International Workshop on *Albizia* and *Paraserianthes* Species

Proceedings of a Workshop
Sponsored by

Winrock International Institute for Agricultural Development

UNDP/FAO Regional Forest Tree Improvement Project (FORTIP)

PICOP Resources, Inc.

Bislig, Surigao del Sur, Philippines

November 13–19, 1994

Neptale Q. Zabala, Editor

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Seed treatment for *Albizia* species

Abstract

The common seed treatment methods include cool-water soak, hot-water soak, acid soak, nicking, and no treatment. To determine which of these methods are appropriate for propagating albizia in community-level tree planting programs, a seed treatment study was conducted on *Albizia lebbeck, A. procera, A. saman*, and *A. saponaria*. Of the seed treatment methods tested, nicking was most effective at producing rapid, uniform seed germination and germinant development. Unfortunately, nicking is time-consuming and only practical for small to medium quantities of seed. Although inferior to nicking, the hot-water treatment also produced good results and is easily applied to large quantities of seed. When propagating large numbers of albizia seedlings, seed should be soaked in boiled water for 3 minutes followed by 24 hours in cool water. Stir seed during the hot-water soak. The volumes of hot and cold water should be five times the volume of seed.

Introduction

The pantropical and warm-temperate genus *Albizia* consists of about 150 trees and shrubs. Albizias are adapted to a variety of soils and environments (NAS 1979, Allen and Allen 1981) and are among the most widely planted trees in the world (Evans 1982). Many of these trees grow fast, compete well with other vegetation, and provide multiple services and products. They are commonly planted for soil reclamation, as ornamentals, in home garden systems, and as shade for tea and other plantation crops. *Albizia* species are also valuable sources of fuelwood, fodder, green manure, and timber (NAS 1979, Allen and Allen 1981, Parrotta 1987a, Parrotta 1987b, Roshetko 1995a).

While the size, shape, and color of albizia seeds vary among species, most have hard seedcoats that are impermeable to water. Over time, exposure to sun, rain, wind, and damage by animals fractures hard seedcoats, allowing water absorption and eventually germination. Under these natural conditions the seed crop of one year germinates unevenly over a long period–some seeds may not germinate for years. Uneven germination ensures that some seedlings will survive environmental hazards such as drought, fire, frost, or insect and animal attack. Seedlings that germinate early may be large enough to survive late-season hazards, while seedlings that germinate later will avoid early-season problems.

By contrast, it is easier to protect seedlings in nurseries or plantations when they are of uniform age and size. Uniform seedling size is achieved by proper seed treatment before sowing. Seed treatments are designed to penetrate the protective seedcoat, allowing water absorption and germination. Common seed treatment methods include cool-water soak, hot-water soak, acid soak, nicking, and no treatment (Roshetko 1995b). To determine which of these methods are appropriate for propagating albizias in community-level tree-planting programs, a seed treatment study was conducted on five provenances of four different species.

Table 1. Seed characteristics of four *Albizia* species.

Species	Seeds/kg	Description of seed
Albizia lebbeck	6,000–16,000	Yellowish to light brown, oblong to oval in outline with a flat surface and hard smooth seedcoat.
Albizia procera	20,000–24,000	Small, greenish-brown, eliptical to round in outline with a convex surface and hard smooth seedcoat.
Albizia saman	6,000–8,000	Reddish-brown, oblong to rectangular in outline with a rounded surface and thick slightly waxy seedcoat.
Albizia saponaria	10,000–22,000	Tan to light brown, oblong in outline, pointed at one end with a flat surface and hard smooth seedcoat.

Methods and materials

Species. *Albizia lebbeck, A. procera* (two provenances), *A. saman,* and *A. saponaria* were included in the study. General seed characteristics of these species are listed in Table 1. Seeds of *A. procera, A. saman,* and *A. saponaria* were collected on the islands of Timor and Flores, Indonesia in 1994. A sample of *A. lebbeck*, collected in Tamil Nadu, India, during 1993, was purchased from a commercial supplier. To replicate seed storage practices used by community-level tree-planting programs, seeds of all species were stored in manila envelopes at room temperature and away from direct light. Seeds of *A. lebbeck* were stored for 20 months. The seeds of the other species were stored for 10 months.

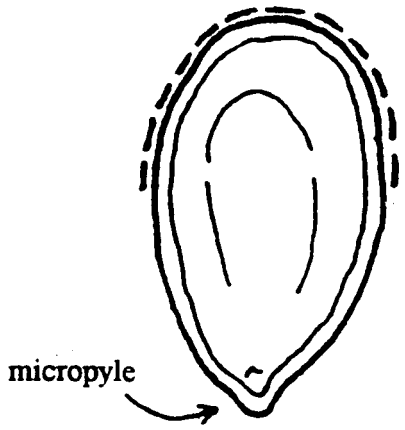
Immediately prior to beginning the study, seeds were removed from storage and sorted. Only large, healthy seeds without holes or cracks in their seedcoats were selected for the study. Suitable seeds of each species were randomly divided into four groups. Each group contained 25 seeds and was subjected to one of four seed treatments.

Seed treatments. The seed treatment methods used in the study were; cool-water soak, hot-water soak, nicking, and no treatment (control). Because acid is dangerous, often expensive, and not available in the rural areas of many developing countries–the location of most community-level tree-planting programs–the acid-soak treatment was considered inappropriate for this study and thus excluded. The treatment procedures followed in the study are described below:

Cool water. Seeds were soaked in cool (room-temperature) water for 12 hours. The volume of water was five times the volume of seeds. After 12 hours, the seeds were wrapped in moist paper towels.

Hot water. Seeds were soaked in boiled water for 2.5 minutes. The seeds and water were stirred for the duration of the soak. The boiled water was poured off and replaced with cool water for 12 hours. The volumes of boiled and cool water used were five times

Figure 1. To avoid damaging the embryo, seedcoats were cut (nicked) opposite the micropyle.



the volume of seeds. After the cool-water soak, the seeds were wrapped in moist paper towels.

Nicking. Using a nail clipper, seedcoats were cut opposite the micropyle (Figure 1). This precaution serves to protect the seed embryo. Nicked seed were then soaked in cool water for 12 hours. The volume of water was five times that of the seeds. After the cool-water soak, the seeds were wrapped in moist paper towels.

Control. Untreated seeds were wrapped in moist paper towels at the same time as the treated seeds from the other three methods. To encourage water absorption and germination, paper towels containing the seeds were kept moist throughout the study by watering the wrapped seeds once or twice a day. After each watering, excess water was drained from the plate holding the wrapped seeds. During this period, seeds remained moist but were not saturated.

Results

A difference between treatment effects was evident immediately after the 12-hour cool-water soak used in three of the four seed treatments. Seeds in the nicking treatment were visibly swollen, with their seedcoats split and partially displaced. The water containing nicked seeds was darkly discolored. Seeds in the hot water treatment were also swollen. Their seedcoats had begun to split and the water was discolored. Seeds in the cool-water treatment were swollen the least. The seedcoats of these seeds were largely intact, and the water was barely discolored. Among species, seed swelling and water discoloration were greatest with *A. saman,* about equal with *A. procera* and *A. saponaria,* and least noticeable with *A. lebbeck.*

After 10 days, seed germination and germinant development were evaluated. Statistical analysis beyond ranking of the means is not necessary for qualitative treatments of the type used in this study (Mize and Schultz 1985). Study data are summarized in Figure 2 and Table 2. For all species, the nicking treatment produced the best germination. Percent germination ranged from 36 to 100 percent for nicked seed, 28 to 60 percent for seeds treated with hot water, 4 to 44 percent for seeds treated with cold water, and 4 to 52 percent for the control. The nicking treatment also produced large,

Figure 2. Comparison of the influence of four seed treatemts on four species of *Albizia* (CON = control, CW = cold water, HW = hot water, Nick. = nicking).

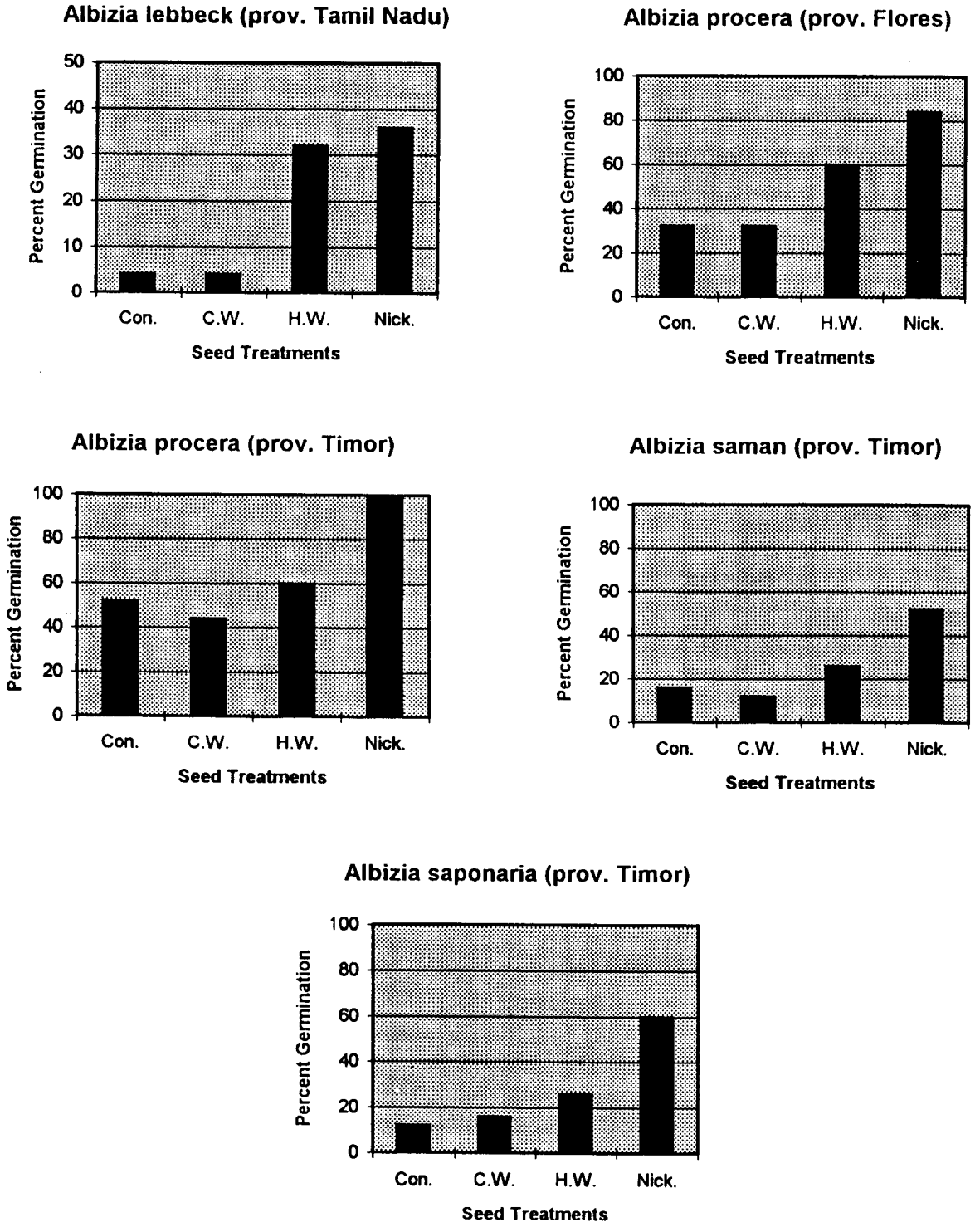


Table 2. Influence of seed treatment on the germination (%) of four *Albizia* species.

Species Provenance	Control	Cool Water	Hot Water	Nick-ing	Comments
A. lebbeck Tamil Nadu	4	4	32	36	In all treatments roots were just beginning to emerge from the seed.
A. procera Flores	32	32	60	84	Nicking treatment germinants were 50–65 mm long and had begun developing true leaves. Hot water treatment germinants were 25–50 mm, with the largest developing true leaves. In other treatments germinants were 10–35 mm.
A. procera Timor	52	44	60	100	Nicking treatment germinants were 25–35 mm long and were beginning to develop true leaves. In the other treatments germinants were no longer than 10 mm, with germinants in the hot water treatments being more developed.
A. saman Timor	16	12	28	52	Nicking treatment germinants had fully expanded cotyledons. In the other treatments roots were just beginning to emerge from the seed.
A. saponaria Timor	12	16	28	60	Nicking treatment germinants were beginning to develop cotyledons. In the other treatments roots were just beginning to emerge from the seed.

well developed germinants. *A. procera* germinants in the nicking treatment were 25–65 mm long and had developed true leaves. *A. saman* germinants had fully expanded cotyledons. The hot-water treatment produced largem well developed germinants of *A. procera* 25–50 mm long. Germinants of all species in the cool-water treatment and control were small and unremarkable (Table 2). Treatment effects were most pronounced with *A. procera* and least pronounced with *A. lebbeck*.

Discussion

The nicking treatment yielded the highest germination and best germinant development of all treatments in the study, and the hot-water treatment produced results which were notably better than the other two treatments. This success is attributed to the treatments circumventing the protective function of the seedcoat. Penetrating the hard

seedcoats, either by cutting or with heat, allows direct contact between the seed embryo and water, resulting in absorption and germination. This study demonstrates that nicking the seedcoat fosters better germination and germinant development than treating the seedcoat with hot water.

Germination may also be prevented by chemical inhibitors in *Albizia* seed. The nicking and hot water treatments followed by cool-water soaking may have removed these chemical inhibitors through leaching. This is indicated by the dark discoloration of the water observed during the 12-hour soak. In the cool-water treatment, water discoloration was hardly visible. The lack of discoloration suggests this method was less successful at penetrating the seedcoat and removing the chemical inhibitors.

Although a productive seed treatment method, nicking is also time-consuming. In this study, each seed was nicked by hand. Nicking a large quantity of seeds for a tree-planting program would be impractical. The best seed treatment method for a large quantity of albizia seed may be to use the hot water method with an extended cool-water soak. Several authors recommend that albizia seeds be treated by hot-water soak for 1–3 minutes, followed by 24 hours in cool water (Halos and Fabian 1981, Hensleigh and Holaway 1988, and Parrotta 1987b). These recommendations represent a 100 percent increase in the cool-water soaking period employed in this study. Such an increase in soaking time would improve water penetration of the seedcoat and water absorption by the seed embryo. This in turn would lead to quicker seed germination and germinant development.

Recommendations

Community nursery and plantation operations are most efficient when seedlings are of uniform age and size. Uniform seedling size is achieved through proper seed treatment prior to sowing. Of the seed treatment methods tested in this study, nicking was most effective at producing rapid, uniform seed germination and germinant (seedling) development. Unfortunately, nicking is time-consuming and only practical for small to medium quantities of seed. Although inferior to nicking, the hot-water treatment also produced good results and is easily applied to large quantities of seed. When propagating large numbers of *Albizia* species seedlings, seeds should be soaked in boiled water for 3 minutes followed by 24 hours in cool water. Stir seeds during the hot-water soak. The volumes of hot and cold water used should be five times the volume of seeds. These recommendations are applicable to the four species included in the study and all other *Albizia* species with hard, thick seedcoats.

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