

Characterization of Fruit Traits of Palmyra Palm (*Borassus flabellifer* L.) Germplasm

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ABSTRACT

Palmyra palm (*Borassus flabellifer* L.) is a minor fruit grown all over of Bangladesh. The fruits are commonly known as palmyra palm or *Tal*. Palms are consumed in almost all of its growing stages. The ripe fruit juice is used as a flavouring agent for making a different kind of foods and traditional cakes. BSRI has been maintaining 64 Palmyra Palm germplasm since 1997. Among the germplasm 14 female germplasm were selected on the basis of attractive fruit and juice characteristics. Differences observed in the size, shape, number of fruits/plant in the germplasm. Therefore, the study was conducted to observe the variation in different fruit traits; such as weight of fruit, the height of fruit, the girth of fruit, juice weight, bark weight, yield etc. during the cropping season 2017-2018. Data were recorded for different fruit traits and analyzed to study variation within genotype. The highest fruit weight (1752.1 g), fruit juice (577.2 g), calyx weight (179.47 g) was observed in genotype number 26. The highest fruit girth (50.27 cm) was observed in genotype 1, which is statistically similar to genotype 26 (48.63). Comparatively, a lower Brix (11.22%) was observed in genotype 26, compared to Brix 20.30% in genotype 5. The number of fruits was also found to be least in genotype 26 (49), where the highest was observed in genotype 2 (84). However, the number of fruits was lower in the genotype 26, but due to the larger size fruits, the yield (95.38 t/ha) was statistically similar with the highest yield (95.38 t/ha) in genotype 37. Therefore, it can be concluded that the genotype 26 is suited for large scale cultivation due to its larger fruits which can ensure good market value for the farmers.

Key words: *Borassus flabellifer* L., palmyra palm, fruit traits, variation, genotypes

INTRODUCTION

Palmyra palm (*Borassus flabellifer* L.) commonly known as *Tal* in Bangladesh is a minor fruit, which belongs to the family Arecaceae. It is a slow growing dioecious perennial plant having no distinguishing features to identify sex until flowering. It's a multipurpose tree species. Palmyra palm is mainly distributed to tropical regions but can also grow in the subtropics. The word 'Borassus' was derived from a Greek word and it means the leathery covering of the fruit and 'Flabellifer' means fan bearer. Palmyra palm is a deep rooted crop. It can be grown well in soils having loam and sandy loam texture containing high organic matter. It can easily grow in drought, saline and alkaline soil also. Minimum sunlight is required for its growth and development. Annual rainfall of 750 mm is required for its growth. These trees grow generally along with agricultural boundaries edges, roadside, wasteland and coastal line (Behera and Dhir, 2013). It is solitary unbranched, stout and erect palm.

The palmyra palm is a large tree growing up to 30m high and the trunk may have a circumference of over 1.5 meters at the base. The trunk is black and looks like

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cylinders. The tree can be easily recognized by its gigantic fan-shaped leaves (Morton, 1988). They are usually very tough and have thick stalks. Palmyra fruits are edible in all the stages (Harrison, 2010).

The growth of the tree is very slow and it takes about 10 to 12 years to bear. At 10 to 12 year of age, first flowering occurs which helps in the sex identification of palmyra palm (Ankita *et al.*, 2018). Inflorescence of the variety comes out during the first week of October and the first week of April in a year. Flowering takes place throughout the year and generally flowers open between 8 and 11 am. The plants are dioecious with male and female flowers on separate plants. Pollination occurs by both wind and insects. The male and female flowers are held by two different trees. Both male and female trees produce spikes of flowers but only the female plant bears fruits. However, both trees are used for harvesting sweet juice from the inflorescence. Female plants give a more juice yield when compared to the male plants (Malshe, 2014).

The flowers are small and appear in densely clustered spikes, developing into large, brown, roundish fruits. The male flowers are smaller than the female flowers. After the opening of the spathe, 16-25 days is required to open the flowers. Pollen shedding and flower opening take place simultaneously. Ellipsoidal pollen grains are present. Only two to four branches are present in female spadix which is sheathed by a spathe. Bracts imbricate upper half of the spike whereas lower end is smooth peduncle. 90-120 days is required for the fertilized female flowers to mature into ripe fruits.

The fruits are round, fleshy drupe. It is spherical with a flat bottom and green in colour turn to dark purple or black when ripe (Suryanarayana and Rao, 2002). Mesocarp is edible, fibrous and yellowish which surrounds the one to three hard-coated seeds. The endocarp is hard. The endosperm is sweet and gelatinous when the seed is young but it becomes hard as the fruit matures (Vengaiah *et al.*, 2017). The endosperm contains fats, protein, oils but no starch. The mature fleshy juicy fruits commonly known as *Tal* are harvested and from its mesocarp juice or fruit sap is extracted. The juicy sap is used as raw juice or flavouring agents for different traditional cakes and foods.

The germplasm of BSRI palmyra palm have been maintained for more than two decades to preserve a rare collection of palmyra palm. The study was taken to evaluate variation in 14 palmyra palm flowering germplasm upon different fruit traits.

MATERIALS AND METHODS

Bangladesh Sugarcrop Research Institute planted 64 Palmyra Palm germplasm in 1997. The Palmyra palms were planted line to line following a spacing of 3m and row to row spacing of 3m. Before sowing the seeds, ripe fruits were kept in shade for 4 weeks, so that seed becomes loosened followed with Carbendazim (0.1%) treatment for 24 hr to prevent the incidence of diseases and to enhance the germination process. Seeds were sown in the nursery bed in November, 1995. Germination started within three weeks of sowing. One year old seedlings were transplanted into the palmyra palm garden after rooting started. 10 kg farmyard manure were applied into every pit before planting and in every two years dosage of farmyard manure were increased to 10 kg/tree till the dose reached to 60 kg farmyard manure/tree/year. After every harvesting 30% leaves were pruned from the every palmyra palm tree.

Data of different fruit traits were collected in 2018 from 14 female palmyra palm plants of palmyra palm garden. The female plants were selected on the basis of attractive fruit traits. Fruit traits such as the number of fruit per plant, fruit height (cm), fruit girth (cm), seed weight (gm), bark weight (gm), calyx weight (gm), the weight of juice (gm), fruits yield and Brix (%) were recorded individually from every female plant. The yield (kg/plant) was converted to t/ha, from the fruit weight and the number of fruits per plant multiplied by standard plant population (1,111 plant/ha).

Three replicates were considered for each fruit traits. The collected data were analyzed statistically following the analysis of variance (ANOVA) and the mean differences were adjusted statistically following the Duncan Multiple Range Test (DMRT) using the statistical software, Statistix 10.

RESULTS AND DISCUSSION

Fruit weight, fruit height and fruit girth

The highest individual fruit weight (1752.1 g) was observed in genotype 26, which was statistically similar to 1628.9 g and 1554 g found in genotype 37 and 15, respectively. The lowest fruit weight (799.4 g) was observed in genotype 2 (Figure 1).

The highest fruit height (24.83 cm) was observed in genotype 31 and the lowest fruit height (11.57 cm) was observed in genotype 2. The highest fruit girth (50.27 cm) was observed in genotype 1, which was statistically similar to 48.63 cm and 45.07 cm, observed in genotype 26 and 37, respectively. The lowest fruit girth (37.37 cm) was observed in genotype 5 (Table 1).

Calyx weight, bark weight and seed weight

The highest calyx weight (179.47 g) was observed in genotype 1 and the lowest calyx weight (58.80 g) was observed in genotype 2. The highest bark weight (119.53 g) was observed in genotype 1, which was statistically similar to 116.90 g, 115.67 g and 108.67 g, observed in genotype 26, 15 and 29, respectively. The lowest bark weight (48.76 g) was observed in genotype 2 (Table 1). Seed weight contributed

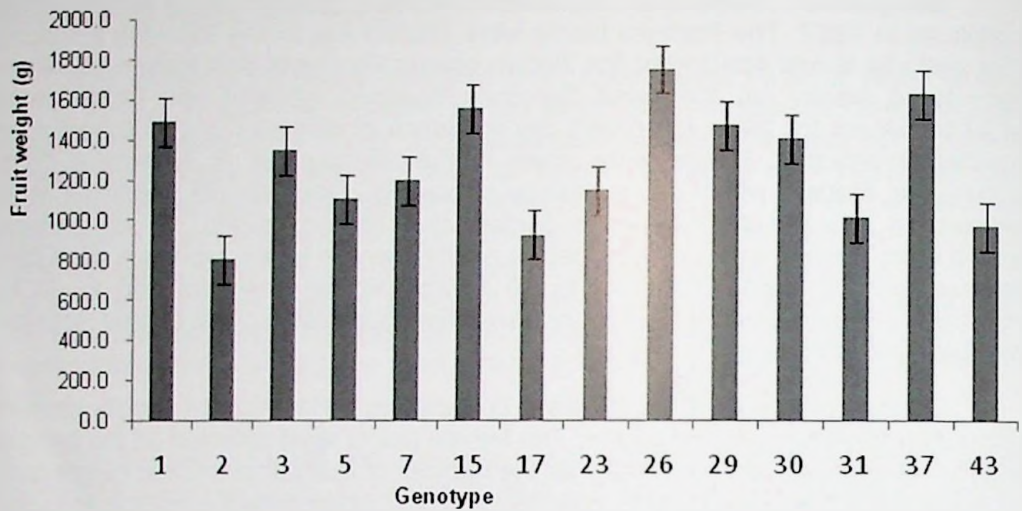


Figure 1. Effect of genotypes on fruit weight in palmyra palm.

largely to the fruit weight. The largest seeds (991.77 g) were found in genotype 15, which was statistically similar with 967.00 g and 946.67 g observed in the genotype 37 and 1, respectively (Table 1).

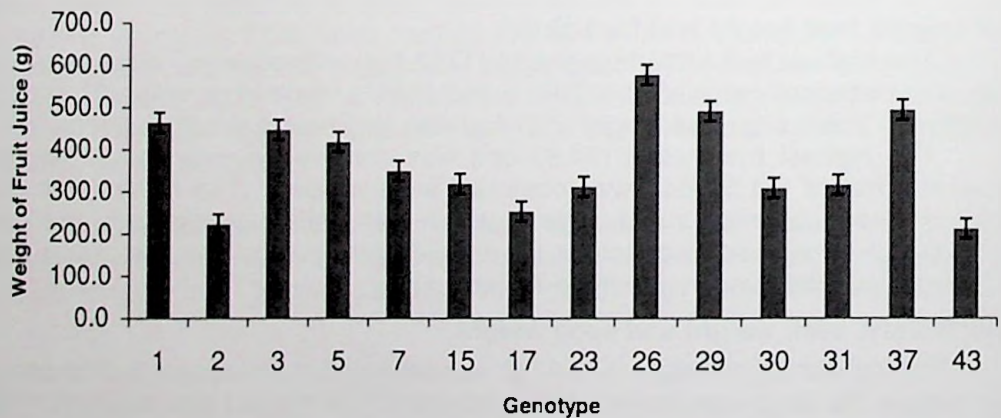


Figure 2. Effect of genotypes on weight of fruit juice in palmyra palm.

Table 1. Effect of genotypes on different fruit traits of palmyra palm

Genotype	Fruit Height (cm)	Fruit Girth (cm)	Calyx weight (g)	Bark weight (g)	Seed weight (g)	Brix (%)	Yield (tha ⁻¹)
1	14.33 b	50.27 a	143.00 b	119.53 a	946.67 ab	16.89 b	91.05 ab
2	11.57 b	38.20 ef	58.80 h	48.76 e	467.57 f	9.20 f	74.60 b
3	12.27 b	43.50 be	109.00 ce	94.83 bc	697.50 cd	14.50 c	94.42 a
5	12.17 b	37.37 f	95.00 df	77.53 cd	512.70 ef	20.30 a	95.77 a
7	12.97 b	39.73 cf	86.80 fg	75.40 cd	677.70 d	12.40 d	95.77 a
15	14.13 b	44.60 bc	128.00 bc	115.67 ab	991.77 a	14.87 c	93.23 a
17	11.63 b	39.00 df	70.00 gh	63.47 de	536.50 ef	14.00 c	80.05 ab
23	11.70 b	42.50 cf	93.20 ef	70.70 de	670.67 d	12.10 de	95.25 a
26	15.00 b	48.63 ab	179.47 a	116.90 ab	879.07 b	11.22 e	95.38 a
29	13.57 b	43.90 bd	103.47 df	108.67 ab	769.00 c	12.50 d	95.07 a
30	12.47 b	42.20 cf	115.00 cd	96.00 bc	883.30 b	14.00 c	95.10 a
31	24.83 a	37.73 f	88.00 fg	70.47 de	539.57 ef	12.22 d	85.66 ab
37	15.20 b	45.07 ac	89.20 eg	78.00 cd	967.00 a	12.34 d	95.91 a
43	11.87 b	38.80 df	128.00 bc	60.20 de	568.00 e	11.62 de	83.86 ab
SE (±)	1.86	2.70	10.15	11.11	36.56	0.45	8.58
CV	16.48	7.83	11.70	15.92	6.20	4.13	11.57

Legend : SE(±)= Standard error of means; CV= Co-efficient of variation,

*=significant at 5% level. Treatments with different letters in a column differ significantly according to DMRT test at $p < 0.05$.

Fruit Juice and Brix (%)

The highest amount of fruit juice (577.2 g) was recorded from the genotype 26 (223.2 g) and the lowest was recorded from genotype 2 (Figure 2). The highest Brix (20.30%) was recorded from genotype 5, and the least Brix (9.2%) was recorded from genotype 2 (Table 1).

Number of fruits and yield

The highest number of fruits (84) was recorded from genotype 2, which was statistically similar to 78 recorded from genotypes 5, 17, 43. The lowest numbers of fruits (49) was observed from genotype 26 (Figure 3). The highest yield (95.91 t/ha) was recorded from the genotype 37, which was statistically similar to the recorded yield from all the genotype except genotype 2. The lowest yield (74.60 t/ha) was recorded from genotype 2 (Table 1).

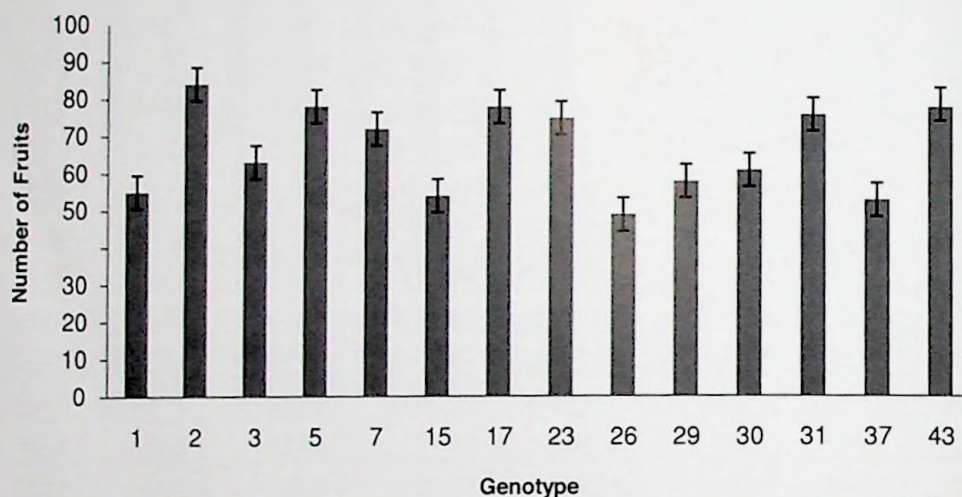


Figure 3. Effect of genotypes on number of fruits in palmyra palm.

It is observed from the result that the genotype 26 produced highest fruit yield which was similar with some other genotypes. However, fruit size, fruit weight and juice content of fruit of the genotype 26 was better than the others genotypes. Considering consumers preference larger fruits have good market value as well.

In conclusion, the palmyra palm genotype 26 might be chosen for large scale cultivation depending on different fruit traits.

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