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Short Communication

Evaluation of Growth and Yield of Four Strawberry (*Fragaria ananassa*) Genotypes

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Abstract

A pot experiment was conducted to evaluate the growth and yield performance of four strawberry germplasms at the Horticulture Farm of Sher-e-Bangla Agricultural University, Dhaka during October 2010 to April 2011. The experimental materials were four strawberry germplasms: V_1 (SAU Line-01), V_2 (SAU Line-02), V_3 (SAU Line-03) and V_4 (SAU Line-04). The experiment was laid out in a Completely Randomized Design (CRD) with five replications. Among the germplasms the maximum number of flowers (32.5/plant), the maximum number of fruits (28.8/plant), the highest average fruit weight (12.3 g) and the highest total fruit yield (361 g/plant) were found in V_1. Considering the overall results of the study, it may be concluded that V_1 (SAU Line-01) is a promising strawberry germplasm for cultivation in Bangladesh.

Key words: Quality yield, strawberry, germplasm

Strawberry (*Fragaria* x *ananassa* Dutch.), a nutritious and delicious exotic fruit has recently been adapted in Bangladesh and it has already drawn attention of the Government, farmers as well as some elite people of Bangladesh. Strawberry plants are propagated through runners. The plant comprises a shorten stem or crown from which arises leaves, runners, roots, auxiliary crowns and inflorescences (Darnell *et al*., 2003). Numbers of growers are becoming interested regarding strawberry cultivation in spite of facing several problems such as, less sweetness, short shelf-life, color degradation and damage during transportation. Furthermore, the degeneration in strawberry cultivars, that is, after successful production of the first year, yield potential and quality decrease or degenerate in the consecutive years. Today it is a great constrain of commercial strawberry production in Bangladesh. Though in Bangladesh, some varietal trials of strawberry (Hossan *et al*., 2013) have been conducted but the number of sustainable strawberry cultivars is absent for the country's climate. So, perception and application of sustainable technology is required to find out suitable cultivar(s) and proper guideline for quality commercial strawberry production in Bangladesh. So, the present study was conducted to find out the suitable strawberry cultivar(s) for Bangladesh condition.

Site: The pot experiment was conducted at the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka-1207 during October 2010 to April 2011.

Plant materials: Plants of four strawberry germplasms: SAU Line-01, SAU Line-02, SAU

Line-03 and SAU Line-04 were collected from the project of "Varietals Trial and Sustainable Technology Development for the Commercial Production of Strawberry in Bangladesh" financed by Sher-e-Bangla Agricultural University Research System (SAURES). All the four strawberry lines of that project were Japanese. Runners were produced profusely from there. Among those, healthy and vigorous plants were selected and used for the experiment.

Experimental Design: The experimental design was the Completely Randomized Design (CRD) with five replications.

Pot preparation and transplantation: Size of each pot was 35 cm in diameter and 30 cm in height. Soil of each pot was fertilized with NPK at the proportion of 1:1:1 (100 g/pot) and single plantlet was planted in each pot on 19 October, 2010.

Data collection and analysis: Data on growth, yield and fruit characteristics were collected from each plant. Leaf and petal area were measured using a portable leaf area meter (CL-202, America) by destructive method. Collected data were statistically analyzed using the MSTAT-C program. Mean was calculated and analysis of variance for each of the traits was performed by F–test. Difference between treatments was evaluated by Duncan's Multiple Range test (Gomez and Gomez, 1984).

Plant height: Significant variation was found among V_1, V_2, V_3 and V_4 germplasm at 30, 40, 50, 60 and 70 DAT in terms of plant height. The tallest plant (22.8 cm) was obtained from V_1 and shortest plant (19.8 cm) was from V_2 germplasm at the matured stage (Table 1). These results indicate that plant heights of different strawberry germplasm are not same and the trait may be genetically controlled.

Leaf Characteristics

Leaf number: Strawberry germplasms varied significantly in terms of leaf number at 30, 40, 50, 60 and 70 DAT. The highest number of leaf (15.8) was obtained from V_1 and the lowest (14.1) was from V_2 germplasm at mature stage (Table 1).

Leaf area: Leaf area of strawberry germplasms showed significant variation at 30, 40, 50, 60 and 70 DAT (Fig. 3). The highest leaf area (45.0 cm^2) was obtained from V_1 but the lowest (36.7 cm^2) was from V_2 germplasm at the mature stage (Table 1).

Number of runners: The number of runner produced per plant varied significantly among the germplasms. The highest number of runners (3.5) of was obtained from V_4 and the lowest (2.3) was in V_1 germplasm (Table 1). Turkben *et al*. (1997) reported that, lower runner production increased fruit production and quality in strawberry.

Floral Characteristics

Days to flower bud initiation: Days to flower bud initiation varied significantly among the germplasm. Flower bud initiation in V_4 required the longest period (82.4 days) while the shortest period (60.2 days) was in V_1 germplasm (Table 1). So, V_1 (SAU Line-01) was the earliest germplasm whereas, V_4 (SAU Line-04) germplasm was the late one.

Days to anthesis: The days to anthesis varied significantly among the germplasm. The shortest days (7.5 days) required for anthesis was in V_1 and the maximum (9.2 days) was in V_2 (Table 1).

Number of flowers per plant: The number of flowers per plant significantly varied among the germplasm. The number was highest (32.5/plant) in V_1 whereas the lowest (23.3/plant) was in V_2 (Table 2). Thus V_1 (SAU Line-01) had the higher potentiality to bear maximum number of flowers/plant.

Petal area: Significant variation of petal area was recorded among the different germplasm. The maximum flower area (48.2 cm^2) was found

in V_3 while the minimum (21.6 cm^2) was in V_2 (Table 2). These indicated that the petal areas may be genetically controlled.

Fruit Characteristics

Days to fruit set: The days to fruit set from anthesis varied significantly among the germplasm. The maximum days (7.0 days) were required in V_1 whereas the minimum (5.0 days) was in V_2 (Table 1). Similar opinion was also put forwarded by Morgan (2006).

Days to maturity: The days to maturity varied significantly. V_3 required 22.0 days whereas V_1 required 31.0 days (Table 1). Strawberry fruit development and ripening requires 30-40 days after flowering and depending on the cultivar and environmental conditions (Perkins-Veazie, 1995 and Morgan, 2006) also provided similar report.

Number of fruit per plant: The average number of fruits per plant varied significantly among the germplasm. The maximum number (28.8/plant) was recorded from V_1 while the minimum (19.1/plant) was in V_2 (Table 2). These results clearly showed that V_1 (SAU Line-01) had potentiality in bearing fruits.

***Fruit length*:** Among the germplasm, the average fruit length varied notably. The results indicated that V_1 produced the longest (33.4 mm) fruit whereas the shortest (26.8 mm) one was in V_2 (Table 2).

Fruit diameter: The average fruit diameter varied significantly among the germplasm. The maximum diameter (24.2 mm) was recorded in V_1, which was statistically similar to V_4 (23.7 mm) and the lowest (21.2 mm) was in V_2 that was statistically identical to V_3 (21.6 mm) (Table 2).

Fruit weight*:* The fruit weight per plant was influenced significantly by the germplasms. V_1 gave the maximum fruit weight (12.3 g/plant) but the minimum (8.9 g/plant) was in V_2 (Table 2).

Total fruit yield per plant: The total fruit yield per plant varied significantly among the germplasm. The total fruit yield was maximum (361 g/plant) in V_1 while the least (172 g/plant) was in V_2 (Table 2).

According to Morgan (2006), the final size and shape of the berry depend on the number of achenes formed, which is determined by pollination and fertilization during blooming. Marketable yield, fruit number, and fruit weight were associated with carbohydrate level in roots and its distribution. The increased fruit size, weight and earlier fruit production per plant appear to be related to increased carbohydrate concentration in crown and roots of strawberry plants. Adequate root starch helps plants to simultaneously generate new feeder roots and provides carbohydrates for flower bud initiation and fruit development. Early fruit growth depends greatly on root starch reserve for up to one month after planting (Mann, 1930; Nishizawa *et al.*, 1997 and Nishizawa and Shishido, 1998). The maximum plant height, leaf number and leaf area were produced by V_1 (SAU Line-01) germplasm. It means the maximum photosynthesis occurred in V_1 germplasm resulting higher food materials and better fruit size as well as weight.

Brix percentage: Brix percentage is a qualitative character of fruit and exhibited distinct variations among the germplasm. The maximum brix (11.0 %) was found in V_3 and the minimum (8.6 %) was in V_2 germplasm (Table 2). These findings are an agreement with Perkins-Veazie (1995) who reported that TSS (Total Soluble Sugar) contents of strawberry fruits varied from 4-11% depending on the cultivar and environment.

Considering the above results it can be concluded that V_1 (SAU Line-01) germplasm bears the maximum flowers and fruits. The fruit weight, fruit length, diameter of fruit were also found maximum in V_1 (SAU Line-01) and might be an appropriate commercial strawberry cultivar for Bangladesh.

Table 1. Growth characteristics of four different strawberry germplasms[Y]

Treatments[X]	No. of runners	Days to flower bud initiation	Days to flower anthesis	Days to fruit set	Days to fruit harvest
V_1	2.3 c	60.2 c	7.5 c	7.0 a	31.0 a
V_2	2.5 bc	75.8 b	9.2 a	5.0 c	29.0 ab
V_3	3.0 ab	81.1 a	8.8 b	6.0 b	22.0 c
V_4	3.5 a	82.4 a	8.5 b	6.0 b	26.0 b
CV (%)	25.0	5.9	5.3	0.0	4.2
LSD 0.05	0.6	3.7	0.4	0.03	3.1

[X] V_1: SAU Line-01, V_2: SAU Line-02, V_3: SAU Line-03 and V_4: SAU Line-04
[Y] In a column means having dissimilar letter (s) differ significantly at the 0.05 level of probability

Table 2. Varietals performance of four different strawberry germplasms related to yield [Y]

Treat-ments[X]	Number of flower	Flower petal area (cm^2)	Number of fruit/ plant	Fruit length (mm)	Diameter of fruit (mm)	Fruit weight (g)	Total Yield/ Plant (g)	Brix (%)
V_1	32.5 a	47.3 a	28.8 a	33.4 a	24.2 a	12.3 a	361.3 a	10.4 b
V_2	23.3 c	21.6 c	19.1 c	26.8 c	21.2 b	8.9 d	171.9 c	8.6 c
V_3	30.2 b	48.2 a	26.0 b	29.8 b	21.6 b	10.6 c	276.6 b	11.0 a
V_4	29.8 b	38.9 b	25.2 b	31.0 b	23.7 a	11.0 b	281.1 b	10.8 ab
CV (%)	7.6	4.1	9.5	5.2	5.9	4.3	11.5	4.6
$LSD_{0.05}$	1.8	1.3	1.9	1.3	1.1	0.4	25.9	0.4

[X] V_1: SAU Line-01, V_2: SAU Line-02, V_3: SAU Line-03 and V_4: SAU Line-04
[Y] In a column means having dissimilar letter (s) differ significantly at the 0.05 level of probability

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