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The effect of sarcotesta and time of sowing on seed germination of papaya (*Carica papaya* L.) cv. GJP-1

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ABSTRACT

Slow and asynchronous germination of papaya seeds partly might be associated with the occurrence of various inhibitors in the gelatinous sarcotesta and seed coat. Similarly, the sowing of papaya seeds at different times affects the germination of papaya seeds. Hence, this experiment was undertaken at JAU, Gujarat to evaluate the influence of both the parameters viz., sarcotesta and time of sowing on seed germination of papaya cv. GJP-1. The removal of sarcotesta by hand rubbing was done and after evaluating the better treatment among the effect of sarcotesta, the seeds were shown in the polybag containing the media mixture of soil: sand: FYM in 1:1:1 ratio. Among the treatment effect of sarcotesta the seeds without sarcotesta executed the highest germination percentage (81.03%), survival percentage (98.29%) and least days for germination (14.28). Among the different dates of sowing, the early germination of papaya seeds (8.28 days) was found on 1st July (T_{13}) whereas, the highest germination and survival percentage (96.66 and 99.28 %) were observed in seeds sown on 16th June (T_{12}) and 1st June (T_{11}), respectively. Hence, it could be concluded that for obtaining good quality papaya seedlings, the seeds (cv. GJP-1) should be soaked for 24 hours in the water, followed by the removal of sarcotesta by hand rubbing and seeds should be sown during June to July months of the year for getting higher germination and survival percentage.

***Keywords*:** Germination, GJP-1, papaya, sarcotesta, survival, time of sowing

Papaya (*Carica papaya* L.) also known as papaw or pawpaw belongs to the family Caricaceae with chromosome number 18. Accelerated demand for fresh fruit leads to an increase in papaya acreage. As a result of its quick and heavy yielding potential, this crop is grown around the tropics and subtropics of the World (Reddy and Gowda, 2014) producing a favourable Cost-Benefit ratio (Sharma and Zote, 2010). It is abundant in carbohydrates, vitamins and minerals (Ram, 2005). In recent days, farmers are getting interested in growing papaya as the main crop because it gives fruiting throughout the year and is regularly in demand. Papaya is commercially propagated through its seeds, which are protected by a gelatinous sarcotesta. Papaya seeds have been found to contain inhibitors, primarily phenolic compounds, in the sarcotesta and the seed coat, which contribute to slow and asynchronous germination(Chow and Lin, 1991; Reyes *et al*., 1980) and affect the subsequent seedling emergence (Malo and Campbell, 2001).The powerful germination inhibitors in the fruit flesh prevent the inhibitor from travelling from the ovary flesh to the seed coat.Also, the papaya seed's sarcotesta/ aril may hinder germination by blocking oxygen and water from reaching the embryo (Yahiro, 1979; Angeline and Ouma, 2008; Rodriguez *et al*.,2019; Sharma *et al*., 2021). So, it is recommended that, after harvesting, the seeds be gently rubbed with sand and thoroughly washed under running water to get rid of the gelatinous sarcotesta before drying and storage. Soaking papaya seeds in water for 24 hours prior to planting helps in better germination (Riley, 1981).

Seed germination and plant development are profoundly influenced by environmental conditions. It has been demonstrated that irregular shifts in climatic parameters have an impact on the success of seed germination and the development of seedlings. Variations in germination and seedling growth parameters result from the sowing of seeds at different times. Climatic parameters like temperature, humidity, bright sunshine hours, rainfall *etc*., are important factors for nursery growers for successful seedling preparation. One of the most influential aspects of seed germination is temperature. Very high or low temperatures may inversely affect the process of germination. Papayas thrive in temperatures between 26 and 30 degrees Celsius during their early stages of growth in the nursery (Ram 1996; Ram and Ray, 1992). The relative humidity of the atmosphere has a direct influence on nursery raising. The optimum relative humidity is necessary to boost seed germination and seedling growth. The bright

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sunshine hour is the key part of the growth of any plant as plants require bright sunshine to make their food for running the normal lifecycle. Inadequate sunshine hours cause the yellowing of plants and will result in uneven and suppressed growth of seedlings. Rainfall will improve the microclimate that is suitable for seed germination and seedling growth. But the continuous and heavy rainfall will decrease the BSS, increase humidity in the atmosphere and will make the soil compact which may hinder seedling growth. Thus, different climatic parameters have varied influences on the seed germination of papaya. So, it is important to study the right time of sowing for papaya for getting higher germination success and good quality seedlings as now-a-days farmers are interested to grow gynodioecious varieties which are very costly. For farmers, every seed is worthy and important. The farmers do not have infrastructure facilities, like playhouses, greenhouses *etc*., for raising seedlings under protected conditions. They grow the seedlings under the shed or under field conditions. The farmers with small land holdings have poor purchasing power and sowing seeds with the wrong method and time will cause economical loss.

MATERIALS AND METHODS

The present investigation was carried out at Fruit Research Station, Lal Baugh, Junagadh Agricultural University, Junagadh, Gujarat. The treatments comprised of S_1 (with sarcotesta) and S_2 (without sarcotesta) and T_1-1st January, T_2-16th January, T_3-1st February, T_4- 16th February, T_5-1st March, T_6-16th March, T_7-1st April, T_8-16th April, T_9-1st May, T_{10}-16th May, T_{11}-1st June, T_{12}-16th June and T_{13}-1st July as time of seed sowing. A Completely Randomized Design (CRD) with three replicates was used to plan the experiment. The papaya seed of variety GJP-1 was procured from Fruit Research Station, Madhadi Baug, Junagadh Agricultural University, Junagadh. Seeds were dipped in water for 24 hours and then gently rubbed with hands for the removal of sarcotesta. This was done precisely and with gentle hands so that it removes sarcotesta only and does not damage the seeds. The seeds were washed once or twice and immediately Carbendazim 2% powder was mixed to avoid any fungal infection. After mixing the Carbendazim seeds were spread on the muslin cloth to avoid sticking off with each other for one hour in the shed. Then seed sowing was done with three seeds sown in each polybag at 1.0 cm depth in a triangle manner. Seed sowing was done from January to July at 15 days intervals in black polybags containing soil: sand: FYM in 1:1:1 ratio.

RESULTS AND DISCUSSION

The perusal of data presented in Table 1 revealed that sarcotesta executed a significant influence on the days taken to germinate the papaya seeds. Significantly the early germination of papaya seeds (14.28 days) was found in seeds without sarcotesta (S_2) and significantly maximum days (17.19 days) required for germination in the case of seeds with sarcotesta (S_1). The better seed germination in papaya seeds without sarcotesta might be attributed to the fact that the removal of inhibitors helps in synchronous germination (Singh and Singh, 1981; Reyes *et al*., 1980; Perez *et al*., 1980; Tokuhisa *et al*., 2007; Sarana *et al*., 2016). Significantly the highest percentage (81.03%) of germination was observed in seeds without sarcotesta (S_2) and significantly the lowest germination percentage (73.17%) was recorded in seeds with sarcotesta (S_1). Significantly the highest survival percentage (98.29%) was observed in seeds without sarcotesta (S_2) and significantly the lowest survival percentage (95.86%) was recorded in seeds with sarcotesta (S_1). The sarcotesta on papaya seed may reduce germination by blocking oxygen infiltration into the seed, which may explain why seeds without sarcotesta have a higher germination rate (Yahiro, 1979; Angeline and Ouma, 2008). Aril acts as a physical barrier, restricting the flow of water and gases into the seeds; combined with the influence of phytohormones, this prevents germination, induces dormancy, stunts embryonic development, and reduces the overall germination rate (Rodriguez *et al*., 2019). Some byproducts of anaerobic metabolism, as reported by Kranner *et al*. (2010), can hinder respiratory transport, setting off a chain reaction that ultimately resulted in the loss of cell function and kills the seed. The survival rate was lowest for seedlings grown from seeds infected with sarcotesta, possibly because this parasite interferes with germination and subsequent plant growth (Sangakara, 1995;Okeyo and Ouma, 2008).

Sowing papaya seeds at different times has a significant effect on the germination parameters of papaya seeds (Table 2). The early germination of papaya seeds (8.28 days) was found in treatment on 1st July (T_{13}). The highest germination and survival percentage (96.66 and 99.28%) were observed in seeds sown on 16th June (T_{12}) and 1st June (T_{11}) respectively. The seeds shown on 1st July give early germination. It might be due to the fact that environmental conditions play a key role in the germination of seeds in a nursery. The favourable conditions of the month of July provide an adequate environment for the early germination of papaya seeds. The maximum germination percentage on 16th June might be attributed to the microclimate of that month like average temperature (29.58°C), humidity (70.5 %) and rainfall (101.66 mm with an average of

Table 1: Effect of sarcotesta on days taken to germinate the papaya seeds, germination percentage and survival percentage of papaya seedlings

Treatments	Days to germination	Germination percentage	Survival percentage
S_1: With sarcotesta	17.19	73.17	95.86
S_2: Without sarcotesta	14.28	81.03	98.29
SEm (±)	**0.108**	**0.558**	**0.398**
LSD (0.05)	**0.31**	**1.59**	**1.13**

Table 2: Effect of time of sowing on days taken to germinate the papaya seeds, germination percentage and survival percentage of papaya seedlings

Treatments	Days to germination	Germination percentage	Survival percentage
T_1: 1st January	23.83	59.79	94.39
T_2: 16th January	23.52	57.76	94.63
T_3: 1st February	20.20	66.39	95.37
T_4: 16th February	17.75	66.82	95.09
T_5: 1st March	18.10	69.28	98.86
T_6: 16th March	16.70	77.11	99.14
T_7: 1st April	16.18	67.94	99.06
T_8: 16th April	14.52	73.50	98.47
T_9: 1st May	12.95	82.98	98.99
T_{10}: 16th May	11.23	94.06	98.42
T_{11}: 1st June	11.55	93.45	99.28
T_{12}: 16th June	9.75	96.66	98.64
T_{13}: 1st July	8.28	96.55	91.65
SEm(±)	**0.275**	**1.424**	**1.015**
LSD (0.05)	**0.78**	**4.04**	**2.88**

3.5 days). The reduction in the germination of seeds sown during January and February might be due to low temperatures (Cheema and Dani, 1930; Naik, 1949). The maximum survival percentage on 1st June is might be due to the environmental conditions of that time (average temperature 30.66°C, average relative humidity 57 %, average rainfall 75.47 mm and average three rainy days). These environmental conditions are relatively congenial for the papaya seedling growth which got more survival percentage.

CONCLUSION

On the basis of the results obtained, it can be comprehended that for the preparation of papaya seedlings in the nursery, the seeds of cv. GJP-1, should be soaked for 24 hours in water and after removal of sarcotesta by hand rubbing the seeds should be sown from 16th May to 1st July for getting higher germination and survival percentage.

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