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Effect of Dairy Effluent on Germination and Morphological changes Associated With the Growth of *Sorghum bicolor* (L.) Moench.seeds

Dr. M.EZHIL BAMA
C.Kandaswami Naidu College for Women, Cuddalore

Abstract

The first and foremost objective of this study is to evaluate the effect of dairy effluent on morphological and chlorophyll content associated with the germination of seed in Sorghum(Sorghum bicolor (L.) Moench). Effluent was analyzed for its pH, EC and chemical compositions. Germinating capacity, morphological changes in the radicle and plumule and chlorophyll content of plumule were studied. The dairy effluent at 75 % concentration is most favourable for seed germination and seedling growth of Sorghum bicolor (L.) Moench. . The crude effluent also did not interfere with growth and chlorophyll content. In conclusion, the slightly acidic dairy effluent with low salinity having the anions and cations well within the admissible limits of I.S.I. can be used for irrigating Sorghum plant as such .But at proper dilutions the dairy effluent can be used as a liquid fertilizer.

Key words:Sorghum bicolor (L.) Moench., dairy effluent,seed germination, morphological changes, chlorophyll content

I. INTRODUCTION

As a result of industrialization, pollution in natural waters by industrial wastes has increased tremendously. Generally the effluents contain high concentrations of anions and cations.In many higher plants, these cations and anions at high concentrations induce disorders such as chlorosis (Greenway, 1965), reduction in growth (Blumenthal – Goldschmidt and Poljakoff- Mayber, 1968), inhibition of germination (Ungar, 1962) and of root growth (Varga, and Szoldos, 1963).Studies have proved even then they can be utilized for beneficial activities like agriculture and other processes. (Bishop 1983; Sahai et al., 1986) The first and foremost importance of utilization of waste water for irrigating crop plant is the safer disposal of the effluent. The other objective is to recycle it as irrigation water for its possible composite value (Manonmani et al ., 1992).

The effects of different factory effluents on seed germination, growth and yield of crop plants have captivated the attention of several workers (Wafaa Mohamed Shukry 2001; Feruzan Daneetal. 2006; Singh et al 2002; Thangavel and Balagurunathan.2002; Tomer et al 2002).The effects vary from effluent to effluent and also from species to species.

The present study is aimed at evaluating the effect of dairy effluent on the morphological and chlorophyll content associated with the germination of seed in Sorghum (*Sorghum bicolor* (L.) Moench.).

II. MATERIALS AND METHODS

The plant material selected for study is *Sorghum bicolor* (L.) Moench. The effluent is dairy effluent, collected from Aavin Milk Society Nagercoil, Tamil Nadu. Effluent was stored at 4^{o} C and placed in cold place throughout the work.

The pH of the effluent was measured using a pH meter. Electrical conductivity measured (Jones and Bradshaw 1933). Anions such carbonate and bicarbonate (APHA.2005), chloride, sulphate (AOAC. 1955) and cations such as sodium (Barber and Kolthoff 1928) potassium (Wander 1942), calcium and magnesium (versenate method) (Cheng and Bray 1951; Diehl et al., 1950), were estimated.

Viability tests were carried on the seeds using tetrazolium seed viability test (AOSA.2002). The seeds were prechilled and soaked separately in 10%, 25%, 50%, 75%, 100%dairy effluent. Seeds soaked in distilled water were kept as control. Seeds were spread on water soaked filter papers kept in petridishes separately at room temperature. Care was taken to irrigate without causing any physical damage at regular intervals. The length of the radicle and plumule were measured until the emergence of first leaf. Chlorophyll-a, chlorophyll-b and total chlorophyll content (Arnon1949) of the plumule were measured.

III. RESULTS

Effluent characterization

The physical and chemical characteristics of the effluent were characterized and the values are given in Table I.

parameters	Effluent Value	Recommended concentration	Reference
Color	Milky	should be absent	I.S.I.249
Odour	Unpleasant	Odourless	I.S.I.2490
pH	6.1	5.5	I.S.I.2296
Electrical conductivity(m.mhos/cm) (m.mhos/cm)	0.62	--	--
Carbonate	Absent	--	--
Bicarbonate (mg/l)	219.67	-	-
Chloride (mg/l)	53.18	600	I.S.I.2296
Sulphate (mg/l)	traces	1000	I.S.I.2307
Calcium (mg/l)	48.1	600	I.C.M.R.1975
Magnesium (mg/l)	7.78	--	--
Sodium (mg/l)	101.16	--	--
Potassium (mg/l)	12.9	--	--

- -- Values could not be available

Percentage of seed germination

Initially, the germination capacity was more in control seeds and in the seeds treated with concentrated effluent (i.e.100% and 75%).But the increase was far more in the seeds treated with diluted effluent and on the 4thday, highest germination percentage was recorded in the control seeds and in the seeds treated with 10% effluent (Table- II).

Morphological Changes:

Length of Radicle and Plumule

The concentrated effluent enhanced radicle and plumule elongation even at 100% concentration.But best results were found in 75% effluent.In considering radicle elongation, the effluent at 50%, 75% and 100% gave better results than diluted effluents, while effluent in diluted concentrations (10% and 25%) were better than control (Fig: I). Crude effluent restricted plumule elongation, while the effects of diluted effluent were on par with that of control (Fig: II).

Table II: Effect of Dairy Effluent on Number of Germinating Seeds of *Sorghum bicolor* (L).Moench During Germination.

Days	Control	Effluent Concentration%				
		10	25	50	75	100
2	33	10	10	10	25	33
3	74	49	49	41	66	66
4	90	90	59	59	66	82

Figure-I

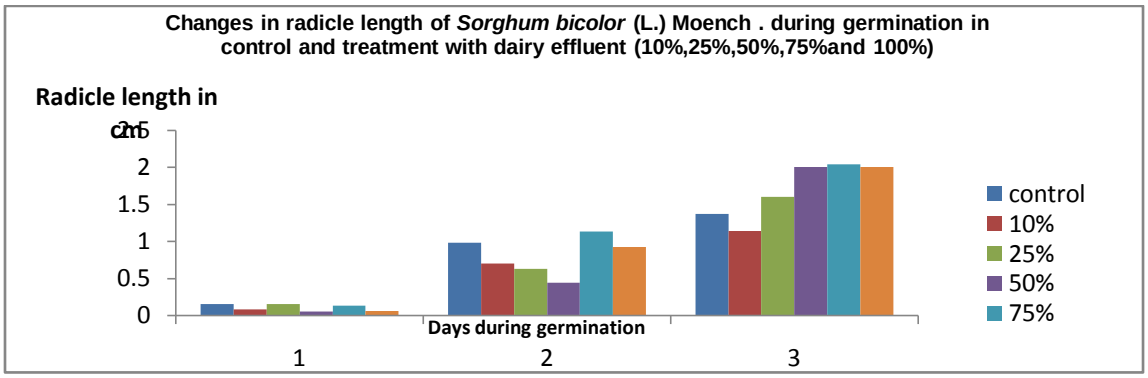
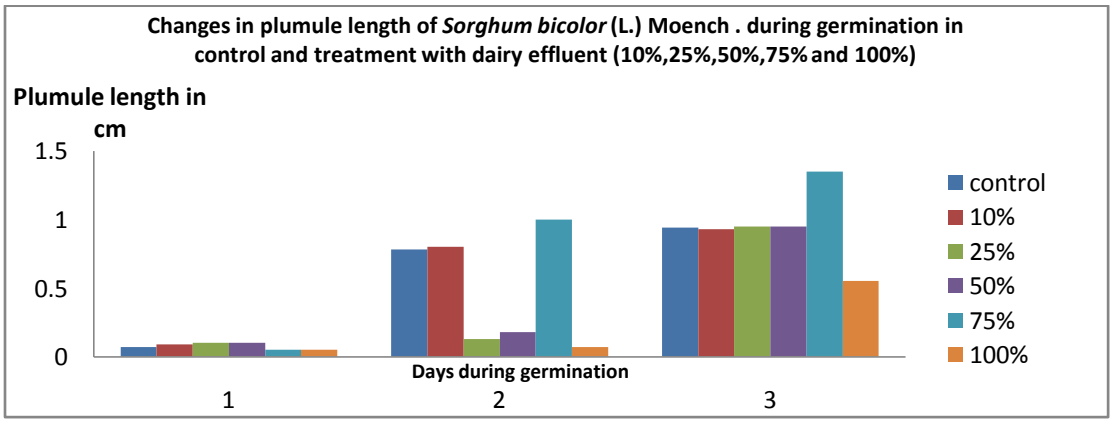
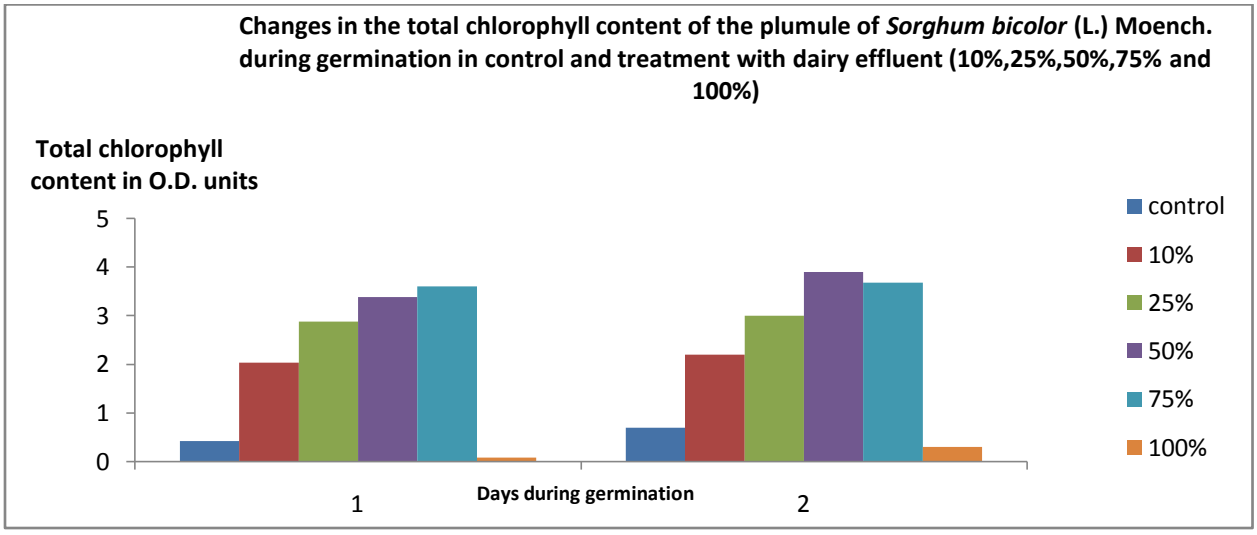


Figure -II



Chlorophyll Content

There was a gradual increase in the concentration of chlorophyll-a, chlorophyll-b and total chlorophyll contents both in control and treated seedlings. Chlorophyll-content was high in the seedlings treated with 100% effluent which was on par with that of control seedlings and the seedlings treated with 75% effluent Chlorophyll-b and total chlorophyll content were high in the seedlings treated with 50% effluent (Fig:III).



IV. DISCUSSIONS

The dairy effluent does not affect greatly the germination percentage. The results give the impression that the permeability of the seed coat to the effluent is approximately same as that of water.

The stimulatory effect of radical elongation by higher concentrations of the effluent might be due to the availability of sufficient amount of basic nutrients, while the inhibition of plumule development at 100% concentration, was likely due to excess deposition of chloride ions. The maximum chlorophyll content at 75% and 100% concentration of the effluent could be due to best growth of the seedlings at this concentration. But the increase of chlorophyll-a, chlorophyll-b and total chlorophyll content was far more in the seedlings treated with crude effluent.

V. CONCLUSION

The study confirms the view that the dairy effluent at 75% concentration is most favourable for seed germination and seedling growth of *Sorghum bicolor* (L.) Moench.The crude effluent also does not interfere with the growth and other physiological activities. It may be concluded that the slightly acidic dairy effluent with low salinity having the anions and cations well within the admissible limits of I.S.I. can be used for irrigating crop plant even as such. But at proper dilutions they can be used as an additional potential source of liquid fertilizer for better production values.

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