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IMPACT OF DAIRY EFFLUENT ON SEEDLING GROWTH OF *SOLANUM LYCOPERSICUM* L.

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ABSTRACT

The earth ecosystems are linked and maintained by water. With increasing industrial development, safe disposal of industrial effluent has become the more ecological challenge. Finding suitable eco-friendly techniques for the potential utilization of these released effluents as a source of nutrients becomes essential. The present investigation was carried out to screen the effect of different concentrations of dairy effluent on the seedling growth of *Solanum lycopersicum* L. in pot culture experiment. In the pot culture experiment, tomato plants were grown up to 40 days, in the soil irrigated with different concentrations of dairy effluent (control, 20%, 40%, 60%, 80% & 100%). At lower dilutions of tomato crop plants showed favourable effect on seed germination. Proper dilution of effluent irrigation resulted in increased growth and nutrients of the crops.

Keywords: Dairy effluent, *Solanum lycopersicum* L. seedling growth.

Introduction

Effluents are wastes produced from industries and vary depending on the human activities that produce them. The discharge of treated or untreated effluent into the environment, particularly in the natural water bodies such as lakes, rivers, and the coastal marine environments can cause severe degradation of these water systems. Therefore, use of wastewater is one of the many options being considered as a source of water in regions of water scarcity. The growing demand of water for irrigation has resulted in a marked increase in the use of treated or untreated wastewater worldwide (Ruma and Sheikh, 2010). The dairy industry generates large quantities of wastewater, as per liter of processed milk, 0.2 to 10 L of wastewater are produced. Dairy wastewaters contain high concentrations of organic matter (e.g. fat, milk, protein, lactose, lactic acid), minerals and detergents. (Subramani *et al*., 2017).

Crops and vegetables grown in the agricultural fields irrigated by textile, detergent and other effluent contaminated waters are adversely affected both quantitatively and qualitatively. (Angadi and Mathad, 1998; Srivastava and Purnima, 1999; Tomar *et al.,* 2000). Tomato (*Solanum lycopersicum* L.) a relatively short lived crop, is one of the most important vegetables worldwide (Seisuke and Neelima, 2008) and is grown in practically every country of the world in outdoor fields, greenhouses and net houses. To recycle nutrients through land application of dairy waste effluent requires the use of crops capable of utilization these nutrients (Macoon *et al .,* 2000). Industrial effluents rich in organic matter and plant nutrients are finding agricultural use as cheaper way of disposal (Nagda *et al.,* 2006). The present investigation impact of the effect of dairy effluent on seed germination of tomato (*Solanum lycopersicum* L.)

Materials and Methods

Collection of dairy effluent

Aavin dairy farm, located in Tirunelveli was selected for the study. The effluent sample was collected in an air tight plastic container. The collected sample was analyzed following its physical properties like pH, temperature, color and odor.

Physiochemical analysis of effluent

Physiochemical parameters of the dairy effluent such as total solids (TS), total suspended solids (TSS), total dissolved solids (TDS), BOD (Winkler's method), COD (Winkler's method), Bicarbonate content, Hardness of water (EDTA titration methods), Calcium, Chloride (Van Slyke method) and phosphates (Fiske Subbarrow method), were estimated using standard methods.

Collection of seeds

Commercially available tomato seeds (*Solanum lycopersicum* L.) were obtained from the Agricultural extension center, Kallakad.

Effluent treatment:

The seeds were soaked in the corresponding effluent (diluted) sample for 30 minutes. The experiment conducted of 6 treatments by dairy effluent such as 20%, 40%, 60%, 80%, and 100% and control pot without effluent treatment.

Morphological Studies

Morphological parameters such as shoot length, root length, height of the plant, fresh weight and dry weight were measured at different concentrations up to the senescence stage (1-40 days).

Results and Discussion

Dairy effluent

The physico-chemical parameters of the dairy effluent were presented in Table 1. The temperature of the effluent was 26°C. pH was slightly acidic i.e., 6.14. The color of the effluent was dirty white with unpleasant odor, Biological oxygen demand 7.5 mg/ L, Chemical oxygen demand 244 mg/ L, Total Dissolved Solids 102 mg/ L. In addition, it contains considerable amount of bicarbonate content 0.80 m.e/L, Total Hardness was 29 mg/L. The physico-chemical parameters of the dairy effluent showed that presence of considerable amounts of calcium, chloride, phosphate, BOD, COD, Bicarbonate content was also noticed in the effluent. In the past studies the free CO_2 in the water is partly responsible for the increased or initial pH reading (Park, 1997). The present work is related with the earlier findings of chandrasekar *et al*. (1998) and Venkatesan *et al.* (2016).

Table 1 : Physico-chemical characteristics of dairy effluent.

No	Parameters	Values
1	Colour	Dirty white
2	Odour	Unpleasant
3	P²	6.14
4	Temperature (°c)	26
5	Total solids (mg/l)	207
6	Total dissolved solids (mg/l)	102
7	Total suspended solids (mg/l)	105
8	Calcium (mg/l)	10
9	Chloride (mg/l)	1
10	Phosphate (mg/l)	8
11	BOD (mg/l)	7.5
12	COD (mg/l)	244
13	Bicarbonate content (m.e/l)	0.80
14	Hardness (mg/l)	29

Growth of *Solanum lycopersicum:*

The plants treated with different concentrations of dairy effluent was presented in Table-2.

Table 2 : Seedling growth of *Solanum lycopersicum* L in different concentration of dairy effluent.

Effluent concentration (%)	Root length (cm)		Shoot length (cm)		Fresh weight (gm)		Dry weight (gm)	
	0-20	21-40	0-20	21-40	0-20	21-40	0-20	21-40
Control	25.2±0.18	30.1±0.21	23.1±0.08	28.10±0.03	14.3±0.04	18.5±0.18	2.93±0.9	4.9±0.07
20%	28±0.08	33.2±0.12	23.5±0.05	32.12±0.008	15.5±1.60	23.6±0.06	3.15±0.14	5.86±0.08
40%	35±0.28	40.3±0.05	28.3±0.04	38.10±0.02	21.5±0.25	28.3±0.32	5.24±0.12	6.13±0.42
60%	33.2±0.12	38.1±0.08	26.5±0.03	36.10±0.03	19±0.04	26.2±0.28	4.53±0.04	5.89±0.08
80%	28.1±0.14	32.8±0.18	24.2±0.09	33.2±0.18	16.2±0.14	24.5±0.25	3.8±0.67	5.98±0.03
100%	27.2±0.18	30.1±0.30	23±0.09	25.6±0.03	15.3±0.08	18.1±0.14	3.12±0.05	4.2±0.05

(0 day is the emergence of third leaf stage)

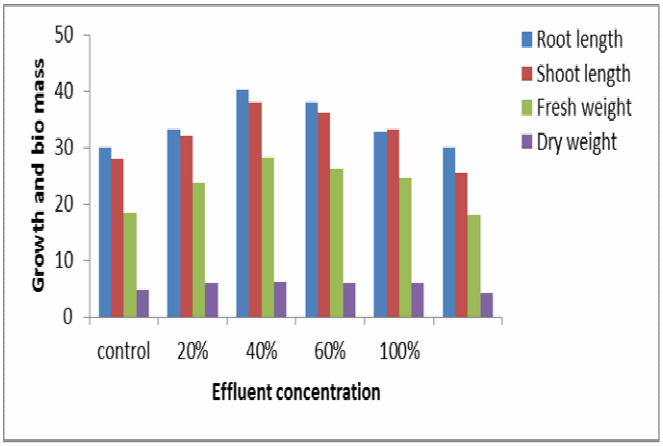

Fig. 1 : Growth of Solanum *lycopersicum* L in different concentration of dairy effluent

The root length in the dairy effluent treated plants 40% showed a maximum root length of 40.3±0.05 cm in 40th day. The higher shoot and root lengths were recorded at 40% effluent concentration. The root and shoot length were adversely affected by higher concentration of 100% effluent. The dairy effluent showed maximum shoot length in 40% concentration 38.10 ± 0.02 cm. Control plants showed a lesser shoot length (28.10 ± 0.03) than treated plants. The minimum shoot length noticed in 100% in the dairy effluent plants of 25.6 ± 0.03 cm on 40th day.

The biomass of both concentrated and control plants were observed and analyzed. The 100% plants showed much lower biomass content compared to control during the study period. The dairy effluent treated plants showed higher biomass at 40% concentration at 40th day. The fresh weight and dry weight of *Solanum lycopersicum* plants were 28.3 ± 0.32g and 6.13 ± 0.42 g. on the 40th day . The root length, shoot length, fresh weight and dry weight is found to be inhibited at the concentration of control, 20%, 60%, 80% and 100% of dairy effluent (Prasannakumar *et al.,* 1997). Seedling growth was due to the lowered activity of inhibited at 100% concentration, may be due to osmotic pressure caused due to high dose.

The root and shoot length were adversely affected by higher concentration of effluent treatment. The same findings were reported earlier... due to treatment by Kumar and Bhargava, 1998 and Hariom *et al.,* 1994. The reduction in shoot and root growth at higher concentration of effluent may be due to the fact that germinated seeds under higher concentration would get less amount of oxygen which might have restricted the energy supply and retarded the growth and development (Kumar, 2000). It is related with Growth parameters .In the present study root length, shoot length, fresh weight and dry weight at 40% concentration of dairy effluent was increased when compared to that of control. It is

related with the findings of Kumar and Bhargava, 1998 and Hariom *et al.,* 1994.

Conclusion

Result of current experiment showed that stimulatory effect noted at lower effluent concentration. Dairy effluent at low concentration accelerated the growth of *Solanum lycopersicum* plants. The dairy industry effluent can also be utilized as irrigation for the growth of *Solanum lycopersicum* L. after appropriate dilution. The effluent application for plant is economical and it conserves water resource.

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