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Effect of Dairy Effluent on Seed Germination, Seedling Growth and Biochemical Parameter in Paddy

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Abstract: Investigation was carried out to study seed germination, seedling growth and certain biochemical parameters in paddy variety ADT-38. Paddy seeds were raised in petriplates irrigated with various concentrations of dairy effluent (0 (control), 5, 140, 25, 50, 75 and 100%). At lower dilutions, the paddy showed favourable effect on seed germination, seedling growth and dry matter production and biochemical parameters *viz.,* protein, amino acid, starch and pigment content over control. Among them 100% concentration of effluent caused inhibitory effect.

Key words:

INTRODUCTION

Water resources are most often affected by industrial pollution. Pollution caused by industrial and dairy effluents is a serious concern in throughout the world. Dairy effluent has high organic loads as milk is its basic constituent with high levels of chemical oxygen demand, biological oxygen demand, oil & grease and nitrogen and phosphorous content [1]. To recycle nutrients through land application of dairy waste effluent requires the use of crops capable of utilization these nutrients [2]. Industrial effluents rich in organic matter and plant nutrients are finding agricultural use as cheaper way of disposal [3]. The present investigation demonstrated the effect of dairy effluent on morphological and biochemical aspect of paddy (*Oryza sativa* L.) variety ADT-38.

MATERIALS AND METHODS

The effluent samples from Cuddalore district Co-operative Dairy Industry Ltd., Sethiyathope, TN, India were collected in plastic containers form the point of disposal brought to the laboratory and analyzed for various physio-chemical properties as per the methods described as per American Public Health Association [4] and results given in table-1. Different concentration of the effluent (0, 5, 10, 25, 50, 75 and 100%) were prepared and used for germination experiments. Paddy seeds were surface sterilized with 0.1% mercuric chloride ($HgCl_2$) and washed with distilled water. Fifty seeds were placed equispacially in sterilized petriplates, lined with filter paper soaked with different concentrations of effluent and distilled water. These petriplates were irrigated with different concentration of effluent uniformly. Number of

Table 1: Physio-Chemical analysis of dairy effluent

S.No.	Parameter	Raw Effluent	Tolerance limit as per TNPCB
General Parameters			
1.	Colour	Milky	Should be absent
2.	Odour	Unpleasant	Odourless
3.	pH	8.45	3.5-9.0
4.	Total solids	2451	2600
	a.Total suspended solids	514	550
	b.Total dissolved solids	1989	2000
5.	Biological oxygen demand	1112.0	30
6.	Chemical oxygen demand	3786.0	250
7.	Oil and grease	58	10
Chemical Parameters			
8.	Ammonical Nitrogen	0.15	-
9.	Nitrite	0.14	-
10.	Nitrate	0.01	-
11.	Phosphate (as P)	0.20	-
12.	Chloride (as Cl)	135	600
13.	Calcium hardness	72	600
14.	Magnesium hardness	14	-
15.	Sulphate (as So_4)	0.055	-

All parameters were expressed in mg/l except pH, colour and odour
TNPCB-Tamil Nadu Pollution Control Board

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seed germination was counted on 7th day and total germination percentage was calculated. Data were taken from three replicates of seedling on 7th day old seedlings. Seventh days old seedlings were separated into root and shoot and were used for estimation of chlorophyll [5], carotenoid [6], sugars [7], protein [8], starch [9] and amino acid [10] content.

RESULTS AND DISCUSSION

Lower concentration of dairy effluent showed promoting effect on sedd germination on seedling growth, dry matter production. Maximum promoting effect was recorded at25% concentration [Table 2]. Results of present investigation support with previous work of black gram and green gram with effect of dairy effluent [11]. The promotion of seedling growth by the lower concentration of effluent might be due to the presence of plant nutrient in the effluent.

Germination percentage and seedling growth was inhibited at 100% concentration [Table 2] may be due to osmotic pressure caused due to high dose. Osmotic pressure of the effluent at higher concentration of total salts making imbibition was more difficult and retarded germination [3].

Biochemical parameters *viz.,* chlorophyll, carotenoids, total sugars, starch, protein and amino acid contents increased at lower concentrations, maximum increase at 25% concentration [Table 3, 4]. Enhancement of chlorophyll could due to high nutrient uptake, synthesis and translocation probably facilitated by optimum availability of iron and magnesium and also due to reduction in phenol content in the treated diary effluent [3]. While, decrease at 100% concentration. This is supported with previous work of finger millet and maize with effect of dairy effluent [12]. Protein, starch, amino acid contents were increased in this study at 25% concentration. The crude protein concentration of corn increased quadratically with increased N fertilizer with dairy effluent application [13]. The enhancement of protein content of crop plants might be due to increased rate of amino acid synthesis which may be attributed to the higher rates of both RNA-ase and transaminase activity [14]. The decrease in starch content at higher concentration may be due to the lowered activity of phosphorylase and the increased activity of beta-amylase and invertase with effect of effluent. Since the higher concentration of effluent is toxic to the plant growth, it is recommended that only after treatment and dilution of dairy effluent be used for irrigation purpose.

Table 2: Effect of dairy on seed germination percentage, seedling growth, fresh and dry weight in paddy variety ADT-38

Effluent concentration in percentage	Germination percentage	Seedling growth cm/seedling	Fresh weight g/seedling	Dry weight g/seedling
Control	90±0.025	11.4±0.031	0.128 ±0.024	0.038±0.022
5	95±0.029	11.9±0.044	0.159±0.032	0.054±0.036
10	97±0.034	12.40±0.022	0.170±0.042	0.067±0.039
25	100±0.042	13.8±0.056	0.198±0.043	0.089±0.044
50	93±0.040	13.0±0.061	0.171±0.058	0.070±0.038
75	87±0.038	12.2±0.052	0.156±0.061	0.058±0.034
100	81±0.032	11.1±0.050	0.119±0.017	0.035±0.027

± Standard deviation

Table 3: Effect of dairy on photosynthetic pigments and total sugar content in paddy variety ADT-38 mg/g fr. wt

Effluent concentration					Total sugar	
in percentage	Chlorophyll 'a'	Chlorophyll 'b'	Total Chlorophyll	Carotenoids	Root	Shoot
Control	0.784±0.0127	0.772±0.0642	1.556 ±0.0621	0.587±0.017	6.529±0.0153	7.628±0.0131
5	0.821±0.0121	0.810±0.0123	1.631±0.613	0.625±0.016	6.871±0.0145	8.868 ±0.0112
10	0.890±0.0132	0.852±0.0173	1.742±0.057	0.689±0.014	7.298±0.0137	9.584±0.0140
25	0.927±0.0107	0.908±0.0101	1.835±0.054	0..742±0.013	8.264±0.0121	10.821±0.0924
50	0.878±0.0113	0.838±0.193	1.716±0.058	0.699±0.0143	7.189±0.0139	9.724±0.0102
75	0.804±0.0124	0.781±0.0128	1.585±0.063	0.633±0.0157	6.980±0.014	8.925±0.0112
100	0.729±0.0137	0.714±0.014	1.443±0.069	0.541±0.0184	6.386±0.156	7.284±0.0137

± Standard deviation

Table 4: Effect of dairy on starch, protein and amino acid content in paddy variety ADT-38 mg/g f. wt

Effluent concentration in percentage	Starch		Protein		Amino acid	
	Root	Shoot	Root	Shoot	Root	Shoot
Control	0.258±0.038	0.272±0.036	1.010 ±0.099	0.990±0.101	3.001±0.033	2.183±0.045
5	0.278±0.035	0.309±0.032	1.484±0.067	1.289±0.077	3.684±0.0271	2.989±0.033
10	0.329±0.030	0.353±0.028	1.819±0.052	1.599±0.062	4.890±0.024	3.785±0.026
25	0.371±0.026	0.384±0.026	2.084±0.047	1.869±0.053	5.423±0.018	4.864±0.020
50	0.304±0.0132	0.357±0.028	1.884±0.053	1.580±0.063	4.980±0.020	3.684±0.027
75	0.286±0.034	0.305±0.032	1.483±0.074	1.109±0.090	3.764±0.026	2.990±0.033
100	0.244±0.037	0.268±0.010	0.989±0.012	0.892±0.012	2.091±0.044	2.001±0.049

± Standard deviation

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