

Effect of Organic Manures and Biofertilizers on Growth Yield and Quality of Broccoli

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ABSTRACT: A field experiment was carried out at main experimental farm Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kalyanpur, Kanpur (U.P.) India during Rabi season in consecutive year of 2019-2020 and 2020-2021. It comprised twelve treatment combinations in a randomized block-design with three replications. The growth parameters of the broccoli crop were significantly affected by different treatments. Maximum plant height viz. (26.12cm), (50.35cm), (53.60cm), number of leaves per plant (10.40), (17.95), (19.45), leaf length (13.25cm), (50.55cm), (52.17cm), the leaf width (5.60cm), (19.30cm), (21.80cm) and maximum plant spread (34.05cm), (57.60cm), (70.85cm) respectively at 30, 60 days after transplanting and at harvesting stage were observed in treatment T₂ (Vermicompost 100% @8 t/ha) and minimum value was recorded under control (T₀). Yield and yield contributing traits viz., days taken to first head initiation (52.97 days), days taken to head maturity (76.25 days) in T₂ (Vermicompost 100% @8 t/ha) whereas maximum days to first head initiation (58.00) and maximum days to head maturity for harvesting (80.00) was observed at harvesting in T₀ (control) respectively. The Stalk length (19.60cm), Stalk diameter (3.83cm), head length (8.10cm), head width (12.75cm), head diameter (13.85cm), yield kg/plant (0.500kg), yield kg/plot (10.00kg), yield q/ha (185.18q) while in quality parameters highest Total soluble solids (8.65°Brix), Vitamin C (89.23), Total sugar (4.07%), Reducing sugar (3.25%), non-reducing sugar (0.77%), at harvesting stage were observed highest with treatment T₂ (Vermicompost 100% @8 t/ha). The challenges in organic vegetable production are more due to low production but continue application of organic manure and biofertilizers the production is increases. Observing the results it can be stated that the using of Vermicompost plants gave better growth, yield and quality contributing characters of broccoli in contemporary with other treatments.

Keywords: Broccoli, Organic manure, Bio-fertilizers, Quality and traits.

INTRODUCTION

Broccoli (*Brassica oleracea* var. *italica* Plenck; 2n=x=18), which is originated from the Mediterranean region commonly known as Hari gobhi in hindi and a member of Cole group, belongs to the family Brassicaceae or crucifereae. Brassica vegetables possess both antioxidant and anti-carcinogenic properties. Broccoli is known as the, Crown of jewel nutrition because it is rich in vitamins and minerals specially vitamin A, vitamin C, carotenoids, fiber, calcium and folic acid. It has about 130 times more vitamin A contents than cabbage. The nutritive value of sprouting broccoli per 100g of edible portion is given below: water (89.3%), protein (3.6%), fat (0.2%), carbohydrates (5.5%), fiber (1.2%), vitamin A (900 I.U.), vitamin B (33 I.U.), vitamin C (137 I.U.), vitamin E (2.3 I.U.), vitamin K (3.5 I.U.), calcium (1.29 mg), manganese (20 mg), Iron (1.3 mg), phosphorus (0.79 mg), and sulphur (1.26 mg) (Thamburaj and Singh 2014). Organic matter plays an important role in the

chemical behaviour of several metals in soil throughout its active groups (Flavonic and humic acids) which have the ability to retain the metals in complex and chelate forms. Vermi-compost provides vital macronutrients and micronutrients. Organic manure not only balance the nutrients supply but also improve the physical and chemical properties of soil. The incorporation of organic nutrients in the form of *vermicompost* and *farmyard manure* is known to influence favourably the physio-chemical and biological properties of the soil resulting in enhanced uptake of nutrients from soil (Lal and Kanaujia 2013). Biofertilizers have a great potential to bridge the gap between demand and supply of nutrient. Bio-fertilizers contain micro-organisms which are capable of mobilizing nutritive elements from non-usable form to usable form through biological processes as well as offers economically attractive and ecologically sound means of reducing external inputs and improving growth and yield as well as quality of vegetable produce. Nutrient management is the key factor, which

influences the productivity and quality of any crop. Organic manure are considered helpful in improving the physical and nutritional status of the soil and also enhance the activity of soil micro flora. They also add considerable amount of major nutrients in the soil besides improving the soil properties. Further, decomposition of organics in the soil leads to different types of biological reactions which are helpful in preventing various disease causing pathogens (Ramesh *et al.*, 2010). The aim of the investigation was to evaluate the growth and yield performance of broccoli influenced by organic manures and bio-fertilizers. Keeping in view the above facts in mind, an experiment entitled effect of organic manures and bio-fertilizers on growth yield and quality of broccoli (*Brassica oleracea* var. *Italica* Plenck.).

MATERIALS AND METHODS

A field experiment was carried out at main experimental farm Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kalyanpur, Kanpur (U.P.), India during rabi season in consecutive years of 2019-2020 and 2020-2021 both the years at same time to determine the growth and yield potential of broccoli in response to organic manures and bio-fertilizers. The seeds of the F₁ hybrid Green Magic were procured from the Sakata Seed Company, (U.P.) India. The field experiment consisted of twelve treatment combination FYM 100% @ 25 t/ha (T₁), Vermicompost 100% @8 t/ha (T₂), *Azotobactor* 100% @ 5kg/ha (T₃), PSB 100% @ 5kg/ha (T₄), 50% FYM + 50% Vermicompost (T₅), 50% FYM + 50% *Azotobactor* (T₆), 50% FYM + 50% PSB (T₇), 50% Vermicompost + 50% *Azotobactor* (T₈), 50% Vermicompost + 50% PSB (T₉), 50% FYM + 50% Vermicompost + 50% PSB (T₁₀), 50% FYM +50% Vermicompost + 50% *Azotobactor* + 50% PSB (T₁₁), Control (T₀) for broccoli production. The experiment was conducted in Randomized Block Design with three replications and 60 cm × 45 cm spacing. The seed of hybrid broccoli cv. Green Magic was sown for raising seedlings. 15 cm raised bed of 3.0×1.0 m size was prepared for the sowing of seeds. The seeds were sown on 20th October 2019-2020 and 2020-2021 in two consecutive years of experimentation. After sowing, seeds were covered with a thin film of soil mixed with farmyard manure. The sown seedbed was finally covered with dry paddy straw to act as mulch. The seedbed was uncovered immediately after the sprouting of seeds to ensure proper germination and growth of sprouts. To ensure healthy growth, seedlings were provided with proper plant protection measures. Weeds were removed as and when necessary. The seedlings were provided with light irrigation as and when required. In the present study the status of soil organic matter (0.78%, 0.82%), available nitrogen (210.60kg/ha, 205.35 kg/ha), available phosphorus (45.60kg/ha, 41.71 kg/ha), available potash (193.45kg/ha, 186.66 kg/ha), pH range (7.66, 7.60) and E.C. (0.28 m mhos, 0.26 m mhos) determined by different methods in the two-year data 2019-2020 and

2020- 2021, respectively. Rating of the N, P, and K status was done based on the soil manual of the Department of Soil Science & Agri. Chemistry, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur.

RESULT AND DISCUSSION

A. Growth parameters of broccoli

Data represented in Table 1, the effect of organic manure *viz.*, FYM, Vermicompost and biofertilizers *viz.*, *Azotobactor*, PSB on growth parameters of broccoli showed the significant differences among the treatments which were recorded at 30, 60 DAT and at harvesting stage during both the years of study. The growth parameters *viz.*; plant height (cm), number of leaves/plants, leaf length (cm), leaf width (cm) and plant spread (cm) have been showing significant differences with the application of different treatments. According to pooled data the maximum plant height (26.12cm), (50.35cm) and (53.60cm) respectively were recorded with the application of (Vermicompost 100% @8 t/ha) T₂ while the minimum plant height *viz.*, (17.40cm), (18.20cm) and (17.80cm) were recorded at 30, 60 DAT and at harvesting stage in T₀ (control) respectively. Further data indicated the maximum number of leaves per plant *viz.* (10.40), (17.95), and (19.45 respectively counted as different days and harvesting stages with application of (Vermicompost 100% @8 t/ha) T₂ while the minimum number of leaves per plants *viz.*, (6.25), (12.20) and (13.40) respectively were recorded as different days in case of control (T₀). The maximum leaf length (13.25cm), (50.55cm) and (52.17cm) respectively were recorded on different days with the application of (Vermicompost100% @8 t/ha) T₂ while the minimum leaf length *viz.*, (6.45cm), (35.55cm) and (37.60cm) respectively were recorded as different days in case of control (T₀). The maximum width of leaves (5.60cm), (19.30cm) and (21.80cm) recorded on different days with the application of (Vermicompost 100% @8 t/ha) T₂ while minimum width of leaves *viz.* (3.10cm), (13.35cm) and (14.55cm) respectively were recorded as different days in case of control (T₀). The maximum plant spread (34.05cm), (57.60cm) and (70.85cm) recorded on different days with the application of (Vermicompost100% @8 t/ha) T₂ while minimum plant spread *viz.*, (21.30cm), (45.00cm) and (50.55cm) respectively were recorded as different days in case of control (T₀). It is also noted that the pool data of growth parameters *viz.*; plant height(cm) (46.74%), (34.62%), (29%) number of leaves/plants (66.40%), (47.13%), (45.14%), leaf length (cm) (105.42%), (42.19%), (38.75%), leaf width(cm) (80.64%), (44.56%), (49.82%) and plant spread(cm) (59.85%), (28%), (40.15%) was increased at 30, 60 DAT and at harvesting stage respectively. The results of the present investigation are in concordance with the findings reported earlier by Atal *et al.* (2019); Mal *et al.* (2015); Mohanta *et al.* (2018) in broccoli.

B. Yield and yield parameters of broccoli

Data represented in Table 2, the effect of organic manure viz., FYM, Vermicompost and biofertilizers viz., Azotobacter, PSB on yield parameters of broccoli observed significant variation among the treatments which were recorded at harvesting stage during both the years. According to the couple of years study revealed that minimum days to first head initiation (52.97) minimum days to head maturity for harvesting (76.25) at harvesting was observed with treatment T₂ (Vermicompost 100% @8 t/ha) which were statistically at par with treatment T₁₁ (50% FYM + 50% Vermicompost + 50% Azotobacter + 50% PSB), T₁₀(50% FYM + 50% Vermicompost + 50% PSB), T₈ (50% Vermicompost + 50% Azotobacter). The maximum days to first head initiation viz. (58.00), maximum days to head maturity for harvesting viz. (80.00) was observed at harvesting in case T₀ (control) respectively. Maximum weight of head with guard leaves (1273.09gm), weight of head without guard leaves (485.57gm), percentage weight loss of head (413.60gm), Stalk length (19.60cm), Stalk diameter (3.83cm), head length (8.10cm), head width (12.75cm), head diameter (13.85cm), yield kg/plant (0.500kg), yield kg/plot (10.00kg), yield q/ha (185.18q)at harvesting was observed with treatment T₂ (Vermicompost 100% @8 t/ha) which were statistically at par with treatment T₁₁ (50% FYM + 50% Vermicompost + 50% Azotobacter + 50% PSB), T₁₀ (50% FYM + 50% Vermicompost + 50% PSB) respectively. The minimum, weight of head with guard leaves (740.00gm), weight of head without guard leaves (292.50gm), Percentage weight loss of head (318.00gm), Stalk length (12.47cm), Stalk diameter (2.90cm), head length (3.30cm), head width (7.00cm), head diameter (8.45cm), yield kg/plant (.290kg), yield kg/plot (5.80kg), yield q/ha (107.40q)was observed at harvesting in T₀ (control).It is also noted that the pool data of yield parameters viz; weight of head with guard leaves (72.03%), weight of head without guard leaves (66.00%), Stalk length (57.17%), Stalk diameter

(32.06%), head length (145.45%), head width (82.14%), head diameter (63.90%), yield kg/plant (72.41%), yield kg/plot (72.41%), yield q/ha (72.42%) was increased at harvesting respectively. Similar results have also been reported by Bahadur *et al.* (2003); Kumar *et al.* (2013); Lodhi *et al.* (2017); Dash *et al.* (2019).

C. Quality parameters of broccoli

Data represented in Table 3, the effect of organic manure viz., FYM, Vermicompost and biofertilizers viz., Azotobacter, PSB on Quality parameters of broccoli observed significant variation among the treatments which were recorded at harvesting stage during both the years. According to the couple of years study revealed that the maximum total soluble solids (8.65°Brix) were recorded with the application of treatment T₂ (Vermicompost @ 8t ha⁻¹) while the minimum Total soluble solids (6.15°Brix) was recorded in case of control (T₀). Further data indicated that the maximum Vitamin C (89.23) were recorded with the application of treatment T₂ (Vermicompost @ 8t ha⁻¹) while the minimum Vitamin C (79.80) was recorded in case of control (T₀). The maximum Total sugar (4.07%) was recorded with the application of treatment T₂ (Vermicompost @ 8t ha⁻¹) while the minimum Total sugar (1.80%) was recorded in case of control (T₀). The maximum Reducing sugar (3.25%) was recorded with the application of treatment T₂ (Vermicompost @ 8t ha⁻¹) while the minimum Reducing sugar (1.22%) was recorded in case of control (T₀) and maximum non-reducing sugar (0.77%) was recorded with the application of treatment T₂ (Vermicompost @ 8t ha⁻¹) while the minimum non-reducing sugar (0.37%) was recorded in case of control (T₀). similar findings also been observed by Kumar *et al.* (2011); Wani *et al.* (2011); Chatterjee *et al.* (2012); Merentola *et al.* (2012); Lal and Kanaujia (2013); Yadav *et al.* (2016); Kumar *et al.* (2017).

Table 1: Study on the Effect of Organic manure and Biofertilizer on Growth of Broccoli (*Brassica oleracea* L. var. *italica* Plenck), based on two years of Pooled data.

Treatment	plant Height cm 30 DAT	60 DAT	At harvesting stage	Number of leaves/plant30 DAT	60 DAT	At harvesting stage	leaf Length cm 30 DAT	60 DAT	At harvesting stage	Width of leaf (cm)30 DAT	60 DAT	At harvesting stage	Plant spread (cm)30 DAT	60 DAT	At harvesting stage
T ₀	17.80	37.40	41.55	6.25	12.20	13.40	6.45	35.55	37.60	3.10	13.35	14.55	21.30	45.00	50.55
T ₁	22.75	46.85	49.75	8.30	16.42	18.37	11.65	48.40	50.55	4.25	17.55	19.60	31.45	54.75	68.22
T ₂	26.12	50.35	53.60	10.40	17.95	19.45	13.25	50.55	52.17	5.60	19.30	21.80	34.05	57.60	70.85
T ₃	20.55	43.85	48.20	7.40	15.10	16.17	9.80	45.62	47.55	3.85	16.40	17.55	28.80	51.77	65.80
T ₄	21.25	45.30	48.42	7.80	15.40	16.55	10.30	46.00	48.50	3.80	15.90	18.15	29.27	53.02	66.50
T ₅	23.02	47.55	50.15	8.62	16.60	18.29	12.05	48.75	50.77	4.35	17.90	20.07	31.80	55.18	68.40
T ₆	21.85	46.65	49.30	8.15	16.09	18.00	11.30	48.32	50.20	4.03	17.25	19.25	30.85	54.40	67.50
T ₇	21.33	45.84	48.80	8.00	15.70	16.90	10.90	47.75	49.67	3.90	17.12	18.55	29.90	53.55	66.50
T ₈	23.78	48.45	51.90	9.32	17.20	18.80	12.50	49.35	51.05	4.90	18.65	20.97	32.80	56.10	69.25
T ₉	22.30	47.85	50.60	8.80	16.85	18.55	12.30	49.10	50.85	4.70	18.08	20.60	32.35	55.55	68.86
T ₁₀	23.95	48.75	52.27	9.85	17.50	19.12	12.75	49.70	51.55	5.15	18.90	21.27	32.92	56.60	70.15
T ₁₁	25.07	49.60	53.20	10.12	17.75	19.30	12.97	50.08	51.85	5.30	19.15	21.60	33.70	57.15	70.55
SE(m)	0.56	1.17	41.55	0.21	0.40	0.44	0.28	0.51	0.64	0.11	0.44	0.49	0.77	0.81	0.78
CD (P=0.05)	1.67	3.45	49.75	0.64	1.20	1.31	0.84	1.53	1.90	0.33	1.30	1.44	2.29	2.39	2.32

Table 2: Study on the Effect of Organic manure and Biofertilizer on Yield Attributing traits of Broccoli (*Brassica oleracea* L. var. *italica* Plenck), based on two years of Pooled data.

Treatment Combinations	Days to first head initiation	Days to head maturity for harvesting	Weight of head with guard leaves (g)	Weight of head without guard leaves (g)	Percentage weight loss of head (g) after 24 hours at room temp	%	Stalk length (cm)	Stalk diameter (cm)	Head length (cm)	Head width (cm)	Head diameter (cm)	Yield kg/plant	Yield kg/plot	Yield (q/ha)
T ₀	58.00	80.000	740.00	292.50	318.00	9.20	12.47	2.90	3.30	7.00	8.45	0.29	5.80	107.40
T ₁	54.85	78.520	1,102.99	422.50	373.10	8.90	17.05	3.46	6.95	11.50	12.55	0.42	8.44	156.48
T ₂	52.97	76.250	1,273.09	500.57	413.60	14.80	19.60	3.83	8.10	12.75	13.85	0.50	10.00	185.18
T ₃	55.20	79.080	978.08	360.20	331.60	9.80	15.75	3.14	6.44	10.35	11.25	0.36	7.20	133.33
T ₄	56.05	78.970	1,025.45	355.20	338.05	9.90	16.15	3.21	6.62	10.65	11.80	0.35	7.10	131.48
T ₅	54.45	78.320	1,125.80	424.50	390.35	8.04	17.50	3.55	7.05	11.73	12.80	0.43	8.70	161.11
T ₆	55.45	78.750	1,068.07	395.55	368.16	6.90	16.65	3.32	6.88	11.25	12.30	0.39	7.90	146.29
T ₇	55.80	78.970	1,050.27	387.85	360.60	7.02	16.35	3.26	6.76	10.78	12.05	0.38	7.75	143.33
T ₈	53.50	77.800	1,205.32	440.72	393.93	10.61	18.25	3.70	7.62	12.17	13.37	0.44	8.80	162.96
T ₉	53.85	78.100	1,175.63	435.49	391.85	10.02	17.96	3.63	7.32	11.90	13.05	0.43	8.70	161.11
T ₁₀	53.27	77.350	1,235.45	472.80	400.63	15.26	18.76	3.72	7.82	12.40	13.58	0.47	9.45	174.81
T ₁₁	53.10	76.750	1,265.22	478.95	405.47	15.3	19.20	3.81	7.97	12.60	13.68	0.47	9.57	177.03
SE(m)	0.52	0.54	38.39	10.44	10.31		0.41	0.08	0.17	0.28	0.31	0.010	0.21	4.24
CD (P=0.05)	1.54	1.61	113.34	30.84	30.44		1.23	0.25	0.52	0.84	0.92	0.031	0.62	12.54

Table 3: Study on the Effect of Organic manure and Biofertilizer on Quality of Broccoli (*Brassica oleracea* L. var. *italica* Plenck), based on two years of Pooled data.

Treatment combinations	Total soluble solids (°Brix)	Vitamin - C (mg/100g)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
T ₀	6.15	79.800	1.80	1.22	0.37
T ₁	8.41	83.600	2.87	2.59	0.52
T ₂	8.65	89.230	4.07	3.25	0.77
T ₃	7.52	79.940	2.37	2.17	0.43
T ₄	7.66	80.920	2.44	2.23	0.44
T ₅	8.46	84.040	3.00	2.67	0.56
T ₆	8.33	83.520	2.79	2.51	0.48
T ₇	7.74	81.780	2.68	2.28	0.45
T ₈	8.56	84.900	3.70	2.97	0.62
T ₉	8.50	84.500	3.18	2.82	0.59
T ₁₀	8.61	85.190	3.86	3.02	0.64
T ₁₁	8.63	88.250	3.92	3.14	0.72
SE(m)	0.20	0.43	0.07	0.07	0.018
CD (P=0.05)	0.60	1.27	0.23	0.21	0.054

CONCLUSIONS

The overall results obtained from the present investigation clearly revealed that among various combinations of organic manures and bio-fertilizers, the treatment T₂ (Vermicompost 100% @8 t/ha) observed growth parameters like- plant height (cm), number of leaves/plants, leaf length (cm), leaf width (cm) and plant spread (cm) highest and the maximum weight of head with guard leaves (1273.09gm), weight of head without guard leaves (485.57gm), yield kg/plant (0.500kg), yield kg/plot (10.00kg), yield q/ha (185.18q) at harvesting was observed. The quality parameters Total soluble solids (8.65°Brix), Vitamin C (89.23), Total sugar (4.07%), Reducing sugar (3.25%), non-reducing sugar (0.77%), at harvesting stage were also recorded highest with treatment T₂ (Vermicompost 100% @8 t/ha). These results conformity with finding of Kumar *et al.* (2013); Meena *et al.* (2017); Lodhi *et al.* (2017); Mohanta *et al.* (2018). Hence, soil application Vermicompost 100% @8 t/ha was found to be the best for obtaining the highest growth, yield (185.18q/ha) as well as quality of broccoli in the condition of Kanpur Uttar Pradesh. Complete organic production technology for broccoli is may be developed for better production and human health because chemically produced vegetables is more harmful.

Conflict of Interest. None.

REFERENCES

- Atal, M. K., Dwivedi, D. H., Narolia, S. L., Bharty, N. and Kumari, R. (2019). Influence of bio-fertilizer (*Rhizobium radiobacter*) 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*, 1, 604-608.
- Bahadur, A., Singh, J. and Upadhaya, A. K. (2003). Effect of manures and bio-fertilizers on growth, yield and quality attributes of broccoli (*Brassica oleracea* L. var. *italica* Plenck.), *Vegetable Chester Science*, 30(2), 192-194.
- Chatterjee, R., Jana, J. C. & Paul, P. K. (2012). Enhancement of head yield and quality of cabbage (*Brassica oleracea*) by combining different sources of nutrients. *Indian Journal of Agricultural Sciences*, 82(4), 324-8.
- Dash, S. K., Sahu, S. G., Das, S., Sarkar, S. and Pathak, M. (2019). Effect of integrated nutrient management on yield, yield attributes and economics of broccoli. *International Journal of Current Microbiology and Applied Sciences*, 8(6), 3254-3258.
- Kumar, M., Das, B., Prasad, K. K. and Kumar, P. (2013). Effect of integrated nutrient management on growth and yield of broccoli (*Brassica oleracea* var. *italica*)

- under Jharkhand conditions. *Vegetable Science*, 40 (1), 117-120.
- Kumar, M., Das, V., Prasad, K. K. and Kumar, P. (2011). Effect of integrated nutrient management on quality of broccoli (*Brassica oleracea* (L.) var. *italica*) cv. Fiesta under Jharkhand conditions. *Asian Journal of Horticulture*, 6(2), 388-392
- Kumar, G. and Biradar, M. S. (2017). Integrated nutrient management studies for protected cultivation of broccoli (*Brassica oleracea* italica L.). *International Journal of Chemical Studies*, 5(4), 225-227.
- Lal, S. and Kanaujia, S. P. (2013). Integrated nutrient management in capsicum under low cost polyhouse condition. *Annals of Horticulture*, 6(2), 170-177.
- Lodhi, P, Singh, D. and Tiwari, A. (2017). Effect of Inorganic and Organic Fertilizers on Yield and Economics of Broccoli (*Brassica oleracea* var. *italica*). *Int. J. Curr. Microbiol. App. Sci.*, 6(8), 562-56.
- Mal, D., Chatterjee, R. and Nimbalkar, K. H. (2015). Effect of vermi- compost and inorganic fertilizers on growth, yield and quality of sprouting broccoli (*Brassica oleracea* L. var. *italica* Plenck). *International Journal of Bio-resource and Stress Management*, 5(4), 507-512.
- Merentola, Kanaujia, S. P. and Singh, V. B. (2012). Effect of integrated nutrient management on growth, yield and quality of broccoli (*Brassica oleracea* var. *italica*). *Journal of Soils and Crops*, 22(2), 233-239.
- Mohanta, R., Nandi, A. K., Mishra, S. P., Pattnaik, A., Hossain, M. M. and Padhiary, A. K. (2018). Effects of integrated nutrient management on growth, yield, quality and economics of sprouting broccoli (*Brassica oleracea* var. *italica*) cv. Shayali. *Journal of Pharmacognosy and Phytochemistr*, 7(1), 2229-2232.
- Ramesh, P., Panwar, N.R., Singh, A. B., Ramana, S., Yadav, S. K. and Rao, A. S. (2010). Status of Organic Farming in India. *Current Science*, 98(9), 1190-1194.
- Thamburaj, S. and Singh, N. (2014). Vegetables, Tubercrops and Spices, Directorate of knowledge Management in Agriculture ICAR New Delhi, 122-123.
- Wani, A. B., Raj, J., Singh, A. K. and Sumati, N. (2011). Influence of organic and inorganic source of nutrients on growth, yield and quality of cauliflower. *Journal of Entomology and Ecology*, 29(4), 1941-1947.
- Yadav, L. P., Singh, A. and Malhotra, S. K. (2016). Growth, yield and quality response of organic broccoli to intercrops and crop geometry. *Indian Journal of Horticulture*, 73(3), 376-382.

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