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Effect of Pre-Sowing Treatments on Seed Germination of Guava (*Psidium guajava* L.)

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ABSTRACT: Guava seed germination is poor and takes long time to germinate because of seed dormancy by virtue of hard seed coat and presence of inhibitors. Therefore, present study was carried out with the aim to reduce the difficulties in seed germination. An experiment was conducted to study the effect of different pre-sowing treatments on seed germination of guava at Precision Farming Development Centre (PFDC), Department of Horticulture, CCS Haryana Agricultural University, Hisar during year 2020-2021. The seeds were treated with 13 different pre-sowing treatments. Results indicated that different pre-sowing treatments has significant effect on seed germination of guava. Among the different pre-sowing treatments minimum days to initiation of germination and days to 50% germination in guava were observed in 5% hydrochloric acid solution for 2 minutes (T_9) and the highest germination percentage, survival percentage and maximum height of seedlings were recorded with scraping of seed coat with sandpaper + seeds soaked in GA_3 200 ppm for 24 hours(T_5). This research evaluated the best pre-sowing treatment for seed germination of guava.

Keywords: Guava, seed, pre-sowing treatments, GA_3, germination.

INTRODUCTION

Guava (*Psidium guajava* L.) is a popular fruit of tropical and sub-tropical regions and belongs to the family Myrtaceae. In Haryana, guava is cultivated in an area of 14543 hectares with an annual production of 260851 metric tonnes (Anonymous, 2021). It is mostly grown in the districts Sonipat, Karnal, Hisar, Jind, Ambala, Yamunanagar, Panipat, Jhajjar and Fatehabad of Haryana. In the recent past, data showed that the area (360 hectares) of guava has increased substantially: which shows that farmers have shown interest in guava cultivation in Haryana. Its performance is better than other fruits in terms of productivity, hardiness and adaptability. The wide adaptability nature of the guava tree helped it to sustain a wide range of environmental conditions, soils, pH (4.5 to 8.2), drought, and salinity. It is quite a hardy, prolific bearer and is considered to be one of the most delicate nutritionally valuable and remunerative crops of the tropics (Sharma *et al*., 2020; Singh *et al*., 2000). But it is susceptible to frost.

The area under guava cultivation expanding day by day which leads to an increase in demand for budded and grafted plants but this demand is not fulfilled because of the paucity of superior seedling rootstock.

To accomplish the increasing demand for quality rootstock, seedlings need to be raised from seeds, while guava seeds take a long time to germinate because seeds suffer from physical dormancy due to hard seed coat and impermeability to water and gases. Low germination is a major hindrance for the nurseryman in raising a large quantity of rootstock with graftable size in a shorter period for the growers. To enhance germination, different methods like water soaking, mechanical scarification and chemical treatments using GA_3 are employed for breaking dormancy in seeds. It has been reported that chemical and mechanical scarification can hasten the imbibition of water by making hard seeds permeable (Sourabh *et al*., 2020). Seed imbibition is a crucial phase for successful germination as ample water is necessary to rehydrate enzymes and their substrates in preparation for seed germination. The seed scarification process involves breaking, scratching and softening the seed coat so that water enters to stimulate the process of seed germination. The influence of different pre-sowing treatments in guava are poorly understood. So, the current investigation aimed with the objective to study the effect of different pre-sowing treatments on days to

initiation of germination, germination percentage and survival percentage of guava.

MATERIALS AND METHODS

The present investigation was carried out at Precision Farming Development Centre (PFDC), Department of Horticulture, CCS Haryana Agricultural University, Hisar in 2020-2021. The experiment was laid out in Randomized Block Design with three replications containing thirteen treatments of varying concentrations and times comprising scraping of seed coat with sand paper (T_1), seed soaked in GA_3 100 ppm for 24 hours (T_2), seed soaked in GA_3 200 ppm for 24 hours (T_3), scraping of seed coat with sand paper + seeds soaked in GA_3 100 ppm for 24 hours (T_4), scraping of seed coat with sand paper + seeds soaked in GA_3 200 ppm for 24 hours (T_5), 0.1% solution potassium hydroxide soaking for 2 minutes (T_6), 0.2% solution potassium hydroxide soaking for 2 minutes (T_7), 30% sulfuric acid soaking at different time intervals [quick dip (i),1 minute (ii) and 3 minutes (iii)] (T_8), 5% hydrochloric acid soaking for 2 minutes (T_9), 10% hydrochloric acid soaking for 2 minutes (T_{10}), hot water soaking at 80^0 C at different time intervals [quick dip (i), 1 minute (ii) and 3 minutes (iii)] (T_{11}), water soaking for 48 hours (T_{12}), control (T_{13}). A set of five seedlings were selected in each treatment replication-wise. The experiment was conducted in open field conditions. Before sowing of seeds, light irrigation was given. In each treatment, fifty seeds were sown during the 1st week of August 2020. The nursery bed was irrigated with the help of water cane soon after seed sowing and thereafter, moisture was maintained regularly. Data recorded during the study was statistically analyzed by applying the technique of analysis of variance (ANOVA) as suggested by Panse and Sukhatme (1995). The mean value of different parameters is represented. All the statistical analysis was carried out by using OPSTAT statistical software.

RESULTS AND DISCUSSION

The observations recorded on various aspects *viz*., seed viability, days to initiation of germination, days to 50 per cent germination, germination percentage, height of seedling and survival percentage of guava are presented in prime heads.

A. Seed Viability

Data indicated that under different pre-sowing treatments, the seed viability of guava (Table 1) was significantly influenced and varied from 56.00 to 84.00 per cent. Maximum seed viability (84.00%) was recorded in control (T_{13}) which was statistically at par with water soaking for 48 hours (T_{12}) (80.00%). Except for control (T_{13}) and water soaking for 48 hours (T_{12}), seed viability decreased significantly in all the treatments. Minimum seed viability (56.00%) was observed when seeds were soaked in 30% H_2SO_4 solution for 3 minutes ($T_{8(iii)}$).

Table 1: Effect of different pre-sowing treatments on seed viability, days to initiation of germination, days to 50% germination and height of seedling (cm).

Treatment	Seed viability (%)	Days to initiation of germination	Days to 50% germination	Height of seedling(cm)
T_1 (Scraping of seed coat with sandpaper)	69.33	23.33	35.33	2.99
T_2 (Seed soaked in GA_3 100 ppm for 24 hours)	73.33	21.00	31.00	3.98
T_3 (Seed soaked in GA_3 200 ppm for 24 hours	72.00	20.33	30.67	4.06
T_4 (Scraping of seed coat with sandpaper + Seeds soaked in GA_3 100 ppm for 24 hours	68.00	19.33	29.33	4.40
T_5 (Scraping of seed coat with sandpaper + Seeds soaked in GA_3 200 ppm for 24 hours)	66.67	18.67	29.00	**4.59**
T_6 (0.1% solution Potassium hydroxide soaking for 2 minutes)	65.33	19.67	30.00	4.28
T_7 (0.2% solution Potassium hydroxide soaking for 2 minutes)	64.00	20.67	32.33	4.12
T_8 (30% Sulfuric acid soaking) i. Quick dip	65.33	19.00	28.67	4.46
ii. 1 minute	62.67	20.67	32.00	4.30
iii. 3 minutes	**56.00**	21.67	34.67	4.15
T_9 (5% Hydrochloric acid soaking for 2 minutes)	62.67	**17.67**	**27.33**	3.59
T_{10} (10% Hydrochloric acid soaking for 2 minutes	60.00	18.33	28.33	4.16
T_{11} (Hot water soaking at 80^o C) i. quick dip	70.67	22	35.67	3.44
ii. 1 minute	65.33	21.33	31.67	3.90
iii. 3 minutes	61.33	20.66	34.33	3.75
T_{12} (Water soaking for 48 hours)	80.00	24.67	36.00	3.13
T_{13} (Control)	**84.00**	**25.33**	**37.33**	**2.75**
C.D. at 5%	5.58	1.36	2.94	0.19

The decrease in seed viability by various pre-sowing treatments may be due to over-exposure of seed to scarification treatments. Sulphuric acid has a detrimental effect on seeds because acid penetrates the seed via its exposed micropyle and ends up damaging the seeds (Ells, 1963). These results are in accordance with the findings of Musara *et al*. (2015) in okra. Seed viability is also reduced when soaked in hot water for a longer duration.

B. Days to initiation of germination

Data revealed that different pre-sowing treatments had a significant effect on days to initiation of germination (Table 1). Among the pre-sowing treatments seeds soaked with 5% HCl for 2 minutes (T_9) required minimum number of days to initiate germination (17.67), followed by 10% HCl for 2 minutes (T_{10}) and quick dip in 30% H_2SO_4 [T8 (i)] i.e. 18.33 and 19.00, respectively. Maximum number of days (25.33) taken to initiate germination was recorded in the control (T_{13})**.** The time taken by seeds for germination was reduced after pre-soaking of seeds in acid because the acid brings about the softening of hard seed coat by dissolution of deposited lipids, pectic substances and high-density waxes from seed coat which are responsible for hard seediness. This in turn make seed coat soft and more permeable to water and gases and induce germination (Chattopadhyay and Dey 1992). Similar results were observed by Brijwal and Kumar (2014) in guava. They reported that pre-soaking of seeds with hydrochloric acid significantly reduced days to initiation of germination as compared to control. Similar results were also reported by Sharma (2016) in chironji.

C. Days to 50 per cent germination

Different pre-sowing treatments had a significant effect on days to 50 per cent germination (Table 1) of guava. Seeds treated with 5 % HCl for 2 minutes (T_9) requires minimum number of days for 50 per cent germination (27.33) that was followed by 10 % HCl soaking for 2 minutes (T_{10}), quick dip soaking in 30% H_2SO_4 ($T_{8(i)}$), scraping of seed coat with sandpaper + seeds soaked in GA_3 200 ppm for 24 hours (T_5), scraping of seed coat with sand paper + seeds soaked in GA_3 100 ppm for 24 hours (T_4) and 0.1% Potassium hydroxide solution soaking for 2 minutes (T_6) i.e., 28.33, 28.67, 29, 29.33 and 30.00 days, respectively. Maximum number of days (37.33) taken for 50 per cent germination was recorded in control (T_{13}). The minimum number of days taken for 50 per cent germination in 5 % HCL might be due to acid accelerating the water absorption capacity and improving the gaseous exchange for seed germination by softening the hard seed coat (Nayak and Sen 1999). Similarly, Brijwal and Kumar (2014) reported in their study that maximum days to 50 per cent germination of seeds was recorded in control. Whereas, minimum days to 50 per cent germination was recorded in seeds treated with 10 per cent hydrochloric acid for 2 minutes.

D. Germination percentage

Germination percentage was increased significantly with different pre-sowing treatments as compared to control (Fig. 1). The germination per cent ranged from 31.33 per cent to 60.00 per cent. Maximum germination percentage (60.00 %) in guava was recorded with the scraping of seed coat with sandpaper + seeds soaked in GA_3 200 ppm for 24 hours (T_5) which was significantly higher as compared to the other treatments, followed by scraping of seed coat with sandpaper + seeds soaked in GA_3 100 ppm for 24 hours (T_4) (56.00 %) whereas, minimum germination (31.33 %) was observed in control (T_{13}). The results indicated that the seeds of guava possess physical dormancy. The remarkable effect of GA_3 on germination percentage might be due to it acts as a growth regulator for breaking seed dormancy, plays an important role in the germination of seed by leaching out retardants and activates the cytological enzymes which stimulate α-amylase enzyme that converts insoluble sugar into soluble sugar (Babu *et al.,* 2010, Hartmann and Kester, 1979). These results are in conformity with the findings of Boricha *et al.* (2020). They reported that maximum germination percentage of seedling (80.77%) were recorded in seeds treated with GA3 @ 150 mg/l for 24 hours in guava. Similarly, Joshi *et al.* (2015) reported that the germination of acid lime seeds was significantly influenced by GA_3. Results are in accordance with the findings of Joshi *et al*. (2017) and Sharma (2016) in chironji.

E. Height of seedling (cm)

Under different pre-sowing treatments height of seedlings varied from 2.75 cm to 4.59 cm (Table 1). Maximum height of seedlings (4.59 cm) was recorded with the treatment of scraping of seed coat with sandpaper + seeds soaked in GA_3 200 ppm for 24 hours (T_5) that was statistically at par with quick dip soaking in 30 % sulphuric acid solution T_8(i) and scraping of seed coat with sandpaper + seeds soaked in GA_3 100 ppm for 24 hours (T_4) (4.46 cm and 4.40 cm, respectively). Results showed that minimum height of seedling (2.75 cm) was observed in control (T_{13}). The reason might be that GA_3 effect the elongation of internodes because it promotes cell elongation by improving osmotic uptake of nutrients resulting in increasing plant height (Feucht and Watson 1958, Krishnamoorthy and Sandooja 1981). Gibberellic acid regulates stem elongation by loosening cell walls, increasing cell wall extensibility, accelerating wall synthesis, narrowing the rigidity of cell wall and boosting cell division, all of which contribute to increased growth. These chemicals have a direct impact on stem elongation by increasing the synthesis of IAA (Leopold and Kriedeman, 1983).

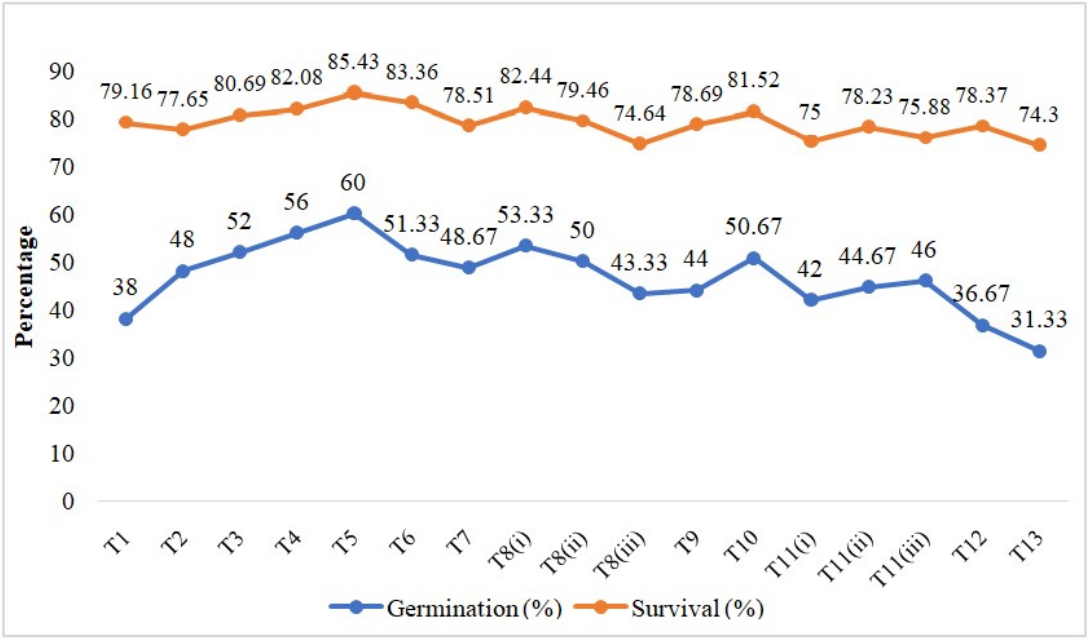

Fig. 1: Effect of different pre-sowing treatments on germination percentage and survival percentage of guava seedlings.

These results are in conformity with the findings of Vasantha *et al.* (2014) in tamarind, Reshma and Simi (2019) in mango and Chiranjeevi *et al.* (2017) in aonla. They reported that maximum height of seedlings was observed in GA_3 200 ppm.

F. Survival percentage

Survival percentage of guava was significantly affected by the different pre-sowing treatments (Fig. 1). Survival percentage under different pre-sowing treatments ranged from 74.30 per cent to 85.43 per cent. Maximum survival percentage (85.43 %) was observed in scraping of seed coat with sandpaper + seeds soaked in GA_3 200 ppm for 24 hours (T_5) that was followed by seed soaked in 0.1% KOH for 2 minutes (T_6), quick dip soaking in 30% H_2SO_4 solution [T_8(i)] and scraping of seed coat with sandpaper + seeds soaked in GA_3 100 ppm for 24 hours (T_4) *i.e.* 83.36, 82.44 and 82.08%, respectively. Minimum survival percentage (74.30 %) was observed in control (T_{13}). The possible cause for the higher survival percentage was the early germination of guava seeds which helps in successful acclimatization and establishment of seedlings in field conditions. The observation analogues to these findings were observed by Joshi *et al*. (2017) in chironji. They concluded that seeds treated with GA_3 (200 ppm) for 24 hours results in maximum survival percentage (64.13 %). Results are also in correspondence with the findings of Manekar *et al.* (2011) in aonla, Dinesh *et al.* (2019) and Banyal *et al.* (2022) in guava.

CONCLUSION

Based on the results of the experiment it may be concluded that minimum days to initiation of germination and 50% germination in guava were observed in pre-sowing seed treatment with 5% hydrochloric acid solution for 2 minutes; while highest germination percentage, survival percentage and maximum height of seedlings were recorded under scraping of seed coat with sandpaper + seeds soaked in GA_3 200 ppm for 24 hours.

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Conflict of Interest. None.

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