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INFLUENCE OF PRE-SOWING SEED TREATMENTS ON THE PERFORMANCE OF SOURSOP (*ANNONA MURICATA* L.) SEEDLINGS

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Abstract

An experiment was carried out to standardize the seed treatment practice on soursop seedlings was laid out in Randomized Block Design, replicated thrice with twelve treatments. It consisted of scarified round the seed (T_1), scarified at hilum point (T_2), scarified at hilum and distal point (T_3), water soaking for 24 hours (T_4), water soaking for 48 hours (T_5), water soaking for 72 hours (T_6), conc. H_2SO_4 for 5 min (T_7), conc. H_2SO_4 for 10 min (T_8), conc. H_2SO_4 for 15 min (T_9), GA_3 250 ppm for 24 hours (T_{10}), GA_3 500 ppm for 24 hours (T_{11}) and control (T_{12}). The results of the experiment revealed that, among the various seed treatments tried, GA_3 500 ppm for 24 hours (T_{11}) achieved maximum value for the characters like germination percentage, shoot length, root length, number of leaves, stem girth and vigour index of the seedlings which was followed by GA_3 250 ppm for 24 hours (T_{10}).

Key words : Soursop, seed treatments, vigour index, rooth length, GA_3.

Introduction

Soursop (*Annona muricata* L.), which belongs to Annonaceae family is an evergreen tree species known for its anti-cancer properties, thanks to its annonaceous acetogenins content. It is a native of Central America. It bears the largest fruit among Annonas. It is mostly distributed in tropical and subtropical regions of the world. Soursop grows on a limited scale in Southern India, in states like Tamil Nadu, Karnataka, Andhra Pradesh and Kerala. It also thrives wild throughout the Southern Sub-tropical India. It does not tolerate frost and grows well in well-drained and semi-dry soil upto an elevation of 300 MSL. In India, soursop flowers and fruits during the months of April to October. The soursop is truly tropical. The optimal range of latitude is between 27ºN and 22.5ºS (Nakasone and Paull, 1998). It grows and produces well at 21 to 30ºC, being very sensitive to severe changes in temperature, especially if the limit of 12ºC is reached (Pinto and Silva, 1994). Some popular annonas are the true custard apple, or bullock's heart or Ramphal (*A. reticulata* Linn.), the sugar apple or sweetsop or Sitaphal or Custard apple (*A. squamosa* Linn.) and the cherimoya (*A. cherimola* Mill.). The tree is low-branching and bushy but slender because of its upturned limbs, and reaches a maximum of 7.5-9 m in height (Morton, 1987). The fruit consists of about 67.5% edible white pulp with a pleasing fragrance and flavor. It is a good source of vitamins B and C with some calcium and phosphorus. Some investigators reported the medicinal values of this 'miracle plant' such as anti-cancer (Wang *et al*., 2002), anti-tumor (Kim *et al*., 1998), anti-parasitic (Jaramillo *et al*., 2000), anti-viral (Betancur-Galvis *et al*., 1999) and antioxidant (Gavamukulya *et al*., 2014) properties. Tea prepared from soursop leaves and stem has recently been gaining wider popularity and shade dried leaves and stem fetches very premium prices in e-commerce vendors. It is more convenient to store and transport dried leaves and stem as opposed to fruits which are highly perishable and may not ripen properly in fluctuation of storage temperature. Therefore, due to changing market demand, leaf production of soursop would be a lucrative business since the leaves contain annonaceous acetogenins. Moreover, economic returns can be obtained in a short period of time since there is no need to wait for the plants to attain reproductive stage like in the case of fruit production. Since the emphasis is to produce leaves, seed propagation is considered as the option when compared to vegetative methods of propagation to save time. Poor emergence of soursop seedlings is as a result of poor storability of the seeds. Soursop seeds lose viability easily and do not store for a very long time and is, therefore, best sown

without delay (Ken and Robert, 2011). Soursop has thick black seed coat that reduces water inhibition during the first stage of germination and therefore requires some pre-sowing treatments to enhance germination and seedling emergence (Okoli *et al*., 2016). Owing to its immense medicinal properties, wide range of uses and its lucrative price, it would be of great national importance to popularize this plant among the growers. Hence, an investigation was conducted to evaluate various seed treatment techniques on the performance of soursop seedlings.

Materials and Methods

The experiment was conducted in Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar (Tamil Nadu), India; during 2015-2017. An experiment was conducted in Randomized Block Design with three replications and twelve treatments. The treatments were coded as mentioned below: $\mathbf{T_1}$ – scarified round the seed, $\mathbf{T_2}$ – scarified at hilum point, $\mathbf{T_3}$ – scarified at hilum and distal point, $\mathbf{T_4}$ – water soaking for 24 hours, $\mathbf{T_5}$ – water soaking for 48 hours, $\mathbf{T_6}$ – water soaking for 72 hours, $\mathbf{T_7}$ – conc. H_2SO_4 for 5 min, $\mathbf{T_8}$ – conc. H_2SO_4 for 10 min, $\mathbf{T_9}$ – conc. H_2SO_4 for 15 min, $\mathbf{T_{10}}$ – GA_3 250 ppm for 24 hours, $\mathbf{T_{11}}$ – GA_3 500 ppm for 24 hours and $\mathbf{T_{12}}$ – control. Soursop (*Annona muricata* L.) fruits were procured from a fruit dealer in Bangalore. The fruits were kept for ripening. After it ripened seeds were extracted, washed and only the sinking seeds were taken. The selected seeds were treated and sown in polybags. Polythene bags of 200 gauge 20 × 10 cm thickness were used for raising soursop seedlings. The pot mixture comprised of sand, red earth and farm yard manure (FYM) in equal proportions. The selected healthy seeds were sown in the polythene bags and maintained in the shade net with necessary care. Watering was done once in two days for the seeds which were sown in the polythene bags. Weeding was done, regularly whenever the weeds appeared. Germination of seeds started from 24 days to 31 days after sowing and continued for 35 to 45 days.

Results and Discussion

The data pertaining to germination percentage and performance of soursop seedlings was recorded and presented in table 1. Significant response among the various pre-sowing seed treatments was observed in germination per cent. The highest value for germination per cent (100%) was obtained by GA_3 500 ppm for 24 hours ($\mathbf{T_{11}}$). It was followed by GA_3 250 ppm for 24 hours ($\mathbf{T_{10}}$) (96.73%). The least value (50.00%) was observed in control. The results agree with the findings of Gonzalez *et al*. (2005) who reported that soaking of soursop seeds in GA_3 500 ppm showed higher germination percentage. Further, the result is in close conformity with the findings of Stino *et al*. (1996), who reported that soaking *Annona squamosa* seeds in GA_3 500 ppm for 24 hours gave the highest germination percentage of 84. These findings may be due to effect of GA_3, which helps in the synthesis of enzymes and one of them is á-amylase which converts the starch into simple sugars during the process of germination. These sugars provide energy that is required for various metabolic and physiological process associated with germination. Other enzymes activated by GA include those which weaken the seed coat and allow the axis to burst through. GA also enhances cell elongation, so the radicle can push through the endosperm and seed coat that restrict its growth (Hartman and Kester, 1979). The highest value for shoot length (40.15 cm) was observed in GA_3 500 ppm for 24 hours ($\mathbf{T_{11}}$) at 180 days after sowing (DAS). It was followed by GA_3 250 ppm for 24 hours ($\mathbf{T_{10}}$) (39.63 cm). The least value (33.24 cm) was observed in control. Similar results were also reported by Parmar *et al*. (2016) that *Annona squamosa* seeds treated with GA_3 200 ppm for 12 hours resulted in greatest stem girth. Ratan and Reddy (2004) also reported similar results that treatment of *Annona squamosa* seeds with 200 ppm of GA_3 resulted in the highest stem diameter. Aatla and Srihari (2013) reported that treatment of mango cv. alphonso extracted kernel with GA_3 500 ppm resulted in greater seedling height and internodal length. Increase in shoot length with GA_3 treatment might be because it activated α- amylase, which digested the available carbohydrate into simple sugar so that energy and nutrition were easily available to faster growing seedlings (Vishwakarma, 2013). Significant response among the various pre-sowing seed treatments was observed in root length at 180 DAS. The highest value for root length (21.79 cm) was observed in GA_3 500 ppm for 24 hours ($\mathbf{T_{11}}$), which was on par with GA_3 250 ppm for 24 hours ($\mathbf{T_{10}}$) (21.50 cm). The least value (18.89 cm) was observed in control. The results are in good harmony with the report of Vijayakumar *et al*. (1991) who reported that guava seeds treated with GA_3 produced higher germination percentage, shoot length, root length and seedling vigour index. The increase in root length with GA_3 treatment might be due to the fact that this hormone increased osmotic uptake of nutrients, causing elongation of the cells in the sub-apical region of roots as reported by Salisbury and Ross (1988). Similar results of increased root growth with GA_3 pre-sowing treatment was also reported by Pampanna and Sulikeri (2001) in sapota cv.

Table 1 : Effect of pre-sowing seed treatments on germination and performance of soursop seedlings.

Treatments	Germination %	Shoot length (cm)	Root length (cm)	Number of leaves	Stem girth (cm)	Vigour index
T_1 - Scarified round the seed.	85.24 (67.41)	38.87	21.09	18.33	2.19	5246.50
T_2 - Scarified at hilum point.	75.45 (60.30)	38.21	20.63	18.33	2.00	5148.50
T_3 - Scarified at hilum and distal point.	81.02 (64.17)	38.38	20.72	18.33	2.09	5171.25
T_4 - Soaking in water for 24 hours.	65.82 (54.22)	37.72	20.32	16.67	1.87	4353.00
T_5 - Soaking in water for 48 hours.	87.50 (69.30)	38.99	21.15	18.67	2.28	5262.25
T_6 - Soaking in water for 72 hours.	91.62 (73.17)	39.09	21.21	18.67	2.32	5276.25
T_7 - Conc. H_2SO_4 for 5 minutes.	60.50 (51.06)	37.60	20.26	16.33	1.83	4339.50
T_8 - Conc. H_2SO_4 for 10 minutes.	70.96 (57.39)	38.15	20.55	17.67	1.98	4402.50
T_9 - Conc. H_2SO_4 for 15 minutes.	54.31 (47.47)	37.09	19.98	13.67	1.73	2853.50
T_{10} - GA_3 250 ppm for 24 hours.	96.73 (79.58)	39.63	21.50	20.67	2.52	6113.00
T_{11} - GA_3 500 ppm for 24 hours.	100.00 (90.00)	40.15	21.79	22.33	2.61	6194.00
T_{12} - Control	50.00 (45.00)	33.24	18.89	13.33	1.69	2606.50
S. Ed	1.10	0.14	0.07	1.41	0.03	91.13
CD (P=0.05)	2.28	0.34	0.14	0.85	0.07	188.99

The values in parentheses are arcsine transformed**.**

Kalipatti. The highest value for number of leaves (22.33) was observed in GA_3 500 ppm for 24 hours (T_{11}) at 180 DAS. It was followed by GA_3 250 ppm for 24 hours (T_{10}) (20.67). The least value (13.33) was observed in control which was on par with conc. H_2SO_4 for 15 minutes (T_9) (13.67). The result is in close conformity with the report of Archana *et al*. (2015), who observed that treatment of *Annona squamosa* seeds with GA_3 50 ppm for 48 hours resulted in maximum number of leaves. Similar results were obtained by Ram Chandra and Govind (1990) in guava in which maximum plant height, number of leaves and size of leaves were obtained in seeds treated with GA_3 3000 ppm. GA_3 moves into the shoot apex, increases cell division and cell growth apparently leading to increased development of young leaves (Salisbury and Ross, 1988). Therefore, the maximum number of leaves per seedlings in the present study with GA_3 may be due to the promotion of physiological processes and stimulatory action of GA_3 to form new leaves at a faster rate. The maximum stem girth of 2.61cm was observed in GA_3 500 ppm for 24 hours (T_{11}) followed by 2.52 cm in GA_3 250 ppm for 24 hours (T_{10}). The smallest stem girth was recorded in control (1.69 cm) at 180 DAS. Similar results of increased stem girth with GA_3 pre-sowing treatment were reported by Rashmi *et al*. (2007) in Aonla. Maximum stem girth in case of seedlings presoaked in GA_3 solution might be due to the fact that it plays a vital role in stimulation of cambium and its immediate cell progeny resulted in cell elongation and cell division of stem portion there by increased girth of seedling (Manoj and Rajesh, 2013). The highest value for vigour index (6194.00) was observed in GA_3 500 ppm for 24 hours (T_{11}), which was on par with (6113.00) GA_3 250 ppm for 24 hours (T_{10}) at 180 DAS. The least value (1982.00) was observed in control. Similar result was reported by Avinash Norman and Manivannan (2012), who found that treating noni seeds in GA_3 1000 ppm for 24 hours improved seed germination, number of days taken for initiation of germination and seedling vigour. The highest seedling vigour index shown by GA3 treatment might be due to increase in germination percentage and seedling height which have contributed to higher vigour index. Based on the observation, pre-sowing seed treatment with GA_3 500 ppm for 24 hours was adjudged as the promising method for obtaining the best seed germination and seedling growth.

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