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Effect of planting time and genotypes growth, yield and quality of strawberry (Fragaria × ananassa Duch.)

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ABSTRACT

The experiment was conducted on strawberry having four planting time one month interval from 01 September to 01 December and five promising strawberry genotypes viz. Sweet Charlie, Festival, Camarosa, FA 008 and BARI strawberry-1 for observing their effects on growth, yield and quality under sub tropical climatic conditions of Bangladesh during the winter seasons of 2009–2010 and 2010–2011. The study revealed that irrespective of planting dates 'Camarosa' had the maximum growth being at par with FA008 but it was not reflected in yield and yield attributes because of higher plant mortality% in 'Camarosa' and FA 008. Plant mortality% was found lower in FA 008 and BARI Strawberry-1 than Camarosa, Festival and Sweet Charlie irrespective of planting time. The genotype 'Camarosa' planted on September exhibited wider harvest duration (96.00 days) followed by 'Festival' (93.67 days) planted on the same date. The maximum number of fruits plant^{-1} was obtained in Sweet Charlie (39.00) of October planting, while plants of BARI Strawberry-1 of December planting produced only 12 fruits. Plants of 'Festival' of October planting gave the heaviest fruit (17.78 g) closely followed by those of 'Sweet Charlie' and 'Camarosa' planted on the same date. On the other hand, plants of FA 008 and BARI Strawberry-1 of December planting gave the lightest fruit. Sweet Charlie planted on 01 October performed well and produced the highest yield (667.22 g plant^{-1}), while BARI Strawberry-1 of December planting produced the lowest yield (79.71 g plant^{-1}). Fruits of early planted plants contained more TSS and ascorbic acid than late planted plants.

1. Introduction

Strawberry (Fragaria × ananassa Duch) belonging to the family *Rosaceae* is a lucrative fruit with high market demand in Bangladesh. Its commercial cultivation has recently begun in the country. According to WHO, per capita requirement of fruits is 115 g but in Bangladesh it is only 78 g, which is much below than our minimum requirement. On the other hand from November to April most of the fruits are not available. In Bangladesh, strawberry is cultivated from October to April. In this point of view, strawberry may help to increase the availability of fruits in this lean period of the country (Ahmad and Uddin, 2012). But planting time is a limiting factor for growing strawberry in this country, because of prevailing short winter season. Seedlings raised from runners are usually planted in mid November that results in short fruiting season, 45 to 60 days and thus the fruit yield is reduced. But the period of fruit availability can be increased if the growing season can be extended from October to April.

There are several reports available in the literature indicating that strawberry can be planted on different times of the year depending on the variety, location and climates (Galletta and Bringhurst, 1990; Sharma and Sharma, 2004). Planting time has direct effect on day and night temperature, day light intensity and photoperiod, which affect the floral induction, fruit size, quality and production. Because 90 to 95% of a plant's dry weight is derived from photosynthesis (Biscoe and Gallagher, 1978) and photosynthesis efficiency directly depends on day and night temperature, day light intensity and photoperiod. So, planting time of strawberry is important for dry matter production as well as the growth and yield a crop. Rice (1990) observed that late planting of strawberry significantly reduced the economically viable yield, because later planted plants did not enjoy enough time for vegetative Chercuitte et al. (1991). On the other hand, the genotypes of strawberry are also significantly influenced by the weather conditions, and planting time (Zheng et al., 2009). According to Anna et al. (2003) for successful strawberry cultivation, time of planting plays a very significant role and its optimization is prerequisite.

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Higher profitability and productivity of strawberry are being ensured in many countries either through manipulating planting time (Wang et al., 1998) or with the use of different cultivars. However, tuning of planting time and selection of suitable genotypes are the important ways of achieving higher yield of strawberries. But, such agro-techniques have not yet been standardized in Bangladesh. Hence, the present study was undertaken to select suitable planting time for strawberry as well as to study the effect of planting time on growth, yield and quality of selected strawberry genotypes in Bangladesh.

2. Materials and methods

2.1. Experiment site

The studies were conducted at the Fruit Research Farm of Horticulture Research Centre of Bangladesh Agricultural Research Institute, (Latitude 23°59′N, Longitude 90°24′E, Altitude 14.33 m), Gazipur, Bangladesh during winter season of 2009 to 2010 and 2010 to 2011. This region falls in sub-tropical zone having hot summers (May–August) and mild winter (December–February). Cumulative rainfall of about 119 mm during August to May with average 82.9% relative humidity. The mean maximum and minimum temperatures during cropping period were 26.29 °C and 15.75 °C, respectively. The soil of the experimental farm was clay loam having pH 6.2, organic carbon (0.95%), phosphorus (9 ppm) and potassium (0.17 meq/100 g soil).

2.2. Treatments

The experiment was consisted of two factors: Factor A—Five genotypes: Sweet Charlie, Festival, Camarosa, FA 008 and BARI Strawberry-1 and Factor B—Four planting time: 01 September, 01 October, 01 November and 01 December.

2.3. Experimental design and layout

The experiment was laid out in a strip-plot design with three replications having four time of planting in main strip plot and five genotypes in sub strip plot. The unit plot size was 100 × 600 cm and the plants were spaced 50 × 40 cm on beds. Beds were raised 30 cm above main field with 50 cm drain in-between 2 beds. Each plot contained double row of crops accommodating 30 plants. Daughter plants of different strawberry genotypes were planted in 01 September, 01 October, 01 November and 01 December in the year of 2009 and 2010.

2.4. Intercultural operations

Runners were removed at every 3 days intervals in order to make the crown capable of initiating flowers. **Straw** mulch was applied around the plants as a normal practice to conserve soil moisture, decrease weed and to provide healthy condition for the fruits. Weeds were removed monthly interval to keep the crop weed free. Irrigation was given at 15 days interval to keep the soil moisture available for better plant growth. The other necessary cultural practices and plant protection measures were followed uniformly for all the plots and treatments during the entire period of experimentation.

2.5. Harvesting

Strawberries were harvested by hand picking during early in the day while environment was cool, at an interval of 3 to 4 days and handled very carefully. The fruits were harvested at commercial maturity when >80% of the fruit surface turned red colour. Immediately after harvest, strawberries were sorted to eliminate damaged fruits. Fruits of uniform size and colour were selected for collecting data.

2.6. Observations recorded

Data were collected from inner plants from of each row to avoid border effect. In each unit plot twenty plants were selected randomly for recording data on different morphological, vegetative, reproductive, yield contributing and chemical attributes. The data were recorded on the following parameters—plant height (cm), leaves plant^{-1}, plant mortality (%), days to 50% flowering, Days to fruiting, harvest duration, fruit weight (g), fruits plant^{-1}, yield plant^{-1} (g) TSS and ascorbic acid contents of fruit.

2.7. Collection of phenological data

Days to flowering: It was estimated as the number of days required from planting to first flower opening of the 50% plants per plot of each plot.

Days to fruiting: It was estimated as the number of days required from days to anthesis to fruit harvest of 10 randomly selected plants from each plot and means were calculated.

Harvest duration: It was estimated as the number of days required form first fruit harvest to completion of fruit harvest of 5 randomly selected plants from each plot under different genotypes and means were calculated.

2.8. Regression analysis

Regression analysis was done between number of leaves plant^{-1} and yield plant^{-1} to observe the relationship between them.

2.9. Data analysis

Two year's data on different morphological, vegetative, phenological, yield contributing and chemical attributes were subjected to pooled analysis following strip-plot design using MSTAT-C program. The mean comparison was done following the Duncan's Multiple Range Test (DMRT).

3. Results

3.1. Plant height

The tallest plant (27.67 cm) was obtained in September planting followed by October planting (25.00 cm) and the shortest (16.87 cm) in December planting (Table 1). In case of genotypes, the tallest plant was recorded in Camarosa (28.50 cm) followed by Festival (24.33 cm) and the shortest in BARI Strawberry-1 (18.42 cm).

3.2. Leaves plant^{-1}

The number of leaves plant^{-1} was maximum in September planting (46.13) followed by October (36.93) and the minimum was in December planting (24.60) (Table 1). In case of genotypes' performance, the maximum number of leaves plant^{-1} was observed in Festival (39.50) followed by Camarosa (37.58) and the lowest in FA 008 (30.67). The trend of performance of genotypes against the four planting times was more or less similar with regard to number of leaves plant^{-1} (Table 1). The genotype Festival produced a large number of leaves plant^{-1}, while FA 008 produced small number of leaves irrespective of planting time.