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Cost effective protocol: Breaking seed dormancy to obtain homogenous germination for large scale propagation of *Gmelina arborea* Roxb

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Abstract
It has always been a challenge for scientists and forest managers to break seed dormancy to obtain homogenous germination for large scale propagation. The hard seed coat plays a major role in dormancy of forest seeds. The effect of pre-treatments such as hot water, conc. sulphuric acid, pre-soaking, hot soil followed by chilled water etc were tested on breaking seed dormancy. Good germination rate was obtained in seeds treated with hot soil followed by pouring chilled water. The method was innovative and successfully. This study gives a cost effective protocol for homogenous seed germination for large scale propagation and commercial production of *G. arborea* saplings.

Keywords: Seed, dormancy, treatment, homogenous germination, forest seed, nursery

Introduction
Gmelina arborea Roxb. belongs to family Verbenaceae and is a pioneer tree native to Asia. The tree has high adaptability and vigour. Plantation of *Gmelina arborea* is done mainly for timber, poles, artificial limbs, pulp and paper production exists in many part of the country. The tree is low maintenance and has multiple uses. As a result, there is a rapid increase in the demand for *Gmelina* based products and its other uses (Esbewole *et al*. 2018) [2].
Seed dormancy has been defined as a temporary failure of a viable seed to germinate in conditions that favour germination (Bewley 1997). Although dormancy has some disadvantages from forester's point of view. Now a days forests are being exploited for their goods and services. Even though seed is a renewable natural resource, once it is exhausted, it may take a long time to regenerate (Owoh *et al*. 2011) [5]. Seed dormancy causes delayed and irregular germination in the nursery, which is a serious constraint on efficient nursery management (Schmidt 2000) [6]. Therefore much research has been carried out for effective artificial treatment to break dormancy for early germination. The dormancy may vary for the same species according to genotype and environment in which seeds are produced (Kheloufi *et al*. 2017). The most frequently used pretreatments are mechanical nature (break) and chemical or wet nature (immersion in a corrosive solution). Although, the duration of immersion must be standardized to ensure best time required for quick germination. A successful plantation cannot be established unless healthy nursery seedlings or stocks are produced.
Therefore, the present work aimed at raising homogenous and healthy seedlings of their stands for commercial agro-forestry uses.

Materials and Methods
The seeds of *Gmelina arborea* Roxb. were purchased from local market. The seeds were subjected to different treatments (*viz*. concentrated H_2SO_4, Boiling water, hot soil and chilled water) to ascertain the best treatment. Initially the seeds were subjected to conc. H_2SO_4 and hot water for 30mins each. The seeds were then soaked in tap water for 24h before sowing. The germination mixture which consists of sand, coco-peat and vermicompost (1:1:1) were autoclaved. The seeds were sown in the plastic trays and spread over this hot autoclaved mixture followed by pouring chilled water over it. Watering was done once, daily. The trays were then kept at room temperature. The germination was carried out using 100 seeds per

tray for each treatment. Germination count was done daily for two weeks. All the experiments were done in triplicate. After two weeks, the seedlings were transferred to black polythene containing soil and allow it to established in the natural condition.

Results and Discussion

The results showed that the percentage germination of seeds treated with H_2SO_4 and boiling water was found to be 50 and 40% respectively. The maximum percentage of germination was found in the seeds which were pre-soaked, then sown on hot soil followed by chilled water (Fig 1). Thenafter, the fully grown seedlings were transferred to polythene bags showed 100% survival rate (Fig 2).

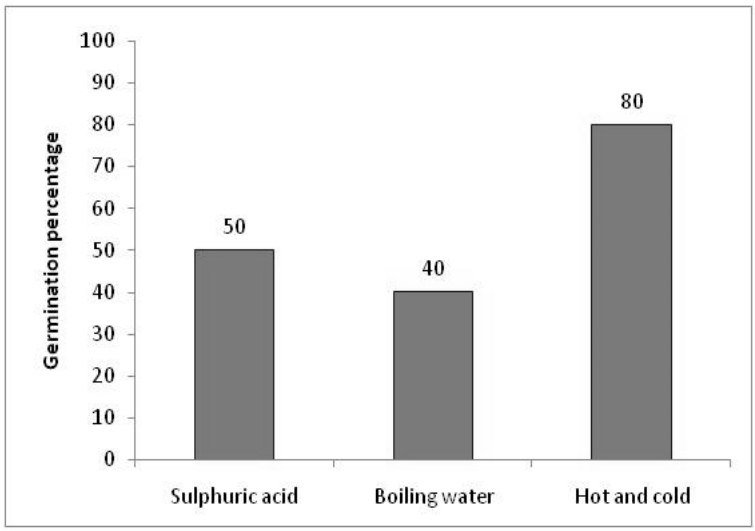

Fig 1: Effect of Different pretreatment methods on germination given to seeds

The present study evident that agroforestry practices significantly enhances growth and development of *Gmelina arborea*. Treatments with chemicals are often used to break down thick impaermeable seed coats. Whereas, the concentrated acids sometimes may damage embryo and hence reduces viability of seeds resulting in low germination percentage (Mousavi *et al*. 2011) [4]. It was observed from the result that the chemical treatment with sulphuric acid for 30mins reduces germination percentage. On the other hand treating seeds with hot water reported to enhance germination by increasing permeability (Sharma *et al*. 2008) [7]. Unlike in this case the germination was found to be decreased. An accidental discovery of treating seeds with hot soil followed by pouring chilled water was found to give best germination results leading to the establishment of a successful and innovative method.

Fig 2: Seeds Germinated in trays (a, b) Saplings In nursery (c)

Conclusion and Recommendations

This study indicated that seeds gave best germination when treated with hot soil and chilled water. Also, the survival rate of the seedlings after transferring to polythene bags was found to be 100%. The large scale production of saplings can be done by this cost effective protocol. This method can be implemented in agroforestry, plant nurseries, botanical gardens, research institutes etc. Extensive plantation of this species must be done to regain its lost glory.

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