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EFFECT OF SEED SCARIFICATION AND SOAKING TREATMENTS ON GERMINATION AND GERMINATION INDICES OF SAPOTA

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Abstract

An experiment was carried out under agri shade net house at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari (Gujarat) in 2017-18 in order to study the effect of seed scarification (without and with scarification) and soaking treatments (GA_3 200 ppm, thiourea 1 %, cow urine 10 %, cow dung slurry, potassium nitrate 2 % and water soaking for 24 hours) on germination and germination indices of sapota. The completely randomized design with factorial concept was used with twelve treatment combinations and repeated thrice. The results generated from the study revealed that the maximum germination percentages, emergence rate index (ERI) and Bartlett rate index (BRI) were obtained when sapota seeds sown without scarification treatment. While no significant differences were observed among scarification treatments on days for initiation of germination. Among seed soaking treatments, the minimum days required for initiation of germination and the maximum germination attributes were recorded in cow dung slurry which was at par with cow urine 10 % and GA_3 200 ppm. Owing to the results obtained during study, it is inferred that the sapota seeds sown without scarification and soaking in cow dung slurry or cow urine (10 %) for 24 hours to get higher seed germination of sapota.

Key words : sapota, scarification, soaking treatments, germination, index

Introduction

Sapota [*Manilkara achras* (Mill.) Fosberg], belongs to family Sapotaceae, is one of the important fruit crop of the tropical region. It is an exotic tree originated from tropical America. The fruit is fleshy berry, globose or egg-shaped, 5-10 cm in diameter, rough rusty, greyish to brown flesh and weight is about 75 to 150 g. Some fruits are seedless, but normally there may be from 1 to 5 seeds.

Sapota can be propagated both by seed as well as vegetative methods *viz.,* inarching and softwood grafting. In early days, it was propagated through seed but it has certain disadvantages, such as variability, slow growth, long juvenile or pre-bearing age taking about 8 to 10 years to fruits and growing to a huge size (Cheema *et al.,* 1954). However, seed propagation is mainly used for the creation of variability, developing hybrids and raising rootstock. So, it is utmost important to get the maximum germination of seed. For raising seedlings through seed, it has been suggested that sapodilla seeds should be collected from the vigorous tree and if possible from large fruits having bolder seeds (Malo, 1968). An experiment by Gonzalez and Fabella (1952) showed that chico seeds from sound fruits germinated better than those from decayed fruits and that seeds sown immediately after collection gave a considerably higher percentage of germination (62.5 - 80.0 %) than seeds sown even a few days after they were extracted (40.0 - 60.0 %). Seeds remain viable for a short period and have a high moisture content, which puts them in the category of recalcitrant seed (Ellis, 1984). The seed viability of sapota reported as 16 days (Duarte and Cruz, 2007). Seedling emergence is rather slow and uneven, possibly due to the hard seed coat. There is a possibility of increasing seed germination in many crops by using scarification treatment, growth regulators and chemicals through their significant effects on germination. Keeping these background facts in mind, the study was framed.

Materials and methods

Experimental detail

The investigation was carried out at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari (Gujarat) during the year 2017-2018. It was laid out in Completely Randomized Design with factorial concept having twelve treatment combinations, comprising of two levels of seed scarification (S) *viz*., without scarification (S_0) and scarification (S_1); and six levels of seed soaking treatments (I) *viz*., GA_3 200 ppm (I_1), Thiourea 1 % (I_2), cow urine 10 % (I_3), cow dung slurry (I_4), potassium nitrate 2 % (I_5) and water soaking (I_6) for 24 hours. The treatments were repeated thrice.

Fully mature fruits of sapota cv. Kalipatti were harvested and kept for ripening at room temperature. The required experimental seeds were extracted manually from the fully ripened fruits. Seeds with uniform size were selected and washed thoroughly with water to remove remaining adhered pulp and dead floating seeds. Then seeds were dried in shade to remove excess water and further subjected to different treatments. Out of whole seed material, the half of seeds lot were scarified by shaking the seeds with the grits in plastic bottle for 30 seconds and followed by soaking treatments for 24 hours, while the unscarified seeds were directly soaked in respective soaking treatments for 24 hours. All the treated seeds were sown in polythene bags of size 7×8" filled with red soil and well-rotted FYM (3:1). Watering was done immediately after sowing of seeds in polythene bags using watering rose and maintained the moisture level. Subsequently, bags were watered as and when required.

Days for initiation of germination

The date of first plumule emergence was recorded and the difference between the date of sowing and plumule emergence was recorded as a number of days taken for germination.

Germination percentage

Germination was recorded at 4 months after sowing and it was calculated as per below mentioned formula.

Germination (%) =

$$\frac{\text{Total number of seed germinated}}{\text{Total number of seed sown}} \times 100$$

ERI

The emergence rate index (ERI) was calculated by the formula of Evetts and Burnside (1972).

$$\text{ERI} = \frac{G_1}{T_1^*} + \frac{G_2}{T_2} + \frac{G_3}{T_3} + ... + \frac{G_n}{T_n}$$

Where,

G_1 - Per cent of seed germinated at first count T_1

G_2 - Additional per cent of seeds germinated at second count T_2

G_3 - Additional per cent of seeds germinated at third count T_3

G_n - Additional per cent of seeds germinated at final count T_n

T_1 - Weeks from sowing to first count

T_2 - Weeks from sowing to second count

T_3 - Weeks from sowing to third count

T_n - Weeks from sowing to last count

***Note:** Germination counts were done on 7, 9, 11, 13, 15, 17 weeks from the date of sowing.

BRI

The Bartlett rate index (BRI) refers to the earliness of germination and was worked out by the following formula (Bartlett, 1937).

$$\text{BRI} = \frac{P_1 + (P_1 + P_2) + (P_1 + P_2 + P_3) + ... + (P_1 + P_2 + P_3 + ...P_n)^*}{N(P_1 + P_2 + P_3 + ...P_n)}$$

Where,

P_1, P_2...Pn = Germination per cent at 1, 2….n weeks, respectively.

N = Total number of weeks in the test.

***Note:** Germination counts were done on 7, 9, 11, 13, 15, 17 weeks from the date of sowing.

The statistical analysis of data was carried out as per the method prescribed by Panse and Sukhatme (1985).

Results and Discussion

An influence of seed scarification and soaking treatments for initiation of germination was measured through certain parameters such as days for initiation of germination, emergence rate index (ERI) and Bartlett rate index (BRI). The higher emergence rate index (ERI) and Bartlett rate index (BRI) values indicate earliness in germination as observed in results (Table 1).

Effect of scarification

Significantly, the maximum germination (58.33 %), emergence rate index (14.15) and Bartlett rate index (0.425) were obtained when sapota seeds sown without scarification (S_0) treatment as compared to scarification treatment. Scarification overcomes inhibition of

germination that is caused by seed coat impermeability and limitation of gaseous exchange (Giersbach, 1934), but in this present study, no significant differences were observed in days for initiation of germination of sapota seeds among scarification treatments.

The observed results are indicative of the deleterious effect of seed scarification resulted in significant reduction in the germination percentage, emergence rate index (ERI) and Bartlett rate index (BRI) which can be attributed to negative impacts that the effect of scarification which might have injured the embryos or provided easy access to micro-organisms also (Maheshwarappa, 1967). Said *et al.* (2008) stated that mechanical scarification is not practical since the embryos could be damaged. Duarte and Hurtado (2001) reported that seed coat removal resulted in no germination due to rotting of sapota seeds. The results are in conformity with those found by Marostega *et al.* (2017) in *Passiflora foetida*; Boora (2016) in ber; Duarte and Villagran (2002) in canistel and Duarte and Suchini (2001) in sapota who reported less germination percentage with scarification treatment as compared to control *i.e.* without scarification. So the evidences show that scarification may or may not help or may even prove injurious for germination of seeds depending on the species and severity of the treatments.

Effect of seed soaking treatments

Regarding different seed soaking treatments under study, the minimum days required for initiation of germination (39.17) and the highest germination (65.67 %), emergence rate index (15.89) and Bartlett rate index (0.439) were obtained by sapota seeds pre-soaked in cow dung slurry (I_4) which was at par with cow urine 10 % (I_3) and GA_3 200 ppm (I_1) for 24 hours The lowest values for all these attributes (48.50 days, 45.00 %, 8.94 and 0.369, respectively) were registered in water soaking treatment (I_6).

The superiority of cow dung slurry treatment (I_4) might be due to the presence of growth promoting substances (auxins) and nutrients in cow dung slurry and cattle urine (Shinde and Malshe, 2015). It might be due to the stimulating effect of imbibitions. The maximum germination percentage might be due to presence of efficient water, N, P, K, micronutrients and biodigestable enzymes which have been the cause for softening of seed coat and thereby inducing the radicle protrusion (Parmar *et al.,* 2018). Similar results on days for initiation of germination and germination parameters were reported by Patel *et al.* (1996), Shirol *et al.* (2005) and Prajapati (2013) in *khirni* and Singh and Bhargava (2009) in date palm.

The next better treatment was cow urine 10 % (I_3) may be due to the fact that cow urine activated the

Table 1: Effect of seed scarification and soaking treatments on germination and germination indices of sapota.

Treatments	Days for initiation of germination	Germination (%)	Emergence Rate Index (ERI)	Bartlett Rate Index (BRI)
Seed scarification (S)				
S_0: Without scarification	42.67	58.33	14.15	0.425
S_1: With scarification	43.00	53.67	11.43	0.380
S.Em.±	0.63	0.89	0.28	0.008
C.D. at 5 %	NS	2.59	0.83	0.024
Seed soaking treatments (I)				
I_1: GA_3 200 ppm	40.50	63.00	14.65	0.406
I_2: Thiourea 1 %	45.83	50.00	11.72	0.395
I_3: Cow urine 10 %	39.83	63.33	14.93	0.420
I_4: Cow dung slurry	39.17	65.67	15.89	0.439
I_5: Potassium nitrate 2 %	43.17	49.00	10.63	0.386
I_6: Water soaking	48.50	45.00	8.94	0.369
S.Em.±	1.08	1.54	0.49	0.014
C.D. at 5 %	3.17	4.49	1.43	0.040
Interaction effect (S × I)				
S.Em.±	1.53	2.18	0.69	0.019
C.D. at 5 %	NS	NS	NS	NS
C.V. %	6.20	6.73	9.38	8.39

embryos and estimated the release of enzyme in endosperm, which in turn liberate the food substances required by quick growing embryo and seedling of kagzi lime (Dongre, 2007). Such type of finding also reported by Sankaranarayanan *et al.* (1994) in tamarind,

Enhanced the germination parameters with GA_3 200 ppm (I_1) treatment might be due to it also enhances cell elongation, so the radicle can push through the endosperm and seed coat that restrict its growth (Hartman and Kester, 1979) and increased the germination percentage might be due to GA_3 acts directly on embryo relieving them from dormancy through promoting protein synthesis and elongation of coleoptile and leaves also helps in the production of ethylene. This ethylene invokes the synthesis of hydrolases, especially-amylase which favour the seed germination (Stewart and Freebarin, 1969). The similar results were coincide with the findings of Bajaniya *et al.* (2019) in *khirni* and Sheoran *et al.* (2018) in ber.

Conclusion

As cow dung slurry and cow urine are the cheaper pre-soaking treatments and also easily available as compared to GA_3 and hence, it is concluded that the sapota seeds sown without scarification and soaking in cow dung slurry or cow urine for 24 hours to get higher seed germination of sapota.

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