Original Research Article

Effect of organic manures and biofertilizers on NPK content of Kasuri methi (*Trigonella corniculata* L.) CV. – Pusa Kasuri

ABSTRACT

The study was carried out at the Research field, Department of Horticulture, College of Agriculture, Gwalior M.P. during rabi 2021-22. The purpose of the study is to evaluate the plant in terms of various parameters such as nitrogen, phosphorous and potassium content in herb and grain. The results of the study indicated that the application of organic manures and bio fertilizers improved the nitrogen, phosphorous and potassium content in herb and grain. The highest nitrogen (1.53% and 3.35%), phosphorous (0.43% and 0.56%) and potassium (0.46% and 0.57%) were observed in the plants treated with FYM (16 t/ha) + Vermicompost (4 t/ha) + *Rhizobium* (10 ml/kg seed) + PSB (10 ml/kg seed) + KSB (10 ml/kg seed) as compared with control.

Key words: biofertilizers, Kasuri methi, organic farming

1. INTRODUCTION

Kasuri methi, scientifically known as *Trigonella corniculata* L and belonging to the Fabaceae family, is an herbaceous plant that grows as an annual spice crop. It is primarily cultivated for its herbage, which is dried for various uses. This herb is commonly grown in the northern plains of India, where its fresh green leaves are utilized in salads and cooked dishes. Additionally, the dried leaves, known for their aromatic qualities, are employed as a seasoning spice for a variety of foods, particularly during the off season. Kasuri methi, a semi – arid crop, typically reaches a height of about 30 cm. Its leaves are pinnate in structure, with individual leaflets measuring between 1.25 to 2.0 cm and it and it produces bright orange – yellow flowers. The pods it bears are approximately 1.2 to 2.2 cm long and possess a sickle shaped appearance, containing 4 to 8 seeds per pod.

Additionally, it is a valuable source of essential minerals, vitamins and dietary fibers. These green leaves are known to contain various alkaloids, including trigonelline, choline, gentianine and carpaine. Furthermore, they are rich in vitamins such as carotene (measuring 2.34 mg/100 g of fresh edible portion), thiamine (0.04 mg), riboflavin (0.31 mg), nicotinic acid (0.8 mg) and vitamin C (52.0 mg/100 g of edible portion).

“Bio-fertilizers are being essential component of organic farming are the preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing or cellulolytic micro-organisms used for application to seed, soil or composting areas with the objective of increasing number of such micro-organisms and accelerate those microbial processes which augment the availability of nutrients that can be easily assimilated by plants. Biofertilizers play a very significant role in improving soil fertility by fixing atmospheric nitrogen, both, in association with plant roots and without it, solubilise insoluble soil phosphates and produces plant growth substances in the soil. They are in fact being promoted to harvest the naturally available, biological system of nutrient mobilization" [1]. "The role and importance of biofertilizers in sustainable crop production has been reviewed by several authors" [2,3,4]. "*Rhizobium* belongs to family Rhizobiaceae, symbiotic in nature, fix nitrogen 50-100 kg/ ha. with legumes only. Several reports have examined the ability of different bacterial species to solubilize insoluble inorganic phosphate compounds. Among the bacterial genera with this capacity are *pseudomonas, Bacillus, Rhizobium, Burkholderia, Achromobacter, Agrobacterium, Microccocus, Aereobacter, Flavobacterium and Erwinia*. A considerably higher concentration of phosphate solubilizing bacteria is commonly found in the rhizosphere in comparison with non rhizosphere soil" [5]. The incorporation of bio-fertilizers (Nfixers) plays major role in improving soil fertility, yield attributing characters and thereby final yield has been reported by many workers [6,7,8].Farm yard manure (FYM) serves as a valuable organic amendment, providing a balanced mix of nutrients essential for plant growth [9].

"Integrated nutrient management enhances synthesis of the carbohydrates, phytohormones and even bio fertilizers also promote maximum growth of crop and build up organic status of the soil and maintain the soil health that also increases the availability of other nutrients. Integrated use of vermicompost and biofertilizers in fenugreek can be a more efficient, economical and judicious approach than chemical fertilizers alone" [10]. "Combination effect of organic manures and nitrogen fixing bio fertilizers and phosphate solubilizing bacteria helps to increase the nitrogen availability. Farm yard manure and vermicompost when integrated with reduced doses of inorganic fertilizers resulted in improved soil fertility, growth and yield of plant" [11].

In Brief, the use of vermicompost, farm yard manure, rhizobium, phosphorus solubilizing bacteria, and potassium solubilizing bacteria in methi cultivation promotes sustainable agriculture by improving soil fertility, nutrient availability, and overall crop health, contributing to increased NPK content ,methi yields and quality.

With the preceding benefits of biofertilizers and organic manures in mind, the present study laid out to Effect of organic manures and biofertilizers on NPK content of Kasuri methi (*Trigonella corniculata* L.) CV. – Pusa Kasuri

2. MATERIAL AND METHODS

The experiment was conducted at Experimental Field, Department of Horticulture, College of Agriculture, Gwalior (M.P.). The experiment was laid out in the Randomized Block Design with three replications. Each replication was comprised of sixteen treatments consisting organic manures i.e. FYM and Vermicompost and bio-fertilizers i.e. *Rhizobium*, PSB and KSB were applied for enhancing the crop quality parameters and NPK content of kasuri methi (*Trigonella corniculata* L.) cv. Pusa Kasuri. The treatment details are given below:

T_0 - Control, T_1 – FYM (16 t/ha), T_2 - Vermicompost (4 t/ha), T_3 - *Rhizobium* (30 ml/kg seed), T_4 – PSB (30ml/kg seed), T_5 - KSB (30 ml/kg seed), T_6 - FYM (16 t/ha) + *Rhizobium* (30 ml/kg seed), T_7 - FYM (16 t/ha) + PSB (30 ml/kg seed), T_8 - FYM (16 t/ha) + KSB (30 ml/kg seed), T_9 - Vermicompost (4 t/ha) + *Rhizobium* (30ml/kg seed), T_{10} - Vermicompost (4 t/ha) + PSB (30 ml/kg seed), T_{11} - Vermicompost (4 t/ha) + KSB (30 ml/seed), T_{12} - FYM (16 t/ha) + *Rhizobium* (10 ml/kg seed) + PSB (10 ml/kg seed) + KSB (10 ml/kg seed), T_{13} - Vermicompost (4 t/ha) + *Rhizobium* (10 ml/kg seed) + PSB (10 ml/kg seed) + KSB (10 ml/kg seed), T_{14} - FYM (16 t/ha) + Vermicompost (4 t/ha) + *Rhizobium* (10 ml/kg seed) + PSB (10 ml/kg seed) + KSB (10 ml/kg seed), T_{15} - *Rhizobium* (10 ml/kg seed) + PSB (10 ml/kg seed) + KSB (10 ml/kg seed)

The Research was conducted in sandy loam soil with good drainage and uniform texture. The physico-chemical properties of soil before start of the experiment - Soil PH 7.6(Slightly alkaline), Electrical conductivity (ds/m) 0.32 (Normal), Organic carbon 0.45 % (Low), Available Nitrogen 197 kg N /ha (Low), Available phosphorus 19 kg P/ha (Medium), Available potash 241 kg K/ha (Low).The experimental plot was ploughed thrice by tractor drown cultivator and leveled. The clods were crushed weeds were removed and brought to fine tilt. The land was divided into plots of required size (1.90 m x 2.70 m). Provision was made for bunds and irrigation channels. The seeds of the variety Pusa Kasuri were used with the seed rate of 18-20 Kg/ha. The nitrogen content in the plant samples was estimated by Micro Kjeldhal method [12]. and expressed in percentage on dry weight basis. The phosphorus content of the di-acid digested plant sample was determined by Vanado molybdo phosphoric yellow colour method [13] and expressed in percentage on dry weight basis. The potassium content in plant samples was determined by flame photometer method as described by [13] and expressed in percentage on dry weight basis.

3. RESULT AND DISCUSSION

There was a significant effect of various treatments on nutrient content. Among the different level of treatment T_{14} recorded the maximum N content (1.45%) in herb and (3.31%) in grain. It was found the best treatment as compared to other treatments. On the other hand, the treatment T_0 – Control was recorded the minimum N content (1.30 %) in herb and (2.90 %) in grain, respectively

The different organic manures and bio-fertilizers were significantly enhanced the P content in Kasuri methi and the maximum P content (0.42%) in herb and (0.55%) in grain was recorded in treatment T_{14} and it was at par to treatments T_9, T_{10}, T_{11}, T_{12} and T_{13}. Conversely, the treatment T_0 – Control was recorded the minimum P content (0.30%) in herb and (0.45%) in grain, respectively.

Among the different level of treatment T_{14} recorded the maximum K content (0.45%) in herb and (0.57%) in grain and it was found the best treatment as compared to other treatments. Equally, the treatment T_0 – Control was recorded the minimum K content (0.32%) in herb and (0.40%) in grain, respectively.

It might be due to the organic manures viz., FYM and vermicompost supplied the nutrients all over crop period. Moreover application of biofertilizers increased the major and micronutrients accessibility in the rhizosphere as a greater expansion, resulted in more uptakes of nutrients by the plants. The application of nutrients through FYM, vermicompost and biofertilizers definitely increased the nutrient content in the crop. Bhayal et al. [14] and Singh et al. [15] found same result and said that the increase in nutrient uptake can be attributed to the organic matter content of FYM, which acts as a rich source of essential nutrients and improves soil fertility. The present study highlights the notable impact of applying biofertilizers on nutrient uptake in crops. The study reveals a significant increase in nutrient uptake in crops following the application of biofertilizers, aligning with previous research findings on the positive effects of biofertilizer use. This outcome is consistent with studies conducted by Aakash et al. [16] and Solanki et al. [17], who demonstrated that the introduction of biofertilizers positively influences nutrient availability and uptake by plants. The mechanism behind this enhancement can be attributed to the activities of beneficial microorganisms present in the biofertilizers Solanki et al. [17]. These microorganisms, such as nitrogen-fixing bacteria and phosphate-solubilizing bacteria, play a crucial role in nutrient mobilization and make them more accessible to plants. The observed increase in nutrient uptake supports the argument that biofertilizers contribute to sustainable agriculture by promoting nutrient cycling and reducing the dependence on chemical fertilizers [18]. The study also demonstrates a substantial increase in nutrient uptake in crops following the application of nitrogen fertilizer, aligning with well-established literature on the positive influence of nitrogen supplementation on plant nutrition. This finding is consistent with previous research by [19] and [20], who reported similar enhancements in nutrient uptake associated with nitrogen fertilization. The primary mechanism driving this improvement is the role of nitrogen as a key component of amino acids, proteins, and other essential plant metabolites. The research findings indicate a significant rise in nutrient absorption by crops after the application of organic manure, consistent with existing literature highlighting the beneficial impacts of organic amendments on plant nutrition. This result aligns with investigations conducted by [21], illustrating that the incorporation of organic manure has a positive effect on nutrient availability and plant uptake. The organic content within the manure acts as a valuable reservoir of essential nutrients, contributing to the enhancement of soil fertility. The gradual release of nutrients from the organic matter ensures their accessibility to plants for an extended duration, facilitating continuous nutrient absorption [18].

Table 1. Effect of organic manures and bio-fertilizers on N, P & K content (%) in herb and grain of kasuri methi

Treatments detail	N content (%) in herb	N content (%) in grain	P content (%) in herb	P content (%) in grain	K content (%) in herb	K content (%) in grain
T_0	1.30	2.90	0.30	0.45	0.32	0.40
T_1	1.35	3.08	0.34	0.47	0.35	0.45
T_2	1.36	3.12	0.34	0.49	0.36	0.46
T_3	1.32	3.00	0.33	0.46	0.33	0.43
T_4	1.33	3.02	0.33	0.46	0.34	0.44
T_5	1.31	2.92	0.32	0.46	0.33	0.41
T_6	1.36	3.17	0.34	0.48	0.36	0.46
T_7	1.36	3.15	0.35	0.50	0.37	0.47
T_8	1.36	3.14	0.34	0.48	0.36	0.46
T_9	1.41	3.20	0.39	0.51	0.41	0.53
T_{10}	1.42	3.23	0.39	0.52	0.42	0.54
T_{11}	1.40	3.19	0.37	0.50	0.40	0.52
T_{12}	1.43	3.24	0.40	0.53	0.43	0.55
T_{13}	1.44	3.27	0.41	0.54	0.44	0.56
T_{14}	1.45	3.31	0.42	0.55	0.45	0.57
T_{15}	1.34	3.04	0.34	0.47	0.35	0.44
SEm ±	**0.029**	**0.049**	**0.024**	**0.019**	**0.026**	**0.017**
CD 5%	**0.085**	**0.140**	**0.068**	**0.054**	**0.076**	**0.050**

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4. CONCLUSION

According to the current research, the use of organic manures and bio fertilizers had a significantly positive impact on the nitrogen, phosphorous and potassium content in herb and grain of kasuri methi. Among the various treatments that were evaluated, T_{14} – FYM (16 t/ha) + Vermicompost (4 t/ha) + *Rhizobium* (10 ml/kg seed) + PSB (10 ml/kg seed) + KSB (10 ml/kg seed) yielded the most favorable results in terms of The highest nitrogen (1.53% and 3.35%), phosphorous (0.43% and 0.56%) and potassium (0.46% and 0.57%) in herb and grain.

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