EFFECTS OF VARIOUS METHODS OF EXTRACTION ON GERMINATION OF *GMELINA ARBOREA* SEEDS/FRUITS

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OGUNNIKA, C.B. & KADEBA, O. 1993. Effects of various methods of extraction on germination of *Gmelina arborea* seeds/fruits. The effects of four methods of extraction of *Gmelina arborea* seeds on germination were investigated. These consisted of seeds extracted: (a) from freshly harvested fruit, (b) after soaking in running water, (c) after fermentation in standing water, and (d) after heaping up in the soil. Intact fruits (unprocessed) were sown as control. The results showed that highest percentage germination was recorded in freshly extracted seeds and this was followed in decreasing order of magnitude by seeds extracted after soaking in running water, heaping and standing in water. Germination was not recorded in the unprocessed fruits. The non-germinability of the seeds was attributed to the non-removal of the fruit pericarp which must have inhibited germination. It was considered best to extract *G.arborea* seeds fresh without fermentation in order to enhance germination.

Key words: *Gmelina arborea* - seed extraction - methods - percentage germination

OGUNNIKA, C.B. & KADEBA, O. 1993. Kesan beberapa kaedah pengekstrakan ke atas percambahan biji benih *Gmelina arborea*. Kajian telah dijalankan terhadap kesan empat kaedah pengekstrakan biji-biji benih *Gmelina arborea* ke atas percambahannya. Ianya terdiri dari biji-biji benih yang diekstrak dari: (a) buah-buah yang baru dikutip, (b) setelah direndam dalam air,(c) setelah diperam dalam air, dan (d) setelah ditimbus dalam tanah. Buah yang tidak diproses di tanam sebagai kawalan. Keputusan menunjukkan peratus percambahan tertinggi direkodkan dari biji-biji benih yang baru dikutip dan diikuti biji-biji benih yang diekstrak setelah direndam dalam air, ditimbus dan yang diperam dalam air. Percambahan tidak direkodkan untuk buah-buah yang tidak diproses. Ketidak cambahan biji-biji benih ini mungkin disebabkan oleh perikarpa buah tersebut yang tidak ditanggalkan. Untuk menambahkan percambahan, adalah dicadangkan agar biji-biji benih *Gmelina arborea* diekstrak semasa segar tanpa diperam.

Introduction

Seed is of fundamental importance in forestry practice. The increasing number of afforestation programmes in which *Gmelina arborea* is being extensively planted demands that nursery waste should be reduced to the minimum by planting good viable seeds. To produce high quality and vigorous tree seedlings, one must sow high quality seeds.

It has been observed that methods of extraction of *G. arborea* seeds could affect subsequent germination and storage. Troupe (1921) recorded 90% germination for seeds extracted from fresh fruits and 30% for fermented seeds after twelve months storage. He also discovered that fruits depulped by animals had a higher

germination percentage. A sharp drop in germination percentage of *G.arborea* seeds occurred when the fruits were allowed to ferment by piling up after collection. Germination was increased by spreading out the fruit after collection (Bello 1981).

In a further investigation, Aminuddin and Zakaria (1980) reported that the products of pericarp fermentation contributed to loss of seed viability. Woessner and McNabb (1979) recommended that seeds from fresh fruits gave best germination. Okoro (1979) reported the depressing effect of freshly extracted pulp of *G. arborea* fruits on germination of the seeds.

A survey of various methods of extraction commonly practised in the different states of Nigeria revealed that the common methods used basically involved fermenting the seeds (Table 1).

In spite of the various investigations by different workers, it appears that the problem of *G. arborea* fruits/seeds germination is far from being solved. There is therefore a great need to evaluate the effects of the various extraction methods on germination of the fruits/seeds of the species, especially, in view of the current emphasis on raising *G. arborea* plantations on a large scale.

Table 1. Different methods of seed extraction of *Gmelina arborea* fruits in Nigeria

State	Treatment	Period of fermentation	Method of extraction
Ondo Plateau Benue Oyo Osun	Fruits spread in the open space	8-14 days	Seeds are pressed out of the fruits
Kaduna Niger Adamawa Katsina Kogi	Collection is restricted to those fruits that have started to rot on the field	2-5 days	Hard objects such as stones are used to break open the fruits
Ogun Edo Lagos Delta	Fruits packed in sack and heavy weight placed on it	7-10 days	Stone is used in the extraction to pound out the seeds.
Kwara Anambra Imo Cross River Akwa Ibom Abia	Fruits gathered up and covered with leaves	12-18 days	Seeds are pressed out of the fruits

Material and methods

Fresh fruits of *Gmelina arborea* were collected from two sources: about 500 fruits from the Alagbaka Nursery of the Federal Department of Forestry, Akure and another 500 from the Oluwa pulpwood plantation, Epemakinde, Ondo State. Fruits from each source were randomly divided into five parts of 100 fruits each and labelled A, B, C, D and E. The experiment was replicated twice. These seeds were sown after the treatments described below:

Treatment A: The fruits were sown intact after drying for seven days without removing the pericarp. This served as the control.
Treatment B: The method involved peeling off the pericarp of the fresh fruits with a sharp knife and extracting the fruit stones or seeds from the fruits. After extraction the fruit stones were thoroughly washed and sun-dried for seven days prior to sowing.
Treatment C: Fruits were softened in running water. Each 100 fruits of the two replicates were carefully packed in a netlike bag and placed in a running stream causing water to flow continuously through the fruits. This was checked regularly in order to find out exactly when the pericarp was soft enough to allow easy washing of the fruit stones. The fruit stones were readily extracted after eight days of soaking in the stream. After extraction and thorough washing, the fruit stones were sun-dried for seven days before sowing.
Treatment D: The fruits were fermented in standing water for a period of two weeks. By this time, the depulping of fruit stones was very easy. The depulped fruit stones were also thoroughly washed and sun-dried for seven days before sowing.
Treatment E: Fruits were laid out in heaps to ferment for about two weeks. After depulping, the fruit stones were thoroughly washed and sun-dried for seven days.

After extraction, cleaning and drying of the fruit stones, samples were drawn from each treatment and the moisture contents determined. The moisture content determination was done by oven-dry method.

The dried fruit stones were then sown in germination boxes laid out in the nursery. Daily watering and weekly counting of the number of germinated fruit stones were carried out for five weeks.

Germination was considered to have taken place when the hypocotyl had emerged above the soil.

Results and discussion

The germination results at the end of five weeks are given in Table 2.

Analysis of variance (Neave 1978) was carried out. The results are shown in Table 3. Since calculated F = 6.59 for treatment exceeds the expected value of 2.87 at 5% probability level, it therefore means that the null hypothesis has to be

Table 2. Moisture content and germination percentage of different treatments at the end of five weeks

Species	Treatment	Moisture content (%)	Germination (%)
Gmelina arborea	A	nd	0
	B	12.3	90
	C	9.3	80
	D	9.3	50
	E	10.1	86

nd = Control, no moisture determination.

rejected. It can be concluded that the methods of extraction have significant effect on the germinability of *Gmelina arborea* fruits/seeds.

As shown in Figure 1, no germination was observed after five weeks in treatment A which served as the control (*i.e.* from the fruits sown intact without removing the pericarp). This suggests that the pericarp may be responsible for inhibiting germination. This agrees with what was reported by Lamb (1968), Okoro (1979) and Bello (1981). The fact that good germination was obtained from treatments B, C, D and E indicates that removing the pericarp or depulping the fruits facilitated germination. Fresh green fruits had about 10% germination when sown directly (that is without depulping) upon collection (Woessner & McNabb 1979).

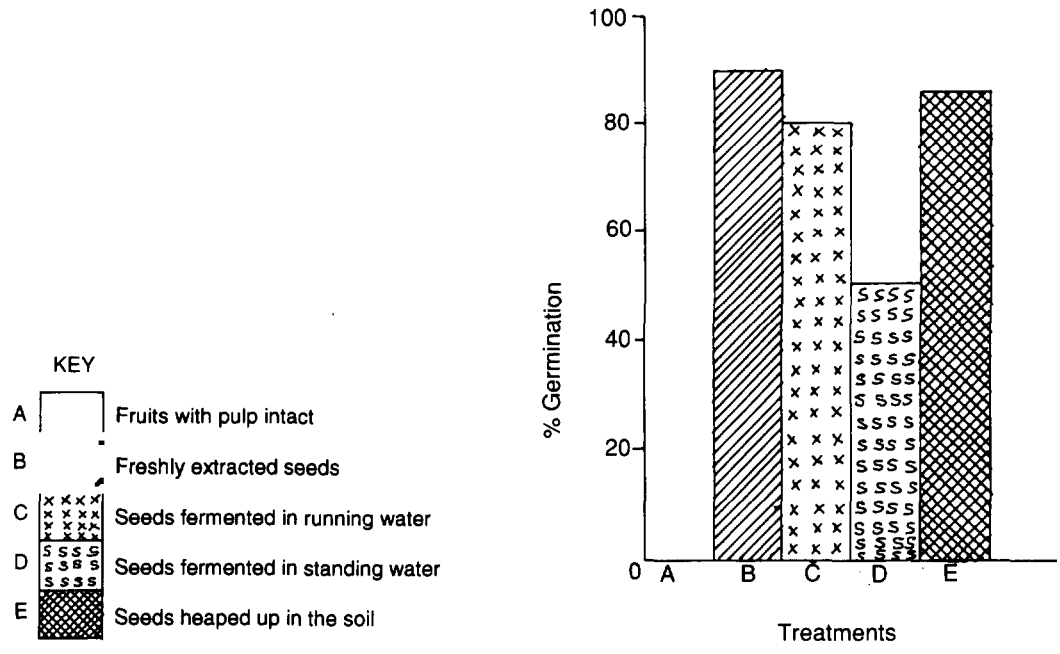

Figure 1. The effects of methods of extraction on germination percentage of *Gmelina arborea* fruits/seeds

Table 3. Analysis of variance

Source of variation	Degrees of freedom	Sum of squares	Mean square	F-Calculated
Treatment	4	1136.76	284.19	6.59*
Error	20	1999.56		

* = Significant at $p \leq 0.05$.

The results obtained from treatment B in which 90% germination was recorded show that the best germination was obtained when the fruit stones (seeds) were extracted fresh. Results shown in the freshly extracted seeds agree with what has been observed by Woessner and McNabb (1979) who recommended collection of fresh fruits only for best germination while Troupe (1921) working with extracted fruit stones obtained 90% germination.

Very high germination percentage had been observed when the fruits were fermented in heaps. We also observed 86% germination in fruits fermented in heaps as shown in treatment E of Figure 1. This was probably due to the heat produced during fermentation of heaped and densely packed fruits which broke the inherent seed dormancy. This enhances and fosters early germination of the seeds and accounts for the high percentage germination recorded. However, the results still indicate that it is better to extract the fruit stones fresh than when fermented in heaps.

The results obtained in treatment C of Figure 1 also show that high germination of 80% occurred when soaking of the fruit was done in running water, indicating that any inhibitors from the pulp may have been removed by the running water. Furthermore, soaking of the impermeable seed/fruit stone of *G. arborea* in running water is a scarification treatment for hastening germination because the running water removes inhibitors and softens the seed coat and thereby shortens the time of germination. In spite of the good germination percentage obtained from treatment C, it is still better to extract the fruit stones fresh than when soaked in running water.

The germination of fruits fermented in standing water was rather low as indicated in treatment D of Figure 1. It gave a 50% germination. This suggests that exudates from the fermenting pulp contributed to the suppression of germinability. This agrees with the results obtained by Aminuddin and Zakaria (1980) and Woessner and McNabb (1979).

From the germination curves (Figure 2), it is observed that germination was fastest when the fruit stones were extracted fresh, intermediate when extracted after fermentation in heaps and least when extracted after fermentation in standing water.

Germination was relatively high when extracted after fermentation in running water. No germination was recorded in fruits sown intact (that is without depulping the pericarp).

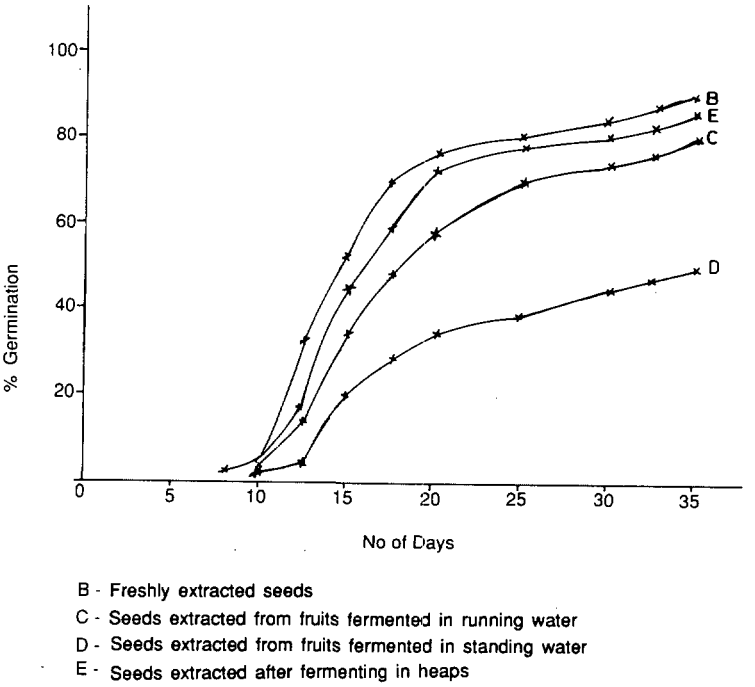

Figure 2. Germination curves of *Gmelina arborea* fruits/seeds extracted by different methods

Conclusion and recommendations

For silvicultural purposes freshly extracted fruit stones of *Gmelina arborea* without fermentation should be preferred in order to obtain high germinability. This will increase efficiency in raising seedlings in the nursery, provided sufficient labour and funds are available. On the other hand, where it is necessary to adopt a less costly method, it will be preferable to soak the fruits in running water. This will save more time than fermenting in heaps. Fermentation in standing water should be avoided, as this suppresses germinability.

References

AMINUDDIN, B.M. & ZAKARIA, B.I. 1980. Grading of *Gmelina arborea* (yemane) fruit by colour. *Malaysian Forester* 40 (3): 337-339.

BELLO, Y.O. 1981. Effect of Technique and Period of Fermentation on *Gmelina arborea* Seeds. (Student dissertation). FRIN-Ibadan. (Unpublished).

LAMB, A.F.A. 1968. *Gmelina arborea. Fast-Growing Timber Trees of the Lowland Tropics.* Commonwealth Forestry Institute, University of Oxford No. 1. 33 pp.

NEAVE, H.R. 1978. *Statistics Tables.* George Allen and Unwin Ltd., (London) W.C.G. ILU.

OKORO, O.O. 1979. Effect of tree age and fruit size on seed quality of *Gmelina arborea.* The 9th Annual Conference of the Forestry Association of Nigeria, Ibadan.

TROUPE, R.S. 1921. *The Silviculture of Indian Trees.* Volume 11. Oxford, Clarendon Press. 787 pp.

WOESSNER, R.S. & MCNABB, K.L. 1979. Large scale production of *Gmelina arborea* (Roxb) seed - a case study. *Commonwealth Forest Review* 53(2): 117-121.