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SEED PRODUCTION POTENTIALITY IN YIELD AND QUALITY OF EGGPLANT (*Solanum melongena* L.) GROWN UNDER SUMMER AND WINTER SEASONS

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Abstract

Two separate field experiments were conducted at the Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur during April to October 2012 (summer season) and October 2012 to March 2013 (winter season) to evaluate and compare the seasonal effect on fruit set, seed yield and seed quality of eggplant. Six eggplant varieties (BARI Begun-1, BARI Begun-5, BARI Begun-6, BARI Begun-8, BARI Begun-9 and Khotkhotia) were grown separately with proper isolation in both the seasons. Significant variation in fruit set per plant, seed yield per fruit and seed quality of eggplant were observed due to execution of growing seasons. The highest seed yield per fruit was obtained from BARI Begun-6 in both the seasons. Number of fruits per plant, seeds per fruit and 1000-seed weight showed the highest in winter season (October to March) as a result the highest seed yield was obtained from the same season. Winter season also showed the best seed quality attributes like germination (%), co-efficient of germination and vigour index irrespective of variety used. Based on seed yield and seed quality, winter season (October to March) found to be more favourable for quality seed production of eggplant in Bangladesh condition.

Keywords: *Solanum melongena* L, growing season, seed yield and quality.

Introduction

Eggplant (*Solanum melongena* L.) is one of the most popular, year round and economically important vegetable among small scale farmers and low income consumers of the entire universe (FAO, 2000). It is a perennial but grown commercially as an annual crop and extensively cultivated in all parts of Bangladesh (Chada, 1993) and covers about 15% of the total vegetable area of the country (Rahman, 2005).

Eggplant is originated from Indian subcontinent and is now generally grown as a vegetable throughout the tropical, sub-tropical and warm temperate areas of the world (Chen, 2001). Environmental factors are important for the production of eggplant seed. The crop requires a long and warm season during growth and fruit maturation. The same climatic factors that influence the cultivation of eggplant as a market vegetable also act as seed production. Eggplant is more susceptible to lower temperatures than tomato and pepper (Chen, 2001). Its production benefit

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from day time temperatures of 27^0C to 32^0C and warm night temperatures of 21^0C to 27^0C (Hartman *et al.,* 1988). The optimum growing temperature is 22-30^0C and growth ceases at temperatures below 15^0C. Pollen deformity increases at temperature of 15-16^0C (Malarkodi *et al.,* 2006). A daily mean temperature of 18 to 21^0C is most favourable for better growth and yield. Brinjal seeds germinate well at 25^0C (Bose *et al.*, 1993) whereas, Sanwal *et al*. (1997) reported that plant grown in the field with maximum temperatures in the range 36.7^{0}C-39.8^{0}C reduced fruit set and fruit yield. As a result increased anther tip burning, reduced pollen germination and pollen tube lengths which affect the total seed yield. Eggplant requires 3000-8000 foot candles of light, minimum 10^0C, maximum 35^0C and optimum of 20-25^0C temperature for crop growth (Hazra and Som, 1999). Therefore, considering above facts, the present investigation was undertaken to evaluate the seasonal effect on fruit set, seed yield and seed quality of eggplant.

Materials and Method

Two separate field experiments were conducted at the Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur during April to October 2012 (summer season) and October 2012 to March 2013 (winter season). The soil was silty clay loam with a pH 5.90 and belongs to the 'Shallow Red-Brown Trace' soil of Salna series under Madhupur tract (24.09^0 N latitude and 90.26^0 E longitude) at 8.5 m above the sea level. The total rainfall during the growing season was 1130.80 mm in summer season (April 2012 to October 2012) and 182.80 mm in winter season (October 2012 to March 2013). Monthly maximum and minimum air temperatures (^{0}C) and relative humidity (%) during the crop growth period are presented in Figure 1.

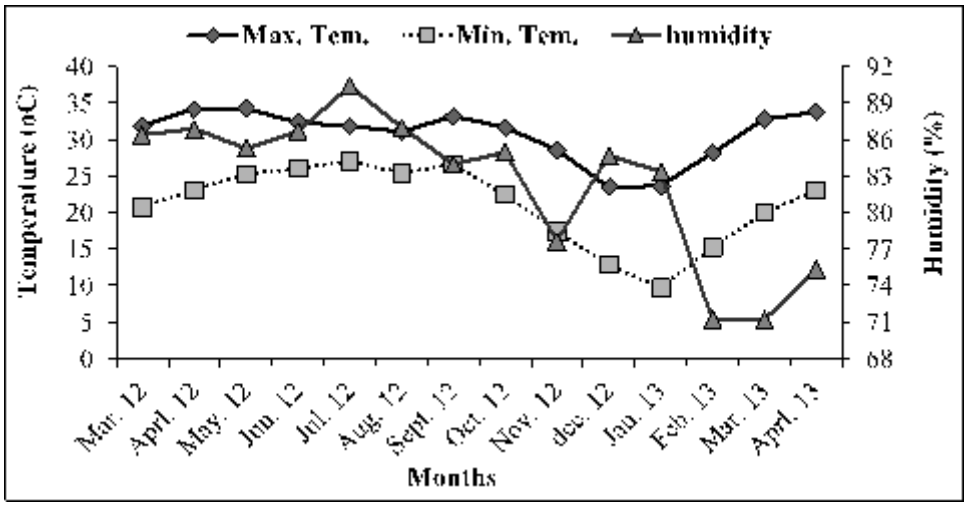

Figure 1. Average max. and min. temperature (^{0}C) and relative humidity (%) during experimental period.

Six varieties of eggplant viz. BARI Begun-1, BARI Begun-5, BARI Begun-6, BARI Begun-8, BARI Begun-9 and Khotkhotia were used in the study. These varieties were grown separately with proper isolation in both the seasons. Healthy, uniform and disease free eggplant seedlings of 35 days old were transplanted on 25 May 2012 (summer season) and on 2 November 2012 (winter season). The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 0.80 m x 10.5 m and fifteen seedlings were planted in a plot with a plant spacing of 70 cm apart in single row maintaining 50 cm drain between the plots. The crop was fertilized with 210-100-120-30 kg N P K S ha^{-1} in the form of urea, triple super phosphate (TSP), muriate of potash (MoP) and gypsum, respectively. In addition, cowdung @ 10 t ha^{-1} was also applied. Total amount of TSP, gypsum, well decomposed cowdung and half of MoP were applied at the time of final land preparation while, the entire urea and rest of MoP was applied at three equal installment. First one-third of urea and one-third of MoP was applied at 15 days after transplanting (DAT) and rest amount of urea and MP were applied in two equal split at 30 and 50 DAT followed by irrigation. Flood irrigation was provided into the drain between two plots immediately after transplanting. Irrigation was applied time to time considering the moisture content status of the field. Weeding was done timely to minimize crop weed competition and mulching was done followed by top-dressing and irrigation at 15 days interval. To protect white flies and brinjal shoot and fruit borer, Admire @ 1.0 ml per litre water and Mackjoint 5 SG was sprayed at 7 days interval alternatively. Furadon 5G @ 5 kg ha^{-1} was also applied in the pit before transplanting.

Full ripen fruits of eggplant (60 DAA) were harvested from the experimental field. Standard size fruits (not the biggest one or the smallest) were selected for seed extraction purpose. The selected fruit were kept in ambient condition for five days post-harvest ripening. These allow the seeds to mature fully and the fruits become soften. The seeds were separated by washing under running tap water and dried to about 8% moisture content. Data on fruit per plant, seed per fruit, 1000-seed weight, seed yield per fruit, germination percentage, co-efficient of germination, seedling length, dry weight of seedling, electrical conductivity test and seedling vigour index were determined.

In the laboratory, germination test were done. Germination percentage was calculated by the following formula:

$$\text{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds tested}} \times 100$$

For electrical conductivity test, 2.00 g seeds of each sample were taken in a conical flask containing 50 ml de-ionized water and incubated at 20 ± 1^0C for 20 hours. After 20 hours, water of the beaker containing seeds was decanted in order to separate the seeds. The electrical conductivity meter (Model: Lutron CD-4301)

was used. Three replications of measurements were made for each sample of seed and expressed on μS $cm^{-1}g^{-1}$.

Co-efficient of germination and vigour index were calculated using the following formula (Copeland, 1976).

$$\text{Co-efficient of germination} = \frac{100(A1 + A2 + \text{- - - - - - - - } + Ax)}{A1T1 + A2T2 + \text{- - - - - - - } + AxTx}$$

Where, A= number of seed germinated, T= time corresponding to A and X= Number of days to final count.

$$\text{Vigour index} = \frac{\text{Number of normal seedlings}}{\text{days of first count}} + \cdots\cdots + \frac{\text{Number of normal seedlings}}{\text{days of final count}}$$

The recorded data on different parameters were subjected to analysis of variance (ANOVA). Microsoft EXCEL and CROPSTAT software programs were used wherever appropriate and the means were compared by least significant difference (LSD) test (Gomez and Gomez, 1984).

Results and Discussion

Seasonal effects on quantity and quality of seed and seedling growth of eggplant have been presented and discussed character wise through different graphs.

Number of fruits per plant

Number of fruits per plant was influenced significantly by growing season within and among the variety. The maximum number of fruits per plant was obtained from BARI Begun-8 followed by BARI Begun-1 irrespective of season (Fig. 2). Variation of fruits per plant among the varieties was possibly due to difference in genetic makeup of the crops. Higher numbers of fruit per plant were observed from winter season in all variety. The result indicates that winter season is more favourable to fruit set of eggplant than summer. This might be due to clear sunshine, cool and gentle weather, high movement of pollinators. Bose *et al*. (1993) also reported that in the hills of Kulu valley in Himachal Pradesh, India the brinjal seeds should be sown in the nursery bed during the months of March and April for growing seed crop. But, Desai *et al*. (1997) reported from India that brinjal seeds may be sown in November for fruit yield and April – May for growing seed crop.

Number of seeds per fruit

Number of seeds per fruit differed significantly among the varieties (Fig. 2). The variety BARI Begun-6 produced the highest number of seeds per fruit, which was statistically superior to rest of the varieties. The lowest number of seeds per fruit was from BARI Begun-1. Number of seeds per fruit was unaffected by growing season in most of the variety except BARI Begun-6 (Fig. 2). There was

a significant different in number of seeds per fruit in BARI begun-6 by growing season. However, numerically higher number of seeds per fruit was found from winter season in all variety. This result indicated that eggplant planted in normal planting time (October to November) gave higher seed yield. Agrawal (2003) also suggested that the seed crops should invariably be sown at their normal planting time.

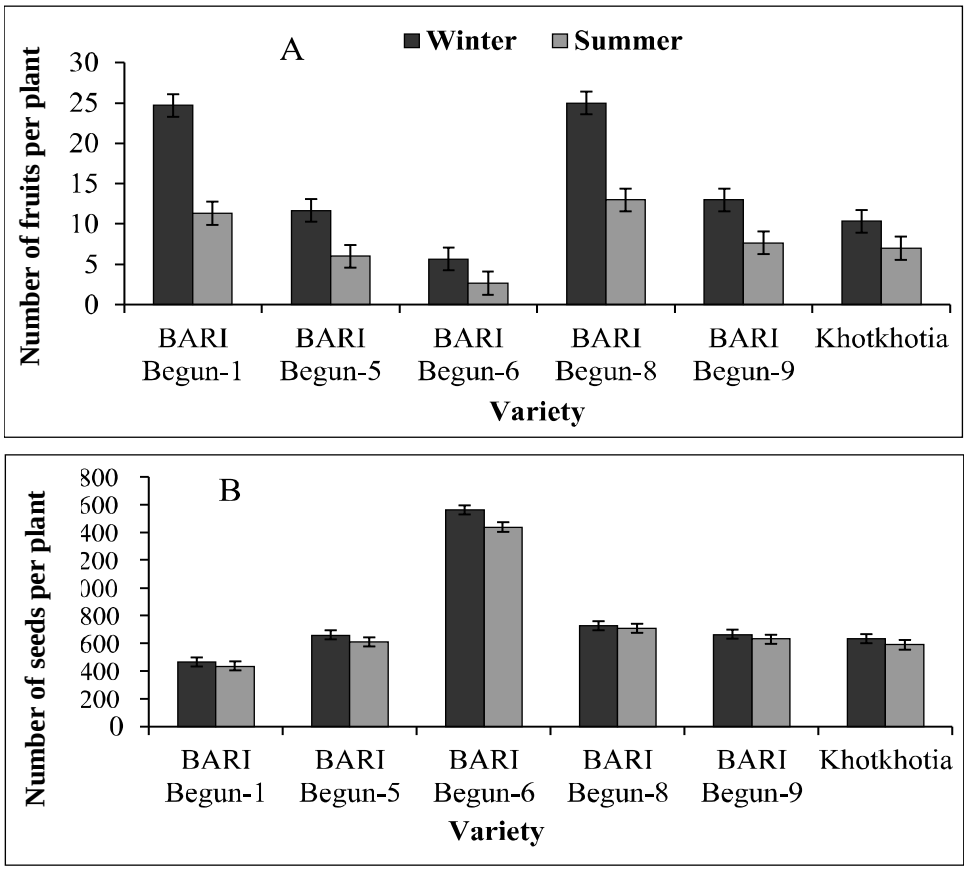

Figure 2. Number of fruits per plant (A) and number of seeds per fruit (B) as influenced by crop growing season.

1000-seed weight

Seed size is an important parameter of seed quality, because bigger seed encourages better seedling establishment in the field. Significant difference in 1000-seed weight was observed in six varieties of eggplant (Fig. 3). The maximum weight of 1000-seed was observed in the variety BARI Begun-5 followed by BARI Begun-6. However, 1000-seed weight was not influenced significantly by growing season of eggplant. All variety showed the same trend of seed weight when grown in different season. But the maximum 1000-seed

weight was found in the variety BARI Begun-5 followed by BARI Begun-6 irrespective of growing seasons. This result showed that higher seed weight was recorded from winter crops than summer.

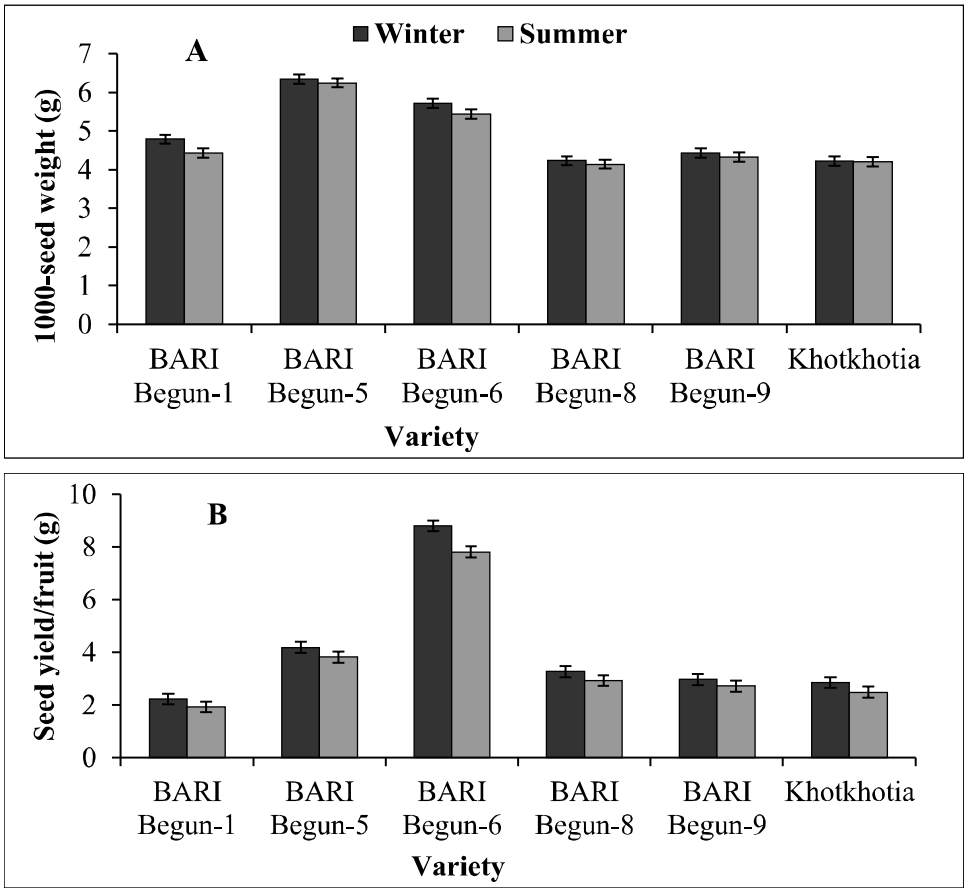

Figure 3. 1000-seed weight (A) and seed yield per fruit (B) of eggplant as influenced by crop growing season.

Seed yield per fruit

Seed yield per plant is of great importance as it constitute total seed yield when uniform stand establishment is achieved. In this study seed yield per fruit varies significantly among six varieties of eggplant (Fig. 3). The highest seed yield per fruit was found in the variety BARI Begun-6 and the lowest from BARI Begun-1. However, the amount of seed per fruit of eggplant remained unaffected by growing season. Only BARI Begun-6 produced significantly higher amount of seed per fruit when grown in winter season. The variety BARI Begun-1 performed lowest seed yield in both seasons. However, numerically higher amount of seed per fruit was recorded from winter season. As numbers of fruit

per plant, seeds per fruit and seed weight determine final seed yield of eggplant, higher number of fruit and higher seed weight increased seed yield of eggplant when grown in winter season.

Seed quality attributes

Seed quality was evaluated in terms of percent germination, electrical conductivity, vigour index and coefficient of germination which have been described in the following headings.

Seed leachate conductivity

Electrical conductivity test provides a quick decision about the seed quality. This test is related to deterioration sequence of seeds. Seed leachate conductivity was not influenced significantly by growing season within and among the variety (Fig. 4). The maximum electrical conductivity was found in the variety Khotkhotia in both the seasons. However, lower electrical conductivity was recorded in all variety from the seeds of winter crops. The result indicated that winter crops produced seeds with better cell membrane integrity and hence these seeds are vigourous.

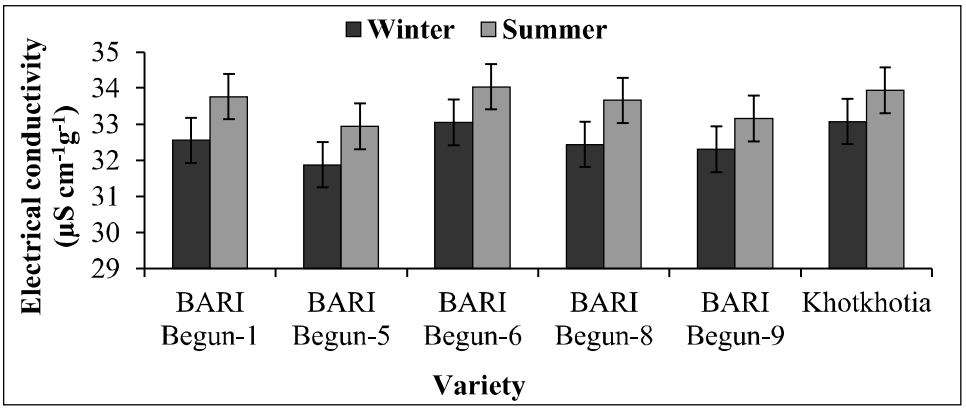

Figure 4. Electrical conductivity of eggplant seed as influenced by crop growing season.

Germination percentage

Germination percentage of seed is strongly related to individual seed weight as germination is energy requiring process. In this study, seed germination percentage was influenced significantly by growing season within the variety. The maximum germination percentage was found in the variety Khotkhotia which was statistically similar to the variety BARI Begun-6 and BARI Begun-8 irrespective of growing seasons. Always higher germination was found from the seeds of winter (October sowing) crops in all variety (Fig. 5). The seeds harvested from winter crop can accumulate higher dry matter due to favourable

environment for crop growth and this may enhance germination capacity of eggplant seed. The result indicates that winter crops may produce high quality seed than summer (April sowing) crops of eggplant.

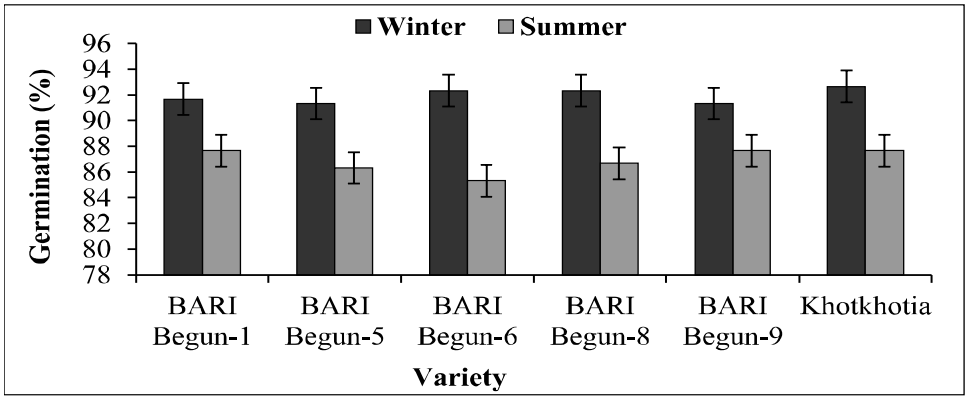

Figure 5. Germination percentage of eggplant seed as influenced by crop growing season.

Co-efficient of germination

Significant variation was observed in co-efficient germination among the six eggplant varieties. The variety Khotkhotia exhibited maximum value followed by BARI Begun-1, BARI Begun-5, BARI Begun-8 and BARI Begun-9. Co-efficient of germination of eggplant also varied greatly by crop growing season. Higher co-efficient of germination was found in the seeds harvested from winter crops of eggplant (Fig. 6). The result indicated that seeds of winter crops was more vigourous than seeds of summer crops as higher the co-efficient value indicates higher speed of germination and higher seed vigour. The seeds having lower vigour values can't germinate well under field condition.

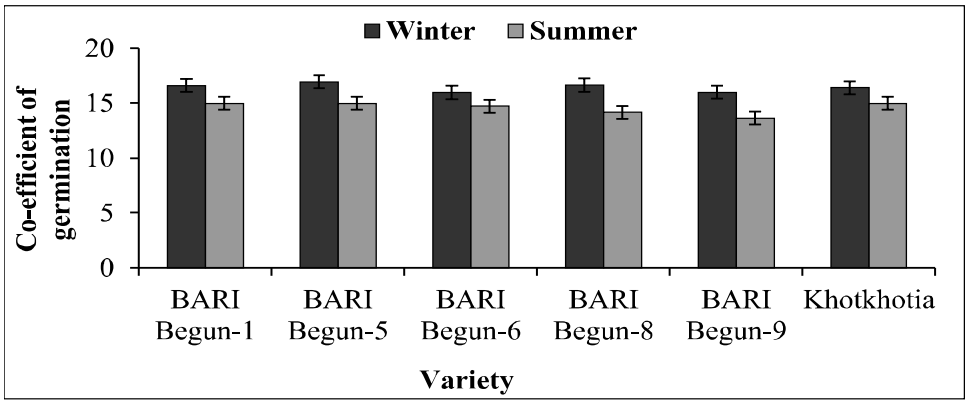

Figure 6. Co-efficient of germination of eggplant seed as influenced by crop growing season.

Vigour index

Significant variation was observed in vigour index among the six eggplant varieties (Fig.7). The variety BARI Begun-1 showed maximum vigour index followed by BARI Begun-5, BARI Begun-6, BARI Begun-8, BARI Begun-9 and Khotkhotia showed the least. Marked variation was also noticed in vigour index by growing season. Higher seedling vigour index was found in the seeds harvested from winter crops of eggplant (Fig. 7). The result indicated that seeds of winter crops were more vigourous than seeds of summer crops of eggplant.

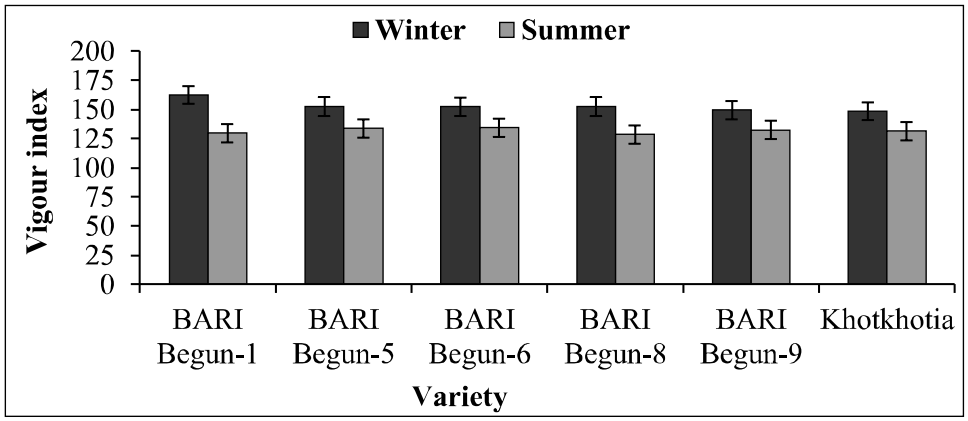

Figure 7. Vigour index of eggplant seedling as influenced by crop growing season.

Conclusion

The result of the study indicated that winter season (October to March) is more favourable to produce higher amount of better quality eggplant seed compared to summer season (April to October) in Bangladesh condition.

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