Chemical Treatment Of Bare-Root Saligna Eucalyptus Seedlings Offers No Advantages

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Economical, effective methods for planting saligna eucalyptus seedlings for reforestation purposes are being sought in Hawaii. Treatments with a commercial transpiration retardant and root stimulant have so far proved disappointing.

Saligna eucalyptus *(Eucalyptus saligna)* is planted on a variety of sites for reforestation in Hawaii. The cost of planting seedlings bare-root is lower than that of planting them with balled-roots. But the survival rate is lower and the rate of initial stem dieback is higher in bare-root seedlings than in balled-root seedlings. These differences in survival and growth rates have been observed in an earlier study (1) and in field plantings of both types of planting stock.

We are seeking a treatment (or treatments) which can combine the cost advantages of bare-root seedlings with the high survival and low dieback rates of balled-root seedlings. In a previous study, the transpiration retardant *All-Safe* [2] significantly reduced seedling dieback on moist and dry sites and significantly increased seedling survival on a dry site (2). Survival rate on the dry site, however, was far below the acceptable minimum-only 53 percent of the seedlings were still alive after 1 year.

In this study, *All-Safe* and a root stimulant called *Nu-Gro*[2] were tested individually and in combination to determine their effect on survival, dieback, growth, and vigor of bareroot saligna eucalyptus seedlings. Their performance was then compared to that of untreated bare-root and balled-root seedlings planted as controls.

Methods

Bare-root and balled-root saligna eucalyptus seedlings were about 6 months old and about 1 foot tall at the time of treatment. Bare-root seedlings were lifted from nursery beds. The four treatments were:

1. Foliage dip: Tops dipped in a

1The author, stationed at Honolulu, Hawaii, acknowledges the cooperation of the Hawaii Division of Forestry.

[2]*All-Safe* and *Nu-Gro* are manufactured by Certified Laboratories, Fort Worth, Tex. *All-Safe* consists of vinyldrine copolymers formulated into a weatherresistant film-forming material. *Nu-Gro* consists of nitrogen (5 percent), available phosphoric acid (20 percent), and water soluble potash (10 percent) formulated into a root-stimulating substance.

All-Safe-Captan-Malathion[3] solution and roots dipped in a Captan-Malathion solution.

2. *Root dip:* Roots dipped in a Nu-Gro-Captan-Malathion solution and tops dipped in a Captan-Malathion solution.
3. *Foliage and root dip:* Tops dipped in *a All-Safe-Captan*Malathion solution and roots dipped in a Nu-Gro-CaptanMalathion solution.
4. *Control:* Bare-root seedlings fully submerged in a CaptanMalathion solution; balled-root seedlings not treated.

After treatment, seedling roots were packed in damp moss and wrapped in plastic.

Seedlings of each treatment and balled-root seedlings were planted at three sites representing wet, moist, and dry conditions. The wet site is on the Waiakea Forest Reserve and the moist site is on the Hamakua Forest Reserve, both on the island of Hawaii. The dry site is on the Puu Ka Pele Forest Reserve on the island of Kauai. The physiographic characteristics of these three sites are:

	Wet Site	Moist Site	Dry Site
Characteristics:			
Rainfall ..... *Inches*	200	80	40
Elevation ..... *Feet*	2,150	2,100	2,350
Aspect	NE	NE	W
Slope ..... *Percent*	3	11	7
Soil type	Keei rocky muck	Honokaa silty clay loam	Haeleele silt loam

The experimental design was identical at each site and consisted of five randomized blocks, five plots to each block. Each plot, or row, contained six trees of a given treatment.

Seedlings at each site were examined at the time of planting and 1, 4, and 12 months later. Tree heights, stem dieback, survival, and vigor were recorded. Seedlings were maintained free of weeds.

Results and Discussion

Wet Site

All seedlings were planted under good conditions-the soil was moist and the weather warm and partly cloudy. Even so, all the bare-root seedlings wilted. But none of the balled-root seedlings wilted.

At 1 month, the effects of planting shock were apparent; about 67 percent of all bare-root seedlings had died back (table 1). Differences in stem dieback between treatments of bare-root seedlings were not statistically significant. None of the balledroot seedlings died back.

After 4 months, survival for the bare-root seedlings averaged 70 percent, with no significant differences among treatments. All of the balledroot seedlings survived. The survival difference between the bare-root control seedlings and the balled-root seedlings was statistically significant (5 percent level). An average of 92 percent of the bare-root seedlings and all the balled-root seedlings were rated as having high vigor at 4 months (table 1).

During the rest of the year, no other seedlings died. The percentage of vigorous seedlings increased in some treatments and decreased in others (table 1).

During the first year, the bare-root seedlings averaged about 1 foot in net height growth; the balled-root seedlings 1.5 feet (table 1).

TABLE 1. *Dieback, survival, vigor, and height growth of saligna eucalyptus bare-root seedlings treated with transpiration retardant and root stimulant and of untreated balled-root seedlings after planting on wet and moist sites, island of Hawaii*

Site and treatment	Dieback	Survival		High vigor		Height growth
	1 month	4 months	12 months	4 months	12 months	12 months
	Percent	*Percent*		*Percent*		*Feet*
Wet site:						
Foliage dip	67	87	87	85	96	0.5
Root dip	67	63	63	89	95	1.0
Foliage dip and root dip	60	70	70	95	90	1.0
Bare-root (control)	73	60	60	100	78	1.0
Balled-root (control	0	100	100	100	95	1.5
Moist site:						
Foliage dip	47	90	90	100	100	4.0
Root dip	57	90	90	100	100	3.5
Foliage dip and root dip	50	97	97	100	100	3.0
Bare-root (control)	40	97	97	100	100	3.0
Balled-root (control)	[1]77	[1]23	[1]23	100	100	4.0

[1]Most seedlings were in poor condition from rough handling before planting.

[3]A11 seedlings shipped from the Central Tree Nursery in Kamuela, Hawaii, are first fully submerged in a Captan-Malathion solution. So that the seedlings in this study would receive as normal a treatment as possible, Captan (a fungicide) and Malathion (an insecticide) were added to the *All-Safe* and *Nu-Gro* solutions (as recommended by the manufacturer) as well as to the control treatment.

On the wet site, treating bare-root seedlings with a transpiration retardant, root stimulant, or both did not significantly affect survival rate, dieback, vigor, or height growth. In all aspects, the balled-root seedlings were superior to the bare-root seedlings.

Moist Site

All seedlings were planted under good conditions-the soil was moist and the weather cool and cloudy. As on the wet site, all bare-root seedlings wilted soon after planting. About 77 percent of the balled-root seedlings were in poor condition when planted because of rough handling and fumigation during shipment.

At 1 month, the effects of planting shock were apparent on about 50 percent of the bare-root, seedlings (table 1). Differences in dieback between treatments were not statistically significant. The same 77 percent of the balled-root seedlings remained in poor condition.

At 4 months, most of the bare-root seedlings that died back had developed vigorous sprouts. But the balledroot seedlings that died back did not recover. Survival for the bare-root seedlings averaged 90 percent or higher in all treatments. Differences between treatments were not significant. Only 23 percent of the balledroot seedlings survived. All seedlings that died were in poor condition when planted. All surviving bare-root and balled-root seedlings had high vigor (table 1).

During the remainder of the 1year study period, no other seedlings died, and seedling vigor remained high.

During the first year, the bare-root seedlings averaged about 3.5 feet in net height growth; balled-root seedlings averaged 4 feet. Height growth differences between treatments were not significant.

On the, moist site, treating bareroot seedlings with a transpiration retardant, root stimulant, or both did not significantly affect survival, dieback, vigor, or net height growth. The balled-root seedlings that survived rough pre-planting handling grew the same amount as the best of the bare-root seedlings.

Dry Site

Three plantings were made on the dry site : Plantings A and B, each with all the bare-root treatments; and Planting C, with balled-root seedlings only, established 1 week after Planting A and 5 weeks before Planting B. Balled-root seedlings were not available when Planting A was made. Data for each planting were analyzed separately.

Planting A was established under poor planting conditions-the soil surface was dry and the subsurface only slightly moist. The weather was warm and sunny. Because it appeared that most of the 93 percent of the seedlings which died back would eventually die, another planting (B) was made. Planting conditions were not much better, however, and 88 percent of these seedlings died back.

Differences in dieback between treatments for either planting were not statistically significant (table 2).

Many seedlings in both bare-root plantings did not recover, so that after 4 months, survival rate in all treatments in both plantings averaged 26 percent. In Planting A, survival rate varied significantly with treatments. The foliage dip treatment had significantly greater survival than the control seedlings, and the root dipped seedlings had significantly less. Survival rate of the foliagedipped seedlings and the control seedlings was similar to that in the earlier test of the transpiration retardant.([2]) In Planting B, survival rate among treatments did not differ significantly. Survival rate of the control seedlings was the same as for Planting A, but that of the foliage dip seedlings decreased. I could not find any obvious cause for reduced survival for either the foliage-dipped seedlings or the increased survival for the foliage-root dip and root dip seedlings. All surviving seedlings had high vigor.

During the remainder of the 1year study period, the seedlings maintained high vigor-few died in either Plantings A or B.

TABLE 2.—*Dieback, survival, vigor, and height growth of saligna eucalyptus bare-root seedlings treated with a transpiration retardant and a root stimulant and of balled-root seedlings after planting on a dry site, island of Hawaii*

Planting and treatment	Dieback	Survival		High vigor		Height growth
	1 month	4 months	12 months	4 months	12 months	12 months
		Percent				*Feet*
Planting A:						
Foliage dip	87	53	47	100	100	5.5
Root dip	97	7	3	100	100	3.5
Foliage dip and root dip	93	20	20	100	100	5.5
Bare-root (control)	93	27	23	100	100	6.0
Planting B:						
Foliage dip	82	23	23	100	100	3.5
Root dip	100	20	20	100	100	3.5
Foliage dip and root dip	83	33	33	100	100	2.5
Bare-root (control)	87	27	23	100	100	3.5
Planting C:						
Ballet-root (control)[1]	0	100	100	100	100	7.0

[1]Planted 1 week after the bare-root seedlings in Planting A and 5 weeks before bare-root seedlings in Planting C.

During the first year, seedlings in Planting A had grown an average of 5 feet and seedlings in Planting B an average of 3.2 feet. Differences in growth between treatments in either planting were not statistically significant (table 2).

Treating bare-root seedlings with a transpiration retardant, root stimulant, or both did not increase survival rate enough to justify the treatment, and did not affect dieback, vigor, or height growth.

Balled-root seedlings of Planting C were planted under good conditions the soil was moist and the weather was warm and cloudy. No dieback occurred and the balled-root seedlings maintained high vigor throughout the year. At 1 year, they averaged 7 feet of height growth (table 2).

Conclusions

Treating bare-root saligna eucalyptus seedlings with the transpiration retardant *All-Safe,* the root stimulant *Nu-Gro,* or both, offered no practical advantages over untreated bareroot seedlings, regardless of planting sites. When properly handled, untreated balled-root seedlings were superior to treated and untreated bareroot seedlings on the wet and moist sites, and probably on the dry sites as well. Rate of survival and vigor of seedlings changed little after 4 months on any of the sites, suggesting that this period is long enough for evaluating plantings.

Literature Cited

(1) Walters, Gerald A.
1970. Bare-root and balled-root planting stock * of saligna euca lyptus-differ in survival, early growth. Tree Planters' Notes 21(2): 14-16.

(2) Walters, Gerald A.
1971. Survival and growth of saligna eucalyptus seedlings treat ed with a transpiration retardant in Hawaii. Tree Planters' Notes 22(l): 2-4.