

## Study on Germination Behaviour and Seedling Growth Performance of Date Palm and Palmyra Palm

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### ABSTRACT

Germination behaviour of date palm and palmyra palm seed which were collected from BSRI garden were examined at Bangladesh Sugarcrop Research Institute palmyra palm and date palm garden. Five different treatments were used before plantation. In palmyra palm highest germination percentage was achieved in T<sub>1</sub> treatment where direct plantation was used. The highest progress of germ tube initiation was observed in T<sub>1</sub> treatment where mechanical scarification with soaking of seeds by 250 ppm GA<sub>3</sub> for 24 hours were used. On the contrary, in case of date palm, the highest germination percentage was achieved in direct plantation (T<sub>1</sub> treatment) and T<sub>2</sub> treatment where seeds were soaked in water for 24 hours and highest progress of shoot and root growth were observed in T<sub>3</sub> treatment where mechanical scarification with soaking of seeds for 24 hours were used. After germination growth pattern were also studied of the palmyra and date palm seedling. Two years after plantation plant height of the date palm seedlings were five times higher than the initial stage. While comparatively slower growth rate was observed in palmyra palm seedlings.

**Key words:** Palmyra palm, date palm, germination behaviour, shoot length, growth rate

### INTRODUCTION

Palms are believed to be among the oldest flowering plants in the world (Redhead, 1989). For centuries, many palm species have been tapped throughout the tropical world in order to produce fresh juice (sweet toddy), fermented drinks (toddy, wine, arak), syrup (honey), brown sugar (jaggery) or refined sugar. One of mankind's first sources of sugar was probably *Arenga pinnata* (Redhead, 1989). Evidence of the use of Palmyra palm (*Borassus flabellifer*) sugar in India has been reported by the Greek historian Megasthenes, ambassador to the court of Chandragupta, in the 4th century. Hindus knew how to extract it about 4,000 years ago (Fox, 1977). Jaggery and treacle extracted from *Caryota urens* sap in Sri Lanka has been an important source of sugar from antiquity (Dissanayake, 1977). In Africa, the main traditional use of palm sap is for wine production. It has been reported in Egypt (Date palm) long before the birth of Christ (Barreveld, 1993) and on the Guinea coast by early navigators in the 15<sup>th</sup> century (Sodah Ayernor and Matthews, 1971).

The weather, climate and soils of Bangladesh are very suitable for crop production. Main profession of this country is agriculture and Sugarcane is one of the most important cash crop in Bangladesh. Sugarcane is the main crop for production of sugar and goor (Jaggery).

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A large quantity of goor is also produced from date palm. Besides there are palmyra palm and golpata (*Nypa fruticans*) which also produces small quantity of goor. Sugar and goor produced in Bangladesh is not sufficient for fulfillment of demand. According to FAO (1982) 13 kg sugar or 17 kg goor is required for each person per year. Accordingly, present requirement of sugar for 160 million populations in Bangladesh is about 20.8 million tons.

Sugarcane is cultivated in 1.8 lakh hectares of land. Every year 4.0-4.4 million tons goor and 1.4-1.8 million tons sugar are produced from 73.75 million tons of sugarcane. At present, yield capacity is only 50 t ha<sup>-1</sup>. So, to produce 1.8 million ton sugar and goor we have to produce 180 million ton of sugarcane. Through using BSRI bred varieties and technologies yield in mill zone is 52 t ha<sup>-1</sup> but in non mill zone is poor due to lack of BSRI bred varieties and technologies. In Bangladesh shortage of sugar and goor is around 13 lakh ton which can't be met up through production of sugar and goor from sugarcane. We can meet up our requirement through production of goor from date palm, palmyra palm and golpata. Sugars from palm trees such as *Phoenix sylvestris* and *Borassus flabellifer* are reported to be more nutritious than cane sugar (Rangaswami, 1977; Morton, 1988). Some medicinal value is also often reported: it is the case for the sugar from *Borassus flabellifer* (Rangaswami, 1977). In Madagascar, *Cocos nucifera* sap is used against nephritis and bladder infections.

There are four types of palm trees grown in Bangladesh. They are coconut, date palm, palmyra palm and golpata (*Nypa fruticans*) which plays an important role in village economy, poverty elevation, create employment opportunities and environment development. Date palm and palmyra palm grows in Bangladesh without any care. They can survive for a long period without water. Besides, they do not die in waterlog and prolong drought condition. For this reason, date palm and palmyra palm grows in Rajshahi and greater part of Jessore and Chuadanga district. These palm grows scattered all over Bangladesh. During 2013-14 and 2014-15 year area of date palm plant is about 1661 and 1805 acre and palmyra palm is about 363 and 349 acre respectively. If we consider 150 date palm/acre and 100 palmyra palm /acre, total number of date palm plant is approximately 2.5-3.0 lakh and palmyra palm is approximately 50 thousand (BBS, 2015). Therefore, to keep the present production sustainable as well as to expand the cultivation area both vertical and horizontal expansions are required which may not be achieved from sugarcane because area of sugarcane is decreasing gradually due to increasing demand for food, vegetable and other cereal crops and utilization of crop lands for houses, roads, industries etc. Vertical expansion in production can be achieved to some extent through development of high yielding varieties of sugarcane. While horizontal expansion can be achieved through cultivation of other sweetening crops like date palm, palmyra palm, and golpata. This study were taken to observe the germination behaviour of date palm and palmyra palm seeds and the growth pattern of date palm and palmyra palm seedlings.

## MATERIALS AND METHODS

An experiment was carried out to observe the germination behavior and establishment of date palm and palmyra palm seedlings during the 2017-18 cropping season. Seeds were collected from palmyra palm and date palm trees grown under ex-situ conditions at BSRI. Following treatments were used for this experiment.

Phase 1: Germination and seedling establishment (2017-18)

T<sub>1</sub>: Direct plantation

T<sub>2</sub>: Soak in water for 24 hours

T<sub>3</sub>: Scarification + Soak in water for 24 hours

T<sub>4</sub>: Scarification + Soak in Gibberelic Acid (GA<sub>3</sub>) @ 250 ppm for 24 hours

T<sub>5</sub>: Soak in dilute (10%) H<sub>2</sub>SO<sub>4</sub> for 24 hours.

This experiment was set up in Randomized Complete Block design with three replications. Data were collected on Germination %, shoot length (days) in date palm seeds and germ tube length in palmyra palm seeds.

Phase 2: Growth and development stage

Data were collected on plant height and number of leaves etc.

Germination percentages were counted from two months after sowing in palmyra palm and 1.5 months after sowing in date palm seeds. After germination and for seedling establishment, six date palm seedlings and three palmyra palm seedlings were planted to observe morphological growing pattern including plant height and leaf number. Growth rate was counted from the date palm seedling after plantation of 1.5 month aged seedling having one tiny leaf and 11.17 - 13.18 cm plant height and one year aged seedling having 60.0 - 71.0 cm plant height with three tiny leaves for palmyra palm. Growth rate was counted from ten months after plantation in each month till now for in date and in each month after plantation till now for palmyra palm seedlings. Statistical analysis was performed and mean values were compared using LSD test at 5% level of significance (Gomez and Gomez, 1984).

## RESULTS AND DISCUSSION

In case of palmyra palm seeds significant differences were observed in germination percentage among different treatments. Highest germination percentage (80%) was found in direct plantation (T<sub>1</sub> treatment) followed by plantation with seeds after soaked in water for 24 hours (T<sub>2</sub> treatments) (76.65%) (Table 1). Statistically no significant differences were observed in germ tube initiation among different treatments of palmyra palm seeds. But morphologically some differences were observed among the treatments. T<sub>5</sub> treatment where mechanical scarification with soaking of seed in GA<sub>3</sub> (250 ppm) for 24 hours were used showed advanced performance on germ tube initiation 2 months after plantation (Table 1 & Figure 1). All the treatments showed statistically significant differences in germination percentages in date palm seeds except T<sub>1</sub> and T<sub>2</sub> treatments. Statistically no



T<sub>1</sub>= Direct Plantation



T<sub>2</sub>= Presoaking of seed in water for 24 hours



T<sub>3</sub>= Mechanical scarification + Presoaking of seed in water for 24 hours



T<sub>4</sub>= Soaking of seed in 10% H<sub>2</sub>SO<sub>4</sub> for 24 hours



T<sub>5</sub>= Mechanical scarification+ Soaking of seed in GA<sub>3</sub> (250 ppm) for 24 hours

Figure 1. Emergence of shoot of palmyra palm seed (after 2 months) in different treatments

significant differences were observed in direct plantation ( $T_1$  treatment) and plantation with seeds which were soaked in water for 24 hours ( $T_2$  treatment) before plantation for date palm seeds. Visually higher germination percentages (48.00%) were observed in  $T_2$  treatment followed by  $T_1$  treatment (43.33%) (Table 2). Statistically significant differences were observed in shoot length among different treatments of date palm seeds.  $T_5$  and  $T_2$  treatments showed no significant difference in shoot length. But morphologically some differences were observed between the treatments.  $T_5$  treatment where mechanical scarification with soaking of seed in  $GA_3$  (250 ppm) for 24 hours were used showed better performance on shoot growth (13.180 cm) followed by  $T_2$  (direct plantation) treatment (11.173 cm) after 1.5 months (Table 2 & Figure 2).

**Table 1. Germination percentages of palmyra palm under different treatments**

| Treatments                                                                         | Germination (%) | Germ tube length (cm) |
|------------------------------------------------------------------------------------|-----------------|-----------------------|
| $T_1$ (Direct Plantation)                                                          | 80.00 a         | 21.33                 |
| $T_2$ (Presoaking of seed in water for 24 hours)                                   | 76.66 ab        | 20.10                 |
| $T_3$ (Mechanical scarification+ Presoaking of seed in water for 24 hours)         | 66.66 ab        | 20.96                 |
| $T_4$ (Soaking of seed in 10% $H_2SO_4$ for 24 hours)                              | 66.66 ab        | 20.20                 |
| $T_5$ (Mechanical scarification+ Soaking of seed in $GA_3$ (250 ppm) for 24 hours) | 63.33 b         | 21.50                 |

\*Figures accompanied by same letter are not significantly different at 5% level as per LSD test

**Table 2. Germination percentages of date palm under different treatments**

| Treatments                                                                         | Germination (%) | Shoot length (cm) |
|------------------------------------------------------------------------------------|-----------------|-------------------|
| $T_1$ (Direct Plantation)                                                          | 41.33 a         | 11.17 ab          |
| $T_2$ (Presoaking of seed in water for 24 hours)                                   | 48.00 a         | 12.40 a           |
| $T_3$ (Mechanical scarification+ Presoaking of seed in water for 24 hours)         | 11.33 c         | 9.56 b            |
| $T_4$ (Soaking of seed in 10% $H_2SO_4$ for 24 hours)                              | 27.33 b         | 6.64 c            |
| $T_5$ (Mechanical scarification+ Soaking of seed in $GA_3$ (250 ppm) for 24 hours) | 18.00 bc        | 13.18 a           |

\*Figures accompanied by same letter are not significantly different at 5% level as per LSD test



T<sub>1</sub>= Direct Plantation



T<sub>2</sub>= Presoaking of seed  
in water for 24 hours



T<sub>3</sub>= Mechanical scarification  
+ Presoaking of seed in  
water for 24 hours



T<sub>4</sub>= Soaking of seed in 10% H<sub>2</sub>SO<sub>4</sub>  
24 hours



T<sub>5</sub>= Mechanical scarification+ Soaking  
of seed in GA<sub>3</sub> (250 ppm)  
for 24 hours

Figure 2. Emergence of shoot of date palm seed after 1.5 months in different treatments

**Table 3. Month wise growth rate of date palm (Plantation date. 01.08.18)**

| 01.06.19          | 01.07.19          | 01.08.19          | 01.09.19          | 01.10.19          | 01.11.19          | 01.12.19          | 01.01.2020        | 01.02.2020        | 01.03.2020        |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) |
| 67.0              | 71.0              | 80.0              | 77.0              | 80.0              | 85.0              | 87.0              | 90.0              | 90.0              | 91.0              |
| 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 5                 | 5                 |
| 45.0              | 45.0              | 50.0              | 48.0              | 50.0              | 52.0              | 52.0              | 56.0              | 56.0              | 58.0              |
| 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |
| 42.0              | 42.0              | 52.0              | 50.0              | 52.0              | 52.0              | 52.0              | 56.0              | 56.0              | 56.0              |
| 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 6                 | 6                 | 6                 |
| 55.0              | 62.0              | 79.0              | 72.0              | 79.0              | 83.0              | 90.0              | 97.0              | 97.0              | 102.0             |
| 4                 | 4                 | 4                 | 4                 | 4                 | 6                 | 7                 | 8                 | 8                 | 8                 |
| 60.0              | 60.0              | 64.0              | 61.0              | 64.0              | 64.0              | 68.0              | 70.0              | 70.0              | 71.0              |
| 4                 | 4                 | 4                 | 4                 | 4                 | 5                 | 6                 | 7                 | 7                 | 7                 |
| 35.0              | 38.0              | 45.0              | 45.0              | 45.0              | 45.0              | 45.0              | 48.0              | 48.0              | 50.0              |
| 3                 | 3                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |

**Table 4. Month wise growth rate of palmyra palm (Plantation date. 04.09.18)**

| 04.09.18          | 04.10.18          | 04.11.18          | 04.12.18          | 04.01.19          | 04.02.19          | 04.03.19          | 04.04.19          | 04.05.19          | 04.06.19          |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) |
| 60.0              | 60.0              | 62.0              | 62.0              | 62.0              | 62.0              | 62.0              | 63.0              | 63.0              | 65.0              |
| 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 4                 | 4                 | 4                 |
| 71.0              | 71.0              | 71.0              | 71.0              | 71.0              | 71.0              | 71.0              | 71.0              | 71.0              | 71.0              |
| 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 | 3                 |
| 63.0              | 63.0              | 64.0              | 64.0              | 64.0              | 64.0              | 64.0              | 65.0              | 65.0              | 66.0              |
| 3                 | 3                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 | 4                 |

**Table 5. Month wise growth rate of palmyra palm (Plantation date. 04.09.18)**

| 04.07.19          | 04.08.19          | 04.09.19          | 04.10.19          | 04.11.19          | 04.12.19          | 04.01.2020        | 04.02.2020        | 04.03.2020        |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) | Plant height (cm) |
| 67.0              | 67.0              | 70.0              | 70.0              | 70.0              | 70.0              | 70.0              | 70.0              | 72.0              |
| 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 |
| 71.0              | 72.0              | 72.0              | 72.0              | 72.0              | 72.0              | 72.0              | 72.0              | 73.0              |
| 3                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 |
| 68.0              | 68.0              | 69.0              | 69.0              | 70.0              | 70.0              | 70.0              | 70.0              | 72.0              |
| 4                 | 4                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 | 5                 |

Table 3 shows the changing trends of growth rate and leaf number in different months after plantation of date palm till now. After 1.9 months plant height and leaf number multiply five times than the initial stage. Table 4 & Table 5 shows the growth pattern on plant height and leaf number in different months after plantation of palmyra palm till now. Comparatively slower growth rate were observed in palmyra palm seedlings than the date palm seedlings.

Overall observations from the above studies are to multiply the date and palmyra palm trees, direct sowing seeds of date and palmyra palm is more cost effective than the other methods.

After analyzing the findings which we received till now it may be concluded that direct sowing of seeds of date palm and palmyra palm is cost effective than other methods to both vertical and horizontal expansions of the sugarcrops to fulfill our sugar requirements.

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