

Chromium uptake by Fenugreek

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Fenugreek (*Trigonella foenum-graecum*) is both [1] herb (leaves) and a spice (seed) belonging to the family Fabaceae. Fenugreek leaves and seeds are used in the cuisine of India. Fenugreek also has [1] medicinal value. Fenugreek seeds are known [2] to reduce serum glucose and improve glucose tolerance and hence are prescribed to diabetic patients. In the recent past supplemental Chromium is being prescribed to diabetic patients [3] to activate (increased- insulin binding, insulin receptor number, insulin receptor phosphorylation) insulin. Plants can uptake substantial quantities of toxic metals from contaminated soils [4] if these soils are well ameliorated.

It is then probable that the medicinal efficacy of Fenugreek in the case of diabetes could enhance if it uptakes chromium from the soil. Preliminary studies are being conducted to note the chromium uptake by Fenugreek from soils which are applied with potassium dichromate.

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Introduction

Medicinal value of fenugreek seeds and chromium in treatment of diabetes is known^[1-3] though they play different roles. Plant tolerance to toxic metals improves^[4] if soils are ameliorated with farm yard manure. The present preliminary study is for the proof of concept of accumulation of Cr in fenugreek seeds and leaves. The experimental conditions in no way are optimized.

Soil Amelioration

The lab scale field trials are conducted at Eshidiya phosphate mine. The soil is highly saline^[5] showing electrical conductivity around 15320 $\mu\text{s}/\text{cm}$ with a Ph around 7.22. The soil was treated with PROM prepared with rock phosphate containing 24.48% P_2O_5 , in 80% passing through 79 microns size that is PR (25/79). The ratio by weight of FYM to rock phosphate in the PROM was 4:1. Three plots of size 1 meterX0.5 meters were made. Each plot was treated with 1.66 Kg of PROM which works out to 1632 Kg of P_2O_5 per Hectare. The P_2O_5 dose is advertantly kept high in view of high salinity of the soil and the impending toxicity of Chromium. It is important to note that P uptake by plants when rock phosphate is used in PROM is as required by the plants and hence the amazing residual effect of PROM.

Dichromate application

Thirty seeds of fenugreek per plot were sowed in all the three plots. While first plot was not given potassium dichromate [treatment one the control] the second [treatment two] and third [treatment three] plots were given two grams and four grams of potassium dichromate respectively as 1% solution in two doses with ten days gap at the time of flowering when the plants reached around ten centimeters height. The dichromate doses to the second and third plots work out to four grams per meter square or forty Kg per Hectare and eight grams per meter square or eighty Kg per Hectare respectively. Plants in the third plot with higher dose of potassium dichromate at eighty Kg per Hectare appeared slow in growth after dichromate application where as the application of dichromate at forty Kg per Hectare was normal as in control and no adverse effect was shown by the plants.

Heavy metal uptake by plants

Most of the heavy metals are toxic^[6] to bio systems. Yet bio systems absorb and accumulate^[6] heavy metals irrespective of their essentiality. Cr⁺³ is reported^[7] to be more toxic than Ag⁺² and UO₂⁺² to Triticum aestivum. L, during seedling growth and Cr⁺⁶ is high in toxicity^[8] compared to Cr⁺³ to Triticum aestivum. L, during seedling growth. It is said that Cr⁺⁶ is reduced to Cr⁺³ in biological materials and hence organic materials almost exclusively contain Cr⁺³. We find^[9-13] a number of research reports that studied Cr absorption and accumulation by bio systems.

Results and discussion

Table - 1

S.No	Treatment	% Cr in leaves	% Cr in seeds
1.	Control, No applied Cr	0.000445	0.000085
2.	Potassium Di Chromate @ 40 kg/ha	0.00184	0.00034
3.	Potassium Di Chromate @ 80 kg/ha	0.01105	0.00043

Table 1 shows Cr concentration in the leaves and seeds of Fenugreek treated with 40 and 80 Kgs of potassium dichromate per hectare. If we take^[3] the requirement of Cr at 200 µg per day for those who are mildly glucose intolerant then 100 grams of chromated Fenugreek leaves may full fill the requirement. The Cr concentration achieved in this study is 24.83 times higher than the control in case of the leaves and 5.1 times higher in case of the seeds. Cr content in the leaves and seeds of chromate fenugreek products may be adjusted by mixing the powders of the leaves and seeds.

Cr content is analyzed at the Department of Chemical Engineering, Andhra University, Vizag with AAS of Perkin El mer (Model: AA200) using air-acetylene flame.

Conclusion

The present study though is of limited scope, proves the concept of concentration of Cr from soils into the leaves and seeds of Fenugreek. This warrants further detailed study.

Acknowledgement

The authors are thankful to Mr. T Kodala Rao for his assistance in conducting the field experiments. The authors are grateful to Er. John Britto for patiently editing and styling the manuscript. Authors are thankful to Prof. N C Aery for providing reprints of his published work related to heavy metal uptake by plants.

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