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Survival and Five-Year Growth in Unit 4, Waiakea Arboretum, Hawaii

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ABSTRACT: Of the nine introduced tree species planted in Unit 4 in 1960, one pine species has failed completely. A slash pine planting on pahoehoe lava shows good survival and growth. And a karri eucalyptus reached a height of 58 feet in 5 years. Competition from wild vegetation was the main cause of mortality.

Unit 4 was the last of four units established at the Waiakea Arboretum, near Hilo, Hawaii, to observe the survival and growth of introduced tree species. Of the nine species planted there, one pine species has failed completely. Units 1 and 2 had 60 species planted in 1956-57. Most of these plantings showed good survival when measured in 1963, but some failed entirely.[1] Unit 3 had 25 species planted in 1959. Measurement 5 years later showed seven pines had failed, but some species displayed good survival and growth.[2] In unit 4, as in unit 3, the plantings suffered from competition from wild vegetation.

The arboretum lies at an elevation of 800 feet on the slopes of Mauna Loa on the island of Hawaii. Median annual precipitation is about 200 inches. Temperature averages about 70° F.

Ikeda[3] described the soil as of the Puna extremely stony-Kona rockland silt loam, low elevation complex. Pahoehoe lava (a type of lava which has cooled at rest, giving a smooth unbroken appearance) outcrops are common and may be easily identified by their grass cover. Ferns, and shrubs are the dominant vegetation on the deeper soils. Soil depths range from 0 to 40 inches.

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[1]Richmond, George B. Species trials at the Waiakea Arboretum, Hilo, Hawaii. U.S. Forest Serv. Pacific SW. Forest & Range Expt. Sta. Res. Paper PSW-4, 21 pp., illus. 1963.

[2]Carpenter, Stanley B., and Richmond, George B. Five-year measurements of unit 3, Waiakea Arboretum, Hawaii. U. S. Forest Serv. Pacific SW. Forest & Range Expt. Sta. Res. Note PSW-63, 5 pp., illus. 1965.

[3]Ikeda W. (n.d.) (Unpublished report on file at Hilo unit office, U. S. Soil Conserv. Serv. Hilo, Hawaii.)

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Figure 1.--Melastome has suppressed this Caribbean pine. Many newly dead trees were found in the midst of dense brush.

Figure 2.--A suppressed jelecote pine has been prostrated by melastome in unit 4.

Figure 3.--Slash pine has grown well on a pahoehoe lava outcrop. Grass cover in the foreground indicates shallow soil.

The nine introduced species planted in unit 4 were set out in blocks or strips. They included seven pines, karri eucalyptus (Eucalyptus diversicolor F. Muell.) and Mexican cypress (Cupressus lusitanica Mill.). The pines were planted at a spacing of 8 feet by 8 feet. The other two species were spaced at 10 feet by 10 feet. The plantings ranged from 20 to 200 individuals. They have not been weeded since their establishment in 1960.

Measurements

Height, diameter, and survival were determined for the entire planting (table 1). Heights were recorded to the nearest foot. Diameters were measured to the nearest one-tenth inch. Survival was determined by presence or absence of the planted tree. Defects and the presence of flowers or fruit were also recorded.

Condition of Plantings in 1965

Considering the absence of weeding, survival and growth of the pine species has been remarkable. Their survival ranged from 1 to 67 percent. A 5-foot Pinus echinata x taeda x wind was the sole survivor in a planting of 200 trees. One jelecote pine reached a height of 32 feet in 5 years. Average height of the surviving Benguet pines was 20 feet.

The largest tree in the 1960 plantings was a karri eucalypt that stood 58 feet tall and had an 8.1-inch diameter. This species showed better survival than any other species in unit 4.

Competition from wild vegetation caused much of the mortality in the Mexican cypress and pine plantings. It appears to have caused the poor form in the eggcone pine (Pinus oocarpa) planting, where many trees have developed crooked stems from shading. We found many newly dead trees in the midst of dense brush in unit 4 (fig. 1). Numerous live trees were overtopped and prostrated (fig. 2). Melastome (Melastoma malabethricum L.), mamaki (Pipturus albidus Rock), and oi (Stachytarpheta jamaicensis (L.) Vahl.) were the main shrub species present.

Shallow soil was responsible for poor survival and growth in units 1, 2, and 3, but was not a major factor in unit 4. Slash pine has shown remarkable growth on pahoehoe lava (fig. 3). Two karri eucalypts were windthrown, however, as a result of poor root development in the shallow soil.

Table 1.--*Survival and growth of 1960 plantings, unit 4, Waiakea Arboretum, July 1965*

Species	Tree planted	Survival		Height		Diameter		General condition; appearance	Flowers or fruit	Remarks
		1962[1]	1965	Average	Range	Average	Range			
	Number	*Percent*		*Feet*		*Inches*				
Cupressus lusitanica Mill. (Mexican cypress)	100	81	58	15	3-28	1.6	<0.5-4.3	Good	Cones	Dense brush, persistent limbs.
Eucalyptus diversicolor F. Muell. (karri eucalyptus)	20	90	85	39	22-58	4.9	1.7-8.1	Good	--	Large limbs, a little rot, two trees windthrown.
Pinus caribaea Morelet (Caribbean pine)	100	38	27	11	5-19	1.6	<0.5-3.7	Fair	--	Dense brush, many suppressed trees.
Pinus echinata x *taeda* x wind[2]	200	4	(3)	5	--	--	--	Poor	--	Only one tree survived, dense brush.
Pinus elliottii Engelm. (slash pine)	40	70	65	13	7-23	2.8	0.8-4.3	Good	--	Planted on pahoehoe.
Pinus oocarpa Schiede. (eggcone pine)	150	82	67	20	6-31	2.8	<0.5-5.6	Good	Cones	Dense brush, many crooked trees.
Pinus insularis Endlich. (Benguet pine)	100	64	41	20	10-29	3.7	0.8-6.1	Good	Male flowers	Dense brush, four trees have long leaders ranging from 9 to 14 feet.
Pinus patula Schlecht. & Chambers (jelecote pine)	200	65	65	21	6-32	2.8	<0.5-5.3	Good	Cones	Dense brush, a few trees have excessive taper.
Pinus taeda L. (loblolly pine)	100	61	45	11	3-18	1.1	<0.5-2.9	Fair	Cones	Dense brush, many forked trees.

[1]Richmond *op. cit.* p. 3.

[2]Seed source: Institute of Forest Genetics, U.S. Forest Serv., Placerville, Calif.

[3]Only one tree survived.

The Author

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