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Research Paper

Study of Chlorophyll, Carbohydrate and Protein Content of *Trigonella foenum graecum* (Fenugreek) Irrigated with Different Sources of Water

P. Sharma, A. Bafna, A.R. Batham
Department of Biochemistry, Government Holkar Science College Indore 452001, (M.P.), INDIA

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Abstract: *Water is the vital resource, necessary for all aspects of human and ecosystem survival and health. Depending on the quality, bore water may be used for human consumption, irrigation purposes and livestock watering. Solid waste from industrial units is being dumped near the factories, which react with percolating rainwater and reaches the ground water. The percolating water picks up a large number of heavy metals and reaches the aquifer system and contaminates the ground water. The usage of the contaminated bore water causes the diseases. Therefore the present work was done to know the impact of water from coalmine, boring and pond added to soil on nutritive biochemical parameters of Trigonella foenumgraecum plant. River water was used as control. Carbohydrate content was insignificantly decreased in Trigonella foenumgraecum seedlings irrigated with boring, pond water and increased in seedlings supplied with coalmine water. There was insignificant change in protein content of Trigonella foenumgraecum seedlings when irrigated with boring and pond water but significant decrease was observed when irrigated with coalmine water. Insignificant change observed in total chlorophyll content of Trigonella foenumgraecum seedlings irrigated with boring, pond and coalmine water. Chlorophyll (a) was significantly decreased in plants irrigated with pond water. Chlorophyll-(b) was insignificantly increased in Trigonella foenumgraecum plant irrigated using boring and decreased in plants irrigated with pond, coalmine water as compared to control. It can be concluded from the present study that boring, pond and coalmine water can be used to irrigate leafy vegetable.*

Keywords: Carbohydrate, Protein, Chlorophyll, Pond water, Boring water, Coalmine water, River water.

Introduction

Most mines in coalfields produce waters dominated by calcium and magnesium sulphates, and have near neutral pH values. The southern fields have high pH and also carbonates such as calcite and dolomite that make water alkaline[1]. The potential use of mine-water for agricultural crops was tested in a series of field trials from year 1993-2000[2,3,4]. The results of these studies indicated that crops were able to tolerate the salinity of gypsiferous water and were grown successfully on a commercial scale, at least in the short term[4,5]. The long-term crop performance and environmental impact, that is, the field scale sustainability of irrigation with mine water, however, had to be evaluated. At present environmental pollution has become a serious problem[6]. The objective of the present study was to know the effect of emitted effluent from Jamuna colliery coalmine and various other sources like boring, pond and river water on biochemical parameters of *Trigonella foenum graecum.*

Material and Methods

- **Seeds:** Seeds were obtained from 121-122, Beej Bhavan, situated at Nandlalpura Sabji Mandi Road, near Rajwada, Indore, M.P. (452004).
- **Water sources used:**

1-River water (Control): Kewai River, Kotma Colliery, M.P. (484336).

2- Boring water: 91-Janki Nagar-Ext. Indore, M.P. (452001).

3- Coalmine water: Filter Plant, Jamuna Colliery, Anuppur, M.P. (484444).

4- Pond water: Chhath Talab, Jamuna Colliery, Anuppur, M.P. (484444).

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

3- Shoot length - Shoot length of seedlings was recorded by using standard centimeter scale.

4- Chlorophyll - It was estimated according to the method of Sadasivam and Manickam (1992) by using 80% acetone (prechilled)[7].

5- Carbohydrate - It was estimated according to the method of Hedge *et al*., (1962) by using Anthrone reagent[8].

6- Protein - It was estimated according to Folin Lowry's method by using (FCR) Folin- ciocalteu reagent [9].

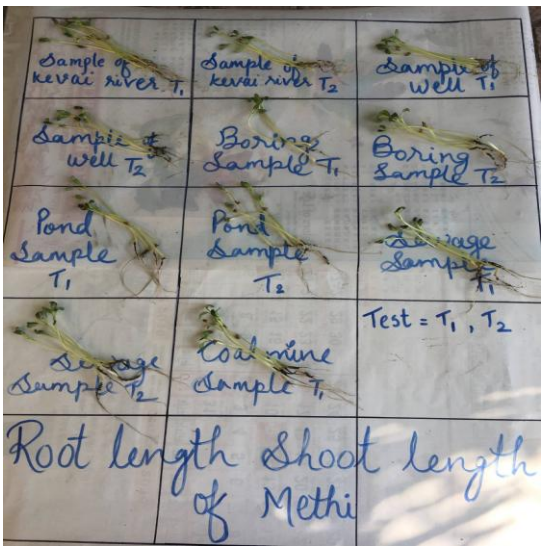

Figure 1: Photograph showing 15 days old seedlings irrigated with different sources of water

Results 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**

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

Effect on Total Chlorophyll, Chlorophyll-(a) or Chlorophyll-(b): Total chlorophyll content was insignificantly decreased in *Trigonella foenum graecum* irrigated with boring, pond and coalmine water as compared to control.

Chlorophyll (a)content was insignificantly decreased in *Trigonella foenum graecum* irrigated with coalmine water while significantly decreased in pond and boring water as compared to control.

Chlorophyll (b) content was insignificantly increased in *Trigonella foenum graecum* irrigated with boring and decreased in pond, coalmine water as compared to control. Changes in pigment concentration by effluent treatment affected the carbohydrate content which supports present study results and stated that there was a negative correlation between the effluent treatment and biochemical parameters such as chlorophyll, protein and sugar[10].

Khan *et al.*, (2011) suggested that higher concentration of waste water are inhibitory to synthesis of chlorophyll molecules particularly chlorophyll(a)[11]. According to Gibert and Dubey, (2003) the concentration of effluent seems to be correlated with the loss of chlorophyll[7]. Excess accumulation of heavy metals causes either deficiency or enrichments of other essential micronutrients which will have direct effect on the concentration of chlorophyll[12]. Mishra *et al.*, (2008), in their study demonstrated that the levels of

chlorophyll and protein decreased in *Eichornea crassipies* when the metal level is increased [13,14].

Table 2: Showing effect of different sources of water on studied parameters

Treatment	River (control)	Boring	Pond	Coalmine
Chlorophyll(a) (mg/g)	0.004±0.001	0.001±0.0005*	0.0018±0.0006*	0.004±0.002NS
Chlorophyll(b) (mg/g)	0.008±0.003	0.010±0.004 NS	0.007±0.0012NS	0.007±0.003NS
Total Chlorophyll (mg/g)	0.012±0.003	0.012±0.0039NS	0.009±0.0016NS	0.011±0.005NS
Carbohydrate (mg %)	1326.6 ±221.2	871.6±698.5 NS	1193.3±280.9NS	1573.3±456.2NS
Protein (mg/g)	1.30±0.29	1.73±0.201 NS	1.32±0.43NS	1.12±0.327*

Values expressed are means ± standard deviation. * Indicates p< 0.05 and is significant.
NS Indicates p > 0.05 and is not significant.

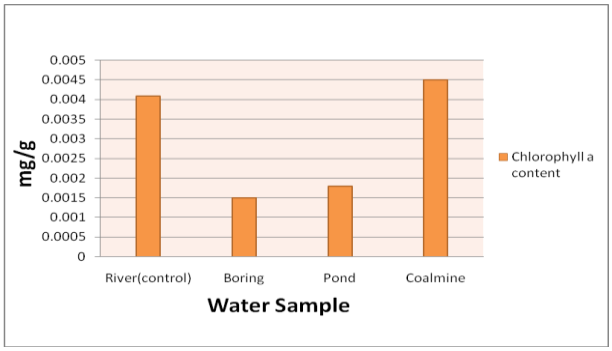

Figure 2: Effect of different sources of water on Chlorophyll(a) content of *Trigonella foenum graecum*

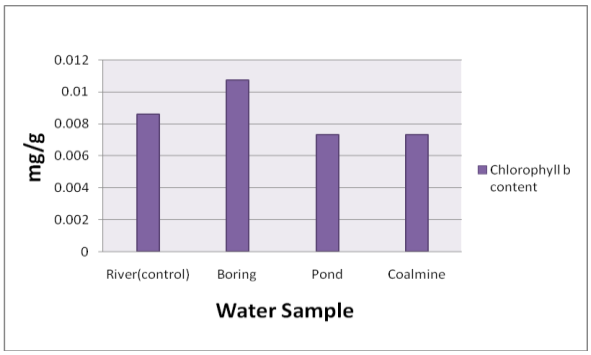

Figure 3: Effect on different sources of water on Chlorophyll(b) content of *Trigonella foenumgraecum*

Effect on Carbohydrate: Carbohydrate content was insignificantly decreased in *Trigonella foenumgraecum* irrigated with boring, pond and increased in *Trigonella foenumgraecum* irrigated with coalmine water as compared to control. Bamniya *et al.,* (2010) studied that total carbohydrate content is higher in waste water irrigated crops than control[15]. Stress causes increase in soluble sugar content[16]. When the concentration of pollutants in the effluent exceeds the detoxifying capacity of the tissue through their normal metabolism, there is a decrease in the biochemical parameters such as chlorophyll, protein, amino acid, carbohydrate and nucleic acid[17,18]. The study done by Dhavan, (2009) showed that there was decrease in starch content of paddy seedlings[19].

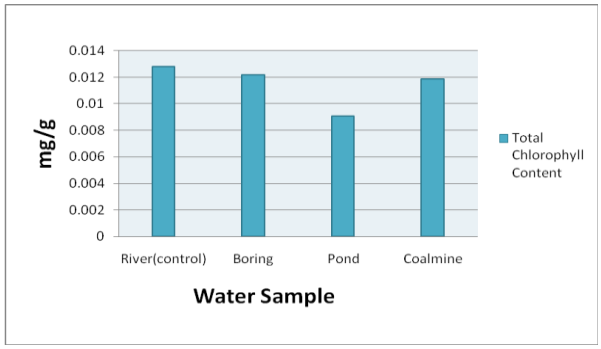

Figure 4: Effect of different sources of water on Total Chlorophyll content of *Trigonella foenum graecum*

Effect on Protein: Insignificant increased was observed in protein content of *Trigonella foenum graecum* irrigated with boring and significantly decrease in plant irrigated using coalmine water as compared to control. Protein content in the leaves recorded significant reduction ($p<0.05$) compared to the control plants treated with sewage[20]. The increase in protein content at lower concentration of effluents could be due to adsorption of most of the nitrogen by plants. Stress induced a decline in soluble protein contents in plants[8]. There was a considerable reduction in the level of protein, lipid and carbohydrate content in the leaves of plant treated with various concentrations of effluent[21].

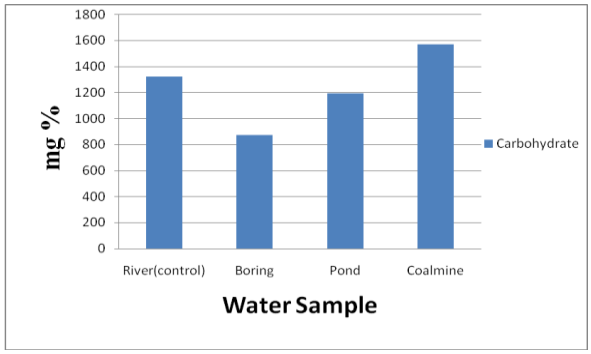

Figure 5: Effect of different sources of water on Carbohydrate content of *Trigonella foenumgraecum*

Because of lower concentration of magnesium and sodium ions the enzymes involved in protein biosynthesis are not accelerated up to extent. So the protein content in *Trigonella foenum graecum* irrigated

with coalmine water is significantly decreased as compared to control.

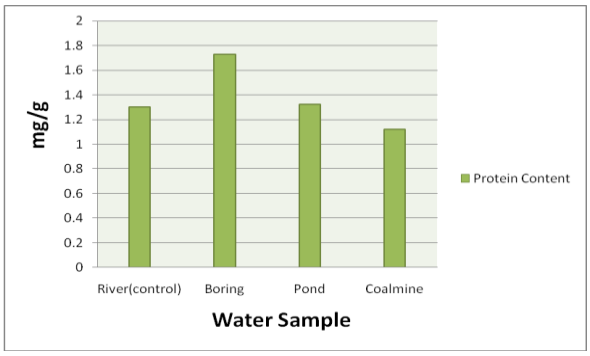

Figure 6: Effect of different sources of water on Protein content of *Trigonella foenum graecum*

Conclusion

It was concluded from the present study that boring water, pond water and water from coalmine can be used irrigate green leafy vegetables without adversely affecting the nutritive value. Though more studies is required related their antioxidant properties.

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