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RESEARCH **P**APER

Study of germination percentage, root length and shoot length of *Trigonella foenum graecum* (Fenugreek) irrigated with river, sewage and coalmine water

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Today soil contamination is becoming a serious problem for irrigation purpose therefore the present work was done to know the impact of water from coalmine and sewage on germination percentage, root and shoot length of *Trigonella foenum graecum.* River water was used as a control. Germination percentage was insignificantly increased in sewage and coalmine water as compared to control (river). Significant increase was observed in root length in sewage water as compared to control. Shoot length was insignificantly decreased in sewage and coalmine water as compared to control. It can be concluded from the present study that sewage and coalmine water can be used to irrigate crops and using different sources of water for irrigation is a good way to utilize different type of wastes.

Key words : Germination percentage, Root length, Shoot length, River water, Sewage water, Coalmine water

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INTRODUCTION

Contamination of soil and water bodies can also occur through runoff from erosion of mine wastes, dusts produced during the transport of crude ores, corrosion of metals and leaching of heavy metals to soil and ground water. Soil contamination of heavy metals occurs due to different types of processing in refineries. The potential use of mine-water for agricultural crops was tested in a series of field trials from 1993-2000 (Jovanovic *et al*., 1998; Annandale *et al*., 1999 and 2001). The results of these studies indicated that crops were able to tolerate the salinity of gypsiferous waters and were grown successfully on a commercial scale, at least in the short term (Annandale *et al*., 2001 and Jovanovic *et al*., 2002).

Contamination causes due to wide range of inorganic or organic compounds like heavy metals, combustible and putrescible substances, hazardous wastes, explosives and petroleum products. Major component of inorganic contaminates are heavy metals (Adriano, 1986). They possess a severe threat to human and animal health by their long-term persistence in the environment (Subhashini and Swamy, 2015).

These metals are present in the waste water from different industries such as metal cleaning, plating baths, refineries, mining, electroplating, paper and pulp, paint, textile and tanneries (Mistry *et al*., 2010). Soil contamination has become a serious problem in all industrialized areas of the country. Soil is equally regarded as the ultimate sink for the pollutants discharge into the environment (Shokoohi *et al*., 2009). Most plants and

animals depend on soil as a substrate for their sustained growth and development. In many instances the sustenance of life in the soil matrix is adversely affected by the presence of deleterious substances or contaminants. The entry of the organic and inorganic form of contaminants results from disposal of industrial effluents (Gowd *et al*., 2010).

RESEARCH METHODOLOGY

Seeds:

For the present study, seeds of *Trigonella foenum graecum* (Methi) were collected from the Krishi Sudhar Beej Bhandar, Nandlalpura Indore M.P.

Collection of water:

– River- Kewai River, Kotma Colliery M.P. 484336

– Sewage- Chawani Indore M.P. 452001

– Coalmine- Filter Plant, Jamuna Colliery, Anuppur M.P. 484444.

Studied parameters:

The various parameters studied in this work are as follows:

– *Water analysis:* Soil testing Laboratory, Krashi Nagar, Agriculture College Indore (452001).

– *Soil analysis*: Soil testing Laboratory, Krashi Nagar, Agriculture College Indore (452001).

– *Germination percentage*: It was estimated according to the method of Rehman *et al*. (1998).

– *Root length*: Root length of seedlings was recorded by using standard centimeter scale.

– *Shoot length*: Shoot length of seedlings was recorded by using standard centimeter scale.

RESEARCH FINDINGS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Effect on Germination percentage:

Germination per cent was insignificantly increased *Trigonella foenum graecum* irrigated with different water samples as compared to control. Khan *et al.* (2011) who reported that seed germination was decreased when treated with waste water which is contaminated by textile industry effluents. Dash (2012) showed discourageable effect of domestic waste water on germination of rice and wheat with higher concentrations of sewage.

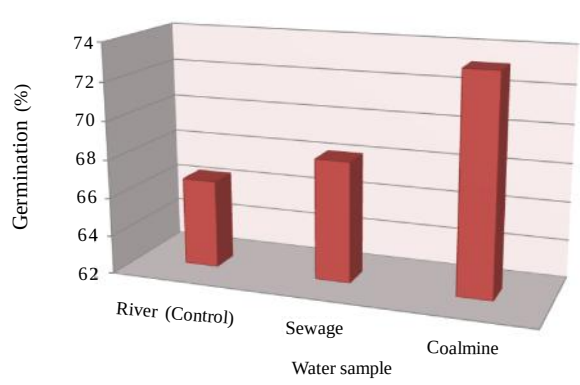

Fig. 1 : Effect of different sources of water on germination percentage of *Trigonella foenum graecum*

Table 1: Showing result of analysis of water from different sources

Parameters	Unit	Boring	River	Well	Pond	Coalmine
pH		7.75	7.90	7.78	7.20	7.29
Electrical conductivity EC	dSm-1	0.56	0.10	0.59	0.11	0.23
Calcium	meL-1	1.30	0.23	1.37	0.26	0.53
Magnesium	meL-1	1.27	0.23	1.34	0.25	0.54
Sodium	meL-1	2.14	0.38	2.25	0.42	0.88
Potassium	meL-1	0.16	0.03	0.17	0.03	0.07
Carbonate	meL-1	0.14	0.00	0.148	0.028	0.00
Bicarbonate	meL-1	0.21	0.00	0.22	0.04	0.00
Chloride	meL-1	2.09	0.37	2.20	0.41	0.86
Sulphate	meL-1	1.33	0.24	1.40	0.26	0.55
Residual sodium carbonate	meL-1	Nil	Nil	Nil	Nil	Nil
Sodium adsorption ratio	(mmolL-1)1/2	1.88	0.80	1.93	0.84	1.21

Effect on root length:

Root length was in significantly decreased in coalmine water irrigated *Trigonella foenum graecum* as compared to control. Significant increased was seen in *Trigonella foenum graecum* irrigated with sewage. Kaushik *et al*. (2005) showed that the effect of textile effluents at lower concentrations (6.25%) had no inhibitory effect on root and shoot length. Seedling length was increased by low concentrations of effluent Augusthy and Mani (2001).

Effect on shoot length:

Shoot length was insignificantly decreased in sewage and coalmine water irrigated *Trigonella foenum graecum* as compared to control. Kaliyamoorthy (2013) showed that the seedling root and shoot length of horse

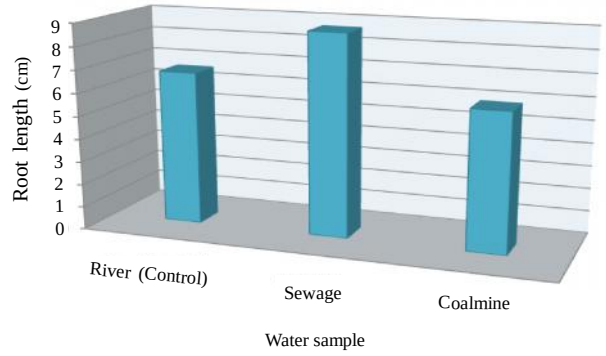

Fig. 2 : Effect of different sources of water on germination percentage of *Trigonella foenum graecum*

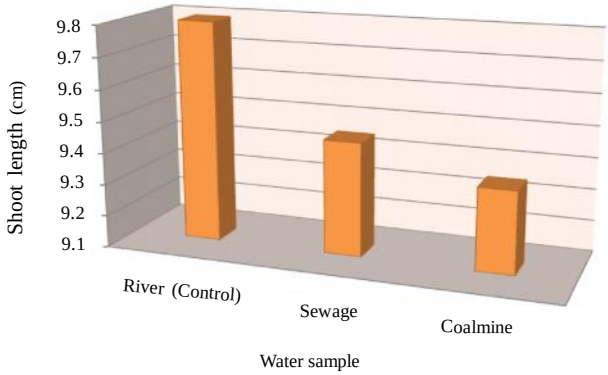

Fig. 3: Effect of different sources of water on germination percentage of *Trigonella foenum graecum*

Table 2: Analysis of soil after growing *Trigonella foenum graecum* (Fenugreek)

Sr. No.	Identity (Soil sample)	(pH) (1:2)	(EC) (1:2) dSm^{-1}	Organic carbon %	Available nitrogen kg/ha	Available phosphorus kg/ha	Available potash kg/ha
1.	River T_1	7.92	0.10	0.42	168	8.0	440
2.	River T_2	7.86	0.09	0.46	184	11.2	480
3.	Boring T_1	7.98	0.15	0.35	166	8.0	440
4.	Boring T_2	7.95	0.15	0.40	160	5.6	400
5.	Well T_1	7.84	0.17	0.33	156	8.0	360
6.	Well T_2	7.75	0.21	0.44	176	9.6	440
7.	Pond T_1	7.84	0.11	0.42	165	8.0	440
8.	Pond T_2	7.86	0.12	0.45	180	9.6	480
9.	Sewage T_1	8.06	0.15	0.30	142	5.6	360
10.	Sewage T_2	8.04	0.15	0.33	156	5.6	400
11.	Coalmine T_1	7.96	0.14	0.44	176	9.6	440
	Medium range for comparison	6.5-7.50	<0.80	0.50	250-400	>10	400

Note: According to their report, all types of water are suitable for the purpose of irrigation because Electrical conductivity (EC) was found in normal range

Table 3: Showing effect of different sources of water on studied parameters

Treatments	River (Control)	Sewage	Coalmine
Germination (%)	66.6 ± 7.63^{NS}	68.3 ± 7.63^{NS}	73.3 ± 7.63^{NS}
Root length (cm)	6.73 ± 0.77^{NS}	$8.8 \pm 0.1^{**}$	6.03 ± 0.55^{NS}
Shoot length (cm)	9.8 ± 0.72^{NS}	9.46 ± 0.15^{NS}	9.36 ± 0.35^{NS}

Values expressed are means ± standard deviation ^{NS} Indicates $p>0.05$ and is not significant * Indicates $p<0.05$ and is significant

gram showed an increasing trend at lower concentration pharmaceutical effluent upto 10 per cent effluent and then it decreases with increase of the pharmaceutical effluent concentration. Huma *et al.* (2012) showed that average shoot and radical length were decreased. These results showed similarly with the results of Bazai and Achakazai (2006) who had suggested that plumule length is decreased in higher concentration of polluted water. According to Rajula and Padmadevi (2000) the germination percentage and morphological characters like root length and shoot length decreased gradually with increase in effluent concentration.

Conclusion:

It was concluded from the present study that coalmine, sewage and boring water can be used to irrigate crops without any adversely affecting the nutritive value.

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