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EFFECT OF DIFFERENT LEVELS OF LIGHT INTENSITY ON MORPHO-PHYSIOLOGY AND YIELD OF BRINJAL (*Solanum melongena* L.)

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ABSTRACT

Low light stress is a limiting factor for crop production especially in agroforestry system. A pot experiment was conducted at Sher-e-Bangla Agricultural University, Dhaka- 1207, during the months of October 2019 to mid April 2020. Three brinjal varieties *viz.* V_1 (BARI Begun-1), V_2 (BARI Begun-4), V_3 (BARI Begun-9) were exposed to four light intensity (100, 75, 50 and 25% PAR which indicate control S_0, S_1, S_2 and S_3 respectively) to evaluate their performances. Light stress (mainly S_2 and S_3) substantially hampered the plant growth, development as well as yield. Low light stress primarily reduced the photosynthetic performance of plants which contribute in reduction of plant height, number of primary branches and leaves of all brinjal plants. Moreover low light intensity negatively affects the fresh and dry weight. It also decreased number of fruits, fruit length, fruit diameter and individual fruit weight in all variety. As a result plant wise brinjal production hampered seriously with low yield. In comparison with control (100% PAR) treatment, 75% PAR condition (S_1) decreased fruit weight by 16.8, 13.5 and 19.7% in V_1, V_2 and V_3 respectively. In 50% PAR condition, yield per plant were decreased by 36.4, 33.5 and 42.4% in V_1, V_2 and V_3 respectively. Lastly severe stress (S_3) decreased fruit weight per plant by 55.0, 61.5 and 67.0% in V_1, V_2 and V_3 respectively. From this result it is clear that under severe stress (S_3) V_1 perform well but V_2 perform well against S_1 and S_2 treatments.

Keywords: agroforestry, light stress, physiological response, *Solanum melongena* L.

INTRODUCTION

Currently low light irradiance is one of the most important environmental stresses throughout the world due to drastic climate change, which hamper crop growth and productivity (Hatamian *et al*., 2015). Now-a-days agroforestry is becoming familiar practice throughout Asia. In agroforestry system agricultural crops suffer from proper light. Generally, vegetables are grown in different agroforestry system including homestead and its surroundings beneath the fruit and timber trees. There are about 19.4 million homesteads in Bangladesh which comprises about 0.45 million hectares of land (BBS, 2009). Most of the vegetables produced and consumed in this country are coming from these homesteads. These areas are also increasing due to the construction of new houses for the ever increasing population. In this situation, vegetables cultivation needs to be increased in homestead areas. To serve this purpose, higher yielding and partial shade tolerant vegetables should be introduced. Vegetables are one of the essential food items of daily requirement. Improvement of daily dietary value depends largely on the vegetables consumption. The per capita consumption of vegetables in Bangladesh is only 53 g, which is far behind the daily requirement of 200 g/head (Rashid, 1999). This figure is lower than that of some other Asian countries like India (167 g), Pakistan (69 g), Sri Lanka (120 g), China (280 g) and Japan (248 g); the world average consumption being 250 g/head/day. So, vegetable production and consumption need to be increased in Bangladesh. Vegetables are not produced evenly throughout the year in Bangladesh. About 35% of the vegetables are produced in summer season and the rest in the winter season (Rashid, 1999). Due to climate change some area of the world facing low light intensity stress. On the other hand for increasing production, introduction of agroforestry system is very urgent. In agroforestry system crops struggle against low light stress. The development or identification of low light tolerant vegetables could be one of the achievable attempts to solve such problems. Besides, Bangladesh is an over populated and agro-based country. Demographic consumption and declining per capita land availability make it clear that Bangladesh will have to produce more farm

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products from less land in near future. It is now a prime need to improve system-based productivity and emphasis should be given on homestead vegetables production.

Brinjal (*Solanum melongena* L.) is a major vegetable crop of Bangladesh and grown all over the world in fields, greenhouses and net houses. It is popular for its taste and various types of uses. Furthermore, brinjal is a good source of vitamins and minerals. They're rich in of vitamin C, vitamin K, vitamin B6, thiamine, niacin, magnesium, manganese, phosphorus, copper, fiber, folic acid, potassium, and more. It is low in calories and sodium, and is a great source of dietary fiber.

In Bangladesh, among the summer vegetables, brinjal is a very popular vegetable. Lack of knowledge or research to find the low light resistant cultivars are the key problems for brinjal cultivation in agroforestry system. Low light stress hampers photosynthesis and occurs flower abortion and fruits drop frequently, which causes very poor yield of most of the vegetables grows in homestead (Haque *et al*., 2009; Dong *et al*., 2014). It can also alter photosynthetic activity of plant (Shao *et al*., 2014). For this reason, farmers are not interested in cultivating brinjal, especially in the homestead or along with other agroforestry practices. Recently, BARI has released different brinjal varieties which can grow both in summer and winter. Unfortunately, screening to find out reduced light and partial shade tolerance of brinjal has not been studied in different homestead conditions. So, it is important to observe the changes in terms of growth and yield in response to low light to evaluate the performances of different BARI brinjal varieties. Considering the above mentioned facts, three popular brinjal varieties are selected in this study for evaluating their performance under low light conditions targeting to evaluate the changes of growth, physiological and yield contributing attributes of three brinjal varieties under different low light stress and to select the most suitable and adaptive variety on yield basis under low light condition.

MATERIALS AND METHODS

The experiment was carried out in the Field laboratory of Agroforestry and Environmental Science Department, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh during the period from October 2019 to Mid April 2020 following completely randomized design (CRD). Three popular varieties of brinjal (BARI Begun-1, V_1; BARI Begun-4, V_2 and BARI Begun-9; V_3) were collected from BARI, Gazipur and conducted the experiment to evaluate the performance of them under 4 level of light intensity (S_0-Control, 100% Photosynthetically Active Radiation (PAR) / full sunlight, S_1-75% PAR, S_2-50% PAR, S_3-25% PAR. So, total number of treatment was 12 which were replicated thrice. Pots were filled with sterilized soil after mixing appropriate doses of fertilizers. 70% ethanol treated seeds were raised in the pots using regular nursery practices and then transferred to main pots for further growing. Though two seedlings initially transferred in each pot but finally one seedling had been kept for performing experiment. After transplantation nylon nets of different sieve size were hanged with the help of bamboo sticks at a height of 2.3 meters to create low light treatments. One, two and three net were used to create 75%, 50% and 25% PAR, respectively. The control treatment was consisted of full sunlight or 100% PAR. Recommended fertilizer dose and cultural practice were maintained throughout the experiment. Different growth (plant height, number of primary branches per plant, girth of main stem, number of leaves per plant, plant fresh weight, plant dry weight), physiological (SPAD value of leaf) and yield contributing parameters (first flowering days, number of fruits per plant, fruit length, fruit diameter, individual fruit weight, yield per plant) were recorded from each pot during the experimentation. All the values of measured parameters are the means of three replications. One way analysis of variance (ANOVA) was undertaken using XLSTAT v.2018 software (Addinsoft 2018) and the mean differences were compared by Fisher's LSD test. Differences at $P \leq 0.05$ were considered as significant.

RESULTS AND DISCUSSION

Growth and physiological parameters

Plant height

Stress potentially hampers plant growth in dose dependant manner which primarily observed from the height reduction. Similarly in current experiment plant height was decreased in all varieties due to low light stress (Table 1). In contrast to control (100% PAR), at 2 weeks after transplanting (WAT), 75% PAR condition (S_1) decreased plant height by 1.6, 4.9 and 4.3% in V_1 (BARI Begun-1), V_2 (BARI Begun-4) and V_3 (BARI Begun-9) respectively. In 50% PAR condition, plant height were decreased by 6.0, 11.2 and 11.4% in V_1, V_2 and V_3 respectively. Finally severe stress (25% PAR condition, S_3) reduced plant height by 9.8, 15.4 and 20.6% in V_1, V_2 and V_3 respectively. Similar findings were observed at 4 and 6 WAT.

Table 1. Effect of different light intensity on plant height of three brinjal varieties at 2, 4 and 6 weeks after transplanting (WAT).

Treatments	Plant height (cm) at 2 WAT	Plant height (cm) at 4 WAT	Plant height (cm) at 6 WAT
V_1S_0	18.85±0.69 de	33.57±1.56 c	47.70±0.56 c
V_1S_1	18.55±0.30 d-f	32.97±0.64 c	45.53±1.63 de
V_1S_2	17.72±0.38 fg	31.30±0.92 d	42.87±1.38 fg
V_1S_3	17.00±0.80 g	29.20±1.35 e	41.20±0.98 g
V_2S_0	20.27±0.78 bc	36.40±1.35 b	51.17±1.62 b
V_2S_1	19.28±0.33 cd	34.43±0.60 c	47.43±1.88 cd
V_2S_2	18.00±0.40 ef	31.20±1.05 d	44.13±0.67 ef
V_2S_3	17.57±0.77 fg	29.67±0.67 e	42.40±1.14 fg
V_3S_0	21.70±0.60 a	39.27±1.01 a	54.23±1.27 a
V_3S_1	20.77±0.55 ab	37.40±0.92 b	50.57±1.52 b
V_3S_2	19.22±0.78 d	33.43±0.60 c	46.50±1.84 cd
V_3S_3	18.00±0.22 ef	29.87±1.46 de	42.87±1.45 fg

V_1, V_2 and V_3 indicate BARI Begun-1, BARI Begun-4 and BARI Begun-9. Control (S_0), S_1, S_2 and S_3 indicate 100%, 75%, 50% and 25% Photosynthetically Active Radiation (PAR), respectively.Means (±SD) were calculated from three replications (n = 3) for each treatment. Means with different letters are significantly different at $P \leq 0.05$ applying Fisher's LSD test

So, it is clear that maximum height reduction was observed under S_3 treatment in all varieties and in variety wise performance, lowest reduction was recorded in V_1 and highest reduction was observed in V_3. The findings of my study is supported by Dong *et al*. (2014) who confirmed that low light intensity effects on the growth specially decreased the straw length of wheat of (*Triticum aestivum* L.) at different growth stages. Similar results were also obtained by Thakur *et al*. (2019) in damask rose (*Rosa damascena* Mill.). Haque *et al*. (2009) also observed low light intensity severely hampered plant height of bottle gourd.

Number of primary (1°) branches per plant

Number of primary (1°) branches differs variety to variety. In present study the number of 1° branches per plant was 9.7 in V_1, 10.0 in V_2 and 11.7 in V_3 (Table 2). These findings has close relation with the findings of Deotale *et al*. (1998) and Rai *et al*. (1998) who reported significant variation among the cultivars of brinjal for the number of branches per plant. Under S_1 light treatment, number of 1° branches decreased and it became 9.0, 9.7 and 11.0 in V_1, V_2 and V_3 respectively. The S_2 treatment further reduced 1° branches which are 8.7, 9.3 and 10.3 in V_1, V_2 and V_3 respectively. Lastly under S_3 light treatment, number of 1° branches decreased and it became 8.0, 8.0 and 9.7 in V_1, V_2 and V_3 respectively (Table 2). Thakur *et al*. (2019) demonstrated that 25 and 50% shading significantly decreased number of branches in damask rose (*Rosa damascena* Mill.).

Table 2. Effect of different light intensity on number of primary branches per plant, girth of main stem and number of leaves per plant at 6 weeks after transplanting; plant fresh and dry weight at harvest of different brinjal varieties.

Treatments	Number of primary branches plant^{-1}	Girth of main stem (cm)	Number of leaves plant^{-1}	Plant fresh weight (g)	Plant dry weight (g)
V_1S_0	9.67±0.58 c-e	2.47±0.17 a	33.33±1.53 c-e	118.7±1.53 c	18.67±1.15 a-e
V_1S_1	9.00±1.00 d-f	2.29±0.17 ab	29.00±1.73 fg	113.7±3.51 cd	19.67±4.04 ef
V_1S_2	8.67±0.58 ef	2.13±0.16 bc	27.67±2.08 gh	109.7±6.06 d-f	13.67±2.89 f
V_1S_3	8.00±1.00 f	2.04±0.14 c-e	25.33±1.53 h	103.7±2.52 f	25.00±3.46 f
V_2S_0	10.00±1.00 b-d	2.21±0.17 bc	37.00±1.00 ab	126.7±3.51 b	27.33±1.15b c
V_2S_1	9.67±0.58 c-e	2.17±0.13 bc	34.67±1.15 b-d	122.3±4.93 bc	23.67±2.31 b-d
V_2S_2	9.33±0.58 c-e	2.12±0.09 b-d	31.00±2.65 ef	118.3±3.21 cd	27.33±1.15 de
V_2S_3	8.00±1.00 f	1.91±0.12 de	28.33±1.53 g	109.0±5.00 ef	26.67±0.58 ef
V_3S_0	11.67±0.58 a	2.26±0.08 a-c	37.33±1.15 a	136.3±3.51 a	16.00±1.73 a
V_3S_1	11.00±1.00 ab	2.10±0.12 b-d	35.67±2.08 a-c	129.3±3.06 ab	34.00±3.46 ab
V_3S_2	10.33±1.15 bc	2.04±0.10 c-e	32.33±1.53 de	124.0±7.55 b	32.67±2.31 b
V_3S_3	9.67±0.58 c-e	1.83±0.09 e	28.00±1.73 g	119.0±1.73 b-d	17.67±0.58 b-d

V_1, V_2 and V_3 indicate BARI Begun-1, BARI Begun-4 and BARI Begun-9. Control (S_0), S_1, S_2 and S_3 indicate 100%, 75%, 50% and 25% Photosynthetically Active Radiation (PAR), respectively.Means (±SD) were calculated from three replications (n = 3) for each treatment. Means with different letters are significantly different at $P \leq 0.05$ applying Fisher's LSD test

Girth of main stem

Main stem girth is also an important parameter to judge growth pattern during stress condition. In this experiment light stress significantly decrease the girth of main stem. Compare with control (100% PAR) treatment, 75% PAR condition (S_1) decreased main stem girth by 7.3, 1.2 and 7.1% in V_1, V_2 and V_3 respectively (Table 2). In 50% PAR condition, stem girth were decreased by 13.8, 4.1 and 9.7% in V_1, V_2 and V_3 respectively. Lastly severe stress (S_3) declined main stem girth by 17.4, 13.6 and 19.0% in V_1, V_2 and V_3 respectively (Table 2). Haque *et al*. (2009) reported that in contrast to control (100%) different levels of low light (75, 50 and 25% PAR) slightly or significantly decreased the stem diameter of bottle gourd which confirmed reduced girth.

Number of leaves per plant

Leaves are the important organ for energy production of plant. Stress significantly hamper leaf number and their growth. In present experiment under S_1 light treatment, number of leaves decreased slightly but under S_2 and S_3 treatment leaves number decreased significantly in all varieties (Table 2). The number of leaves under control condition was 33.3, 37.0 and 37.3 in V_1, V_2 and V_3 respectively. The S_1 treatment decreased number of leaves which were 29.0, 34.7 and 35.7 in V_1, V_2 and V_3 respectively. Under S_2 light treatment, number of leaves decreased and it became 27.7, 31.0 and 32.3 in V_1, V_2 and V_3 respectively (Table 2). Lastly, in severe stress (S_3) number of leaves recorded as 25.3, 28.3, 28.0 in V_1, V_2 and V_3 respectively. Similar findings was also recorded by Kubota and Hamid (1992) who reported that under low light condition, plant expense more energy to structural development compare to the plant grown under full sunlight. Haque *et al*. (2009) and Pathiratna and Perera (2005) also found that numbers of leaves per plant decreased due to the reduced light levels in different plants.

Plant fresh weight

Plant fresh weight is a vital parameter that negatively influenced by any sort of stress. In current experiment, S_1 light treatment decreased plant fresh weight slightly but under S_2 and S_3 treatment fresh weight decreased significantly in all varieties. The amount of fresh weight under control condition was 118.7, 126.7 and 136.3 g in V_1, V_2 and V_3 respectively (Table 2). The S_1 treatment the amount of fresh weight decreased which were 29.0, 34.7 and 35.7 g in V_1, V_2 and V_3 respectively. Under S_2 light treatment, the amount of fresh weight further decreased and it became 27.7, 31.0, 32.3 g in V_1, V_2 and V_3 respectively. Lastly, in severe stress (S_3) amount of fresh weight were recorded as 25.3, 28.3, 28.0 g in V_1, V_2 and V_3 respectively (Table 2). Reduction of plant weight under stress condition indicate the damages towards growth of brinjal plant which corroborate others findings (Haque *et al*., 2009; Dong *et al*., 2014).

Plant dry weight

Like as plant fresh weight dry weight also followed similar pattern under light stress condition. The amount of fresh weight under control condition was 13.2, 14.1 and 15.2 g in V_1, V_2 and V_3 respectively (Table 2). The S_1 treatment the amount of fresh weight decreased which were 12.6, 13.6 and 14.4 g in V_1, V_2 and V_3 respectively. Under S_2 light treatment, the amount of fresh weight further decreased and it became 12.2, 13.2, 14.1 g in V_1, V_2 and V_3 respectively. Lastly, in severe stress (S_3) amount of fresh weight were recorded as 11.9, 12.4, 13.9 g in V_1, V_2 and V_3 respectively (Table 2). Thakur *et al*. (2019) also found similar growth reduction in damask rose (*Rosa damascena* Mill.). Dong *et al*. (2014) found similar result in whet plant.

SPAD value of leaf

SPAD value gives an idea about photosynthetic performance of a plant. In this experiment light stress significantly decrease SPAD value of leaves (Fig. 1). In comparison with control (100% PAR) treatment, 75% PAR condition (S_1) decreased SPAD value by 7.9, 5.3 and 1.7% in V_1, V_2 and V_3 respectively. In 50% PAR condition, stem girth were decreased by 15, 14 and 10% in V_1, V_2 and V_3 respectively. Lastly severe stress (S_3) declined SPAD value by 20.6, 24.6 and 18.0% in V_1, V_2 and V_3 respectively (Fig. 1). So, it clear that light stress in this study significantly decreased photosynthetic activity of brinjal as SPAD value indicate the concentration of chlorophyll content of leaves. Gregoriou *et al*. (2017) reduced irradiance on olive (*Olea europaea* L.) on notably decreased SPAD value. Rezai *et al*. (2018) found similar result in sage (*Salvia officinalis* L.) under low light condition.

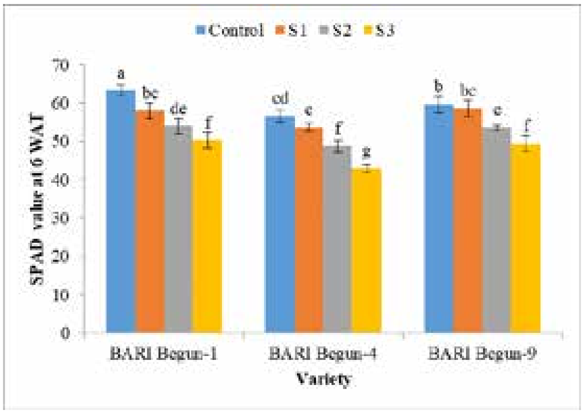

Fig. 1. Effect of different light intensity on leaf SPAD value at 6 weeks after transplanting of different brinjal varieties.

Control, S_1, S_2 and S_3 indicate 100%, 75%, 50% and 25% Photosynthetically Active Radiation (PAR), respectively. Means (±SD) were calculated from three replications (n = 3) for each treatment. Bars with different letters are significantly different at P≤0.05 applying Fisher's LSD test

Yield and yield contributing components

First flowering days

First flowering days after transplanting indicate the level of stress because in stress condition every organism wants to complete their life cycle in shortest possible time. In my study S_1 and S_2 treatment decreased first flowering days slightly but under severe stress (S_3 treatment) condition first flowering days decreased significantly (Table 3). The time of first flowering for control treatment was 30.3, 31.0 and 33.7 days in V_1, V_2 and V_3 respectively but for S_3 treatment they were 26.3, 27.3 and 29.3 days in V_1, V_2 and V_3 respectively (Table 3).

Number of fruits per plant

Fruit number is hampered by any kind of stress. The reduction of fruit number increases with the increase of stress intensity and duration. In comparison with control (100% PAR) treatment, 75% PAR condition (S_1) decreased number of fruit per plant by 7.5, 5.3 and 8.1% in V_1, V_2 and V_3 respectively (Table 3). In 50% PAR condition, stem girth were decreased by 16.9, 14.2 and 18.8% in V_1, V_2 and V_3 respectively. Lastly severe stress (S_3) declined SPAD value by 33.1, 35.3 and 39.4% in V_1, V_2 and V_3 respectively (Table 3). Reduction of fruit number decreases the total production of plant. Kumar *et al*. (2013) and Gregoriou *et al*. (2017) also carried out experiments under shade condition with clary sage and olive. Both research findings support my experimental findings.

Table 3. Effect of different light intensity on first flowering days, number of fruits per plant, fruit length, fruit diameter and individual fruit weight of different brinjal varieties.

Treatments	First flowering days	Number of fruits plant^{-1}	Fruit length (cm)	Fruit diameter (cm)	Individual fruit weight (g)
V_1S_0	30.33±2.52 ab	21.33±1.53 a	18.67±1.15 a	2.23±0.12 e	102.67±2.52 c
V_1S_1	29.67±3.79 ab	19.67±1.15 ab	18.33±2.08 a-c	2.20±0.00 ef	93.33±3.51 de
V_1S_2	29.00±1.00 a-c	17.67±1.15 bc	16.67±0.58 bc	1.93±0.06 f-h	79.67±4.51 f
V_1S_3	26.33±2.08 bc	16.00± 1.00 cd	13.33±1.53 e	1.80±0.10 h	62.00±2.00 h
V_2S_0	31.00±4.58 ab	19.00±1.00 b	19.67±1.53 a	2.17±0.06 e-g	106.33±5.51 bc
V_2S_1	29.33±2.89 ab	18.00±2.00 bc	18.67±1.58 ab	2.10±0.10 e-g	96.33±5.69 d
V_2S_2	29.67±3.06 ab	16.33±1.53 cd	16.33±0.58 cd	1.90±0.10 gh	80.33±2.52 f
V_2S_3	27.33±2.52 bc	12.33±1.53 f	14.33±1.15 de	1.70±0.10 h	63.33±1.53 gh
V_3S_0	33.67± 3.79 a	16.00±2.00 cd	8.67±0.58 f	5.80±0.10 a	125.00±5.57 a
V_3S_1	33.67±4.04 a	14.67±2.08 de	8.33±0.58 f	5.30± 0.36 a	111.00±2.65 b
V_3S_2	32.00±2.00 ab	13.00±1.00 ef	6.67±0.58 fg	4.47±0.32 c	89.00±2.65 e
V_3S_3	29.33± 4.16 a-c	9.67±0.58 g	5.67±0.58 g	3.87±0.15 d	68.33±1.53 g

V_1, V_2 and V_3 indicate BARI Begun-1, BARI Begun-4 and BARI Begun-9. Control (S_0), S_1, S_2 and S_3 indicate 100%, 75%, 50% and 25% Photosynthetically Active Radiation (PAR), respectively. Means (±SD) were calculated from three replications (n = 3) for each treatment. Means with different letters are significantly different at $P \leq 0.05$ applying Fisher's LSD test

Fruit length

Fruit length of brinjal can directly affect on total production. In present study fruit length drastically decreased in S_3 treatment (under severe stress) in comparison with control. The fruit lengths for control treatment were 18.67, 19.67 and 8.67 cm in V_1, V_2 and V_3 respectively but for S_3 treatment they were 13.33, 14.33 and 5.67 cm in V_1, V_2 and V_3 respectively (Table 3). On the other hand fruit length for S_1 treatment were 18.33, 18.67 and 8.33 cm and for S_2 treatment they were 16.67, 16.33 and 6.67 cm. But, Haque *et al*. (2009) conducted an experiment with bottle gourd and found reverse result. They confirmed that under 50% and 75% PAR condition fruit length increased and no significant variation was observed under 25% PAR, compared to control treatment.

Fruit diameter

Like fruit length fruit diameter of brinjal can directly affect on total production. In this experiment S_1 treatment slightly decreased fruit diameter in V_1 and V_2 but significantly in V_3 treatment. But under S_2 and S_3 treatment all varieties showed notable decrease of fruit length. The fruit diameter of brijal under control condition was 2.23, 2.17 and 5.80 cm in V_1, V_2 and V_3 respectively (Table 3). The S_1 treatment the fruit diameter decreased which were 2.20, 2.10 and 5.30 cm in V_1, V_2 and V_3 respectively. Under S_2 light treatment, the amount of fresh weight further decreased and it became 1.93, 1.90 and 4.47 cm in V_1, V_2 and V_3 respectively. Lastly, in severe stress (S_3) fruit diameter were recorded as 1.80, 1.70 and 3.87 in V_1, V_2 and V_3 respectively (Table 3). Hoque *et al*. (2009) got reverse result under similar stress treatment.

Individual fruit weight

Individual fruit weight depends on fruit length and diameter. As both fruit length and diameter decreased significantly under light stress (in most of the cases), so fruit weight also decreased substantially. In comparison with control (100% PAR) treatment, 75% PAR condition (S_1) decreased fruit weight by 9.1, 9.4 and 11.2% in V_1, V_2 and V_3 respectively (Table 3). In 50% PAR condition, stem girth were decreased by 22.4, 24.5 and 28.8% in V_1, V_2 and V_3 respectively. Lastly severe stress (S_3) declined SPAD value by 39.6, 40.4 and 45.3% in V_1, V_2 and V_3 respectively (Table 3). Reductions of fruit weight ultimately decrease production which corroborates other findings (Kumar *et al.*, 2013 and Gregoriou *et al*., 2017).

Yield per plant

Almost all yield attributes of brinjal were significantly affected by shade level. As a result yield per plant also decreased notably under stress condition. The fruit weight per plant of brijal under control condition were 2.20, 2.00 and 2.03 kg in V_1, V_2 and V_3 respectively (Fig. 2). The S_1 treatment the fruit diameter decreased which were 1.83, 1.73 and 1.63 kg in V_1, V_2 and V_3 respectively. Under S_2 light treatment, the amount of fresh weight further decreased and it became 1.40, 1.33 and 1.17 kg in V_1, V_2 and V_3 respectively. Lastly, in severe stress (S_3) fruit diameter were recorded as 0.99, 0.77 and 0.67 kg in V_1, V_2 and V_3 respectively (Fig. 2). In comparison with control (100% PAR) treatment, 75% PAR condition (S_1) decreased fruit weight by 16.8, 13.5 and 19.7% in V_1, V_2 and V_3 respectively. In 50% PAR condition, yield per plant were decreased by 36.4, 33.5 and 42.4% in V_1, V_2 and V_3 respectively (Fig. 2). Lastly severe stress (S_3) declined fruit weight per plant by 55.0, 61.5 and 67.0% in V_1, V_2 and V_3 respectively. Here lower yield reduction was observed in V_1 under severe stress (S_3) and V_2 under S_1 and S_2 treatment condition. Haque *et al.* (2009), Dong *et al*. (2014) and Thakur *et al.* (2019) confirmed similar yield reduction in different plants.

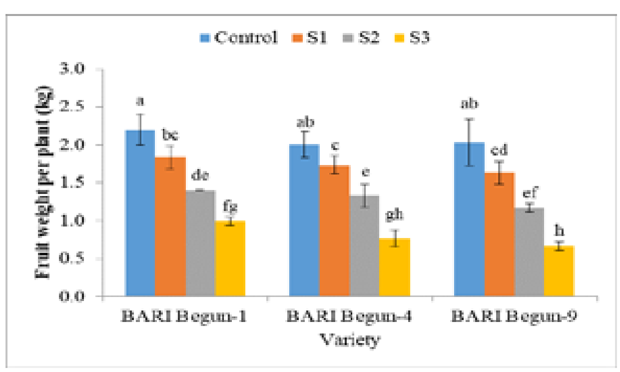

Fig. 2. Effect of different light intensity on fruit weight per plant of different brinjal varieties.

Control, S_1, S_2 and S_3 indicate 100%, 75%, 50% and 25% Photosynthetically Active Radiation (PAR), respectively. Bars (±SD) were calculated from three replications (n = 3) for each treatment. Bars with different letters are significantly different at P≤0.05 applying Fisher's LSD test

CONCLUSION

Taking consideration of the yield performance, BARI Begun-4 variety was the best brinjal variety under 75% and 50% PAR level while BARI Begun-1 was the best variety under severe low light condition (25% PAR). But before recommendation the variety for agroforestry system this research work should be evaluated in field condition under different agro-climatic zone in Bangladesh. Also more new released variety should be included such type of varietal screening research.

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