It seems that we are finally on the right track with the cutting propagation of *Actinidia*, and hopefully our future production will no longer be a problem.

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MAILE SEED GERMINATION AS AFFECTED BY PREPLANT SOAKING IN WATER WITH AND WITHOUT AERATION AND BOTTOM HEAT

MICHAEL J. TANABE

College of Agriculture, University of Hawaii
1400 Kapiolani St.
Hilo, Hawaii 96720

Abstract. Removal of fleshy seed pulp accelerated germination of maile (*Alyxia olivaeformis*). Trendwise, presoaking in aerated water was the most effective treatment. Non-heated medium produced highest germination whereas 31°C severely inhibited germination.

REVIEW OF LITERATURE

Maile (*Alyxia olivaeformis*), a valuable foliage plant for making leis in the Hawaiian Islands, is propagated primarily by seeds. Tanabe (5) demonstrated that preconditioning with growth regulators increased the germination rate and percentage of depulped maile seeds. A 48 hr soak in 1000 ppm gibberellic acid (GA) resulted in 97% germination after 13 weeks. The control had only 3% germination for that same period. Although presoaking with growth regulators proved effective, these compounds are not readily available. GA is also expensive and requires a centigram weighing balance to weigh the small amounts of material required.

It has been documented that soaking seeds in water increases germination rate for several plant species (1,2). Kidd and West (3) found that germination rate could be increased for pea, dwarf bean, barley, and sunflower without injury. Chippendale (1) worked with cocksfood (*Dactylis glomerata* L.) and speculated that soaking seed increased water uptake through the palea, thereby accelerating germination.

Bottom heat in conjunction with chemical soaking treatments has been employed as a means of increasing seed germination (4). Germination rate of presoaked Macarthur palm seeds was greatly increased with 27°±1°C medium temperature when compared to an unheated medium.

This study was conducted to evaluate the effectiveness of presoaking seeds in water, with and without aeration, in conjunction with bottom heat.

MATERIALS AND METHODS

Vine-ripened maile seeds were obtained from the 365 M elevation at Kalapana, Hawaii. Thirty seeds with intact pulp served as the control. The pulp was removed from the remaining seeds prior to treatment and placed in beakers containing 250 ml water. Aeration was provided by a Whisper model 700A air pump. The seeds were planted in flats containing No. 2 vermiculite and placed in a shade cloth covered greenhouse under 27 klx. Low watt propagation mats (model OP-175) were used as a source of bottom heat. Germination percentage was based on plumule emergence from the growing medium.

Each treatment consisted of 3 replications and 10 seeds per replication. The presoaking treatments included the following: 72, 96 and 120 hr soak in water with daily water change; 72, 96 and 120 hr soak in water with aeration and daily water change. The bottom heat treatments provided the following media temperatures: 26°C, 31°C, and 18° to 27°C.

RESULTS AND DISCUSSION

Depulping increased maile seed germination rates and percentages at all media temperatures (Tables 1, 2 and 3). Germination percentage at 10 weeks was 2½ to 5 times higher than the control, probably because the fleshy seed pulp inhibited seed germination. Very poor germination was observed at 31°C medium temperatures. The higher medium temperature probably reduced seed viability because no germination occurred after the bottom heat source was removed.

Germination was higher than the control for all no aeration presoaking treatments but was not different from the depulping treatments (Table 1, 2 and 3). This implies that germination inhibitors were probably not involved or that the inhibitors were not readily leached by presoaking treatments. There was also no difference between presoaking treatments at all media temperatures. The extended water soak apparently had no adverse affect on seed germination. The 31°C medium temperature delayed germination and greatly reduced germination percentage at 10 weeks.

Table 1. The effect of depulping and presoaking in water with and without aeration on the germination of maile seeds with 26°C medium temperature.

Treatment		Percent Germination			
		4 wk	6 wk	8 wk	10 wk
Control (seeds + pulp)		3 a[z]	3 c	3 c	10 b
Depulped		3 a	13 bc	27 bc	50 a
Presoaking Treatments					
No aeration,	72 hr	13 a	33 abc	40 ab	47 ab
	96 hr	3 a	37 ab	47 ab	57 a
	120 hr	3 a	20 abc	40 ab	53 a
With aeration,	72 hr	3 a	27 abc	43 ab	47 ab
	96 hr	13 a	47 a	63 a	67 a
	120 hr	7 a	23 abc	40 ab	30 ab

[z] Mean separation in columns by Duncan's multiple range test, 5% level.

Table 2. The effect of depulping and presoaking in water, with and without aeration, on the germination of maile seeds with 31°C medium temperature.

Treatment		Percent Germination			
		4 wk	6 wk	8 wk	10 wk
Control (seeds + pulp)		0 a[z]	0 a	0 a	0 c
Depulped		0 a	0 a	7 a	17 ab
Presoaking Treatments					
No aeration,	72 hr	0 a	7 a	10 a	17 ab
	96 hr	0 a	13 a	17 a	23 a
	120 hr	0 a	3 a	3 a	3 bc
With aeration,	72 hr	0 a	7 a	7 a	7 bc
	96 hr	0 a	3 a	13 a	13 bc
	120 hr	0 a	0 a	10 a	17 ab

[z] Mean separation in columns by Duncan's multiple range test, 5% level.

Table 3. The effect of depulping and presoaking in water with and without aeration on the germination of maile seeds with 18° to 27°C medium temperature.

Treatment		Percent Germination			
		4 wk	6 wk	8 wk	10 wk
Control (seeds + pulp)		0 f[z]	3 c	13 e	20 cde
Depulped		20 bcd	43 b	47 bc	53 ab
Presoaking Treatments					
No aeration,	72 hr	3 ef	35 bc	35 bcd	38 bcd
	96 hr	17 bcde	43 b	57 abc	60 ab
	120 hr	7 def	23 bc	40 bcd	50 abc
With aeration,	72 hr	23 bc	40 b	57 abc	67 ab
	96 hr	40 a	70 a	77 a	80 a
	120 hr	30 ab	40 b	43 bc	57 ab

[z] Mean separation in columns by Duncan's multiple range test, 5% level.

Presoaking aeration treatments produced a trendwise increase in germination rate and percentage especially at 18° to 27°C medium temperature (Table 3). Highest germination was observed with the 96 hr aeration presoaking treatment. Total germination percentage at 10 weeks was 80% for 96 hr aeration presoak, 20% for control, 53% for depulping, and 60% for 96 hr no aeration treatments. The effect of high medium temperature was consistent with the other experiments. A 31°C medium temperature severely inhibited seed germination.

In summary, depulping greatly improved maile seed germination. Presoaking the depulped seeds in water with and without aeration produced similar germination trends to the depulping treatments. However, presoaking with aeration for 96 hr produced the highest seed germination with the unheated medium (18° to 27°C). Bottom heat is not necessary and 31°C medium temperature drastically reduced germination.

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COMPARISON OF ROOTING MATERIALS ON LEUCOSPERMUM CUTTINGS

PHILIP E. PARVIN

Maui Agricultural Research Center, University of Hawaii
Kula, Maui, Hawaii 96790

The development of proteas as an export cut flower crop for Hawaii is relatively recent. As a result of a research project in the University of Hawaii's Department of Horticulture, the first commercial protea farm was planted on a 6-acre tract of land adjacent to the Experiment Station in Kula, Maui in the fall of 1972. The second farm was planted in 1975, encompassing approximately 12 acres. Today, there are over 110 acres of proteas planted in Hawaii on the cool slopes of volcanoes on Maui and the Island of Hawaii.

At first, plants from seed were considered to be the appropriate material to use. As the protea industry expands on an