



## Varietal screening of cabbage (*Brassica oleracea* var. *capitata* L.) in coastal area of Bangladesh

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### ABSTRACT

An experiment was carried out at Nabagram Farm house, Mannannagar, Noakhali, Bangladesh during the period from September 2018 to January 2019 to screen out of different cabbage varieties in coastal area of Bangladesh. The experiment was laid out Randomized Complete Block Design (RCBD) with three replications. Three varieties viz., V<sub>1</sub>= Atlas-70, V<sub>2</sub>=Summer warrior and one is red cabbage, V<sub>3</sub>= Ruby king were selected for screening out. Data were collected on seedlings height at transplanting stage, plant height, number of leaves/seedlings, number of leaves/plant, leaf length and diameter, days to head formation, days to head harvesting, head diameter, average weight of head, yield/plot and yield (ton/ha). Maximum parameters were significantly differed among the varieties except seedlings height, leaf length and leaf diameter. Highest seedlings height (13.15 cm) were found from V<sub>2</sub> (Summer warrior) whereas highest plant height (30.51 cm) notified from V<sub>3</sub> (Ruby king). Summer warrior (V<sub>2</sub>) gave maximum number of leaves/seedlings (4.8), leaves/plant (15.97), leaf diameter (19.67 cm), early head formation (46.10 days), head diameter (21.29 cm) average weight of head (1.14 kg), yield/plot (28.97 kg) and yield/ha (54.63 ton). On the other hand highest leaf length (21.41 cm) were recorded from V<sub>3</sub> (Ruby king) and minimum head harvesting days as well as duration were recorded from Atlas-70 (V<sub>1</sub>). Lowest seedlings height (10.98 cm) was found from V<sub>3</sub> (Ruby king) as well as lowest plant height (24.57 cm) obtained from Atlas-70 (V<sub>1</sub>). Lowest number of leaves/seedlings (2.67), number of loose leaves/plant (13.74), average head weight (0.64 kg), yield/plot (15.93 kg) and yield/ha (30.67 ton) as well as highest days required to head formation (56.78 days) and harvesting (141.38 days) were noted from V<sub>3</sub> (Ruby king) Considering the results it can be concluded that Summer warrior cabbage variety was found to be statistically superior to the rest of the varieties in terms of maximum growth and yield contributing characters.

### INTRODUCTION

Cabbage (*Brassica oleraceae* var. *Capitata* L.) belongs to the Brassicaceae family and is one of the most important of the green leafy vegetables grown under temperate to tropical climate conditions (Singh et al., 2010). The cabbage is a cool season crop which grows best under cool, moist weather conditions (Thompson, 2002). Cole crops are biennials, but are generally grown as annuals. It is one of the five best vegetables in the world (Rashid, 1999). It is an also important winter leafy vegetables grown in Bangladesh. It is

herbaceous plant distinguished by a short stem upon which is crown with a mass of leaves (head), usually green but in some varieties red or purplish (Sarker et al., 2002). The cabbage is a crop plant that is easily grown on a wide range of soil types and is adaptable to many different climatic conditions (Smith, 1995).

The average per hectare yield of cabbage in Bangladesh is very low as compared to that of other countries (Anon, 1988). The low yield potentiality of this crop is responsible for the lower yield attribute. This low yield may be

attributed to a great extent on the method of low production management practices adopted by the farmers. Farmers specially use of poor quality of seeds, maintenance of lower soil fertility, inadequate irrigation and time of sowing, proper spacing and diseases control is an important inputs for realizing higher cabbage growth, yield and quality contributing characters as well as nutrient content.

It is fairly easy to grow a successful crop of cabbages, as long as varieties suitable to the growing environment are selected and the proper cultural and pest management practices are followed. Cultivar selection is one of the critical decisions that the commercial grower must make each season. Variety selection is a dynamic process. Some varieties may remain favorable for many years while others might be supplanted by newer cultivars after a few seasons (Avoy and Ozores-Hampton, 2010). Besides cultivar it plays a great role for higher yield of the crop. Cabbage varieties have been bred to produce good yielding mature heads very early in the season (Cervenski et al., 2011). For farmers growing cabbage in both tropical and temperate climates, varieties with a short growing season, or less number of days to maturity, are more advantageous for meeting early market demands (Adeniji et al., 2010). Tanaka and Niikura (2006) have concluded the same, in their analysis of the development characteristics related to the earliness of head formation in cabbage. They reasoned that, in order to address market demands, head shape, size and density must correlate with earliness of head formation (Ricardson, 2012). There is a wide scope of increasing cabbage production with the introduction of new suitable cultivars from abroad. There are many cabbage varieties available in the market, which have been imported by different seed companies. Prior to recommendation for farmers, varietal evaluation needs to be determined. Otherwise farmers will be deprived of getting benefit from cabbage cultivation. The object of this study was to evaluate the yield and growth characteristics of three commercial cabbage varieties in order to determine the best suited to growing conditions within the Noakhali (slightly alkaline condition).

## **MATERIALS AND METHODS**

The present research was conducted at Nabagram Farm house, Mannannagar, Noakhali, Bangladesh during the period from September 2018 to January 2019 to screen out of different cabbage varieties in coastal area of Bangladesh. The experiment was laid out under the AEZ 18 i.e. Young Meghna Estuarine Floodplain. This region occupies young alluvial land adjoining the Meghna estuary. The soil of experimental site was slightly alkaline pH 8.3 and EC 1.32dS/m. The soil was tested by Soil Resource Development Institute, Noakhali (Table 1). The experiment is carried out Randomized Complete Block Design with three replications. Three varieties viz.,  $V_1$ = Atlas-70,  $V_2$ = Summer warrior and purple once  $V_3$ =Ruby king were used. Total number of plot was 9. Seed sowing was done on 22<sup>th</sup> September 2018 in the seedbed. Before seed sowing, seed treatment with Carbandazim 50 WP. The land was ploughed to fine tilth properly. Seedlings were uprooted carefully from the seed bed. The unit plot size was 5.28 meter square. The distance between the blocks was 1 m and that between plots was 50 cm. 30 days old healthy seedlings are transplanted on 30 October maintaining spacing 45 cm × 60 cm (plant to plant and row to row) at the rate of one seedlings per hill. 24 plants are planting in the each plot. Immediately after transplanting, light watering to the individual seedlings was provided to overcome water deficit. After establishment of the seedlings, watering was done as and when necessary.

Ten tones of cow dung, 250 kg of urea, 150 kg of TSP and 250 kg of MP per hectare were applied in the experimental plot. Entire amount of cow dung and TSP and half of MP was applied during final land preparation. The entire urea and rest of MP were applied in three equal installments at 15, 30 and 50 days after transplanting in the field by ring method. Weeding and mulching were done to keep the plots free from weeds, easy aeration of soil and to conserve soil moisture, which ultimately ensured better growth and development. Continuous observation was done to ensure better growth of plants for good yield. Insect attack was not severe. Diseases infestation was not too severe to cause damage to the crop. The data were collected from the 8 plants except yield/plot from each plot in different stages of crop growth for obtaining various growth and yield parameters were discussed. The recorded data of different

parameters in this study were analyzed statistically by using MSTAT-C and Microsoft office Excel 2013 to find out the significant or non-significant within treatments and means were compared at 5% probability level (Gomez and Gomez, 1984).

## RESULTS AND DISCUSSION

### Seedlings and plant height (cm)

Statistically non significant variation were obtained among the varieties in terms of seedlings height at transplanting stage whereas significant variation were noted from plant height at 50 days after transplanting (Table 2). Highest seedlings height (13.15 cm) was found from summer warrior (V<sub>2</sub>) followed by Atlas-70 (12.69 cm) and lowest

data (10.98 cm) recorded from Ruby king (V<sub>3</sub>). Highest plant height (30.51 cm) were noted from V<sub>3</sub> (Ruby king) followed by Summer warrior (25.91 cm) as well as lowest plant height obtained from Atlas-70 (24.57 cm. Similar results was found from Moniruzzaman, (2011). Plant height differed among the varieties of cabbage due to the variation of varieties. Sajib et al., 2015 reported that plant height can be increased by mixture application of 50% *Trichoderma* compost along with 50% recommended doses of fertilizers. Abey et al., (2002), that vegetable crop performance could be linked to both genetic and environmental influences amongst which is nutrient source, climatic condition, soil fertility status etc.

**Table 1:** Physical and chemical characteristics of soil of the experimental plots (Soil Resource and Development Institute, Noakhali)

Soil characteristics	Analytical results
Agro-ecological zone	Young Meghna Estuarine Floodplain (AEZ -18). This reason occupies young alluvial land in doing the Meghna Estuary.
Soil texture and particle	Sandy loam Sand:52%, Silt: 30%, Clay:18%
pH, EC	8.3, 1.32 dS/m
Nitrogen	0.04%
Phosphorous, Boron, Sulphur, Copper, Iron, Zinc	27.79 µg/g soil, 0.15 µg/g soil, 12.43 µg/g soil, 3.45 µg/g soil, 256.6 µg/g soil, 0.55 µg/g soil
Magnesium, potassium	3.87 meq/100g soil, 0.18 meq/100g soil,
Organic matter	0.64%

AEZ= Agro Ecological Zone, EC= Electrical Conductivity.

**Table 2:** Performance of varieties on growth contributing characters of cabbage

Variety	Seedlings height at transplanting stage (cm)	Plant height at 50 DAT(cm)	Number of leaves/ seedlings	Number of loose leaves/plant at 50 DAT	Leaf length (cm)	Leaf diameter (cm)
V1 (Atlas 70)	12.69	24.57b	2.97b	14.48b	19.77	18.39
V2(Summer warrior)	13.15	25.91b	4.8a	15.97a	20.97	19.67
V3 (Ruby king)	10.98	30.51a	2.67b	13.74b	21.41	18.74
CV (%)	12.26	5.95	12.12	3.70	3.58	5.52
Level of significance	NS	*	**	*	NS	NS

CV=coefficient of variation, NS= not significant, \*= significant at 5% level of probability, \*\*= significant at 1% level of probability. Means separation at 5% level of probability

**Table 3:** Performance of varieties on yield contributing characters of cabbage

Variety	Days to head formation (DAT)	Days to head harvesting (DAT)	Diameter of head (cm)	Average weight of head (kg)	Yield/plot of (kg)	Yield (ton/ha)	Duration (days)
V <sub>1</sub> (Atlas-70)	48.08b	83.05b	18.65ab	0.91ab	22.34b	42.39b	121.37b
V <sub>2</sub> (Summer warrior)	46.10b	86.67b	21.29a	1.14a	28.97a	54.63a	125.63b
V <sub>3</sub> (Ruby king)	56.78a	102.67a	14.26	0.64b	15.93c	30.67c	141.38a
CV (%)	7.26	4.25	11.84	14.26	9.03	6.85	2.32
Level of significance	*	*	*	*	**	**	**

CV=coefficient of variation, NS= not significant, \*= significant at 5% level of probability, \*\*= significant at 1% level of probability. Means separation at 5% level of probability

### Number of leaves/seedlings and number of loose leaves/plant

Significant variation were recorded among the varieties in terms of number of leaves/seedlings as well as number of leaves/plant at 50 days after transplanting (Table 2). Highest number of leaves/seedlings (4.8) was obtained from Summer warrior (V<sub>2</sub>) in compared with Atlas-70 (2.97) and lowest data (2.67) was showed from red cabbage variety (V<sub>3</sub>). In case of number of leaves/ plant at 50 days after transplanting highest data (15.97) were stated from Summer warrior (V<sub>2</sub>) and lowest data(13.74) were noted from Ruby king (V<sub>3</sub>)whereas Atlas-70 (V<sub>1</sub>) gave (14.48) leaves/plant at 50 days after transplanting. Similarly results were found from Sajib et al., (2015).Variation of leaves among the varieties might be due to varietal characteristics, which are controlled and expressed by certain genes. The number of leaves per plant differed significantly among the varieties as well as fertilizer rates (Hope et al., 2016). Different crop varieties possess varying genotypic and phenotypic traits and these probably led to the differences in leaf number since the varieties were grown under the same environmental conditions (Adeniji et al., 2011).

### Leaf length and diameter

Number of loose leaf length and diameter were not statistically significant differed among the varieties (Table 2). Highest leaf length (21.41 cm)

obtained from Ruby king (V<sub>3</sub>) in compared with Summer warrior (20.97 cm) whereas lowest data (19.77 cm) were taken from Atlas-70 (V<sub>1</sub>). Highest leaf diameter (19.67 cm) noted from Summer warrior (V<sub>2</sub>) in compare with Ruby king (18.74 cm) and lowest data (18.39 cm) obtained from Atlas-70 (V<sub>1</sub>). Teshome, (2019) stated that suggest large genetic difference among the variety and that environmental differences among varieties influence the expression of crop growth characters.

### Days to head formation

Significant variation were noted in terms of days to head formation among the cabbage varieties (Table 3). Highest days (56.78 days) required at head formation after transplanting of seedlings was found from Ruby king variety (V<sub>3</sub>) whereas lowest days (46.10 days) required for initiating curds from Summer warrior variety (V<sub>2</sub>) in compared with Atlas-70 (48.08 days). This agreements similar to Moniruzzaman, 2011; Sajib et al., 2015. Variation among the varieties in terms of head formation due to varietal characteristics. Islam, 2011 reported that combination of organic and inorganic fertilizers probably supplied adequate plant nutrients due to higher microbial activities in the soil resulting in the early head formation.

### Days to head harvesting

Highest days (102.67 days) required to head harvesting was found from red cabbage variety,

Ruby king ( $V_3$ ) in compare with Summer warrior ( $V_2$ ; 86.67 days) and lowest days (83.05 days) required to head harvesting noted from Atlas-70 ( $V_1$ ). Statistically 5% significant were recorded among the varieties in terms of days to head harvesting after transplanting of the seedlings. Isenberg et al., (1975) considered cabbage maturity was recorded by observing compactness and maximum size of the head. Subhan, (1988) reported that application of manure reduced the number of days for head maturity. This result indicates that days required to head harvesting are not the same among the varieties and this character might be genetically controlled.

### **Diameter of head**

Statistically significant variations were found among the varieties in terms of diameter of head (Table 3). Highest head diameter (21.29 cm) was noted from Summer warrior ( $V_2$ ) in compared with Atlas-70 (18.65 cm). Lowest head diameter was found from red cabbage Ruby king ( $V_3$ ). It could be concluded that red cabbage gave lowest head diameter in compared with green cabbage varieties. Similar findings were obtained from Ricardson, (2012). Cabbage variety showed difference in the diameter of cabbage head (Olaniyi and Ojetayo, 2011). Meena et al., (2010) yield and its component characters are polygenic in nature, hence influenced by the environmental factors. Sundstorm and Story (1984) also found that cultivar and growing season influenced head development as well as temperature had a significant effect on cabbage head shape as average head length/width ratios were greater in fall (August) vs. spring (January) planted crops.

### **Average weight of head**

Average weight of head was significantly influenced among the varieties (Table 3). Highest head weight were obtained from Summer warrior ( $V_2$ ) whereas lowest weight of head (0.64 kg) was found from Ruby king ( $V_3$ ) whereas Atlas-70 gave 0.91kg of head weight. Wide variation among the varieties in respect of average weight of head was due to the varietal characteristics. Varietal influence on average weight of head was also reported Elaverasan et al., (2013).

### **Yield/plot and Yield (ton/ha)**

Yield/plot and yield (ton/ha) were statistically differed among the varieties (Table 3). Highest yield per plot (28.97 kg) were noted from Summer warrior in compared with Atlas-70 (22.34 kg) and lowest data were recorded from Ruby king ( $V_3$ ; 15.94 kg). Highest yield (54.63 ton/ha) were secured from Summer warrior ( $V_2$ ) in compared with Atlas-70 (42.39 ton/ha) whereas lowest yield (30.67 ton/ha) were recorded from Ruby king ( $V_3$ ). It is observed that different yield potentialities were observed in different studies. This might be due to variation in varieties, seasons and experimental setup. Sajib et al.,(2015) reported that organic manures mainly vermicompost goes mineralization and return available nutrient for purpose plant growth and attributed to physiological changes within the plant and helps to increasing number healthy head formation of cabbage plants plot and finally the total yield per hectare increased. Greenland et al., (2000) stated that cabbage contains high head densities, small to medium-sized heads, and good appearance are referred to good quality for fresh market

### **Duration**

Significantly differed was obtained among the varieties in terms of duration (seed sowing in the seedbed to harvesting of the head) (Table 3). Highest days (141.38 days) required to seed sow to head harvesting noted from Ruby king ( $V_3$ ) and lowest days (121.37 days) obtained from Atlas-70 whereas summer warrior required (125.63 days) days to seed sow to head harvesting. Similarly Albert stated that cabbage comes to harvest in 80 to 180 days from seed and 60 to 105 days from transplanting depending upon the variety.

### **CONCLUSION**

Results stated that, performance of Summer warrior variety was better than other varieties in terms of seedlings height, number of leaves/seedlings, number of loose leaves/plant, leaf diameter, early head formation, diameter of head, head weight, yield/plot and yield/ha in compared with others varieties whereas Ruby king gave highest plant height at 50 days after transplanting and early harvesting as well as



lowest duration was found from Atlas-70. Considering the results it can be concluded that Summer warrior variety showed better results in compared to other varieties in coastal area where soil was slightly alkaline in terms of growth and yield contributing characters.

### Conflict of interest statement

The authors have done this research and wrote the article and there is no conflict of interest including any financial, personal or other relationships with other people or organizations.

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