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EFFECT OF BORON ON YIELD AND QUALITY OF BROCCOLI GENOTYPES

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ABSTRACT

Islam M, Hoque MA, Reza MM, Chakma SP (2015) Effect of boron on yield and quality of broccoli genotypes. *Int. J. Expt. Agric.* 5(1), 1-7.

A field experiment consisting of four broccoli genotypes (G_1= Premium Crop, G_2= Early Green, G_3= Green Calabrese and G_4= Late Calabrese) with four different levels of boron (L_1 = control or without boron, L_2= 1 kg/ha, L_3= 2 kg/ha and L_4= 3 kg/ha) was conducted at the experimental field of Department of Horticulture, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur during the winter (Rabi) season of 2012-13 to find out the suitable dose(s) of boron and genotype for higher yield and good quality head in the climatic condition of Bangladesh. Maximum β-carotene and dry matter content of main curd were noted in the genotype Green Calabrese. Whereas maximum dry matter content of secondary curd, ascorbic acid, iron and calcium content were measured in genotype Late Calabrese. Premium Crop produced minimum number of hollow stem plant per plot. Early Green performed the best regarding highest potassium content, yield per plant (681.1 g) and total yield (27.24 t/ha). Result revealed that, there was a significant and positive effect of boron application on the yield and quality of broccoli and 2.0 kg B/ha was found to be an optimum rate. The genotype Early Green yielded the highest (32.19 t/ha) when boron was applied @ 2 kg/ha. Dry matter, ascorbic acid, and potassium content were increased with the increase of boron level up to 2.0 kg/ha and then declined with further increase of boron. On the other hand, iron and β-carotene content increases with the increase of boron level up to 3.0 kg/ha. Calcium content was found to be decreased with the increase of boron level.

Key words: *broccoli, boron, yield, nutritional quality, hollow stem, Bangladesh*

INTRODUCTION

Broccoli (*Brassica oleracea* var. *italica* L.) is a cool-season vegetable under the cruciferae family and more nutritious than any other vegetables of the same genus (Rashid 1999; Yoldas *et al.* 2008). Vitamin C content in fresh broccoli is almost twice than that in cabbage and cauliflower. It is also rich in carotene and contains appreciate quantities of thiamin, riboflavin, niacin and iron (Thomson and Kelly, 1985; Rahman 1988). Broccoli helps to lower the cholesterol and lessen the impact of allergy-related substances in our body. Isothiocyanates (ITCs) are the detox-regulating molecules made from broccoli's glucosinolates and they help to control the detox process at a genetic level. The unique combination of antioxidant, anti-inflammatory, and pro-detoxification components in broccoli make it a unique food in terms of cancer prevention (Mateljan 2009). It is thought that broccoli is the first crop to be domesticated among 'Cole" crops but it was unfamiliar until 1930s (Gill 1993). It is originated from west Europe (Prasad and Kumar, 1999). Broccoli is one of the non-traditional and relatively new winter vegetables in Bangladesh. But cultivation of broccoli in our country is confined into a very limited area with a minimum production and its average yield is only about 10.5 metric tons per hectare (Anonymous 2004) which is very low compared to other broccoli growing countries like 24 t/ha in Italy, 20 t/ha in Japan and 18 t/ha in Turkey (Ahmed *et al*. 2004). Broccoli genotypes have significant effect on yield and other qualities. Therefore, it is urgently needed to evaluate the performance of available broccoli genotypes in respect of yield and other nutritional quality in Bangladesh condition. The production of broccoli is influenced by the application of fertilizers, and it is evident that balanced application of fertilizer is the prerequisite for obtaining higher yield and better quality of broccoli (Brahma *et al.* 2002). Broccoli responds significantly to major essential elements like N, P, and K in respect of its growth and yield (Thompson and Kelly, 1985). Boron significantly improves the vegetative growth and quantitative parameters of cole crops. It is essential for translocation of sugars, starch, nitrogen and sulphur (Singh 2003). Its application to the soil increased head yield of broccoli (Yang *et al.* 2000). Application of boron significantly increases curd diameter, weight of curd, yield and quality of cauliflower (Kumar *et al.* 2002). An abiotic disorder 'hollow stem' is commonly associated with boron deficiency (Shelp *et al.* 1992), which becomes an important quality factor, particularly when displayed at market because the hollow stem area is visible at the base of the stem (Hipp 1974; Hudson *et al.* 1988). The disorder has been most severe when individual plants grow rapidly such as: wide spacing, high N fertilizer levels, warm weather, adequate moisture and B deficiency (Vigier and Cutcliffe, 1985). Moreover, in cole crops like cauliflower and broccoli, boron requirement is high (Mengal and Kirkby, 1987). The scientific researches show that application of optimum dose of boron and nitrogen decrease head rot and hollow stem of broccoli and increase macronutrient and micronutrient concentrations such as nitrogen, phosphorus, potassium, iron and zinc in broccoli head those are useful and necessary for human's health (Yoldas *et al.* 2008). Therefore, the objective of this experiment was to evaluate the curd quality and chemical content of broccoli as affected by different boron doses on broccoli genotypes for optimizing the boron dose with appropriate genotype.

MATERIALS AND METHODS

The field experiment was conducted at the Horticultural Research Farm of Bangabandhu Sheikh Mujibur Rahman Agricultural University, (BSMRAU) Gazipur from October, 2012 to February, 2013 and the nutritive quality analysis was done in both the laboratories of Horticulture and Soil Science Department, BSMRAU, during the period from January to April, 2013. The experimental site was located at the centre of Madhupur Tract (24˚09´ N latitude and 90˚26´ E longitudes at 8.5 meter above the sea level) belongs to AEZ 28. The soil is Clay loam in texture having a pH of 6.2. The detailed information of the initial soil analysis are presented in Table 1. The experiment was factorial and had 16 treatment combinations, a randomized complete block design with three replications having four broccoli genotypes, *viz.*, G_1= Premium Crop, G_2= Early Green, G_3= Green Calabrese and G_4= Late Calabrese with four levels of boron, *viz.*, L_1= control (boron nil), L_2= 1 kg/ha, L_3= 2 kg/ha and L_4= 3 kg/ha. Plot dimension was 2.0 m x 1.5 m and plant spacing was 50 cm x 50 cm. Manure and fertilizers were applied to the soil @ 15 tons well rotten cowdung, 210 kg urea, 120 kg TSP, 100 kg MP and 1 kg Molybdenum per hectare. The full amounts of cowdung, TSP, MP and molybdenum were applied during final land preparation, while the urea was applied in two equal installments at 15 and 30 days after transplanting. Treatment wise boron was applied during final land preparation. Boron was applied to the soil as Solubor (20% B).

Table 1. Physical and chemical properties of experimental soil prior to fertilizer application

Value	Textural class	g/cm^3		pH	Percentage			meq/100 g				ppm		
		Bulk density	Particle density		Soil porosity	OM	Total N	CEC	Ca	Mg	K	P	S	B
Analytical	Clay loam	1.36	2.65	6.2	48.7	0.79	0.119	19.87	7.9	2.36	0.49	13.9	16.9	0.1
Critical		-	-	-	-	-	0.075	-	2.0	0.8	0.2	14.0	14.0	0.2
Optimum		-	-	-	-	-	3.0	-	18.0	9.0	1.5	60.0	60.0	2.0

The seeds were sown in seed bed on 2 October, 2012. Because of heavy rainfall and unfavorable condition of the main field, forty days old healthy seedlings were transplanted in the experimental field on 11 November, 2012 in the afternoon. Harvesting was started on 7 January, 2013 and 50% harvest was completed on 21 January, 2013.

The parameters under study included yield per plant, total yield, dry matter content, ascorbic acid, β-carotene, iron, calcium, phosphorus, potassium and hollow stem plant per plot were recorded from randomly selected five plants in each plot. Ascorbic acid and β-carotene were determined from fresh broccoli head according to Pleshkov, (1976) and Nagata *et al*. (1992), respectively. Iron, calcium, phosphorus, potassium also determined as suggested by Piper, (1966). All data were analyzed statistically with MSTATC and means were separated by Duncan's Multiple Ranges Test (DMRT) at 5% level of probability for interpretation of result.

RESULTS AND DISCUSSION

Analytical data of all the parameters are shown in Table 2.

Curd yield per plant (g)

Genotypes of broccoli differed significantly regarding yield per plant. The genotype Early Green produced maximum yield per plant (681.1 g) followed by Premium Crop (500.0 g). The minimum yield per plant (247.7 g) was found in Green Calabrese.

Yield per plant varied significantly with application of boron fertilizers. The maximum yield per plant (495.0 g) was measured with treatment of L_3 (2 kg B/ha) and lowest curd weight (363.9 g) was obtained from the control treatment. Sharma and Tanuja (1991) mentioned that Leaf water potential, stomatal opening, transpiration rate, net photosynthesis and intercellular CO_2 concentration were greatly reduced by B deficiency. So yield per plant might be reduced because of B deficiency.

Significant variation was observed in yield per plant due to the combined influence of genotypes and boron. The highest yield per plant (804.8 g) was obtained from G_2L_3 (Early Green and 2 kg B/ha) while it was minimum (225.4 g) in G_3L_1 (Green Calabrese and 0 kg B/ha). The treatment combination G_2L_3 performed best may be due to the production of higher number of leaves, curd diameter, curd weight and secondary curd weight by the genotype Early Green in presence of good environmental condition.

Curd yield (t/ha)

The total curd yield of broccoli consisted of the main curd and the secondary curd those developed after the removal of the main curd. Although the core of stem is also edible, it was usually not included as part of the yield. However, significant variation in yield (t/ha) was observed among the genotypes. Genotype Early Green yielded the maximum (27.24 t/ha). This might be due to best performance of this genotype in curd diameter, curd weight and secondary curd weight. The minimum yield (9.91 t/ha) was recorded from Green Calabrese.

Boron fertilizer also had significant influence on the yield of broccoli. The maximum yield (19.80 t/ha) was measured with treatment of L_3 (2 kg B/ha). Moniruzzaman *et al.* (2007) also recorded maximum yield at 2 kg B/ha. Kumar *et al.* (2002) reported that Borax at 10kg/ha increased yield by 32%. Kotur and Kumar (1990) and Firoz *et al.* (2008) found almost similar result. On the other hand, lowest yield (14.56 t/ha) was obtained from the control treatment.

The plants of G_2L_3 (Early Green and 2 kg B/ha) produced maximum yield (32.19 t/ha) while the lowest yield (9.02 t/ha) was obtained from G_3L_1 (Green Calabrese and 0 kg B/ha).

Dry matter content of main curd

Genotypic differences were observed on dry matter content in main curd. Early Green contained minimum dry matter (8.71%) of main curd. The maximum dry matter (10.85%) of main curd was recorded in genotype Green Calabrese.

Boron application also showed significant influence on the dry matter content in main curd. The lowest dry matter content (9.51%) was recorded in the control treatment. The plants treated with L_3 (2 kg B/ha) treatment performed the highest significant dry matter content (10.19%) of main curd.

The interaction effect of genotypes and different levels of boron fertilizer on the dry matter content of main curd showed significant response. The dry matter content of main curd varied from 8.18% to 10.97% with the application of different levels of boron fertilizer on different genotypes of broccoli. The lowest dry matter content was recorded with treatment combination of G_4L_1 (Late Calabrese and 0 kg B/ha) on the other hand highest dry matter content (10.97%) of main curd was recorded with the treatment combination of G_3L_3 (Green Calabrese and 2 kg B/ha) which is statistically similar to G_3L_4 (Green Calabrese and 1 kg B/ha).

Dry matter content of secondary curd

Genotypic differences were also observed on dry matter content of secondary curd. Early Green contained minimum dry matter (9.493%) of secondary curd. The maximum dry matter (11.82%) of secondary curd was recorded in genotype Late Calabrese.

Boron application also showed significant influence on the dry matter content of secondary curd. The lowest dry matter content (10.34%) was recorded in the control treatment. The plants treated with L_3 (2 kg B/ha) treatment gave the highest significant dry matter (10.89 %) of secondary curd.

The interaction effect of genotypes and different levels of boron fertilizer on the dry matter content of secondary curd showed significant response. The dry matter content of secondary curd varied from 9.24% to 12.50% with the application of different levels of boron fertilizer on different genotypes of broccoli. The lowest dry matter content of secondary curd was recorded with treatment combination of G_2L_1 (Early Green and 0 kg B/ha) on the other hand highest dry matter content (12.50%) of secondary curd was recorded with the treatment combination of G_4L_3 (Late Calabrese and 2 kg B/ha) which is statistically similar to G_4L_1 (Late Calabrese and control treatment) and G_4L_4 (Late Calabrese and 3 kg B/ha).

Ascorbic acid

Genotypes of broccoli differed significantly regarding ascorbic acid content of curd. The genotype Late Calabrese contained maximum ascorbic acid (45.03 mg/100g) followed by Premium Crop (39.67 mg/100g). The minimum ascorbic acid (36.31 mg/100g) was found in Green Calabrese.

The ascorbic acid content of curd varied significantly with application of boron fertilizers. The maximum ascorbic acid (42.87 mg/100g) was measured with treatment of L_3 (2 kg B/ha) followed by treatment of L_2 (1 kg B/ha) and lowest ascorbic acid (36.87 mg/100g) was measured from the control treatment (L_1).

Significant variation was observed in yield per plant due to the combined influence of genotypes and boron. The highest ascorbic acid (52.09 mg/100g) was found from G_4L_3 (Late Calabrese and 2 kg B/ha) while it was minimum (26.49 mg/100g) in G_3L_4 (Green Calabrese and 3 kg B/ha).

β-carotene

There was a significant variation in the amount of β-carotene were found among the genotypes. The highest β-carotene content (1498 IU/100g) of curd was found in Green Calabrese and the minimum was in Premium Crop (519.7 IU/100g).

The β-carotene content of curd differed significantly due to application of boron fertilizers ranged from 629.4 to 1214 IU/100g. The maximum β-carotene (1214 IU/100g) content of curd was measured with treatment of L_4 (3kg B/ha) and lowest β-carotene content (629.4 IU/100g) was measured from the control treatment.

The combined effect of genotypes and application of boron fertilizer was found significant on β-carotene content of curd. The β-carotene content varied from 33.00 to 1976.00 IU/100g. The maximum β-carotene (1976 IU/100g) of curd was obtained from treatment combination G_3L_3 (Green Calabrese and 2kg B/ha) while it was minimum (33.00 IU/100g) in G_4L_3 (Late Calabrese and 2 kg B/ha).

Iron

There was a significant variation in the amount of iron content were found among the broccoli genotypes. The maximum iron content (155.4 ppm) was recorded from the Late Calabrese which was statistically different from others and minimum iron content (110.3 ppm) was recorded from the Premium Crop.

Differences in iron content in broccoli curd were found significant in relation with boron level. Iron content was maximum (138.9 ppm) in L_4 (3 kg B/ha) and minimum (110.3 ppm) in L_1 (0 kg B/ha).

Iron content varied due to the interaction effect of different levels of boron fertilizer and broccoli genotypes. The highest iron content (180.6 ppm) was recorded in both T_{14} (G_4L_2) and T_{15} (G_4L_3). The lowest iron content (93.78 ppm) was found in T_1 (G_1L_1).

Calcium

Significant variation in calcium content was observed due to influence of broccoli genotypes. Maximum amount (0.277%) of calcium was found in (Late Calabrese) and lowest (0.212%) calcium was found in Premium crop which was followed by Early Green and Green Calabrese.

In case of boron levels an insignificant result was found in calcium content.

The interaction effect of different levels of boron fertilizers and different broccoli genotypes on the calcium content was found significant. The highest calcium content (0.299%) was recorded in the treatment combination of T_{13} (G_4L_1) which was statistically identical to treatment T_{14} (G_4L_2). The lowest calcium content (0.184%) was found in T_4 (G_1L_4) which was statistically identical to treatment T_2 (G_1L_2), T_6 (G_2L_2), T_7 (G_2L_3) and T_8 (G_2L_4).

Phosphorus

In case of different broccoli genotypes an insignificant result was found in phosphorus content.

But there was a significant variation in phosphorus content due to different boron levels. It ranged from 0.29% to 0.34%. The maximum phosphorus content (0.34%) was recorded in L_4 (3 kg B/ha) followed by L_2 (0.33%), L_3 (0.32%). The lowest (0.29%) was in L_1 (0 kg B/ha).

Different levels of boron fertilizer and broccoli genotypes had significant effect on the phosphorus content in curd. The highest phosphorus content (0.391%) was recorded in T_4 (G_1L_4). The lowest phosphorus content (0.255%) was found in the treatment combination T_5 (G_2L_1) which was statistically identical to treatment T_7 (G_2L_3) and T_9 (G_3L_1).

Potassium

In case of different broccoli genotypes a significant result was found in potassium content. The maximum potassium content (1.57%) was recorded from the genotype Early Green which was followed by Green Calabrese (1.55%) and minimum potassium content (1.53%) was recorded from Late Calabrese.

Highest amount of potassium (1.57%) was recorded in L_3 (2 kg B/ha). Rakhsh and Golchin (2012) found maximum potassium concentration from 1.7 kg B/ha. Lowest Potassium content (1.53%) was in L_1 (0 kg B/ha) which was statistically similar to L_2 (1 kg B/ha). Higher than 2 kg B/ha decreasing trend of potassium was observed. Similar findings were also obtained by El-Kholi and Hamdy (1977); Da Silva *et al.* (1996) and Wojcik (2000) on several crops.

The interaction effect of different levels of boron and broccoli genotypes on the potassium content was significant. The highest potassium content (1.60%) was recorded in T_3 (G_1L_3) which was statistically similar to T_7 (G_2L_3) and T_8 (G_2L_4). The lowest potassium content (1.48%) was found in T_{13} (G_4L_1).

Hollow stem plant per plot

Genotypic differences were observed on number of hollow stem plant per plot. Premium Crop showed minimum number of hollow stem plant per plot (2.08). The maximum number (6.75) of hollow stem plant per plot was recorded in the genotype Green Calabrese which is statistically similar to Early Green (6.50).

The application of boron fertilizers markedly influenced the number of hollow stem plant per plot. The highest number (6.50) of hollow stem plant per plot was recorded in the control treatment; whereas, the least number of hollow stem plants (4.25) was recorded in L_3, when boron was applied @ 2 kg/ha. In general, it was found that number of hollow stem plants decreased with the increase of boron level up to 2 kg/ha and then increased again with further increase of boron level. This was agreement with the findings reported by Moniruzzaman *et al.* (2007), who found least hollow stem plants in broccoli at a boron level of 1.59 kg/ha. Batal *et al.* (1997) showed that they observed hollow stem plants in cauliflower to be decreased with the increase of boron levels up to 8.8 kg/ha. This result indicated that boron had a significant role on producing hollow stems in cruciferous crops, although, their requirement varied species to species.

The numbers of hollow stem plant per plot responded significantly to interaction of genotypes and different levels of boron fertilizer. The numbers of hollow stem plant per plot varied from 1.33 to 8.67 with the application of different levels of boron fertilizer on different genotypes of broccoli. The treatment combination of G_1L_3 (Premium Crop and 2 kg B/ha) and G_1L_4 (Premium Crop and 2 kg B/ha) produced least number (1.33) of hollow stem plant per plot while the highest number (8.67) of was recorded with treatment combination of G_2L_1 (Early Green and 0 kg B/ha) which is statistically similar to G_3L_1 (Green Calabrese and 0 kg B/ha) and G_3L_4 (Green Calabrese and 3 kg B/ha).

Table 2. Effect of genotype and boron levels on yield and quality of broccoli

Treatment	Curd yield per plant (g)	Total curd yield (t/ha)	Dry matter content (%)		Ascorbic acid (mg/100g)	β-carotene (IU/100g)	Iron (ppm)	Calcium (%)	Phosphorus (%)	Potassium (%)	Hollow stem plant/plot
			Main curd	Secondary curd							
Effect of genotypic differences											
G_1 = Premium Crop	500.0 b	20.0 b	10.63 b	9.988 c	39.67 b	519.7 d	110.3 d	0.212 b	0.34	1.54 ab	2.08 c
G_2 = Early Green	681.1 a	27.24 a	8.708 d	9.493 d	38.74 b	988.4 b	119.0 c	0.213 b	0.30	1.57 a	6.50 a
G_3 = Green Calabrese	247.7 d	9.91 d	10.85 a	10.89 b	36.31 c	1498 a	128.5 b	0.236 b	0.31	1.55 ab	6.75 a
G_4 = Late Calabrese	285.8 c	11.43 c	9.057 c	11.82 a	45.03 a	660.0 c	155.4 a	0.277 a	0.33	1.53 b	5.33 b
Effect of boron levels											
L_1 = 0 kg B/ha	363.9 c	14.56 c	9.508 c	10.34 b	36.87 b	629.4 d	110.3 c	0.253	0.29 b	1.53 b	6.50 a
L_2 = 1 kg B/ha	416.6 b	16.66 b	9.748 b	10.39 b	42.59 a	800.0 c	129.4 b	0.232	0.33 ab	1.53 b	5.00 b
L_3 = 2 kg B/ha	495.0 a	19.80 a	10.19 a	10.89 a	42.87 a	1022. b	134.6 ab	0.230	0.32 ab	1.57 a	4.25 c
L_4 = 3 kg B/ha	439.1 b	17.57 b	9.796 b	10.58 ab	37.42 b	1214 a	138.9 a	0.223	0.34 a	1.55 ab	4.92 bc
Interaction Effect (Genotype X Boron level)											
G_1L_1	435.0 f	17.40 f	10.49 e	9.713 fg	39.76 ef	314.3 l	93.78 i	0.24 ab	0.32 ab	1.53 abc	3.67 e
G_1L_2	524.1 de	20.96 de	10.71 cd	10.32 c-f	41.00 de	470.3 k	100.7 hi	0.19 b	0.31 ab	1.50 bc	2.00 f
G_1L_3	556.1 d	22.24 d	10.82 bc	10.00 d-g	37.70 fg	991.0 g	107.7 f-i	0.23 ab	0.32 ab	1.60 a	1.33 f
G_1L_4	484.9 ef	19.40 ef	10.51 e	9.917 efg	40.21 ef	303.4 lm	138.9 bcd	0.18 b	0.39 a	1.52 abc	1.33 f
G_2L_1	548.5 de	21.94 de	8.530 h	9.240 g	35.32 g	537.0 j	114.6 e-h	0.22 ab	0.26 b	1.53 abc	8.67 a
G_2L_2	631.6 c	25.26 c	8.633 h	9.470 fg	37.53 fg	1040 fg	121.6 d-g	0.21 b	0.34 ab	1.57 ab	6.00 bc
G_2L_3	804.8 a	32.19 a	8.513 h	9.907 efg	43.26 cd	1089 f	125.0 def	0.21 b	0.30 b	1.58 a	5.33 cd
G_2L_4	739.4 b	29.57 b	9.153 f	9.353 g	38.85 ef	1287 e	114.6 e-h	0.21 b	0.32 ab	1.59 a	6.00 bc
G_3L_1	225.4 h	9.02 h	10.83 bc	10.64 cde	35.32 g	799.3 i	128.5 cde	0.25 ab	0.28 b	1.56 abc	7.33 ab
G_3L_2	237.5 h	9.50 h	10.68 d	10.91 bcd	45.03 bc	1436 d	114.6 e-h	0.23 ab	0.32 ab	1.53 abc	6.33 bc
G_3L_3	285.4 gh	11.42 gh	10.97 a	11.16 bc	38.41 efg	1976 a	125.0 def	0.22 ab	0.32 ab	1.54 abc	6.00 bc
G_3L_4	242.6 h	9.70 h	10.92 ab	10.86 cd	26.49 h	1780 b	145.9 bc	0.24 ab	0.33 ab	1.56 abc	7.33 ab
G_4L_1	246.7 h	9.87 h	8.183 i	11.75 ab	37.08 fg	867.1 h	104.2 ghi	0.30 a	0.32 ab	1.48 c	6.33 bc
G_4L_2	273.1 gh	10.93 gh	8.973 g	10.85 cd	46.79 b	254.3 m	180.6 a	0.29 a	0.33 ab	1.53 abc	5.67 cd
G_4L_3	333.7 g	13.35 g	10.47 e	12.50 a	52.09 a	33.00 n	180.6 a	0.26 ab	0.34 ab	1.57 ab	4.33 de
G_4L_4	289.7 gh	11.59 gh	8.603 h	12.17 a	44.15 bc	1486 c	156.3 b	0.26 ab	0.33 ab	1.54 abc	5.00 cde
CV(%)	8.69	8.69	0.77%	4.68%	3.31%	2.48%	5.94	6.76	10.92	1.07	16.26

Means followed by different letter(s) in the same column differ significantly at 1% and 5% level by DMRT

CONCLUSION

According to nutritional quality (Ascorbic acid, β-carotene, Iron, and Calcium) Genotype Green Calabrese and Late Calabrese was better but gave the lower curd yield. On the other hand, Early Green contained highest potassium and produced maximum curd yield. Number of hollow stem plants per plot was noticed minimum in Premium Crop. It was found that 2.0 kg boron/ha is optimum regarding yield and nutritional quality. So genotype Early Green and 2.0 kg boron/ha will be more satisfactory for broccoli cultivation.

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