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Research Article

Effect of Domestic Waste Water on Rice and Wheat Crop in Saharanpur, Uttar Pradesh, India

Anirudh Rana[1], Amit Kumar[2] and Sheesh Pal Singh[2]

[1]*Department of Botany, Satguru Institute of Education and Technology, Nakur*

[2]*Department of Botany, Janta Vedic College, Baraut*

Abstract

In the present study, impact of domestic waste water (sewage) on seed germination parameters of rice and wheat were studied. Use of sewage for irrigation purposes has emerged an important way to utilize its nutrients and removal of its pollution load by growing tolerant plant species. A two way analysis of variance showed that, the difference in rate of seed germination was statistical significant among different concentration of treatment (F1 = 250.71 & 80.27) as well as between different time period of incubation (F2 = 8.96 & 4.5) for both rice and wheat respectively. The effect of sewage on seedling A growth was significant at various concentrations of sewage (F1= 81.65 & 78.17) as well as between different period of incubation (F2 = 30.04 & 26.36) for both rice and wheat respectively.. One way analysis of variance for total chlorophyll content between various concentrations of sewage showed a statistically significant result in both rice (F=270.11) and wheat (F = 1391. 84). Germination efficiency, seedling length, total chlorophyll content was found to be increased with increase in concentration of sewage up to 50% dilution after which it decreases. Thus, the sewage, after proper dilutions can be used as a potential source of water for seed germination and plant growth in agricultural practices.

Keywords: *Sewage, Seed germination, Seedling growth, Chlorophyll.*

Introduction

Urban centres are discharging waste water into the water bodies and for irrigation in the agriculture fields. The major sources of organic pollution in fresh water bodies are sewage. Sewage includes domestic, hospital and small scale industrial wastes operating under municipal area. In India, all the cities and towns did not have sewage treatment facilities. Disposal of waste water is one of the major problems of Saharanpur city. In most of the places sewage is discharged in to open drains without any treatment, which joints to form Dhamola river. Pavdhoi nadhi which finally meets river dhamola river, serves as the ultimate for the waste water discharge of Saharanpur city.Dhamola river is a natural stream which receives maximum discharge from the city. Domestic waste water rich in organic materials and plant nutrients are finding agricultural use as a cheap way of disposal. Use of domestic waste water in agriculture may contribute considerable to alleviate the pressure in using fresh water resources. Waste water from different sources contains considerable amount of organic matter and plant nutrients (N, P, K, Ca, S, Cu, Mn & Zn) and has been reported to increase the crop yield (Pathak, *et al.*, 1998; Pathak, *et al.*, 1999; Ramana, *et al.*, 2000; Lubello, *et al.*, 2004; Nagajyothi, *et al.*, 2009; Nath, *et al.*, 2009). Sewage sludge consists of multi-element organic wastes that are also used commonly as manure (Otobbang, *et al.*, 1997). Dash and Mishra, (1999) has studied that, sewage enriched paper mill waste water has a positive effect on growth and pigment content of *Westiellopsis prolifica*. Efforts have been

***Corresponding Author:**
Anirudh Rana;

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made by different workers to determine the effect of different industrial waste water on seed germination of various crops such as maze (Choudhury, *et al*., 1987); rice (Behera & Mishra, 1982; Singh, *et al*., 1985); wheat (Agarwal, *et al*., 1995; Nagda, *et al*., 2006); pine (Czabator, 1962); green gram (Subramani, 1999); mung bean (Nagda, *et al*., 2006); pea, lentil & gram (Khan, *et al*., 2011);It has been done on the aegropotentiality of domestic waste water. Seed germination is a critical stage that ensures reproduction and control is the dynamics of plant populations, thus it is a critical test of probable crop productivity. In view of such perspectives, the present investigation was conducted to evaluate the impact of different concentrations of domestic waste water on seed germination, seedlingand pigment content of rice and wheat.

Material and Methods

Domestic Waste Water Sample

For the present study, domestic waste water was collected from the mid stream site of dhamola river near paper mill in Saharanpur city in up. For the present bioassays, waste water was diluted to Control, 10%, 25%, 50%, 75% & 100% (pure waste water without dilution).

Table 1: shows the physic- chemical analysis results of domestic waste water.

Sl.No.	Parameters	value
1	Colour	Dark Blue
2	Odour	Unpleasant
3	Ph	8.20
4	Turbidity (JTU)	94
5	Total Suspended Solid mg/l	412
6	Total Dissolved Solid mg/l	804
7	Total Solids mg/l	611
8	Biochemical Oxygen Demand (3 days at 270C) mg/l	1.02
9	Chemical Oxygen Demand mg/l	0.780
10	Nitrogen	2.5 60
11	phosphate	0.345
12	Total Heavy Metal	16.0

Experimental Set-Up

Seeds of rice (*Oriza sativa* L.) and wheat (*Triticum aestivum* L.) were sterilized with 0.1% w/v aqueous solution of mercuric chloride for 5 minutes to remove the microbes, followed with repeated washings by using sterilized double distilled water. A laboratory experiment of petri dish culture was designed with three replicates from each dilution and 20 healthy treated seeds of uniform size per petri dish were used. Plant seeds were spread on equal distance in each sterilized petri dish lined with blotting paper. Then each petri dish were irrigated with 5ml. of different concentrations of waste water into the respective petri dish and then incubated at 25+20C. Different parameters like germination percentage, seedling length, chlorophyll content were recorded on different period of growth. First recording were done after 12hr. of incubation and subsequent recordings were after 1day interval till 10th day of incubation. The petri dish were rearranged at random on every 2days to ensure no systematic effects due to positioning within the incubator.

Germination (%)

Seed germination was observed by providing optimum conditions for each experimental set. Germination in each experimental set was recorded and total germination was calculated and expressed in percentage.

Seedling Length (cm)

The root length and shoot length of the germinated seeds were measured from each experimental set. The shoot length was measured from the base of the primary leaf to the base of the hypocotyl and the mean shoot length was expressed in centimetre.

Chlorophyll

Total chlorophyll content after eight days was extracted by 80% acetone and determined spectro- photo- metrically at wave lengths 663nm, 645nm & 470nm, after centrifugation of the extract at 5000rpm for 5min and calculated as per Lichenthaler and Wellburn, (1983).

Result and Discussion

The rate of seed germination for both rice and wheat cultivars increases progressively with increasing concentration of domestic wastewater up to 50% and thereafter it decreases (Table 2 and 3). The effect of domestic wastewater on germination of rice and wheat was discourageable towards higher concentrations (70 to 90% inhibition rate with treatment of 75% and 100% wastewater). Khan, *et al*., (2011) in their experiment on impact of textile waste water on seed germination found that, in higher concentrations, the germination of seed is affected. Nagda, *et al*., (2006) found that, at higher concentration of industrial effluent, the seed germination efficiency decreases. Osmotic pressure of the effluent increases at higher concentrations of total salts making inhibition more difficult and retard germination efficiencies. The ability of seeds to germinate under high osmotic pressure differs with variety as well as species (Unger, 1987). Lower concentration of effluent supports 100% seed germination in Kidney bean and millet, but osmotic pressure associated with higher concentration of sugar factory effluent were found to reduce the germination in kidney bean and millet (Ajmal and Khan, 1983). The treatment with polluted water also delayed seed germination in both rice and wheat. This may be due to decrease in water uptake at higher level of salinity in view of toxicity of high osmotic pressure of the seedling medium. Khan and Sheikh, (1976) have reported significant reduction and delay in the germination of Capsium annum seeds. In the present study, difference in the rate of seed germination in both rice and wheat was statistically significant among different concentrations of treatment ($F1 = 250.71$ & 80.27 at $P \leq 0.01$) as well as between different time periods of incubation ($F2 = 8.96$ & 4.5 at $P \leq 0.01$). The reduction in seed germination may be due to higher soluble salt in the polluted water. Khan and Sheikh, (1976) have reported significant reduction and delay in the germination of Capsicum annum seeds with the treatment of sewage. They revealed that, this is due to decrease in water uptake at higher level of salinity in view of toxicity of high osmotic pressure due to high soluble salts.

Table 2: Percentage germination of rice grown in different concentrations of domestic waste water

Time after treatment	**Concentrated of treated domestic waste water**					
	Control	10%	25%	50%	75%	100%
12hrs	X	x	x	x	x	x
1st day	X	10	13	12	20	x
2nd day	80	80	90	100	60	50
3rd day	100	100	100	100	80	80
4th day	100	100	100	100	90	80
5th day	100	100	100	100	90	80

Table 3: Percentage germination of wheat grown in different concentrations of domestic wastewater

Time after treatment	**Concentrated of treated domestic waste water**					
	control	10%	25%	50%	75%	100%
12hrs	**x**	**x**	**x**	**x**	**x**	**x**
1st day	x	x	x	x	x	x
2nd day	50	90	90	100	40	30
3rd day	100	100	100	100	80	50
4th day	100	100	100	100	90	70

5th day	100	100	100	100	90	70

The data presented here also depicted significant declined in seedling length with treatment of sewage at the concentrations (75% and 100%). However, treatment at lower concentrations (25% and 50%) seedling length in both rice and wheat increases (Figure 1 & 3). Bazai and Achakzai, (2006) in their experiment on effect of aste water from Quetta city on the germination and seedling growth of lettuce increased as compared with the control, but at higher concentration it decreases.

Table 4: Effect of domestic wastewater on seedling length in cm of rice

Time after treatment	control	10%	25%	50%	75%	100%
12thhour	00	0	0	0	00	00
1st day	0.0	0.0	0	0	00	00
2nd day	2.5	2.4	3.0	3.9	1.2	0.5
3rd day	3.9	2.9	3.8	5.8	1.9	1.4
4th day	5.7	4.3	5.8	5.9	2.8	1.7
5th day	6.4	6.5	7.9	7.9	4.7	2.8
6th day	8.2	7.1	9.5	8.9	5.4	3.2
7th day	8.7	7.9	9.7	10.2	6.6	3.5
8th day	8.7	8.7	9.8	10.5	6.9	3.8
9th day	8.9	9.7	10.0	10.6	7.2	4.9

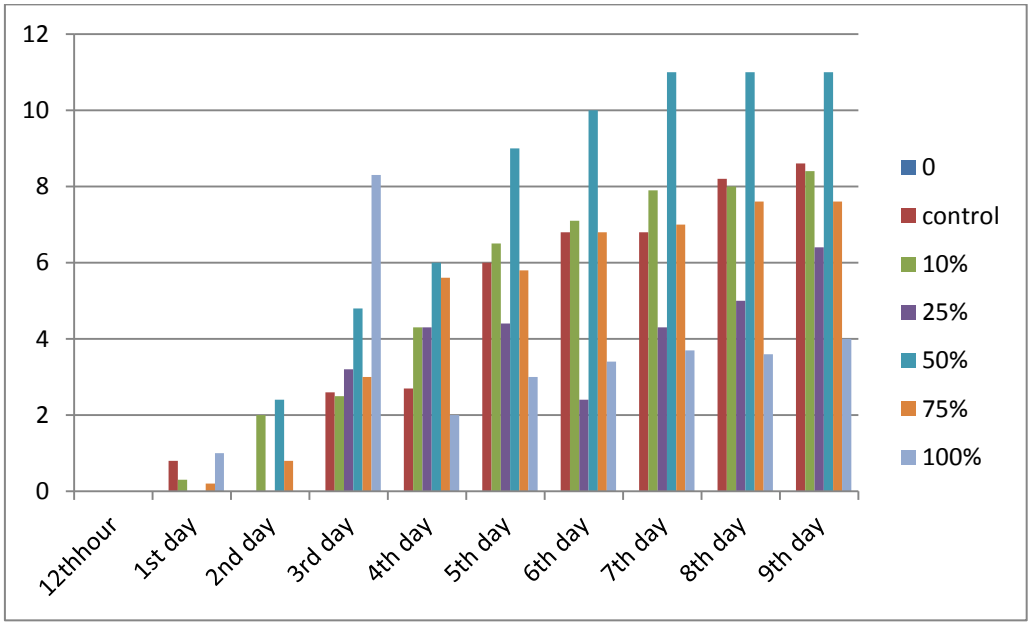

Figure 1: Histogram representation of seedling of rice

Table 5: Effect of domestic wastewater on seedling length in cm of wheat

Time after treatment	control	10%	25%	50%	75%	100%
12thhour	0.0	0	0	0	00	00
1st day	0.0	0.0	0	0	00	00
2nd day		2.4	2.5	3.9	1.9	0.8

	2.6					
3rd day	3.0	2.9	3.8	5.8	3.1	1.4
4th day	3.9	4.3	5.8	5.9	3.8	1.7
5th day	4.5	6.5	7.9	7.9	4.7	2.8
6th day	6..2	7.1	9.5	8.9	5.4	3.2
7th day	8.8	7.6	9.7	10.2	6.6	3.5
8th day	8.7	8.7	9.8	10.5	6.9	3.8
9th day	8.9	9.0	10.0	10.6	7.2	4.9

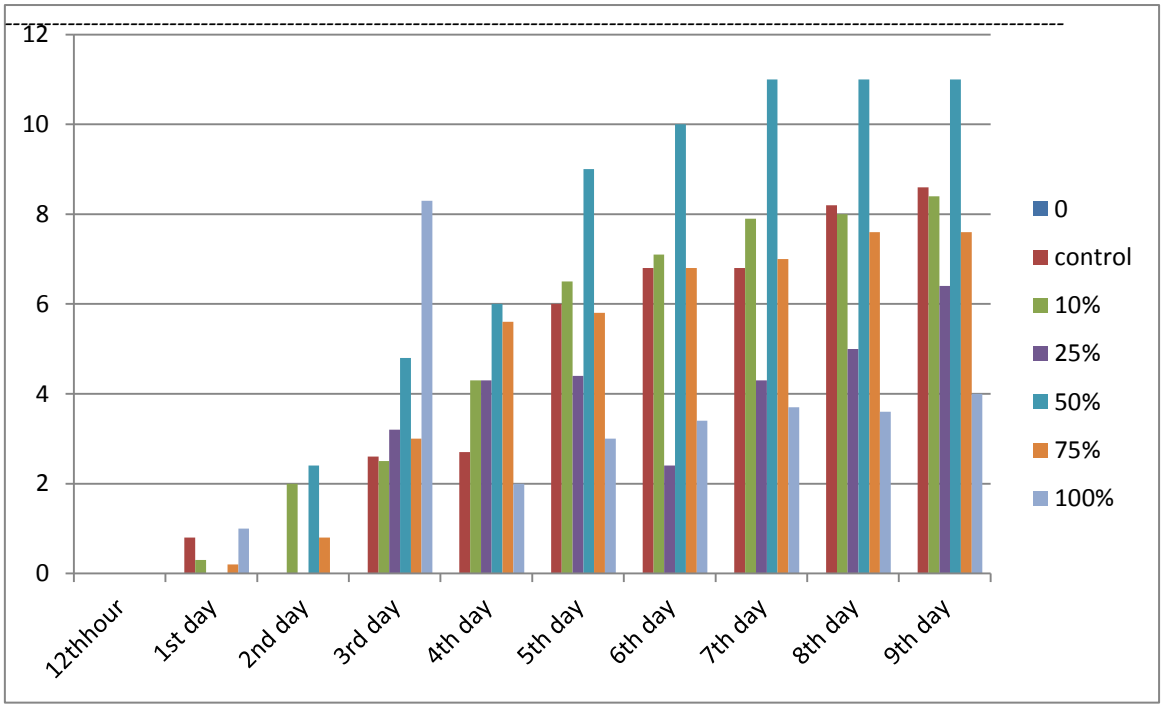

Figure 2: Histogram representation of seedling of wheat

Table 5: Effect of domestic wastewater on total chlorophyll content of rice and wheat

Concentration of domesticwaste water	**RICE**	**WHEAT**
CONTROL	0.8	0.6
10%	1.8	1.5
25%	2.5	2.4
50%	1.2	1.4
75%	1.3	1.2
100%	0.4	0.5

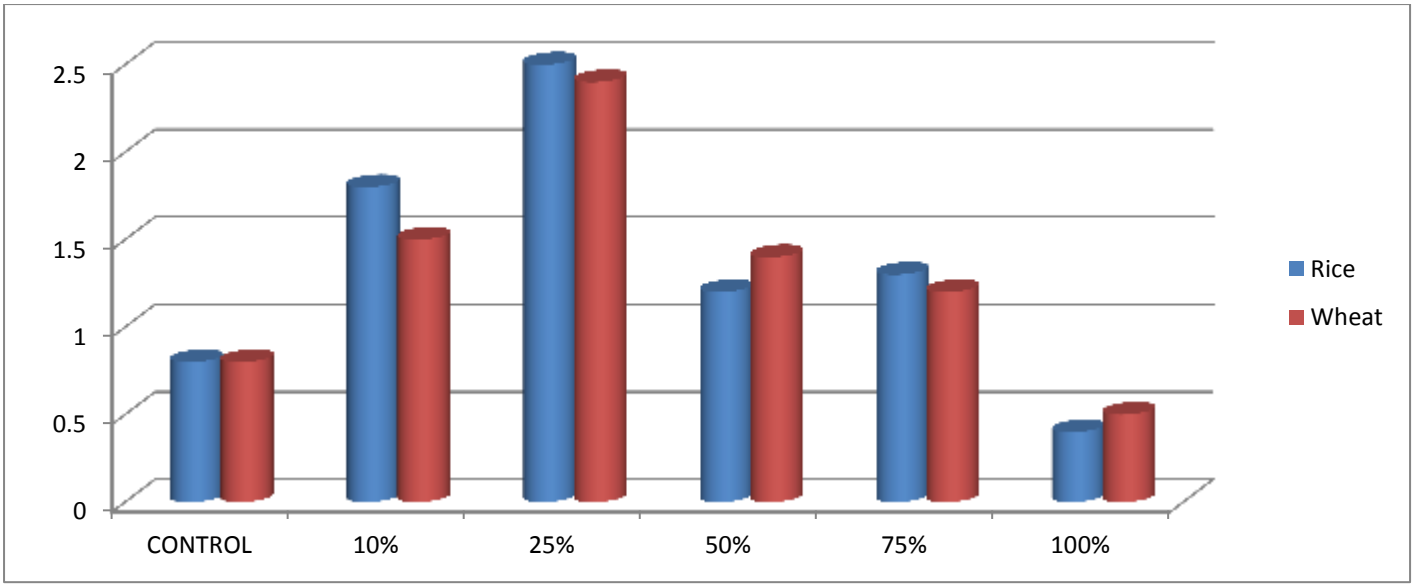

Figure 3: Effect of domestic wastewater on total chlorophyll content of rice and wheat

Further, the chlorophyll content in both rice and wheat seedling was increased upto 50% treatment of sewage and there after declined gradually at high concentrations (Figure 3). Enhancement of chlorophyll content in both rice and wheat may be due to higher nutrient uptake from the wastewater. Nagda, *et al*., (2006) in their experiment on seed germination bioassays to assess toxicity of molasses fermentation based bulk drug industry effluent also found similar result. Srivastava and Sanhai, (1987) also found similar results using distillery wastewater. Higher concentration of waste water are inhibitory to synthesis of chlorophyll molecules particularly chlorophyll *a* (khan, *et a*l., 2011). The variation in chlorophyll content was found to be statistically significant with treatment at various concentration of sewage (F = 270.11 & 1391.84 at P ≤ 0.01 both in rice and wheat respectively). --

The effect of polluted water on seedling length was found to be statistically significant with treatment at various concentrations of sewage (F1 = 81.65 & 78.17 at P ≤ 0.01) as well as between different time period of incubation (F2 = 30.04 & 28.36 at P ≤ 0.01) in both rice and wheat seedlings *nt of rice and wheat.*

Conclusion

The use of domestic wastewater in plant nourishment would be beneficial alternative resources to fresh water. On the basis of overall performance as exhibited by two crops (rice & wheat when subjected to domestic wastewater, it can be suggested that, sewage is a prospective source of different plant nutrients. Thus, sewage can be used for irrigation purposes in agricultural practices after proper dilutions. It is also suggested that, treatment of sewage is necessary to minimise the pollution effects before it is discharged to the land.

References

1. Agarwal, S.R., C. Chaturvedi and C. Chaturvedi. "Effect of industrial effluents of a paper and sugar mill on the germination of wheat (*Triticum aestivum*)." *Journal of Living World* 2 (1995): 16-19.
2. Ajmal, M. and Khan, A.U. "Effects of sugar factory effluent on soil and crop plants." *Environmental pollution* 30 (1983): 135-141.
3. APHA. "Standard methods for examination of water and wastewater, 20th ed." *American Public Health Association, Water pollution control federation, Washington, D.C* (1998).
4. Bazai, Z.A. and Achakzai, A.K.K. "Effect of waste water from Quetta city on germination and seedling growth of Lettuce (*Lactuca sativa* L.)." *Journal of Applied Science* 6.2 (2006): 380-382.
5. Behera, B.K. and Mishra, B.N. "Analysis of industrial effluent on growth and devel-

opment of rice seedling." *Environmental Research* 28 (1982): 10-20.
6. Choudhury, S.K., Jha, A.N., Srivastava, D.K. "Effect of paper mill effluent on seed germination and seed germination and seedling growth in maize." *Environmental Ecology* 5 (1987): 285-287.
7. Czabator, F.J. "Germination value: An index combining seed and completeness of pine seed germination." *Forensic Science* 8 (1962): 386-396.
8. Dash, A.K. snd Pramod, C. M. "Growth response of the blue-green alga, *Westiellopsis prolifica* in sewage enriched paper mill waste water." *Review of International Contamination Ambient* 15.2 (1999): 79-83.
9. Doke, M.K., Ejazuddin, M. K., Joseph, R. and Asif, S. "Physico-chemical analysis of sugar industry effulunt and its effect on seed germination of *Vignangularis, Vigna cylindrical* and *Sorghum cernum*." 5 (2011): 7-11.
10. Khan, M.G., G. Daniel., M. Konjit., A. Thomas., Eyasu, S. S. and G. Awoke. "Impact of textile waste water on seed germination and some physiological parameters in pea (*Pisum sativum* L.), Lentil (*Lens esculentum* L.) and gram (*Cicer arietinum* L.)." *Asian Journal of Plant Science* 10(2011): 269-273.
11. Khan, S.S. and Sheikh, K.H. "Effects of different level of salinity on seed germination and growth of *Capsicum annam*." Biologia 22 (1976): 15-25.

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