

PACIFIC SOUTHWEST Forest and Range Experiment Station

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A SPACING TRIAL IN TROPICAL ASH... an interim report

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Tropical ash (*Fraxinus uhdei*) was planted extensively in Hawaii between 1957 and 1967—particularly on the Big Island. But as the stands developed, many trees were found to be undesirable because of forking, multiple branching, and lodging. Thus, tropical ash now receives less emphasis in the State's planting program. However, the species is a good watershed cover and the wood is high quality. Therefore, further evaluation of its desirability for reforestation purposes is warranted.

Among several tropical ash studies is a spacing trial established by Gerald D. Pickford on the Waiakea Forest Reserve, island of Hawaii, in 1961.¹ The objective of the study is to determine the optimum spacing interval at which to plant tropical ash. A remeasurement of the trial plots in November 1969 yielded these results:

- With replanting to insure 100 percent stocking of plots at the end of the first year, the average survival rate in all spacings was 99 percent 7 years later, and was not affected by the planting intervals of 6, 8, 10, and 12 feet.
- Eight years after planting, spacing had not produced a statistically significant effect on diameter or height growth.
- Basal area per acre varied inversely with spacing.
- The proportion of acceptable, desirable, and cull trees to the total number of trees planted was not affected by spacing.

THE EXPERIMENT

The Waiakea Forest Reserve is at an elevation of 1,800 feet. Annual rainfall is 200 inches, and annual temperature averages 68°F. The soil is Kiloa extremely stony muck (dysic, isothermic family of typic tropofolists) and of extremely variable depth within short distances. This soil is typical of thousands of acres in the same general area. The study site was prepared for planting by harvesting the treefern, and then bulldozing the native ohia rainforest type.

ABSTRACT: The optimum interval at which to plant tropical ash (*Fraxinus uhdei*) is being studied on the Waiakea Forest Reserve, island of Hawaii. Four spacing intervals are being tried: 6, 8, 10, and 12 feet. Measurements of trial plots in 1969—8 years after plots were set up—suggest that (a) interval had not affected survival rate; (b) spacing had not affected diameter or height growth; (c) basal area per acre varied inversely with interval; and (d) spacing had not affected proportion of acceptable, desirable, and cull trees to total number of trees planted.

OXFORD: 176.1 *Fraxinus uhdei*: 232.43:(969).

RETRIEVAL TERMS: *Fraxinus uhdei*; spacing trials; Waiakea Forest Reserve.

Treefern-harvesting skidroads caused severe soil compaction. One such road crosses parts of some spacing plots.

The plots were installed in a Latin-square design, with four replications of each of four spacing intervals: 6, 8, 10, and 12 feet. Twenty-five trees were planted in each spacing replication, with a buffer of at least two rows of trees between plots. According to Pickford¹ the entire planting stock of tropical ash was thrifty.

A spacing trial of Australian toon (*Toona australis*) was installed at the same time, alongside the tropical ash plots. The sites are similar enough to allow a comparison of the results of the two studies.²

In July 1966 the tropical ash plots were measured for growth only. In November 1969, they were measured for both growth and quality, with information being recorded on d.b.h., height, cull factor, clear panel, log length, sweep or crook, defects, crown class, and vigor.

An analysis of variance for the Latin-square sample design was used in analyzing the data.

RESULTS

At the end of the first year, trees planted on treefern skidroads were of below average vigor. But in the 5-year remeasurement of the plots, Schubert³ found that soil compaction on skidroads was no longer adversely affecting tree growth. This finding was supported by the 8-year remeasurement.

In the first year, it was necessary to replant eight seedlings to assure 100 percent stocking of 16 plots at the end of the first year. Survival at age 8 ranged from 98 to 100 percent, and averaged 99 percent in all spacings. Planting interval had no effect on survival. The comparable survival rate in the Australian toon spacing trial was 95 percent.²

Table 1—Average diameter, height and basal area of 8-year-old tropical ash plantings by four spacing intervals, Waiakea-Olaa Reforestation Area, Island of Hawaii

Spacing (feet)	Average diameter		Average height		Average basal area
	Age 5	Age 8	Age 5	Age 8	Age 8
	— Inches —		— Feet —		Sq. ft./acre
6	2.3	3.3	25	36	86
8	2.4	3.5	23	32	54
10	2.8	4.3	25	34	53
12	2.6	4.2	22	32	38

Initial spacing of planted trees did not produce a statistically significant effect on diameter or height growth. Consequently, basal area per acre was greatest on the plots with the closest spacing. It ranged from 86 square feet per acre in the 6-foot spacing to 38 square feet per acre in the 12-foot spacing (table 1).

At this point in the growth of the trees, spacing had no effect on the probability of producing a desirable, acceptable, or cull tree (table 2). The trend is for a higher proportion of acceptable and desirable trees and a lower proportion of cull trees at closer spacings, but this trend is not statistically significant at the 95 percent level. Thirty-eight percent of the trees in all spacings are cull due to excessive forking, 4 percent due to excessive lean, and less than 1 percent due to lodging (fig. 1).

We defined tree quality classes as follows:

- *Desirable tree*: growing stock tree of commercial species with no serious defects or serious pathogens, and of good vigor; must have now or potentially, a sawlog length of more than 32 feet, less than 4 inches sweep or crook in the 16-foot butt; no scale reducing seams, rot, splits, or cracks, and a clear panel at least 8 feet long in the third best face in the butt log.

Table 2—Number of trees by spacing and quality class in 8-year-old tropical ash spacing trials, Waiakea-Olaa Reforestation Area, Island of Hawaii

Quality class	Trees per plot ¹ at spacing (feet) of . . .				Trees per acre at spacing (feet) of . . .			
	6	8	10	12	6	8	10	12
Desirable	0.50	0.25	0.50	0.75	24	7	9	9
Acceptable	15.50	15.75	14.50	11.00	750	429	253	133
Total	16.00	16.00	15.00	11.75	774	436	262	142
Cull	8.75	8.75	9.50	13.25	424	238	165	160
Total	24.75	24.75	24.50	25.00	1,198	674	427	302

¹ Average of four plots—each initially had 25 trees.



Figure 1—Tropical ash planted at the 12-foot spacing interval. The tree in the center is classed as acceptable; the two trees to the right of it are cull because of forking below 12 feet.

- *Acceptable tree*: growing stock tree that does not meet the specifications for desirable trees, but has now or potentially a butt sawlog length of at least 12 feet and is not culled because of forking, sweep, crook, or other factor indicated below.

- *Cull*: tree with one or more characteristics that prevents it from being classed as desirable or acceptable, such as lodged or arched over; stem lean of more than 8 degrees; forked between 4.5 feet and 12 feet; heavy branching below 12 feet, thereby having the effect of forking or excessive taper; or overtopped and of low vigor. An example of acceptable and cull trees is shown in *figure 1*.

Tropical ash yielded a lower percentage of acceptable and desirable trees regardless of spacing than did Australian toon, but has had a higher survival rate.² If the stocking goal is about 400 acceptable and desirable trees per acre, it appears that tropical ash will yield this result at an original planting spacing slightly less than 8 by 8 feet (*table 2*).

NOTES

¹Pickford, G. D. *Establishment report for Australian toon spacing study in the Waiakea Forest Reserve*. 1962. (Unpublished rep. on file at Institute of Pacific Islands Forestry, Honolulu, Hawaii.)

²Wick, Herbert L., and Robert E. Burgan. *A spacing trial in Australian toon... an interim report*. USDA Forest Serv. Res. Note PSW-220, Pacific SW. Forest & Range Exp. Sta., Berkeley, Calif. 3 p., illus. 1970.

³Schubert, Thomas H. *Report on five-year measurements of tropical ash and Australian toon spacing studies at Waiakea*. 1966. (Unpublished rep. on file at Institute of Pacific Islands Forestry, Honolulu, Hawaii.)

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