www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(5): 555-558

www.thepharmajournal.com
Received: 24-02-2023
Accepted: 29-03-2023

HD Gami
College of Horticulture,
S. D. Agricultural University,
Jagudan, Gujarat, India

YD Pawar
Krishi Vigyan Kendra,
S. D. Agricultural University,
Deesa, Gujarat, India

Pavan K Patel
College of Horticulture,
S. D. Agricultural University,
Jagudan, Gujarat, India

Corresponding Author:
YD Pawar
Krishi Vigyan Kendra,
S. D. Agricultural University,
Deesa, Gujarat, India

Effect of biostimulant enriched organic manures on growth and quality of sprouting broccoli (*Brassica oleracea* var. *italica*)

HD Gami, YD Pawar and Pavan K Patel

Abstract
A field experiment was conducted to evaluate the "Effect of biostimulant enriched organic manures on growth and quality of sprouting broccoli (*Brassica oleracea* var. *italica*)" at College Farm, College of Horticulture, S. D. Agricultural University, Jagudan, Dist. Mehsana, Gujarat, India. The experiment was laid out in Randomized Block Design with three replications and thirteen treatments under study. It showed significant differences among different treatments for maximum plant height at 45 DAT (39.66 cm) and at harvest (58.40 cm), number of leaves per plant at 45 DAT (12.10) and at harvest (21.23) and curd diameter (12.63 cm) were recorded with application of FYM (20 t/ha) along with 100:50:50 kg/ha NPK. Among the various organic manure enriched treatments, significantly maximum plant height at 45 DAT (36.40 cm) and at harvest (55.08 cm), number of leaves per plant at 45 DAT (11.10) and at harvest (19.80) and curd diameter (11.90 cm) were recorded with application of RDN through vermicompost enriched with NPK consortium. On the basis of results of present investigation, among the various organic manure enriched treatments, it may be concluded that RDN (100 kg/ha) through vermicompost enriched with NPK consortium was found superior in terms of growth and quality parameters of sprouting broccoli.

Keywords: Biostimulants, organic manures, RDN, sprouting broccoli

Introduction
Broccoli (*Brassica oleracea*. var *italic*, 2n=x=18) is an important and highly nutritive exotic vegetable., which is originated from the Mediterranean region commonly known as hari ghobi in Hindi and a member of Cole group, belongs to the family brassicaceae or crucifereae. The term Cole has originated from the word "Colewart'' meaning wild cabbage. While the term broccoli derived its name from the Latin word "Brachium" meaning an arm or branch (Thamburaj and Singh, 2018) [15].

In recent years cultivation of broccoli has gained momentum in India especially around big cites. In India it is mostly cultivated in the hilly areas of Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir, Nilagiri hills and northern plains. However, it's cultivation has also become popular in eastern India. The commercial cultivation of broccoli has increased day by day due to increasing the demand. In India, cauliflower and broccoli occupies about 4.30 lakh hectare area with an annual production of 8.20 million tonne with productivity of 19.06 t/ha during 2016 (Anonymous, 2018) [1].

Broccoli is known as the "Crown of jewel nutrition" because it is rich in vitamins and minerals (Meena *et al*., 2017) [8]. 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 mg) per 100g edible portion of fresh curd. Broccoli is rich source of glucosinolates (40-80 mg/100 g fresh), predominantly sinigrin and glucobrassicin which have prominent anti-carcinogenic property. Broccoli is also a rich source of sulphoraphane, a compound associated with reducing the risk of cancer (Hazra and Som, 2015) [4].

Now, throughout the world, the demand for organic foods is increased among the consumers that are good for health and the environment. Furthermore, consumers often look upon the taste of organic products and it should be healthier one than the conventional one. Apart from the release of nutrient is slow manner, the application of organic fertilizers, which are made from animal excreta or other agricultural wastes is usually used to improve the structure and stability of the soil and in addition to enhancing the yield and quality of the crop plants (Atal *et al*., 2019; Ibrahim *et al*., 2018 and Kalbani *et al*., 2016) [2, 5, 6].

The growth and yield of vegetable crops are mainly depends on the quality and quantity of fertilizers used (Atal *et al*., 2019) [2]. So, to increase the soil fertility and yield, inorganic/chemical fertilizers are often used. Frequent and high rate uses of inorganic fertilizer have been associated with some environmental pollution, alteration in soil textures and physical property of the soil. Moreover, the nutritional value of the crops will be affected seriously by the continuous use of synthetic fertilizer (Brar *et al*., 2015) [3] also inorganic fertilizers will increase the cost of crop production.

Material and Methods

A field experiment was conducted during *Rabi* season at College Farm, College of Horticulture, S. D. Agricultural University, Jagudan, Dist. Mehsana which falls under sub-tropical climate of North Gujarat, India. An experiment was laid out in Randomized Block Design with three replications and consisting thirteen treatments. In this experiment combinations of organic manure *viz*., FYM, neem cake, vermicompost and poultry manure with biostimulants *viz*., NPK consortium (2.5 litre/ha), jeevamruta (500 litre/ha) and novel culture (2.5 litre/ha) embedded under the study after enrichment along with control *viz.*, T_1: Control (20 t/ha FYM + 100:50:50 NPK kg/ha), T_2: RDN through FYM enriched with NPK consortium, T_3: RDN through neem cake enriched with NPK consortium, T_4: RDN through vermicompost enriched with NPK consortium, T_5: RDN through poultry manure enriched with NPK consortium, T_6: RDN through FYM enriched with jeevamruta, T_7: RDN through neem cake enriched with jeevamruta, T_8: RDN through vermicompost enriched with jeevamruta, T_9: RDN through poultry manure enriched with jeevamruta, T_{10}: RDN through FYM enriched with novel culture, T_{11}: RDN through neem cake enriched with novel culture, T_{12}: RDN through vermicompost enriched with novel culture, T_{13}: RDN through poultry manure enriched with novel culture.

Method of enrichment

All the organic manures were analysed for available nitrogen content before enrichment. On the basis on nitrogen content required quantity of different organic manures enriched with different biostimulants as per treatments before 7 days of transplanting. Make twelve different heaps of organic manure with calculated quantity as per treatments in the shady area. Required quantity of liquid organic substances added in the heaps as per the treatments and then mixed well. Cover the heaps with shade net and provided sufficient water to maintain the moisture within heaps.

Table 1: Required quantity of organic manures on nitrogen basis

Sr. No.	Organic manures	N (%)	kg per hectare	kg per plot (4.86 m^2)
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

Recommended dose of fertilizer - NPK 100:50:50 kg/ha

Around five week old uniform seedlings of variety Palam Samridhi were transplanted at a spacing of 45 cm × 30 cm with adopting recommended cultural practices and plant protection measures. The various observations were recorded from randomly selected ten plants and curds in each plot. Most of quality parameters were recorded after bio-chemical analysis in the laboratory. The data were analyzed statistically by adopting the standard procedures described by Panse and Sukhatme (1985) [11].

Results and Discussion

Effect of biostimulant enriched organic manures on growth parameters

Data presented in Table 2 revealed that, Effect of enriched organic manures on plant height at 45 days after transplanting and at harvest was found significant. The maximum plant height at 45 DAT and at harvest (39.66 cm and 58.40 cm, respectively) was recorded with treatment T_1 [Control (20 t/ha FYM + 100:50:50 NPK kg/ha)] which was statistically at par with treatments T_4 and T_5 at 45 DAT and T_4, T_5 and T_3 at harvest. This might be due to the availability of nutrients from inorganic fertilizers, could be due to the organic manure enhances soil aggregation, aeration, water holding capacity and inorganic fertilizers give more available form of nutrients. So, the combinations of organic and inorganic fertilizers give better response. These results are close conformity with the findings of Singh *et al.* (2018a) [13] and Mohanta *et al.* (2018) [9] in broccoli, Pawar and Barkule (2017) [12] and Singh *et al.* (2018b) [14] in cauliflower.

Among the organic manure enriched treatments, maximum plant height at 45 DAT and at harvest (36.40 cm and 55.08 cm, respectively) was found in T_4 (RDN through vermicompost enriched with NPK consortium). The increase in plant height as a result of application of biofertilizers may be attributed to the fact that the biofertilizers are known to synthesize the growth promoting substances besides nitrogen fixation, as a result of this, the plant have shown luxurious growth. The plant height considered to be an important factor to judge the vigour of the plant. Moreover, vermicompost application might have resulted in sustainable healthy plant system leading to increased plant height (Brar *et al*., 2015) [3]. These findings are in the accordance with the results of Meena *et al.* (2017) [8] in broccoli, Ibrahim *et al.* (2018) [5] and Narayan *et al.* (2018) [10] in Chinese cabbage.

The maximum number of leaves per plant at 45 DAT and at harvest (12.10 and 21.23, respectively) was recorded with treatment T_1 [Control (20 t/ha FYM + 100:50:50 NPK kg/ha)] which was statistically at par with treatment T_4 and T_5 at 45 DAT and T_4, T_5 and T_3 at harvest. It is probably due to the fact that the integrated use of nutrients actually resulted in rapid cell division, multiplication and cell elongation in meristematic region of plant which promoted vegetative growth of the plant. These results are in close conformity with the findings of Mohanta *et al.* (2018) [9] in broccoli, Pawar and Barkule (2017) [12] and Singh *et al.* (2018b) [14] in cauliflower.

On the other hand among the enriched organic manures treatments, maximum number of leaves per plant at 45 DAT (11.10) and at harvest (19.80) was recorded in T_4 (RDN through vermicompost enriched with NPK consortium).

The increase in number of leaves per plant under supply of organic fertilizer and bio-fertilizers may be attributed to increased soil tilth and aeration ability as well as availability

of essential macro and micro nutrients. The superiority of vermicompost over other organic manures may also be attributed to its more mineral elements contents and also their available forms. Also biofertilizers might have helped in production of growth regulating substances, also supplemented by favourable micro climate which proved for increasing number of leaves per plant and other growth parameters. These findings are in accordance with the findings of Meena *et al.* (2017) [8] and Atal *et al.* (2019) [2] in broccoli, Ibrahim *et al.* (2018) [5] and Narayan *et al.* (2018) [10] in Chinese cabbage.

It is apparent from the data present in Table 2 showed that the effect of enriched organic manures on days taken for curd initiation after transplanting and days taken for curd harvesting were found non-significant.

Table 2: Effect of biostimulant enriched organic manures on growth parameters

Treatments	Plant height (cm)		Number of leaves per plant		Days taken for curd initiation	Days taken for curd harvesting
	At 45 DAT	At harvest	At 45 DAT	At harvest		
T_1	39.66	58.40	12.10	21.23	45.10	64.20
T_2	33.25	49.90	10.07	18.00	52.67	73.53
T_3	35.31	52.77	10.60	19.07	51.70	71.60
T_4	36.40	55.08	11.10	19.80	48.73	68.70
T_5	36.07	53.91	10.97	19.37	49.80	70.53
T_6	33.06	49.78	10.00	17.80	52.87	74.93
T_7	33.34	50.46	10.17	18.13	52.30	73.30
T_8	34.75	51.42	10.43	18.47	51.97	73.10
T_9	34.33	51.20	10.30	18.27	52.10	73.13
T_{10}	31.05	46.04	9.63	16.87	57.73	80.47
T_{11}	31.86	47.83	9.77	17.07	57.03	78.47
T_{12}	32.87	48.65	9.97	17.57	53.33	75.57
T_{13}	32.13	48.33	9.80	17.37	54.67	77.07
S.Em. ±	1.47	2.12	0.43	0.79	2.26	3.03
C.D. at 5%	4.30	6.18	1.26	2.29	NS	NS
C.V. (%)	7.47	7.18	7.22	7.40	7.48	7.16

Effect of biostimulant enriched organic manures on quality parameters:

Effect of different treatments on curd diameter are summarized in Table 3 and it showed that curd diameter was significantly influenced by different treatments. The maximum curd diameter (12.63 cm) was recorded with treatment T_1 [Control (20 t/ha FYM + 100:50:50 NPK kg/ha)] which was statistically at par with treatment T_4, T_5 and T_3. Positive influence of organic manures and inorganic fertilizers on curd diameter may be due to the better availability of soil nutrient that produced healthy plants with large vegetable growth, which reflected curd diameter and improved soil chemical and physical properties by using organic manure. These results are close conformity with the findings of Singh *et al.* (2018a) [13], Mohanta *et al.* (2018) [9] and Lodhi *et al.* (2017) [7] in broccoli and Singh *et al.* (2018b) [14] in cauliflower.

Among the organic manure enriched treatments, maximum curd diameter (11.90 cm) was found in T_4 (RDN through vermicompost enriched with NPK consortium). It was observed that an increasing application nitrogen through organic manure, bio-fertilizer increased the curd diameter. This better availability of soil nutrients and favourable soil condition resulted in better translocation of carbohydrates to storage organs and healthy plants with large vegetative growth, which lead to higher curd diameter. These results are in conformity with the findings of Meena *et al.* (2017) [8] and Atal *et al.* (2019) [2] in broccoli, Ibrahim *et al.* (2018) [5] and Narayan *et al.* (2018) [10] in Chinese cabbage.

Data summarized in Table 3 indicated that there was no significant difference among different treatments for TSS content, chlorophyll content a, b and total in curd (mg/100g) and ascorbic acid (mg/100 g).

Table 3: Effect of biostimulant enriched organic manures on quality parameter

Treatments	Curd Diameter (cm)	TSS (°B)	chlorophyll content (mg/100g)			Ascorbic acid (mg/100g)
			a	B	Total	
T_1	12.63	7.83	18.22	13.39	31.61	85.16
T_2	10.65	8.21	17.31	12.81	30.12	77.73
T_3	11.33	8.47	17.59	12.94	30.53	80.01
T_4	11.90	8.65	17.90	13.33	31.22	82.73
T_5	11.69	8.54	17.63	12.99	30.62	80.76
T_6	10.52	8.18	17.06	12.72	29.78	77.22
T_7	10.82	8.26	17.42	12.83	30.24	78.31
T_8	11.15	8.41	17.44	12.92	30.35	79.51
T_9	10.97	8.29	17.43	12.84	30.27	78.93
T_{10}	10.13	7.98	16.51	12.25	28.75	73.97
T_{11}	10.23	8.03	16.54	12.31	28.85	74.85
T_{12}	10.37	8.13	16.80	12.47	29.27	76.49
T_{13}	10.30	8.05	16.58	12.51	29.09	76.11
S.Em. ±	0.47	0.17	0.43	0.30	0.60	2.12
C.D. at 5%	1.37	NS	NS	NS	NS	NS
C.V. (%)	7.35	3.61	4.34	4.01	3.45	4.67

Conclusion

On the basis of results of present investigation following conclusion may be drawn that combined application of FYM (20 t/ha) along with 100:50:50 kg/ha NPK was found superior in terms of growth and most of quality parameters of sprouting broccoli.

Among the various organic manure enriched treatments, it may be concluded that RDN (100 kg/ha) through vermicompost enriched with NPK consortium was found superior in terms of growth and quality parameters of sprouting broccoli.

References

1. Anonymous; c2018. FAOSTAT Website. http://faostat3.fao.org/home/E
2. Atal MK, Dwivedi DH, Narolia SL, Bharty N, Kumari R. 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. Journal of Pharmacognosy and Phytochemistry. 2019;SP(1):604-608.
3. Brar NS, Thakur KS, Kumar R, Mehta DK, Sharma N, Kumar D, *et al*. Effect of organic manures and biofertilizers on fruit yield and its contributing traits of tomato (*Solanum lycopersicum* L.). Ecology, Environment and Conservation. 2015;21(4):1783-1787.
4. Hazra P, Som MG. Vegetable science: Nutritive value of different vegetables. Edn 2, Vol. I, Kalyani Publishers, Ludhiana; c2015. p. 24 and 290.
5. Ibrahim M, Ali MT, Narayan S. Effect of different sources of plant nutrients on growth, yield and quality of Chinese cabbage (*Brassica rapa* L. var. *pekinensis*). International Journal of Chemical Studies. 2018;6(2):3120-3122.
6. Kalbani FO, Salem MA, Cheruth AJ, Kurup SS, Senthilkumar A. Effect of some organic fertilizers on growth, yield and quality of tomato (*Solanum lycopersicum*). Edn 1, Vol. 53. International Letters of Natural Sciences; c2016. p. 1-9.
7. Lodhi P, Singh D, Tiwari A. Effect of inorganic and organic fertilizers on yield and economics of broccoli (*Brassica oleraceae* var. italica). International Journal of Current Microbiology and Applied Sciences. 2017;6(8):562-566.
8. Meena K, Ram RB, Meena ML, Meena JK, Meena DC. Effect of organic manures and bio-fertilizers on growth, yield and quality of broccoli (*Brassica oleracea* var. *italica* Plenck.) cv. KTS-1. Chemical Science Review and Letters. 2017;6(24):2153-2158.
9. 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. Journal of Pharmacognosy and Phytochemistry. 2018;7(1):2229-2232.
10. Narayan S, Ibrahim A, Khan FA, Hussain K, Malik AA, Mir SA, Narayan R. Organic nutrient management for improved plant growth and head yield of Chinese cabbage. International Journal of Current Microbiology and Applied Sciences. 2018;7(9):3049-3059.
11. Panse VG, Sukhatme PV. Statistical methods for Agricultural workers. Indian Council of Agricultural Research Publication, New Delhi; c1985. p. 381.
12. Pawar R, Barkule S. Study on effect of integrated nutrient management on growth and yield of cauliflower (*Brassica oleracea* var. *botrytis* L.). Journal of Applied and Natural Science. 2017;9(1):520-525.
13. Singh G, Sarvanan S, Kerketta A, Rajesh J. Effect of organic manures and inorganic fertilizers on plant growth, yield and flower bud quality of broccoli (*Brassica oleracea* var. *Italica*) cv. Green Magic. International Journal of Pure and Applied Bioscience. 2018[a];6(5):1338-1342.
14. Singh SK, Singh DK, Singh PK, Singh SK, Adarsh A. and Pratap T. Effect of integrated nutrient management on growth, quality, yield and economics of cauliflower (*Brassica oleracea* var. *botrytis* L.). Bulletin of Environment, Pharmacology and Life Sciences. 2018[b];7(3):08-11.
15. Thamburaj S, Singh N. Vegetables, Tuber Crops and Spices. Directorate of Knowledge Management in Agriculture, ICAR, New Delhi; c2018. p. 136.