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# Effect of sewage on Growth Parameters and Chlorophyll content of *Trigonella foenumgraecum* (Methi)

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## Abstract

*Urban centers are discharging waste water into the water bodies and for irrigation in the agriculture fields. The major sources of organic pollution in fresh water bodies are sewage which contains various wastes. Disposal of waste water is one of the major problem of Indore & also other cities of Madhya Pradesh. So the this study was aimed to study the effect of different dilutions i.e 100%, 75%, 50%, 25% and 0% of sewage of Krishnapura nallah Indore on growth parameters and chlorophyll content of Trigonella foenumgraecum. The parameters studied were germination percentage, root length, shoot length, vigour index, fresh weight, dry weight and viability percentage, and chlorophyll content. At all the studied dilutions there was decrease in germination percentage, viability percentage, dry weight, total chlorophyll, chlorophyll a, and chlorophyll b content but increase in root length , shoot length, vigour index, and fresh weight. Maximum decrease in germination percentage (12.67%), viability percentage (10%) occurred at 0% and 25% dilutions respectively. Maximum increase in root length (18.65%) and shoot length (12.5%) occurred at 75% dilution of sewage. The vigour index reached its maximum increase (16.83%) at 25% dilution of sewage. In fresh weight and dry weight maximum increase (19.2%) and maximum decrease (32.07%) occurred at 50% and 25% 0r 0% dilution respectively. Maximum decrease in total chlorophyll (26.9%), chlorophyll a (75%) and chlorophyll b (22.44%) occurred at 50% and 0% respectively.*

**Keywords:** Sewage, *Trigonella foenumgraecum* seedlings, viability percentage, vigour index.

## Introduction

Domestic waste water rich in organic materials and plant nutrients are finding agricultural use as a cheap way of disposal. Use of domestic waste water in agriculture contributes considerably to alleviate the pressure in using fresh water resources. Waste water from different sources contains considerable amount of organic matter and plant nutrients (N, P, K, Ca, S, Cu, Mn and Zn) which has been used to increase the crop yield[1]. Sewage sludge consists of many essential elements that can be used as manure[2]. Using sewage waste water can cause many environmental problems such as soil sickness, soil and ground water contamination and phytotoxicity[3]. Sewage adversely affects many crops such as radish during maturity stage and as a result the production decreases substantially[4]. The city sewage is mainly used for growing vegetables in the vicinity of the cities. Most of the Leafy vegetables like, cauliflower, cabbage, spinach etc., grow quite well in the presence of sewage water[4]. Therefore the present study was undertaken with a view to understand the effect of Krishnapura nallah sewage (Indore) on the growth parameters and chlorophyll content of *Trigonella foenumgraecum* seedlings.

## Material and Methods

The sewage of Krishnapura nallah Indore was used for the present study. Different dilutions of sewage viz. 100%, 75%, 50%, 25% and 0% were used in the study. Healthy seeds were surface sterilized with 0.1% $HgCl_2$ for 5 min and then were washed thoroughly with distill water. The seeds were then allowed to germinate for 24 hrs. Germinated seeds were then transferred in petriplates lined with Whatman filter paper no. 1. At the start of the experiment 3 ml of respective concentration was added to moisten filter paper in each petriplates and every day, 2 ml of respective concentration was added for consecutive 6 days in case of *Trigonella foenumgraecum*. Three sets in each concentration were maintained along with the control for comparison. On the seventh day various growth parameters and chlorophyll content were evaluated as follows: i. Germination percentage: Germination percentage was estimated by the below formula[5]: Germination % = no. of seeds germinated/ total no. of seeds × 100, ii. Root and shoot length: Root and shoot length of seedlings were recorded using the standard centimeter scale[6]. iii. Vigour index: Vigour index was calculated by using following given by Abdul-Baki and Anderson[7]. Vigour index = germination % × (root length +shoot length)* (* indicate that root length and shoot length should be in cm), iv. Fresh and dry weight: Four seeds of each treatment were weighed in order to determine the fresh weight and then dried in oven at 80˚C for 24 hrs to obtain dry weight[6]. Fresh weight and dry weight were recorded in gms. v. Viability percentage: It was determined using method given by G. Lakon[8] in which colourless Triphenyl Tetrazolium dye was used which turns red when is reduced by respiring embryo i.e. indication of germination. vi. Chlorophyll estimation: Chlorophyll was estimated according to the method given by Sadasivam S. and A. Manickam[9].

## Results and Discussion

Table 1 is showing effect of different dilution of sewage on germination %, root length, shoot length and vigour index of *Trigonella foenumgraecum* seedlings, table 2 is showing effect of sewage on fresh weight, dry weight and viability % of wheat seedlings and table 3 is showing effect of sewage on chlorophyll content of *Trigonella foenumgraecum* seedlings.

Germination percentage in control was 100±0 and at 75%, 50%, 25% and 0%, dilution of sewage was 94.66±6.11, 94±4, 94.66±2.3, 87.33±3.05 respectively. Highest decrease in germination percentage was observed at 0% (12.67%) dilution of sewage.

Root length in untreated seedling was observed to be 8.93±3.15 cm. Root length of wheat seedlings at 75%, 50%, 25%, and 0% dilutions was found to be 11.04 ± 0.79, 10.34 ± 1.10, 11.56 ± 0.36 and 10.55 ± 1.42 cm respectively. Maximum root length was found at 75% (18.65%) dilution of sewage.

Shoot length in control seedlings was 0.77±0.023 cm and at 75%, 50%, 25%, and 0% dilutions was found to be 0.88 ±0.052, 0.81± 0.09, 0.83 ± 0.046, and 0.78 ± 0.05 cm respectively. The highest increase i.e. 12.5% was found at 75% dilution.

Vigour index of wheat seedling in control was 975.33±315.40. Vigour index of wheat seedlings at 75%, 50%, 25%, and 0% dilution was found to be 1139.01±125.94, 1075.5±141.07, 1172.7±11.51 and 1000.7±144.26 respectively. Thus among the entire studied dilution highest % increase in vigour index i.e. 16.83% was observed at 25% dilution of sewage.

Fresh weight in control seedlings was 0.57 ± 0.055 gms. Fresh weight at 75%, 50%, 25% and 0% was found to be 0.59 ± 0.064, 0.68 ± 0.026, 0.64 ± 0.072 and 0.63 ± 0.051 gms respectively. The highest % increase in fresh weight was 19.2% which corresponds to 50% of sewage.

In control dry weight was observed to be 0.053 ± 0.023 gms. Dry weight at 75%, 50%, 25%, and 0% dilutions of sewage was found to be 0.043± 0.005, 0.043 ± 0.005, 0.036 ± 0.005 and 0.036 ± 0.005 gms respectively. The highest decrease i.e. –32.07% was found at 50% and 25% dilutions of sewage.

In control viability % was observed to be 100 ±0. Viability % at 75%, 50%, 25% and 0% was found to be 96.66±5.77, 93.33±5.77, 90±10, and 90±10 respectively. The highest % decrease in viability % was 10% which corresponds to 25% and 0% dilutions.

Total chlorophyll in control was 0.26±0.020 mg/g. Total chlorophyll at 75%, 50%, 25%, and 0% was found to be .22±.014, .19±.011, .20±.008, .25±.050 mg/g respectively. Highest decrease (26.92%) was found at 50% dilution. chlorophyll a in control was .10±.022 mg/g. chlorophyll a at 75%, 50%, 25%, and 0% was found to be .067±.013, .025±.014, .039±.007, .060±.021 respectively. Highest decrease (75%) was found at 50% dilution.

In control chlorophyll b was observed to be 0.19±0.034 mg/g. chlorophyll b at 75%, 50%, 25%, and 0% was found to be .15±.018, .16±.003, .16±.0018, .15±.006 mg/g respectively. Highest decrease (22.44%) was found to be at 0% dilution.

**Discussion:** All the studied growth parameters and chlorophyll content of *Trigonella foenumgraecum* seedlings were highly influenced by sewage. Germination % in *Trigonella foenumgraecum* was decreased in germinating seedlings treated with sewage as compared to 100% dilution. These results were in accordance with the work of Khan et al[10] who reported that seed germination was decreased when treated with waste water which is contaminated by textile industrial effluents. A.K. Dash [11] showed discourageable effect of domestic wastewater on germination of Sto 25% concentration can be used for irrigation of groundnut enhances germination percentage. Root length and Shoot length of *Trigonella foenumgraecum* were increased with decrease in dilutions of sewage. These results corroborate with the findings of N. Sawaf[13] who reported that *Sorghum durra* and *Sorghum dochna* showed increased root and shoot length when irrigated with sewage waste water. On the contrary to these Z.A. Bazai and A. Kabir Khan Achakzai[14] observed waste water of Quetta city effect Quetta the germination and growth of Lettuce seedling, noted that in the initial doses of polluted water, the plumule length was increased as compared with the control, but at higher concentrations it decreases. Fresh weight of *Trigonella foenumgraecum* increases with the decrease in dilutions. The present results are in accordance to the assessment done by Tamrabet *et al*[15] that showed that increase in the weight may also be the result of improvement in soil fertility due to sewage sludge application. Dry weight affected significantly at all dilutions of sewage as compared to 100% dilution. The present findings showed decrease in dry weight of *Trigonella foenumgraecum* with decrease in dilutions of sewage. The findings of study are contradictory to Bouzerzour *et al*[15] who observed that sewage increased dry matter of barley (*Hordeum vulgare* l.) and oat (*Avena sativa* l.) genotypes, evaluated in pots experiment. Khan et al[10] reported that with the increased application of sewage sludge increased total dry matter yield. The results of present study showed a significant decrease in Vigour index of *Trigonella foenumgraecum* at all dilutions as compared to the 100% dilution. The result were in contradictory with the work of Dash[11] who observed that the vigour index was increased with the treatment of sewage upto 50% both in rice and wheat and thereafter it declined gradually towards high concentrations both in rice and wheat. Viability % of the Trigonella *foenumgraecum* was decreased with the decrease in the dilutions of sewage as compared to 100% dilution. In the present study chlorophyll content in *Trigonella foenumgraecum* was decreased with decreased in dilutions of sewage which is corroborated with the findings of khan *et al* [16]

who suggest that Higher concentration of waste water are inhibitory to synthesis of chlorophyll molecules particularly chlorophyll *a* .

The result of present study was supporting to the study of Liu D *et al*[17] i.e decreased chlorophyll level in wheat seedlings when irrigated with sewage.

**Table-1**
**Showing effect of fungicide on germination %, root length, shoot length and vigour index of *Trigonella foenumgraecum* seedlings**

| S.No. | Dilution of sewage% | Germination % | Root length in cm | Shoot length in cm | Vigour index |
|---|---|---|---|---|---|
| 1. | 100 | 100±0 | 8.98±3.15 | 0.77±0.023 | 975.33±315.40 |
| 2. | 75 | 94.66±6.11$^{ns}$ (-5.34%) | 11.04±0.79$^{ns}$ (18.65%) | 0.88±0.052$^{*}$ (12.5%) | 1139.01±125.9$^{ns}$ (14.37%) |
| 3. | 50 | 96±4$^{ns}$ (-4%) | 10.34±1.10$^{ns}$ (13.15%) | 0.81±0.09$^{ns}$ (4.9%) | 1075.5±141.07$^{ns}$ (9.31%) |
| 4. | 25 | 94.66±2.30$^{ns}$ (-5.34%) | 11.56±0.36$^{ns}$ (22.31%) | 0.83±0.04$^{*}$ (7.2%) | 1172.7±11.51$^{ns}$ (16.83%) |
| 5. | 0 | 87.33±3.05$^{**}$ (-12.67%) | 10.55±1.42$^{ns}$ (14.88%) | 0.78±0.05$^{ns}$ (1.28%) | 1000.7±144.26$^{ns}$ (2.53%) |

*= Significant values (p<0.05), **= very significant values (p <0.01) and ns= not significant(p>0.05). Note: values in the brackets indicate the % increase or decrease in the studied growth parameters of *Trigonella foenumgraecum* when irrigated with sewage.

**Table-2**
**Showing effect of sewage on fresh weight, dry weight and viability % of *Trigonella foenumgraecum* seedlings**

| S.No. | Dilution of sewage % | Fresh weight in gms | Dry weight in gms | Viability % |
|---|---|---|---|---|
| 1. | 100 | 0.57±0.055 | 0.053±0.023 | 100±0 |
| 2. | 75 | 0.59±0.064$^{ns}$ (3.3%) | 0.043±0.005$^{ns}$ (-18.86%) | 96.66±5.77$^{*}$ (-3.34%) |
| 3. | 50 | 0.68±0.026$^{*}$ (19.2%) | 0.043±0.005$^{ns}$ (-18.86%) | 93.33±5.77$^{ns}$ (-6.67%) |
| 4. | 25 | 0.64±0.072$^{ns}$ (10.9%) | 0.036±0.005$^{ns}$ (-32.07%) | 90±10$^{ns}$ (-10%) |
| 5. | 0 | .63±.051$^{ns}$ (6.3%) | 036±.005$^{ns}$ (-32.07%) | 90±10$^{ns}$ (-10%) |

*= Significant values (p<0.05), **= very significant values (p <0.01) and ns= not significant (p>0.05). Note: values in the brackets indicate the % increase or decrease in the studied growth parameters of *Trigonella foenumgraecum* when irrigated with sewage.

**Table-3**
**Showing effect of sewage on chlorophyll content of *Trigonella foenumgraecum* seedlings**

| S.No. | Dilution of sewage % | Total chlorophyll | Chlorophyll a | Chlorophyll b |
|---|---|---|---|---|
| 1. | 100 | 0.26±0.020 | 0.10±0.022 | 0.19±0.034 |
| 2. | 75 | 0.22±0.01$^{ns}$ (-15.38%) | 0.067±0.01$^{ns}$ (-33%) | 0.15±0.018$^{ns}$ (-21.42%) |
| 3. | 50 | 0.19±0.01$^{**}$ (-26.92%) | 0.025±0.014$^{ns}$ (-75%) | 0.16±0.003$^{ns}$ (-16.3%) |
| 4. | 25 | 0.20±0.00$^{ns}$ (-19.23%) | 0.039±0.007$^{ns}$ (-61%) | 0.16±0.001$^{ns}$ (-16.3%) |
| 5. | 0 | 0.25±0.05$^{*}$ (-3.8%) | 0.060±0.021$^{*}$ (-40%) | 0.15±0.006$^{*}$ (-22.44%) |

*= Significant values (p<0.05), **= very significant values (p <0.01) and ns= not significant(p>0.05). Note: values in the brackets indicate the % increase or decrease in the studied growth parameters of *Trigonella foenumgraecum* when irrigated with sewage.

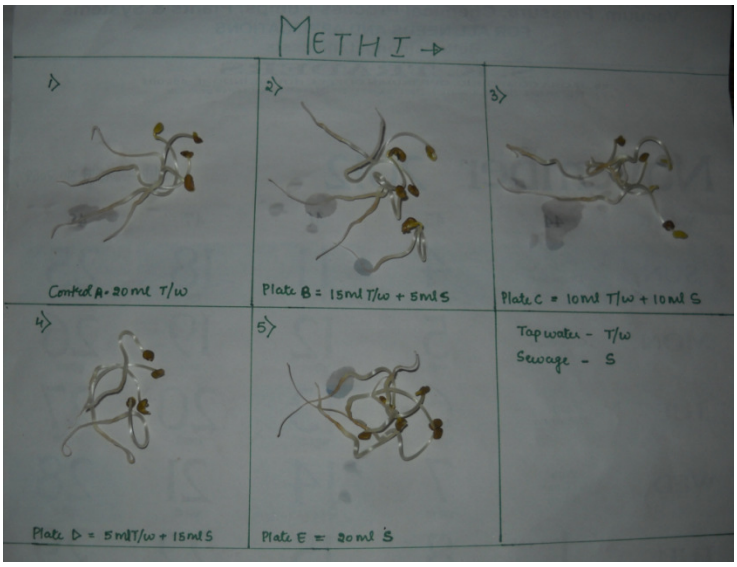


**Figure-1**
**Showing Root length & shoot length of *Trigonella foenumgraecum* seedlings when germinated with different dilutions of sewage**

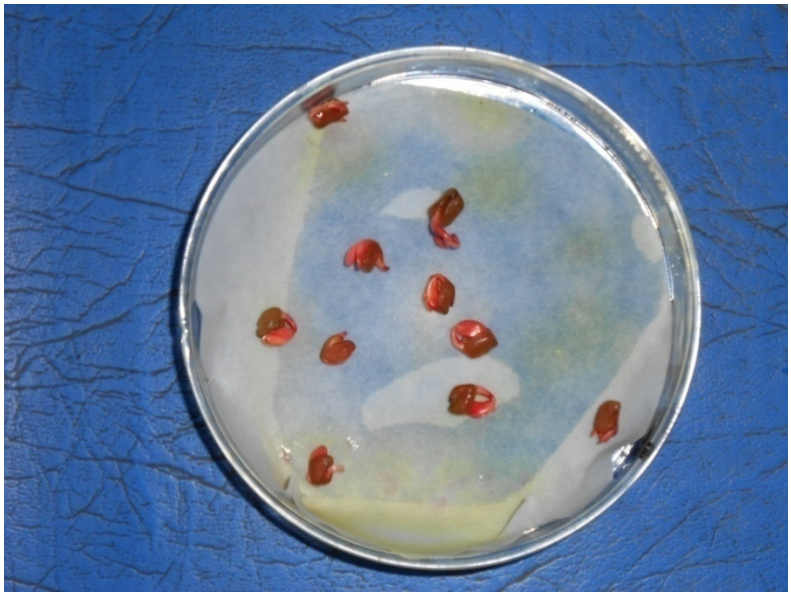

**Figure-2**
**Showing Viability Test in *Trigonella foenumgraecum***

## Conclusion

This study shows that as the dilutions of sewage were decreased, it has positive as well as negative impact on the physicochemical parameters of *Trigonella foenumgraecum*. These effects also appeared as visible symptoms.

These findings were important to understand sewage water stress mechanisms and also to find their solution to prevent the toxic elements.

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