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REGULAR ARTICLE

CHANGES IN GROWTH AND BIOCHEMICAL PARAMETERS OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) INFLUENCED BY TANFAC EFFLUENT

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SUMMARY

Wastewater discharged by the industries is one of the major causes of environmental pollution, particularly in the developing countries. Present study was conducted in influence of TANFAC effluent (0, 10, 25, 50, 75 and 100%) on groundnut varieties (*Arachis hypogaea* L.) var. TMV-7, TMV-2, TMV-10 and TMV-13). The growth parameters such as seedling vigour, vigour index, tolerance index and percentage of phytotoxicity were measured on 10th day seedlings. The morphological and biochemical parameters such as chlorophyll, carotenoid, sugar and starch contents decreased with the increase of effluent concentrations except 10% effluent concentration. Among the four varieties studies TMV-7 performed better under TANFAC factory effluent treatment and it proved to be tolerant when compared to the remaining varieties.

Keywords: Growth parameters, Effluent, Phytotoxicity, Groundnut.

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1. Introduction

The growing demand and supply of fuel oil and new chemicals by the industrialized society of the twenty first century has placed increasingly higher stress on the natural environment. Large amount of diverse chemicals enter the environment via industrial discharges and other anthropogenic activities of particular concern are the hydrophobic organic compounds, because of their toxicological characteristics and their ability to accumulate in the environment. Among the various kinds of pollution, the problem of water pollution has a serious one in India, due to rapid economic and industrial developments. Polluted water is one of the biggest carriers of certain microorganisms, which cause various diseases including cholera, typhoid, dysentry and diarrhoea.

The various industries at SIPCOT (State Industrial Promotion Corporation of Tamilnadu) utilize water for various purposes. The waste has been discharged in to nearly streams and lakes. The adverse effects emphasis is need to treat the

effluent before discharging them into the nearly streams. To recycle nutrients through land application of dairy waste effluent requires the use of crops capable of utilization these nutrients [1]. The present investigation was carried out to study the effect of TANFAC factory effluent on seed germination and seedling growth of four varieties of groundnut (Arachis hypogace L. Var. TMV-7, TMV-2, TMV-10 and TMV-13).

2. Materials and Methods

Seed Materials

The seeds of four varieties of groundnut TMV-2, TMV-7, TMV-10 and TMV-13 were obtained from Tamilnadu Corporation Oil Research Station, Tindivanum, Tamilnadu, India. The seeds with uniform size, colour and weight were selected for experimental purpose. The experiments were conducted at the Department of Botany, Arignar Anna Government Arts College, Villupuram, Tamilnadu, India.

Effluent Treatment

The Effluent samples from TANFAC factory, cuddalore were collected in plastic containers from the point of disposal. The effluent sample was brought to the laboratory for the physico – chemical analysis.

The effluent samples were analyses for its various physico–chemical properties as per the methods mentioned in (Table-1). 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 experiments.

Groundnut seeds were surface sterilized with 0.1% mercuric chloride and washed with distilled water. Twenty seeds for each treatment were placed equispacially in sterilized petridishes, lined with filter paper soaked with different concentration of effluent. The Seedlings raised in distilled water was designated as control.

Table-1. Physico- Chemical Properties of TANFAC industrial effluent

Sl. No	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

Germination Study I

The Germination percentage was calculated on 10th day. The seedlings from each treatment were randomly selected for the germination percentage seedling growth, fresh weight and (Table – 2, 3 and 4). The tolerant variety and dry weight upon the above mentioned characters.

Table 2
Effect of TANFAC effluent of germination percentage of five varieties of groundnut at 10th day seedlings

Name of Varieties	C	10%	25%	50%	75%	100 %
TMV-20	90	95	85	81	85	50
TMV-70	95	100	90	95	85	59
TMV-10	90	90	89	80	70	40
TMV-13	89	90	85	82	75	55

Germination Study II

TMV- 7 was selected as tolerant variety vigour index. Tolerance index, Percentage of seed germination index, Percentage of phytotoxicity were calculated.

Table 3. Effect of TANFAC effluent on root length, shoot length of four varieties of groundnut at 10th day seedlings (cm/ Plant)

Root length						
Name of Varieties	C	10%	25%	50%	75%	100%
TMV-2	9.0	0.1± 3.06	9.0± 8.16	7.8± 20.40	8.8± 10.20	6.2± 6.73
TMV-7	9.2	9.9 ± 7.60	8.0 ± 13.04	5.6 ± -19.13	6.5 ± 29.3	6.5 ± 29.34
TMV-10	7.7	8.7 ± 12.98	8.5 ± 10.38	6.9 ± 10.38	15.9 ± 23.37	6.0 ± 22.07
TMV-13	8.0	7.9 ± 1.25	7.8 ±2.5	7.9 ± 1.25	6.5 ± 18.75	5.5 ± 1.25
Shoot length						
Name of Varieties	C	10%	25%	50%	75%	100%
TMV-2	18.3	20 ± 11.11	19 ± 44.44	12 ± 3.33	6 ± 66.66	5 ± 72.22
TMV-7	18.	15 ± 15.6	14 ±77.69	10 ± 3.07	8 ± 38.46	6 ± 53.84
TMV-10	18	19 ± 5.55	6 ± 66.66	15 ± 7.77	5 ± .5432	4 ± 77.77
TMV-13	15	16 ± 6.66	8 ± 46.66	6 ± 60.0	4 ± 73.33	3 ± 80.00

± per cent increase/decrease over control

Biochemical analysis

Groundnut seedlings were separated in to root, stem, leaf and cotyledon and they were used for biochemical aspects like chlorophyll [3] carotenoid [4] sugars [5] and starch [6].

Table 4. Effect of TANFAC effluent on fresh weight four varieties of groundnut (*Arachis hypogea* L.) at 10th day Seedlings (cm/Plant).

Name of Varieties	TMV-2		TMV-7		TMV-10		TMV-13	
	Root	Stem	Root	Stem	Root	Stem	Root	Stem
C	0.026	0.533	0.092	0.717	0.061	0.530	0.231	0.948
10%	0.038 ±46.15	0.737 ± 38.27	0.093 ± 1.086	1.747 ± 14.36	0.062 ±1.639	1.035 ± 5.28	0.242 ± 47.61	0.951 ± 0.376
25%	0.037 ±42.30	.696 ± 30.58	0.037 ±59.78	0.834 ± 16.34	0.052 ±14.75	1.012 ±89.05	0.040 ±82.68	0.896 ± 5.485
50%	0.036 ±38.46	0.542 ± .688	0.030 ± 7.39	0.128 ± 82.14	0.041 ± 2.18	1.910 ± 2.78	0.032 ± 6.147	0.766 ± 19.19
75%	0.030 ± 5.38	0.430 ± 19.32	0.28 ± 69.56	0.997 ± 39.05	0.032 ± 48.38	0.983 ± 47.5	0.024 ± 89.61	0.598 ± 36.91
100%	0.025 ±3.846	0.398 ±25.32	0.012 ± 86.95	0.891 ± 24.26	0.021 ± 5.57	0.350 ±33.96	0.023 ± 90.04	0.495 ± 47.78

± per cent increase/decrease over control

Germination percentage

The Germination percentage was found to be very less at 100% concentration. The four varieties of groundnut seeds were screened for their tolerance to the effluent treatment. The highest percentage of germination was shown in TMV cultivars, which compared to other varieties. 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 and conductivity of the absorbed solute by seed before germination [7]. Several works have been done regarding the impact of effluents on germination of crops [8 - 11].

Table 5. Effect of TANFAC effluent on germination percentage, vigour index, tolerance index, percentage of phytotoxicity, percentage of seed germination index of *Arachis hypogaea* Var. TMV-7 Seedlings

Concentration of effluent Varieties	Germination Percentage	Vigour Index	Tolerance Index	Percentage of Phytotoxicity	Percentage of seed Germination index
C	95	152	-	-	100.00
10%	100	190	1.0547	56.086	43.051
25%	90	117	0.9596	43.043	33.051
50%	95.6	143.4	0.8126	39.13	23.821
75%	85.3	119.42	0.7982	29.34	21.974
100%	59.6	53.64	0.6974	29.34	20.324

Seedling growth

Root length, shoot length, fresh weight and dry weight of groundnut seedlings also gradually increased in 10% concentration. The Same trend was observed earlier in Oryza sativa [12, 13]. Among all the varieties studied TMV- 7 showed the higher percentage of germination, seedling growth and dry weight, while TMV-13 showed a lower percentage of germination, seedling growth and dry weight under different concentration of TANFAC effluent treatments. The cotyledons weight seems to be increased in higher concentration may be due to the non utility of reserve food.

Germination Study II

Tolerance index, vigour index, speed of germination index was increase at lower concentration and decreased at higher concentration (Table-5). The same trend was observed [14, 15, 21]. The percentage of

phytotoxicity showed a reverse trend, the toxicity of the effluent increased gradually with increase in effluent concentration. The results are in conformity with the reports of [16, 17].

Biochemical studies

In the chlorophyll estimation, chlorophyll a, b, total chlorophyll and carotenoid content of the plant significantly affected under TANFAC factory effluent irrigation. The seedlings grown in 10% effluent concentration shows an increase in the chlorophyll content compared with control. The increased chlorophyll content at lower concentration may be due to the favourable elements present in the effluent on the pigment system [18 - 20). The increase in carotenoid content might be due to enhanced influence of nitrogen and other inorganic element present in the effluent (Table – 6).

Table 6. Effect TANFAC effluent on photosynthetic pigments of groundnut Var. TMV –7 at 10th days seedling (mg/g fr. wt)

Concentration	Chlorophyll a	Chlorophyll b	Total Chlorophyll	Carotenoids
C	0.0859 ± 0.002	0.0655 ± 0.006	0.1820 ± 0.001	0.2018 ± 0.002
10%	0.0595 ± 0.001	0.0648 ± 0.002	0.2032 ± 0.003	0.3012 ± 0.003
25%	0.0565 ± 0.003	0.0552 ± 0.001	0.1630 ± 0.006	0.2232 ± 0.007
50%	0.0499 ± 0.002	0.0530 ± 0.007	0.1585 ± 0.004	0.2180 ± 0.006
75%	0.0450 ± 0.004	0.0201 ± 0.003	0.0909 ± 0.006	0.2090 ± 0.004

± Standard deviation

Total sugar content was high at 10% effluent concentration, whereas it gets gradually reduced as the concentration of the effluent increases (Table – 7). The same trend was recorded with treatment implies the deranged starch metabolism and poor translocation of sugar to growing parts [12, 17].

The decrease in starch may be due to the increase in the concentration of various cations, anions present in the effluent (Table – 8). These results are in conformity with the results of [12, 18, 22].

Table 7. Effect of TANFAC effluent on sugar content of groundnut Var. TMV –7 at 10th days seedling (mg/g fr. wt)

Concentration	Root	Stem	Leaves	Cotyledons
C	2.27 ±. 063	8.77 ±. 063	9.66 ±. 063	7.924 ±. 059
10%	3.03 ±. 054	10.12 ±. 062	9.729 ±. 015	7.637 ±. 034
25%	2.84 ±. 063	7.00 ±. 015	7.19 ±. 063	8.710 ±. 067
50%	2.33 ±. 015	4.08 ±. 075	4.34 ±. 096	9.910 ±. 034
75%	1.71 ±. 052	2.846 ±. 069	3.942 ±. 034	10.99 ±. 065
100%	0.602 ±. 004	1.504 ±. 009	3.852 ±. 028	11.924 ±. 015

± Standard deviation

Table 8. .Effect of effluent on starch content of groundnut Var. TMV –7 at 10th days seedling (mg/g fr. wt)

Concentration	Root	Stem	Leaves	Cotyledons
C	8.89 ±. 025	1.608 ±. 003	1.526 ±. 002	1.77 ±. 001
10%	9.536 ±. 009	2.168 ±. 008	2.792 ±. 002	1.62 ±. 006
25%	7.536 ±. 006	1.368 ±. 004	1.072 ±. 004	1.82 ±. 004
50%	6.472 ±. 004	1.344 ±. 005	0.808 ±. 009	2.14 ±. 003
75%	4.024 ±. 009	0.928 ±. 003	0.704 ±. 007	2.38 ±. 007
100%	1.054 ±. 008	0.886 ±. 003	0.424 ±. 008	2.56 ±. 009

± Standard deviation

Hence, from this investigation, it is concluded that TMV- 7 is more tolerant than the other varieties in different concentration of the effluent. The effluent must be diluted and it is recommended to use by the farmers as a liquid fertilizer.

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