

Original Research Article

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Effect of Inorganic and Organic Fertilizers on Yield and Economics of Broccoli (*Brassica olerasia* var. *italica*)

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ABSTRACT

Keywords

Broccoli, Curd, Economics, Poultry manure, Vermicompost.

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A field experiment was conducted during winters 2015-16 to study the effect of inorganic and organic fertilizers on yield and economics of broccoli cv. Green Magic. The experiment was laid out in Randomized Block Design with twelve treatments and three replications. Different doses of recommended dose of nitrogen (RDN), Farm yard manure (FYM), Poultry manure, Vermicompost and their combinations are used with all other cultural practices taken uniform. The maximum curd diameter (15.37cm), weight of trimmed curd (413.33g), curd yield per plot (7.44 kg) and curd yield (14.16 t/ha) were recorded in the plants treated with 50% recommended dose of nitrogen(RDN) + 16.6 % farm yard manure (FYM) + 16.6 % Vermicompost + 16.6 % Poultry Manure. Economic returns of the same treatment were also found best in term of gross income, net returns and benefit-cost ratio.

Introduction

Broccoli (*Brassica olerasia* var. *italica*) is one of the important cool season vegetable of Brassicaceae family (Swarup, 2012). It is a high value exotic vegetable and cultivated for its tender flowering head and the secondary heads *i. e.* spears. It was a rare cole crop in India but now it is gaining popularity in metropolitan cities, reputed hotels and restaurants (Maurya, 2008). Generally it can be classified into three distinct group viz., white purple and green, out of which green type is highly nutritious (Yoldas *et al.*, 2008). Broccoli is rich source of vitamins, minerals and essential amino acids, also contains the compound glucoraphanin which have anticancerous properties (Swarup, 2012). It is

either consumed raw as salad or cooked to prepare curries, soup and pickles. In the world market broccoli sold about 60 percent as frozen and remaining 40 percent as fresh. Now days, broccoli emerges as an important crop under protected cultivation during off season around metropolitans and tourist places (Swarup, 2012).

To increase the yield, plenty of chemical fertilizers along with a small quantity of organic once are being used by different workers which ultimately affects the health of soil as well as human (Meena *et al.*, 2017). Due to excess use of chemical fertilizers a decline pattern is observed in soil fertility,

therefore integrated nutrient management is an important demand of present era (Attigah *et al.*, 2013). The main aim of integrated nutrient management is to cultivate a land in such a way that the soil should remain sustainable with maximum quality production of crop (Mishra *et al.*, 2014). Manures provide a source of all necessary macro and micro-nutrients in available forms, thereby improving the physical and biological properties of the soil (Abou El-Magd *et al.*, 2006). Considering the above factors, the present experiment was undertaken to determine the best inorganic and organic fertilizer combination for maximum yield and net profit in broccoli.

Materials and Methods

The present experiment was carried out during winter season of 2015-16 at the Vegetable Research Field, Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh. The experiment was laid out in randomized block design with twelve treatments and three replications. Broccoli cultivar Green Magic was taken as test crop. The treatments included T₀: recommended dose of NPK (120:80:80 kg/ha), T₁: Farmyard manure @ 20 t/ha, T₂: Vermicompost @ 10 t/ha, T₃: Poultry manure @ 6 t/ha, T₄: 33.3 % FYM + 33.3 % Vermicompost + 33.3% Poultry manure, T₅: 50 % RDN +50% FYM, T₆: 50% RDN+50% Vermicompost, T₇: 50% RDN +50% Poultry manure, T₈: 50% RDN +25% FYM +25 % Vermicompost, T₉: 50% RDN +25% Vermicompost + 25% Poultry manure, T₁₀: 50% RDN + 25% FYM + 25% Poultry manure and T₁₁: 50 % RDN + 16.6% FYM+ 16.6% Vermicompost + 16.6% Poultry Manure. The crop was raised with a spacing

of 60 cm × 50 cm and plot size of 3.5 m × 1.5 m. Standard cultural practices recommended for Broccoli was followed uniformly for all the experimental plots. According to treatment details, organic manures (FYM, Poultry Manure and Vermicompost) were applied in plots one month before the transplanting of seedlings. Nitrogen, phosphorous and potassium were applied in the form of Urea, Diammonium Phosphate and Muriate of Potas. Before transplanting, half of nitrogen and full doses of phosphorous and potassium were applied in the plots and the crop was top dressed with remaining half dose of nitrogen in two splits after 4th and 6th week of transplanting. The observations like diameter of curd (cm), weight of curd (g), curd yield per plot (kg) and curd yield (tonnes/ha) were recorded. Economics of the experiment was worked out on the basis of prevailing market prices of inputs and outputs. The data of the trial obtained were subjected to statistical analysis and the results were documented, analysed and presented in tabular form.

Results and Discussion

The presented data in table 1 is concerning with the yield attributes of broccoli as affected by different organic and inorganic fertilizers either alone or in combinations. Maximum curd diameter (15.37cm) was recorded with Treatment T₁₁ (50% RDN + 16.6 % FYM + 16.6 % Vermicompost + 16.6 % Poultry Manure) followed by 14.18 cm with T₁₀ (50% RDN + 25% FYM + 25% Poultry Manure) and the minimum (11.50 cm) was recorded with T₁ (20 t ha⁻¹ FYM). The combined application of optimum levels of inorganic fertilizers and Organic fertilizers in deficient soil might have improved the physicochemical and biological characteristics of the growth medium.

Table.1 Effect of inorganic and organic fertilizers on yield and economics of broccoli

| Treatments | Diameter of curd(cm) | Weight of curd(g) | Curd yield/Plot (kg) | Curd yield(t/ha) | Selling Rate (Rst ⁻¹) | Gross Return (Rs ha ⁻¹) | Cost of Cultivation (Rs ha ⁻¹) | Net Return (Rs ha ⁻¹) | B:C Ratio |
|-----------------|----------------------|-------------------|----------------------|------------------|-----------------------------------|-------------------------------------|--|-----------------------------------|-----------|
| T ₀ | 13.12 | 386.04 | 6.94 | 13.22 | 25,000 | 330000 | 85446 | 244554 | 3.80 |
| T ₁ | 11.50 | 285.33 | 5.13 | 9.77 | 25,000 | 244250 | 125260 | 118990 | 1.94 |
| T ₂ | 11.52 | 291.86 | 5.25 | 10.03 | 25,000 | 257500 | 107260 | 150240 | 2.40 |
| T ₃ | 11.92 | 302.23 | 5.44 | 10.35 | 25,000 | 258750 | 89260 | 169490 | 2.89 |
| T ₄ | 12.40 | 320.33 | 5.91 | 11.25 | 25,000 | 281250 | 107160 | 174090 | 2.62 |
| T ₅ | 12.47 | 385.67 | 6.94 | 13.21 | 25,000 | 330250 | 105362 | 224888 | 3.13 |
| T ₆ | 12.85 | 394.00 | 7.09 | 13.50 | 25,000 | 337500 | 96362 | 241138 | 3.50 |
| T ₇ | 12.65 | 386.00 | 6.95 | 13.23 | 25,000 | 330750 | 87362 | 243388 | 3.78 |
| T ₈ | 12.80 | 394.67 | 7.10 | 13.52 | 25,000 | 338000 | 100862 | 237138 | 3.35 |
| T ₉ | 12.42 | 391.33 | 7.04 | 13.40 | 25,000 | 335000 | 91862 | 243138 | 3.64 |
| T ₁₀ | 14.18 | 403.67 | 7.26 | 13.83 | 25,000 | 345750 | 96362 | 249388 | 3.58 |
| T ₁₁ | 15.37 | 413.33 | 7.44 | 14.16 | 25,000 | 366500 | 96292 | 270208 | 3.81 |
| CD (P=0.05) | 0.03 | 8.69 | 0.16 | 0.30 | | | | | |

There increased the concentration of essential nutrients in soil solution resulted in steady uptake of major nutrients, sturdy plant growth and improvement of head weight and total yield. Kumar *et al.*, (2013) and (Singh *et al.*, 2010) also noted the similar findings in various cole crops.

Maximum weight of trimmed curd (413.33g) was recorded with Treatment T₁₁ (50% RDN + 16.6 % FYM + 16.6 % Vermicompost + 16.6 % Poultry manure) followed by 403.67 g with T₁₀ (50% RDN + 25% FYM + 25% Poultry manure) and the minimum (285.33 g) was recorded with T₁ (20 t ha⁻¹FYM). The increase in curd weight might be due to the more photosynthesis from a larger area of the leaves and the translocation of photosynthates to the sink which is ultimately the curd. The increase in the curd weight at this level might also be due to the increase in the length and width of the leaves, plant spread, curd diameter and curd depth. Shree *et al.*, (2014) in cauliflower reported that maximum curd weight was observed in various combinations of organic and inorganic fertilizers.

Maximum curd yield per plot (7.44 kg) was recorded with Treatment T₁₁ (50% RDN + 16.6 % FYM + 16.6 % Vermicompost + 16.6 % Poultry Manure) followed by 7.26 kg with T₁₀ (50% RDN + 25% FYM + 25% Poultry Manure) and the minimum (5.13 kg) was recorded with T₁ (20 t ha⁻¹ FYM). These results are in accordance with the findings of Singh (2000) in cabbage and Sharma (2000) in broccoli have reported that integration of organic and inorganic fertilizers synergistically increase the head yield over inorganic fertilizer alone. Maximum curd yield per hectare (14.16 t) was recorded with Treatment T₁₁ (50% RDN + 16.6 % FYM + 16.6 % Vermicompost + 16.6 % Poultry Manure) followed by 13.83 tonnes with T₁₀ (50% RDN + 25% FYM + 25% Poultry Manure) and the minimum (9.47 t) was

recorded with T₁ (20 t ha⁻¹). Maurya *et al.*, (2008) also record highest values of yield related traits with application of Vermicompost and half dose of recommended fertilizers. These results are in close conformity with the finding of Devi *et al.*, (2003) in Cabbage, Manivannan and Singh (2004) in Broccoli, and Wani *et al.*, (2011) in Cauliflower.

The economics of different treatments *viz.*, yield (t ha⁻¹), cost of cultivation, gross return and benefit cost ratio has been worked out and presented in table 1. Maximum gross return (3,66,500 Rs ha⁻¹), Maximum net return (2,70,208 Rs ha⁻¹) and Maximum benefit cost ratio (3.81:1) were recorded with treatment T₁₁ (50% RDN + 16.6% FYM + 16.6% Vermicompost + 16.6% Poultry Manure) followed by T₁₀ (50% RDN + 25% FYM + 25% Poultry Manure) whereas, the minimum was recorded with (2,44,250 Rs ha⁻¹) T₁ (24 t ha⁻¹ FYM). These results are found similar to USDA Economics, Statistics and Market Information System.

In conclusion, study revealed that the integration of organic and inorganic fertilizers had shown a marked effect in enhancing yield as well as productivity of broccoli with maximum net returns. On the basis of results, it could be concluded that the application of 50% recommended dose of nitrogen + 16.6 % FYM + 16.6 % Vermicompost + 16.6 % Poultry Manure were best for higher yield with maximum profit. It can be recommended for commercial production of broccoli under Allahabad conditions of Uttar Pradesh.

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