J. Sher-e-Bangla Agric. Univ., 8(1): 23-29, January 2014 ISSN 1997-6038

INTEGRATED MANAGEMENT FOR HIGHER CURD YIELD AND QUALITY OF BROCCOLI (*Brassica oleracea* var. *italica* L.)

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ABSTRACT

An integrated management was taken to investigate the effect of macronutrients, micronutrients, cowdung, mustard oilcake and mulches on different yield contributing characters, yield and quality parameters of broccoli during October 2011-March 2012 at the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka. The experiment included six treatments using T_1= 15 t/ha Cowdung + $N_{115}P_{72}K_{120}$ (recommended dose of cauliflower) ,T_2= 15 t/ha Cowdung + $N_{120}P_{100}K_{140}S_{20}$ kg/ha ,T_3= 15 t/ha Cowdung + $N_{120}P_{100}K_{140}S_{20}$ + $Zn_4B_{1.5}Mo_1$ kg/ha, T_4= 20 t/ha Cowdung + 400 kg/ha mustard oilcake , T_5= $N_{120}P_{100}K_{140}S_{20}$ +Zn $_4B_{1.5}Mo_1$ kg/ha + 20 t/ha Cowdung + 400 kg/ha mustard oilcake and water hyacinth mulch ,T_6= $N_{120}P_{100}K_{140}S_{20}$ + $Zn_4B_{1.5}Mo_1$ kg/ha + 20 t/ha Cowdung + 400 kg/ha mustard oilcake. Significant variation was recorded in case of plant height, number of leaves, leaf length, leaf breadth, days to curd initiation, stem length, stem diameter, primary curd diameter, curd weight, number and weight of secondary curd, curd yield, moisture (%) , ascorbic acid, β carotene content, protein and carbohydrate percentages except total fat percentages, iron and calcium content. The maximum curd yield (24.15 t/ha) was found from T_6 treatment and the minimum was recorded from T_4 (15.26 t/ha) treatment. T_6 treatment showed the best performance on the maximum yield and quality curd production over all the other treatments.

Keywords: broccoli, integrated management, yield and quality.

INTRODUCTION

Broccoli (*Brassica oleracea* var. *italica* L.) is one of the non-traditional winter vegetable in Bangladesh, which was introduced to this country several years ago. Analytical data represented that the broccoli is more nutritious than other "Cole" crops such as cabbage, cauliflower and kohlrabi (Nieuwhof, 1969). Broccoli is not extensively cultivated in Bangladesh and yield is relatively low compared to that of other broccoli producing countries. This is mainly due to lack of awareness regarding its method of production. Nutrients are applied to the soil through organic and inorganic means. Macro and micro fertilizers contain large amount of specific plant nutrients in readily available form. Organic manures improves soil texture, structure, humus, colour, aeration, water holding capacity and microbial activity of soil .Combined application of organic and inorganic fertilizer may give a better performance of the crop. Adequate supply of nutrients increases the yield. In order to increase the yield and quality of broccoli, there should have the technologies which will eventually fulfill the growers as well as consumers need. Studies on integrated management practices would help increasing yield and quality of broccoli. Available information on the stated subject under Bangladesh conditions is inadequate. So, a systematic study it is important to find out the optimum requirement of broccoli plant.

MATERIALS AND METHODS

The experiment was conducted during October, 2011 to March 2012 at the Horticulture Farm of Sher-e-Bangla Agricultural University, Sher-e Bangla Nagar,Dhaka. Premium crop variety of

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broccoli was used in the experiment. The experiment was laid out in a single factor Randomized Complete Block Design with three replications. There were six treatments combination using T_1= 15 t/ha Cowdung + $N_{115}P_{72}K_{120}$ (recommended dose of cauliflower) ,T_2= 15 t/ha Cowdung + $N_{120}P_{100}K_{140}S_{20}$ kg/ha ,T_3= 15 t/ha Cowdung + $N_{120}P_{100}K_{140}S_{20}$ + $Zn_4B_{1.5}Mo_1$ kg/ha, T_4= 20 t/ha Cowdung + 400 kg/ha mustard oilcake , T_5= $N_{120}P_{100}K_{140}S_{20}$ +Zn $_4B_{1.5}Mo_1$ kg/ha + 20 t/ha Cowdung + 400 kg/ha mustard oilcake and water hyacinth mulch ,T_6= $N_{120}P_{100}K_{140}S_{20}$ + $Zn_4B_{1.5}Mo_1$ kg/ha + 20 t/ha Cowdung + 400 kg/ha mustard oilcake. The unit plot size was 3m ×2 m and spacing of 60 cm and 40 cm. Healthy and uniform sized twenty days old seedlings were transplanted in the experimental plots on 25 October. The entire quantity of cow dung, Mustard oil cake, TSP, ½ MP, gypsum, Zn, B, and Mo were applied as a basal dose during final land preparation. Total amount of urea and ½ MP were applied in three splits, the half of the amount of urea was applied during final land preparation before sowing and the rest was applied as side dressing in two equal installments at 20, 30 and 40 days after transplanting. The applied fertilizers were mixed properly with the soil of the plot. Data was collected from 10 randomly selected plant on plant height, number of leaves, leaf length, leaf breadth, days to curd initiation, stem length, primary curd diameter, stem diameter, weight of primary curd per plant, number and weight of secondary curds per plant, yield per hectare, moisture, protein, ascorbic acid, carbohydrate, fat, dietary fiber, calcium, iron content in curd. Recorded data on different parameters were statistically analyzed using MSTAT- computer programme and means were adjusted by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Plant height was measured at 20 days interval starting from 20 days after transplanting, and was continued upto the harvest (Table 1). At 60 DAT the highest plant height (77.03 cm) was recorded from T_6 treatment, while the minimum height (69.09 cm) was recorded from T_4 treatment at 60 DAT. It may be inferred that cowdung and mustard oilcake manure improves the physical, chemical and biological condition of soil .On the other hand, macro and micro fertilizers contain large amount of specific plant nutrients in readily available form. Therefore, combined application of organic and inorganic manure may ensure a better performance of the crop. Farooque and Islam (1989) found in an experiment that combined application of cowdung, oilcake, Urea, TSP and MP produced better growth and the highest yield of cabbage. The findings of the present study agree with that of Thompson and Kelly (1988). It is also in agreement with the result of Thakur *et al.* (1991).

The number of leaves per plant was found to be significantly influenced by different treatments. An increasing trend was found upto 60 DAT for all treatments and thereafter gradually decreased (Table 1). It was observed that at 60 DAT the maximum number of leaves (23.43) per plant was observed from T_6 treatment, which was statistically similar toT_3 (21.80) treatment at the same growth stage, while the minimum was obtained from T_4 (19.70) treatment. The use of macro and micro nutrients in combination with cowdung manure and mustard oilcake might have induce better performance in the crop ultimately resulting in the production of more leaves per plant. The effect of different treatments on leaf length per plant was observed to be significant (Table-2).The leaf length per plant was found to increase gradually with different treatments upto 60 DAT and then slowly decreased upto 80 DAT. The highest leaf length (59.21 cm) was found from T_6 treatment at 60 DAT, which is statistically identical toT_3 (58.74 cm) treatment and similar to T_5 (55.26 cm), T_2 (55.03 cm) and T_1 (54.41 cm) treatments respectively at 60 DAT. The lowest leaf length was observed from T_4 (50.88 cm) treatment at 60 DAT. It may be that, optimum levels of macro and micro nutrients (N, P, K, S, Zn, B and Mo) in combination with cowdung and mustard oilcake helped the uptake of the nutrients and thus enhanced the cell division and meristematic activity of tissue expansion of cell. The results are in partial agreement with the findings of Balyan *et al.* (1988).

Table 1. Effect of integrated management on plant height at different growth stages of broccoli

Treatments	Plant height (cm)				Number of leaves			
	20DAT	40DAT	60DAT	Harvest	20DAT	40DAT	60DAT	80DAT
T_1	26.17 b	56.01c	73.00 ab	66.60 bc	6.70bc	15.13c	17.83 c	13.37 b
T_2	28.70a	62.66ab	75.25 a	71.43a-c	6.57 c	15.67 bc	19.89 bc	14.79 ab
T_3	29.88 a	65.41a	75.90 a	72.24 ab	7.47 a	16.77 ab	21.80 ab	15.43 a
T_4	25.21 b	55.15 d	69.09 b	64.31 c	5.93d	14.57c	19.70 bc	14.73 ab
T_5	28.89 a	59.32bc	73.72 ab	70.79a-c	7.00ac	16.73 ab	20.69 b	14.92 ab
T_6	30.49 a	67.23a	77.03 a	75.38 a	7.13 ab	17.03 a	23.43 a	16.40 a
$LSD_{(0.05)}$	2.301	5.265	4.513	6.831	0.460	1.256	2.089	1.603
CV(%)	4.48	4.75	4.35	5.35	5.73	4.32	5.58	5.90

Means in a column followed by the same letter do not differ significantly at 5% level; by DMRT

T_1= 15 t/ha Cowdung, $N_{115}P_{72}K_{120}$, T_2=15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}$ kg/ha, T_3= 15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, T_4= 20 t/ha Cowdung, 400 kg/ha mustard oilcake, T_5= $N_{120}P_{100}K_{140}S_{20}Zn_{4}B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcake and water hyacinth mulch, T_6= $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcak

Table 2. Effect of integrated management on leaf length and leaf breadth per plant at different growth stages of broccoli

Treatments	Leaf length (cm)				leaf breadth (cm)			
	20DAT	40DAT	60DAT	80 DAT	20DAT	40DAT	60DAT	80 DAT
T_1	18.51bc	45.67bc	54.41ab	48.40a	7.22bc	14.30b	20.28 d	16.62bc
T_2	21.01 ab	46.59 b	55.03 ab	47.75 a	7.63 bc	14.76 b	22.08 bc	17.15 b
T_3	22.24 a	50.15 a	58.74 a	49.51 a	9.09 a	17.42a	24.11 a	19.23 a
T_4	16.00c	42.79c	50.88b	42.12b	7.19c	13.27 b	21.36 cd	15.53 c
T_5	19.27 b	46.16 b	55.26 ab	50.28 a	8.51 a-c	17.20 a	23. 19 ab	17.59 b
T_6	22.89 a	50.41 a	59.21 a	49.56 a	8.62 ab	18.11 a	24.12 a	19.97 a
$LSD_{(0.05)}$	2.604	2.951	4.911	4.171	1.302	2.413	1.612	1.419
CV(%)	7.16	7.45	4.86	4.78	8.90	8.38	5.93	4.41

Means in a column followed by the same letter do not differ significantly at 5% level;

T_1= 15 t/ha Cowdung, $N_{115}P_{72}K_{120}$ T_2= 15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}$ kg/ha , T_3= 15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, T_4= 20 t/ha Cowdung, 400 kg/ha mustard oilcake, T_5= $N_{120}P_{100}K_{140}S_{20}Zn_{4}B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcake and water hyacinth mulch, T_6= $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcake

The effect of different treatments on leaf breadth per plant was observed to be significant (Table-2).The maximum leaf breadth was found from T_6 (24.12 cm) treatment, which was statistically identical to T_3 (24.11 cm) and similar to T_5 (23.19 cm) at 60 DAT and the minimum was found from T_1 (20.28 cm) treatment. Soil organic matter is the key to soil fertility. Optimum levels of macro and micro nutrients increase the availability and thus the absorption of essential plant nutrients, which results in increased plant growth. So, the combinations of organic + inorganic fertilizer probably led to better performance and increased the leaf breadth. Different treatment combinations showed statistically significant influence on the days to first curd initiation of broccoli (Table 3). The maximum days (65.14) to curd initiation was found from T_1 treatment, while the minimum day (49.10) was recorded from T_6 treatment. Kadir (2002) observed similar results in this respect who stated that combined application of N, P, K, S and B fertilizers showed early curd initiation of broccoli. Different treatment combinations showed statistically significant influence on stem length (Table 3).The maximum length of stem was recorded from T_5 (23.26 cm) treatment, which was statistically similar to T_6 (22.93 cm) and T_3 (22.09 cm) treatments, while the minimum (18.16 cm) was obtained from T_4 treatment. Masson *et al.* (1991) reported that high nitrogen rates accelerated shoot growth at the expense of root growth.

Table 3. Effect of integrated management on days to curd initiation, stem length, primary curd and stem diameter (cm) of broccoli

Treatments	Days to curd initiation	Stem length (cm)	Stem diameter (cm)	Primary curd diameter (cm)	Primary curd weight /plant (g)	Number of secondary curds/plant	Weight of secondary curds/plant (g)
T_1	65.14 a	19.42 cd	3.48 b	17.13 c	397.40bc	5.46 c	94.40b
T_2	52.43 b	20.67 bc	3.70 b	18.58 b	471.19b	6.49 b	107.77ab
T_3	49.22 b	22.09 ab	4.27a	18.90 b	562.26a	6.85 b	114.41ab
T_4	60.62 a	18.16 d	3.41 b	16.92 c	376.31c	5.27c	91.14b
T_5	60.75 a	23.26 a	4.23 a	19.25 b	557.32a	7.01 b	119.84a
T_6	49.10 b	22.93 ab	4.36 a	20.47 a	588.76a	7.75 a	127.20a
$LSD_{(0.05)}$	4.467	2.209	0.478	1.095	77.00	0.570	22.14
CV(%)	4.37	5.76	6.72	4.25	8.60	4.84	11.15

Means in a column followed by the same letter do not differ significantly at 5% level; by DMRT

T_1= 15 t/ha Cowdung, $N_{115}P_{72}K_{120}$ T_2= 15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}$ kg/ha, T_3= 15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, T_4= 20 t/ha Cowdung, 400 kg/ha mustard oilcake, T_5= $N_{120}P_{100}K_{140}S_{20}Zn_{4}B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcake and water hyacinth mulch, T_6= $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcak

Different treatment combinations showed statistically significant influence on stem diameter of broccoli (Table3).The maximum stem diameter (4.36 cm) was observed from T_6 treatment, which was statistically identical to T_3 (4.27 cm) and T_5 (4.23 cm) treatments, while the minimum (3.41 cm) was obtained from T_4 treatment.T_2 and T_1 treatments showed statistically similar results in this respect. The results of the present study show that the stem diameter increased with the combination of optimum levels of macro and micro nutrients. This result is supported by Dufault (1988) reported that for quality broccoli production 5.6 g N, 0.21 g P and 16.0 g K per liter pot were required and increasing N rates increased head fresh weight, stem diameter, floret total chlorophyll, root and top dry weight, plant height, head quality and decreased days to heading and harvest. The effect of different integrated treatments showed statistically significant influence on primary curd diameter of broccoli (Table 3).The maximum primary curd diameter (20.47 cm) was obtained from T_6 treatment while, the lowest (16.92 cm) was found from T_4 treatment. This result is supported by Brahma *et al.* (2002). The formation of bigger curd with the application of higher NPK and S fertilizers with Zn, B and Mo and organic manure dose may be due to better synthesis of carbohydrate and their translocation to the sink i.e. broccoli curd, and forming larger and comparatively broader broccoli curd. Akter *et al.* (1996) reported that, 10 ton/ha of poultry manure with the recommended dose of nutrients produced the maximum yield of broccoli curd. In absence of NKPS organic manure alone could not produce higher curd yield. Different treatment combinations showed statistically significant influence on primary curd weight per plant of broccoli (Table 3). The maximum primary curd weight (588.76 g) was recorded from T_6 treatment, which is statistically identical to T_3 (562.26 g) and T_5 (557.32 g) treatments and the minimum was observed from T_4 (376.31 g) treatment. It was probably due to fact that the combination of organic and inorganic fertilizers provided good soil conditions for growth as well as supplied moisture and plant nutrients. Ying *et al.* (1997) reported that N, P and K application produced maximum yield of broccoli. The effect of different treatments of broccoli production on number of secondary curds per plant was observed to be statistically significant (Table 3).The maximum number of secondary curds was also observed from T_6 (7.75) treatment and the minimum were obtained from T_4 (5.27) and T_1 (5.46) treatments. T_5, T_3 and T_2 treatments respectively showed statistically similar results in this respect. This result is in agreement with the result obtained by Cutcliffe *et al.* (1968) they

investigated the effects of N, P, K and manure on the yield and maturity of broccoli and reported that terminal inflorescence, lateral and total yields were substantially increased by the applications of high rates N P and K. Manure treatment increased lateral and total yields of broccoli. Different treatment combinations showed statistically significant influence on secondary curd weight per plant of broccoli (Table 3). The maximum secondary curds weight 127.20 g was recorded from T_6 treatment, which was statistically similar to T_5 (119.84 g), T_3 (114.41 g) and T_2 and (107.77 g) treatments respectively. The minimum (91.14 g) was obtained from the T_4 treatment. Sharma (2000) found that integration of organic and inorganic fertilizers application significantly increased the head yield of broccoli over inorganic fertilizers alone and also over control.

Different treatment combinations showed statistically significant influence on curd yield ton per hectare of broccoli (Table 4). The maximum curd yield (24.15 t/ha) was found from T_6 treatment, which is statistically identical to T_3 (23.15 t/ha) and T_5 (22.83 t/ha) treatments, while the minimum yield was recorded from T_4 (15.26 t/ha) and T_1 (16.89 t/ha) treatments. Brahma *et al.* (2002) reported that balanced application of fertilizer is the prerequisite for obtaining higher yield and better quality of broccoli .Magalhaes *et al.* (1980) reported that the micro elements, Zn, B and Mo plays an important role directly and indirectly in improving the growth, yield and quality of broccoli in addition to checking various diseases and physiological disorders.

Table 4. Effect of integrated management on yield per plot (kg) and yield per hectare (t) of broccoli

Treatments	Yield /ha (t)	Moisture (%)	Ascorbic acid (mg/100g)
T_1	16.89 c	88.20	103.00 c
T_2	18.96 b	86.15	105.01bc
T_3	23.15 a	86.40	111.00b
T_4	15.26 c	87.65	106.33bc
T_5	22.83 a	87.65	105.00 bc
T_6	24.15 a	85.75	118.00 a
$LSD_{(0.05)}$	2.074	--	5.780
CV(%)	5.64	3.23	3.01

Means in a column followed by the same letter do not differ significantly at 5% level; by DMRT

T_1= 15 t/ha Cowdung, $N_{115}P_{72}K_{120}$, T_2= 15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}$ kg/ha, T_3= 15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, T_4= 20 t/ha Cowdung, 400 kg/ha mustard oilcake, T_5= $N_{120}P_{100}K_{140}S_{20}Zn_{4}B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcake and water hyacinth mulch, T_6= $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcake

The different integrated treatments of broccoli production had no significant effect on moisture content of broccoli curd (Table 4).

Table 5. Effect of integrated management on quality of fresh broccoli (100 g edible portion)

Treatments	â Carotene (µg/100g)	Total Fat (%)	Protein (%)	Dietary fibre (%)	Carbohydrate (%)	Iron (mg/100g)	Calcium (mg/100g)
T_1	2151.66 c	0.20	4.29 c	1.30 bc	5.47 a	1.30	130
T_2	2198.00 c	0.21	4.78 b	1.31 bc	5.50 a	1.29	128
T_3	2361.33 ab	0.20	5.14 a	1.34 ab	5.54 a	1.32	131
T_4	2222 .00bc	0.21	3.80 d	1.27 c	5.15 b	1.31	129
T_5	2301.66 a-c	0.21	5.16 a	1.35 ab	5.52 a	1.30	131
T_6	2432.00 a	0.19	5.31 a	1.39 a	5.65 a	1.32	132
LSD (0.05)	144.8	--	0.287	0.057	0.257	--	-
CV(%)	3.49	4.49	3.36	2.79	2.60	4.74	2.24

Means in a column followed by the same letter do not differ significantly at 5% level; by DMRT

T_1= 15 t/ha Cowdung, $N_{115}P_{72}K_{120}$, T_2= 15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}$ kg/ha, T_3= 15 t/ha Cowdung, $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, T_4= 20 t/ha Cowdung, 400 kg/ha mustard oilcake, T_5= $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcake and water hyacinth mulch, T_6= $N_{120}P_{100}K_{140}S_{20}Zn_4B_{1.5}Mo_1$ kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcake

Marked differences in the effect of different integrated approach of broccoli production on the ascorbic acid content of broccoli curd was observed (Table 4). The maximum ascorbic acid (118 mg/100 g) was found from T_6 treatment combination followed by (111 mg/100 g) T_3 treatment, while the minimum (103 mg/100 g) was noted from the T_1 treatment. It was stated that increased application of nitrogen on cauliflower showed positive response in increasing the number of leaves, yield, protein and ascorbic acid contents (Randhawa and Bhail, 1976). Kaniszewski and Rumpet (1983) reported that nitrogen fertilization had significantly influenced on ascorbic acid content. The content of β-carotene was significantly influenced by the different kind and rate of fertilizer applied (Table 5).

The maximum β-carotene content (2432.00 μg/100 g) of broccoli curd was observed from T_6 treatment, which was statistically similar to T_3 and T_5 treatments respectively and the minimum (2151.66 μg/100 g) was found from the T_1 treatment. This might be fact that content of ß-carotene in edible portions increased with increasing levels of fertilizers. Application of N has been reported to improve ß-carotene content in cabbage (Nillson 1979). Salisbury and Ross (1991) reported that nitrogen facilitates formation of chloroplasts, which are rich in ß-carotene. No significant effect of integrated treatments on fat content of broccoli curd was observed (Table 5). The effect of integrated treatments on protein content of broccoli curd was found to be significant (Table 5). The maximum protein content (5.31%) of broccoli curd was observed from T_6 treatment, which was statistically identical to T_5 (5.16%) and T_3 (5.14%) treatments respectively. On the other hand, the minimum (3.80%) was found from the T_4 treatment. The effect of integrated treatments on fiber content of broccoli curd was found to be statistically significant (Table 5). The maximum fiber content (1.39%) of broccoli curd was found from the T_6 treatment, which was statistically similar to T_5 (1.35%) and T_3 (1.34%) treatments respectively, while the minimum (1.27%) was observed from T_4 treatment. The effect of integrated treatments on carbohydrate content of broccoli curd was found to be statistically significant (Table 5). The maximum carbohydrate content of curd (5.65%) was recorded from the T_6 treatment and the minimum (5.15%) was recorded from T_4 treatment. The treatment combinations were found to have statistically non-significant influence on the Fe and Ca content of broccoli curd (Table 5).

The results of the investigations suggested that, high yield and good quality broccoli can be obtained with the application of 120 kg N, 100kg P, 140kg K, 20kgS, 4kg Zn, 1.5kgB, 1kgMo per hectare in combination with 20 ton/ha cowdung and 400 kg/ha mustard oilcake.It can therefore be suggested that integrated treatment T_6 (N_{120} P_{100} K_{140} S_{20} Zn_4 $B_{1.5}$ Mo_1 kg/ha, 20 t/ha Cowdung, 400 kg/ha mustard oilcake) is considered to be the best for commercial broccoli production.

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