International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 700-703

Received: 13-05-2019
Accepted: 15-06-2019

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Cost and return analysis of broccoli (*brassica Oleracea var. italica*) with the application of Fym and boron

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Abstract
Broccoli (*Brassica oleracea var. italica*,) belongs to Brassicaceae family. This is one of the exotic vegetable introduced in India. To evaluate the most profitable treatment, economic analysis of treatments was worked out in terms of net return and Cost benefit ratio (C: B) ratio. The production cost of crop per hectare, marketing cost per hectare, Cost of FYM per hectare, Cost of Boron per hectare, and miscellaneous charges (Irrigation, plant protection measures, harvesting of fruits etc.) was found different as per the treatments. The cost incurred on the different application of boron and FYM in various treatments was found to be 88250, 87550 and 86850 costs with soil application of boron followed by 84890 costs with foliar application of boron. In case of 50% FYM and soil application of boron with different treatments it was found 80250, 79550, 78850 costs and followed by 68050 costs of control. It was found that T_7 (Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 100% of FYM) treatment was best and showed highest yield and net returns per hectare 208.1 q ha^{-1} and Rs. 223900 respectively but T_{10} (Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 50% of FYM) treatment was found to be best treatment combination as evidenced by cost: benefit ratio of 1: 3.70.

Keywords: Broccoli, boron, farm yard manure, net returns and C:B ratio

Introduction
Broccoli (*Brassica oleracea var. italica*, family*:* Brassicaceae) which is one of the exotic vegetable introduced in India. The first selection of sprouting broccoli was probably made in Greece and in the pre- Christian era (Heywood, 1978) [4]. Broccoli is an edible green plant in the cabbage family whose large, flowering head is eaten as a vegetable (Nirmal *et al*., 2004) [7]. The word broccoli comes from the Italian plural of *broccolo*, which means "the flowering crest of a cabbage", and is the diminutive form of *brocco*, meaning "small nail" or "sprout". Broccoli is often boiled or steamed but may be eaten raw (Bose, 2000) [3]. A Broccoli consists of immature flowering buds which would commonly contain the energy for a plant to fruit it is very high nutrients and often termed as super-food. Broccoli which is nutritious among cole crops being rich in vitamin and minerals and boiling broccoli reduces the levels of suspected anti-carcinogenic compounds, such as sulforaphane (Abd El-All, 2014) [1]. Broccoli has about 14 times more beta-carotene, a precursor of vitamin A than commonly cultivated cabbage (Sharma, 2003) [10]. It has high amount of vitamin C and significant amount of potassium, folic acid and several phytochemicals. Due to its high levels of vitamin C, beta carotene and fibre broccoli is a powerful antioxidant. High fiber content also believed to be of benefit in case of diabetes. It has as much calcium as milk, and is therefore an important source of nutrition for those with osteoporosis or calcium deficiencies (Nirmal *et al*., 2004) [7].
Boron is much required for cell division and development in the growth regions of the plant near the tips of shoots and roots. Boron is taken up by plant roots as the neutral molecule $HB_4O_7^-$and BO_3^-. It also affects sugar transport and appears to be associated with some of the functions of calcium. Boron affects pollination and the development of viable seeds which in turn affect the normal development of fruit.

Materials Methods
The experiment was conducted at Research Farm, Chatha, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu during year 2013-2014 and 2014-2015.

The Geographical area falls under sub-tropical climate and the place is situated at 32º39'29''N and 74º47'56''E and located at a height of 296 m above the Mean Sea Level. The maximum temperature raises upto 45 ˚C and minimum temperature goes down to 4-5º C. The mean annual rainfall ranges between 1000-1200 mm and large part of it is received during rainy season (July - September).

A. Experimental Design

The experiment was laid out in randomized block design with three replications, comprising of 10 treatments including control. The size of each plot was 3 m × 3 m = 9 m^2. However, the spacing between plants was 60 cm × 45 cm. Five plants from each plot were randomly selected and they were labeled. These plants were used for recording all morphological observations in respect of growth and yield of the crop. The details of the observations recorded are as follow: plant height (cm) (60 DAT), plant spread (cm) (60 DAT), number of Leaves per plant (60 DAT), Diameter of the Curd (cm), Curd Weight (g), Number of Lateral shoots, Diameter of Lateral shoots (cm), Total weight of Lateral shoots (g), Total Yield per hectare (q). The obtained data were analyzed statistically using ANOVA.

B. Experimental details

T_1 - Control (Recommended dose of NPK)
T_2 - Spray of Boron @ 0.3% applied 20 days after transplanting + recommended dose of NPK + 100% of FYM
T_3 - Spray of Boron @ 0.3% applied 35 days after transplanting + recommended dose of NPK + 100% of FYM
T_4 - Spray of Boron @ 0.3% applied 45 days after transplanting + recommended dose of NPK + 100% of FYM
T_5 - Soil application of Borax @ 10 kg/ha + recommended dose of NPK + 100% of FYM
T_6 - Soil application of Borax @ 12.5 kg/ha + Recommended dose of NPK + 100% of FYM
T_7 - Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 100% of FYM
T_8 - Soil application of Borax @ 10 kg/ha + Recommended dose of NPK + 50% of FYM
T_9 - Soil application of Borax @ 12.5 kg/ha + Recommended dose of NPK + 50% of FYM
T_{10} - Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 50% of FYM

Economic Analysis

In order to evaluate the most profitable treatment, economic analysis of treatments was worked out in terms of net returns and cost benefit (C:B) ratio. The net returns and C:B ratio was calculated as follows: Net returns were calculated by deducting the cost of cultivation from the gross income. C:B ratio = Gross return 100 Cost of cultivation

Results

The actual costs were worked out for control treatments (Table 1) which include production cost (nursery preparation, seed, field preparation, labour charges, fertilizer, insecticide/ pesticide, miscellaneous etc.) and marketing cost. The actual costs of all other treatments which includes control treatments cost plus FYM cost and boron cost which shown in table 2. Gross returns of all the treatments were varied from Rs 242700 to Rs 312150 and highest average yield was found in T_7 (Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 100% of FYM) which is also reported by others in cabbage (Narayanamma *et al*., 2007) [6], cauliflower (Mohamed El, 2011) [5] and Saha *et al.*, 2010 [9]. The total cost of cultivation was Rs 68050 and Rs 74550 including marketing cost but in C:B ratio we were include without marketing cost. The table 3 revealed that total cost of cultivation per hectare was observed to be highest (Rs 312150) in T_7 (Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 100% of FYM) whereas it was found to be lowest (Rs 242700) in T_1 (Control). Cost and return analysis of Broccoli cultivation produced in different treatments of FYM and boron application is presented in Table 2. The table 3 revealed that the net returns were higher (Rs 223900) in treatment T_7 (Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 100% of FYM) whereas it was found to be lowest (166660) in T_2 (Spray of B @ 0.3% applied 20 days after transplanting + Recommended dose of NPK + 100% of FYM). It is because of higher yield which was found to be 161.8 q/ hectare with the treatment Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 100% of FYM (T_7). The cost benefit ratio ranged from 1: 2.96 in T_2 (Spray of B @ 0.3% applied 20 days after transplanting + Recommended dose of NPK + 100% of FYM) to 1: 3.70 in T_{10} (Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 50% of FYM). Similar results were obtained by (Rajput 2008) [8] who found that application of 30 ppm GA3 gave highest net realization (Rs 167164) and cost benefit ratio (1:6.0) in guava. Bhosale (2012) [2] also reported highest net realization (Rs 50204.96) and cost benefit ratio (1:2.9) with 20 ppm GA3. Results are also in consonance with the findings of Verma (2014) [11] who recorded the highest net realization (Rs 23460 per hectare) with a cost benefit ratio of 1: 7.53 as compared to control.

Table 1: Average cost of cultivation of Broccoli under control (T_1) treatment. (Rs/ ha)

S. No.	Operation	No. / Quantity	Cost
A	**Production cost**		
1.	Nursery bed preparation for one hectare land	3 beds	750
2.	Seed	350 gm	1750
3.	Field preparation (Tractorisation)	2 times	9000
4.	Hired labour		
(a)	Layout	40	10000
(b)	Fertilizer application & ridge making	40	10000
(c)	Transplanting	15	3750
(d)	Irrigation	4	1000
(e)	Hoeing & Weeding	40	10000
(f)	Earthing up	20	5000
(g)	Harvesting	10	250
(h)	Spray of insecticides/ pesticides	02	500
5.	Fertilizer (N,P,K)	120:60:60	6550
6.	Insecticides/ Pesticides		2500

7.	Miscellaneous expenditure		7000
	Total Production cost		68050
B.	Marketing cost		
1.	Transporting cost		4500
2.	Carry bag		2000
	Total marketing cost		6500
	Total cost (A+B)		74550

Table 2: Average cost of cultivation of Broccoli under different treatments

S. No.	Treatments	Cost ha^{-1}	Cost of FYM	Cost of B	Total Cost ha^{-1}
1.	T_1 - Control (Recommended dose of NPK)	68050	-	-	**68050**
2.	T_2 - Spray of B @ 0.3% applied 20 days after transplanting + Recommended dose of NPK + 100% of FYM	68050	16000	840	84890
3.	T_3 - Spray of B @ 0.3% applied 35 days after transplanting + Recommended dose of NPK + 100% of FYM	68050	16000	840	84890
4.	T_4 - Spray of B @ 0.3% applied 45 days after transplanting + Recommended dose of NPK + 100% of FYM	68050	16000	840	84890
5.	T_5 - Soil application of Borax @ 10 kg/ha + Recommended dose of NPK + 100% of FYM	68050	16000	2800	86850
6.	T_6 - Soil application of Borax @ 12.5 kg/ha + Recommended dose of NPK + 100% of FYM	68050	16000	3500	87550
7.	T_7 - Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 100% of FYM	68050	16000	4200	88250
8.	T_8 - Soil application of Borax @ 10 kg/ha + Recommended dose of NPK + 50% of FYM	68050	8000	2800	78850
9.	T_9 - Soil application of Borax @ 12.5 kg/ha + Recommended dose of NPK + 50% of FYM	68050	8000	3500	79550
10.	T_{10} - Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 50% of FYM	68050	8000	4200	80250

Table 3: Cost: Benefit ratio analysis of Broccoli cultivation with different application of boron and FYM. (Rs. ha^{-1})

S. No.	Treatment	Average yield (q)	Price per quintal	Gross return	Cost of cultivation	Net return	Cost : Benefit ratio
1.	T_1 - Control (Recommended dose of NPK)	161.8	1500	242700.00	68050	174650	1:3.57
2.	T_2 - Spray of B @ 0.3% applied 20 days after transplanting + Recommended dose of NPK + 100% of FYM	167.7	1500	251550.00	84890	166660	1:2.96
3.	T_3 - Spray of B @ 0.3% applied 35 days after transplanting + Recommended dose of NPK + 100% of FYM	170.6	1500	255900.00	84890	171010	1:3.01
4.	T_4 - Spray of B @ 0.3% applied 45 days after transplanting + Recommended dose of NPK + 100% of FYM	171.6	1500	257400.00	84890	172510	1:3.03
5.	T_5 - Soil application of Borax @ 10 kg/ha + Recommended dose of NPK + 100% of FYM	183.5	1500	275250.00	86850	188400	1:3.17
6.	T_6 - Soil application of Borax @ 12.5 kg/ha + Recommended dose of NPK + 100% of FYM	194.9	1500	292350.00	87550	204800	1:3.34
7.	T_7 - Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 100% of FYM	208.1	1500	312150.00	88250	223900	1:3.54
8.	T_8 - Soil application of Borax @ 10 kg/ha + Recommended dose of NPK + 50% of FYM	188.3	1500	282450.00	78850	203600	1:3.58
9.	T_9 - Soil application of Borax @ 12.5 kg/ha + Recommended dose of NPK + 50% of FYM	185.5	1500	278250.00	79550	198700	1:3.50
10.	T_{10} - Soil application of Borax @ 15 kg/ha + Recommended dose of NPK + 50% of FYM	197.8	1500	296700.00	80250	216450	1:3.70

Conclusion

It can be concluded from the results that application of FYM and boron T_7 treatment (Soil application of Borax @ 15 kg/ha + recommended dose of NPK + 100% of FYM) was best among all other treatments. The total cost of cultivation was found to be highest (Rs 88250/ha) with (T_7) and lowest in control (T_1) (Rs 68050/ha). The highest net return (Rs 223900 per hectare) was registered under treatment (T_7) and lowest (Rs 166660 per hectare) in (T_2). Thus, Broccoli cultivation with Soil application of Borax @ 15 kg/ha + recommended dose of NPK + 100% of FYM was found to be the best treatment in average yield, gross return and net return but Broccoli cultivation with soil application of Borax @ 15 kg/ha + recommended dose of NPK + 50% of FYM was found to be the best treatment as it is evident from cost: benefit ratio of 1: 3.70.

References

1. Abd El-All HM. Improving growth, yield, quality and sulphoraphan content as anticancer of broccoli (*Brassica oleracea* L. var. *italica*) plants by some fertilization treatments. Middle East J of Agric. Research. 2014; 3(1):13-19
2. Bhosale GH. Effect of plant growth regulators on growth, yield quality of ber (*Zizyphus mauritiana* Lamk.) cv. Mehrun under Saurashtra region. M.Sc. (Ag.) thesis subm. To Junagadh Agricul. Univ, Junagadh, 2012. 69-70.
3. Bose TK. Sprouting Broccoli. Vegetable crops. 2000; (1):411-418.
4. Heywood VH. Flowering plant of the world. Mayflower Books, New York, 1978, 2-3.
5. Mohamed El-Sayed Ahmed, Abdelnaser, Abdelghany Elzaawely. Effect of the foliar spraying with molybdenum and magnesium on vegetative growth and curd yields in cauliflower (*Brassica oleraceae var. botrytis* L.) World J of Agric. Sci. 2011; 7(2):149-156.
6. Narayanamma M, Chiranjeevi C, Ahmed SR. Effect of foliar application of micronutrients on the growth, yield and nutrient content of cabbage (*Brassica olfracea* L, Var. Capitata). In Andhra Pradesh. Veg. Sci. 2007; 34(2):213-214.

7. Nirmal D, Singh KP, Benerjee MK, Rai M. Exotic vegetables-Technical Bulletin Indian Institute of Vegetable Research, Varanasi, India. 2004; 2(1):4-6.
8. Rajput RP. Effect of boron and various plant growth regulators on yield and quality of guava (*Psidium guajava* L.) cv. Lucknow-49. M.Sc. (Ag.) thesis subm. to Junagadh Agricul. Univ, Junagadh, 2008, 44-45.
9. Saha P, Das NR, Chatterjee R. Boron and molybdenum nutrition in sprouting broccoli (*Brassica oleracea var. italica*) under terai region of West Bengal. The Asian J of Horticulture. 2010; 5(2):353-355.
10. Sharma SR. Broccoli vegetable crops production. Div. of vegetable crops, India, 2003, 50-52.
11. Verma S. Effect of ZnSO4 and GA3 on growth, yield and quality of sapota [*Manilkara achras* (Mill.) Forsberg] cv. Kalipatti. Ph.D. thesis submitted to Junagadh Agricul Univ., Junagadh, 2014, 90-92.