



P-ISSN: 2349-8528
 E-ISSN: 2321-4902
 www.chemijournal.com
 IJCS 2022; 10(5): 04-07
 © 2022 IJCS
 Received: 08-05-2022
 Accepted: 11-07-2022

Praveen Jaiswal
 M.Sc., Vegetable Science
 RVSKVV, Gwalior, Madhya
 Pradesh, India

Anamika Tomar
 PhD Scholar, RVSKVV,
 Gwalior, Madhya Pradesh, India

Dr. KP Asati
 Associate Professor, RVSKVV,
 Gwalior, Madhya Pradesh, India

Dr. Swati Barche
 Associate Professor, RVSKVV,
 Gwalior, Madhya Pradesh, India

Corresponding Author:
Praveen Jaiswal
 M.Sc., Vegetable Science
 RVSKVV, Gwalior, Madhya
 Pradesh, India

International Journal of Chemical Studies

Integrated nutrient management in broccoli (*Brassica oleracea var. italica*) under Malwa condition of Madhya Pradesh

Praveen Jaiswal, Anamika Tomar, Dr. KP Asati and Dr. Swati Barche

Abstract

The experiment was laid out in a randomized block design with three replications and fourteen treatments. The treatments consisted of T₀ Control, T₁ 100% RDF, T₂ 100% FYM, T₃ 100% Vermicompost, T₄ 100% Poultry manure, T₅ 100% Biofertilizer, T₆ 50% RDF + 50% FYM, T₇ 50% RDF + 50% Vermicompost, T₈ 50% RDF + 50% Poultry manure, T₉ 50% RDF + 50% Biofertilizer, T₁₀ 50% RDF + 25% FYM + 25% Vermicompost, T₁₁ 50% RDF + 25% FYM + 25% Poultry manure, T₁₂ 50% RDF + 50% FYM + Biofertilizer, T₁₃ 50% RDF + 16.6% FYM + 16.6% Vermicompost + 16.6% Poultry manure + Biofertilizer. Application of different levels of fertilizers in combination, bio-fertilizers, vermicompost and different compost significantly increased the growth, yield and quality of broccoli. Treatment T₇-50% RDF+50% Vermicompost was recorded best for growth parameters (*i.e.*, plant height, leaf length, leaf width and number of leaves per plant) Phenological Parameters *i.e.*, (days to first curd emergence and days taken to 50% curd formation) It is cleared from the data procured that a statistically significantly maximum in the treatment T₇-50% RDF + 50% Vermicompost (16.70 t/ha), net income (Rs.204800) and C:B ratio (5.35). These results suggested that the optimum production of broccoli can be obtained with integrated application of 50% RDF + 50% Vermicompost.

Keywords: Vermicompost, Poultry manure, FYM, NPK, growth and Biofertilizer

Introduction

Broccoli (*Brassica oleracea var. italica* L.) is one of the most nutritious vegetable amongst the cole crops grown for its tender heads. It is a native of eastern Mediterranean region, derived from ancient forms of *Brassica oleracea*. It is regarded as important functional food due to its high nutritional value *i.e.* vitamin A, protein and anticarcinogenic compounds. It is richest source of sulphoraphane, a compound associated with reducing risk of cancer in human beings (Thamburaj and Singh, 2013) [6]. The curd of broccoli contains following nutrients per 100 g of edible portion; moisture 89.9 g, carbohydrates 5.5 g, fat 0.2g, protein 3.3g, vitamin A 3500 IU, thiamine 0.05 mg, riboflavin 0.12 mg, phosphorous 79 mg, calcium 80 mg, iron 0.8 mg, ascorbic acid 137 mg and calories 37g (Singh and Nath, 2012) [5].

During green revolution the trend was using excessive fertilizer and pesticides for enhancing crop production. Continuous application of inorganic substances kills the beneficial microorganism in the soil and create pollution. This ultimately affects the human health in the form of cancer, kidney problems, respiratory ailments, cardiac diseases etc. Hence, the nutrient management is the key factor for influencing yield and quality of any crop. Various organic sources like FYM, vermicompost, poultry manure, biofertilizers plays an important key role in the vegetable production. Organic manure play a direct role in plant growth as a source of all necessary macro and micronutrient in available forms during mineralization and improving physical and chemical properties of soils. Therefore, utilization of locally produced manures by vegetable production operations may increase crop yield with less use of chemical fertilizer. In recent times, consumers are demanding higher quality and safe food vegetables.

In the last few decades, production of vegetable crops has been enhanced manifold by the excessive use of chemical fertilizers and pesticides (Sharma *et al.*, 2008) [3]. Nutrient management is the key factor, which influences the productivity and quality of any crop. The benefit from organically cultivated crops is strongly related to the maintenance of soil fertility based to a great extent on the soil organic matter content. Farmyard manure (FYM) is one of the more valuable organic fertilizers maintaining soil fertility in the systems of alternative agriculture. FYM is partially composed dung, urine, bedding and straw.

Dung comes mostly as undigested material and the urine from the digested material. FYM contains approximately 5 - 6 kg nitrogen, 1.2 - 2.0 kg phosphorus and 5 - 6 kg potash per tonne.

Yield of broccoli curd will decline if the essential nutrient to broccoli is unavailable to the plants. Among the several constraints improper nutrient management is key factor for poor productivity of broccoli. Inorganic fertilizer provide the nutrient early and directly to the plant but continuous use of inorganic fertilizer depletes the soil fertility and have adverse effect on soil health. Therefore it is appropriate to promote use of organic fertilizers which not only conserve soil fertility but also avails the healthy and organic produce to people.

Material and Methods

Broccoli (*Brassica oleracea* var. *italica*) cv. 'Palamvichitra' was used for present study. The plot size was 2.25m × 2.25m and a spacing of 45 cm × 45 cm. recommended crop production and practices were followed to grow the crop. The experiment was laid out in randomized block design with three replications comprising of fourteen treatment combination inorganic fertilizers, Bio-fertilizers, vermicompost, poultry manure, FYM. The treatments were T₀ Control, T₁ 100% RDF, T₂ 100% FYM, T₃ 100% Vermicompost, T₄ 100% Poultry manure, T₅ 100% Biofertilizer, T₆ 50% RDF + 50% FYM, T₇ 50% RDF + 50% Vermicompost, T₈ 50% RDF + 50% Poultry manure, T₉ 50% RDF + 50% Biofertilizer, T₁₀ 50% RDF + 25% FYM + 25%

Vermicompost, T₁₁ 50% RDF + 25% FYM + 25% Poultry manure, T₁₂ 50% RDF + 50% FYM + Biofertilizer, T₁₃ 50% RDF + 16.6% FYM + 16.6% Vermicompost + 16.6% Poultry manure + Biofertilizer Observation on plant height, number of leaves, leaf length, leaf width were recorded with the five selected plants for study. Days to first head emergence, No. of days taken to 50% flowering and benefit: cost ratio.

Result and Discussion

Growth parameters

The analysis of variance revealed significant differences among the treatments for all the plant growth attributes under study.

Significantly maximum plant height, leaf length, leaf width and number of leaves per plant of broccoli at 30, 60 and 90 DAT were recorded in the treatment T₇ (50% RDF+50% Vermicompost) and minimum growth parameters were recorded under treatment T₀ (local control). The increased growth parameter might be due to integrated application of inorganic and organic fertilizer combination of 50% RDF along with 50% Vermicompost. Use of vermicompost might have increased the soil health and soil fertility which ultimately increased the nutrient uptake in plants and showed the positive effect on the growth parameters of the plants. While minimum growth parameter in plants might be due to inadequate availability of nutrients due to treatment T₀ (Local control). Similar finding was reported by Meena *et al.* (2017)^[2] in broccoli.

Table 1: Effect of integrated nutrient management on plant height (cm) and leaf length (cm) in Broccoli at different growth stages.

S.N.	Treatments	Plant height (cm)			Leaf length (cm)		
		30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T ₀	Control	14.03	27.57	47.27	9.70	26.23	30.40
T ₁	100% RDF	19.47	34.60	56.90	13.97	33.57	37.30
T ₂	100% FYM	15.10	28.07	48.43	10.73	28.30	31.77
T ₃	100% Vermicompost	19.27	32.87	55.80	13.20	33.40	36.13
T ₄	100% Poultry manure	17.13	31.53	53.30	12.40	33.27	35.10
T ₅	100% Biofertilizer	15.90	30.33	51.67	11.13	31.97	33.40
T ₆	50% RDF+50% FYM	16.50	30.37	52.70	11.47	32.73	34.43
T ₇	50% RDF+50% Vermicompost	24.13	42.87	66.10	21.30	38.53	44.47
T ₈	50% RDF+50% Poultry manure	23.20	40.77	64.70	19.63	37.87	42.83
T ₉	50% RDF+50% Biofertilizer	20.37	38.23	59.77	15.50	34.50	38.50
T ₁₀	50% RDF+ 25% FYM+25% Vermicompost	22.10	37.87	62.40	17.00	36.07	40.43
T ₁₁	50% RDF+25% FYM+25% Poultry manure	21.57	36.80	60.10	16.10	35.20	39.40
T ₁₂	50% RDF+50% FYM + Biofertilizer	22.47	39.97	63.97	18.17	36.67	41.37
T ₁₃	50% RDF+16.6% FYM+16.6% Vermicompost+16.6% Poultry manure+Biofertilizer	15.83	29.53	48.60	11.07	30.20	32.43
	S.Em. ±	0.77	1.33	1.93	0.59	1.20	1.29
	CD at 5%	2.26	3.87	5.61	1.71	3.51	3.75

Table 2: Effect of integrated nutrient management on Number of leaves per plant and leaf width (cm) in Broccoli at different growth stages.

S. N.	Treatments	Number of leaves per plant			Leaf width (cm)		
		30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T ₀	Control	4.13	8.93	12.73	5.77	9.17	15.33
T ₁	100% RDF	6.13	11.83	16.13	9.40	13.06	18.33
T ₂	100% FYM	4.37	9.40	13.13	6.20	9.80	15.90
T ₃	100% Vermicompost	5.90	11.43	15.73	8.83	12.57	17.87
T ₄	100% Poultry manure	5.67	11.17	14.90	8.10	12.03	17.50
T ₅	100% Biofertilizer	4.93	10.20	13.77	7.10	11.13	16.67
T ₆	50% RDF+50% FYM	5.17	10.53	14.07	7.93	11.57	17.10
T ₇	50% RDF+50% Vermicompost	8.20	15.90	21.63	11.73	16.70	23.50
T ₈	50% RDF+50% Poultry manure	8.03	14.97	20.53	11.17	15.70	22.37
T ₉	50% RDF+50% Biofertilizer	6.57	12.40	17.10	9.70	13.73	18.67
T ₁₀	50% RDF+ 25% FYM+25% Vermicompost	7.20	13.97	18.77	10.40	14.67	19.60
T ₁₁	50% RDF+25% FYM+25% Poultry manure	6.77	12.90	17.53	10.10	14.03	19.03

T12	50% RDF+50% FYM + Biofertilizer	7.47	14.30	19.47	10.83	15.23	20.13
T13	50% RDF+16.6% FYM+16.6% Vermicompost+16.6% Poultry manure+Biofertilizer	4.60	9.57	13.47	6.57	10.40	16.13
	S.Em. \pm	0.24	0.48	0.61	0.35	0.48	
	CD at 5%	0.71	1.39	1.78	1.02	1.41	

In phonological parameters such as days to first curd emergence and days taken to 50% curd formation were observed. On the basis of data represented in the Table 3 was revealed that the maximum days taken to first curd emergence was observed in treatment T₀ -Local control and minimum was recorded in the treatment T₇ (50% RDF+50% Vermicompost) was revealed that the maximum days taken to 50% flowering was reported in T₀ -Local control while minimum was reported in T₇ -50% RDF+50% Vermicompost.

It might be due to the application of organic and inorganic fertilizer in combination which might have improved physiological and biochemical process in plants due to availability of micronutrients such as zinc and other essential nutrients to the plant that resulted in early head emergence by increasing enzymatic activity. Similar findings were also reported by Mal *et al.* (2015) ^[1], Meena *et al.* (2017) ^[2] and shree *et al.* (2014) ^[4].

Table 3: Effect of integrated nutrient management on Days to First Curd Emergence, Days taken to 50% curd formation in Broccoli.

S.N.	Treatments	Days to First curd Emergence	Days taken to 50% curd formation
T0	Control	68.53	76.77
T1	100% RDF	64.60	72.83
T2	100% FYM	67.93	76.40
T3	100% Vermicompost	64.20	73.33
T4	100% Poultry manure	65.10	73.70
T5	100% Biofertilizer	65.57	75.07
T6	50% RDF+50% FYM	65.27	74.60
T7	50% RDF+50% Vermicompost	56.37	66.80
T8	50% RDF+50% Poultry manure	57.93	67.90
T9	50% RDF+50% Biofertilizer	65.03	72.03
T10	50% RDF+ 25% FYM+25% Vermicompost	61.57	69.40
T11	50% RDF+25% FYM+25% Poultry manure	63.20	71.60
T12	50% RDF+50% FYM + Biofertilizer	60.67	68.67
T13	50% RDF+16.6% FYM+16.6% Vermicompost+16.6% Poultry manure+Biofertilizer	66.50	70.97
	S.Em. \pm	1.88	2.09
	CD at 5%	5.48	6.08

From the data given in the Table 4 it could be depicted that there was significant effect of various treatments on the crop economics. The maximum gross return, net profit and benefit: cost ratio were obtained under the treatment T₇ - 50% RDF+50% Vermicompost which was significantly superior to

other treatments. Whereas, minimum gross return was recorded in the treatment T₀ - Local control, but the minimum net profit was recorded in the treatment T₂ - 100% FYM and the minimum benefit: cost ratio in the treatment T₄ - 100% Poultry Manure.

Table 4: Effect of integrated nutrient management on economics of different treatment.

Treatment	Common Expenditure (Rs.)	Treatment Cost (Rs.)	Total cost of cultivation (Rs./h)	Gross income	Net income (Rs./ha)	C:B Ratio
T ₀	31450	0	31450	145650	114200	4.63
T ₁	31450	7200	38650	195000	156350	5.05
T ₂	31450	10000	41450	153150	111700	3.69
T ₃	31450	24000	55450	190200	134750	3.43
T ₄	31450	30000	61650	187650	126000	3.04
T ₅	31450	6000	37450	170400	132950	4.55
T ₆	31450	8600	40050	187650	147600	4.69
T ₇	31450	15600	47050	251850	204800	5.35
T ₈	31450	18600	50050	212250	162200	4.24
T ₉	31450	6600	38050	197550	159500	5.19
T ₁₀	31450	9100	40550	199950	159400	4.93
T ₁₁	31450	13600	45050	199950	154900	4.44
T ₁₂	31450	9500	40950	207450	166500	5.07
T ₁₃	31450	15000	46450	170400	123950	3.67

Conclusion

With respect to the research made, it is concluded that the Treatment T₇-50% RDF+50% Vermicompost responded well in terms of the Phenological, Growth parameters. Treatment T₇-50% RDF+50% Vermicompost was recorded best for growth parameters (*i.e.*, plant height, leaf length, leaf width

and number of leaves per plant) Phenological Parameters *i.e.*, (days to first curd emergence and days taken to 50% curd formation) It is cleared from the data procured that a statistically significantly maximum in the treatment T₇-50% RDF+50% Vermicompost (16.70 t/ha), net income (Rs. 204800) and C:B ratio (5.35).

Application of research: Beneficial to farmers and improve soil health.

Research category: Integrated Nutrient Management in Broccoli (*Brassica oleracea var. italica*) under Malwa condition of Madhya Pradesh.

Abbreviations

NPK: Nitrogen, Phosphorous, Potassium

RDF: Recommended Dose of Fertilizer

Kg: Kilogram

G: Gram

B: C: Benefit Cost ratio

SEm: Standard Error due to mean

CD: Critical Differences

Cm: centimeter

Acknowledgement

Authors are thankful to Rajmata Vijayaraje Sindhiya Krishi Vishwa Vidhayalaya, Gwalior, Madhya Pradesh.

Author Contributions: All authors equally contributed.

Author Statement: All authors read, reviewed, agree and approved the final manuscript.

Reference

1. 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 and Stress Manag. 2015;5(4):507-512.
2. 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 oleraceavar. italica* Plenck.) cv. KTS-1. Chem. Sci. Rev. Lett. 2017;6(24):2153-2158.
3. Sharma A, Parmar DK, Kumar P, Singh Y, Sharma RP. *Azotobacter* soil amendment integrated with cow manure reduces need for NPK fertilizers in sprouting broccoli. Int. J Veg. Sci. 2008;14(3):273-285.
4. Shree S, Singh VK, Kumar R. Effect of integrated nutrient management on yield and quality of cauliflower (*Brassica oleraceavar. Botrytis* L.). Int. Quaterely J Life Sci. 2014;9(3):1053-1058.
5. Singh DN, Nath Vishal. Winter Vegetables: Advances and Developments. Satish Publishing House, Delhi (India); c2012, p. 360.
6. Thamburaj S, Singh Narendra. Textbook of Vegetables, Tuber crops and Spices. Indian Council of Agricultural Research, New Delhi (India); 2013, p. 136.