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Influence of Seed Treatments on Germination and Seedling Growth of Soursop Annona Muricata

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Abstract
At the Federal University of Agriculture Abeokuta, Ogun State, Nigeria, study was carried out in the screenhouse of College of Plant Science and Crop Production (COLPLANT) to determine the germination of seeds and seedling growth of *Annona muricata* as affected by different seed treatments. The seeds that were extracted from fruit, depulped, washed, air dried for 48 hours and stored for 38 days were subjected to the following seed treatments prior to sowing: soaking in cold water for 72 hours, soaking in cold water for 96 hours, scarified and control. The result indicated significant effect only at 22 days after sowing (DAS) in seeds soaked for 72 hours with 13 % germination compared to all other treatment that has no germinated seed. However at 25 DAS higher germination percent was recorded in the seeds soaked in water with 96 hour soaking (40%) and trend was consistent until 43 DAS with 67 % which was similar to untreated seeds. It was observed that scarification resulted in consistently lowest values (27 -50 %). The seedling growth was enhanced by seed treatment especially soaking in cold water compared to untreated seeds that gave abnormal seedlings. The seedlings from 96 hours soaking had the tallest seedling (14 cm) 71 DAS while other treatment had values in the range of 11 - 11.7 cm. Earlier leaf formation was encouraged by soaking in cold water compared to scarification and control.
Key words: *Soursop, seed treatment, germination, seedling, growth, abnormal seedlings*

Introduction

The name *Annona* is derived from Latin meaning “annual harvest”. *Annonas* are shrubs or small trees with low-branching and bushy slender upturned branches and 5.0 to 9 m tall. The leaf is alternate, smooth, glossy, evergreen, dark green on the upper surface, lighter beneath in colour and varies in shape from oblong to narrow obovate and pointed at both ends. The size varies between 6.25 - 20 cm long and 1 2.5 - 6.25 cm wide. The flowers, which are borne singly, may emerge anywhere on the trunk, branches or twigs. The fruit could be oval, heart-shaped or curved in shape. The fruit is 10 - 30 cm long and up to 15 cm in width and 4.5 - 6.8 kg in weight. The fruit is covered with a reticulated, leathery-appearing but tender, inedible, bitter skin from which protrude few or many stubby and curved, soft, pliable "spines". Its inner surface is cream-colored and granular and separates easily from the mass of snow-white, fibrous, juicy segments. The aroma is somewhat pineapple-like with unique musky, sub acid to acid flavour. Each fertile segment contains a single oval, smooth, hard, black seed, 1.25-2 cm long with about 100 to 200 per fruit (SCUC. 2006; Leena, 2010).

Annonas are economically important in many countries of Africa and Asia, South, North and Central America. The yields vary from 8 to 25 t/ha. The species with the strongest consumer demand and are cherimoya, soursop and sugar apple. The fruits from these three species are delicate and are marketed mainly in local, regional or national trade, and only rarely internationally.

Annona muricata is the largest-fruited of the family Annonaceae and belongs to the tropical region. It is variously called *guanabana* (Spanish-speaking countries); as *guanaba* (E1 Salvador); *huanaba* (Guatemala), *zopote de viejas* or *cabeza de negro* (Mexico), *catoche* or *catuche* (Venezuela), *anona de puntitas* or *anona de broquel sinini* (Argentina, as; in Bolivia), *araticum do grande, graviola*, or *jaca do Para* (Brazil), *sorsaka* or *zunrzak* (the Netherlands Antilles) (Morton, 1987) while In Nigeria it is called *sopsop* or *shawa shawa* Soursop is a multipurpose plant with acceptable nutritional value as food products, sources of medicinal and industrial products as well as contributing directly to food security and supplementary household income for small- and medium-scale farmers (SCUC, 2006). Presently there is a noticed change in attitude in the past 5 - 10 years among policy makers and the public in respect of the quality of life as related to the quality and diverse sources of food. Vitamins and other micronutrients are for instance being searched in crops and plant species with greater emphasis than in the past in recognition of their role in combating diet imbalances. In developing countries the problem of ‘hidden hunger’ in children and older people as more vulnerable social groups is increasingly being recorded. With the current strong consumer demand for soursop fruits and other parts and its increased popularity in this part of the world due to some medicinal benefits and cure for cancer (FAO, 1997, SCUC 2006). Germination of the seed under sub-optimal conditions has been found to be delayed for 2 - 3 months but can occur in three weeks if condition is okay. Seedlings are usually ready for field transplant in 6 - 9 months therefore need to examine how best to raise healthy seedlings for field establishment cannot be over

emphasised. It is against this backdrop that the study to examine the effects of seed treatments on germination was carried out.

Materials and methods

Seeds of *Annona muricata* were extracted from ripe fruit, depulped, washed; air dried for 48 hours and stored for 38 days. The seeds were poured into cold water and those that sank were selected for treatments. The seeds treatments were soaking in cold water for 72, 96 hours and slight abrasion at both sides with a file while untreated seeds served as control. The seeds were sown in standard 10 cm x15cm nursery bag filled with top soil and kept moist. Data were collected on days to germination, germination percentage, vegetative growth parameters and occurrence of normal and abnormal seedling. The experiment was a CRD with three replicates. Data were analysed with ANOVA and means separated with LSD $p \leq 0.05$.

Results

Germination and days to germination

The treatment imposed on the seeds had significant effects on days to germination and germination percentage of soursop seeds (Table 1). The earliest germination occurred 22 days after sowing (DAS) with seeds soaked in water for 72 hours having highest germination percentage (13 %) and other treatments recorded no germination. However, at 25 DAS, seeds soaked for 96 hours in cold water had highest germination (40 %) and this trend was maintained till 43 DAS with 67 % which was at par with untreated seeds. Between 22 and 28 DAS scarified and untreated seeds had least germination percentage (27 % and 30 %) which were comparable to other treatments. However, at 71 DAS the cumulative germination percent was highest (100) in seeds soaked in cold water for 96 hours and was comparable to 72 hours soaking with 96.67 %. The scarified seeds and those not treated had comparable lower values and were 80 % and 76.67 % (Figure 1).

Normal and abnormal seedlings

The seedlings of *Annona muricata* exhibited abnormal seedlings principally in the untreated seeds. They were grossly deficient in morphological structures and abnormalities observed were seed coat retention, poor root development and poor leaf formation. The normal seedling which had well developed morphological structures in terms of number of leaves root development and vigour. The morphological development observed in normal seedlings could enhance nutrient absorption and uptake as well as enhanced photosynthesis that will result in vigorous plantable seedlings (Plates 1 a- h and 2 a-b)

Vegetative growth

Number of leaves

The effect of seed treatment was not significantly different for the vegetative growth of soursop seedlings. The seeds soaked in cold water for 72 hours had the maximum number of leaves (5) which was comparable to other treatments 74 DAS. The effect of the soaking duration was comparable and enhanced better and earlier leaf formation compared to scarification and control which had comparable values with soaked seeds at 74 DAS only (Table 2).

Plant height

The effect of seed treatments on the plant height was only significant at 71DAS (Table 3). Seeds soaked in cold water for 96 hours consistently had tallest seedlings with maximum value (14 cm) 71 DAS. Scarified seeds and untreated seeds had comparable values (9.0 - 11.3 cm) which were lower than soaking in cold water.

Stem diameter and Root length

The seed treatments were not significant on the stem diameter and the root length of normal seedlings as these parameters had comparable values (Table 4). The seeds soaked for 72 hours had sturdier seedlings (2.7 mm) which was comparable to other treatments with values (2.2 - 2.5 mm). The seeds soaked in water for 96 hours had the least value. The maximum root length (10.0 mm) was obtained in seedlings from untreated seeds while the least (8.7 mm) occurred in scarified seeds.

Table 1: Effects of seed treatments on days to and percentage germination of *Annona muricata* seeds

Seed treatment	22	25	28	31	37	43
Soaking 72 hours	13	30	30	30	37	43
Soaking 96 hours	0	40	40	57	63	67
Scarified	0	27	27	33	43	50
Untreated	0	30	30	33	60	67
LSD (0.05)	5.44	ns	Ns	ns	Ns	ns

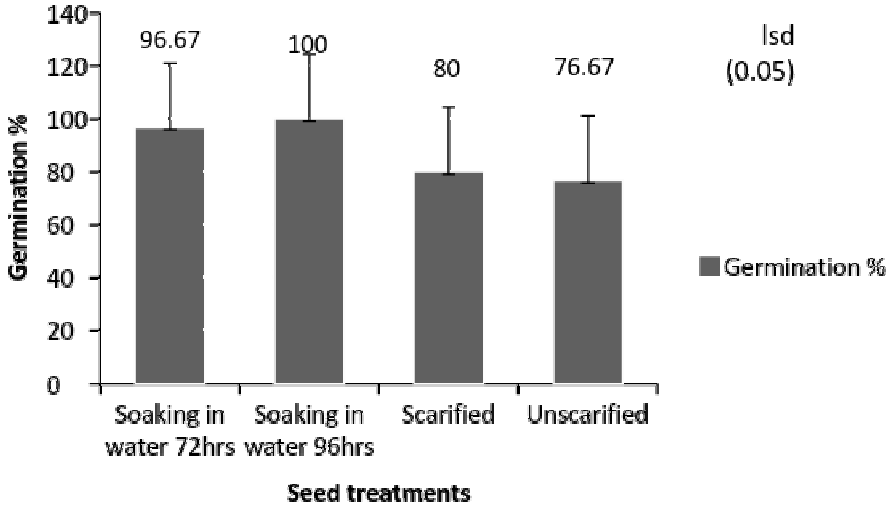

Figure 1: Effect of seed treatments on percentage germination of soursop (*Anona muricata*) 71 days after sowing

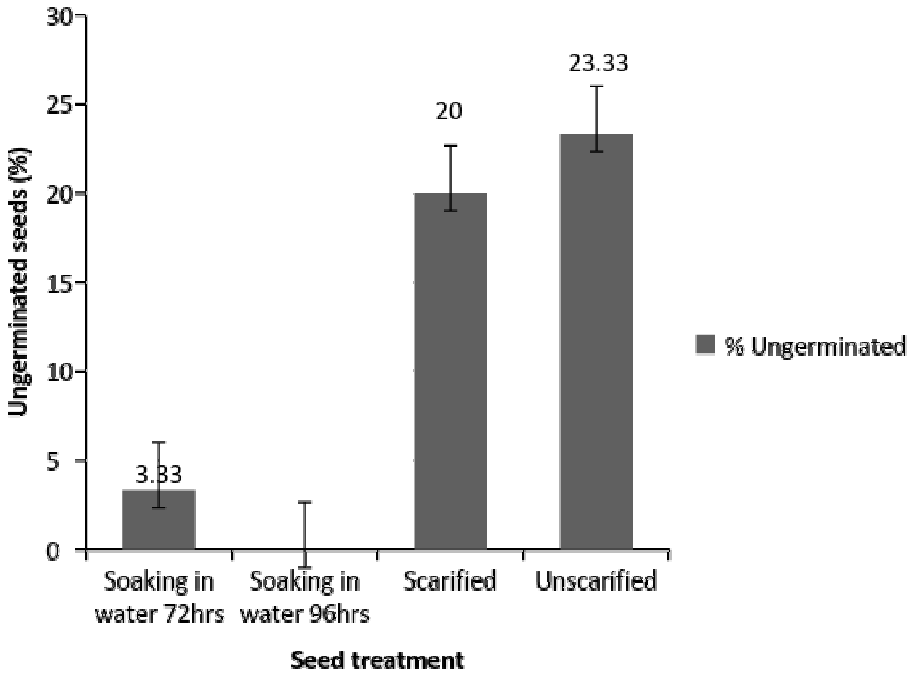

Figure 2: Percentage of ungerminated seeds of *Annona muricata* under different seed treatment 71 days after sowing.

Plate 1: Morphological abnormality in seedlings from untreated seeds (a & b) Poor leaf formation, (c & d) No leaf formation, (e) Seed coat retention (f, g & h) Poor root development 74 days after sowing.

Plate 2: Vigorous seedlings from treated soursop seeds with well (a) formed leaves and (b) roots 74 days after sowing

Table 2: Effect of seed treatments on number of leaves of *Annona muricata*

Seed treatments	53	57	60	71	74
Soaking 72 hours	1	2	2	3	5
Soaking 96 hours	1	2	2	3	4
Scarified	0	1	2	2	4
Untreated	1	1	2	2	4
LSD (0.05)	1.8	1.96	0.94	1.88	0.94

Table 3: Effect of seed treatments on plant height (cm) of *Annona muricata* seedlings

	Days after sowing		
Seed treatments	57	60	71
Soaking 72 hours	10.0	10.3	11.7
Soaking 96 hours	11.3	11.7	14.0
Scarified	9.0	10.0	11.3
Untreated	10.3	10.7	11.0
LSD (0.05)	2.61	2.66	2.24

Table 4: Effect of seed treatments on stem diameter and root length of *Annona muricata* Seedlings 74 days after sowing

Seed treatments	Stem diameter (mm)	Root length (mm)
Soaking 72 hours	2.7	9.2
Soaking 96 hours	2.2	9.3
Scarified	2.4	8.7
Untreated	2.5	10.0
LSD (0.05)	0.80	3.93

Discussion

One way of improving the production of healthy seedlings for orchard and plantation establishment is the ability to obtain vigorous and uniform sized seedlings in short time. Most tropical tree seeds have inherent dormancy that result in delayed and uneven germination of the seeds. Seed treatment has been reported by many researchers to enhance the germination of recalcitrant seeds (Aduradola *et al,* 2005, Aduradola and Adejumo, 2005, Agbogodi, *et al,* 2007). The present work has shown that seed germination percentage, time of germination and seedling vigour were all influenced by seed soaking in cold water (priming). The different pre sowing treatments had different effects on the parameters assessed. While soaking in cold water enhanced better germination percentage, the days to germination were not different for all the treatments. Soaking in cold water for 96 hours had the highest number of germinated seeds while untreated seeds were consistently low. With regards to morphological development the seeds soaked in water soaking duration not withstanding presented normal seedlings while untreated seeds had abnormal seedlings with retained seed coat which is in line with findings of Ehiagbonare1 *et al.,* 2008 who found abnormality in seedlings of C. albidum and reported that the seed coat attached to the cotyledon could not be removed without damage to the tender shoot. This problem discouraged farmers from cultivating the tree crop. However as a way of working in line with the Global Forum on Agricultural Research (GFAR) of 1999 which emphasized the role of underutilized species in raising income of the rural poor (Frison *et al*., 2000) vis - a - vis the current drive towards poverty alleviation, ability to obtain uniform and vigorous seedlings will go a long way in the achievement of cultivation of this fruit tree of great potential through sustainable production and bring economic gain to the grower.

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