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REGULAR ARTICLE

EFFECT OF TANFAC EFFLUENT ON VARIETAL RESPONSE OF BLACK GRAM (*VIGNA MUNGO* L. HEPPER)

S. Dhanam*, D. Arulbalachandran
Post-Graduate Department of Botany, Arignar Anna Government Arts College
Villupuram – 605 602, Tamilnadu, India

SUMMARY

The present research work has been carried out to understand the effect of different concentrations of TANFAC effluent on seed germination and seedling growth of five varieties of black gram (*Vigna mungo* (L.) Hepper). The Increasing pace of industrialization in public and private sectors along with urbanization, population explosion and green revolution are reflected in varying degree of pollution of air, water, and soil. The TANFAC effluent is having a higher amount of organic and inorganic element. The Physico-chemical analysis showed that it was acidic in nature. It was rich in total suspended and dissolved solids with large amount of Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). The effluents severally affect crop plants and soil properties when used for irrigation. The growth parameters such as germination percentage root length shoot length, number of lateral roots, fresh weight and dry weight were taken on 10th day. All the parameters were found to increase at 10% effluent concentration and it decrease from 25% effluent concentration onwards. Among black gram, variety V-2 was tolerant to TANFAC effluent when compared to other varieties.

Keywords: Black gram, Chemical oxygen demand, chemical factory effluent.

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***Corresponding Author**, *Email*: arulmutbred@yahoo.co.in

1. Introduction

Industrial effluents are the major pollutants, which pollute not only the water bodies but also the entire biosphere. The disposal is a big problem in urban areas, applying the waste water to agricultural fields instead of disposing off in lakes and rivers can make crops grow better due to presence of various nutrients like N, P, K, Ca, Mg. There can be both beneficial and damaging effects of irrigation with waste water on various crops including vegetables. To recycle nutrients through land application of dairy waste effluent requires the use of crops capable of utilization these nutrients [1]. The present investigation is therefore, carried out to study the effect of TANFAC factory effluent on seed germination and seedling growth of five varieties of Black gram (*Vigna mungo* (L) Hepper variety V-2, V-3 V- 4, V-5 and T-9.

2. Materials and Methods

Collection of Seeds

The seeds of black gram varieties were obtained from National Pulse Research Institute, Vamban, Pudukottai, Tamilnadu, India. The Experiments were conducted at the Department of Botany, Arignar Anna Government Arts College, Villupuram, Tamilnadu, India.

Effluent Treatment

The TANFAC factory is one of India's largest suppliers of fluorine chemicals with the facility spreading over 60 acres in the chemical complex of SIPCOT (State Industrial Promotion Corporation of Tamilnadu) at Cuddalore, TN, 180 kms South of Chennai, India. TANFAC is engaged in the manufacture of chemicals such as aluminum fluoride, anhydrous hydrogen fluoride with germination capacity at 15600 tpa. The chemicals are used as intermediates in the manufacture of pharmaceuticals, drugs and agrochemicals. The fluorine based chemical have vital applications in industries such as aluminum smelting, petroleum, refining, refrigerant gases, steel re-rolling, glass, ceramics, sugar and fertilizer.

Table 1. Physico- Chemical Properties of TANFAC industrial effluent

Q	Parameters	Values
1	PH	7.4
2	EC	36.6
3	Temperature	32.8
4	Total solids	3.128
5	TSS (mg/l)	1.892
6	BOD	2.108
7	COD	2.252
8	Phosphate	32.5
9	Nitrate	48.6
10	Fluoride	165.8
11	Sulphur	1.18
12	Sodium	965
13	Potassium	1.122
14	Aluminum	635
15	Ammonia	718

The effluent samples were analyzed for its various physico chemical properties with the help of Central Board for Pollution, Puducherry, India (Table 1) as per the methods mentioned in American Public Health Association [2]. The different concentrations of the effluent (C, 10, 25, 50, 75 and 100%) were prepared and they were used for the germination experiment.

Seed Germination

Black gram seeds were surface sterilized with 0.1% mercuric chloride and washed with distilled water. Twenty seeds for each treatment were placed equispacially in sterilized petri dishes lined with filter paper soaked with different concentration of effluent. The number of seeds germinated in each treatment was counted on 10th day. The seedlings from each treatment were randomly selected for the germination percentage, seedling growth, fresh weight and dry weight.

3. Results and Discussion

Germination Percentage

Germination percentage of all the cultivars of black gram decreased gradually with progressive increase in effluent concentration. Germination percentage was found to be very less at 100% concentration. The highest percentage of germination was shown in black gram var V-2 (Table 2). Inhibition of seed germination may be due to high level of dissolved solids, which enrich the salinity, and conductivity of the absorbed solute by seed before germination [3, 4] cautioned on the deleterious effects of higher concentration effluent by decreasing the growth of crop observed suppressed germination of *Pennisetum typhoides* and *Pisum sativum*. Even varieties and cultivars of a single species show differential

sensitivity to the chemical toxicants in seed germination.

Table 2. Effect TANFAC effluent of germination percentage of five varieties of Black gram (10th day) Seedlings

Name of Varieties	C	10%	25%	50%	75%	100%
T9	90 ± 1.25	95 ± 1.36	80 ± 1.25	75 ± 1.85	65 ± 1.22	35 ± 1.31
V2	95 ± 1.19	100 ± 1.11	85 ± 1.49	75 ± 1.48	65 ± 1.77	40 ± 1.74
V3	90 ± 1.36	95 ± 1.96	85 ± 1.88	70 ± 1.47	60 ± 1.52	45 ± 1.18
V4	95 ± 1.19	100 ± 1.17	90 ± 1.25	75 ± 1.18	55 ± 1.10	40 ± 1.11
V5	85 ± 1.17	95 ± 1.47	80 ± 1.21	70 ± 1.14	60 ± 1.11	45 ± 1.16

± Standard deviation

Table 3. Effect TANFAC effluent on Root length of five varieties of Black gram (10th day) seedlings (cm/ Plant)

Name of Varieties	C	10%	25%	50%	75%	100%
T9	4.5 ± 0.33	6.0 ± 0.15	3.2 ± 0.09	2.8 ± 0.16	1.2 ± 0.04	0.5 ± 0.09
V2	4.5 ± 0.15	5.2 ± 0.15	3.2 ± 0.18	3.0 ± 0.12	1.5 ± 0.03	1.0 ± 0.03
V3	5.5 ± 0.25	6.3 ± 0.14	4.5 ± 0.16	2.5 ± 0.09	1.0 ± 0.04	0.5 ± 0.04
V4	4.2 ± 0.12	6.0 ± 0.25	3.2 ± 0.19	3.2 ± 0.04	1.5 ± 0.19	1.0 ± 0.08
V5	5.3 ± 0.18	6.2 ± 0.14	3.0 ± 0.14	3.0 ± 0.08	1.5 ± 0.01	0.5 ± 0.06

± Standard deviation

Table 4. Effect TANFAC effluent on shoot length of five varieties of Black gram (10th day) seedlings (cm/Plant)

Name of Varieties	C	10%	25%	50%	75%	100%
T9	22.5 ± 1.15	24.2 ± 1.15	17.5 ± 1.15	10.2 ± 1.15	3.2 ± 1.15	2.0 ± 1.15
V2	21.7 ± 1.15	25.2 ± 1.15	15.8 ± 1.15	11.5 ± 1.15	5.2 ± 1.15	2.1 ± 1.15
V3	22.2 ± 1.15	23.8 ± 1.15	12.3 ± 1.15	10.5 ± 1.15	3.1 ± 1.15	1.5 ± 1.15
V4	21.8 ± 1.15	24.3 ± 1.15	16.5 ± 1.15	10.5 ± 1.15	5.0 ± 1.15	2.2 ± 1.15
V5	22.8 ± 1.15	23.0 ± 1.15	13.6 ± 1.15	11.5 ± 1.15	3.3 ± 1.15	2.0 ± 1.15

± Standard deviation

Table 5. Effect TANFAC effluent of lateral Root of five varieties of Black gram (10th day) Seedlings (cm/Plant)

Name of Varieties	C	10%	25%	50%	75%	100%
T9	8.6 ± 0.25	9.2 ± 0.25	7.1 ± 0.25	5.1 ± 0.25	3.2 ± 0.25	2.1 ± 0.25
V2	9.8 ± 0.25	10.6 ± 0.25	8.8 ± 0.25	6.9 ± 0.25	5.2 ± 0.25	2.7 ± 0.25
V3	9.3 ± 0.25	10.1 ± 0.25	8.5 ± 0.25	6.1 ± 0.25	3.6 ± 0.25	2.4 ± 0.25
V4	7.3 ± 0.25	8.3 ± 0.25	6.6 ± 0.25	6.2 ± 0.25	2.3 ± 0.25	2.3 ± 0.25
V5	7.9 ± 0.25	9.6 ± 0.25	6.6 ± 0.25	6.5 ± 0.25	3.2 ± 0.25	2.2 ± 0.25

± Standard deviation

Seedling Growth

The increase in seedling growth fresh weight and dry weight is observed up to 10 % in black gram and then in decrease with the increase of effluent concentration. In the varietal screening test, under different effluent concentration variety V-2 black gram seedlings show greater root length, shoot length, fresh weight, dry weight and number of lateral roots when compared to other varieties studied (Table 3-7). The same trend was observed earlier in [5 – 8]. A disturbance in mineral supply either an excess or a deficiency induced by changes in concentrations of specific ions in the growth medium, might directly affected growth. The promotion of seedling growth by the lower concentration of effluent might be due to the presence of optimum level plant nutrient in the effluent in the present investigation.

Table 6. Effect of TANFAC effluent on fresh of weight of five varieties of black gram (10th day) seedlings

Name of Varieties	T9		V2		V3		V4		V5	
Concentration	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot
C	00.50 ±0.0002	0.610 ±0.0002	00.91 ±0.0001	0.532 ±0.0004	00.65 ±0.0003	0.682 ±0.0001	00.51 ±0.0001	0.508 ±0.0002	00.68 ±0.0004	0.606 ±0.0002
10%	00.62 ±0.0005	0.658 ±0.0003	00.93 ±0.0002	0.582 ±0.0004	00.72 ±0.0008	0.696 ±0.0002	00.68 ±0.0004	0.626 ±0.0002	00.69 ±0.0002	0.662 ±0.0008
25%	0.040 ±0.0007	0.596 ±0.0004	0.058 ±0.0006	0.492 ±0.0003	0.046 ±0.0002	0.587 ±0.0003	0.052 ±0.0002	0.440 ±0.0007	0.061 ±0.0004	0.437 ±0.0004
50%	0.036 ± 0.0001	0.463 ± 0.0002	0.052 ±0.0005	0.490 ±0.0008	0.034 ±0.0004	0.419 ±0.0009	0.035 ±0.0001	0.419 ±0.0007	0.042 ±0.0007	0.412 ±0.0007
75%	0.027 ±0.0008	0.451 ± 0.0001	0.036 ±0.0008	0.441 ±0.0009	0.026 ±0.0001	0.423 ±0.0006	0.031 ±0.0007	0.356 ±0.0004	0.032 ±0.0002	0.388 ±0.0005
100%	0.023 ±0.001	0.443 ± 0.0002	0.022 ±0.0004	0.434 ±0.0001	0.018 ±0.0004	0.419 ±0.0005	0.024 ±0.0008	0.323 ±0.0005	0.026 ±0.0004	0.278 ±0.0002

Table 7. Effect of TANFAC effluent on dry of weight of five varieties of black gram (10th day) seedlings

Name of Varieties	T9		V2		V3		V4		V5	
Concentration	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot
C	0.008 ±0.0002	0.054 ±0.0001	0.007 ±0.0004	0.072 ±0.0004	0.009 ±0.0004	0.70 ±0.0002	0.008 ±0.0002	0.066 ±0.0001	0.007 ±0.0002	0.060 ±0.0001
10%	0.015 ±0.0002	0.071 ±0.0003	0.019 ±0.0001	0.082 ±0.0004	0.010 ±0.0002	0.080 ±0.0005	0.019 ±0.0004	0.058 ±0.0003	0.009 ±0.0003	0.069 ±0.0005
25%	0.004 ±0.0004	0.047 ±0.0002	0.005 ±0.0004	0.061 ±0.0003	0.007 ±0.0004	0.0.048 ±0.0004	0.007 ±0.0003	0.058 ±0.0002	0.006 ±0.0004	0.057 ±0.0007
50%	0.004 ±0.0007	0.046 ±0.0007	0.003 ±0.0002	0.052 ±0.0008	0.005 ±0.0005	0.046 ±0.0004	0.004 ±0.0005	0.044 ±0.0007	0.005 ±37.7	0.051 ±0.0004
75%	0.003 ±0.0005	0.038 ±0.0007	0.002 ±0.0003	0.030 ±0.0008	0.003 ±0.0002	0.017 ±0.0003	0.003 ±0.0004	0.036 ±0.0005	0.004 ±0.0002	0.040 ±0.0003
100%	0.002 ±0.0004	0.025 ±0.0002	0.001 ±0.0004	0.025 ±0.0007	0.002 ±0.0004	0.020 ±0.0002	0.001 ±0.0002	0.015 ±0.0004	0.002 ±0.0004	0.037 ±0.0002

The reduction in shoot and root growth at higher concentration of effluent may be due to the fact that germinating seeds under higher concentrations would get less amount of oxygen which might have restricted the energy supply and retarded the growth and development [9]. The reduction in dry weight of plant materials may be due to the growth under effluent irrigation [10]. The presence of optimum level of nutrients in the lower concentrations of effluent might have increased the fresh weight and dry weight of crop plants. Among the varieties studied black gram var V-2 shows higher tolerance at different effluent concentrations. At 10% concentration the maximum growth is seen and it decreases as the concentration of the effluent increases. Hence it is recommended to use by the farmers living in and around the factory area to use it as a liquid fertilizer for better growth of *Vigna* species.

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