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Effect of sugar factory effluent on seed germination and early seedling growth in groundnut (*Arachis hypogea* L.) varieties

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SUMMARY

Effect of different concentrations (25%, 50%, 75% and 100%) of treated sugar factory effluent on seed germination and early seedling growth in four varieties (SB-XI, TG-26, TAG-24 and TPG-41) of groundnut was assessed. The effluent had most beneficial effects on percentage of seed germination and seedling development at lower (25%) concentration. Increase in effluent concentration showed decrease in seed germination and vigour index. Var. TAG- 24 with highest vigour index while var.TPG-41 with the lowest vigour index was found to be effluent tolerant and susceptible, respectively. The treated effluent can be used as a liquid fertilizer after dilution to a suitable concentration.

Key words : Effluent, Concentration, Groundnut, Seed germination, Root length, Vigour

Industries release out significant quantity of waste water known as effluents which are responsible for causing severe pollution in water, soil and air. Effluents discharged from the industries have either beneficial or lethal effects on the germination, growth and development of agricultural crops. The beneficial and harmful effects of the different concentrations of effluents on crops have been assessed and after suitable dilution can be used as liquid fertilizer for several crops. (Sahai *et al.*, 1983; Rajaram and Janardhanan, 1988; Behera and Mishra, 1982; Singh *et al.*, 1985; Somasekhar *et al.*, 1992; Subramani *et al.*, 1995; Kumar, 1995; Kumar and Bhargav,1998; Kumar,1999 and Reddy and Borse, 2001).

Sugar industry is the largest agro-based industry next to textile industry in India. The revolution of Co-operative sugar industries took place only after the establishment of the first Co-operative sugar factory in Asia in 1950 at Pravaranagar in Ahmadnagar district in Maharashtra by Late Padmashri Vitthalrao Vikhe Patil (Karche, 1989). This industry discharges 15000 M^3 effluent per day which after treatment is used for irrigation purpose.

In this paper effect of different concentrations *viz*., 25%, 50%, 75% and 100% of effluent discharged from Padmashri Dr. Vitthalrao Vikhe Patil Co-operative sugar factory on the seed germination and early seedling development is reported.

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MATERIALS AND METHODS

Treated samples of the effluent were collected from the outlet of the industry and analysed for the physico-chemical characteristics following the methods given by Trivedi and Goel (1986) (Table 1). Different concentrations of the effluent *viz*., 25%, 50%, 75% and 100% were prepared by proportionately adding distilled water. Healthy seeds samples of groundnut varieties SB-XI, TG-26, TAG-24 and TPG-41 were procured from Mahatma Phule Agricultural University, Rahuri and surface sterilized with 1% $HgCl_2$ for about 2 minutes and then rinsed in sterile distilled water for three times.

Ten seeds were evenly placed for germination on a blotter paper moistened with different concentrations in separate Petri plates (in six replicates). The filter paper was moistened with corresponding concentration after every two days. Seeds treated with distilled water were also kept as control. All the sets were kept in seed germinator at 28 ± 2°C. On the tenth day number of seeds germinated was noted. Emergence of the radicle from the seed was taken as a criterion for considering the seed as germinated. (Iyengar *et al.*,1977).

Percentage of germination, average shoot length, root length and vigour index was calculated. Vigour index was calculated following Abdul Baki and Anderson, (1973). Statistical analysis of the observations is presented in Tables 2 and 3. Student't' test wass applied to determine the differences between the control and experimental sets. (Table 2).

RESULTS AND DISCUSSION

The effluent is alkaline, light black in colour with total solids, total dissolved solids, total suspended solids, DO,

BOD and COD values within the ISI limits (IS: 2490, 3307, 1974) set for the discharge of industrial effluents for irrigation. (Table 1). The effluent had beneficial effects on the percentage of germination (Table 2), root length, and shoot length and vigour index. (Table 3) at 25% concentration. However, the root length, shoot length, vigour index, decreased considerably with the increase in concentration of effluent as compared with the control.

Table 1: Physico chemical characteristics of the treated sugar factory effluent

Sr. No.	Property	Value
1.	Colour	Light blackish
2.	Temperature	25^0 C
3.	pH	7.6
4.	Electrical conductivity	0.69 mmhos/ cm.
5.	Total solids	250
6.	Total suspended solids	50
7.	Total dissolved solids	200
8.	Biochemical oxygen demand	45
9.	Chemical oxygen demand	90
10.	Dissolved oxygen	2.0
11.	Alkalinity	1380
12.	Hardness	460
13.	Sulphates	68
14.	Calcium	130
15.	Magnesium	05
16.	Chlorides	57
17.	Oil and grease	05

All values except pH, temperature and conductivity are expressed in mg/lit.

Table 2 : Effect of different concentrations of effluent on seed germination in groundnut

Sr. No.	Var.	Control	25%	50%	75%	100%
1.	SB - XI	100	100	95	90	85
2.	TG - 26	100	100	95	90	90
3.	TAG - 24	100	100	95	90	85
4.	TPG - 41	100	100	95	90	85

The beneficial effect of effluent at lower concentrations may be due to the presence of optimum levels of plant nutrients in it (Subramani *et al*., 1995). Thus the effluent at 25% concentration may be used as liquid fertilizer.

Such similar observations were also reported by Kumar (1995), Kumar and Bhargav (1998), Kumar (1999), Behera and Mishra (1982) and Singh *et al*. (1985).

The var.TAG-24 showed highest (1645) while the var. TPG-41 showed lowest (816) vigour indices at 25% and 100% concentrations, respectively as compared to control and other varieties, which indicates the former as effluent tolerant and latter as effluent susceptible groundnut varieties.

Conclusion:

Effluent at 25% concentration favoured the seed germination as well as seedling development which may be attributed to the optimum levels of inorganic nutrients and reduction in toxicity level due to dilution. The highest vigour index seen in TAG-24 may be due to it's tolerance to the effluent. Thus the effluent after diluting upto 25% can be used for irrigation as liquid fertilizer for the better germination and growth of agricultural crops.

Table 3 : Effect of different concentrations of effluent on vigour index of groundnut

Concentration	Var. SB - XI			Var. TG - 26			Var. TAG - 24			Var. TPG - 41		
(%)	RL	SL	VI	RL	SL	VI	RL	SL	VI	RL	SL	VI
Control	4. 72 ± 0. 44	5. 88 ± 0. 18	1060	10. 33 ± 0. 60	3. 83 ± 0. 47	1413	5. 33 ± 0. 38	4. 35 ± 0.33	968	8. 25 ± 0. 39	7. 35 ± 0. 61	1560
25	6. 72 ± 0. 30	7. 12 ± 0. 31	1384	6. 93 ± 0. 94	7. 62 ± 0. 77	1455	10. 12 ± 0. 95	6. 33 ± 0. 74	1645	7. 80 ± 0. 79	5. 33 ± 0. 25	1313
50	6. 17 ± 0. 34	6. 87 ± 0. 39	1238	6. 63 ± 0. 48	7. 08 ± 0. 67	1302	9. 82 ± 1. 62	4. 60 ± 0. 30	1370	7. 22 ± 0.90	4. 72 ± 0. 23	1134
75	6. 03 ± 0. 35	5. 92 ± 0. 40	1075	6. 43 ± 0. 30	4. 88 ± 0. 29	1018	8. 88 ± 1. 16	4. 47 ± 0. 22	1201	5. 55 ± 0. 60	4. 58 ± 0. 28	912
100	5. 52 ± 0. 33	5. 87 ± 0. 33	968	6.10 ± 0.70.	4.58 ± 0.19	961	8. 47 ± 1. 52	4. 33 ± 0. 15	1088	5. 12 ± 0. 57	4. 48 ± 0. 23	816

RL= Root length. SL= Shoot length. (cm).
Note: All values of RL and SL are significant at 1%

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