Indian Journal of Agricultural Sciences **93** (6): 664–667, June 2023/Short Communication
https://doi.org/10.56093/ijas.v93i6.136517

Effect of pre-sowing treatments on germination, growth and vigour attributes of white sapote (*Casimiroa edulis*)

MURALIDHARA B M[1]*, RAJENDIRAN S[1], MADHU G S[1], RANI A T[1], DEEKSHITH D[1] and MITHUN P M[1]

Central Horticultural Experiment Station, Chettalli, Kodagu, Karnataka 571 248, India

Received: 17 May 2023; Accepted: 31 May 2023

Keywords: Chemicals, Germination, Growth regulators, Scarification, White sapote

White sapote (*Casimiroa edulis* Llave & Lex) is an exotic fruit crop commonly known as "Casimiroa, Mexican apple" and belongs to family Rutaceae. It is native to highlands of Mexico and Central America and is mainly grown in USA, Mexico, Guatemala and South Africa (Yahia and Gutierrez-Orozco 2011). The fruits are a rich source of β -carotene and vitamin-C and are used for preparation of juice, sherbet, ice cream, biscuit, milkshake and jam (Osama 2002). The extracts of seeds, leaves and bark contain casimirosine which has been used in Mexico as sedatives, soporifics and tranquilizers mainly (Mora *et al*. 2005). Another important phytochemical zapotin has powerful anti-cancerous activity, helps to prevent colon cancer and also helps to reduce pain caused by rheumatism and arthritis (Murillo *et al*. 2007). The white sapote is commonly propagated through seeds. It is also propagated through grafting in other countries (Morton 1987). The healthy, strong and vigourous rootstock plays a significant role in success of graft union (Patel *et al.* 2017). Due to the existance of hard seed coat, the poor and delay germination was reported in white sapote and also seedlings take more time to attain graftable size. Many studies proved that pre-sowing treatments helped in quick germination and high seedling vigour in mango, phalsa and aonla (Muralidhara *et al.* 2016, Chiranjeevi *et al.* 2017, Muralidhara *et al.* 2017). Hence, this study was undertaken to know the influence of pre-sowing treatments on seed germination and growth attributes of white sapote.

The experiment was carried out under polyhouse conditions at Central Horticultural Experiment Station, Chettalli, Kodagu, Karnataka during the year 2022. The fully matured and ripened white sapote fruits were selected for the experiment by rejecting the damaged and malformed fruits. The seeds were extracted manually from fruits, healthy and heavier seeds weighing 6–8 g were used for the experiment (Fig 1). The experiment was conducted in complete randomized design with three replications and seven treatments, viz. T_1, control (no pre-sowing treatment); T_2, water soaked; T_3, potassium nitrate 0.5%; T_4, potassium nitrate 1%; T_5, GA_3 100 ppm; T_6, GA_3 200 ppm and; T_7, seed coat removal. Seeds of white sapote were soaked for 24 hours for all the treatments except control and seed coat removal. The hard seed coat was removed with the help of knife and secateurs without damaging the embryo (Fig 1). The seeds were sown in black polythene covers (5 inch × 6 inch) containing regular potting mixture, i.e. two parts of red soil, one part sand and one part FYM. The watering and weeding was done regularly. The observations were recorded on daily basis for germination characters, viz. initiation of germination, 50% of germination, complete germination. Six months after sowing, stem girth (cm), plant height (cm), number of leaves, plant fresh weight (g) and dry weight (g) were recorded. The germination (%), rate of germination, vigour index-I (cm), vigour index-II (g) was calculated as per the formulas given by Bewley and Black (1982). Correlation studies were also done to know relationship between the germination, plant growth and vigour of seedlings. The experimental results were analyzed statistically using WASP 2.0 software.

Germination parameters of white sapote were significantly influenced with pre-sowing treatments (Table 1). The seeds without seed coat and KNO_3 0.5% had taken minimum days for germination initiation, 50% germination and complete germination whereas maximum days for initiation, 50% and complete germination was found in the treatment control. Similar findings were also reported in mango, phalsa and custard apple (Gharge *et al.* 2011, Muralidhara *et al.* 2016, Muralidhara *et al.* 2017). The faster germination in seed coat removal might be due to the association of seed coat in obstruction of water uptake which leads to a mechanical control on the growth of embryo (Muralidhara *et al.* 2016). The delay in germination of non-treated seeds could be due to the thick endocarp that acts as obstacle for escape of inhibitors. The highest germination (%) and germination rate was recorded in seed coat removal treatment followed by seeds treated

[1]Central Horticultural Experiment Station, Chettalli, Kodagu, Karnataka. *Corresponding author email: murlidhara.m@icar.gov.in

Fig 1 White sapote. a, Fruits; b, Seeds with seed coat; c, Seeds without seed coat and; d, Seedlings.

with KNO_3 0.5% and minimum germination per cent was noticed in GA_3 200 ppm which was at par with control, 100 ppm GA_3 and 1% KNO_3 (Table 1). The low rate of germination was observed in control which was on par with GA_3 200 ppm. The removal of seed coat and seeds treated with KNO_3 0.5% helps to break the barriers against the escape of inhibitors enhances the germination. It also helps for easy water uptake and faster intiation enzymatic activity in seed. The simple absorption of water boosts the activity of α-amylase and aids in the early development of plumules. Shashikala and Madhulika (1992) reported KNO_3 and $MgSO_4$ at 200 ppm was effective in improving germination in white sapote. The variance in germination rate caused by the existence of a hard seed coat and the concentration of growth regulators utilized, which may have impacted the number of days needed for germination, a factor that determines germination rate (Muralidhara *et al.* 2015). The similar results were corroborated by Samir

Table 1 Effect of presowing treatments on germination parameters of white sapote

Treatment	Days taken to germination	Days taken to 50% germination	Days taken to complete germination	Germination (%)	Rate of germination
T_1	21.33	27.67	41.33	68.87	0.024
T_2	19.33	25.00	35.00	70.00	0.029
T_3	15.33	23.00	30.67	82.23	0.032
T_4	19.67	26.00	33.33	66.67	0.030
T_5	20.67	27.33	33.00	68.90	0.030
T_6	20.33	25.00	37.33	66.63	0.027
T_7	15.00	22.67	30.33	92.20	0.033
CV (%)	4.92	4.97	6.46	5.23	6.210
CD (P=0.01)	2.25	3.05	5.41	9.35	0.004

Refer to Methodology for treatment details.

Table 2 Effect of presowing treatments on growth and vigour of white sapote

Treatment	Plant height (cm)	Stem girth (cm)	No. of leaves	Fresh weight (g)	Dry weight (g)	Vigour index-I	Vigour index-II
T_1	18.70	0.23	3.67	4.80	1.19	1288.10	81.93
T_2	20.43	0.26	5.33	6.60	1.53	1431.10	107.00
T_3	24.67	0.31	5.67	8.32	2.63	2024.43	216.90
T_4	22.00	0.28	5.00	6.97	1.77	1464.47	117.33
T_5	21.33	0.27	5.00	7.37	2.07	1471.10	143.10
T_6	19.17	0.24	4.33	4.53	1.10	1280.57	73.97
T_7	29.00	0.34	6.33	11.34	3.39	2675.57	312.20
CV (%)	6.47	5.98	12.23	6.40	8.87	8.57	9.72
CD (P=0.01)	3.49	0.04	1.50	1.11	0.42	346.28	35.51

Refer to Methodology for treatment details.

et al. (2015), Muralidhara *et al.* (2016) and Muralidhara *et al.* (2017).

Data (Table 2) revealed that seed coat removal recorded significantly higher stem girth, plant height and leaf number at six months after sowing which was at par with 0.5% KNO_3. Seed coat removal increases the vigour of seedlings due to early initiation of germination; it may also due to the development of a good root system for nutrient uptake, which also increases the photosynthetic activity due to exposure of leaves to sunlight. Similar results were also reported by Muralidhara *et al.* (2016). The early onset of germination and the formation of a healthy root system for nutrient intake boost the vigour of seedlings and exposure of leaves to sunlight increases photosynthetic activity. Muralidhara *et al*. (2016) reported that seed coat removal treatment significantly enhanced seedling height (19.5 cm), number of leaves (8.3), seedling girth (0.62 cm) and leaf area (219.2 cm^2), during the year of experimentation. The similar results were also reported by Samir *et al.* (2015) in Khirni. The maximum fresh weight, dry weight, vigour index-I and II was recorded in seed coat removal treatment followed by KNO_3 0.5%. Similar results were corroborated by the findings of Samir *et al.* (2015) and Muralidhara *et al.* (2016). This might have happened due to fact that seed coat removal resulted in early initiation of seedlings and development of good rootsystem which helps for sufficient nutrient uptake.

The correlation matrix (Table 3) indicated the early initiation of seedlings showed positive correlation with days taken for 50% of germination and complete germination and highly significant negative correlation for vigour characters. The fresh weight and dry weight of seedlings showed highly positive correlation for vigour index-I and II. The correlation results clearly showed that, early emergence of seedlings will have maximum plant vigour and attains early grafting stage. Highly positive correlation between initiation of germination and 50% of germination (r=0.932**); length and dry weight of seedling; dry weight

Table 3 Correlation matrix for different germination and seedling growth characters of white sapote

	DIG	DFG	DCG	GP	RG	PH	SG	NL	FW	DW	VI-I	VI-II
DIG	1.00											
DFG	0.93	1.00										
DCG	0.79	0.69	1.00									
GP	-0.93	-0.80	-0.65	1.00								
RG	-0.82	-0.73	-1.00	0.71	1.00							
PH	-0.91	-0.77	-0.83	0.93	0.87	1.00						
SG	-0.92	-0.78	-0.88	0.91	0.91	0.99	1.00					
NL	-0.86	-0.80	-0.93	0.79	0.96	0.90	0.92	1.00				
FW	-0.85	-0.67	-0.86	0.89	0.89	0.97	0.97	0.92	1.00			
DW	-0.88	-0.69	-0.85	0.92	0.88	0.98	0.98	0.89	0.98	1.00		
VI-I	-0.92	-0.79	-0.74	0.98	0.79	0.98	0.96	0.85	0.94	0.96	1.00	
VI-II	-0.91	-0.74	-0.79	0.96	0.83	0.99	0.97	0.87	0.97	0.99	0.99	1.00

DIG, Days taken for initiation of germination; DFG, Days taken for 50% of germination; DCG, Days taken for complete germination; GP, Germination percentage; RG, Rate of germination; PH, Plant height; SG, Stem girth; NL, Number of leaves; FW, Fresh weight; DW, Dry weight; VI-I, Vigour Index-I; VI-II, Vigour Index-II.

and vigour index was reported by Reshma and Simi (2021) in mango. Hence, removal of seed coat in white sapote before sowing and soaking seeds in KNO_3 for 24 hr will helps to improve the germination percent, seedling growth and vigour of the plants and it also helps seedlings to attain early graftable stage.

SUMMARY

White sapote is an exotic fruit crop gaining popularity at present days due to the occurrence of high medicinal value. The present experiment was carried out under polyhouse conditions at Central Horticultural Experiment Station, Chettalli, Kodagu, Karnataka during 2022 with an objective to know the effect of pre-sowing treatments on germination and growth attributes of white sapote. The experimental results revealed that the initiation of germination and complete germination was faster in seed coat removal treatment and KNO_3 0.5% treated seeds as compared to control. The high germination per cent was also reported in seed coat removal followed by KNO_3 0.5% and minimum was noticed in GA_3 200 ppm which was on par with KNO_3 1% and control. The seedling growth and vigour traits were also found superior in seed coat removal compare to other treatments. The correlation studies showed that, the initiation of germination had positive correlation with days taken for 50% and complete germination and negative correlation with other plant characters. In conclusion, the seed coat removal and soaking of seeds in KNO_3 0.5% improves seed germination seedling vigour which helps in attaining early grafting stage.

ACKNOWLEDGEMENT

The authors are grateful for the financial support provided by Indian Council of Agricultural Research, Ministry of Agriculture and Farmer's Welfare, GOI.

REFERENCES

Bewley J D and Black B M. 1982. *Physiology and Biochemistry of Seed Germination*, Vol II, p. 375. Springer Verlag, New York.

Chiranjeevi M R, Muralidhara B M, Sneha M K and Shivanand H. 2017. Effect of growth regulators and biofertilizers on germination and seedling growth of Aonla (*Emblica officinalis* Gaertn). *International Journal of Current Microbiology and Applied Sciences* **6**(12): 1320–26.

Gharge V R, Kadam A S, Patil V K, Lakade S K and Dhomane P A. 2011. Effect of various concentrations of GA_3 and soaking period on seed germination of custard apple (*Annona squamosa*). *Green Farming* **2**(5): 550–1.

Mora S, Diaz-Veliz G, Lungenstrass H, Garcia-Gonzalez M, Coto-Morales T, Poletti C, De Lima T C M, Herrera-Ruiz M and Tortoriello J. 2005. Central nervous system activity of the hydroalcoholic extract of *Casimiroa edulis* in rats and mice. *Journal of Ethnopharmacology* **97**(2): 191–7.

Morton J. 1987. White sapota. *Fruits of Warm Climates*, pp. 191–96. University of Florida, Miami, USA.

Muralidhara B M, Reddy Y T N, Akshita H J and Srilatha V. 2015. Effect of presowing treatments on germination, growth and vigour of polyembryonic mango seedlings. *Environment and Ecology* **33**(3): 1014–18.

Muralidhara B M, Reddy Y T N, Srilatha V and Akshitha H J. 2016. Effect of seed coat removal treatments on seed germination and seedling attributes in mango varieties. *International Journal of Fruit Science* **16**(1): 1–9.

Muralidhara B M, Singh R S and Veena G L. 2017. Effect of plant growth regulators and chemicals on seed germination of Ker (*Capparis decidua* L.) and Phalsa (*Grewia subinaequalis*). *Progressive Horticulture* **49**(1): 24–26.

Murillo G, Hirschelman W H, Ito A, Moriarty R M, Kinghorm A D, Pezzuto, J M and Mehta R G. 2007. Zapotin, a phytochemical present in a Mexican fruit, prevents colon carcinogenesis. *Nutritionand Cancer* **57**(1): 28–37.

Osama Samaha R A. 2002. Characteristics and utilization of white sapote (*Casimiroa edulis* L. Lave) fruits. *Alexandria Journal of Agricultural Research* **47**(3): 49–53.

Patel C R, Heiplanmi Rymbai, Patel N L, Ahlawat T R, Tandel Y N, Saravaiya S N, Swamy G S K, Nataraja K H and Sabarad A I. 2017. Rose apple (*Syzygium jambos* (L.) Alston). *Underutilized Fruit Crops: Importance and Cultivation* 1134–58.

Reshma U and Simi S. 2021. A correlation study of pre-sowing treatments, sowing positions and age of stones after extraction from fruit on germination of mango: Study on germination of mango. *Journal of AgriSearch* **8**(2): 99–107.

Samir M, Rai R and Prasad B. 2015. Seed germination behaviour as influenced by pre-sowing treatments in khirni. *Journal of Hill Agriculture* **6**(1): 132–5.

Shashikala K and Madhulika G. 1992. Studies on the effect of certain inorganic chemicals on the germination behavior of the seeds of *Ephedra foliate* Boiss. *Physiological Research* **2**(1): 117–9.

Yahia E M and Gutierrez-Orozco F. 2011. White sapote (*Casimiroa edulis* Llave & lex). *Postharvest Biology and Technology of Tropical and Subtropical Fruits*, pp. 474–83. Woodhead Publishing Limited, England.