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Effect of Integrated Nutrient Management on Yield, Yield Attributes and Economics of Broccoli

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A B S T R A C T

Present investigation was undertaken to study the effect of INM on growth and yield of broccoli cv. Shayali. For this, a field experiment was carried out in Randomized Block Design with three replications. The experiment was conducted at the All India Crop Research Project, during *Rabi* season of 2014-15. For the experiment, Nine treatment combinations viz. 100% RDF (T_1), FYM @ 20 tonnes /ha (T_2), 50% RDF + FYM @10 tonnes/ha (T_3), Neem cake@5q/ha (T_4), 50 % RDF + Neem cake @ 2.5q/ha (T_5), Vermicompost @ 5 t/ha (T_6), 50% RDF+ Vermicompost @2.5t/ha (T_7), Poultry manure@5t/ha (T_8), 50% RDF + Poultry manure @ 2.5t/ha (T_9). Sayali variety of broccoli was transplanted at a spacing of 50cm x 45cm. Results revealed that the treatment T_7 (50% RDF + Vermicompost @ 2.5t/ha) recorded maximum values for recorded highest head length (14.67 cm), head width (13.37cm), gross head weight (348.22 g), net head weight (298.85g), marketable yield (13.25kg plot^{-1}) marketable yield (163.60 q/ha), and benefit: cost ratio (3.93) followed by treatment T_9(50 % NPK + poultry manure) and 100% RDF (T_1).

Introduction

Broccoli (*Brassica oleracea* L. 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 Cruciferae (mustard family). Broccoli is an Italian vegetable which is cultivated in Italy in ancient roman times. Commercial cultivation of broccoli was started around 1923 (Decoteau, 2000). Watt (1983) reported that broccoli is more nutritious than any other Cole crops such as cabbage, cauliflower and kohlrabi. On the other hand, broccoli is environmentally better adapted than cauliflower, and reported to with stand comparatively at higher temperature than cauliflower (Rashid, 1976). Brassica vegetables possess both antioxidant and anticarcinogenic properties (Cartea *et al.*, 2008) and it is well known that dietary intake of food containing antioxidants provides effective support for the body's defensive systems and may prevent some diseases (Mc Carty, 2008) Broccoli is one of the most

nutritious *Cole* crops and contains vitamin A (130 times and 22 times higher than cauliflower and cabbage, respectively), thiamin, riboflavin, niacin, vitamin C and minerals like Ca, P, K and Fe (Kumar *et al.*, 2011). Broccoli contains indole-3-carbinol which helps to fight breast and lung cancer (Anon. 2006). It is used as curries, soups and pickles and also eaten as a salad and cooked as a single or mixed vegetable with potato (Thamburaj and Singh, 2001). Broccoli is a cool-loving crop and very sensitive to high temperature which cause the heads to be distorted, making it a high-risk crop.

Integrated nutrient management (INM) consists of improvement and maintenance of soil fertility for sustainable crop productivity through optimization of all available organic, inorganic and biotic resources in an integrated manner, appropriate to each cropping system and farming situations with its ecological, social and economic ramifications. Recent energy crisis and consequent price hike of chemical fertilizers due to withdrawal of relevant subsidies coupled with low purchasing power of farming community have generated renewed interest in organic recycling throughout the world for sustainable crop production (Agarwal, 2000).

There is an urgent need to adopt an integrated nutrient supply and management system for promoting efficient and balanced use of plant nutrients. While the main emphasis was given on increasing the proper and balanced used of mineral fertilizers, the role of organic manure, biofertilizers, green manuring and recycling of organic wastes should be considered supplementary and not substitutable.

Being a newly introduced crop of Odisha, there was an urgent need for standardization of integrated nutrient management packages having locally available organic sources integrated with chemical fertilizers. Keeping this in view, the research was carried out with the objectives to study the effect of integrated application of inorganic and organic manures on yield and yield attributes of broccoli.

Materials and Methods

The present investigation was undertaken to ascertain the effect of integrated management of nitrogen, phosphorus and potassic fertilizers through organic manures in sprouting broccoli during the period of December 2014 to March 2016 in three consecutive *Rabi* seasons. The broccoli variety used in this experiment is Shayali, which is an early maturity variety, which takes around 70 days for 1st harvesting from transplanting, with the plant height being around 50cm and average head weight being 250gm.The experiment was conducted in RBD design with 3 replications. The experiment was conducted in plots of size 3 m x 2.7 m with a spacing of 50 cm in between rows and 45 cm in between plants. Fertilizers were provided at a dose of 200 kg nitrogen, 50 kg phosphorus and 100 kg potash per hectare. The sources of fertilizers (both organic and inorganic) used were the basis of formation of different treatment combinations. The details of the treatment are T_1: Full dose of NPK through chemical fertilizer, $T_{2:}$ FYM@ 20t/ha, T_3: FYM @10t/ha + half NPK through fertilizer, T_4: Neem Cake @5q/ha, T_5: Neem Cake @ 2.5q/ha + half NPK through fertilizer, T_6: Vermicompost @5t/ha, T_7: Vermicompost @2.5t/ha + half NPK through fertilizer, T_8: Poultry manure @ 5t/ha, T_9: Poultry manure @ 2.5t/ha + half NPK through fertilizer. The observations were taken on different yield and yield attributing characters like gross head weight, net head weight, yield etc. The B: C ratio was calculated taking into considerations of the costs incurred and income generated. The statistical formulas were used for compilation of data and drawing of conclusion.

Results and Discussion

Several factors have been found to influence growth and yield of high value crops like vegetables, which ensure high and quick returns per unit area and time. It is an established fact that continuous sole and imbalanced use of chemical fertilizers leads to deterioration of soil health and ecological balance in conjunction with decrease in nutrient uptake efficiency of the applied nutrients. Although chemical fertilizers contribute a lot in fulfilling the nutrient requirement of sprouting broccoli, which is an exhaustive crop, but their regular, excessive and unbalanced use may lead to deterioration of physical and chemical properties of the soil and ultimately poor crop yields. Consequently, there is stagnation or plateau in crop yield and this poses challenge to environment and food safety.

It was observed that the head length and head width were markedly influenced by different treatments. The data shown in table 1 revealed that the length of broccoli head is significantly at par in the treatment containing 2.5 tonnes/ha of vermicompost + 50 % RDF was on par with all other treatments except T_4 and T_6. The maximum head width was observed in treatment T_7 (13.37 cm) followed by T_9 (13.31 cm) & T_5 (13.18 cm). The lowest head diameter was observed in T_4 where neem cake @ 5q/ha was applied.

The data regarding effect of integrated nutrient management on curd/head weight is presented in Table 1. A perusal of detailed data analyzed indicated that weight of head per plant showed significant variation among the treatments. The data revealed that the lowest gross head weight of 280.57g in broccoli was found in T_4 plots, which were fertilized with neem cake only @5q/ha. It was found that in broccoli maximum gross head weight was obtained in treatment T_1 (367.56 g) with (Full dose of NPK through fertilizers) which was on par with T_3, T_5, T_7 and T_9. The lowest net head weight of 220.30 g in broccoli was found in T_4 plots again and maximum net head weight was obtained in treatment T_7 (298.85 g) with (Vermicompost @2.5 T/ha + 50% NPK through fertilizers) which was on par with T_1(279.52 g) with (Full dose of NPK through chemical fertilizer), T_3(269.43 g) with (FYM @ 10t/ha+1/2 NPK through fertilizer), T_5 (267.32 g) with (Neem Cake @ 2.5q/ha+1/2 NPK through fertilizer) and T_9 (277.14 g) (Poultry manure @2.5t/ha+1/2 NPK through fertilizer).The increase in net head 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 head. The increase in the net head weight at this level might also be due to the increase in the leaf weight and also due to higher values of head length and head width cited by Sharma *et al.*, (2008).

It was clearly observed that a wide variation in yield per plot and per hectare can be obtained by altering the different fertilizer levels among the treatments. The head yield per plot and per hectare showed significant variations among all the treatments. The data in the clearly signifies that a wide variation in total head yield per plot can be obtained by altering the levels of N, P and K among the treatments. Highest yield per plot (13.25 kg) was obtained from T_7 (Vermicompost @2.5 T/ha + 50% NPK through fertilizers) followed by 12.53 kg in T_1, 12.24 kg in T_9 and 11.70 kg in T_3, which were on par with each other. Lowest yield per plot (7.49 kg) was recorded in plot T4. It was found that the various doses of nutrient produced significant variation in total head yield per plot. Highest head yield (163.60 t/ha) per hectare was recorded in T_7 followed by 154.74 t/ha in T_1. The beneficial role of farmyard manure and vermicompost in improving physical, chemical and biological

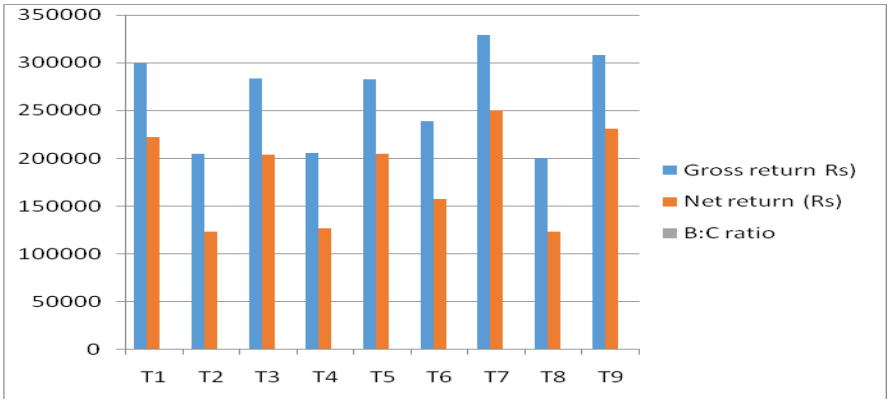
properties of soil, which in turn, help in better nutrient absorption by plants, also resulted in higher values for yield contributing parameters. The study further revealed that various yield parameters (Table 1) have not been significantly influenced when organic manures are not applied (treatment T_1), which signifies the role of organic manures in combination with inorganic fertilizers for enhancing yield parameters in sprouting broccoli. Similar results were reported by Bahadur *et al.*, (2003) and Chaterjee *et al.*, (2005) (Fig. 1).

Table.1 Effect of integrated nutrient management on yield and yield attributes of broccoli (Over a period of three years (2014-15 to 2016-17)

Treatments	Head Length (cm)	Head width (cm)	Gross Head wt. (g)	Net Head wt (g)	Net yield (Kg/plot)	Net yield (q/ha)	B:C ratio
T1: Full dose of NPK through chemical fertilizer	14.60	12.65	367.56	279.52	12.53	154.74	4.30
T2: FYM @ 20t/ha	13.93	13.17	309.41	239.61	8.42	103.94	2.50
T3: FYM @ 10t/ha+1/2 NPK through fertilizer	14.03	13.12	350.01	269.43	11.70	144.38	3.73
T4: Neem Cake @5q/ha	13.17	12.16	280.57	220.30	7.49	92.49	2.67
T5: Neem Cake @ 2.5q/ha+1/2 NPK through fertilizer	14.02	13.18	323.63	267.32	11.01	135.92	3.90
T6: Vermicompost @5t/ha	13.07	12.77	296.61	223.96	9.89	122.07	2.57
T7: Vermicompost @2.5t/ha+1/2 NPK through fertilizer	14.67	13.37	348.22	298.85	13.25	163.60	3.93
T8: Poultry manure @5t/ha	13.86	12.76	288.98	242.03	7.97	98.41	2.17
T9: Poultry manure @2.5t/ha+1/2 NPK through fertilizer	14.33	13.31	352.52	277.14	12.24	151.16	3.70
CD @ 5%	1.45	1.41	57.49	43.34	1.80	22.27	

Gross Head wt. – Head weight along with leaves and stalk; Net Head wt.- Head weight excluding leaves & stalk

Fig.1



The B:C ratio of different treatment on sprouting broccoli with respect to gross and net returns per hectare and benefit cost ratio have been presented in Table 1. The data presented depicted that highest benefit cost ratio (4.3) were obtained in T_1 (Full dose of NPK through fertilizers), followed by treatment T_7 (4.7). Lowest benefit cost ratio of 2.17 and 2.50 was

recorded in treatment T_8 (Poultry manure @ 5t/ha) and T_2 (20 tonnes/ha of FYM) respectively.

The present investigation on integrated application of inorganic fertilizers and vermicompost proved on par yield performance with 100% RDF whereas, treatments without inorganic manure resulted in significant reduction in growth and yield attributing parameters. Among all the treatments, application of 50% RDF /ha + 2.5 tonnes /ha vermicompost in sprouting broccoli was found to be the best for obtaining highest yield as well as good benefit cost ratio in Odisha condition.

References

Agarwal SK.2000. Role of integrated nutrient management using biological resources for sustainable agriculture, *Microbes in Integrated Nutrient Management* (Sep15 to Oct 12, 2002), A.A.R.E.M.C.C.S.H.A.U, Hissar.

Bahadur A, Singh J and Upadhaya AK. 2003. Effect of manures and bio fertilizers on growth, yield and quality attributes of broccoli (*Brassica oleracea* L. var. *italica* Plenck.), *Vegetable Science*, 30(2):192-194.

Cartea, M. E. Pablo Velasco, S. O. and Guillermo Padilla, A. H. (2008). Seasonal variation in glucosinolate content in *brassica oleracea* crops grown in northwestern Spain. *photochemistry*, 69: 403–410.

Chaterjee B, Ghanti P, Thapa U and Tripathy P. 2005. Effect of organic nutrition in sprouting broccoli (*Brassica oleracea* L. var. *italica* Plenck.), *Vegetable Science*, 32(1): 51-54.

Decoteau, D. R. (2000). Vegetable crops. Upper rever company. New Jersey, U.S.A

Kumar, M. Das, B. Prasad, K. K. and Kumar, P. (2011). Effect of integrated nutrient management on quality of broccoli (*Brassica oleraciavar* var *Italica*) cv. fiesta under Jharkhand conditions. The Asian Journal of Horticulture. 6: 388-392.

Mc carty and Mark, F. (2008). Scavenging of peroxynitrite derived radicals by flavonoids may support endothelial no syntheses activity, contributing to the vascular protection associated with high fruit and vegetable intakes. *Medical hypotheses.* 70: 170–181.

Rashid, M.M. (1976). Vegetable of Bangladesh (In Bengali). First edition. *Bangla academy, dhaka.* 283

Sharma A, Parmar DK, Kumar P, Singh Y and Sharma RP.2008. *Azotobacter* soil amendment integrated with cow manures reduces need for NPK fertilizers in Sprouting Broccoli, *International Journal of Vegetable Science*, 14(3): 273-285.

Thamburaj, S. and Singh, N. (2001). Vegetables, tuber crops and spices. *Directorate of Information and Publications of Agriculture, ICAR, New Delhi.* 137.

Watt, B. K. (1983). Nutritive Value of Fruits and Vegetables. *USAID, Hand Book. An Avi Book Published by Van Nostrand Reinhold, New York.* 369. 414.

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