PROPAGATION METHODS FOR SOME IMPORTANT SAMOAN TIMBER TREE SPECIES

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The US Territory of American Samoa is part of a volcanic archipelago located approximately 4100 km southwest of Hawaii at 14° S latitude and 170° W longitude. American Samoa consists of one main island, Tutuila, and several smaller islands including Aunu'u, Swain's Island, Rose Atoll and the Manua group of Ta'u, Ofu and Olosega. In total, the Territory is approximately 200 km^2. The climate is warm and wet with a mean temperature of 27° C and annual precipitation varying from 320 cm at sea level to more than 700 cm on Mt. Lata, the highest point in the Territory at 1000 m asl. Hurricanes are relatively common and have a major influence on vegetation.

The Samoan archipelago is the eastern most extent in the Pacific of tall rain forest vegetation type, which originates in Southeast Asia. Tree species richness is low in American Samoa due to the small size and isolation of the islands in the Territory (Whistler 1994, 2002). Nevertheless, many tall trees, often fine timber species, occur in the American Samoa. Two of these are *Pometia pinnata,* the most important timber tree in Samoa, and the leguminous *Intsia bijuga* that produces a heavy, dark, cabinet-quality wood favoured for traditional kava bowls. Other prominent native timber trees include *Diospyros samoensis, Syzygium inophylloides* and *Terminalia richii.* A recent introduction, *Flueggea flexuosa,* is a fast-growing tree widely planted as boundary markers and are harvested for */ale* (a traditional Samoan house) posts.

Seed germination percentage and germination rates vary widely among these species. Nursery-grown *Diospyros* showed 90% seed germination within two months (Foliga & Blaffart 1995). *Terminalia* trees produce tens of thousands of seeds but less than 0.1% of them germinate in the field (Foliga & Blaffart 1995). Seeds of this tree sown in the nursery did not germinate even after four months. Vegetative propagation can be used as an alternative to collecting and germinating seeds. The use of cuttings for propagating *Terminalia* has been investigated in Samoa (Alatimu 1998).

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The objective of this study was to test nursery propagation methods for important native Samoan timber trees. Performance of seed propagation, in terms of germination percentage and rate, was compared with vegetative propagation using cuttings. This work is important to determine the best means to provide adequate planting stock for reforestation of these trees in their native range.

Members of the Land Grant Forestry Program at the American Samoa Community College collected mature seeds and branch cuttings of *Diospyros, Flueggea, Intsia, Pometia, Syzygium* and *Terminalia* from February till September 1998 on the island of Tutuila, following the guide for season of peak availability by Trail (1994). The study was conducted at the greenhouse in Mapusaga, Tutuila.

Seed processing for most of the species in this project was quite simple. *Diospyros, Intsia, Pometia, Syzygium,* and *Terminalia* seeds were gathered from the ground and planted in the greenhouse. *Flueggea* seeds required more processing due to their small size. The fruits were collected from the tree, crushed by hand to remove the fleshy coat, and washed under running water using a sieve. The extracted seeds were placed in the sun to dry for 30 to 60 min. The seeds for all species were sown in 52 × 31 × 6 cm plastic germination trays filled with a 2:1 pasteurized top soil:perlite mixture. Seeds were placed just below the soil surface and kept moist by watering daily.

Propagation by vegetative means was carried out simultaneously. Fifty branch cuttings from each species were collected. Of these, 25 were treated with indole butyric acid (IBA) powder rooting hormone prior to planting, while the remaining 25 were untreated controls. Cuttings were planted in 2.3 litre plastic bags filled with a 2:1 mixture of pasteurized top soil:perlite and allowed to grow with daily watering to keep the cuttings moist.

Data on seed weight, onset of germination, length of germination trial, per cent germination and cutting survival were recorded beginning immediately after planting. Germination rate (R) was computed using the following equation:

$$R = P / (L - O)$$

where

P = per cent germination
L = length of the trial (day) and
O = onset of germination (day)

Relationships between seed weight and onset of germination, per cent germination, and germination rate (Table 1) were tested using Pearson's correlation with Bonferroni probabilities. The same method was used to test for correlations of onset of germination with per cent germination, and with germination rate. The onset of germination varied widely among species (Table 1). *Pometia* germinated first, starting seven days after planting. *Diospyros* and *Intsia* germinated at 14 and 15 days respectively. *Flueggea* and *Syzygium* began germinating 20 and 35 days after planting respectively. The slowest species, *Terminalia*, took 51 days to start germination.

Table 1 Seed weight and germination data for selected Samoan tree species

Species	Average seed weight (g)	No. of seeds	Onset of germination (days)	Length of germination trial (days)	Per cent germination	Average germination rate (%/day)
Diospyros samoensis	0.43	341	14	22	50	6.25
Flueggea flexuosa	0.0024	800	20	76	39	0.7
Intsia bijuga	3.2	207	15	87	75	1.04
Pometia pinnata	5.2	210	7	15	62	7.75
Syzygium inophylloides	N/A	68	35	63	96	3.43
Terminalia richii	1.9	434	51	178	7	0.06

Note: N/A = not available

Among the species tested, *Syzygium* had the highest germination (96%) followed by *Intsia* (75%), *Pometia* (62%), *Diospyros* (50%), *Flueggea* (39%) and *Terminalia* (7%) (Table 1). Three species, *Pometia, Diospyros* and *Syzygium*, had rapid average germination rates of 7.75, 6.25, and 3.43% per day respectively. *Flueggea* and *Intsia* responded somewhat less rapidly with germination rates of 0.70 and 1.04% per day. *Terminalia* had the lowest germination rate of 0.06% per day.

There was no correlation between seed weight and onset of germination, per cent germination, or germination rate. Similarly, there was no correlation between onset of germination and per cent germination or germination rate.

Data on seedling survival after germination was not collected. There was, however, sufficient survival that the seedlings were used as part of an old-field reforestation study.

No survival of hardwood cuttings was recorded in all treatments. The greenhouse mix may have been too fine or too moist to promote root initiation. *Terminalia* cuttings propagated in Samoa performed best in sand, which was the coarsest medium and had the least water-holding capacity (Alatimu 1998).

Propagation results from this project differed from those in Samoa (Foliga & Blaffart 1995). However, results of this project will be useful for nurseries in planning the propagation of their planting stock with regard to length of time required for germination and amount of seed required. The study should be repeated with both spatial and temporal replication while monitoring environmental conditions to increase understanding of how the nursery environment and seasonality affect the germination of species. Additional trials are needed to improve vegetative propagation methods for all species particularly those that are difficult to reproduce by seed, e.g. *Planchonella samoensis* and *Terminalia*. Methods to be investigated include factors affecting rooting success of cuttings, assessing growth rates of cutting types, and out-planting survival.

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