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PACIFIC SOUTHWEST
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SELECTING TIMBER SPECIES TO REPLACE KILLED FIRETREE IN HAWAII

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ABSTRACT: A species with little commercial value, firetree *(Myrica faya* Ait.*)* infests several islands of Hawaii. A test of replacing herbicide-killed firetrees by underplanting selected timber species is underway. Among the seven species planted, Austrailan toon—on the basis of its initial survival and growth—shows the most promise for reforestation. Falling limbs and stems from dead firetrees are damaging many planted trees, but probably enough will survive to develop a productive forest cover.

OXFORD: (969):441–414.26 Tordon 22K:176.1 *Myrica faya*:235.1[+ *Toona australis* + *Fraxinus uhdei*].

RETRIEVAL TERMS: Myrica faya; Hawaii; weed control; type conversion; underplanting; *Toona australis; Fraxinus uhdei;* Tordon 22K.

Firetree *(Myrica faya* Ait.*)*, a scrubby tree native to the Azores and Canary Islands, has been planted as an ornamental on several of the Hawaiian Islands. The species has little or no value for wood products. It has naturalized aggressively and become a pest on both range and forest lands. A survey in 1967 by the Hawaii Department of Agriculture showed that more than 40,000 acres of the Island of Hawaii were infested to some degree with firetree. The heaviest stands found there are in and next to the Hamakua Forest Reserve.

To prevent the continuing spread of firetree and to develop a productive forest cover on infested areas, it is necessary to eradicate this plant pest and to reforest. Akira Kawasaki and Robert Kami of the Hawaii Department of Agriculture demonstrated in 1967 that firetree can be killed by injections of Tordon 22K (4-amino-3,5,6-trichloropicolinic acid).[1] But prescriptions for reforesting treated areas with desirable species are not known. On the basis of Kawasaki's and Kami's results, the Experiment Station and the Hawaii Division of Forestry began a study in 1967 to determine the effectiveness of under-planting treated firetree stands with selected timber species.

Among the seven tree species being tested, Australian toon is the most satisfactory for reforestation on the basis of its initial survival and growth. Three other species—Queensland-maple, tropical ash, and Moreton-Bay-chestnut—are probably also suitable for this purpose, but would require more weedings. Damage to planted trees from falling firetree limbs and stems could be reduced by delaying planting. But problems with weeds would be greater. Therefore such a practice needs further study.

METHODS

The study site is on the Hamakua Forest Reserve, at about 2,200 feet elevation. Rainfall averages about 80 inches annually. Topography is undulating, with

the general aspect being north with a 10 percent slope. The soil is a Honokaa silty clay loam. A dense firetree stand averaging about 55 feet tall and 12.7 inches in basal diameter at one time occupied the area.

All firetree stems within a 2-acre area, 2-chains by 10-chains, were injected with the herbicide Tordon 22K. Four blocks, each with five randomized plots, were established within the 2 acres. Each plot, measuring 1-chain square, was planted with a different species. On each plot, we planted 100 seedlings of Queensland-maple *(Flindersia brayleyana* F.v.M.*)*, tropical ash *(Fraxinus uhdei* Wenzig Lingelsheim*)*, saligna eucalyptus *(Eucalyptus saligna* Sm. *)*, Australian toon *(Toona australis* Harms*)*, or blackwood *(Acacia melanoxylon* R. Br.*)*. They were planted at 6.6- by 6.6-feet spacing immediately after firetrees were treated.

Because only 13 percent of the saligna eucalyptus seedlings were alive after 6 months, plots were replanted with Moreton-Bay-chestnut *(Castanospermum australe* A. Cunn.*)* and hoop-pine *(Araucaria cunninghamii* Sweet.*)* seedlings. Each species occupies one-half of each of the original saligna eucalyptus plots. Saligna eucalyptus mortality may have been the result of poor seedling quality because the few surviving seedlings were vigorous.

Circular sample plots one-fortieth acre in size were established in the center of each plot. The sample plots were examined after 6, 12, and 24 months. Data on seedling survival and growth and firetree reinvasion were collected.

RESULTS AND DISCUSSION

The firetree canopy was completely killed by the injection of Tordon 22K. Two years after treatment, an equivalent of 12 trees per acre had sprouted. Each tree averaged two sprouts. Only one firetree seedling was found—the equivalent of four per acre. This 5-inch tall seedling was growing out of the top of a 3-foot treefern *(Cibotium* spp.*)*. A dense ground cover probably prevented other seedlings from developing.

Once the firetrees were eradicated, the planted trees were free to take over the site. However, as on most good sites, weeds became a problem. Suppressed seedlings were released periodically, but some seedlings still died because of weed competition.

Australian toon appears to be the most promising of the species being tested. It had 86 percent survival and averaged 5 feet tall after 1 year *(table 1)*. After 2 years, survival was still high, and the trees averaged 12.5 feet tall. Little maintenance was needed; more than 85 percent of the trees were taller than the weeds after 1 year. The wide spreading crowns of Australian toon helps keep fronds and branches of weeds away from the terminal *(fig. 1)*.

Tropical ash was promising after 1 year with 97 percent survival and an average height of 5 feet. But after 2 years the survival was down to 76 percent. Trees continued to grow well, and averaged 10 feet tall after 2 years. About 10 percent of the tropical ash stems have lodged. Tropical ash required little maintenance as 85 percent of the stems were taller than the weeds after 1 year.

Table 1 —*Initial survival, height and crown diameter growth, and vigor of Queensland-maple, Tropical ash, Australian toon, Blackwood, Moreton-Bay-chestnut, and Hoop-pine in Hawaii, 1969*

Species	Age	Survival	Height		Crown diameter		Vigor		
			Average	Range	Average	Range	Good	Average	Poor
	Years	*Percent*	*Feet*		*Feet*		*Pct. of live trees*		
Queensland-maple	1	70	2.5	0.5-6.0	2.0	1.0-4.5	76	12	12
	2	55	5.5	1.0-11.0	4.0	1.0-6.5	87	7	6
Tropical ash	1	97	5.0	1.0-8.5	2.0	1.0-3.5	89	9	2
	2	76	10.0	1.5-17.0	3.0	1.0-5.0	81	17	2
Australian toon	1	86	5.0	1.0-9.5	3.5	1.0-6.0	96	4	0
	2	83	12.5	1.5-25.0	5.0	.5-8.0	86	9	5
Blackwood	1	38	2.0	1.0-5.0	.5	.0-1.5	11	5	84
	2	7	4.0	2.0-6.5	1.0	1.0-1.5	71	29	0
Moreton-Bay-chestnut	½	96	2.0	.5-3.0	1.0	.5-1.5	69	20	11
	1½	95	3.5	1.0-5.5	2.0	1.0-4.5	89	11	0
Hoop-pine	½	100	1.0	.5-1.0	1.0	.5-1.5	77	23	0
	1½	98	2.0	1.0-2.5	1.5	1.0-2.0	94	6	0

Figure 1—*Australian toon 2 years after being underplanted in a firetree stand killed by injecting the herbicide Tordon 22K.*

Queensland-maple had 70 percent survival after 1 year; 55 percent after 2 years. Its height growth was slower than that of tropical ash and Australian toon. Queensland-maple trees averaged 2.5 feet after 1 year and 5 feet tall after 2 years. About 45 percent of the seedlings were taller than the weeds after 1 year, and 95 percent were taller after 2 years.

Blackwood shows the least promise of the species being tested. It had poor survival and only averaged 2 feet tall after 1 year. Only about 30 percent of the blackwood seedlings were taller than the weeds. And many stems were leaning or bent over. The few seedlings (7 percent) that were alive after 2 years were taller than the weeds.

Moreton-Bay-chestnut and hoop-pine seedlings were slow to become established. They grew little during the 6 months after planting. The Moreton-Bay-chestnut seedlings averaged 2 feet in height; hoop-pine seedlings averaged but 1 foot. Only about 25 percent of seedlings of both species were taller than the weeds. Moreton-Bay-chestnut and hoop-pine seedlings are apparently quite shade tolerant, because only a few died. After 1½ years 80 percent of the Moreton-Bay-chestnut and 50 percent of the hoop-pine seedlings were taller than the weeds.

All species tested, except blackwood, seem to be well adapted to the site. More than 80 percent of the trees were rated as having high vigor at the latest examination.

Dead firetrees still pose a problem. About 60 percent of the firetree limbs have fallen, and many main stems have toppled during the 2 years since injection. The falling limbs and stems have broken, bent, or scraped many of the planted trees *(fig. 2)*. The amount of damage appears to be related to the size of the planted trees—the large, faster growing seedlings were damaged most. The damage, by species:

Species:	Stems damaged *(percent)*
Australian toon	27
Tropical ash	36
Queensland-maple	23
Blackwood	0
Moreton-Bay-chestnut	15
Hoop-pine	0

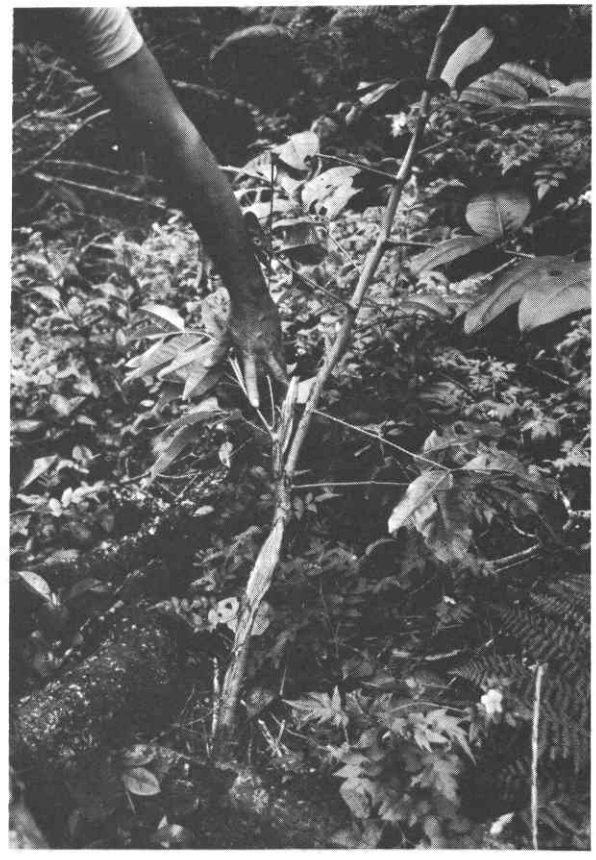

Figure 2—*Planted Queensland-maple trees have been damaged by falling branches of dead firetrees.*

Tropical ash seems more susceptible than other species to such damage because many of the stems were already leaning. The Moreton-Bay-chestnut and the hoop-pine are small and have suffered little damage. The fact that these two species were planted 6 months after the others indicates that a delay between injecting and planting may reduce the damage. The methods used in this study, however, may be adequate to accomplish reforestation.

NOTES

[1]Mention of trade names is solely for information. No endorsement by the U.S. Department of Agriculture is implied.

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