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Effect of biofertilizers and inorganic sources of Nitrogen and Phosphorus on quality production of kasuri methi (*Trigonella corniculata*)

S. Singh[1], M.R. Choudhary[1], O.P. Garhwal[1], M.L. Jakhar[2], and B.L. Yadav[3]

[1]Department of Horticulture, S.K.N. College of Agriculture, Jobner, Jaipur.

[2]Department of Plant Breeding & Genetics S.K.N. College of Agriculture, Jobner, Jaipur.

[3]Department of Soil Science, S.K.N. College of Agriculture, Jobner, Jaipur.

ABSTRACT

Kasuri methi (*Trigonella corniculata*) is a slow growing seed spice plant remains in a rosette condition during vegetative growth. It is mainly grown as leafy vegetable and seeds in the plains of north India. The experiment consisted of four treatments of fertility levels (control, 50% RDF, 75% RDF and 100% RDF) and four treatments of bio-fertilizers (Control, *Rhizobium*, PSB and *Rhizobium* + PSB), thereby making sixteen treatment combinations. The experiment was laid out in Randomized Block Design and replicated three times. The treatment combination of 100 per cent RDF and *Rhizobium* + PSB resulted in the highest and significantly more leaf area, nodules per plant, yield, protein and ascorbic acid content in leaves while it was found statistically at par with 75 per cent RDF and *Rhizobium* + PSB. Thus, combined application of 75% RDF and *Rhizobium* + PSB is a treatment for better quality production of kasuri methi leaves.

Key words : Biofertilizers, Inorganic, Nitrogen, Kasuri methi

INTRODUCTION

Kasuri Methi *(Trigonella corniculata)* is mainly grown as leafy vegetable and seeds in the plains of north India. It contains all important nutrients required for growth and maintenance of human body. Its fresh tender leaves and pods are eaten as fried vegetable being rich in iron, calcium, protein and vitamins. Being a leguminous crop, kasuri methi is highly responsive to nitrogenous fertilizer application especially in early stages. The supply of phosphorus is also reported to serve dual purpose of increasing the yield of legume as well as that of succeeding crop. Bio-fertilizers are one of the important components used in supplementing the effectiveness of chemical fertilizers. Apart from fixing atmospheric nitrogen (*Rhizobium*) the micro-organism of the bio-fertilizers helps in synthesis of phytohormones and built up organic status of the soil that also increases the availability of other nutrients. (Pareek *et al.*, 6).

MATERIALS AND METHODS

The experiment was conducted at Horticulture Farm,SKN College of Agriculture ,Jobner during 2010-11. The experiment consisted of four treatments of fertility levels (control, 50% RDF, 75% RDF and 100% RDF) and four treatments of bio-fertilizers (Control, *Rhizobium*, PSB and *Rhizobium* + PSB), thereby making sixteen treatment combinations. The experiment was laid out in Randomized Block Design with three replications. In order to evaluate the effect of different treatments on growth, yield and quality of crop, necessary periodical observations were recorded namely leaf area per plant (cm^2) at harvest by leaf area meter (LICOR-3100, Lincoln, USA), number of effective nodules per plant, total leaf yield (q/ha), protein content in leaves (%) and ascorbic acid in leaves (mg / 100 g) etc. The experimental data recorded were subjected to statistical analysis using analysis of variance as outlined by Panse and Sukhatme (5).

RESULTS AND DISCUSSION

The application of 100 per cent RDF of NP with *Rhizobium* + PSB recorded the maximum leaf area per plant, but it was found statistically at par with 75 per cent RDF and *Rhizobium* + PSB and 100 per cent RDF with PSB. Thus, the application of 100 per cent RDF and *Rhizobium* + PSB and 75 per cent RDF and *Rhizobium* + PSB were found to be the best treatment (Table 1). Under present experiment, the effect of application of higher doses of RDF of NP on growth parameters of the kasuri methi crop appears to be on account of enrichment of soil with both the nutrients to the level of sufficiency. The significant improvement in nutrient status of plant parts resulted in better availability of nutrient for growth and development of the plant right from early stages. PSB + *Rhizobium* might also have improved both nitrogen and available phosphorus in rhizosphere as they are symbiotic nitrogen fixers and phosphate solubilizers, respectively. N and P are the major plant nutrients and combined inoculation of N fixers and PSB benefit the plants than

*Corresponding author: Email: mrcrau@gmail.com

Table 1. Effect of fertility levels (N-P) and bio-fertilizers on effective number of nodules per plant, leaf yield per cutting and total leaf yield(q/ha)

Bio-fertilizers	Fertility levels (N-P)											
	Effective no. of nodules per plant				Average Leaf yield per cutting (kg/plot)				Total leaf yield (q/ha)			
	Control	50% RDF	75% RDF	100% RDF	Control	50% RDF	75% RDF	100% RDF	Control	50% RDF	75% RDF	100% RDF
Control	29.04	49.25	53.17	56.74	0.309	0.411	0.496	0.524	92.70	123.30	148.80	157.20
Rhizobium	50.29	53.09	64.13	70.36	0.417	0.477	0.518	0.530	125.10	143.10	155.40	159.00
PSB	47.14	54.87	56.26	60.21	0.486	0.515	0.526	0.558	145.80	154.50	157.80	167.40
Rhizobium+ PSB	49.15	56.94	71.33	74.11	0.523	0.547	0.559	0.582	156.90	164.10	167.70	174.60
SEm±	1.65				0.012				3.65			
CD (P = 0.05)	4.75				0.035				10.48			

Table 2. Effect of fertility levels (N-P) and bio-fertilizers on leaf area, protein content and ascorbic acid content of leaves

Bio-fertilizers	Fertility levels (N-P)											
	Leaf area				Protein content in leaves (%)				Ascorbic acid content in leaves (mg/100g)			
	Control	50% RDF	75% RDF	100% RDF	Control	50% RDF	75% RDF	100% RDF	Control	50% RDF	75% RDF	100% RDF
Control	10.98	18.32	22.93	24.09	3.017	4.155	4.189	5.092	143.16	198.89	201.57	207.09
Rhizobium	17.82	19.56	23.99	26.04	3.924	4.208	4.312	5.245	194.52	202.12	211.03	214.45
PSB	17.89	20.17	22.97	26.88	3.845	4.288	4.356	5.207	196.38	206.99	215.62	217.69
Rhizobium+ PSB	21.04	26.65	29.76	30.62	4.058	4.741	5.240	5.462	201.27	209.89	229.36	237.64
SEm±	0.55				0.084				4.28			
CD (P = 0.05)	1.59				0.242				12.34			

Table 3. Effect of fertility levels (N-P) and bio-fertilizers on net returs and B: C ratio.

Bio-fertilizers	Fertility levels (N-P)							
	Net returns (Rs./ha)				B: C ratio			
	Control	50% RDF	75% RDF	100% RDF	Control	50% RDF	75% RDF	100% RDF
Control	54200	93722	120293	130344	1.08	1.82	2.33	2.52
Rhizobium	96484	115006	129277	134828	1.72	2.23	2.50	2.60
PSB	116884	126406	131977	145028	2.33	2.45	2.56	2.80
Rhizobium+ PSB	130978	138400	145771	154322	2.61	2.69	2.82	2.98
SEm±	2997				0.06			
CD (P = 0.05)	8697				0.17			

either group of organism alone and may have an added advantage in the degraded agro-ecosystem. These findings are in close conformity with that of Chattopadhyay and Dutta (1) and Tyagi *et al.* (9).

The application of 100 per cent RDF and *Rhizobium* + PSB, 75 per cent RDF and *Rhizobium* + PSB and 100 per cent RDF + PSB were found to be the best treatment with respect to leaf yield kg per plot and total leaf yield (Table 1). The significant increase in yield under the combined application of inorganic fertilizers as basal dose and seed inoculation was largely a function of improved growth and other yield attributes. The profound influence of N and P fertilization and inoculation with *Rhizobium* + PSB biofertilizers on biological yield mediated via increased photosynthetic efficiency and nutrient accumulation might have ultimately led to production of higher yield under its application. The interactive advantages of combining fertility levels and bio-fertilizers generally proved superior might be due to synergistic effects of both and enhanced plant growth by promoting the miasmatic activity, which favours plant growth and finally leaf and seed yield. Similar results were reported by Shukla *et al*. (7) and Mehta *et al*. (3).

The effect of inorganic fertilizers and bio-fertilizers were found to be significant on protein content and ascorbic acid of leaves. The maximum protein content and ascorbic acid of leaves were recorded with treatment 100% RDF and *Rhizobium* + PSB. This treatment was found statistically at par with 75% RDF and *Rhizobium* + PSB and 100% RDF + *Rhizobium* (Table 2). Significant increase in protein content observed in the present investigation because of increased N content in grains and leaves which might be the result of increased availability of nitrogen to plants. These results are in close conformity with the findings of Pandya and Bhatt (4) and Gupta *et al*. (2). Seed inoculation with *Rhizobium* + PSB significantly enhanced the protein content and ascorbic acid in leaves over control and sole inoculation of *Rhizobium* and PSB (Table 2). The combined inoculation of seeds with *Rhizobium* + PSB was more beneficial in enhancing all the above parameters due to increased solubility of phosphorus and higher nitrogen fixation in nodules leading to increased availability of nitrogen and phosphorus. These results corroborate the findings of Tanwar *et al.* (8).

Application of 100 % RDF with *Rhizobium* + PSB inoculation in combination under kasuri methi crop recorded significantly higher net return and B: C ratio over control and rest of treatments. Although, the combined application of 75 % RDF with Rhizobium + PSB inoculation was found statistically at par to it (Table 3).

On the basis of results, it may be concluded that the combined application of 75% RDF and *Rhizobium* + PSB was found suitable in terms of yield and net return and resulted in saving of 25% RDF. Thus, application of 75% RDF and seed inoculation with *Rhizobium* + PSB to kasuri methi is recommended for sandy loam conditions of the soil.

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