

## Influence of Enriched Organic Manures on Yield and Economics of Sprouting Broccoli (*Brassica oleracea* var. *italica*)

H. D. Gami, Y. D. Pawar, Pavan K. Patel

Received 24 April 2023, Accepted 5 July 2023, Published on 20 September 2023

### ABSTRACT

Present investigation was executed to evaluate the “Influence of enriched organic manures on yield and economics of sprouting broccoli (*Brassica oleracea* var. *italica*)” during *rabi* season at College of Horticulture, SD Agricultural University, Jagudan, Dist. Mehsana, Gujarat, India. A field experiment was laid out in Randomized Block Design and replicated thrice. Significant differences among different treatments for maximum average weight of curd (236.30 g), yield per plot (3.78 kg), yield per hectare (175.15 q), maximum gross return (₹ 437875 per ha), maximum net return (₹ 355583 per ha) and B:C ratio (5.32) were recorded with application of FYM (20 t/ha) along with 100:50:50 kg/ha NPK (T<sub>1</sub>). Among the various organic manure treatments, maximum

average weight of curd (196.93 g), yield per plot (3.12 kg), yield per hectare (144.45 q) and maximum gross return (₹ 361125 per ha) were recorded with treatment of RDN through vermicompost enriched with NPK consortia (T<sub>4</sub>). Whereas, maximum net return (₹ 278926 per ha) and B:C ratio (4.71) were found under treatment T<sub>5</sub> (RDN through poultry manure enriched with NPK consortia).

**Keywords** Enriched organic manures, NPK consortia, RDN, Sprouting broccoli, Vermicompost.

### INTRODUCTION

Broccoli is an important and highly nutritive exotic vegetable, which is originated from the Mediterranean region. *Brassica oleracea* var. *italica* belongs to the family crucifereae. In recent years, cultivation of broccoli has gained momentum in India especially around big cities. In India it is mostly cultivated in the hilly areas of Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir, Nilagiri hills and northern plains of India.

Broccoli is a rich source of vitamins and minerals such as vitamin A and C, carotenoids, fiber, calcium and folic. It contains carbohydrates (5.5 g), protein (3.3 g), vitamin-A (3500 IU), vitamin-C (50.0 mg), vitamin-B1 (0.05 mg), vitamin-B2 (0.12 mg), calcium (20 mg), iron (0.4 mg) and phosphorus (60.0

---

H. D. Gami<sup>1</sup>, Y. D. Pawar<sup>2\*</sup>, Pavan K. Patel<sup>3</sup>

PG Student<sup>1</sup>, Scientist<sup>2</sup>, PhD Scholar<sup>3</sup>

<sup>1,3</sup>College of Horticulture, SD Agricultural University, Jagudan, India

<sup>2</sup>Krishi Vigyan Kendra, SD Agricultural University, Deesa, India

Email: [yogeshpawar@sdau.edu.in](mailto:yogeshpawar@sdau.edu.in)

\*Corresponding author

mg) per 100 g edible portion of fresh curd. Broccoli is also a rich source of sulphoraphane, a compound associated with reducing the risk of cancer (Hazra and Som 2015).

Growth as well as yield of vegetable crops are mainly depends on the fertilizer quantity and quality (Atal *et al.* 2019). So, to increase the soil fertility and yield, inorganic/chemical fertilizers are often used.

Due to increasing use of chemical fertilizers, the soil properties have also been declined. Continuous use of inorganic fertilizers hazards the soil health in respect of physical, chemical and biological properties of soil. Additionally, the nutritional content of the crops will be affected seriously by the continuous use of chemical fertilizer (Bulluck *et al.* 2002).

Therefore, it is necessary to minimize the application of inorganic fertilizers by substituting with organics. Organic manures on the other hand are eco-friendly and cheap. Among various sources, FYM (Farm yard manure) is oldest and principle source of organic matter in our country. It increases water holding capacity, encourages the soil microbial activities and improves the soil physical, chemical and biological properties. Neem cake is the by-product of neem tree fruits/kernels and it acts as botanical pesticide and also reduces alkalinity of soil. Vermicompost is adopted as organic manure produced by use of earthworm and it modifies soil physical and chemical properties. Poultry manure provides the essential nutrients to the plants and also improve the soil structure because of having more phosphorus and nitrogen content that plays a vital building blocks for plant proteins. Jivamrut is a cheaper eco-friendly organic preparation made from cow products namely dung and urine. It is used to activate soil micro-flora and fauna and to protect the plants from diseases. Novel culture is a patented product of Navsari Agricultural University, Navsari. It is prepared from banana pseudostem sap which contains NPK as well as micronutrients and naturally occurring growth promoters. Biofertilizers are low cost, effective and renewable source of plant nutrients carrying living microorganisms derived from the root or cultivated soil.

Organic farming strategy is a one of the way to

conserve soil quality, human health and environment also therefore, present investigation was carried out to validate the response on yield and economics of sprouting broccoli to the different enriched organic manures.

## MATERIALS AND METHODS

A field experiment was conducted during *rabi* season at College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist Mehsana, Gujarat, India. An experiment was framed in Randomized Block Design having three replications and consisting thirteen treatments (Table 1). In this experiment combinations of organic manure viz., FYM, neem cake, vermicompost and poultry manure with liquid organic substances viz., NPK consortia (2.5 liter/ha), Jivamrut (500 liter/ha) and novel culture (2.5 liter/ha) embedded under investigation are as follows.

**Method of enrichment :** Organic manures under study were analyzed for available nitrogen content

**Table 1.** Treatment details.

Sl. No.	Notation	Treatments
1	T <sub>1</sub>	Control (20 t/ha FYM + 100:50:50 NPK kg/ha),
2	T <sub>2</sub>	RDN through FYM enriched with NPK consortia
3	T <sub>3</sub>	RDN through neem cake enriched with NPK consortia
4	T <sub>4</sub>	RDN through vermicompost enriched with NPK consortia
5	T <sub>5</sub>	RDN through poultry manure enriched with NPK consortia
6	T <sub>6</sub>	RDN through FYM enriched with Jivamrut
7	T <sub>7</sub>	RDN through neem cake enriched with Jivamrut
8	T <sub>8</sub>	RDN through vermicompost enriched with Jivamrut
9	T <sub>9</sub>	RDN through poultry manure enriched with Jivamrut
10	T <sub>10</sub>	RDN through FYM enriched with novel culture
11	T <sub>11</sub>	RDN through neem cake enriched with novel culture
12	T <sub>12</sub>	RDN through vermicompost enriched with novel culture
13	T <sub>13</sub>	RDN through poultry manure enriched with novel culture

**Table 2.** Required quantity of organic manures on nitrogen basis. Recommended dose of fertilizer - NPK 100:50:50 kg/ha.

Sl. No.	Organic manures	N (%)	Kg per hectare	Kg per plot (4.86 m <sup>2</sup> )
1	FYM	0.49	20,408	9.91
2	Neem cake	5.17	1,934	0.94
3	Vermicompost	1.17	8,547	4.15
4	Poultry manure	3.39	2,949	1.43

before the enrichment (Table 2). On the basis on nitrogen content, required quantity of organic manures enriched with different liquid organic substances as per treatments before 7 days of transplanting. In shady area, twelve heaps of various organic manures as per calculated quantity were prepared, then heaps supplement with liquid organic substances as per the treatments and then mixed well. Heaps were covered with shade net and applied sufficient water to maintain the moisture level within heaps.

Around five week old uniform seedlings of variety Palam Samridhi were transplanted at a spacing of 45 cm × 30 cm in a plot having dimensions of 2.7 m × 1.8 m. Other cultural practices and plant protection measures were taken as per recommendations. The data on the average weight of curd (g), number of sprouts per curd, average sprout weight (g), yield per plot (kg) and yield per hectare (q) were recorded from randomly selected ten plants in each plot. Economics of the experiment was worked out on the basis of prevailing market prices of inputs and outputs. The data recorded for various parameters during the course of investigation were statistically analyzed by a procedure appropriate to the design of experiment as described by Panse and Sukhatme (1985).

## RESULTS AND DISCUSSION

### Yield and yield attributes

The data pertaining to influence of enriched organic manures on average weight of curd are summarized in Table 3 and it was found significantly superior over all other treatments. The maximum average weight of curd (236.30 g), yield (3.78 kg per plot and 175.15 q per hectare) was recorded with treatment T<sub>1</sub> (Control (20 t/ha FYM + 100:50:50 NPK kg/ha)) and it was

**Table 3.** Influence of enriched organic manures on yield and yield attributes.

Treatments	Average weight of curd (g)	Number of sprouts per curd	Average sprout weight (g)	Yield per plot (kg)	Yield per hectare (q)
T <sub>1</sub>	236.30	12.53	18.89	3.78	175.15
T <sub>2</sub>	174.77	10.83	16.13	2.77	128.24
T <sub>3</sub>	190.00	11.27	16.92	3.02	139.97
T <sub>4</sub>	196.93	11.43	17.23	3.12	144.45
T <sub>5</sub>	192.93	11.30	17.04	3.06	141.66
T <sub>6</sub>	172.00	10.70	16.06	2.70	125.16
T <sub>7</sub>	178.43	10.97	16.24	2.83	130.87
T <sub>8</sub>	185.83	11.13	16.66	2.98	137.81
T <sub>9</sub>	181.17	11.07	16.38	2.93	135.65
T <sub>10</sub>	156.33	9.70	16.10	2.46	113.89
T <sub>11</sub>	160.77	9.97	16.19	2.54	117.75
T <sub>12</sub>	166.17	10.13	16.40	2.64	122.23
T <sub>13</sub>	163.83	10.10	16.23	2.57	119.14
SEm±	9.75	0.52	0.53	0.17	7.86
CD at 5%	28.47	NS	NS	0.50	22.93
CV (%)	9.32	8.26	5.49	10.22	10.22

found significantly superior over all other treatments. The combined application of optimum levels of inorganic fertilizers and organic fertilizers in deficient soil might have improved the physico-chemical and biological characteristics of the growth medium. Also, due to increased vegetative growth as induced by integrated nutrient management which might account for increased carbohydrates accumulation as a result of increased photosynthesis. These results are close conformity with the findings of Singh *et al.* (2018a), Mohanta *et al.* (2018) and Lodhi *et al.* (2017) in broccoli, Pawar and Barkule (2017) and Singh *et al.* (2018b) in cauliflower.

Among organic manure enriched treatments, maximum average weight of curd (196.93 g), yield per plot (3.12 kg) and yield per hectare (144.45 q) were recorded in T<sub>4</sub> (RDN through vermicompost enriched with NPK consortia). According to Negi *et al.* (2017) increase of weight of curd is probably due to the fact that biofertilizers in combination with organic fertilizers help in better root proliferation, which facilitate more uptake of nutrients and water, higher leaf number and more area responsible for effective photosynthesis and enhanced food accumulation. Yield enhancement might be because of appropriate levels of nitrogen, which acts as an integral component of many compounds including chlorophyll and

**Table 4.** Influence of enriched organic manures on economics. Selling price of sprouting broccoli ₹ 25/kg.

Treat-ments	Yield per hectare (q)	Gross re-alization (₹/ha)	Cost of cultivation (₹/ha)	Net re-turms (₹/ha)	B:C ratio
T <sub>1</sub>	175.15	437875	82292	355583	5.32
T <sub>2</sub>	128.24	320600	77938	242662	4.11
T <sub>3</sub>	139.97	349925	104850	245075	3.34
T <sub>4</sub>	144.45	361125	109956	251169	3.28
T <sub>5</sub>	141.66	354150	75224	278926	4.71
T <sub>6</sub>	125.16	312900	78188	234712	4.00
T <sub>7</sub>	130.87	327175	105100	222075	3.11
T <sub>8</sub>	137.81	344525	110206	234319	3.13
T <sub>9</sub>	135.65	339125	75474	263651	4.49
T <sub>10</sub>	113.89	284725	77738	206987	3.66
T <sub>11</sub>	117.75	294375	104650	189725	2.81
T <sub>12</sub>	122.23	305575	109756	195819	2.78
T <sub>13</sub>	119.14	297850	75024	222826	3.97

enzymes that are critical for carbohydrate use within plants. Vermicompost improves availability of water, macro and micro-nutrients due to favorable soil condition (Chaudhary *et al.* 2012). Variation in yield due to application of various organic manures and biofertilizers were previously reported by Meena *et al.* (2017), Negi *et al.* (2017) and Atal *et al.* (2019) in broccoli, Sarangthem *et al.* (2011) in cabbage and Ibrahim *et al.* (2018) in Chinese cabbage.

### Economics

The economics indicating cost of cultivation, gross return, net return and benefit cost ratio under various treatments are summarized in Table 4.

Among the all treatments, maximum gross return (₹ 437875 per ha), maximum net return (₹ 355583 per ha) and B:C ratio (5.32) were found under treatment T<sub>1</sub> (Control (20 t/ha FYM + 100:50:50 NPK kg/ha)).

Among the organic manure enriched treatments, maximum gross return (₹ 361125 per ha) was recorded under T<sub>4</sub> (RDN through vermicompost enriched with NPK consortia) whereas, maximum net return (₹ 278926 per ha) and B:C ratio (4.71) was found under treatment T<sub>5</sub> (RDN through poultry manure enriched with NPK consortia). The minimum net return (₹ 189725 per ha) was found in treatment T<sub>11</sub> (RDN through neem cake enriched with novel culture).

### CONCLUSION

The overall results obtained from the present investigation concluded that the application of FYM (20 t/ha) along with 100:50:50 kg/ha NPK (T<sub>1</sub>) was found superior in terms of yield and yield attributes as well as higher economic return of sprouting broccoli.

In case of various organic manure treatments, it is revealed that application of RDN (100 kg/ha) through vermicompost enriched with NPK consortia (T<sub>4</sub>) was found higher in terms of yield and yield attributes of sprouting broccoli, while application of RDN (100 kg/ha) through poultry manure enriched with NPK consortia (T<sub>5</sub>) was most remunerative for sprouting broccoli.

### REFERENCES

- Atal MK, Dwivedi DH, Narolia SL, Bharty N, Kumari R (2019) Influence of bio-fertilizer (*Rhizobium radiobacter*) in association with organic manures on growth and yield of broccoli (*Brassica oleracea* L. var. *italica* Plenck) cv Palam Samridhi under Lucknow conditions. *J Pharmacog Phytochem SP* (1) : 604—608.
- Bulluck LR, Brosius M, Evanylo GK, Ristaino JB (2002) Organic and synthetic fertility amendments influence soil microbial, physical and chemical properties on organic and conventional farms. *Appl Soil Ecol* 19 (2) : 147—160.
- Chaudhary S, Soni AK, Jat NK (2012) Effect of organic and inorganic sources of nutrients on growth, yield and quality of sprouting broccoli cv CBH-1. *Ind J Horticult* 69 (4) : 550—554.
- Hazra P, Som MG (2015) Vegetable science: Nutritive value of different vegetables. Kalyani Publishers, Ludhiana, pp 24 and 290.
- Ibrahim M, Ali MT, Narayan S (2018) Effect of different sources of plant nutrients on growth, yield and quality of Chinese cabbage (*Brassica rapa* L. var. *pekinensis*). *Internat J Chem Stud* 6 (2) : 3120—3122.
- Lodhi P, Singh D, Tiwari A (2017) Effect of inorganic and organic fertilizers on yield and economics of broccoli (*Brassica oleracea* var. *italica*). *Internat J Curr Microbiol Appl Sci* 6 (8) : 562—566.
- Meena K, Ram RB, Meena ML, Meena JK, Meena DC (2017) Effect of organic manures and bio-fertilizers on growth, yield and quality of broccoli (*Brassica oleracea* var. *italica* Plenck.) cv KTS-1. *Chem Sci Rev Letters* 6 (24) : 2153—2158.
- Mohanta R, Nandi AK, Mishra SP, Pattnaik A, Hossain MM, Padiary AK (2018) Effects of integrated nutrient management on growth, yield, quality and economics of sprouting broccoli (*Brassica oleracea* var. *italica*) cv Shayali. *J Pharmacog Phytochem* 7 (1) : 2229—2232.
- Negi E, Shailaja P, Pant SC, Kumar S, Bahuguna P, Bengia M,

- Nautiyal BP (2017) Effect of organic manures and bio-fertilizers on growth, yield, quality and economics of broccoli (*Brassica oleracea* L.var. *italica* Plenck) cv Green Head under high-hill conditions of Uttarakhand. *Internat J Advanced Biological Res* 7 (1) : 96—100.
- Panse VG, Sukhatme PV (1985) Statistical methods for Agricultural workers. *Ind Council Agricult Res Public*, New Delhi, pp 381.
- Pawar R, Barkule S (2017) Study on effect of integrated nutrient management on growth and yield of cauliflower (*Brassica oleracea* var. *botrytis* L.). *J Appl Natural Sci* 9 (1) : 520—525.
- Sarangthem I, Misra ADD, Chakraborty Y (2011) Cabbage productivity, nutrient uptake and soil fertility as affected by organic and bio-sources. *Agricult Sci Digest* 31 (4) : 260—264.
- Singh G, Sarvanan S, Kerketta A, Rajesh J (2018a) Effect of organic manures and inorganic fertilizers on plant growth, yield and flower bud quality of broccoli (*Brassica oleracea* var. *italica*) cv Green Magic. *Internat J Pure Appl Biosci* 6 (5) : 1338—1342.
- Singh SK, Singh DK, Singh PK, Singh SK, Adarsh A, Pratap T (2018b) Effect of integrated nutrient management on growth, quality, yield and economics of cauliflower (*Brassica oleracea* var. *botrytis* L.). *Bulletin Environ, Pharmacol Life Sci* 7 (3) : 08—11.