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Seed imbibed effect of sugarcane industrial effluent on germination percentage and seedling growth of *Triticum aestivum* cv. (PBW-226 AND LOK-1)

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SUMMARY

The seed imbibed effect of different concentration of sugarcane industrial effluent (*i.e.* 10% to 100% v/v) on germination percentage and seedling growth of *Triticum aestivum* cvs. (PBW-226 AND LOK-1) had been assessed. In present findings all doses of the effluent show promotion on germination percentage of *Triticum aestivum* cv. LOK-1, while no specific effect of doses is found on germination percentage of *Triticum aestivum* cv.PBW-226. Higher doses show promotary effects on seedling growth of *Triticum aestivum* cv. PBW-226 and inhibitory effects on *Triticum aestivum* cv. LOK-1.

Key words : Sugarcane industrial effluent, Germination %, Seedling growth, *Triticum aestivum*

Establishment of more and more industries resulted in the generation of waste in huge quantities, which also may cause a serious threat to the quality of the environment in near future.The water pollution is a major global problem as large amount of waste water or effluent discharged by industries reached to water bodies.The industries significant from water pollution point of view are sugar industries, ditillaries, oil refineries, fertilizer units, steel plants, texti,e mills, chemical industries,paper and pulp industries and metal works industries (Manivasakam 1987).

The main sourse for waste water in sugar a sugar mill are mill house waste, condenser waste water, boiler house waste, floor washing and filter cloth washing if filter is used (Shastry,1990).The physiochemical properties of sugar mill waste water dischargeare are pH 5.5-7.5, Temperature 250C-350C, Suspended solid 300-1200mg , BOD 300-1200mg/,COD 300-1200mg/l,oil and grease 10-50mg/l,total nitrogen 10-40mg/l.The sugar mills waste are also concentrated with a number of inorganic substances (Anderson and Nilson, 1976).

The sugar mill waste contain a no. of inorganic and organic pollutants. These pollutants changed chemical and physical properties of soil, water and air (Chakrabarthy 1964).

Singh *et.al*.(1984) studied the pollutinary effects of sugar mill and distillery effluent on seed germination and seedling growth of three varieties of rice. The result showed that cent percent germination and best seedling growth occurred in 10% effluent concentration and there after a progressive decline in germination percentage, speed of germination index, seedling height and seedling biomass has been found. *O.sativa* L.var.Cavery tolerated the polluted effect much better than *O.sativa* var.Jaya and *O.sativa* L.var.Ratna. Bahadur and Sharma (1990) studied the effect of industrial effluent in relation to seed germination and seedling growth on a variety of wheat. Goel and Kulkarni (1994) studied the effect of sugar factory waste on germination of gram seed (*Cicer arietinum* L.) Kumar Rajesh (1995) noted the effct of sugar mill effluent on seed germination and sedling growth of *Cicer arietinum* cv.NP 58. The effect of various concentration of sugar mill effluent carried on seed germination and seedling growth of *Cicer arietinum* cv.NP58 was presented. The result shows that there was significant increase and decrease in the lower and higher concentration of sugar mill effluent.

In view of the above literature further to understand the nature of sugar mill effluent seeds of *Triticum aestivum* cvs. PBW-226 and LOK-1 were imbibed in different concentrations of sugarcane industrial effluent and effect of such treatment was studied on seed germination and seedling growth.

MATERIALS AND METHODS

The seeds of uniform size, shape, colour and weight of *Triticum aestivum* cvs. (PBW-226 and LOK-1) as far as possible were selected, surface sterilized with 0.1% Hgcl2 solution, thoroughly washed with distilled water and kept in solutions of different concentrations (from 10% to 100%) of sugarcane industrial effluent separately for imbibition period. Seeds simultaneously kept in distilled water constituted the control. After requisite imbition they were transferred to petridishes having distilled water

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moistened filter paper and kept for germination and subsequent seedling growth at 25± 3°C in dark.

Germination was assessed by radicle emergence (2-3 mm) and the percent germination in each case was recorded. For dose response relationhips, seedling growth was studied at a particular day (ie.5th day) of germination by dissecting the seedling into various parts and subjecting to measurement of their length, fresh weight and dry weight.

RESULTS AND DISCUSSION

The effect of sugarcane industrial effluent on *Triticum aestivum* cv. PBW-226 as studied from Table 1 and Fig. 1,(1a,1b and 1c) indicate that seed germination percentage is slightly inhibited in 40 % and 70 % doses, germination percentage in these doses are 90% of control respectively. While in other doses no specific response is found. Doses from 50 % to 100 % show promotion except dose 70 % and doses from 10% to 40 % show inhibition on seedling growth. Radicle is mush more affected than coleoptile. All doses show inhibitory effects on fresh weight of radicle except 20% and 60%. Out of all promotory doses, dose 60% show maximum promotion, because in this dose,

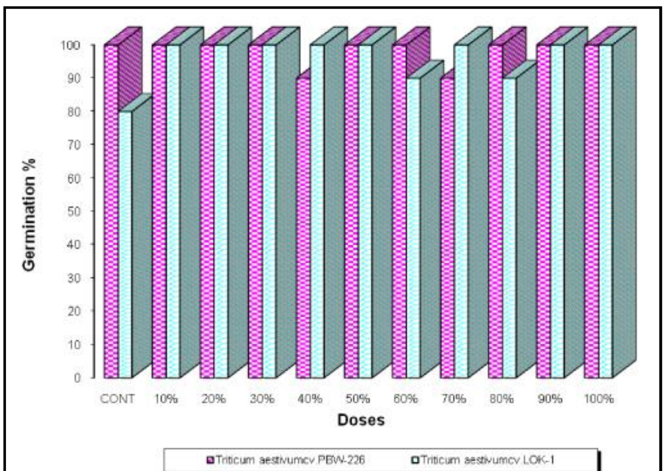

Fig.1 : Seed imbibed effect of sugarcane industrial effiluent on germination % of *Triticum aestivum* cvs.

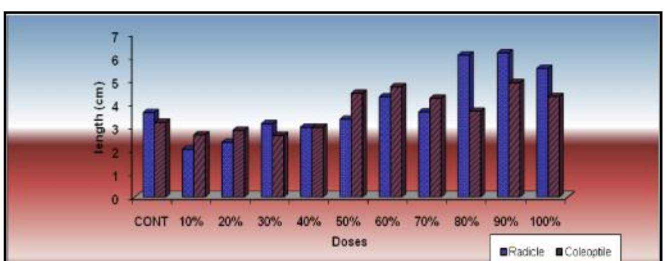

Fig.1 a: Seed imbibed effect of sugarcane industrial effiluent on length of radicle and coleoptile of *Triticum aestivum* cv. PBW-226

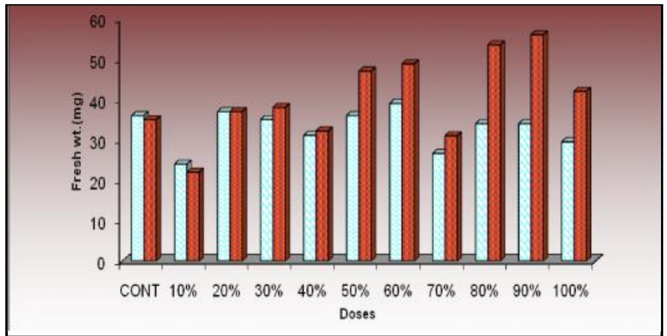

Fig.1 b: Seed imbibed effect of sugarcane industrial effiluent on fresh wt. of radicle and coleoptile of *Triticum aestivum* cv. PBW-226

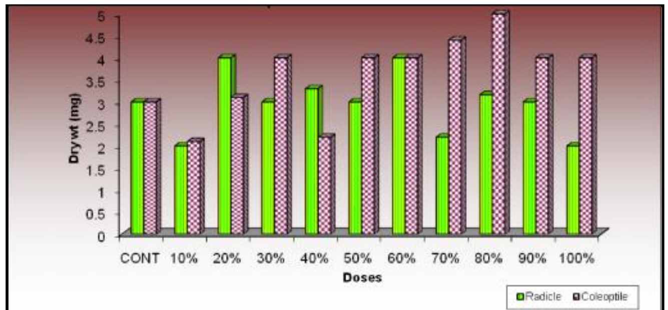

Fig.1 c: Seed imbibed effect of sugarcane industrial effiluent on dry wt. of radicle and coleoptile of *Triticum aestivum* cv. PBW-226

length of radicle and coleoptile is 118 % and 146 %, fresh weight of radicle, coleoptile and rasidual cotyledon is 108 %, 139 % and 87% and dry wt. of radicle, coleoptile and rasidual cotyledon is 133%, 133% and 97% of control respectively. On the other hand dose 10% show maximum inhibition, because in this dose, length of radicle and coleoptile is 56 % and 83 %, fresh weight of radicle, coleoptile and rasidual cotyledon is 66%, 62% and 80% and dry wt. of radicle, coleoptile and rasidual cotyledon is 66 %, 70 % and 76 % of control respectively.

All doses of effluent show slight promotion in germination whereas they show inhibitory effects on seedling growth of *Triticum aestivum* LOK-1 as studied from Table 2 and Fig. 1 (2a, 2b and 2c). The seed germination percentage in 60 % and 80% doses is 112% of control and in all remaining doses it is 125% of control respectively. Out of all the doses, 10 % dose show maximum inhibition on seedling growth. In this dose, length of radicle and coleoptile is 76 % and 74 %, fresh wt. of radicle, coleoptile and rasidual cotyledon is 36 %, 57 % and 77 % and dry wteight of radicle, coleoptile and rasidual cotyledon is 81 %, 105 % and 83 % of control respectively.

Above mention results indicate that different doses of sugarcanr industrial effluent shows promotary effects

Table 1 : Seed imbibed effect of different concentrations of sugarcane industrial effluent on seedling growth of *Triticum aestivum cv.* PBW-226

	Effluent concentrations %										
Doses	Control	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Germination %	100	100	100	100	90	100	100	90	100	100	100
Seedling parts	Length (cm) ± S.D										
Radicle	3.6±1.20	2.0±0.25 *****	2.3±0.74 *****	3.1±1.13	3.0±0.35 *	3.3±1.01	4.3±0.51 **	3.6±1.10	6.0±1.10 *****	6.1±1.36 *****	5.5±0.96
Coleoptile	3.2±0.63	2.6±0.50 ***	2.8±0.47 *	2.6±0.58 ***	3.0±0.97	4.4±0.48 *****	4.7±0.46 *****	4.2±0.54 *****	3.6±1.14 *	4.9±0.81 *****	4.3±0.28 *****
	Fresh wt. (mg) ± S.D										
Radicle	36.0±18.97	24.0±10.74 **	37.0±9.48	35.0±10.80	31.1±10.54	36.0±10.74	39.0±16.63	26.6±12.24 **	34.0±13.49	34.0±15.05	29.5±13.4
Coleoptile	35.0±19.57	22.0±12.29 **	37.0±13.37	38.0±18.13	32.2±10.92	47.0±11.59 **	48.8±43.68	31.0±20.70	53.5±22.30 **	56.0±21.18 ***	42.0±21.4
Residual cotyledon	70.0±14.1	56.0±15.70 ***	61.0±11.00 **	61.0±9.94 **	60.0±16.30 *	63.0±18.20	61.0±13.70 *	67.0±14.10	69.0±15.20	64.0±16.40	70.0±12.4
	Dry wt.(mg) ± S.D										
Radicle	3.0±0.88	2.0±0.57 *****	4.0±0.76 ****	3.0±0.64	3.3±0.80	3.0±0.54	4.0±0.76 ****	2.2±0.72 ***	3.16±0.81	3.0±0.97	2.0±0.74 ****
Coleoptile	3.0±16.3	2.1±1.03 *	3.1±0.97	4.0±0.99 **	2.2±1.29 *	4.0±0.87 **	4.0±1.36 *	4.4±1.13 ***	5.0±1.75 ****	4.0±1.68 *	4.0±1.23 *
Residual cotyledon	34.0±8.43	26.0±9.66 **	31.0±13.70	37.0±12.51	33.0±11.59	30.0±8.16 *	33.0±9.48	28.0±7.88 **	27.0±11.59 *	30.0±10.54 **	34.0±10.74

N.B. *= Significance at 0.10 % level **= Significance at 0.05% level *** = Significance at 0.025 % level **** = Significance at 0.01 % level ***** = Significance at 0.005 % level

Table 2 : Seed imbibed effect of different concentrations of sugarcane industrial effluent on seedling growth of *Triticum aestivum* cv. LOK1

	Effluent concentrations %										
Doses	Control	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Germination %	100	100	100	100	90	100	100	90	100	100	100
Seedling parts	Length (cm) ± S.D										
Radicle	3.5±1.11	2.7±1.06 *	2.8±1.93	2.7±2.05	2.8±0.97	4.1±1.16	3.5±2.12	4.2±1.58	3.1±1.08	5.1±1.84 **	3.6±1.09
Coleoptile	3.9±1.39	2.9±1.85 *	2.2±1.12 ****	2.5±1.79 **	2.9±0.97 **	3.5±0.91	3.1±1.71	4.5±1.92	3.8±1.17	4.4±1.50	3.9±0.95
	Fresh wt. (mg) ± S.D										
Radicle	43.7±19.22	16.0±6.99 *****	20.5±20.47 *****	10.7±15.90 *****	13.5±8.51 *****	34.0±11.73 *	16.6±9.68 *****	19.5±11.16 *****	35.5±24.03	34.0±15.05 *	34.0±11.73 *
Coleoptile	47.5±19.82	27.0±8.23 *****	22.0±15.31 *****	21.5±14.53 *****	38.0±9.18 *	39.0±13.70 *	31.1±16.15 **	36.0±20.11 *	45.5±22.97	46.0±14.29	48.0±12.29
Residual cotyledon	79.0±1.97	61.0±13.70 *****	62.0±13.98 *****	59.0±19.69 *****	63.0±18.28 ***	70.0±13.33 *	65.0±27.18 *	71.0±11.97 *	71.0±19.69 *	60.0±12.47 *****	70.0±12.47 **
	Dry wt.(mg) ± S.D										
Radicle	3.7±1.36	3.0±0.73 *	2.0±0.87 *****	1.0±0.42 *****	2.0±0.63 *****	4.0±1.32	1.1±0.52 *****	2.0±0.91 *****	4.4±1.50	3.0±1.08 *	3.04±1.18 *
Coleoptile	3.7±1.14	4.0±1.17	3.0±1.35 *	3.0±1.15 *	3.0±1.75	5.0±1.93 **	3.3±1.72	4.0±1.71	3.3±2.50	5.0±1.92 **	3.0±1.03 *
Residual cotyledon	37.0±6.74	31.0±7.37 **	42.0±10.32 *	39.0±5.67	32.0±7.88 *	36.0±6.99	37.0±9.48	33.0±8.23 *	37.0±8.23	32.0±11.35 *	30.0±8.16 **

N.B. *= Significance at 0.10 % level **= Significance at 0.05% level *** = Significance at 0.025 % level **** = Significance at 0.01 % level ***** = Significance at 0.005 % level

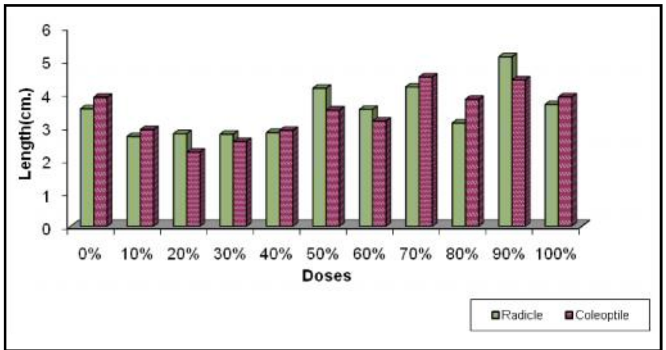

Fig. 2a : Seed imbibed effect of sugarcane industrial effiluent on length of radicle and coleoptile of *Triticum aestivum* cv. LOK-1

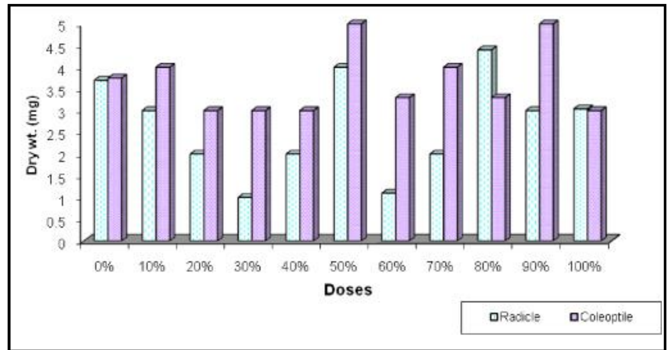

Fig. 2c : Seed imbibed effect of sugarcane industrial effiluent on dry wt. of radicle and coleoptile of *Triticum aestivum* cv. LOK-1

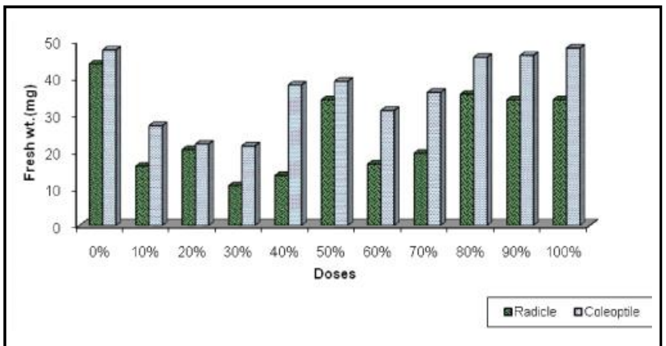

Fig. 2b : Seed imbibed effect of sugarcane industrial effiluent on fresh wt. of radicle and coleoptile of *Triticum aestivum* cv. LOK-1

on germination percentage. Higher doses show promotary effects on seedling growth of *Triticum aestivum* cv. PBW-226 and inhibitory effects on *Triticum aestivum* cv. LOK-1. Similar observation in respect to promotion in seed germination and variable effects on seedling growth in difeerent cvs. were studied by several workers. Balashouri(1994) noted that the values of germination percent increased over control set with corresponding increase of effluent concentrations. According to Karande (1994) untreated effluent when employed as it is or in diluted form, then it show negligible or no adverse effect on overall seed germination and early seedling growth. Some plant cvs. show variable results in response to doses. Ghimire and Bajracharya (1996) reported significant differences in the sensitivity of four types of vegetable seeds (*Brassicajuncea*, *B. oleracea*, *B.rapa* and *Raphanus sativus*) of a single family Brassicaceae to the effluent .Gupta and Chapagain (1999) observed significantly different effect of polluted water on *Pisum sativum* and *Lepidium sativum*. Seed germination and seedling growth of all tested vegetables were highly sensitive to the effluents but the nature of the sensitivity varied with the type of effluents and seed types. Jha and Niroula(1998) showed differential sensitivity to various industrial effluents and municipal sewage on germination and dry weight increase on rice and blackgram. Variable results has been found in different plant cvs. in response to doses, why? Seeds having better growth promoting substance which resists and compete the inhibition posed by effluent germinate. Niroula (1996), Shrestha (2000) reported that The ability of tolerant variety for effluent treatment may be due to the genetic constitution of the variety as well as due to some internal conditions ie. Endogenous growth regulators, cytoplasmic and nuclear status of the embryo and cotyledons.

Doses shows inhibitory effects on seedling growth of *Triticum aestivum* LOK-1 and on fresh weight of radicle of *Triticum aestivum* cv. PBW-226 may be due to osmotic inhibition of water absorption which inhibiting the functions of essential enzymes such as á-amylase and protease (Jerome and Ferguson ,1972, Mayer *et al*.,1982). The supply of excessive amount of nutrients by the effluent causes temporary saline conditions near the surface whereas excess of salts get accumulated and such activities affect germination and further growth(Shinde and Trivedy,1987).

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