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ORIGINAL ARTICLE

UTILIZATION OF SUGAR MILL EFFLUENT ON GERMINATION AND BIO CHEMICAL CHANGES OF FINGER MILLET (*ELEUSINECORACANA*L. GAERTN)

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ABSTRACT

The present investigation was carried out to assay the utilization of sugar mill effluent on germination and bio chemical changes of finger millet (*Eleusinecoracana*L. Gaertn). Germination studies were conducted with finger millet seeds treated with different concentrations such as control, 10, 25, 50, 75 and 100 per cent of sugar mill effluent. Germination studies parameters such as germination percentage, root length, shoot length, fresh weight, dry weight, vigour index, tolerant index, percentage of phyto toxicity, chlorophyll 'a', 'b', total chlorophyll and carotenoids of seedlings were found to be increased up to 10per cent concentration of effluent. Bio chemicals such as protein, amino acid, total sugar and starch contents also measured. The highest growth performance was recorded at 10per cent effluent concentrations when compared with others.

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Keywords:: Sugar mill effluent, Irrigation, Biochemical constituents .

1.INTRODUCTION

Water is one of the most important precious resources found on the earth. The water resources are most often affected by anthropogenic activities and also from industries. Pollution caused by human beings and industries is a serious concern throughout the world. Water pollution is a large set of adverse effects upon water bodies such as lakes, rivers, oceans and ground water caused by human activities. This type of pollution is a result of addition of large amounts of toxic materials. Industries discharge a variety of pollutants in their wastewater (effluents) including heavy metals, resin pellets, organic toxins, oils, nutrient and solids.The industrial effluents are nowadays used for the irrigation purpose, due to the scarcity of water.

In the present investigation, the seeds finger millet (*Eleusinecoracana*L. Gaertn) was, chosen for variety was selected on the experiments in under effluent treatment.

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2.MATERIAL AND METHODS

Sample collection

Sampling for sugar mill effluent was done form the outlet of Rajshree sugars and chemicals ltd at Villupuram district. They were placed in cold place throughout the work. Samples were preserved for nitrate by adding 2mL concentrated H_2SO_4 L^{-1} and it was stored at 4^oC.

Seed material

The finger millet seeds were obtained from Tamil Nadu Agricultural University, Coimbatore.

Physico-chemical analysis

The effluent sample was collected from the outlet ofRajshree sugars and chemicals Ltd. at Villupuram district.Effluent samples analysis of various physic-chemical properties, as per the standard methods of American Public Health Association (APHA, 1992).

Effluent on seed germination

The effluent was diluted to control, 10, 25, 50, 75 and 100per cent with distilled water. The healthy and uniformly

seedswere selected and surface sterilized using 0.2per cent mercuric chloride ($HgCl_2$) for 5 minutes in order to remove the microbes and then washed the distilled water. For germination, 50 seeds of each crop were kept in sterilized petriplates lined with filter paper. These petriplates were irrigated with different concentration of effluent uniformly and the distilled water taken as control. The number seeds germinated was recorded 48 hrs. The root length and shoot length were recorded after 15^{th} days and dry weight of seeding was taken after keeping them in hot air oven at 80^{o}C for 24 hrs.

Germination percentage

Germination refers to the initial appearance of the radicle by visual observation. It was calculated by using the following formula.

$$\text{Germination percentage} = \frac{\text{Number of seeds germination}}{\text{Number of seeds sown}}$$

Vigour index

Vigour index of the seedling was calculated by using the formula proposed by Abdul Baki and Anderson (1973)
Vigour index= germination % x length of the seedling

Tolerance index

Tolerance index of effluent was calculated by using the formula suggested by Turned and Mashal (1972)

$$\text{Tolerance index} = \frac{\text{Mean length of longest root in treatment}}{\text{Mean length of longest root in control}}$$

Sowing of seeds

Seeds of uniform in size were selected and sown in each pot with 5cmx5cm intervals, pots irrigated with well water was maintained as control.

Irrigation schedule

30 litres of various concentrations of raw effluent were poured uniformly in relevant pots and the control pots were irrigated with well water. The irrigation was done thrice in a week.

Sampling methods

The plant samples were collected once in 15 days up to harvest for the measurement of various morphological growth parameters each sample consists of five randomly selected plants from each concentration. The plant samples were dug from each pot carefully washed under running canal water.

Biochemical analysis

Chlorophyll (Arnon 1949), Carotenoid (Jenson, 1978) Amino acid (Moore & Stein 1948) Sugar (Nelson 1944) method were used to the experiments.

3.RESULTS

Germination percentage

The germination percentage of finger millet cultivars as affected by different concentration of sugar mill effluent are furnished in Table-1. The germination percentages of the finger millet are found to be maximum at 10per cent concentration of sugar mill effluent.

Root and shoot length

The seedling root and shoot length of finger millet cultivars showed an increasing trend at lower concentration sugar mill effluent up to 10per cent. Among the cultivars studied, the maximum seedling root and shoot length (5.747 & 2085) at 10% concentration and minimum seedling root and shoot length (0.225 & 2.33) was observed 100per cent sugar mill effluent.

Fresh and dry weight of seedling

Fresh and dry weights of finger millet seedling under different concentrations of sugar mill effluent. The maximum fresh and dry weights of seedlings (0.980 & 0.136 mg/g) was occurs in 10per cent sugar mill effluent concentration. The minimum fresh and dry weights of seedlings (0.106 & 0. 009 mg/g) were observed in 100per cent sugar mill effluent concentration.

Vigour index

The vigour index of finger millet seedling grown under the different concentrations of sugar mill effluent. The maximum vigour index of seedling (895.3) occurs in 10per centeffluent concentration. The minimum vigour index of seedling (164.1) was observed in finger millet at 100per cent sugar mill effluent concentration.

Tolerant index

The tolerant index of finger millet seedling grown under different concentrations of sugar mill effluent. The maximum tolerant index of seedling (1.9854) occurs in 10per cent effluent concentration. The minimum tolerant index of seedling (0.4845) was observed in finger millet variety at 100per cent sugar mill effluent concentration.

Bio chemical analysis

The biochemical work was conducted on 15^{th} day plant in the ecology laboratory, CVR labs, Chennai to study the amount of chlorophyll ‘a’, ‘b’, total chlorophyll, carotenoids, protein, amino acid, reducing sugar, non-reducing sugar, total sugar and starch.

Pigment content (mg/g fr. weight)

The efficacy of sugar mill effluent on chlorophyll ‘a’, chlorophyll ‘b’, total chlorophyll and carotenoid content were furnished in Table-2. The minimum amount of chlorophyll ‘a’, chlorophyll ‘b’, total chlorophyll and carotenoid content were (0. 038, 0. 028, 0.318 & 1. 032). Found at 10per cent sugar mill effluent concentrations. The minimum values (0.003, 0.002, 0.5 & 0.103) were recorded at 100per cent sugar mill effluent.

Protein

The amount of protein content present in the 15th day plants were recorded. The maximum amount of protein content was observed at 10per cent (1.538) and minimum amount of was observed (0. 008) at 100per cent effluent concentration.

Amino acid

The amount of amino acid content present in the 15th day plants were recorded. The maximum amount of amino acid content was observed at 10per cent (4.528) and minimum amount of was observed (1.542)at 100per cent effluent concentration.

Total sugar and starch

The amount of total sugar and starch content present in the 15th day plants were recorded. The maximum amount of total sugar and starch content was observed at 10per cent (2.835 & 0.22) and minimum amount of was observed (1.10 & 0.201) at 100per cent effluent concentration.

4.CONCLUSION

The highest percentage of germination, seedling growth, root and shoot length, fresh and dry weight and biochemical were noticed at 10per cent of sugar mill effluent promote the growth of finger millet seedlings.

Table-1 Effect of sugar mill effluent on morphological parameters of finger millet(*Eleusinecoracana*L. Gaertn) on 15th day seedlings.

Effluent con. %	Germination %	Root length	Shoot length	Fresh weight	Dry weight	Vigour index	Tolerant index
Control	98	5.585±0.051	2.056±0.035	0.853±0.05	0.123±0.006	823.8	-
10	100	5.747±0.068	2.085±0.070	0.980±0.05	0.136±0.006	895.3	1.9854
25	86	4.488±0.045	2.00± 0.045	0.603±0.010	0.125±0.005	785.8	1.8787
50	75	4.00± 0.025	1.475±0.024	0.483±0. 003	0.110±0.004	623.8	0.9548
75	64	2.334±0.015	1.00± 0.015	0.356±0. 002	0.105±0.004	485.8	0.8430
100	35	0.225±0.002	0.233±0.002	0.106±0. 001	0.009±0.001	164.1	0.4845

± Standard Error

Table -2 Effect of sugar mill effluent on Chlorophyll 'a', 'b', Total chlorophyll and carotenoids of finger millet(*Eleusinecoracana*L. Gaertn) on 15th day seedlings.

Effluent con. in %	Chlorophyll 'a'	Chlorophyll 'b'	Total Chlorophyll	Carotenoid
Control	0.025±0.005	0.015±0.004	0.04 ±0.009	0.8552±0.0057
10	0.038±0.008	0. 028±0.007	0.0318± 0.015	1.032± 0.0088
25	0.018±0.004	0. 010±0.003	0.028± 0.007	0.601± 0.0048
50	0.108±0.002	0. 006±0.002	0.114± 0.004	0.458± 0.0035
75	0.008±0.002	0. 005±0.002	0. 013± 0. 004	0.365± 0.0028
100	0.003±0.001	0. 002±0.001	0. 005± 0. 002	0.103± 0.0201

± Standard Error

Table -3 Effect of sugar mill effluent on protein, amino acid, total sugar and starch of finger millet (*Eleusinecoracana*L. Gaertn) on 15th day seedlings.

Effluent con. in %	Protein	Amino acid	Total sugar	Starch
Control	1.425±0.0072	4.115±1.64	2.44 ±0.199	0.84±0.0047
10	1.538±0.0087	4.528±1.57	2.835± 0.218	1.03± 0.00511
25	1.418±0.0069	3.610±1.43	2.228± 0.187	0.62± 0.00482
50	1.308±0.0054	3.006±1.10	2.116± 0.102	0.46± 0.00351
75	1.038±0.0492	2.115±0.092	1.113±0. `094	0.36± 0.0028
100	0.008±0.0022	1.542±0.080	1. 1± 0. 025	0.22± 0.0201

± Standard Error

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