investigate the impact of domestic waste water for irrigation purpose on soil fertility. Now-a-days due to the increasing the population, the demand of water has increased considerably resulting in the generation of more domestic wastewater. The use of the domestic wastewater improves the physicochemical properties of the soil as compared to the application of ground water. Domestic wastewater helps in better crop growth with increased fertility status of the soil. Application of domestic water increases total N, P, K and organic carbon content of soil & thereby increases the yield of crops compared to irrigation with ground water.

KEYWORDS-*Domestic sewage, Soil parameters (N, P, K), Waste parameters (pH ,B.O.D)*

1. INTRODUCTION

Efficient use of water is a central issue throughout the world. Water, a finite source, is essential for both the human society and the ecological systems that humans rely on. With the population growth and economic development, water has become increasingly scarce in a growing number of countries and regions in the world. In spite of having the largest irrigated area in the world, India too has started facing severe water scarcity in different regions. Owing to various reasons the demand for water for different purposes has been continuously increasing in India, but the potential water available for future use has been declining at a faster rate. The agricultural sector (irrigation), which currently consumes over 80% of the available water in India, continues to be the major water-consuming sector due to the intensification of agriculture. Though India has the largest irrigated area in the world, the coverage of irrigation is only about 40% of the gross cropped area as of today. One of the main reasons for the low coverage of irrigation is the predominant use of flood method of irrigation (conventional), where water use efficiency (WUE) is very low due to various reasons. Available estimates indicate that WUE under flood method of irrigation is only about 35% to 40% because of huge conveyance and distribution losses. This requires an increase in water productivity (WP) and WUE. It is much more pertinent for a vast tropical country like India, which experiences extreme variation in climate and rainfall. India, though achieved self-sufficiency in food with the help of efficient management of her natural resources leading to green revolution but arid and semi-arid regions are still lagging behind. It is necessary to economize the use of water and at the same time increase the productivity per unit area and per unit quantity of water.

There has been an increasing interest in reuse of wastewater in agriculture over the last few decades due to increased demand for freshwater. Population growth, increased per capita use of water, the demands of industry and of the agricultural sector all put pressure on water resources. Treatment of wastewater provides an effluent of sufficient quality that it should be put to beneficial use and not wasted (Asano, 1998). The reuse of wastewater has been successful for irrigation of a wide array of crops, and increases in crop yields from 10-30% have been reported (*cited in* Asano, 1998). In addition, the reuse of treated wastewater for irrigation and industrial purposes can be used as strategy to release freshwater for domestic use, and to improve the quality of river waters used for abstraction of drinking water (by reducing disposal of effluent into rivers). Wastewater is used extensively for irrigation in certain countries e.g. 67% of total effluent of Israel, 25% in India and 24% in South Africa is reused for irrigation through direct planning, though unplanned reuse is considerably greater.

2. LITERATURE REVIEW-

The use of sewage waste water for crop irrigation has gained importance throughout the world for the last hundred years or even more in some countries. In India sewage farming was established as far back as in 1895. The realization of the importance of sewage farming came with the declining water resources, costly treatment of waste water and its disposal problem. Therefore, sewage farming became an important development in the water resource management.

Borry*el al.* (1980) were of the opinion that biological, organic and inorganic composition of domestic waste water were generally suitable for irrigating horticultural plant, providing them with some nutrients.
Vimal and Talashikar (1985) advocated the recycling of sewage waste in agriculture as a rich source of plant nutrients. The concentration of nutrients viz., N, P, K, Ca, Mg and Na increased linearly with the increased application rate of liquid sewage and sludge i.e. 40, 80, 120, 160 t/ha.
Sbeih*et al.* (1994) investigated the use of waste water for irrigation and advocated that sewage waste water irrigation spread disease. They proposed treatment of waste water before its application and considered the economic benefits of using sewage water for agriculture

Ghafoor*et al.* (1996) assessed the quality of drain sewage waste water with respect to EC, SAR, ESC macro and micronutrient and its impact on soil and plants. All the contributing effluents were reported unfit for irrigation. The waste water irrigated field growing cauliflower and Chinese squash contained higher amounts of Na, Ca, Mg, CI, SO4, Fe, Mn, Cu, Zn and total soluble salts as compared to canal irrigated field of the same locality. It was reported that concentration of N, P, K, Ca, Mg and CI in leaves and fruits of both the vegetables were almost within the safe limits, with leaves showing higher amount as compared to other parts including fruits. It was also reported that field receiving sewage waste water for 8-10 years were still notsalinized/sodicated.

3. MATERIALS AND METHODLOGY-

Soil sample collection and analysis-

An experimental setup was made for conducting the work to investigate the impact of application of domestic wastewater on soil. For this agricultural soil was collected at an average depth of 30 cm from surface at different irrigation fields near to the Sewage treatment plant. Soils were categorized into three classes- first and second which comprised of those soil samples (6 samples) which are continuously receiving effluent discharges. Third which had those soil samples (3 samples) which are totally unaffected from effluent discharges but irrigation was done using groundwater.

Water sample collection and analysis-

Samples were taken from treated sewage effluent from Sewage treatment plant Nandri (Nandri STP), Jodhpur and underground water analysis at various sampling locations along the irrigation fields. Two samples of underground water were taken. The effluent samples were collected from 3 points viz. primary treated, secondary treated and mix of both. Waste effluents were taken at different dates with interval of 7days.

Methods and Analysis-

The two different types of water samples were discharged into soil separately at intervals of 25days, 30days (1M) and 90days (3M) respectively for different fields. After application of water samples, soil parameters N, P, K, pH etc. were calculated in the two types of soils containing treated sewage effluent and underground water.

4. TEST PERFORMED-

Following test was performed on soil and waste water:

1.Determining water parameters (EC, pH and concentration of cations and anions) in sample of underground water and treated sewage effluent. Also, AWQ index parameters like SSP, SAR and RSC were find out.
2. Determining B.O.D of samples of treated sewage effluent.
3. Determining the soil parameters (N, P, K, pH, EC and Micro-nutrients) of three soil sample after 25 days of application of underground water.
4. Determining the soil parameters (N, P, K, pH, EC and Micro-nutrients) of three soil sample after 30 days of application treated sewage effluent.
5. Determining the soil parameters (N, P, K, pH, EC and Micro-nutrients) of three soil sample after 90 days of application treated sewage effluent.

5. RESULT ANALYSIS

The tests were performed by soil testing laboratory(STL) and water testing laboratory(WTL), "KrishiBhavan ,Paota , Jodhpur (Raj.)".

Table-1. Water Parameter Analysis

Parameters	Unit	Sewage Water Sample No.									Underground Water Sample No.	
		W-1	*W-2*	*W-3*	W-4	W-5	W-6	W-7	W-8	W-9	W-10	W-11
pH		6.8	6.8	6.8	6.9	6.8	6.9	6.9	6.8	6.8	7.6	8
Electric Conductivity (EC)	ds/m	1.14	1.08	1.08	1.16	1.08	1.06	1.16	1.08	1.08	3.05	3.14
$Ca^{++} + Mg^{++}$	meq/lit	6.4	6.2	5.6	6	6.4	6.0	6	5.4	5.6	8.4	4.
Na^{+}	meq/lit	5	4.6	5.2	5.6	4.4	4.6	5.6	5.4	5.2	22.	25.6
$CO_3^{--} + HCO_3^{-}$	meq/lit	10.8	14	10.2	9.6	9.6	8.8	9.8	9.2	9.8	19.8	13.8
Cl^{-}	meq/lit	0.6	1.4	0.6	2	1.2	1.8	1.8	1.6	1	7.9	13.8
Sodium absorption ratio (SAR)	meq/lit	2.79	2.61	3.10	3.23	2.45	2.65	3.23	3.28	3.10	10.78	16.52
Soluble sodium percentage(SSP)	meq/lit	43.5	42.59	48.14	48.27	40.74	43.39	48.27	50	48.14	72.45	84.21
Residual sodium carbonate (RSC)	meq/lit	4.4	3.2	4.6	3.6	3.2	2.8	3.8	3.8	4.2	11.4	9.0

Table-2. Soil Parameter Analysis

S. No	Parameters	Unit	Standard Values		Results								
			Status	Values	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9
1	*pH*		*Normal*	*7-8.5*	*7.5*	**8**	**7.9**	**9.2**	**9**	**9.4**	**7.8**	**7.6**	**7.5**
			Basic	8.5-9.5									
			Highly Basic	>9.5									
2	Electric Conductivity (EC)	dc/m	Normal	≤1.5	**0.19**	**0.11**	**0.07**	**0.16**	**0.09**	**0.12**	**0.05**	**0.04**	**0.03**
			Salty	1.5-3.0									
			Highly Salty	>3.0									
3	Organic Carbon	(%)	Low	<0.5	**0.23**	**0.23**	**0.15**	**0.27**	**0.2**	**0.27**	**0.27**	**0.16**	**0.21**
			Medium	0.50-0.75									
			High	>0.75									
4	Phosphorus (P_2O_5)	kg/hac	Low	<23.0	**33**	**67**	**38**	**46**	**61**	**28**	**18**	**36**	**28**
			Medium	23.0-56.0									
			High	>56.0									
5	Potash (K_2O)	kg/hac	Low	<144	**478**	**478**	**478**	**335**	**445**	**378**	**478**	**425**	**478**
			Medium	144-336									
			High	>336									
6	Zinc (Zn)	mg/lit	Low	<0.6	**0.8**	**0.56**	**0.38**	**0.44**	**0.36**	**2.78**	**2.2**	**0.22**	**0.66**
			Normal	>0.6									
7	Ferrous (Fe)	mg/lit	Low	<4.5	**2.3**	**2.12**	**5.58**	**3.6**	**3.24**	**1.38**	**11**	**6.34**	**2.38**
			Normal	>4.5									
8	Copper (Cu)	mg/lit	Low	<0.2	**0.28**	**0.12**	**0.08**	**0.1**	**0.1**	**1.04**	**0.56**	**0.16**	**0.34**
			Normal	>0.2									
9	Manganese (Mn)	mg/lit	Low	<2.0	**5.44**	**5.08**	**5.52**	**5.32**	**5.76**	**2.37**	**7.76**	**5.72**	**5.06**
			Normal	>2.0									

6.CONCLUSIONS-

The application of municipal sewage effluent had a positive effect on the growth and production of millet in the nutrient-poor soil of the arid areas of Nandri(Jodhpur), without an excessive accumulation of any toxic elements in plants. Thus, the efficient use of this type of municipal sewage effluent can effectively increase water resources for irrigation and may prove to be a boon for agricultural production. From this study, it can be concluded that sewage effluent, in addition to being a source of irrigation water, is a potential source of plant nutrients, and that effluent application can result in an increase in micro- and macro-nutrients in soils. The effect of the effluent was more pronounced when micro-nutrient foliar spraying was also used. Significant depletion of available Zn and Cu in intensively cultivated soils is likely to induce a lack of sustainability of soil productivity. Hence, Zn and Cu should be included in fertilization programs, including those which utilize municipal sewage effluent. Hence, in this study the soil samples of treated sewage have better more quality parameters in comparison to soil samples which are been treated with groundwater samples. It can be concluded from above study that in irrigation areas near to Nandri sewage treatment plant the treated wastewater used for irrigation is far better for soil and crop health in comparison to nearby groundwater found in bore wells which is poorer in quality for irrigation purpose.

REFRENCES-

1.Central Water Commission, 2010. Water and Related Statistics. Water Planning and Project Wing.
2.UNICEF, FAO and SaciWATERs, 2013. *Water in India: Situation and Prospects*.
3.World Bank, 2005. *India's Water Economy: Bracing for a Turbulent Future*. Report No. 34750-IN. World Bank Agriculture and Rural Development Unit, South Asia Region.

4.Central Pollution Control Board, 2010. CPCB Report Series: CUPS/70/2009-10. *Status of Water Supply, Wastewater Generation and Treatment in Class I Cities and Class II Towns of India*. Central Pollution Control Board, India.

5.Central Pollution Control Board, 2005. *Status of Sewage Treatment in India*. Central Pollution Control Board, India.

6.Amerasinghe, P., Bhardwaj, R.M., Scott, C., Jella, K., and Marshall, F. 2013. *Urban Wastewater and Agricultural Reuse Challenges in India*. International Water Management Institute (IWMI) Research Report 147.

7.Data Book-2011, Indian Agricultural Statistics Research Institute, New Delhi.

8.McKinsey Global Institute, 2010. *India's Urban Awakening: Building Inclusive Cities, Sustaining Economic Growth*. Available at: http://www.mckinsey.com/insights/urbanization/urban_awakening_in_india

9.Palrecha, A., Kapoor, D., and Malladi, T. 2012. Wastewater irrigation in Gujarat: An exploratory study. IWMI-TATA Water Policy Program. Available at: www.iwmi.cgiar.org/iwmi-tata/PDFs/2012_Highlight-30.pdf

10.Institute of Wetland Management and Ecological Design, 2004. Preliminary Study on Biodiversity of Sewage Fed Fisheries of East Kolkata Wetland Ecosystem. Report submitted to the Department of Environment, Government of West Bengal.

11. Central Pollution Control Board, 2005. Performance Status of Common Effluent Treatment Plants in India. Central Pollution Control Board, India.

12.Central Pollution Control Board, 1984. Minimal National Standards: Fermentation Industries. New Delhi, India.

13.WHO (2006) Guidelines for the safe use of wastewater, excreta and greywater. Volume 2: Wastewater use in agriculture, Geneva, Switzerland.

