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The Effects of Seed Size on Germination and Early Seedling Growth Performance of *Symphoniaglobulifera* L.F in Nigeria

Omokhua G.E., Oyebade, B.A. and Ebosele, C.
Department of Forestry and Wildlife Management
Faculty of Agriculture, University of Port Harcourt, Nigeria

Abstract: *Effects of seed size on germination and early seedling growth of Symphoniaglobulifera was carried out in the Department of Forestry and Wildlife Management, University of Port Harcourt. The experiment was arranged in a Completely Randomised Design (CRD) involving 3 replicates. Three hundred seeds were sown per treatment using large, medium and small seeds. Ten seedlings from each treatment were used to estimate seedling growth and biomass production. Results showed that the large seed size had the highest germination percentage of 78.52%±0.849 followed by the medium seed size with 65.91%±0.257 and the small seed size with 26.08%±0.240. Large seed size also had the best seedling growth parameters with total seedling length of 42.7cm ±1.234 followed by the medium seed size with 31.30cm±1.253 and then the small seed size which had a value of 22.47 cm±1.122. Large seed size had the largest collar diameter of 0.50mm±0.043 and followed by medium seed size which had a collar diameter of 0.32mm±0.018 and small seed size which had a collar diameter of 0.22mm±0.009. For leaf area, large seed size had the highest leaf area of 120.9cm^2±1.704 followed by medium seed size which had a leaf area of 90cm^2±0.67 and the smallest seed size with a value of 59.85cm^2±0.655. Large seed size had the highest value of total dry weight of 4.46g±0.272 compared to medium and small seed size with a value of 3.17g±0.283 and 2.03g±0.155 respectively. These imply that the large seed size has the ability to produce high quality seedlings of Symphoniaglobulifera.*

Keywords:*Symphoniaglobulifera, seed size, germination, early seedling growth.*

I. Introduction

The Freshwater ecosystem in Nigeria is highly diversed and home to trees and shrubs adapted to the non-saline coastal habitats in the tropics and sub tropics. The forest provides a variety of valuable products, such as timber, firewood, fibre, wine, ropes, spices, fruits, nuts, medicine and other numerous wood products. The ecosystem is also very important in the provision of non-tangible forest services such as combating of coastal erosion, carbon sequestration enhancement, protection of water sheds, ecotourism enhancement, provision of wildlife habitat, recreation and bioremediation of pollutants especially in the Niger Delta, where oil exploration and exploitation has been devastating the environment for decades.

The species is endemic in the fresh water swamp forest of the Niger Delta. *S. globulifera* is an evergreen medium-to-tall tree that can reach 20 to 30 m in height and 0.30m to 1m diameter at breast height*Symphoniaglobulifera* is a hermaphroditic tropical tree species with a wide natural distribution. In Nigeria the tree has small densely narrowed crown with long drooping branches having dark green leaves. Its bole is long, straight, sometimes buttressed and cylindrical. It has short, stout, stilt-like roots at its lower part. The bark is brownish, fairly smooth and slashes thin exuding a yellow gum. Leaves 7.5-10cm long by 2-3.5cm broadare opposite, without stipules, lanceolate to 12 cm long, acuminate, glabrous, and leathery, with very short petioles and cuneate bases (Keay, 1989; Akinnifesi*et al;* 2007) Flowers on pedicels up to 1.3 cm long.

Fruit is globose up to 4cm long with a dark green becoming brownish or yellowish-red berry, fleshy and edible. Seeds are one to three in a fruit. The flowers, usually profuse, are pinkish red to deep crimson(Abdul-Salim, 2002), while only the species *globulifer*a grow in Nigeria.It is a valuable multipurpose tree used in the wood industry for furniture. It is commonly known as bark gum, or 'hog gum' because of the distinctive yellow resin that exudes from the trunk (Dick*et al*., 2003). This bark gum is insoluble in water and serves as glue used for caulking boats, making torches, joining wood, fixing tool handles, calabashes and candles. In medicine, the resin is taken internally in Nigeria for gonorrhoea and as a diuretic and externally for wound-dressing, and for application to craw-craw(Oyen, 2005). The species is morphologically distinctive from the rest. The flowers are red and brightly coloured and attract numerous pollinators such as nectar feeding birds and bees. The berries serve as food for Monkeys, squirrels, bats and rodents.

Studies of the relationship between seed size and early growth have been reported since early this century (Willenborg*et al*., 2005). Seed size is an important physical indicator of seed quality that affects growth and is frequently related to yield, market grade factors and harvest efficiency. Seed germination is controlled by many internal and external factors. Seed size is an important parameter, which influences the germination,

growth and biomass of nursery seedlings(Zareian*et al.*, 2013). The main purpose of seed grading is to understand the better physiological quality of the seed lot (Dar *et al*., 2002).

Inadequate information on the silvicultural requirements of *S. globulifera* in terms of effect of seed size on germination and early seedling growth for regeneration programme is a major problem.The usefulness of seed size as a desirable trait in the regeneration of *S. globulifera* will provide some information on the biology of the species for its uniform, maximum and rapid propagation in the nursery. Conservation of genetic resources of forest species is very important in the tropical world where ecosystem destruction continues unabated. Therefore a major step aimed at forest ecosystem conservation is species regeneration. Hence, the use of seeds with desirable traits is undoubtedly a major step in the regeneration process. Therefore, the objectives of this study are to determine the effects of seed size on germination indices and early seedling growth characteristics of *S. globulifera.*

II. Materials And Methods

Study area: This study was carried out at the forest nursery in the Department of Forestry and Wildlife Management, Faculty of Agriculture, University of Port Harcourt, Rivers State. The forest nursery lies between latitude 04^0 53' 38.3''N and longitude 00.6^0 54' 38.0''E. The study was conducted in the site between August 2013 and March 2014.Matured fruits of *S.globulifera* were collected from ten (10) elite trees from a fresh water swamp forest in Emohua local government area of Rivers State latitude 4^0 35^1 0''N and longitude 6^0 52^1 0''E and covers an area of 831km^2. The fruits were processed manually by depulping them to get the seeds which were used for the study. The seeds were thoroughly mixed to form a seed lot.The processed seeds were subjected to viability test.Thosethat floated in water after 24 hours of soaking in cold water were considered unviable and were discarded.

Seed collection and germination: Seed size determination of *S. globulifera* was done by random selection of seeds from the seed lot. The seeds were grouped into three (3) seed size classes.The length and width was used to determine the three (3) seed size classesnamely: large seed size (≥2.0 by 1.5cm); medium seed size (≥1.5 by 1.0cm) and small seed size (<1.5 by 1.0cm). These three seed size classes constituted the three (3) treatments used in the experiment. Germination was taken to have occurred when the plumule emerged from the soil surface while the germination count was done daily for eight weeks until no more germination occurred.

At the end of the germination experiment, a total of one hundred and twenty fairly uniform seedlings were selected and transplanted into polyethene bags (30cm×20cm×10cm) filled with top soil collected from the forest floor. Each treatment had a total of forty seedlings out of which ten (10) seedlings from each treatment were randomly selected and taken as individual replicates which was carefully used to estimate the seedling biomass. The uprooted seedlings were carefully separated into roots, shoots and leaf components. They were separately dried at 70^0c in an electric oven until a constant weight was obtained.The effects of seed size on germination of *S.globulifera* were assessed by counting germinated seeds daily and adding them up to obtain total germination percentage for each seed size and the data on germination percentage were arcsine transformed in order to normalize the data. Germination percentage was calculated by dividing the number of germinated seeds with the total number of seeds and multiplied by hundred (Gharieneh*et al.*, 2004).

Data analysis:A completely randomised design (CRD) was used because the source of variation apart from the error was the treatment applied and all the experimental units were placed under high humidity propagators in a green house. Randomly selected seeds from each seed size class were sown in nine (9) germination boxes (60×45×20cm) filled with washed and sterilized river sand. A total of three hundred (300) seeds were sown per treatment and the total number of seeds for the three replicates was nine hundred (900). The boxes were watered dailyto maintain adequate moisture content. Data were also collected on the time each treatment took to germinate from the time of sowing andgermination duration from the inception of germination until termination was recorded. At the end of six (6) months, all the seedlings per treatment were measured for shoot length, root length, total length, number of leave stem collar diameter, leaf area, root dry weight, dry weight stem and leaf dry weight. Shoot, root and total lengths were determined by measuring the plants using a meter rule calibrated in centimeters (cm); stem collar diameter was determined by measuring the diameter of the plants using veneercalipercalibrated in millimeter (mm); number of leaves was determined by visual counting, while leaf area was determined by using a plant planimeter method. Seedling vigour index of the seed size classes was calculated as germination percentage multiplied by seedling total length and divided by 100.Data on biomass production were calibrated in grams (g). The root, shoot and leaf dry weights were added together to obtain the total dry weight per treatment.

Germination percentage (G%) = $\frac{n}{N} \times \frac{100}{1}$

Where n= Number of germinants

N= Total number of seeds, sown.

Total dry weight (g)=leaf + stem + root (dry weight)(g)

Seedling vigor index= $\frac{G\,\%\times SL}{100}$

Where, G%= germination percentage

SL= seedling length

III. ResultsAnd Discussion

There were significant differencesin germination percentage between the different seed sizes at 5% level of probability. Large seed size was recorded to have the highest mean germination percentage of 78.52%, followed by medium and small seed size with mean germination percentage of 65.91% and 26.08% respectively (Table 1). Small seed size took the longest time to germinate in 27 days followed by the medium seed size which took 18 days to germinate while the large seed size had the shortest time of germination with 13 days (Figure 1).Results showed that seed size significantly affected germination period among the different seed sizes (Table 2). Large seed size had the shortest germination period of 13 days compared to the medium seed size which hada germination period of 20 days and the small seed size was recorded to have the longest germination period of 37 days (Figure 1).

Table 1: Average values on germination indices of *S.globulifera*at eight weeks after sowing

Seed size	Germination percentage Mean ± SE	Time of germination (days) Mean ± SE	Germination period (days) Mean ± SE
Large	78.52 ± 0.849^{a}	13.33 ± 0.333^{a}	13.33 ± 0.333^{a}
Medium	65.91 ± 0.257^{b}	18.00 ± 0.57^{b}	20.33 ± 0.33^{b}
Small	26.08 ± 0.240^{c}	27.33 ± 0.667^{c}	37.33 ± 0.333^{c}

Meanswith the same subscript are not significantly different from one another along the column at 5% level of probability

Table 2: Average values of early seedling growth of Symphonia globuliferaat six (6) months after transplanting

Variables	Seed sizes		
	Large seed size	Medium seed size	Small seed size
	Mean ± SE	Mean ± SE	Mean ± SE
Shoot length (cm)	28.09 ± 0.539^{a}	$20.77 \pm 0.682_{b}$	$13.79 \pm 0.627_{c}$
Root length (cm)	14.56 ± 0.704^{a}	$10.53 \pm 0.574_{b}$	$8.68 \pm 0.498_{c}$
Total length (cm)	42.65 ± 1.234^{a}	$31.30 \pm 1.253_{b}$	$22.47 \pm 1.122_{c}$
Number of leaf	21.60 ± 0.653^{a}	$18.30 \pm 0.473_{b}$	$9.60 \pm 0.499_{c}$
Collar diameter (mm)	0.50 ± 0.043^{a}	$0.32 \pm 0.018_{b}$	$0.22 \pm 0.009_{c}$
Leaf area (cm)	120.90 ± 1.704^{a}	$90.03 \pm 0.670_{b}$	$59.85 \pm 0.655_{c}$
Root dry weight(g)	0.60 ± 0.075^{a}	$0.28 \pm 0.030_{b}$	$0.16 \pm 0.014_{b}$
Stem dry weight (g)	2.73 ± 0.137^{a}	$2.11 \pm 0.103_{b}$	$1.52 \pm 0.081_{c}$
Leaf dry weight (g)	1.13 ± 0.072^{a}	$0.686 \pm 0.124_{b}$	$0.35 \pm 0.062_{c}$
Total dry weight (g)	4.46 ± 0.272^{a}	$3.17 \pm 0.283_{b}$	$2.03 \pm 0.155_{c}$
Seedling vigour index	4.43 ± 0.108^{a}	$2.96 \pm 0.137_{b}$	$1.88 \pm 0.101_{c}$

Meanswith the same subscript are not significantly different from one another along the column at 5% level of probability

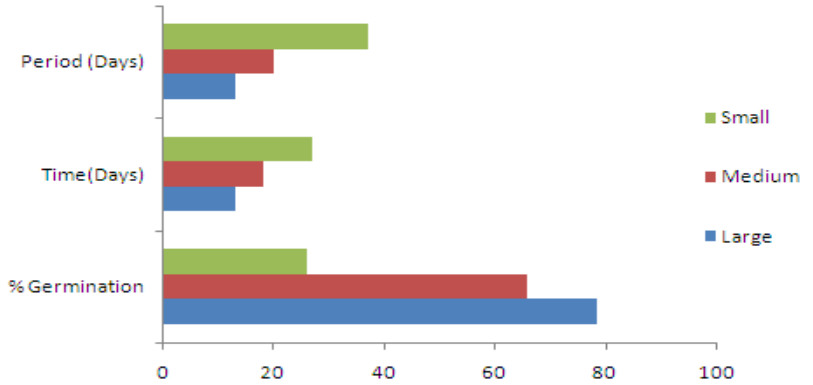

Fig. 1 : Percentage, time and period of germination of *Symphonia globulifera*

The results from the study showed significant increase in germination percentage with increasing seed sizes (Figure 1) with the highest mean germination percentage recorded in large seed size with 78.52%, followed by the medium sized seed which had 65.91% and the small sized seed was found to have the least mean germination percentage of 26.08%. This occurrence was in line with the study of(Amin and Brinis, 2013) on the effect of seed size (large, medium and small) of Durum wheat on germination. They reported that large seed size gave the best germination percentage compared to medium and small seed sizes of the species. Mosseler*et al*.,(2000)and Ahirwar*et al*., (2012) also reported that germination percentage was strongly influenced by seed size and that such germination percentage was highest in large seed size compared to the medium and small seed of loblolly pine (*Pinustaeda*) and *Alangiumlamarckii* seeds respectively. However, thereport of Missanjo*et al*., (2013)showed that seed sizes of *Albizialebbeck* did not have any effect on the germination percentage of the species. The present result indicates that grading seed of *S.globulifera* with the aim of enhancing germination percentage in the nursery is very important.

Similarly, this result showed that early germination emergence was favoured in large seed sizeand could be as a result of storage of morefood substances in its seed which influenced quicker metabolic activities for faster germination.In line with thisoccurrence, Hojjat (2011) reported that large seeds of Lentil genotypes showed early germination compared with smaller size. Increased seed size resulted in decreased germination period (Figure 1). The small seed size was recorded to have the highest mean germination period of 37 days followed by that of medium sized seed with a germination period of 20 days and the largest seed size with the shortest germination period of 13 days (Table 2). Similar trend was observed by Martinson (2009) who reported that larger seeds tend to give faster emergence and produce larger seedlings in trees.

It was observed that large seeds had the highest mean shoot length of 28.10cm followed by that of the medium seed size having 20.80cm while that of small seed had the shortest mean length of 13.80cm (Figure 1). In contrast to the present study,Roshanak*et al*., (2013) reported that medium seed size of soybean (Glycine maximum) had the highest value of shoot length followed by the small seed size while the large seed size had the lowest value of shoot length.

The different seed sizes varied in their root length values as large seed recorded the highest mean root length of 14.60cm while medium and small seed sizes recorded mean root length of 10.50cm and 8.70cm respectively (Table 2). In agreement to the present study, Nagarajan*et al*.,(2006) reported on the effect of seed size of *Colophospermummopane*and concluded that the large seed size had higher root length than medium and small seed sizes. Generally, the results of the study revealed that larger seed germinate quicker and have lesser duration, with better seedling vigour and other growth attributes when compared to smaller seeds (Akinnifesi, 2007; Ahirwar*et al*, 2012; Gunaga*et al*., 2007; Moles and Westoby, 2004).

Importantly, growth in plants is particularly involve both survival and reproduction depend on plant size and therefore on growth rate. Seed size is one of the important yield components which have an effective role on cultivar adaptation to different condition which affects seedling vigour(Morrison and Xue, 2007). Seed size is also an important parameter, which influences the germination, growth and biomass of the nursery seedlings and that trend leads to the future crop. A positive relationship between seed weight or size and germination percentage existed within seed lots in a number of studies (Turk *et al*., 2002; Larsen and Andreasen, 2004).

IV. Conclusion And Recommendations

The study has provided some basic information on germination and early seedling growth characteristics of *S.globulifera*. The study indicated that large seed sizes gave the best germination indices in terms of germination percentage, time of germination and germination period compared to the medium and small seed sizes. It was also shown that large seed size had the highest values for all the growth parameters measured followed by the medium seed size while the small seed size had the lowest values in all.The study significantly showed that seed size was very important in the germination, early seedling growth, seedling vigour index, biomass production and seedling establishment in tropical forest species.The result from this study is vital to silviculturists and horticulturists, and can provide plausible options for regenerating the species for conservation and domestication purposes. The large seed sizeisrecommended, as itwould ensure rapid maximum and uniform germination as well as promote early maturity of *S.globulifera*which is pivotal to high quality seedling production in the nursery.

References

[1]. Abdul-Salim K. 2002.Systematics and Biology of*Symphoniaglobulifera* L. f. (Clusiaceae). Harvard University Cambridge Press. 22.

[2]. Ahirwar J. R. 2012. Effect of seed size and weight on seed germination of *Alangiumlamarckii*. *Research Journal of Recent Sciences*. 1:320- 322.

[3]. Akinnifesi F. K., Silesh G., Mkondaa., Ajayi O. C., Mhango J. and Chilanga T. 2007. Indigenous Fruit Trees in the Tropics: Domestication, Utilization and Commercialisation, CABI Publishing, UK. 34-56.

[4]. Amin C. and Brinis L. 2013. Effect of seed size on germination and establishment of vigorous seedlings in Durum wheat (Triticum durum Desf.). *Advances in Environmental Biology*, 7:1, 77-81. ISSN 1995-0756.
[5]. Dar F. A., Gera M. and Gera N. 2002.Effect of Seed Grading On Germination Pattern of Some Multipurpose Tree Species of Jammu Region. 128: 509-512.
[6]. Dick C. W., Abdul-Salim, K..andBermingham E. 2003. Molecular Systematic Reveals Cryptic Tertiary Diversification of a Widespread Tropical Rainforest Tree. 162:691–703.
[7]. Gharieneh M, Bakhshande A, Ghassemi-Golezani K. 2004. Effects of viability and vigor of seed on establishment and grain yield of wheat cultivars in field conditions. *Iranian Journal of Nahal and Bazr*., 20: 383-400
[8]. Gunaga R. P., Hareesh T. S. and Vasudura R. 2007. Effect of Fruit Size on Early Seedling Vigour and Biomass in White dammer (Vateriaindica); A Vulnerable and Economically Important Tree Species of The Western Ghals. *Journal of NTFP's*. 14: 197-200.
[9]. Hojjat S. S. 2011. Effect of seed size on germination and early seedling growth of some Lentil genotypes. *International Journal of Agriculture and Crop Sciences*. 3:1-5.
[10]. Keay R. W. J. 1989. Trees of Nigeria. Clarendon Press Oxford. 476 pp.
[11]. Larsen S. U. and Andreasen C. 2004. Light and Heavy Seeds Differ in Germination Percentage and Mean Germination Thermal Time Crop Sciences. 44: 1710-1720.
[12]. Martinson S. 2009. Growth and Yield Performance of Four Groundnut Varieties in Responses to Seed Size. A Thesis Submitted to the Department of Crop and Soil Sciences. Kwame Nkrumah University of Science and Technology Kumasi, Ghana.
[13]. Missanjo E., Maya C., Kapira D., Banda H., and Kamanga-Thole G. 2013. "Effect of Seed Size and Pre-treatment Methods on Germination of *Albizialebbeck*," ISRN Botany, Article ID 969026. 1: 4
[14]. Moles A. T. and Westoby M. 2004. Seedling Survival and Seed Size: A Synthesis of the Literature. Journal of College sciences. 92: 372-383.
[15]. Morrison M. J. and Xue A. G. 2007. The Influence of Seed Size on Soybean Yield in Short- Season Region. Canadian Journal of Plant Science. 87: 89-91.
[16]. Mosseler A., Major J. E., Simpson J. D., Daigle B., Lange K., and Park Y. S., 2000. Indicators of population viability in red spruce, *Picearubens*. I: Reproductive Traits and Fecundity.*Canadian Journal of Botany*. 78: 7, 928–940.
[17]. Nagarajan M. and Mertia R. S. 2006. Effect of Seed Size and Sowing Depth on Germination and Seedling Growth of *Colophospermummopane* (Kirth ex. Benth) Kirt ex. J. Leon, Indian Forester. 138: 8, 1007-1012.
[18]. Oyen L. P. A. 2005.*Symphonia globulifera* L. F. PROTA (Plant Resources of Tropical Africa Timbers / Bois doeuvre/protawageningen). Netherlands. 7:1
[19]. Roshanak R., HamdollahK., Mehrdad Y., and Parisa Z. 2013. Effect of Seed Size on Germination and Seed Vigour of Two Soybeans (glycin max. L). International Research Journal of Applied and Basic Sciences. 4 :11, 3396-3401. ISSN 2251-838.
[20]. Turk M. A., Maghaereh G. A. and Tawaha A. R. 2002. Response of Barley to Herbicide versus Weed. Control under Semi-Arid Conditions. *Journal of Agronomy and Crop Sciences* 188: 2, 106-112.
[21]. Willenborg, C. J., Wildeman J. C., Miller A. K., Rossnaged B. G. and Shirtliffe S. J. 2005. Oat Germination Characteristics Differ among Genotypes, Seed Sizes, and Osmotic Potentials. Crop Science. 45: 2023-2029.
[22]. Zareian A., Hamidi A., Sadeghi H. and Jazaeri M. R. 2013.Effect of Seed Size on Some Germination Characteristics, Seedling Emergence Percentage and Yield of Three Wheat (*Triticumaestivum*L.) Cultivars in Laboratory and Field.Middle-East.*Journal of Scientific Research* 13:8, 1126-1131.