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Asian Journal of Plant Science and Research, 2015, 5(7):16-21

ISSN : 2249-7412
CODEN (USA): AJPSKY

Responses of fenugreek (*Trigonella foenum-graecum* L. cultivars 'RMT-1' and 'PEB') to potassium treatments

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ABSTRACT

Fenugreek (Trigonella foenum-graecum L.) is an annual herb belonging to family fabaceae and because of its strong flavour and aroma its leaves and seeds are used as spices and condiments. Fenugreek has also attracted attention as a component of traditional medicines. Reports regarding the chemical constituents and pharmacological properties are available in the literature. Many studies stated the influence of nitrogen and phosphorus applications on fenugreek, however, there are hardly any reports available on the effects of potassium treatments. The present study focuses on potassium induced alterations in fenugreek. Laboratory and pot experiments have been conducted on two cultivars of fenugreek viz., RMT-1 and PEB (procured from JNKVV, Jabalpur and Government Nursery, Dhar respectively) in School of Studies in Botany, Jiwaji University, Gwalior. Different potassium treatments were employed to evaluate the effects of potassium on growth and biochemical parameters. Nitrate reductase activity, total phenols, chlorophyll and carotenoid contents were estimated using standard methods. K+ rate was calculated using flame photometer. Supplementation of potassium has resulted into enhanced nitrate reductase activity in leaf, stem and root which is also reflected in the fresh and dry weight of respective parts. Interestingly, applied potassium has also shown an impact on total phenols, total chlorophylls and carotenoids which may have a bearing on its pharmacological value in general and antioxidant potential in particular. Chlorophyll and carotenoid contents exhibited an increase as a result of potassium treatment more conspicuously in cultivar 'PEB' so also is true for nitrate reductase activity indicating cultivar difference. This communication presents and discusses these aspects of fenugreek as influenced by potassium treatments.

Keywords: *Trigonella foenum-graecum* L., nitrate reductase, total phenols, total chlorophylls, carotenoids etc.

INTRODUCTION

Leaves of *Trigonella foenum-graecum* L. are consumed as leafy green vegetables in India and are rich in Ca, Fe, Carotene B and vitamins [1]. Fenugreek is a good soil renovator and is widely used as a green manure [2]. Potassium (K) is the third important macronutrient after nitrogen (N) and phosphorus (P) required for plant growth and is implicated in many basic biochemical and physiological processes [3]. Leaves and seeds of fenugreek are included in normal diet of family, especially diet of growing kids, pregnant ladies, puberty reaching girls and elder members of family because of their haematinic value [4]. Legumes are functional foods having therapeutic properties and promoting good health [5, 6]. Methi was used to ease childbirth and to increase milk flow, and modern Egyptian women are still using it to relieve menstrual cramps. The Chinese call it *hu lu ba*, and also use it to ease abdominal pain. This cool season crop is grown in most corners of the world, however, awareness about its value and uses vary considerably. In India, fresh *methi ka saag* (the stems and leaves of the plant) is a very common winter vegetable, and the seeds are used year round as a flavouring agent for various dishes whereas, it is not so well known in west. The leaves of methi rich in iron, calcium, sulphur and vitamins A and C and are highly alkaline.

They possess as much protein as most pulses do, and therefore can substitute for other sources of protein [7]. Fenugreek possesses restorative and nutritive properties and is useful in healing of ulcers in digestive tract stimulating digestive processes [8]. Strong flavor and aroma of the leaves and seeds of fenugreek are possibly responsible for its consumption as spice in oriental countries. Fenugreek is a rich source of calcium, iron, ß-carotene and other vitamins [9]. Fenugreek exhibits antitumor, antiviral, antimicrobial, anti-inflammatory and antioxidant properties [10]. Legumes are low in Na and are good source of starch, dietary fibre, protein and minerals such as Ca, Fe, K, Mg and Zn and are containing no cholesterol [6].

MATERIALS AND METHODS

Seeds of *Trigonella foenum-graecum* L. (fenugreek) cultivars 'RMT-1' and 'PEB' were obtained from JNKVV, Jabalpur and Govt. Nursery, Dhar, M.P. respectively. Healthy and uniform seeds were screened for sowing.

Healthy seeds were selected and used for germination under different treatments of potassium salts. Seeds were surface sterilized using 0.01% mercuric chloride and thoroughly washed with water and finally with distilled water. For laboratory experiments each petriplate was lined with Whatman's filter paper number 1 in two layers. Ten seeds were placed in each petriplate. Salt of K_2O were used in varying concentrations (0.001M, 0.01M and 0.1M). Seven days after sowing seedlings were used for recording data and analysis.

For pot experiment separate pots were maintained for each treatment. Three levels of potassium K_1 (20 kg ha^{-1}), K_2 (40 kg ha^{-1}) and K_3 (60 kg ha^{-1}) were maintained with reference to the control without potassium.

Chlorophyll contents in leaves were estimated following Arnon's method [11] and Carotenoides were calculated following Kirk and Allen's [12] formulae.

In vivo Nitrate reductase activity was determined following Srivastava [13] as adopted by Tiwari [14].

Potassium and Sodium estimation was done flame photometrically as adopted by Tiwari [14] and total phenols in leaf, stem and root of cultivar 'PEB' of fenugreek were estimated by using procedure given in Sadasivam and Manickam [15].

RESULTS AND DISCUSSION

Total chlorophylls, carotenoids, total phenols and nitrate reductase activity increased as a result of potassium treatments. Total phenols were found to be maximum in leaves of 0.001 M K_2O treatment (21.166±1.388 mg/ gm dry wt). Leaves under all treatments were found to have higher levels of total phenols than other parts i.e, stem and roots (Fig. 1, 2, 3 and 4).

Nitrate reductase activity was greater in leaves than root and stem and potassium treatment enhanced it. Nevertheles, cultivar difference was obvious.

Potassium contents estimated in different parts of plants have shown an increase with increasing potassium supplementation (Figure 5).

Fig. 1: Chlorophyll and carotenoid contents (mg/gm fresh wt) in *Trigonella foenum-graecum* L. cultivar PEB under different potassium treatments (7 DAS)

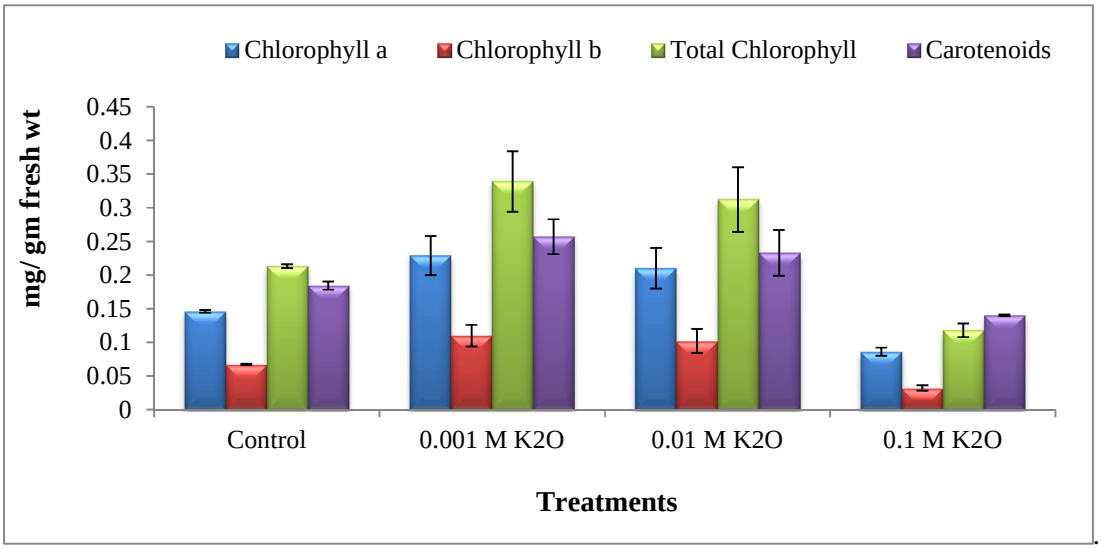


Fig. 2: Total phenols (mg/ gm dry wt) in *Trigonella foenum-graecum* L. cultivar PEB with varying potassium doses

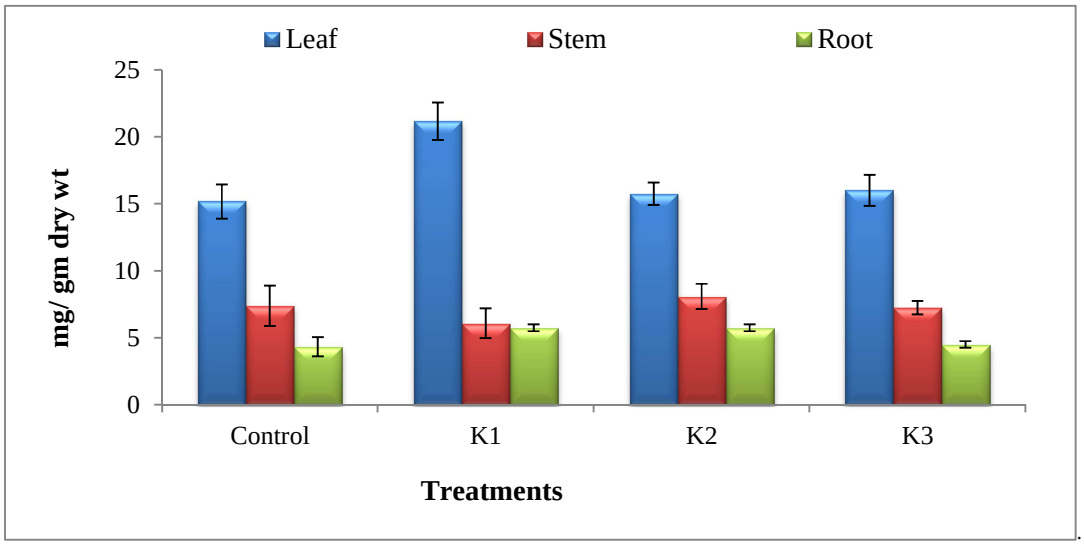


Fig. 3: Nitrate Reductase activity (µmole nitrite produced/hr/gm fresh wt) in *Trigonella foenum-graecum* L. cultivar PEB under different potassium treatments (7 DAS)

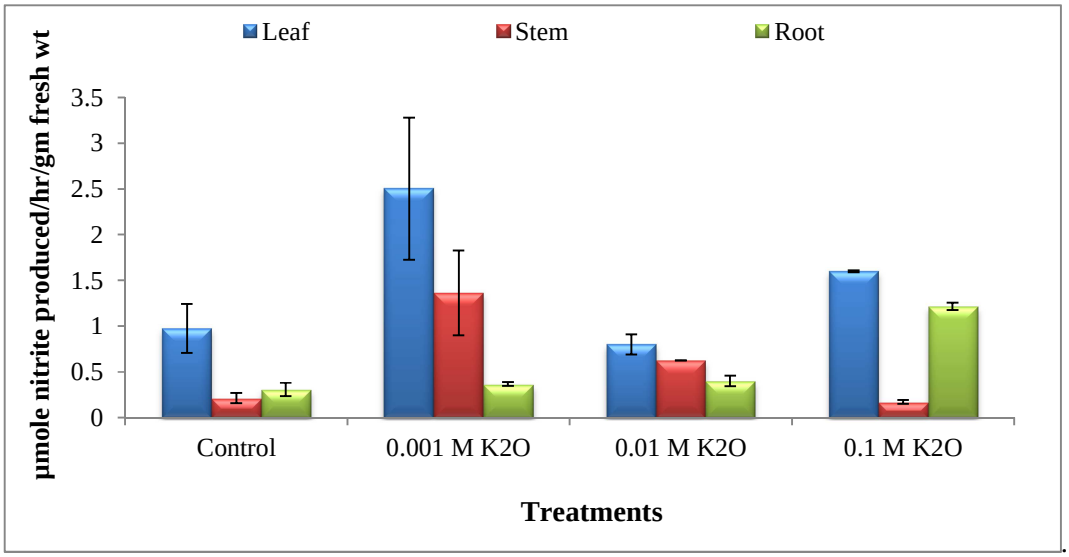


Fig. 4: Nitrate Reductase activity (µmole nitriteproduced/hr/gm fresh wt) in *Trigonella foenum-graecum* L. cultivar RMT-1 under different potassium treatments (7 DAS)

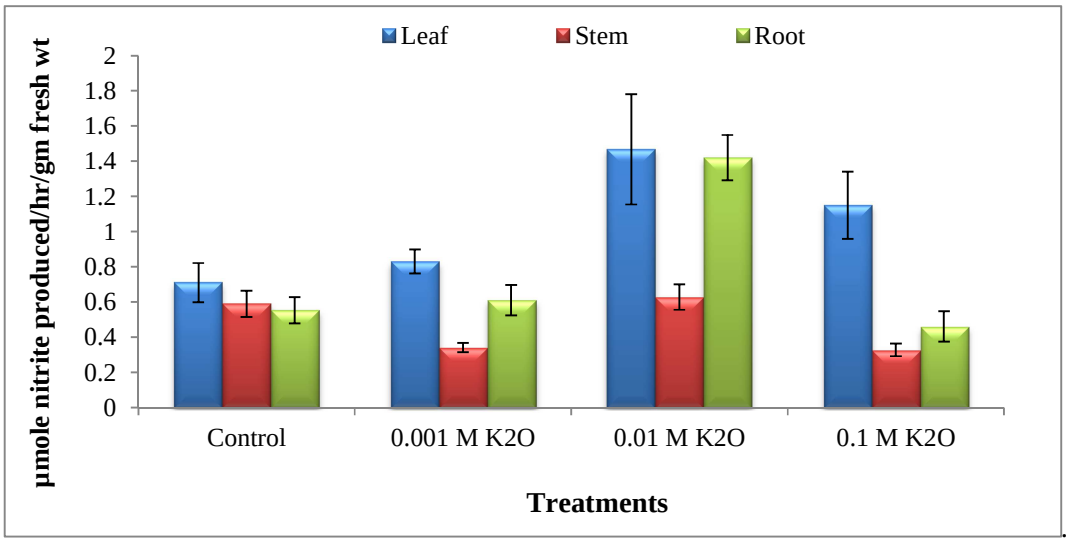
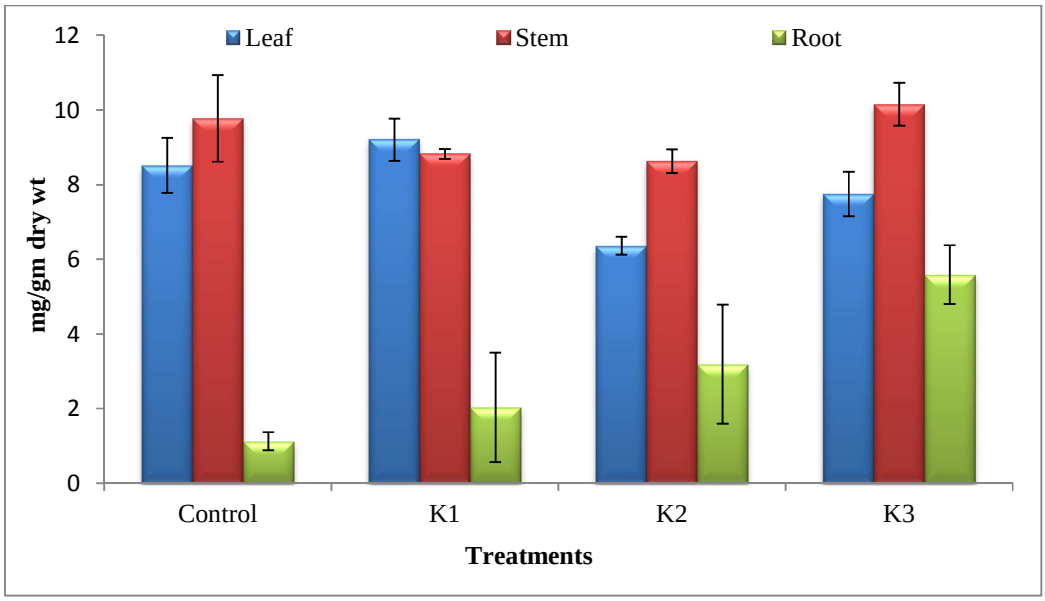


Figure 5: Potassium in *Trigonella foenum-graecum* L. cultivar PEB with varying potassium doses (pot experiments)



Disease incidence increased with increase in nitrogen levels but decreases with potassium application [16]. Application of potassium also increased the phenolic contents which in turn inhibits the pathogen growth [17].

Improvement in nitrogen utilization and overall nitrogen metabolism is observed with the application of potassium that reflects the importance of potassium in nitrogen metabolism [18, 19].

Insufficient level of potassium is often accompanied by a decrease in leaf area leading to an increased concentration of cellular components, carbohydrates and nutrients over a given unit of leaf area compared with leaves with adequate potassium levels ultimately diminishing the yield and quality produced by those plants [20, 21]. Our experiments also corroborate that potassium supplementation not only improves growth but also enhances nitrate reductase activity, the initial enzyme of nitrogen assimilation which will be reflecting on nitrogen utilization. Positive influence of potassium on total phenols and carotenoids may have an impact on pharmacological value of the plant.

CONCLUSION

Substantial information is available on influence of nitrogen treatments to different crops however, work has been done in potassium induced changes particularly fenugreek. The paper repots positive influence of potassium on certain growth parameters of fenugreek which could be of multifarious value.

Acknowledgements
I am grateful to Prof R M Agarwal, Head, School of Studies in Botany, Jiwaji University, Gwalior for providing facilities during work.

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