P-ISSN: 2618-0723
E-ISSN: 2618-0731

NAAS Rating: 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 7; Issue 11; November 2024; Page No. 203-206

Received: 19-09-2024
Accepted: 23-10-2024

Indexed Journal
Peer Reviewed Journal

Assessment of integrated nutrient management on growth, yield and economics of broccoli (*Brassica oleracea* var. italica) Cv. Green star

Bhoopendra Singh, AK Rai, Chanchila Kumari, Manish Kumar and Vinay Kumar

ICAR- Krishi Vigyan Kendra (National Rice Research Institute), Koderma, Jharkhand, India

DOI: https://doi.org/10.33545/26180723.2024.v7.i11c.1317

Corresponding Author: Bhoopendra Singh

Abstract

The present investigation was carried out to the Assessment of integrated nutrient management on growth, yield and economics of broccoli conducted by Krishi Vigyan Kendra, Koderma during winter season for three years i.e., 2022-2023 & 2023-2024 in selected villages Tarwan, Lohadanda, Chehal & Sardarodih. The result revealed that the maximum plant height (48.76 cm), number of leaf (14.3) and length of leaf (29.0 cm), head initiation day after transplanting (53.0), head diameter (13.16 cm), weight of head (488.33 g), and yield per ha (142 q) were recorded under treatment T4 [50% RDF + 4 t Vermi compost] The highest gross return (₹ 1,70,400), net returns (₹ 79,400) were observed in treatment T4 [50% RDF + 4 t Vermi compost]. Among all the treatments the highest B: C ratio (2.81:1) was observed in treatment T4 [50% RDF + 4 t Vermi compost] as compare to other treatment combination.

Keywords: Broccoli, INM, organic, manure, fertilizers, economics

Introduction

Broccoli (*Brassica oleracea* L. var. italica) is one of the most important members of cole crops and has originated in the Mediterranean region. It belongs to the family Brassicaceae and is mainly grown as cool season vegetable crop. Its basic chromosome number is 2n = 2x = 18. Broccoli being a cole crop is heavy feeder of plant nutrients. India rank second area and production in Broccoli. World area and production is 1.21 million hectare and 20.88 million tone and Indian production and area are 6745 thousand tones and 369 thousand hectare. In India, it is commonly known as Harigobhi. The word broccoli derived its name from the Latin word 'Brachium' meaning an arm or branch. Broccoli is of two types, sprouting and heading. Heading broccoli forms curd like cauliflower, while sprouting broccoli contains a group of green immature buds and thick fleshy flower stalk forming a head (Jindal *et al*., 2017) [6] Broccolis are rich source of glucosinolates, the precursor of the chemoprotective isothiocyanate (Sulphoraphane), a compound associated with reducing risk of cancer (Aires *et al*., 2006). It grows best when exposed to an average daily temperature between 18 - 23 °C. It is well known for its nutritional value, as it provides vitamins and fiber, preventing against some types of cancers, heart diseases and has already spread its popularity on global market (Baenas *et al*., 2016).

Materials and Methods

The present investigation was carried out to on farm trail (OFT) on Assessment of integrated nutrient management on growth, yield and economics of broccoli conducted by Krishi Vigyan Kendra, Koderma during winter season for three years i.e., 2022-2023 & 2023-2024 in selected villages- Tarwan, Lohadanda, Chehal & Sardarodih. The details of experimental material used and methodology followed during the trail of the investigation have been described. Plant height was measured at the time of harvesting from the soil level to the highest tip of the plant with the help of a measuring scale. The height of five randomly selected plants was measured and the average value was expressed in centimeter. Numbers of leaves per plant was recorded under each treatment at the time of harvesting. All the fully grown leaves were counted except those which were attached to the heads. The number of leaves were counted from five randomly selected plants and averaged to get number of leaves per plant. Five leaves was selected from lower, middle and top part of the selected plants per plot and then length of the leaves was measured from the tip of the entire leaf down to the base of the lowest leaflets where they meet the leaf stem using ruler and average was worked out as mean length of leaves. Head weight (g) after harvesting of head from selected 5 plants, individual weight of fruit using the digital balance was recorded and the average weight was calculated and expressed as fruit weight in grams. Head diameter (cm) mature green head were used for measuring diameter of individual fruit. Diameter was measured using ruler. The mean diameter of fruit was calculated and expressed in centimeter. Yield per hectare (q/ha) each net plot's individual yield from each of the several treatments was recorded and converted to hectares. Economics analysis the cost of cultivation of each treatment was calculated per hectare on the basis of prevailing rates of labour, organic manures, irrigation and other expenditure. The total income

per hectare was calculated as per the average wholesale price of broccoli in the local market. The net profit per hectare was obtained by deducting the cost from treatment. Cost of cultivation (₹/ha) by presuming the item-wise input cost based on the local market rate, the cost of cultivation per hectare of land was worked out and were computed treatment-wise also Gross returns (₹/ha) from the total yield of each treatment plot, the gross monetary return was worked out based on the average selling price of the product and it was recorded accordingly in ₹/ha.

Gross return (₹/ha) = Market price × Yield/ha

Net returns (₹/ha) the most crucial factor to consider before recommending any remedies to farmers for widespread use is their economic viability. The average treatment yield and current market rates for inputs and output were utilized to determine the therapy's economics. The cost of cultivation for each treatment was deducted from the gross return from the economic yield to determine the net return. Net returns (₹/ha) are calculated as follows:

Net return (₹/ha) = Gross returns (₹/ha) - Cost of cultivation (₹/ha)

Benefit cost ratio were worked out for each nutrient treatment by adopting the following formula: ultimately to yield per hectare by multiplying with a suitable factor. It determined how much head was produced per hectare, and their quantities were expressed in quintals. Soil analysis Soil samples from 0-15 cm depth were collected from all the plots separately and were air dried, crushed, passed through 2 mm sieve and then soil testing was done for water holding capacity, soil pH, available NPK and organic carbon concentration. Benefit: Cost ratio = Net return (₹/ha) / Cost of cultivation (₹/ha

Results and Discussion

Growth parameters

The plant height is one of the key factors in predicting crop productivity. Among all the treatments the maximum plant height (48.76 cm) was recorded in treatment T4 [50% RDF + 4 t Vermi compost] which was statically at par with the treatment T3 (50% RDF + 20 t FY) while the minimum plant height (42.23 cm) was found in treatment T0 (5 t FYM + 75:40:50). Taller plants are regarded as more desirable because they produce more leaf/branches for photosynthesis and accumulate more carbohydrates, which increase productivity and yield. The results of present study are similar with Faysal *et al*., (2006) [5], Singh *et al*., (2021) [16] and Biswas *et al*., (2021) [1]. The higher number of leaves (14.13) were recorded in treatment T4 (50% RDF + 4 t Vermi compost) which was statically at par with the treatment T3 (50% RDF + 20 t FY] (18.21), while the minimum number of leaves (10.6) were found in treatment T0 as a Farmers' practice (5 t FYM + 75:40:50)This might be the result of applying organic manures to make sure adequate air circulation and soil water-holding capacity, which would promote soil health. The results of present study are similar with Singh *et al*., (2021) [16], Biswas *et al*., (2021) [1] and Faysal *et al*., (2006) [5]. Among all the treatments the maximum length of leaves (30.0 cm) were recorded in treatment T4 (50% RDF + 4 t Vermi compost) which was statically at par with the treatment T3 (50% RDF + 20 t F) (29.0), while the minimum number of leaves (24.33 cm) were found in treatment T0 Farmers' practice (5 t FYM + 75:40:50). The use of vermin compost probably enhanced soil fertility and productivity, resulting to increased plant nutrient uptake and longer leaf lengths. The result of present study is similar with Mal *et al*. (2014) [10] and Sharma *et al*., (2018) [15]. The earliest days to head initiation (53.0) were recorded in treatment T4 (50% RDF + 4 t Vermi compost) which was statistically at par with the treatment T3 (50% RDF + 20 t F) (29.0), (57.6), while the maximum days (63.6) for head initiation was found in treatment T0 Farmers' practice (5 t FYM + 75:40:50). A potential reason for early head maturity is the intake of carbohydrates, which were created during the nitrogen-induced protein synthesis. Furthermore, phosphorus is a key component of phospholipids, and nucleic acid. It also plays a significant role in the early stages of development since it supplies the necessary nutrients and ensures the development of strong roots. The results of present study are similar with Maurya *et al*., (2008) [11] and Kumar *et al*., (2013) [7].

Table 1: Effect of different treatments on growth & Yield parameters of broccoli

Treatment	Plant height (cm)	Number of leaves/plant	Leaf length (cm)	Head initiation (Days)	Head diameter (cm)	Head weight (g)	Yield per hectare (q)
T0 (Farmers' practice) (5 t FYM + 75:40:50)	42.23	10.6	24.3	63.6	9.63	381.66	82.5
T1: RDF (150:80:100) + 5 t FYM	48.30	12.3	27.3	58	11.36	418.13	112.0
T2: 50% RDF + 20 t FYM	47.43	13.3	29	57.6	12.16	451.66	134.0
T3: 50% RDF + 4 t Vermicompost	48.76	14.3	30	53.0	13.16	488.33	142.0
S.Em ±	0.83	0.33	0.74	0.62	0.41	5.2	0.68
CD(0.05)	2.72	1.08	2.43	2.03	1.35	17.18	2.22

Table 2: Economical analysis of INM of broccoli

Treatments	Yield/ ha	Cost of cultivation (₹/ha)	Gross return (₹/ha)	Net returns (₹/ha)	Benefit: Cost Ratio
T0 (Farmers' practice) (5 t FYM + 75:40:50)	82.5	42800	82500	39700	1.92
T1: RDF (150:80:100) + 5 t FYM	112	52400	134400	81600	2.56
T2: 50% RDF + 20 t FYM	134	58200	160800	102600	2.76
T3: 50% RDF + 4 t Vermicompost	142	60600	170400	79400	2.81

Yield parameters

The data showed that the weight of the central head is significantly affected by the treatments. Maximum head weight (488.33 g) was recorded in treatment T4 (50% RDF + 4 t Vermi compost) which was followed by the treatment T3 (50% RDF + 20 t F), while the minimum head weight (381.66 g) were found in treatment T3 (50% RDF + 20 t F). The broccoli's improved head size may have resulted from the application of vermin compost, which imposed the plant's head weight by providing enough nutrients, moisture, and other vital elements for healthy growth and development. Similar result is close refers with the finding of Devi *et al*., (2018) [4], Shankar *et al*., (2019) [14] and Singh *et al*., (2021) [16]. Head size is an important attribute that correlates broccoli yield. Bigger head size equals greater yields and higher returns. A perusal of data revealed that treatments have significant effect on diameter of central head. In the present study the maximum head diameter (13.16 cm) was recorded in treatment T4 (50% RDF + 4 t Vermi compost) which was statistically at par with treatment T3 (50% RDF + 20 t F), (12.16), while the minimum head diameter (9.63 cm) were found in treatment T0 Farmers' practice (5 t FYM + 75:40:50). The results of present study are similar with Choudhary *et al*., (2018) [2], Varsha *et al*., (2022) [18], Kumar *et al*., (2023) [9], and Shankar *et al*., (2019) [14]. In the present study the maximum yield per hectare (142.0 q) was recorded in treatment T4 (50% RDF + 4 t Vermi compost) while the minimum yield per hectare (82.5 q) was found in treatment T0 Farmers' practice (5 t FYM + 75:40:50). The application of inorganic fertilizers improving the rate of photosynthetic energy and their ability to absorb proteins, carbohydrates and other nutrients broccoli yield increased when organic and inorganic fertilizers were used together because the uptake of nutrients was improved. In addition, farm yard manure improves the chemical, biological and physical characteristics of the soil, which facilitates optimal nutrient uptake by the plants and an increase in output. The results of present study are similar with Mohanta *et al*., (2018) [13], Devi *et al*., (2018) [4] and Shankar *et al*., (2019) [14]. Economics analysis the combine use of organic manures and inorganic fertilizers has substantial effect on economics. The highest cost of cultivation ₹ 60,600 was incurred in treatment T4 (50% RDF + 4 t Vermi compost) followed by T3 (50% RDF + 20 t F), i.e. ₹ 58,200. The economics in terms of gross return (₹ 1,70,400), net return (₹ 79,400) were maximum in T4 (50% RDF + 4 t Vermi compost) and higher B: C ratio (2.41:1) was found in T4 (50% RDF + 4 t Vermi compost). The minimum gross return (₹ 82,500), net return (₹ 39,700) and B: C ratio was found in treatment T0 Farmers' practice (5 t FYM + 75:40:50).

Conclusion

The combination of organic and inorganic sources of nutrients in the current study revealed significant variations for growth and yield of broccoli. On the basis of present investigation, it can be concluded that treatment T4 (50% RDF + 4 t Vermi compost) recorded best for growth and yield contributing traits. This treatment also had highest net return and gross returns show best result for growth and yield as compare to other treatments.

References

1. Biswas A, Upadhyay D, Rathiya PS. Effect of inorganic fertilizer and organic manures on growth and yield of broccoli (*Brassica oleracea* var. italica) cv. Palam Samridhi at Northern Hill of Chhattisgarh. The Phar Inn J. 2021;10(10):1000-1003.
2. Choudhary K, Dev P, Kumar J, Kumar V, Kumar T. Effect of integrated nutrient management on yield parameters of broccoli (*Brassica oleracea* L. var. italica) cv. Pusa Kts-1. Int J Agri Inv. 2018;3(02):223-226.
3. Choudhary K. Effect of different levels of NPK and vermicompost on physico-chemical properties of soil, growth and yield of okra [*Abelmoschus esculentus* L.] var. Kashi Kranti. 2022.
4. Devi M, Spehia RS, Menon S, Mogta A, Verma A. Influence of integrated nutrient management on growth and yield of cauliflower (*Brassica oleracea*e var. botrytis) and soil nutrient status. Int J Che Studies. 2018;6(2):2988-2991.
5. Faysal M. Effect of different sources of organic manures on the growth and yield of broccoli. [doctoral dissertation]. Dhaka: Sher-e-Bangla Agricultural University; 2018.
6. Jindal SK, Dhaliwal MS. Development of vegetable nutrition garden model for diet diversification and improved nutrition security of urban and peri-urban households. Int J Horti. 2017;7: [no page number].
7. Kumar M, Das B, Prasad KK, Kumar P. Effect of integrated nutrient management on growth and yield of broccoli (*Brassica oleracea* var. italica) under Jharkhand conditions. Veg Sci. 2013;40(1):117-120.
8. Kumar P, Bhardwaj ML, Kumar D, Kumar R, Tripathi D, Thakur KS, *et al*. Comparative performance of organic and inorganic fertilizers on plant growth, head yield, soil health, and severity of black rot in sprouting broccoli cv. Green Head. Int J Farm Sci. 2017;7(1):69-76.
9. Kumar S, Kumar M, Singh SK, Chaudhary SK, Prabhakar M, Choudhary SK. Influence of inorganic fertilizers in conjunction with organic manures on growth, yield, and quality of broccoli (*Brassica oleracea* var. italica). Int J Plant Soil Sci. 2023;35(14):246-255.
10. Mal D, Chatterjee R, Nimbalkar KH. Effect of vermicompost and inorganic fertilizers on growth, yield and quality of sprouting broccoli (*Brassica oleracea* L. var. italica Plenck). Int J Bio-resource Stress Manag. 2014;5(4):507-512.
11. Maurya AK, Singh MP, Srivastava BK, Singh YV, Singh DK, Singh S, *et al*. Effect of organic manures and inorganic fertilizers on growth characters, yield, and economics of sprouting broccoli cv. Fiesta. Ind J Horti. 2008;65(1):116-118.
12. Mitra S, Emran TB, Chandran D, Zidan BRM, Das R, Mamada SS, *et al*. Cruciferous vegetables as a treasure of functional foods bioactive compounds: Targeting p53 family in gastrointestinal tract and associated cancers. Front Nutr. 2022;9:951935.
13. Mohanta R, Nandi AK, Mishra SP, Pattnaik A, Hossain MM, Padhiary AK. Effects of integrated nutrient management on growth, yield, quality and economics

of sprouting broccoli (*Brassica oleracea* var. italica) cv. Shayali. J Pharm Phytochem. 2018;7(1):2229-2232.
14. Shankar A, Kumar S, Kumar R, Kumar P. Efficacy of organic manures and bio-fertilizers on growth, yield, and quality of broccoli (*Brassica oleracea* L. var. italica Plenck). [no further details provided].
15. Sharma C, Kang BS, Kaur R, Singh SK, Aulakh K. Effect of integrated nutrient management on growth, yield, and quality of broccoli (*Brassica oleracea* L. var. italica). Int J Che Studies. 2018;6(2):1296-1300.
16. Singh DP, Rajiv R, Tomar S, Kumari M. Integrated nutrient management in broccoli (*Brassica oleracea* var. italica). Ind J Agri Sci. 2021;91(11):1627-1630.
17. Singh MK, Chand T, Kumar M, Singh KV, Lodhi SK, Singh VP, Sirohi VS. Response of different doses of NPK and boron on growth and yield of broccoli (*Brassica oleracea* L. var. italica). Int J Bioresource Stress Manag. 2015;6(1):108-112.
18. Varsha P, Prasad VM, Topno SE, Bahadur V. Effect of organic manures and inorganic fertilizers on growth, yield, and quality of broccoli (*Brassica oleracea*e var. italica L.) cv. Green Magic. Int J Plant Soil Sci. 2022;34(21):665-671.