



Five-Year Measurements of Unit 3, Waiakea Arboretum, Hawaii

STANLEY B. CARPENTER AND GEORGE B. RICHMOND

ABSTRACT: Measurements were taken of 25 exotic tree species planted in 1959 in the Waiakea Arboretum near Hilo, Hawaii. After 5 years, some species show good survival and growth, but seven pines failed to survive. All plantings have suffered from shallow soil, and competition from wild vegetation.

The Waiakea Arboretum was established in 1956 by the Hawaii Division of Forestry for the trial of exotic tree species. Four units have been established to date. Richmond¹ reported on the performance

of species in units 1 and 2, and included a location map of all four units. This note concerns the performance of plantings within unit 3. Measurements of unit 4 will be reported at a later date.

The arboretum lies about 6 miles south of Hilo on the island of Hawaii, at an elevation of 800 feet. Median annual precipitation is about 200 inches. Temperature averages about 70° F.

The soil is of the Puna extremely stony-Kona rockland silt loam, low elevation complex². Pahoehoe lava³ outcrops occur over 25 percent of the surface. Soil depths range from 0 to 40 inches.¹

MEASUREMENTS

Twenty-five exotic tree species were planted in unit 3 in 1959. Twelve of the species were pines. Plantings ranged from 6 to 114 individuals. Trees were planted at a spacing of 10 feet by 10 feet without regard to ground conditions.

Height, diameter, and survival⁴ were determined from the entire planting or a portion of it. If a planting contained 30 or fewer planting spots, all planting spots were sampled. If it contained more than 30 spots, a sample of 30 was made. Several of the larger

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

²Ikeda, W. (n.d.) (Unpublished report on file at Hilo Unit Office, U.S. Soil Conservation Service, Hilo, Hawaii.)

³Geological term for a type of lava which has cooled at rest, giving a smooth unbroken appearance.

⁴Presence or absence of a planted tree.

plantings showed great variation in the size and vigor of individual trees. An attempt was made to include these differences by splitting the sample between shallow pahoehoe soil and deeper soil.

CONDITION OF PLANTINGS IN 1964

Table 1 lists the species planted and summarizes the measurements taken. Caribbean pine (Planting A) is the only pine that has been moderately successful. Seven pines failed to survive. Soft yar, Papuan ironwood, and Queensland-maple have been very successful in both survival and growth. Yellowbox eucalyptus also failed to survive. Three other eucalypts show extremely poor survival and growth.

All plantings in unit 3 reflect the wide range of soil depth. Entire plantings or parts of them on shallow pahoehoe lava show extremely poor survival and growth. Generally those planted in deep soil and filled depressions have been successful in both survival and growth.

Competition by wild vegetation rather than shallow soil depth appears to have caused the failure of several pine plantings (fig. 1). But wild vegetation appears to have had little effect on other plantings (fig. 2). Guava (Psidium guajava L.), melastome (Melastoma malabathricum L.), and Indian pluchea (Pluchea odorata (L.) Cass.) are the main shrub species present.

The Authors. . .

are both conducting silvicultural research in forest tree plantations in Hawaii. Native of Searcy, Ark., STANLEY B. CARPENTER holds forestry degrees from the University of Idaho (B.S., 1959) and the University of Washington (M.F., 1961). He joined the Pacific Southwest Station's staff in 1964. GEORGE B. RICHMOND, native of Missouri, holds a bachelor's degree in forestry (1961) and a master's degree in plant ecology (1962) from the University of Missouri. He has been headquartered in Hawaii since early 1962.



Figure 1.--Competing wild vegetation has killed several pine plantings. Melastome overtops this five-year-old Caribbean pine.

Figure 2.--Five-year-old Papuan ironwood is beginning to shade out competing wild vegetation. This planting averages 30 feet tall.



Table 1. Survival and growth of 1959 plantings, unit 3, Waiakea Arboretum, July 1964

| Species | Trees planted | Planting spots examined | Survival (based on sample) | Height | | Diameter b.h. | | General condition, appearance | Remarks |
|--|---------------|-------------------------|----------------------------|---------|-------|---------------|-----------|-------------------------------|---|
| | | | | Average | Range | Average | Range | | |
| | Number | Number | Percent | Feet | Feet | Inches | Inches | | |
| <i>Ackama paniculata</i> Engl. (Ackama) | 90 | 30 | 40 | 11 | 5-18 | 0.9 | < 0.5-1.9 | Good | Severe brush competition. |
| <i>Acacia longifolia</i> Willd. (Sydney acacia) | 26 | 26 | 0 | -- | -- | -- | -- | -- | Entire planting died, several trees windthrown. |
| <i>Acacia saligna</i> Wendland. (goldwreath acacia) | 10 | 10 | 40 | 24 | 22-28 | 5.8 | 4.2-9.2 | Good | |
| <i>Acacia sophora</i> R. Br. (longleaf acacia) | 10 | 10 | 20 | 22 | 21-22 | 3.4 | 2.7-4.0 | Poor | Only two trees survived, one tree was windthrown. |
| <i>Araucaria klinkii</i> (Klinki araucaria) | 18 | 18 | 94 | 7 | 3-11 | 0.4 | < 0.5-1.2 | Poor | Severe brush competition. |
| <i>Callitris cupressiformis</i> Vent. (drooping cypress-pine) | 24 | 24 | 0 | -- | -- | -- | -- | -- | Entire planting died. |
| <i>Casuarina oligodon</i> (soft yar) | 11 | 11 | 50 | 37 | 17-57 | 3.8 | 2.3-4.9 | Good | |
| <i>Casuarina papuana</i> (Papuan ironwood) | 41 | 30 | 97 | 30 | 19-40 | 4.5 | 2.3-6.2 | Good | Many aerial roots on stem and main branches. |
| <i>Eucalyptus cladocalyx</i> F. Muell. (sugar-gum eucalyptus) | 14 | 14 | 7 | 1 | -- | -- | -- | Poor | Only one tree survived. |
| <i>Eucalyptus maculata</i> Hook. (spotted-gum eucalyptus) | 29 | 29 | 17 | 3 | 1-5 | -- | -- | Poor | Planted on pahoe-hoe lava. |
| <i>Eucalyptus melliodora</i> A. cunn. ex. Schau. (yellowbox eucalyptus) | 20 | 20 | 0 | -- | -- | -- | -- | -- | Entire planting died. |
| <i>Eucalyptus nitens</i> Maiden (shining eucalyptus) | 15 | 15 | 13 | 8 | 4-11 | 0.5 | < 0.5-0.5 | Fair | Only two trees survived, planted on pahoe-hoe lava. |
| <i>Flindersia brayleyana</i> F. Muell. (Queensland-maple) | 114 | 30 | 50 | 11 | 1-27 | 1.0 | < 0.5-3.3 | Fair | Size and vigor varied greatly with planting spot. |
| <i>Pinus ayacahuite</i> Ehrenb. (Mexican white pine) | 11 | 11 | 0 | -- | -- | -- | -- | -- | Entire planting died. |
| <i>Pinus canariensis</i> D. Smith. (Canary-Island pine) | 29 | 29 | 0 | -- | -- | -- | -- | -- | Entire planting died. |
| <i>Pinus caribaea</i> Morelet. 'A' ¹ (Caribbean pine) | 6 | 6 | 100 | 12 | 9-15 | 1.8 | 0.8-3.5 | Fair | Severe brush competition. |
| <i>Pinus caribaea</i> Morelet. 'B' ¹ (Caribbean pine) | 44 | 30 | 21 | 4 | 3-7 | 0.5 | < 0.5-0.5 | Poor | Severe brush competition. |
| <i>Pinus echinata</i> Mill. (shortleaf pine) | 18 | 18 | 0 | -- | -- | -- | -- | -- | Entire planting died. |
| <i>Pinus glabra</i> Walt. (spruce pine) | 13 | 13 | 8 | 5 | -- | -- | -- | Poor | Only one tree survived. |

See footnote at end of table.

Table 1. Survival and growth of 1959 plantings, unit 3, Waiakea Arboretum, July 1964, continued

| Species | Trees planted | Planting spots examined | Survival (based on sample) | Height | | Diameter b.h. | | General condition, appearance | Remarks |
|--|---------------|-------------------------|----------------------------|---------|-------|---------------|-----------|-------------------------------|---|
| | | | | Average | Range | Average | Range | | |
| | Number | Number | Percent | Feet | Feet | Inches | Inches | | |
| <i>Pinus michoacana</i> var. <i>cornuta</i> 'A' ¹ (Michoacan pine) | 20 | 20 | 0 | -- | -- | -- | -- | -- | Entire planting died. |
| <i>Pinus michoacana</i> var. <i>cornuta</i> 'B' ¹ (Michoacan pine) | 20 | 20 | 30 | 7 | 4-10 | 0.8 | < 0.5-2.0 | Fair | Severe brush competition. |
| <i>Pinus oocarpa</i> Schiede. (eggcone pine) | 10 | 10 | 0 | -- | -- | -- | -- | -- | Entire planting died. |
| <i>Pinus occidentalis</i> Swartz. (Cuban pine) | 12 | 12 | 17 | 10 | 6-15 | 0.9 | < 0.5-0.9 | Poor | Only two trees survived, severe brush competition |
| <i>Pinus pinaster</i> Soland. (cluster pine) | 6 | 6 | 0 | -- | -- | -- | -- | -- | Entire planting died. |
| <i>Pinus sinensis</i> var. <i>yunnanensis</i> Shaw. (Yunnan pine) | 18 | 18 | 0 | -- | -- | -- | -- | -- | Entire planting died. |
| <i>Pinus serotina</i> Michx. (pond pine) | 12 | 12 | 17 | 9 | 7-11 | 0.6 | < 0.5-0.8 | Poor | Only two trees survived, severe brush competition. |
| <i>Pinus taeda</i> L. (loblolly pine) | 6 | 6 | 33 | 9 | 8-10 | 0.9 | < 0.5-1.4 | Poor | Only two trees survived, severe brush competition |

¹Letter suffixes 'A' and 'B' denote separate plantings.

