Original Research Article

Productivity and profitability of sprouting broccoli (*Brassica oleracea var.italicaPlenck*) under different major nutrient management with organic sources

ABSTRACT

A field experiment was carried out at the present experiment entitled "Productivity and profitability of sprouting broccoli (Brassica oleracea var.italicaPlenck) under different major nutrient management with organic sources" was conducted at Vegetable farm, Chandra Shekhar Azad University Of Agriculture And Technology, Kanpur during rabi season 2021-22.The experiment consists of twenty-four treatment combinations of six sources of organic manure and four levels of major nutrients. The experiment was laid out in factorial RBD design and replicated three times. Palam samridhi variety of broccoli was transplanted at spacing of 45x45 cm. Results of the experiment revealed that the total head yield (q/ha) was significantly higher under M_6 (FYM 20 t +Vermicompost 5 t + Poultry manure 5 t ha^{-1}) source of manure which was at par application of M_4 (Vermicompost 5 t ha^{-1}) whereas in case of major nutrients it was significantly higher under application of (140:80:80 kg NPK ha^{-1}) but it was at par with (120:60:60 kg NPK ha^{-1}) and significantly superior to rest sources of organic manure. Maximum cost of cultivation, gross return as well as net return was associated with F_3 (140:80:80 kg NPK ha^{-1}) level of major nutrient but higher benefit cost ratio was noted under M_3 (Poultry manure 5t/ha) source of manure and combination of M_6 sources of manure along with F_2 level of major nutrient fetches maximum net return of 9.71 which was followed by rest treatment combinations.

Keywords: Sprouting Broccoli, FYM, Vermicompost, Poultry manure, NPK recommended.

UNDER PEER REVIEW

Introduction

Broccoli is extremely healthy, with 130 times more vitamin A content than cauliflower and 22 times more vitamin A content than cabbage. It's also high in sulphoraphane, a substance that's linked to a lower risk of cancer. Broccoli is high in vitamins and minerals, with moisture 89.9 g, carbohydrate 5.5 g, fat 0.2 g, protein 3.3 g, vitamin-A 3500 IU, thiamine 0.05 mg, riboflavin 0.12 mg, phosphorous 79 mg, calcium 80 mg, iron mg, ascorbic acid 137 mg, and calories 37 g in each 100 g edible amount (Singh and Nath, 2012). Food and health are linked in a variety of ways. Broccoli is one of these linkages, and it has several health advantages for humans. Malnutrition, which is frequently caused by a lack of micronutrients, may be prevented by including vegetables in our diet. It is one of the most nutritious Cole crops and are having cancer-fighting compounds such as phyto-chemicals, ß-carotenes, Indole -3-Carbinol, and isothiocynates help to reduce the prevalence of several forms of cancer in humans. Depending on the species, soil, climate, plant density, and growth methods, the amount of ideal nutrients provided to broccoli might vary significantly. Broccoli (*Brassica oleracea* var. *italica* L.) is a popular vegetable which belongs to the family cruciferae. Broccoli is derived from the Latin word *brachium* and the Italian term brocco, both of which imply "arm" or "branch." It is often divided into three groups: white, purple, and green, with the green form being the most nutritious (*Yoldas et al*., 2008). Appropriate fertilisation may ensure lucrative and high-quality crops, as well as the use of the right amount and combination of fertilisers to boost agricultural output. Despite its relevance, broccoli nutrition management has received little attention in our country. The purpose of this investigates is to design yield regime for a profitable broccoli production utilising both organic and major nutrients most of us an aware that broccoli highly nutrients and cancer fighting but, we still hesitate in buying it because we have only seen in pasta and don’t know how to home-cook it, the Indian war. A formerly exotic and difficult to find vegetable broccoli (Hariphoolgobhi) is now quick easily available in India. In fact you can ever grow organic broccoli at home. Anonymous, (2022), how to cook broccoli the Indian way, website: https://www.allthatgrows.in

Materials and methods

The field experiment was conducted at Vegetable Research Farm Chandra Shekhar Azad University of Agriculture And Technology, Kanpur during *Rabi* season 2021-22. The experiment was laid out in Factorial Randomized Block Design (FRBD) with 3 replications. Twenty-four treatment combinations of six sources of organic manure and four levels of major nutrients. Organic sources i.e. M_1: Farm Yard Manure (20 t/ha), M_2:Vermicompost (5 t/ha), M_3: Poultry Manure (5 t/ha), M_4: Farm Yard Manure + Vermicompost (20 t/ha + 5 t/ha), M_5: Farm Yard Manure + Poultry Manure (20 t /ha +

UNDER PEER REVIEW

5 t/ha), M_6:Farm Yard Manure + Vermicompost + Poultry Manure (20 t/ha + 5 t/ha + 5 t/ha) and major nutrients i.e. F_0: Control, F_1: 80 N + 40 P_2O_5 + 40 K_2O, F_2: 120 N + 60 P_2O_5 + 60 K_2O, F_3: 140 N + 80 P_2O_5 + 80 K_2O. The soil was sandy loam with organic carbon 0.34%, available N 152.0kg/ha, phosphorus 14.76 kg/ha and potassium 180.0 kg /ha at initiation of experiment. The broccoli variety Palam samridhi was used in the experiment, which is an early -maturity variety and takes around 70 days from transplanting to first harvesting.The crop was transplanted in plots size of 1.8m x1.8m with a spacing of 45cm between rows and 45cm between plants. Organic manures were applied at the time of field preparation as per treatment. All other recommended cultural practices were followed to raise healthy crop. On the basis of total variable cost and gross return, net return and B:C ratio were calculated as per methods suggested by **Devasenapathy*et al* (2008).**

Results and Discussion:

The sources of organic manure and major nutrient doses had significant effect on marketable head yield of broccoli. Marked influence of organic sources was noted on marketable head yield of broccoli and maximum marketable head yield of broccoli ie 199.36 q ha^{-1} g was obtained with M_6 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1} + Poultry manure 5 t ha^{-1}) which was on par with treatment M_4 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1}) which recoded 195.51 q yield and these were significantly superior to other organic sources. However, minimum marketable head yield was recorded with M_1 FYM (20 tha^{-1}) which was 178.89 q ha^{-1}. Application of different doses of major nutrient showed significant effect on the marketable yield of broccoli. Maximum marketable yield of 197.38qha^{-1} was obtained with F_3(140+80+80 kg NPK ha^{-1}) which was at par with F_2 (120+60+60 kg NPK ha^{-1}) and significantly superior to over rest treatments. However, the lowest marketable yield of 181.54 q ha^{-1} was recorded with F_0(0+0+0 kg NPK ha^{-1}) nutrient level. The interaction between organic sources and nutrient levels The production of significantly higher level of marketable head yield have been achieved by the cumulative combination of average head weight size of head and head compactness. The significant effect of higher level of application of FYM 210t/ha + Vermi compost 5t/ha + Poultry manure 5t/ha + Poultry manure 5t/ha and 140 kg + 80 kg NPK/ha in achieving higher level of marketable head yield (190q/ha) which might be obtained due to higher yield attributing characters *viz.*, average head weight, head size and head compactness. Similar observations were also recorded by**Sushanta*et al.*, 2019**, **Vishwa *et al.*, 2021and Singh *et al.*, 2021.**

As data presented in Table 1 clearly indicate that cost of cultivation increased due to organic sources of manure and increasing doses of major nutrients. The maximum cost of cultivation (Rs. 90650.90 ha^{-1}) was obtained under treatment M_6 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1} + Poultry manure 5 t ha^{-1}). Minimum cost of cultivation of (Rs 52650.90 ha^{-1}) was incurred in treatment M_4 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1}). Variation in values of cost of cultivation was also noted due

UNDER PEER REVIEW

to Major nutrients. More cost of cultivation was incurred (Rs 76924.67 ha^{-1}) under F_3 (140+80+80 kg NPK ha^{-1}) followed by F2, F1 and control.Combination of M_6 source of manure along with F_3 level of major nutrient fetches maximum cost of cultivation of Rs 95758 ha^{-1} which was followed by rest treatment combinations.

The maximum gross return (Rs. 598074.10 ha^{-1} was recorded under M_6 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1} + Poultry manure 5 t ha^{-1}). Minimum gross return of cultivation of (Rs536666.7 ha^{-1}) was incurred intreatment M_4 (FYM 20 t ha^{-} +Vermicompost 5 t ha^{-1}). Variation in values of cross return was also noted due to Major nutrients. Maximum gross return of was incurred(Rs 592148.4 ha^{-1}) under F_3(140+80+80 kg NPK ha^{-1}) followed by F2, F1 and control. Combination of M_6 source of manure along with F_3 level of major nutrient fetches maximum gross return of Rs 624444.4 ha^{-1} which was followed by rest treatment combinations.

Summary of data given in above table revealed that maximum gross return (Rs. 507423.2 ha^{-1} was recorded under M_6 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1} + Poultry manure 5 t ha^{-1}). Minimum net return of cultivation of (Rs 484015.8 ha^{-1}) was incurred in treatment M_4 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1}). Variation in values of net return was also noted due to Major nutrients. Maximum net return of was incurred (Rs. 515223.5 ha^{-1}) under F_3 (140+80+80 kg NPK ha^{-1}) followed by F2, F1 and control. Combination of M_6 source of manure along with F_3 level of major nutrient fetches maximum net return of Rs 528686.4 ha^{-1} which was followed by rest treatment combinations.

The maximum B:C ratio of 9.22 was recorded under M_3 (Poultry manure 5 t ha^{-1}). It was contrary to net return and gross return due to heavy input cost. Variation in values of net return was also noted due to Major nutrients. Maximum B:C ratio of 7.47 was noted under F_2 (120+60+60 kg NPK ha^{-1}) followed by F3, F1 and control. Combination of M_6 source of manure along with F_2 level of major nutrient fetches maximum net return of 9.71 which was followed by rest treatment combinations. Although maximum gross return as well as net return was associated with M_6 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1} + Poultry manure 5 t ha^{-1}) source of manure and F_3 (140+80+80 kg NPK ha^{-1}) level of major nutrient but contrary to this maximum benefit cost ratio of 9.71 was noted with M_3(Poultry manure 5 t ha^{-1}). Similarly in case of major nutrients F_2 (120:60:60 kg NPK ha^{-1}) was responsible for fetching maximum value of benefit cost ratio (7.47). It may be due to the fact that cost of inputs in M_6 source of manure and F_3 level of major nutrient was comparatively higher than that in M_4 and F_2 treatment. These results are in agreement with results of **Singh *et. al.* (2021).**

UNDER PEER REVIEW

Table-1 Effects of organic sources and major nutrients on economics of broccoli.

Treatments	Marketable yieldQ/ha.	Cost of cultivation(Rs.)	Gross return(Rs.)	Net return (Rs.)	B:C ratio
Organic sources					
M_1 FYM (20 tha^{-1})	178.89	61650.90	547629.6	485978.7	7.90
M_2 Vermicompost (5 t ha^{-1})	191.69	73650.90	575074.1	501423.2	6.82
M_3 Poultry manure(5 t ha^{-1})	182.54	52650.90	536666.7	484015.8	9.22
M_4 (FYM 20 t ha^{-} + Vermicompost 5 t ha^{-1})	195.51	86650.90	586518.5	499867.6	5.77
M_5 (FYM 20 t ha^{-} + Poultrymanure 5t ha^{-1})	186.19	65650.90	558555.6	492904.7	7.52
M_6 (FYM 20 t ha^{-} + Vermicompost 5t ha^{-1} + Poultrymanure 5t ha^{-1})	199.36	90650.90	598074.1	507423.2	5.60
SEm(±)	3.71	-	11088.7	10585.7	0.136
CD (P=0.05)	10.57	-	31565.7	30134.0	0.386
Major nutrients					
F_0 (0+0+0 kg NPK ha^{-1}) Control	177.54	67916.67	544617.3	476700.6	7.29
F_1 (80+40+40 kg NPK ha^{-1})	185.42	72420.67	556271.6	483850.9	6.90
F_2 (120+60+60 kg NPK ha^{-1})	191.77	70008.27	575308.6	505300.4	7.47
F_3 (140+80+80 kg NPK ha^{-1})	197.38	76924.67	592148.1	515223.5	6.89
SEm(±)	3.03	-	9053.9	8643.2	0.111
CD (P=0.05)	8.63	-	25773.3	24604.3	0.316

UNDER PEER REVIEW

References

1. Anonymous, 2021
2. Hamza, O. M., & AL-Taey, D. K. (2020), A study on the effect of Glutamic acid and benzyl adenine application upon growth and yield parameters and active components of two broccoli hybrids. *Int. J. Agricult. Stat. Sci*, *16*, 1163-1167.
3. Mehedi, M. N. H., Mohosina, F., Khanom, A., Ali, M. I., &Peda, M. N. (2018), EFFECTS OF ORGANIC MANURES ON THE GROWTH AND YIELD OF BROCCOLI. *Bangladesh J*, *35*, 47-50.
4. Srichandan, S., Mangaraj, A. K., Mohanty, A., Behera, K. K., & Panda, D. (2015), Influence of organic and inorganic fertilizer on nutrient content in broccoli (Brassica oleracea var. italica). *Plant Archives*, *15*(2), 1127-1130.
5. Biswas, A., Upadhyay, D., &Rathiya, P. S. (2021), Effect of inorganic fertilizer and organic manures on growth and yield of broccoli (Brassica oleracea var. italica) cv. Palam Samridhi at Norther Hill of Chhattisgarh.
6. Char, G., Singh, T. K., & Singh, S. (2020), Effect of bio-fertilizers and mulching on yield attributes, yield and economics of Broccoli (Brassica oleracea var. italicaPlenck) under protected condition. *Journal of Pharmacognosy and Phytochemistry*, *9*(5), 3137-3140.
7. Choudhary, S., Soni, A.K. and Jat, N.K. 2012, Effect of organic and inorganic sources of nutrients on growth, yield and quality of sprouting broccoli cv. CBH-1. Indian Journal of Horticulture, 69(4): 550-554
8. Kayesh, E., Sharker, M. S., Roni, M. S., &Sarker, U. (2019), Integrated nutrient management for growth, yield and profitability of broccoli. *Bangladesh Journal of Agricultural Research*, *44*(1), 13-26
9. Singh D.N. and Nath Vishal (2012) Winter Vegetables: Advances and Developments. Satish Publishing House, Delhi (India).p. 360.
10. Singh D.P., Rajiv, Tomar Saurabh And Kumari Meenakshi (2021) Integrated nutrient management in broccoli (Brassica oleracea var. italica) Indian Journal of Agricultural Sciences 91 (11): 1627–30
11. Srichandan, S., Mangaraj, A. K., Mohanty, A., Behera, K. K., & Panda, D. (2015), Influence of organic and inorganic fertilizer on nutrient content in broccoli (Brassica oleracea var. italica). *Plant Archives*, *15*(2), 1127-1130.
12. Tarafder, S. K., Biswas, M., Alim, M. A., Mondal, A. B., &Alam, M. (2022). Effects of Organic and Inorganic Sources of Nutrient on Yield, Quality and Shelf Life of Broccoli. *Current Research in Agricultural Sciences*, *9*(1), 44-58.
13. Yaldas, F., S. cylan, B. Yagmur and N. Modogan, (2008) "Effect of nitrogen fertilizer on yield, quality and nutrient content in broccoli. Journal plant nutrition, 311: 1333-1343.

UNDER PEER REVIEW