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Effect of integrated nutrient management on quality and NPK content of Kasuri Methi (*Trigonella corniculata* L.) under Telangana conditions

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Abstract

A field experiment was conducted during *rabi* 2018-19 at College of Horticulture, Rajendranagar, Hyderabad, India, to study the effect of integrated nutrient management on Kasuri Methi (*Trigonella corniculata* L.) var. Pusa Kasuri. The experiment was evaluated in randomized block design with eleven treatment combinations were replicated thrice. Among the treatments, T₃ - 75% RD NPK + FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹) recorded significantly maximum crude protein content of herb and seed (10.41% and 19.97%, respectively), total chlorophyll content (23.68 mg/100 mg of tissue) and nitrogen, phosphorous and potassium content in herb, straw and seed (1.67%, 1.37% and 3.20%, 0.54%, 0.39% and 0.60%, 0.51%, 0.83% and 0.43% respectively) over other treatments.

Keywords: *Rhizobium*, *azospirillum*, PSB, NPK, FYM, vermicompost and RDF

Introduction

Kasuri methi is an herbaceous, bushy, slow growing annual spice crop, belongs to the family fabaceae and is native to the Mediterranean region. It has diploid number of chromosomes 2n=16 (Anon., 2004) [2]. It has many regional names like 'Champamethi' and 'Marwari methi' (Hindi), Piring (Assami) and in English it is popularly called as sickle fruited fenugreek. Kasuri methi is mainly grown in India, Pakistan, China, Nepal and Bangladesh. In India, it is commercially grown in Rajasthan, Gujarat, Madhya Pradesh, Haryana, West Bengal, Punjab and Maharashtra. Moreover Rajasthan occupies 80 per cent of area and production (Babaleshwar and Shetty, 2017) [4].

In India it is cultivated in an area of 1.49 lakh ha with a production of 2.02 lakh MT (National Horticulture Board, 2017) [8].

Kasuri methi is a semi arid crop, grows up to 30 cm height and its leaves are pinnate shape with size of leaflets being 1.25-2.0 cm and consists bright orange-yellow coloured flowers. Pods are 1.2-2.2 cm long, sickle shaped with 4-8 seeded number. Kasuri Methi is mainly grown for herbage as well as for seed, used as a spice to add aroma and flavor to the food products. Presently Kasuri methi cultivation is confined to North Indian States only. However due to increase in its usage as well as an assured remuneration, there is a need to expand an area under this valuable spice crop. Improper nutrient management is one of the major reason which causes lower yield and poor quality seed in Kasuri Methi. So, the integrated nutrient management approach could be a rational way to increase herbage yield and seed quality.

The indiscriminate and continuous application of chemical fertilizers causes soil and environmental degradation and also increases the cost of cultivation of the crop. Hence, a lot of importance is given to integrated nutrient management (INM) which involves supplying of nutrient requirements by integration of organic, inorganic and bio fertilizers helps not only in increasing the yield but also in maintains the soil health and eco-friendly environment. It is mainly grown as a *rabi* season crop and the cultivation methods are more or less similar to that of common methi. The nutrient requirement of the crop through integrated approach is not

studied so far under Telangana conditions. Hence, there is a need to study the optimum dose of nutrients from different sources.

Material and Methods

Present field experiment was conducted during *rabi* 2018-19 at College of Horticulture, Rajendranagar, Hyderabad, Telangana, India. The experiment was carried out with eleven treatments i.e. T₁ - 75% RD NPK+ FYM (7.5 t/ha) + *Rhizobium* (1.5 kg ha⁻¹) + PSB (5 kg ha⁻¹), T₂ - 75% RD NPK+ Vermicompost (4 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + PSB (5 kg ha⁻¹), T₃ - 75% RD NPK +FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹), T₄ - 75% RD NPK + Vermicompost (4 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹), T₅ - 75% RD NPK + FYM (3.75 t ha⁻¹) + Vermicompost (2 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹), T₆ - 50% RD NPK + FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + PSB (5 kg ha⁻¹), T₇ - 50% RD NPK + Vermicompost (4 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + PSB (5 kg ha⁻¹), T₈ - 50% RD NPK + FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹), T₉ - 50% RD NPK + Vermicompost (4 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹), T₁₀ - 50% RD NPK + FYM (3.75 t ha⁻¹) + Vermicompost (2 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹) and T₁₁ - Control - RD of fertilizers (NPK @ 80:50:50 kg ha⁻¹ + FYM - 7.5 t ha⁻¹) in a Randomized Block Design and replicated thrice. Seeds were sown in the plot of 2 m × 2 m at spacing of 30 cm × 10 cm. The recommended dosages of N, P and K @ 80:50:50 kg ha⁻¹ were applied in the form of urea, single super phosphate and muriate of potash respectively. Urea was applied in the two splits, the first as basal application and the other at 30 days after sowing. The entire dose of single super phosphate and muriate of potash were applied at the time of sowing as basal dose. The vermicompost and the farmyard manure were incorporated in to respective plots just prior to sowing of seed and then slightly covered with the fine soil.

The biofertilizer viz., *Rhizobium* was applied as seed inoculation (1.5 kg ha⁻¹) and *Azospirillum* and PSB (5 kg ha⁻¹) as soil application. The experimental data was analysed statistically by the method of analysis of variance as outlined by Panse and Sukhatme (1985) [9].

To determine the crude protein content nitrogen was estimated by Micro-Kjeldhal method and crude protein content was calculated by multiplying the nitrogen content of the leaves and the seeds by 6.25 and mean value was expressed. Chlorophyll content was estimated by using dimethyl sulphoxide (DMSO) as suggested by Shoaf and Lium (1976) [10]. The nitrogen content in the plant samples was estimated by Micro Kjeldhal method (AOAC, 1995) [3] and expressed in percentage on dry weight basis. The phosphorus content of plant sample was determined by Vanado molybdo phosphoric yellow colour method (Jackson, 1967) [7] and expressed in percentage on dry weight basis and the potassium content in plant samples was determined by flame photometer method as described by Jackson (1967) [7] and expressed in percentage on dry weight basis.

Results and Discussion

Quality parameters

Quality parameters such as crude protein content in herb and seed and chlorophyll content of leaves were studied. The results related to quality parameters indicated that, among the

treatments, T₃ - 75% RD NPK + FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹) recorded significantly maximum crude protein content of herb and seed (10.41% and 19.97%, respectively) and total chlorophyll content (23.68 mg/100 mg of tissue) over other treatments showed in Table 1.

The data enunciated on crude protein content revealed that, among the treatments T₃ - 75% RD NPK + FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹) recorded the highest value. Which might be due to the application of FYM and N fixing biofertilizers which helped in availability of nitrogen element throughout the cropping period, which in turn resulted in better uptake and assimilation of crude protein in herb and seed. These results are in conformity with the Dubey *et al.* (2012) [6] and Anitha *et al.* (2015) [11] in fenugreek.

Maximum total chlorophyll content was recorded in T₃ - 75% RD NPK + FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹). This might be due to the availability of major and micronutrients supplied by the organic manure, inorganic fertilizers and biofertilizers. Which would be slow down senescence and improve the photosynthates, similarly increasing the chlorophyll content in leaf tissue. The similar results were also obtained by Sunanda *et al.* (2014) [11] and Baballeshwar *et al.* (2017) [5] in kasuri methi.

NPK content in herb, straw and seed

The results related to NPK content showed that, among the treatments, T₃ - 75% RD NPK + FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹) recorded significantly maximum nitrogen, phosphorous and potassium content in herb, straw and seed (1.67%, 1.37% and 3.20%, 0.54%, 0.39% and 0.60%, 0.51%, 0.83% and 0.43% respectively) as compared to rest of the treatments showed in Table 2.

Maximum nitrogen, phosphorous and potassium content in herb, straw and seed was recorded in T₃ - 75% RD NPK + FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹) which might be due to better uptake of nutrients by adopting the INM practices helped in availability of nutrients throughout the crop period. Moreover application of biofertilizers increased the major and micronutrients availability in the rhizosphere as a greater expansion, resulted in more uptake of nutrients by the plants. The application of nutrients through FYM definitely increased the nutrient content in the crop and also improved the physicochemical properties of the soil. The present findings are comparable with that of Dubey *et al.* (2012) [6] in fenugreek and Baballeshwar *et al.* (2017) [4] in kasuri methi.

Conclusion

From above investigation, it could be concluded that different treatment combinations significantly influence the quality and NPK content in kasuri methi var. Pusa Kasuri. The crude protein content, chlorophyll content and NPK content can be increased with the application of treatment T₃ - 75% RD NPK + FYM (7.5 t ha⁻¹) + *Rhizobium* (1.5 kg ha⁻¹) + *Azospirillum* (5 kg ha⁻¹) + PSB (5 kg ha⁻¹). The present study indicated that practising INM promoted favourable soil environment for the growing crop by improving soil organic carbon and soil physico-chemical properties leading to better herb and seed quality and NPK content of kasuri methi than inorganic farming system with RDF only.

Table 1: Effect of integrated nutrient management on quality parameters of kasuri methi var. Pusa Kasuri

Treatments	Crude protein content (%)		Chlorophyll contents (mg/100 mg of tissue at 60 DAS)		
	Herb	Seed	Chlorophyll 'a'	Chlorophyll 'b'	Total chlorophyll
T ₁	8.54 ^d	18.12 ^{cd}	15.23 ^d	5.33 ^{bc}	20.56 ^{cd}
T ₂	8.37 ^{de}	17.77 ^d	14.02 ^f	4.80 ^{cd}	18.83 ^f
T ₃	10.41 ^a	19.97 ^a	17.35 ^a	6.32 ^a	23.68 ^a
T ₄	8.77 ^{cd}	18.29 ^c	15.41 ^{cd}	5.06 ^c	20.24 ^d
T ₅	9.47 ^b	18.98 ^{bc}	16.17 ^b	6.16 ^a	22.33 ^b
T ₆	7.21 ^g	17.22 ^{de}	12.63 ⁱ	4.02 ^e	16.65 ⁱ
T ₇	7.08 ^g	16.83 ^e	11.47 ^j	3.39 ^f	15.50 ^j
T ₈	7.27 ^{fg}	17.58 ^d	15.24 ^d	4.98 ^c	20.23 ^{de}
T ₉	7.89 ^{ef}	17.18 ^e	12.92 ^{hi}	4.43 ^{de}	17.36 ^h
T ₁₀	7.33 ^f	17.14 ^e	13.42 ^{gh}	4.78 ^d	18.20 ^g
T ₁₁	7.97 ^e	17.60 ^d	14.46 ^{ef}	5.18 ^c	19.65 ^e
SEm ±	0.22	0.31	0.18	0.21	0.21
CD at 5%	0.64	0.92	0.54	0.62	0.62

Table 2: Effect of integrated nutrient management on NPK content of Kasuri Methi var. Pusa Kasuri

Treatments	Nitrogen content (%)			Phosphorous content (%)			Potassium content (%)		
	Herb	Straw	Seed	Herb	Straw	Seed	Herb	Straw	Seed
T ₁	1.37 ^d	1.10 ^b	2.90 ^{cd}	0.39 ^d	0.30 ^b	0.45 ^{cd}	0.35 ^e	0.63 ^d	0.32 ^{bc}
T ₂	1.34 ^{de}	1.05 ^c	2.84 ^d	0.42 ^c	0.31 ^b	0.49 ^c	0.36 ^{de}	0.66 ^{cd}	0.34 ^b
T ₃	1.67 ^a	1.37 ^a	3.20 ^a	0.54 ^a	0.39 ^a	0.60 ^a	0.51 ^a	0.83 ^a	0.43 ^a
T ₄	1.40 ^{cd}	1.08 ^{bc}	2.93 ^c	0.43 ^c	0.27 ^c	0.50 ^{bc}	0.40 ^{cd}	0.68 ^c	0.36 ^b
T ₅	1.52 ^b	1.24 ^{ab}	3.04 ^{bc}	0.49 ^{ab}	0.34 ^{ab}	0.56 ^{ab}	0.45 ^b	0.80 ^a	0.40 ^a
T ₆	1.15 ^g	0.92 ^c	2.76 ^d	0.33 ^{ef}	0.24 ^{cd}	0.35 ^{ef}	0.33 ^{ef}	0.57 ^{ef}	0.25 ^d
T ₇	1.13 ^g	0.90 ^c	2.69 ^e	0.31 ^f	0.22 ^d	0.32 ^f	0.31 ^f	0.55 ^f	0.23 ^d
T ₈	1.16 ^g	1.04 ^c	2.81 ^d	0.41 ^{cd}	0.27 ^c	0.48 ^c	0.34 ^e	0.58 ^e	0.27 ^c
T ₉	1.26 ^{ef}	1.02 ^c	2.75 ^{de}	0.35 ^e	0.26 ^c	0.42 ^d	0.35 ^e	0.61 ^{de}	0.26 ^{cd}
T ₁₀	1.17 ^{fg}	0.95 ^c	2.74 ^e	0.38 ^{de}	0.29 ^{bc}	0.45 ^{cd}	0.33 ^{ef}	0.59 ^e	0.29 ^c
T ₁₁	1.28 ^e	1.03 ^c	2.82 ^d	0.46 ^{bc}	0.31 ^b	0.52 ^b	0.39 ^d	0.69 ^{bc}	0.38 ^{ab}
SEm ±	0.03	0.06	0.05	0.02	0.02	0.02	0.01	0.02	0.02
CD at 5%	0.10	0.18	0.15	0.05	0.06	0.06	0.04	0.05	0.06

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