Tolerance of Polluted Water on Seedling Growth of Some Cereal Crops

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Abstract **- Attempts were made to study the influence of sugar mill industrial polluted water on seed germination and seeding growth of cereal crops from Tuljabhavani Sahakari Sakhar Karkhana Naldurg. The higher concentration of distillery effluent were found to inhibit the germination of cereal crops. Maize (*Zea mayes*) and Rice (*Oryza sativa*) were more susceptible and Jowar (*Sorghum vulgare*) was less susceptible to polluted water as compared to other crops. Polluted water showed low pH (2.02) and high temp., OD, TS, TDS & TSS than tap water. In the phytotoxicity was more in *Sorghum vulgare* than other crops.**

Key words: *Effluent, pollution, seed germination, cereal crop seeds*

1. Introduction

The various kinds of pollution caused by rapid industrialization. The problem of water pollution due to industrial effluents waste water. The most important effluent discharging industries are distilleries, sugar mills, Pulps, paper mills etc. Polluted water not only affects animal life but also the vegetations. An investigation was conducted to utilize and observe the influence of Tuljabhavain Sahakari Sakhar Karkhana Naldurg polluted water on seed germination and seeding growth of some important cereal crops.

2. Materials and Methods

Five different types of cereal craps seeds viz. *Penisetium typhoides* (Bajara), *Sorghum vulgare* (Jowar), *Zea mayes* (Maize), *Oryza sativa* (Rice) and *Triticum aestivum* (Wheat**)** were selected for the present experiment. Thirty seeds of each were soaked in polluted water and another set in tap water as control for 24 hr in separate Petri dishes. Using filter paper method **(*Agrawal*, 1995),** the seeds were folded in germinating paper. Each paper contains 10 seeds in triplicate. The folded paper along with seeds were tied with thread and kept in 500 ml beaker. 200 ml polluted water was poured in it , while another beaker was kept as control by using tapwater. After every two days interval, water was added as per requirements depending upon rate of absorption. After seven days the germinated seeds were removed. Shoot & Root length, fresh and dry weight of the seedlings were measured & analyzed statistically (Mungikar, 1997). The standard method of (APHA, 1992), (Saxena, 1990), and (Trivedy, 1998) were followed for the analysis of effluent.

The phytotoxicity (%) was calculated using the formula Chou et al. (1978).

$$\text{Percentage of phytotoxicity} = \frac{Length\ of\ Control - Length\ of\ Test(Polluted)}{Length\ of\ Control} \times 100$$

The Effluent tolerance index (ETI) was calculated using the formula determined by Turner & Marshal (1972).

$$\text{Effluent tolerance index} = \frac{Mean\ length\ of\ the\ longest\ root\ \&\ shoot\ in\ the\ \ Effluent}{Mean\ length\ of\ the\ longest\ root\ \&\ shoot\ in\ the\ control}$$

3. Result and Discussion

Table -1. Analysis of physico-chemical parameters of tap water and polluted water used for seedling growth.

Parameter	Tap water	Polluted water
Colour	Transparent	Faint yellow colour.
Odour	No specific smell.	Foul smell.
Temp.(°c)	29	32
pH	7.2	2.02
Optical Density (OD)	0.01	0.67
Total Solids (TS) mg/1.	320	550
Total dissolved Solids. (TDS) mg/l	300	500
Total Suspended Solids. (TSS) mg/1.	150	250

Table 2. Effect of polluted effluent on seed germination of some cereal crops.

Sr. No.	Characterstics		Bajra	Jowar	Maize	Rice	Wheat
1.	Seed Germination (%)	Control	96.00	86.00	23.00	96.00	91.00
		Polluted	04.00	10.00	92.00	73.00	04.33
2.	Root length (cm)	Control	01.2±0.4	01.0 ± 0.2	02.99 ± 0.3	82.23 ± 0.1	04.99 ± 0.3
		Polluted	00.00	0.30 ± 0.2	04.11 ± 0.3	03.32 ± 0.4	00.10 ± 0.1
3.	Shoot length (cm)	Control	04.11 ± 0.2	02.22 ± 0.2	03.33 ± 0.2	07. 22 ± 0.1	05.11 ± 0.2
f>		Polluted	00.00	00.00	3.22 ± 0.4	4.11 ± 0.2	1.00 ± 0.1
4.	Fresh weight of root (mg)	Control	00.70	00.70	01.32	00.21	00.10
		Polluted	00.00	00.10	00.30	00.09	00.10
5.	Fresh weight of Shoot (mg)	Control	00.20	00.60	01.11	00.20	00.770
		Polluted	00.00	00. 300	00. 255	00.210	00.20
6.	Dry weight of root (mg)	Control	00.17	00.34	00.00	00.10	00.200
		Polluted	00.00	00.10	00.40	00.22	00.002
7.	Dry weight of Shoot (gm)	Control	00.10	00.10	00.00	00.50	00.23
		Polluted	00.00	00.20	00.50	00.10	00.20
8	Phytotoxicity (%)	Root	16.80	71.90	00.00	13.00	17.33
		Shoot	00.00	33. 30	00.00	31.50	12.33
9.	Effluent tolerance index (%)	Root	00.00	00.20	00.60	28.60	12.33
		Shoot	00.00	00.45	00.60	04.80	09.14

The physical properties of industrial water used for seedling are given in table 1. The presence of total suspended solids to the extent of 250 mg/l was responsible for faint yellow coloration of waste water. The pH of Polluted water 2.02, total dissolved solids (500 mg /l) total Solids (550 mg / l) & optical density (0.67) was stunted seedling growth. Morever root also adversely affected the fresh and dry weight of all seedlings except *Z. mayes* and *O. sativa* in polluted water.

The shoot length, root length, fresh and dry weight of different seedling treated with polluted water and tap water are give in Table 2. The observations showed that *Z. mayes* and *O. sativa* were most susceptible to polluted water as compared to others. Its root length and shoot length were decreased that form 4.11 to 2.99, 3.32 to 2.23 & 3.22 to 3.33, 4.11 to 7.22 cm respectively due to polluted water, while its fresh weight increased to 0.300 gm and 0.255 gm which were 1.32 gm & 1.11 g m respectively in control. Seed in polluted has maximum germination i.e. 92.00%, 73.00% in *Z.mayes* and *O.sativa*. Seed in polluted has minimum 04.00% in *S.vulgare* and *P.typhoides*. Phytotoxicity was increased in shoot of *O.sativa* (31.50 %) and effluent tolerance index was also adversely affected in root and shoot.

The results showed that the industrial polluted water adversely affected seedling growth of cereal crops due to suspended solid and low pH of polluted water. Therefore, it is concluded that the industrial polluted

water from "Tuljabhabani Sahakari Sakhar karkhana Naldurg" is suitable for seedling growth of *Z.mayes* and *O.sativa*.

Several workers like Arokia Sami et. al. (1981) , Sahai et. al. (1983), Gupta et al. (2003), Swaminathan & Vidheeswaran (1997), Nanda et al,(1991) & Shreshtha & Niroula (2003) have observed the influence of different kinds of industrial effluents on seed germination and seedling growth.The higher concentration of distillery effluent were found to inhibit the germination and growth of paddy (*Oryza sativa L.*) (Suresha et.al,2006). Population studies of sugar mill effluent showed that most of the physico - chemical parameters like colour, odour total solids, COD, BOD, alkalinity and fluoride were found to be exceed the ISI prescribed permissible values while pH , phosphate and sulphate were found within permissible limit (Senthil Kumar et.al; 2001). Recently, Bhale and Gogle (2008) were reported the *Hibiscus esculentus* was more susceptible and *vigna radiata* was more resistant to polluted water as compared to other vegetable seeds.

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