Effect of water from different sources on quality and morphological parameters of *Trigonella foenum graecum* (Fenugreek)

P. Sharma
Department of Biochemistry
Govt. Holkar Science College Indore 452001, (M.P.), India

Abstract: 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. 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. Seed germination and growth are vital for continuation of life. Therefore, the present work was done to know the impact of water from coalmine, sewage, boring, pond and well added to soil on quality and morphological parameters of *Trigonella foenum graecum* (Fenugreek) plant. River water was used as a control. There was insignificant change in vigour index of *Trigonella foenum graecum* seedlings when irrigated with coalmine, sewage, boring, pond and well water as compared to control. Fresh weight was significantly decreased in pond and well water but insignificantly increased in sewage water as compared to control. Dry weight was insignificantly increased in sewage, boring and pond water as compared to control. It can be concluded from the present work that all types of water can be used to irrigate leafy vegetables.

Keywords: Vigour index, Fresh weight, Dry weight, River water, Coalmine water, Sewage water, Boring water, Pond water, Well water.

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. Energy- supplying power stations such as coal burning power plants, petroleum combustion, nuclear power stations and high tension lines contribute many heavy metals such as Se, B, Cd, Cu, Zn, Cs and Ni to the environment (Verkleji, 1993). The long-term crop performance and environmental impact, that is, the field scale sustainability of irrigation with mine water, however, had to be evaluated. Since long-term field experiments are expensive, time consuming and produce only site-specific information, computer simulation models were required to predict the performance of various crops irrigated with different water qualities, on different soil types and under different climatic conditions. All effects are related to ultra structural, biochemical, and molecular changes in plant tissues and cells brought about by the presence of heavy metals (Gamalero *et al*., 2009). Contamination of agricultural soil by heavy metals has become a

critical environmental concern due to their potential adverse ecological effects. Such toxic elements are considered as soil pollutants due to their widespread occurrence and their acute and chronic toxic effect on plants grown of such soils.

Material and Methods:

- **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:**

1. River- Kewai River, Kotma Colliery M.P. 484336
2. Boring- 91 Janki Nagar Extension Indore M.P. 452001
3. Well- Jamuna colliery, Anuppur M.P. 484444
4. Pond- Chhath Talab, Jamuna Colliery, Anuppur M.P. 484444
5. Sewage- Chawani Indore M.P. 452001
6. Coalmine- Filter Plant, Jamuna Colliery, Anuppur M.P. 484444

- **Sterilization of seed:** Seeds of uniform size were selected and surface sterilized with 0.1% solution of mercuric chloride for 5 minutes to avoid any fungal growth, followed by washing for 4-5 times with distilled water. The seeds were then placed in 10cm diameter petridishes lined with Whatman No. 1 filter paper moistened with distilled water for 24 hours in dark for germination.
- **Stage of seed studied:** Seeds were then grown in petriplate until root emerged out after which they were transferred to pots containing soil irrigated with different sources of water i.e. river, boring, well, pond, sewage, coalmine and grown for 15 days.
- **Studied parameters:** The various parameters studied in this work are as follows:

1. **Water analysis -** Soil Testing Laboratory, Krashi Nagar, Agriculture College Indore (452001).
2. **Soil Analysis -** Soil Testing Laboratory, Krashi Nagar, Agriculture College Indore (452001).
3. **Vigour index:** Vigour index was calculated by using the below formula as suggested by Abdul-Baki and Anderson (1973) and expressed in whole number.

   Vigour Index= Germination (%) × (Root length + Shoot length in cm)
4. **Fresh weight:** It was estimated according to the method of M.Kabir (2008). It was recorded by using electrical balance.
5. **Dry weight:** It was estimated according to the method of M.Kabir (2008). It was recorded by using electrical balance.

Figure 1: Showing fifteen days old seedlings of *Trigonella foenum graecum* irrigated with different sources of water

Result and Discussion:

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**

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

S. NO	IDENTITY	(pH) (1:2)	(EC) (1:2) dSm^{-1}	Organic Carbon %	Available Nitrogen Kg/ha	Available Phosphorus Kg/ha	Available Potash Kg/ha
1	Soil Sample (Botany Department, Govt. Holkar Science College Indore	7.70	0.15	0.45	190	9.6	440
	Medium range for comparison	6.5-7.50	<0.80	0.50	250-400	>10	400

Table 3: Analysis of soil after growing *Trigonella foenum graecum* (Fenugreek)

S. 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 T1	7.92	0.10	0.42	168	8.0	440
2	River T2	7.86	0.09	0.46	184	11.2	480
3	Boring T1	7.98	0.15	0.35	166	8.0	440
4	Boring T2	7.95	0.15	0.40	160	5.6	400
5	Well T1	7.84	0.17	0.33	156	8.0	360
6	Well T2	7.75	0.21	0.44	176	9.6	440
7	Pond T1	7.84	0.11	0.42	165	8.0	440
8	Pond T2	7.86	0.12	0.45	180	9.6	480
9	Sewage T1	8.06	0.15	0.30	142	5.6	360
10	Sewage T2	8.04	0.15	0.33	156	5.6	400
11	Coalmine T1	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 4: Showing effect of different sources of water on studied parameters

Treatment	River (Control)	Boring	Well	Pond	Sewage	Coalmine
Vigour index	1103.5±143.5 ^{NS}	1157.3±96.52 ^{NS}	1130.1±141.5 ^{NS}	1236.1±231.3 ^{NS}	1248.8±148.5 ^{NS}	1133.8±181.6 ^{NS}
Fresh weight	0.7±0.01 ^{NS}	0. 66±0.04 ^{NS}	0.65±0.01***	0.65±0.01***	0.75±0.40 ^{NS}	0.7±0.02 ^{NS}
Dry weight	0.02±0.005 ^{NS}	0.03±0.01 ^{NS}	0.02±0.005 ^{NS}	0.03±0.01 ^{NS}	0.03±0.01 ^{NS}	0.02±0.01 ^{NS}

Values expressed are means ± standard deviation.

^{NS} Indicates $p>0.05$ and is not significant.

* Indicates $p<0.05$ and is significant.

Effect on Vigour Index: Vigour index was insignificantly increased in *Trigonella foenum graecum* irrigated with boring, well, pond, sewage & coalmine water as compared to control. There results were in accordance with the work of Dash *et al.*, (2012) who also observed that the vigour index was increased with treatment of sewage upto 50% both rice and wheat. Girisha *et al., (*2008*)* rewarded that when sewage water is diluted to 25% for irrigation of *Arachis hypogea* it enhances the vigour index. The study by Singh *et al*., (2007) which showed that seedling vigour index of rice and wheat decreased significantly with an increase in spent wash concentration.

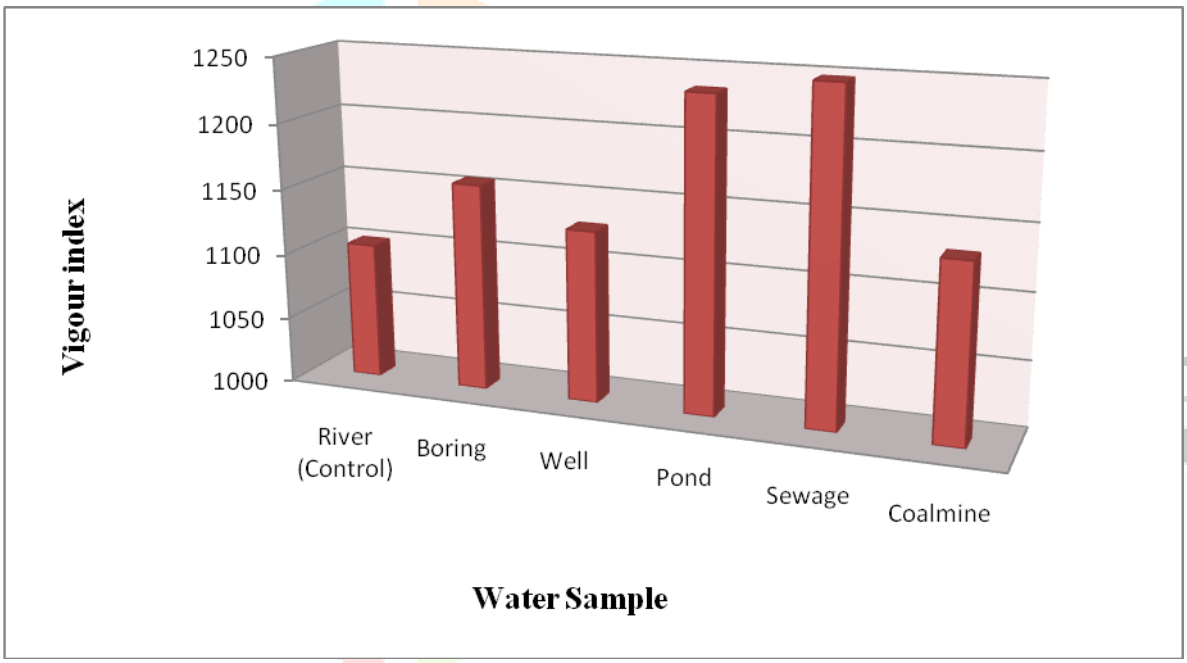

Figure 2: Effect of different sources of water on Germination percentage of *Trigonella foenum graecum*

Effect on Fresh weight:

Fresh weight was significantly decreased in *Trigonella foenum graecum* irrigated with pond and well water while insignificantly increased in sewage water irrigated *Trigonella foenum graecum* as compared to control. The study by Varma and Sharma, (2012) showed that weights decreases as the concentration of effluent increases. Similarly Kaushik *et al*., (2005) found that textile effluent did not show any inhibitory effect on bio mass of three cultivators of wheat at low concentration (6.25%). Powel *et al*., (1996) suggested due to pollution stress the fresh weight of seedling reduced.

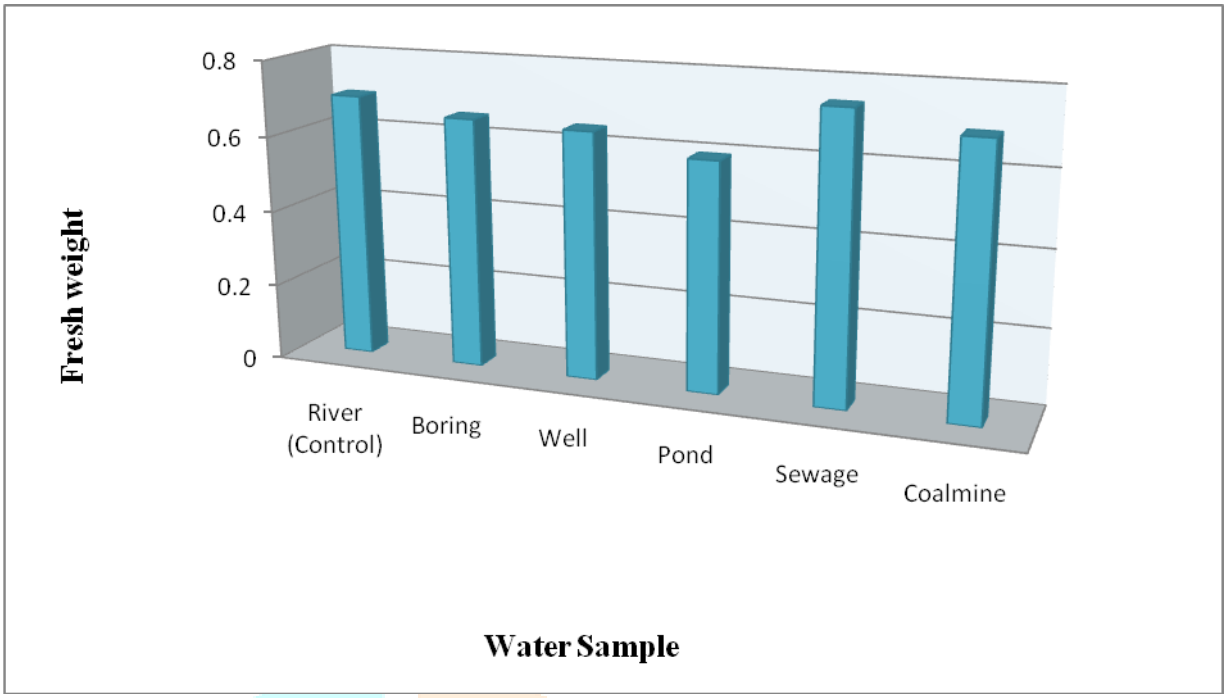

Figure 3: Effect of different sources of water on Germination percentage of *Trigonella foenum graecum*

Effect on Dry weight: Dry weight was insignificantly increased in sewage, boring and pond water irrigated *Trigonella foenum graecum* as compared to control. Huma, (2012) found that application of polluted water decreased dry weight. Powel *et al*., (1996) reported reduction in fresh weights of seedlings, while dry weights remained unaffected under the pollution stress. The assessment done by Singh and Agrawal (2010) support the present findings that higher bioavailability of heavy metals in waste water irrigated sites may have reduced the nutrient availability to plants that may be the cause for not showing significant increments in biomass of these plants grown at ground water irrigated sites khan *et al.*, (2007) reported that with increased application of sewage sludgy increased total dry matter yield. Dewiny *et al.*, (2006) showed that dry weight of radish and spinach plants increased with application of sewage sludge.

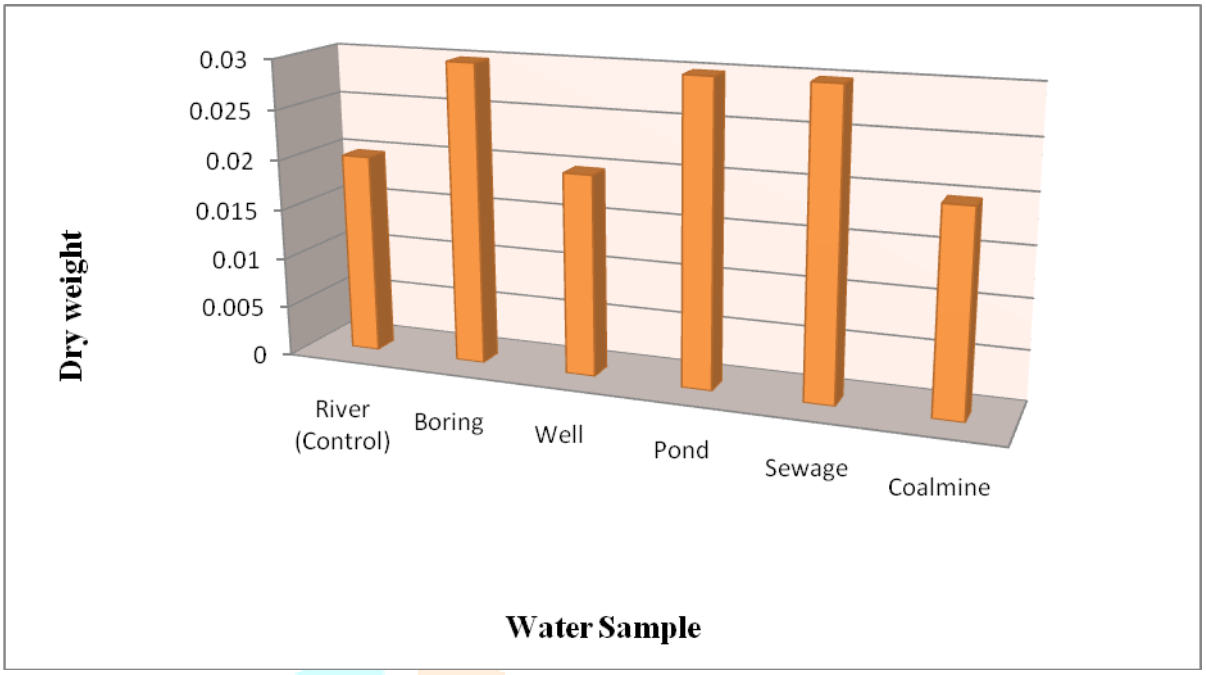

Figure 4: Effect of different sources of water on Germination percentage of *Trigonella foenum graecum*

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.

Acknowledgement: I express my sincere thanks to Dr. Rooplekha Vyas, Principal of Govt. Holkar Science College, Indore (M.P.) for providing necessary laboratory facilities and encouragement.

References:

[1] Abdul Baki A.A, Anderson J.D. (1973): Vigour determination of soybean seeds by multiple criteria. Crop Science. 13:630-633.

[2] Dash A.K. (2012): Impact of Domestic waste water on seed germination and physiological parameters of Rice and Wheat. IJRRAS. 12(2): 2-5.

[3] El-Dewiny C.Y., Moursy K.S., El-Aila H.I. (2006): Effect of organic matter on the release and availability of phosphorus and their effects on spinach and radish palnts. Research Journal of Agriculture and Biological Sciences. 2(3): 103-108.

[4] Gamalero, E., Lingua, G., Berta, G., and Glick B. R.,(2009): Beneficial role of plant growth promoting bacteria and arbuscular mycorrhizal fungi on plant responses to heavy metal stress. Canadian. J. Microbiol. 55(5):501–514.

[5] Girisha S., Raju N. (2008): Effect of sewage water on seed germination & vigour index of different varieties of groundnut (*Arachis hypogea l.*). Journal of Environmental Biology. 29(6): 937-939.

[6] Kabir M., Iqbal M.Z., Shafiq M. and Farooqi Z.R. (2008): Reduction in germination and seedling growth of *Thespesia populnea l*., caused by lead and cadmium treatments. Pakistan Journal of Botany. 40(6):2419-2426.

[7] Kaushik P., Garg V.K. and Singh B. (2005): Effect of textile effluents on growth performance of wheat cultivators. Bioresour. Technol. 96:1189-1193.

[8] Khan M.A., Kazi T.G., Ansari R., Mujtaba S.M., Khanzada B., khan M.A., Shirani M.U., Mumtaz S. (2007): Effect of untreated sewage sludge on wheat yield, metal uptake by grain and accumulation in the soil. Pakistan Journal of Botany 39(7): 2511-2517.

[9] Powel W., Morgant M., Andre C., Hanafay M., Vogel J., Tingrey S. and Rafalski A. (1996): The comparison of RFLP, AFLP, RAPD and SSR (microsatellite) markers for germ plasm analysis. Molecular Breeding. 21:225-238.

[10] Singh A. and Agrawal M. (2010): Effects of municipal waste water irrigation on availability of heavy metals and morpho-physiological characteristics of *Beta vulgaris L*. 31(5): 727-736.

[11] Singh P.K., Sharma K.P., Kumar S., Sharma S. and Subhasini (2007): Assessment of environmental contamination potential of distillery effluent using plant and animal bioassays. Nat. Environ. Poll.Technol., 6:63-74.

[12] Varma L. and Sharma J. (2012): Effect of dairy and textile waste water on growth of plant wheat. RASAYAN J.Chem. 5(3):351-355.

[13] Verkleji J.A.S. (1993): The effects of heavy metals stress on higher plants and their use as bio monitors. In: Markert B (ed) Plant as bioindicators: indicators of heavy metals in the terrestrial environment. VCH, New York, pp 415–424.