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IMPACT OF DISTILLERY EFFLUENT ON THE GROWTH AND DEVELOPMENT OF *ORYZA SATIVA* L.

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ABSTRACT

The present study is to analyse the impact of diluted distillery effluent on the growth of rice (*Oryza sativa L.*). Of the different concentrations of the effluent used, 20% dilution was found to be best suited for the plant growth. The results indicate that after proper dilution, distillery effluent can be used effectively as a source of fertilizer irrigant. This also can be considered as an effective effluent disposal option too.

INTRODUCTION

Rice (*Oryza sativa L.*) is the most important food crop of the developing world. Asian farmers produce about 90% of total, with two countries, China and India, growing more than half the crop (USDA, 2008). Rice belongs to the genus *Oryza* and has two cultivated and 22 wild species. The cultivated species are *Oryza sativa* and *Oryza glaberrima.* Rice is grown under many different conditions and production systems, but submerged in water is the most common method used wild wide. Rice is the only cereal crop that can grow for long periods of time in standing water. 57% of rise is grown on irrigated land, 25% on rain fed lowland , 10% on the upland , 6% in deepwater, and 2% in tidal wetlands. There are so many factors, which inhibit the normal growth of paddy crops like flood, drought, pest attack etc. In the present scenario of industrial growth, the disposal of effluents is a problem of increasing importance throughout the world. The effluent from distilleries is one among many such effluents. In India, a huge amount of waste water generated from distillery industries is discharged on land or into the running waters. Distillery waste water is characterized by low pH, high BOD and COD values and contains a high percentage of organic and inorganic materials.

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Distillery effluents also contains considerable amount of elements like N, P, K, Ca, and S. Since it is rich in plant nutrients (N, P, K, S), its use as fertilizer cum irrigation source for agricultural fields is a very feasible disposal option. The present study was undertaken with the objective to understand the impact of distillery effluent when used as a fertilizer cum irrigation source for paddy cultivation. The observations were made at different growth periods of the plant such as seedling stage, vegetative stage, flowering stage and fruiting stage.

MATERIALS AND METHODS

The materials and methods of the present study are as follows. The experimental plant selected was Oryza sativa L. (Rice). Different concentrations of the effluents used were 20%.40%, 60%, 80% and 100%. As control, distilled water was used. Various growth parameters considered for the study were:

Morphological Parameters

- General appearance
- Shoot length of the plant

Plant Biomass

- Fresh weight of the stem, leaves, roots
- Dry weight of the stem leaf roots

Plant Pigments

- Chlorophyll a
- Chlorophyll b
- Chlorophyll c
- Carotenoids

Primary Metabolites

- Carbohydrate
- Protein

Methodology

- General appearance
- General appearance of the plant was noted and compared at regular intervals
- Shoot length
- Shoot length of the each plant was measured using twine and scale (measurement were taken at 3 week intervals)
- Fresh weight of the seedlings
- Fresh weight was obtained using weighing balance after uprooting the plant on 90^{th} day
- Dry weight
- Dry weight (oven dried) was obtained on 90^{th}day after uprooting the plants

Chlorophyll and carotenoid content

The method of Arnon (1949) was employed for the quantitative estimation of chlorophyll and carotenoid content. The results obtained where compared with the of control

Total carbohydrate content

For the quantitative estimation of carbohydrate the method adapted was that of Shirlaw and Gilchirst (1967).

Total protein

The proteins were assayed by the method of Lowry (Lowry *et al.,* 1957).

Phytomass and productivity

In order to find out the phytomass, the plants were thoroughly cleaned and the plant parts like leaves stem, branches and root were separated and kept in separate paper packets. They were dried thoroughly in a hot air oven at 80^0C till weights became constant. The weight of each plant part were found out separately and from this the total phytomass value and the Net Primary Productivity (NPP) was found out by dividing the phytomass value by the plant age expressed in days.

RESULT

In the 20% distillery effluent the growth and development of *Oryza sativa* as obviously better and the plants had higher levels of protein and carbohydrate content compared with the paddy plants grew in other concentration of distillery effluent as well as the control.

Shoot Length

The shoot length of the plants was measured at different intervals. The results are shown in Table1

Table 1. Growth Performance of *Oryza sativa* L. Grown under Different Experimental Set Up

Sl.No	Treatments	Day	Shoot Length
1	Control	21	15cm
		42	18.9cm
		63	22.7cm
		84	28cm
		90	31.4cm
2	20% Effluent	21	15.7cm
		42	19.1cm
		63	23.4cm
		84	29.2cm
		90	33.5cm
3	40% Effluent	21	10cm
		42	14.2cm
		63	16.8cm
		84	19.5cm
		90	23.4cm
4	60% Effluent	21	12cm
		42	15.9cm
		63	19.1cm
		84	19.9cm
		100	25cm
5	80% Effluent	21	13cm
		42	16.3cm
		63	18.6cm
		84	22.9cm
		90	25cm
6	100% Effluent	21	15cm
		42	16.5cm
		63	18.7cm
		84	19.6cm
		100	23cm

Fresh weight (Table. 2)

Fresh weight was found out after uprooting the plant on 90^{th}day. The results are given in Table 2

Table 2. Fresh Weight of Whole Plant of *Oryza Sativa* L. Grown In Different Concentration of Distillery Effluent

Sl.No	Treatments	Day	Fresh Weight
1	CONTROL	90^{TH}	0.74g
2	20%	90^{TH}	0.84g
3	40%	90^{TH}	0.64g
4	60%	90^{TH}	0.78g
5	80%	90^{TH}	0.54g
6	100%	90^{TH}	0.50g

Dry weight of Whole Plant

The plants were dried in the hot air oven and dry weight was found out on the 90^{th} day. The results are given in Table 3

Table 3. Dry Weight of Whole Plant of *Oryza sativa L.* Grown in Different Concentrations of Distillery Effluent

Sl.No.	Treatments	Day	Dry Weight
1	CONTROL	90^{TH}	0.21g
2	20%	90^{TH}	0.24g
3	40%	90^{TH}	0.20g
4	60%	90^{TH}	0.22g
5	80%	90^{TH}	0.19g
6	100%	90^{TH}	0.18g

Chlorophyll and Carotenoid Content

Chlorophyll and carotenoid content was calculated calorimetrically on the 30th day. Results are shown in Table 4.

Table 4. Leaf Pigment Content of *Oryza sativa* L. Grown Indifferent Concentrations of Distillery Effluent

SL. No.	Conc. of effluents	Chl a(mg/g)	Chl b(mg/g)	Total chlorophyll(mg/g)	Carotenoid(mg/g)
1	Control	1.421	1.497	1.333	4.747
2	20%	5.841	6.409	11.420	4.847
3	40%	3.174	2.517	5.217	2.583
4	60%	2.920	2.288	4.637	2.583
5	80%	2.158	1.602	3.478	1.823
6	100%	0.313	0.108	0.637	3.115

Carbohydrate content was calculated calorimetrically on 90thday.Results are shown in Table 5

Table 5. Carbohydrate Content in *Oryza sativa* L. Grown in Different Effluent Concentration

Sl. No:	Treatments	Carbohydrate Content
1	Control	55mg/g
2	20%	75.21mg/g
3	40%	57mg/g
4	60%	51.1mg/g
5	80%	45mg/g
6	100%	30.1mg/g

Protein content was calculated colorimetrically on 90thday. Results are in Table 6

Table 6. Protein Content in Oryza Sativa L. Grown In Different Effluent Concentrations

Sl. No:	Different Effluent Concentration	Protein Content
1	Control	.0731mg/g
2	20%	0.93mg/g
3	40%	0.603mg/g
4	60%	0.533mg/g
5	80%	0.320mg/g
6	100%	0.181mg/g

DISCUSSION

The present work was carried out to find out the impact of distillery effluent on the growth and development of response *Oryza sativa* L. When used as a source of liquid organic fertilizer cum irrigation. The different concentrations of the effluent selected were 20%, 40%, 60%, 80%, Distillery effluent is collected from beverage factory at Cherthala. Various parameters such as height of the plants, length and number of roots, number of branches and spikelet, phytomass of the plants and spikelet were observed and compared. The study revealed that there was a considerable variation in the growth and productivity of plants. Plants which grown in the soil amended with 20% distillery effluent showed higher growth and productivity than the plants grown in the soil amended with 40% , 60% , 80% , 100% and also in control (farmyard manure) . The chlorophyll and carotenoid content of leaves was also higher in plants grown in soil amended with 20% distillery effluent. Protein and carbohydrate content is also high in plants grown in soil amended with 20% distillery effluent. The study revealed that there was a considerable increase in the growth and productivity of plants treated with 20% effluent. But the concentrations higher than 20% markedly hindered plant growth. According to the study by Kulkarni *et al.* spent wash as a dilute liquid organic fertilizer with high potassium contents and whose nitrogen mostly in the colloidal form , behaves as a slow release fertilizer better than most of the inorganic nitrogen source. The result of present study also supports this finding. Similar results were also obtained by workers like Chinnusamay *et al.* 2001 and Sahai *et al*. (1983). In the present study plant pigment concentration is highest in plants grown in soil amended with 20% distillery effluent than those in control and other concentrations. The higher concentration markedly decreased the plant pigment content.

The effect of alcohol and chemical factory effluent on seed germination and seedling growth of black gram was studied by Rajaram *et al* (1988) and they observed the inhibition in seed germination and seedling growth in the higher concentrations whereas the diluted effluent promoted the growth. Yet in another study by Mala and Bahu (2005) an increase in germination and seedling growth in the lower concentrations in plants treated with textile mill effluent was observed. Sisoida and Bedi (1985) studied the impact of distillery effluent on germination and growth of wheat and explained the action of diluted effluent treatment for the promotion in germination. Tripathy (1978) studied the effect of chemical and fertilizer factory effluent on mineral composition in wheat and he observed a reduction in the higher concentration. The present study also supported his observation. The effect of distillery effluents on *Phaseolus aureus* and *Pennisetum typhoides* was studied under laboratory conditions by Kannan (2001). His study revealed that irrigation with effluent gave the highest values of shoot length, root length and vigour index. The result of the present study also exhibited an increase in shoot and root lengths of the plants treated with 20% effluent. It was also revealed that there was considerable increase in the productivity of plants treated with 20% effluent. The plants which were grown in the soil amended with 20% distillery effluent showed higher growth and productivity than the plant grown in the soil amended with 40, 60, and 80,100% and also in control. The chlorophyll and carotenoid content of leaves was also higher in plants grown in soil amended with 20% distillery effluent.

In the present work it was observed that the growth and development of *Oryza sativa* L. when treated with 20% effluent was better compared to control and other higher effluent concentrations. This effect may be due to the presence of the organic matter and minerals in the effluent (Table A). In 20% effluent the nutrient and mineral contents are in optimum concentration, so that the growth performance of the plants was enhanced when treated with this concentration. At higher concentrations, the growth was negatively affected due to the excessive amounts of minerals and nutrients. From the result of the present study, it may be concluded that distillery effluent after proper dilution can be used as an effective liquid organic fertilizer. Such agricultural practices will also provide as a proper economical and ecofriendly method of industrial effluent disposal. More studies are needed in this direction.

Summary and Conclusion

In the present study an attempt had been made to understand the fertilizer potential of properly diluted distillery effluent for growing rice plants. The results indicated that rice plants can perform very well when treated with 20% effluent. All the other higher concentrations disturbed the plant growth considerably. It may be recommended that distillery effluent after proper dilution may be used as a source of irrigation cum fertilizer for plant cultivation. The environmental impact it might cause also should be taken into consideration.

REFERENCES

Arnon, D.I. 1949. Copper enzymes in is isolate chloroplast polyphenoloxidase in *Beta vulgaris,* Plant physiol. 24: 1-15.

Kannan, J. 2001. Effect of distillery effluent on crops plants. Adv. Plant. Sci. 14: 127- 132.

Kulkarni, A.D., Modah, H.M., Jadhav, S.J., 1987. Fertilizer from spent wash: A review. – BhartiyaSug. 12(9): 17-20.

Lowry, O.H., Roesbrough, N.J., Farr, A. and Randall R.J. 1951. Protein measurement with the folin phenol reagent. *J. Biol. Chem*. 193: 265-275.

Sahai, R., Jabeen, S. and Saxena, P.K. 1983. Effect of distillery effluent on seed germination, seedling growth and pigment content of rice. *Ind. J. Eco.*10: 7-10.

Sisoida, G.S and S.J. Bedi, 1985. Impact of chemical industry effluent on seed germination and early seedling growth performance of wheat. *Ind. J. Ecol*. 2: 189-192.

Tripathy, B.D. 1978. Effect of effluents of a chemical and fertilizer factory on germination and mineral composition of wheat. *Ind. J. Ecol*. 5: 128-133.

Rajaram, N., Manoharan, M. and Janardhanan, K. 1988. Effects of Alcohol and Chemical effluents on seed germination and seedling growth of black gram. *Curr. Sci.*10: 559-560

Mala, R and Babu S.S. 2005. Comparative seed germination tests using three plant species for toxicity assessment of textile dyeing effluent. *J. Indus. Poll. Cont*. 21 (2): 315-320

Shirlaw, D.W.S and Gilchrist, D.W. 1967. A practical course in agriculture Chemistry; Pergaman pub, London: 122-130.

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