



## **Effect of Organic Manures and Inorganic Fertilizers on Growth, Yield and Quality of Broccoli (*Brassica oleraceae* var. *italica* L.) cv. Green Magic**

**P. Varsha<sup>a\*</sup>, Vipin M. Prasad<sup>a#</sup>, Samir E. Topno<sup>a†</sup> and Vijay Bahadur<sup>a‡</sup>**

<sup>a</sup> Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj-211007, Uttar Pradesh, India.

### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/IJPSS/2022/v34i2131316

### **Open Peer Review History:**

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/90054>

**Original Research Article**

**Received 10 May 2022**  
**Accepted 21 July 2022**  
**Published 23 July 2022**

## **ABSTRACT**

The present investigation was carried out with title "Effect of organic manures and inorganic fertilizers on growth, yield and quality of Broccoli (*Brassica oleraceae* var. *italica* L.) cv. Green Magic" at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj (UP) During October 2021 to February 2022. The experiment was laid out in RBD with 8 treatments with 3 replications. The results revealed that Treatment T<sub>6</sub> (50% RDF+ 25% Vermicompost + 25% Poultry Manure) – performed the best in terms of days to Plant Height (55.17), No. of Leaves (21.25), Leaf width (18.76), leaf area (238.17), leaf area index (19.16), days to initiation (56.83), Head weight (308.33), Head yield per plot (3.03), Head yield per hectare (11.36), Head diameter (15.5), TSS Brix (13), Vitamin C (103.97), B:C Ratio (3.04:1). Therefore, the Treatment T<sub>6</sub> (50% RDF + 25% Vermicompost + 25% Poultry Manure) is the best when compared to other treatments. As, the highest benefit cost ratio was observed in treatment T<sub>6</sub> (50% RDF + 25% Vermicompost + 25% Poultry Manure) i.e., (3.04:1) which states that it is economically profitable compared to all other treatments.

<sup>o</sup> PG Student,

<sup>#</sup> Professor,

<sup>†</sup> Assistant Professor,

<sup>‡</sup> Associative Professor,

\*Corresponding author: E-mail: varshapanoly@gmail.com;

**Keywords:** Broccoli; growth; yield; quality; NPK; vermicompost; poultry manure.

## 1. INTRODUCTION

Broccoli (*Brassica oleraceae* L. var. *italica*) is an important Cole crop of Europe and USA. Being a native of Italy, it was introduced by Italian immigrants around 1925 in US. Broccoli is an Italian word from Latin *Brachium* meaning an arm on branch [1]. It belongs to family Cruciferae and US is the world's largest producer of broccoli, other major growing areas are Italy, Northern Europe and cooler regions of the far East. It resembles cauliflower in its morphology except for secondary head which develops in the axil of leaves and may contribute up to 50% of total yield. Broccoli is fairly high in protein (3.3%), vitamin 'A' (9000 IU) and Ascorbic Acid (137 mg/ 100g). It also contains appreciable quantities of carbohydrates (5.5%), thiamine, riboflavin, niacin and iron [2]. Broccoli has the maximum content of glucosinolate (0.05 – 0.2 %) on fresh weight basis. Broccoli is used in a variety of ways viz., salad in making curry, soup, pickles and for freezing. Broccoli is of 3 types i.e. heading, purple and green sprouting, out of which green type is highly nutritious.

Throughout their life cycles, Brassica crops require particular nutrients in varying quantities to support optimal growth and reproduction. Nitrogen is the nutritional element that most cultivated crops need in the greatest amount. Plants use it to form proteins, cultivated crops need in the greatest amount. Plants use it to form proteins, chlorophyll, protoplasm and enzymes. In Cole crops, it is most important for overall growth and adequate amount are necessary for best yield. Usually the initial nitrogen available from organic source is enough, but as the plant develops; it may need supplemental nitrogen. The mineralization of nitrogen its availability to plants varies greatly, depending on the nitrogen source. Composted manure usually provides enough phosphorus for Brassicas, Potassium requirement for Cole crops is high. Composted manures are acceptable source of potassium. Micronutrients like calcium, boron, manganese, molybdenum and iron are important for Cole crops development. Biologically active soils with adequate organic matter usually supply enough of these nutrients. Compost is a rich source of supplemental micronutrient. Beneficial effects of integrated management strategies on broccoli have been reported by various workers [3-6]. An increase in benefit: cost ratio has been observed in most of

these studies which is attributed to increased yield of broccoli coupled with reduction in the cost of fertilizers.

Organic manures comprise of a variety of plant-derived materials that range from fresh or dried plant material to animal manures and litters to agricultural by-products [7]. The nutrient content of organic fertilizers varies greatly among source materials, and readily biodegradable materials make better nutrient sources. Nitrogen and Phosphorus content is lower, often substantially lower, in organic manures compared to chemical fertilizers. Moisture content is another factor that reduces or dilutes the nitrogen and phosphorus concentrations of organic fertilizers. Thus, it can be cost ineffective to transport high-moisture organic manures long distances.

## 2. MATERIALS AND METHODS

The field experiment entitled, "Effect of organic manures and inorganic fertilizers on growth, yield and quality of broccoli (*Brassica oleraceae* var. *italica* L.)" was conducted in winter season adopting randomized block design consisting of 8 treatments and three replications during October 2021 to February 2022. Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The experiment includes the following treatments. T<sub>0</sub> : 100% Recommended Dose of Fertilizers (RDF) (120Kg/ha N+ 80Kg/ha P+ 80Kg/ha K) T<sub>1</sub> :33.3% FYM + 33.3% Vermicompost + 33.3% Poultry Manure T<sub>2</sub> :50% RDF+ 50% FYM T<sub>3</sub> :50% RDF+ 50% Vermicompost T<sub>4</sub> :50% RDF+50% Poultry Manure T<sub>5</sub> :50% RDF+ 25% FYM+ 25% Vermicompost T<sub>6</sub> :50% RDF+ 25% Vermicompost+25% Poultry Manure T<sub>7</sub> :50% RDF+25% FYM+ 25% Poultry Manure. The mean (maximum and minimum) temperature was 35.77°C and 8.28°C respectively, mean (maximum and minimum) relative humidity was 93.5percent and 43.71 percent during the crop growing season. The experimental soil was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.318%), medium in available N (87Kg/ha), medium available P (375Kg/ha) and medium available K (50Kg/ha). Fertilizers were applied in the form of urea, single super phosphate and murate of potassium, respectively.

### 3. RESULTS AND DISCUSSION

#### 3.1 Growth Parameters

The maximum Plant height was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 14.33, 38.00 and 55.17 cm in 25, 50 and 75 DAT and the minimum plant height was found in T0 (100% RDF (120:80:80) kg ha<sup>-1</sup>) which was 9.5, 20.88 and 31.44 in 25, 50 and 75 DAT.

This results indicates the beneficial effect of Organic and Inorganic fertilizer, which helped crop to respond well. Similar, results were obtained by Maurya et al. [6].

The maximum No. of leaves plant<sup>-1</sup> was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 4.83, 8.97 and 21.25 in 25, 50 and 75 DAT and the minimum No. of leaves plant<sup>-1</sup> was found in T0 (100% RDF (120:80:80) kg ha<sup>-1</sup>) which was 3.75, 7.38 and 16.67 in 25, 50 and 75 DAT.

This variation is due to the availability of nutrients especially nitrogen, Phosphorus, Potassium and Vermicompost. Also, it could be due to the soil water holding capacity. The findings were confirmed with Maurya et al. [6].

The maximum Leaf width was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 5.62, 14.03 and 18.76 in 25, 50 and 75 DAT and the minimum Leaf width was found in T0 (100% RDF (120:80:80) kg ha<sup>-1</sup>) which was 3.82, 11.43 and 14.96 in 25, 50 and 75 DAT.

The application of vermicompost along with NPK fertilizers improved the growth parameters significantly due to maintenance of soil fertility and plant nutrient at an optimal level. These similar findings were recorded by Singh et al. [8] in Tomato.

The maximum leaf area was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 132.5, 220.83 and 238.17 cm in 25, 50 and 75 DAT and the minimum leaf area was found in T0 (100% RDF (120:80:80) kg ha<sup>-1</sup>) which was 88.66, 117.16 and 205.50 in 25, 50 and 75 DAT.

This may be due to the better nutritional environmental in the root zone for growth and

development of Plant. Similar result is found by Wani et al. [9].

The maximum leaf area index was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 5, 10.5 and 19.16 cm in 25, 50 and 75 DAT and the minimum leaf area was found in T0 (100% RDF (120:80:80) kg ha<sup>-1</sup>) which was 3.23, 6.27 and 12.3 in 25, 50 and 75 DAT.

Organic manures help in maintaining soil fertility, efficient use of nutrients and enhance water holding capacity of the soil. It was found that the treated treatments gave better growth over the control. These similar were recorded by These similar findings were recorded by Singh et al. [8] in tomato.

The maximum Days taken for head initiation was found in T0 (100% RDF (120:80:80) which was 61.4 75DAT and the minimum Days taken for head initiation was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) kg ha<sup>-1</sup> which was 56.83 in 75 DAT.

This is due to the different macro and micro nutrients present in Organic and Inorganic fertilizer plays a significant role in enhancing the Initiation of Curd. Similar findings have also been recorded by Wani et al. [9].

#### 3.2 Yield & Quality Parameters

The maximum Head weight was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 308.33 in 75 DAT and the minimum Head weight was found in T0 (100% RDF (120:80:80) kg ha<sup>-1</sup>) which was 151.93 in 75 DAT.

This is due to increase in vegetative growth, more photosynthetic activity and better mobilization of plant nutrients particularly nitrogen, Phosphorus, Potassium and Vermicompost during latter stage of plant growth. This result is confirmed the findings of Wani et al. [9] and Choudhary et al. [1].

The maximum Head yield plot<sup>-1</sup> was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 3.03 in 75 DAT and the minimum Head yield plot<sup>-1</sup> was found in T0 (100% RDF (120:80:80) kg ha<sup>-1</sup>) which was 1.77 in 75 DAT.

**Table 1. Effect of organic manures and inorganic fertilizers on Plant height No. of leaves per plant, Leaf width, Leaf area, Leaf area index, Day taken to head initiation**

Notation	Treatment	Plant height			No. of leaves per plant			Leaf width			Leaf Area			Leaf area index			Day taken to head initiation
		25 DAT	50 DAT	75 DAT	30 DAT	60 DAT	90 DAT	25 DAT	50 DAT	75 DAT	25 DAT	50 DAT	75 DAT	25 DAT	50 DAT	75 DAT	
T1	100% RDF (120:80:80) kg ha <sup>-1</sup>	9.5	20.88	31.44	3.75	7.38	16.67	3.82	11.43	14.96	88.66	117.16	205.50	3.23	6.27	12.3	61.4
T2	33.33%FYM +33.33%Vermicompost +33.33% Poultry Manure	10.26	25.73	47.93	3.8	7.50	18.56	4.25	11.46	15.33	112.66	192.16	210.50	3.3	6.7	12.5	61.1
T3	50% RDF + 50% FYM	10.46	29.37	50.17	4.1	7.78	18.73	4.34	12.10	15.5	116.33	194.16	220.50	3.66	7.03	13.53	60.4
T4	50% RDF + 50% Vermicompost	13.5	37.37	54.80	4.63	8.53	20.6	5.5	14.00	18.13	129.83	216.83	235.50	4.9	9.8	18.03	57.5
T5	50% RDF + 50% Poultry Manure	13.03	34.60	54.70	4.46	8.41	19.73	5.13	13.97	17.8	125.5	213.66	231.50	4.66	9.2	17.3	58.5
T6	50% RDF + 25% FYM + 25%Vermicompost	12.76	34.18	54.47	4.43	8.27	19.17	5.07	13.40	17.43	121.66	200.83	227.50	4	8.7	17	59.53
T7	50% RDF + 25%Vermicompost +25% Poultry Manure	14.33	38.00	55.17	4.83	8.97	21.25	5.62	14.03	18.76	132.5	220.83	238.17	5	10.5	19.16	56.83
T8	50% RDF + 25% FYM + 25%Poultry Manure	11.5	31.53	50.30	4.39	7.83	18.83	4.6	12.77	15.76	117.83	197.5	225.83	3.9	7.2	16	59.6
	'F' test	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	SE.d(±)	0.29	0.80	0.90	0.08	0.20	0.46	0.13	0.35	0.29	1.13	0.80	0.44	0.09	0.15	0.32	0.31
	C.D. at 5%	0.60	1.68	1.93	0.18	0.41	0.96	0.27	0.73	0.62	2.34	1.67	0.93	0.20	0.31	0.67	0.65
	C.V.	4.49	4.74	3.42	3.77	4.57	4.41	5.04	4.99	3.29	1.75	0.79	0.36	4.41	3.38	3.81	0.98

**Table 2. Effect of organic manures and inorganic fertilizers on Head diameter, Head weight, Head yield per plot, Head yield per hectare, TSS, Vitamin C content**

**Yield& Quality parameters:**

Treatments	Head diameter(cm)	Head weight(g)	Head yield per plot(kg)	Head yield per hectare(t/ha)	TSS (°Brix)	Vitamin C content	B:C Ratio
T <sub>0</sub>	10.46	151.93	1.77	3.1	<b>12</b>	83.93	1:1.043209
T <sub>1</sub>	10.6	163.36	1.83	7.1	12.15	84.68	1:1.049619
T <sub>2</sub>	11.06	163.63	2.00	8.8	12.27	89.87	1:1.235871
T <sub>3</sub>	13.63	273.83	2.80	9.56	12.90	100.91	1:2.447391
T <sub>4</sub>	13.2	252	2.40	9.06	12.86	97.37	1:2.552791
T <sub>5</sub>	12.6	229.66	2.13	8.56	12.57	91.80	1:1.552597
T <sub>6</sub>	15.5	308.33	3.03	11.36	<b>13</b>	103.97	1:3.047514
T <sub>7</sub>	11.26	210	2.10	9	12.50	90.78	1:1.687045
<b>F-Test</b>	S	S	S	S	S	S	
<b>SE.d(±)</b>	0.21	1.97	0.05	0.19	0.10	0.57	
<b>C.D at 5%</b>	0.44	5.77	0.11	0.41	0.20	1.19	
<b>C.V.</b>	3.20	2.33	4.68	4.50	2.52	3.95	

The increased yield and yield attributes with poultry manure, vermicompost and RDF is because of rapid availability and utilization of nitrogen for various internal plant processes for carbohydrates production. Later on these carbohydrates undergo hydrolysis and get converted into reproductive sugars, which ultimately helped in increasing yield. Similar result was obtained by Choudhary et al. [1].

The maximum Head yield  $\text{hec}^{-1}$  was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 11.36 in 75 DAT and the minimum Head yield  $\text{hec}^{-1}$  was found in T0 (100% RDF (120:80:80)  $\text{kg ha}^{-1}$ ) which was 4.46 in 75 DAT.

Organic manures help in maintaining soil fertility, efficient use of nutrients and enhance water holding capacity of the soil. It was found that the treated treatments gave better growth over the control. These similar were recorded by Elizabeth et al. [10] in Cauliflower, Reza et al. [11] in Cabbage.

The maximum Head Diameter was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 15.5 in 75 DAT and the minimum Head Diameter was found in T<sub>0</sub> (100% RDF (120:80:80)  $\text{kg ha}^{-1}$ ) which was 10.46 in 75 DAT.

The positive effect if this Vermicompost, Organic Manure and RDF f on Head Diameter is due to the better availability of soil nutrients that produced healthy plants with large vegetative growth which reflected in Head diameter. This result agreed with previous findings obtained by Basel et al. [12].

The maximum TSS was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 13 in 75 DAT and the minimum TSS was found in T0 (100% RDF (120:80:80)  $\text{kg ha}^{-1}$ ) which was 12 in 75 DAT.

This result agreed with previous findings obtained by Hussain et al. [13]

The maximum Vitamin C was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 103.97 in 75 DAT and the minimum Vitamin C was found in T0 (100% RDF (120:80:80)  $\text{kg ha}^{-1}$ ) which was 83.93 in 75 DAT.

This result agreed with previous findings obtained by Chatterjee and Ali Hussain et al. [14].

The Maximum benefit cost Ratio was found in T6 (50% RDF + 25% Vermicompost + 25% Poultry Manure) which was 3.04 and the net Return INR 267133.

#### 4. CONCLUSION

On the basis of present investigation, it is concluded that the treatment T6 (50% RDNF+ 25% Vermicompost + 25% Poultry Manure) was found best in respect to growth, yield and quality. Along with the net Return ₹267133 and 3.04 as Benefit Cost Ratio.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

#### REFERENCES

1. Choudhary B. Vegetables. 2nd revised edition, National BookTrust, New Delhi. 1970;78-79.
2. Ramphal. Gobhi vargiya sabgiyan. ICAR, New Delhi. 2000;70-75.
3. Sharma KC. Influence of INM on yield and economics in broccoli (*Brassica oleracea L. var. italic*) cv "Green Head" plenck under cold temperature conditions. Vegetable Science. 2000;27(1):62-63.
4. Sharma SK, Rajendra Sharma, Korla BN. Response of N and P on growth and yield of sprouting broccoli (*Brassica oleracea var. italic*). Indian Journal of Horticulture. 2002;59(3):313-314.
5. Sharma RP, Akhilesh Sharma, Sharma JK. Productivity, nutrient uptake, soil fertility and economics as affected by chemical fertilizers and farmyard manure in (*Brassicaoleraceae var. italic*) in an Entisol. Indian Journal of Agricultural Sciences. 2005;75(9):576-579.
6. Maurya AK, Singh MP, Srivastava BK, Singh YV, Singh S, Singh PK. Effect of organic manures and inorganic fertilizers on growth characters, yield and economics of sprouting broccoli cv. Fiesta. Indian J. Horticulture. 2008;65(1):116-118.
7. Kumar Pradeep, Sharma SK. Integrated nutrient management forsustainable cabbage-tomato cropping sequence under mid hill conditions of himachal Pradesh. Indian Journal Horticulture. 2004;61(4): 331-334.

8. Singh PK, Pandey M. Study the effect of integrated nutrient management on yield and nutrient uptake in cabbage. Indian J. Hill Farming. 2010;23(2):39-41.
9. Wani AJ, Raj Narayan, Ahmed N, Singh AK, Chattoo MA, Narayan S. Influence of organic and inorganic sources of Nutrients on growth, yield and quality of cauliflower (*Brassica oleracea var botrytis L.*). Environ. Ecol. 2011;29(4): 1941-1947.
10. El-Magd MM, Abd El- Fattah, Selim EM. Influence of mineral and organic fertilization methods on growth, yield and nutrients uptake by Broccoli crop. World J. of Agril. Sciences. 2014;5(5):582-589.
11. Reza, Md, Sajjadul Islam KM. A and Rahman , Md and Miah, Md and Akhter, Sohela and Mosheur Rahman, Md. Impact of organic fertilizers on yield and nutrient uptake of cabbage (*Brassica oleraceae var. capitata*). Journal of Science Technology and Environment Informatics. 2016;3:231-244.10.18801/jstei. 030216.26
12. Basel A, Ouda, Atif YM. Effect of fertilizers on growth, yield, yield components, quality and certain nutrients contents in broccoli. Int. J. of Agr. & Bio. 2008; 10:627–632.
13. Hussein JM, Al-Bayati, Waleed BAM. Allela, Nagham Salah Salim and Fathel F.R.Ibraheem Effect of The Combined Application of Organic and Mineral Fertilizers on The Growth and Yield of Broccoli (*Brassica Oleracea Var. Italica*) IOP Conference Series: Earth and Environmental Science, Volume 910, Fourth International Conference for Agricultural and Sustainability Sciences; 2021, Babil, Iraq.
14. Chaterjee B, Ghanti P, Thapa U, Tripathy P. Effect of organic nutrition in sprouting broccoli. Vegetable Science. 2005;33(1): 51-54.

© 2022 Varsha et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*

*The peer review history for this paper can be accessed here:*  
<https://www.sdiarticle5.com/review-history/90054>