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PERFORMANCE OF BROCCOLI UNDER INORGANIC AND ORGANIC CULTURE SYSTEM

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Abstract

A study was conducted to evaluate the performance of broccoli genotypes under inorganic and organic culture system during October 2013 to March 2014. Three broccoli genotypes were used for the experiment. The study with inorganic was conducted at the Horticulture Research Field of Sylhet Agricultural University (SAU), Sylhet while the same experiment under organic culture system was conducted at the field of FIVDB (Friends in Village Development Bangladesh), Surmagate, Sylhet. Thus, the two systems were considered as two factors totalling 6 combinations with three replications. The data were statistically analyzed following Randomized Complete Block Design (RCBD). The whole experiment area (separately for inorganic and organic) was divided into three blocks, representing three replications. Each block consisted of three plots. Thus, total numbers of plots were nine for each culture system. Different morphological characteristics, yield and yield attributes were largely influenced by the genotypes. The highest individual curd weight (183.87 g plant^{-1}) and secondary curd weight (136.05 g plant^{-1}) were recorded from Premium while both of these were lowest for BR001. The mean weight of individual curd (138.01 g plant^{-1}) and secondary curd weight (144.81 g plant^{-1}) of broccoli in the inorganic culture system were significantly higher than under the organic production system. This difference could be attributed due to higher supply of nutrient in the inorganic culture system than organic culture system. Again the genotype Premium performed better in respect of individual curd weight (265.67 g plant^{-1}) and secondary curd weight (216.36 g plant^{-1}) in inorganic culture system while both were lowest (39.29 and 33.81 g plant^{-1}, respectively) for the genotype BR001 when grown in organic culture system. Therefore, the genotype Premium can be recommended as a genotype for cultivation under both organic and inorganic culture systems.

Keywords: Broccoli, organic, inorganic, growth and yield

Introduction

Broccoli (*Brassica oleracea* var. *italica* L.) is a cole crop belonging to the family cruciferae. It is originated from West Europe (Prasad and Kumar, 1999). It is more nutritious than other cole crops such as cabbage, cauliflower and kohlrabi (Thompson and Kelly, 1985) and excellent source of vitamin C, dietary fiber, potassium and vitamin A. Therefore, it can contribute significantly to improve human diet. However, it is now growing successfully in many areas of Bangladesh. Now-a-days organic agriculture is getting much popularity among the consumers since it safer for both human health and environment. Price of the commodity produce under organic system is much higher compared to that of commodity produce under inorganic system. Although the yield of some vegetable crops under organic system are lower than that of inorganic production system (Anon., 2011) but this low yield can be compensated by the higher price of the organic produce. Present market scenario revealed that the demand of organically produced vegetable in the urban areas is increasing day by day. Present demand of broccoli in Sylhet region is mostly met from the supply from the other districts of the country. Production of broccoli in Sylhet region can also be possible since this region has got huge fallow land during rabi season (BARC, 2011). In this regard selection of suitable variety for inorganic and organic production system, development of production technology, optimization of sowing dates etc are the key factors for successful broccoli production in Sylhet region. However research based information on the production of this crop under Sylhet conditions are almost absent in our hand. Therefore, the present investigation was designed to evaluate the broccoli genotypes under organic and inorganic culture system under Sylhet condition.

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Materials and Methods

The experiment was conducted at the Horticulture research field of Sylhet Agricultural University, Sylhet (inorganic) and at the organic field of FIVDB (Friends in Village Development Bangladesh) during October 2013 to March 2014. Two different locations were selected for this experiment because of unavailability of organic and inorganic field in the same location. Since the field of FIVDB was previously cultivated as organically (4-5 years), it was selected as organic and the inorganic field of SAU was selected as inorganic. Three broccoli genotypes (BR001, BR002 and Premium) collected from different sources were included in the study. Thus, two locations were considered as two systems and these two systems with 3 broccoli genotypes in combination, there were 6 combinations and the data were statistically analyzed following Randomized Complete Block Design (RCBD) with 3 replications. The seeds were sown in the seedbed on 25 October 2013 and 25 day-old seedlings were transplanted in the main field on 18 November 2013. Plants were spaced at 60 cm × 40 cm in 3.2m × 1m unit plot. In case of inorganic culture system the land was fertilized with cowdung, urea, TSP and MOP @ 15 t, 240 kg, 150kg and 200 kg ha^{-1}, respectively. The whole amount of cowdung, TSP and MOP were applied at final land preparation. About one third of the urea was applied during pit preparation. The remaining urea was applied in three equal installments at 15, 30 and 45 days after transplanting. In case of organic culture system the land was fertilized with cowdung @ 15t ha^{-1} and cow urine @ 400 L ha^{-1}. The whole amount of cowdung was applied during final land preparation. The cow urine was diluted with water in 1:10 ratio applied in three installments at 15, 30 and 45 days after transplanting at the base of the plant as side dressing (120 ml $plant^{-1}$. Weeding, irrigation and other intercultural operations were done as required. Five plants were randomly selected from each replication for data collection and replicated thrice. Data on different horticultural traits such as plant height, individual curd weight, curd length, curd diameter, curd yield etc. were recorded and statistically analyzed using MSTAT software for interpretation of result. Nutrition status of the soil of both inorganic and organic field is given in Table 1.

Table 1. Chemical characteristics of the soil (1-15 cm)

Soil properties	Analytical data	
	Inorganic culture system	Organic culture system
Soil pH	4.98	5.10
Organic matter(%)	1.79	1.69
Total N (%)	0.09	-
Exchangeable K (meq100 g $soil^{-1}$)	0.13	0.06
Available P (µg g^{-1} soil)	14.98	98.00
Available S (µg g^{-1} soil)	27.01	26.00

Results and Discussion

Effect of genotype on growth and yield of broccoli

Significant variations were observed among the broccoli genotypes in respect of curd yield and yield attributes (Table 2). Days to first curd initiation (50.17) and days to first harvest (63.50) of Premium were significantly lower than that of two other genotypes BR001 and BR002. Curd length(11.62 cm) and curd diameter (12.27 cm) of the genotype Premium were significantly higher than the other genotypes, resulting in the highest individual curd weight (183.87 g $plant^{-1}$) by the Premium compare to other two genotypes BR001 (54.6 g $plant^{-1}$) and BR002 (63.4 g $plant^{-1}$). Not only individual curd but also secondary curd weight (136.05 g $plant^{-1}$) harvested from Premium was significantly higher than that of other genotypes. These variations might be attributed due to genotypic variations. Similar variation in yield was also recorded when six advance lines of broccoli was tested under Gazipur condition (Anon., 2010). The biggest leaf length (38.60 cm) and breadth (20.14 cm) of the genotype Premium were also higher than the other genotypes but in case of BR001 and BR002, the height of plant and number of leaves at harvest were significantly higher compared to Premium. Therefore, the genotype Premium can be considered as a promising genotype for cultivation under Sylhet conditions.

Table 2. Mean effect of genotype on curd yield and yield attributes of Broccoli.

Genotype	Days to first curd initiation	Days to first harvest	Individual curd weight (g plant^{-1})	Curd length (cm)	Curd diameter (cm)	Height of plant at harvest (cm)	No. of leaf at harvest	Biggest leaf length at harvest (cm)	Biggest leaf breadth at harvest (cm)	Secondary curd weight (g plant^{-1})
BR001	57.33a	67.00a	54.60b	9.03b	7.04b	61.31a	14.23a	36.46b	18.78b	70.39b
BR002	57.17a	67.17a	63.40b	8.08b	6.88b	59.63ab	14.19a	37.21b	19.92b	73.37b
Premium	50.17b	63.50b	183.87a	11.62a	12.27a	57.42b	13.18b	38.60a	20.14a	136.05a
F-test	**	**	**	**	**	**	**	*	**	**
CV%	1.48	0.72	5.75	6.51	5.81	2.10	3.52	2.75	2.60	8.70

*ns = not significant; *,** = significant at 5% and 1% level respectively; Means followed by the same letters in a column do not differ significantly at 5% level of probability.*

Effect of culture system on growth and yield of broccoli

Effect of culture system on curd yield and yield attributes is presented in Table 3. Significant variations were observed between two culture systems in respect to curd yield and yield attributes except days to first harvest. In case of curd attributes, it was observed that the variety from inorganic culture system showed better performance over organic culture system in respect of individual curd weight (138.01 g plant^{-1}), curd length (10.56 cm), curd diameter (10.07 cm) and secondary curd weight (144.81g plant^{-1}). It was obviously due to the uninterrupted growth of the varieties which did not suffer from mineral nutrient deficiency. In case of plant height (61.96 cm), number of leaves plant^{-1} (14.23) and the biggest leaf length (40.4 cm) at harvest were significantly higher under inorganic production system in comparison to organic production system (56.94 cm, 11.96 and 34.41 cm, respectively). Results indicated that nearly 60% higher yield was obtained from inorganic culture system than that of organic system. However, in study with nine different vegetable crops under organic culture revealed appreciable yield can be made when the crops grown under different rate of organic manures (Anon., 2010).

Table 3. Mean effect of culture system on yield and yield attributes of Broccoli.

Culture system	Days to first curd initiation	Days to first harvest	Individual curd weight (g plant^{-1})	Curd length (cm)	Curd diameter (cm)	Height of plant at harvest (cm)	No. of leaf at harvest	Biggest leaf length at harvest (cm)	Biggest leaf breadth at harvest (cm)	Secondary curd weight (g plant^{-1})
S_1	54.44	65.67	138.01	10.56	10.07	61.96	15.77	40.40	19.61	144.81
S_2	55.33	66.11	63.23	8.59	7.40	56.94	11.96	34.41	18.95	41.73
F-test	*	NS	**	**	**	**	**	**	*	**
CV%	1.48	0.72	5.75	6.51	5.81	2.10	3.52	2.75	2.60	8.70

*S_1= Inorganic production system and S_2= Organic production system; ns = not significant; *,** = significant at 5% and 1% level respectively; Means followed by the same letters in a column do not differ significantly at 5% level of probability.*

Interaction effect between genotype and culture system

Interaction effect between genotype and culture system is presented in Table 4. Some of the parameters had significantly influenced by the interaction between genotype and culture system. The number of days to first curd

initiation was significantly affected by the interaction effect between genotype and culture system. The number of days (48.67) required to curd initiation for Premium when planted in inorganic condition was the lowest than that of other treatment combinations. In case of curd yield attributes like individual curd weight, curd diameter and secondary curd weight had significantly interacted due to interaction between genotype and culture system. The variety Premium produced the highest individual curd weight (265.67 g plant^{-1}) when planted in inorganic system compared to BR001 (39.29 g plant^{-1}) planted in organic culture system. The highest curd diameter (15.11 cm) and secondary curd weight (216.36 g plant^{-1}) were also recorded from Premium when planted in inorganic system. Significant interaction effect between genotype and culture system was observed for the biggest leaf length at harvest where BR002 (42.48 cm) produced the highest leaf length under inorganic culture system. Overall, the data presented in Table 4 showed that the genotype Premium tended to perform better than the other two genotypes.

Table 4. Interaction effect between genotype and culture system on Broccoli production.

Genotype × Culture System	Days to first curd initiation	Days to first harvest	Individual curd weight (g plant^{-1})	Curd length (cm)	Curd diameter (cm	Height of plant at harvest (cm)	No. of leaf at harvest	Biggest leaf length at harvest (cm)	Biggest leaf breadth at harvest (cm)	Secondary curd weight (g plant^{-1})
G_1S_1	57.33a	67.00	69.91c	10.20	7.70c	63.85	16.19	38.07bc	18.91	106.98b
G_1S_2	57.33a	67.00	39.29d	7.87	6.39c	58.76	12.27	34.86d	18.64	33.81d
G_2S_1	57.33a	67.00	78.46c	8.86	7.40c	62.76	16.31	42.48a	19.06	111.10b
G_2S_2	57.00a	67.33	48.33d	7.29	6.36c	56.50	12.07	31.93e	18.79	35.65cd
G_3S_1	48.67c	63.00	265.67a	12.64	15.11a	59.28	14.82	40.64ab	20.86	216.36a
G_3S_2	51.67b	64.00	102.07b	10.61	9.44b	55.57	11.53	36.57cd	19.42	55.73c
F-test	**	NS	**	NS	**	NS	NS	**	NS	**
CV%	1.48	0.72	5.75	6.51	5.81	2.10	3.52	2.75	2.60	8.70

*G_1=BR001, G_2=BR002 and G_3= Premium; S_1= Inorganic production system and S_2= Organic production system; ns = not significant; *,** = significant at 5% and 1% level respectively; Means followed by the same letters in a column do not differ significantly at 5% level of probability.*

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