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DIRECT SEEDING
of brushbox, lemon-gum eucalyptus, and cluster pine in Hawaii

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ABSTRACT: Seeds of brushbox, lemon-gum eucalyptus, and cluster pine were sown in separate seed spots on the Mokuleia Forest Reserve, Oahu. Half the seed spots were mulched. After 1 year, only two brushbox seed spots were stocked; lemon-gum eucalyptus had significantly (5 percent level) more seed spots stocked in the mulched plots; cluster pine had significantly less. These two species show promise for direct seeding on similar sites.

RETRIEVAL TERMS: direct seeding; *Tristania conferta; Eucalyptus citriodora; Pinus pinaster;* aforestation; Hawaii.

OXFORD: 233(969)[–232.33 + 176.1 *Eucalyptus citriodora*–232.33 + 176.1 *Tristania conferta*–232.33 + *Pinus pinaster*–232.33] + (969)233–232-33.

Sowing seeds rather than planting nursery-grown seedlings could reduce the cost of reforestation and speed up the conversion of non-productive forests on selected sites in Hawaii. This method of reforestation has been proved feasible in the South, where about 1 million acres have been sown in the last decade. Slash, loblolly, and longleaf pine forests there have been established on bare land or on sites occupied by low-grade hardwoods.[1]

Direct seeding trials in Hawaii were begun in 1910 by Hosmer.[2] He got generally poor results for most of the 29 species that he tried. Bryan[3] direct-seeded native koa *(Acacia koa)*, and had favorable results at the end of 1 year. Other undocumented attempts with direct seeding through the years have had variable results.

Direct seeding of three species was tried recently on the Mokuleia Forest Reserve, Oahu, Hawaii, under wetter than usual conditions. The species tested were brushbox *(Tristania conferta* Br.*)*, lemon-gum eucalyptus *(Eucalyptus citriodora* Hook*)*, and cluster pine *(Pinus pinaster* Ait.*)*. The results suggest that direct seeding to establish cluster pine and lemon-gum eucalyptus forests is feasible. The trial of direct seeding of brushbox was not promising. Before this method of reforestation can be recommended, further trials with these and other species under more normal weather conditions are planned.

STUDY SITE

The study site is at 1,400 feet elevation. Aspect is northeast, with 15-percent slopes. The soil is mapped as the Halawa silty clay. Rainfall averages about 40 inches annually, with most of it coming in winter. The rainfall during the 1-year study period, beginning

January 11, 1968, followed this seasonal pattern–except that the total was more than twice the normal amount.

METHODS

Seeds were sown in prepared seed spots in separate rows in each of five blocks. Each row consisted of 10 seed spots. After seed of each species was sown in two rows in each block, one of the two rows was mulched with about one-fourth inch layer of bagasse (sugar-cane extraction residue). The number of seeds sown per spot was based on germination tests. Enough seeds were sown to insure at least five viable seeds in each spot. The seed spots, which averaged about 15 inches in diameter, were maintained free of weeds.

Seed spots were checked for developing seedlings every 2 weeks for the first 2 months, and monthly thereafter. Height of the tallest seedling in each spot was measured during the final examination. A seed spot was considered stocked if it contained at least one seedling.

Heavy rains during the first 2 weeks of the experiments caused heavy damage to about 55 percent of the seed spots. The mulch afforded some protection, but in many cases, the mulch, soil, and probably the seeds were washed away. The damaged spots were remulched. None of the seed spots was reseeded. Heavier than normal rains continued through spring. The summer months were drier than normal–less than 5 inches of rain fell from May to September.

RESULTS AND DISCUSSION

Brushbox

Stocking.–The first brushbox seeds germinated in both the mulched and unmulched spots during the fifth month after the seeds were sown. At 6 months, the mulched spots had a maximum stocking of 14 percent; the unmulched spots 12 percent. Considering seed size and depth of sowing, there was not much to keep the seeds from washing away. Percent of stocked spots decreased rapidly for both the mulched and unmulched plots during the dry period that followed germination.

Height growth.–Only two seedlings were alive after 1 year, but both appeared vigorous. However, the tallest was still only 13 inches tall *(fig. 1)*.

Results of this trial as to the feasibility of direct seeding brushbox are inconclusive. Under normal weather conditions, stocking and height growth may be adequate.

Cluster Pine

Stocking.–The first cluster pine seeds germinated before the sixth week in both the mulched and unmulched spots. By then, the unmulched plots had a maximum stocking of 98 percent, the mulched plots, 92 percent. The heavy rains did not affect the stocking of this species because its seeds are larger and were sown deeper. After 1 year, 90 percent of the unmulched spots were stocked compared to 76 percent of the mulched spots. This difference was statistically significant at the 5 percent level. The dry period was the apparent cause of seedling mortality.

Height growth.–Cluster pine seedlings in the mulched plots grew, on the average, only 3 inches in a year; those in unmulched plots, only 4 inches *(fig. 2)*. New growth noted on many seedlings in both treatments after 1 year gives us hope that growth rate will increase.

Figure 1.–*After a year, only two brushbox seed spots were stocked. This seedling is about 13 inches tall.*

Figure 2.–*Cluster pine directly seeded show poor growth. The six seedlings are 1-year old.*

The high percentage of stocked seed spots indicates that cluster pine is well suited for direct seeding in the Mokuleia Forest Reserve. The slow initial growth of the seedlings, however, would create maintenance problems.

Lemon-gum Eucalyptus

Stocking.–The first lemon-gum eucalyptus seed germinated before the sixth week in both mulched and unmulched spots. Maximum stocking of 62 percent for the mulched spots was reached 5 months after the seeds were sown. Maximum stocking of 52 percent for the unmulched spots did not occur until 3 months later.

Lemon-gum seeds are intermediate in size between brushbox and cluster pine seed and were sown accordingly. Many of the more succulent seedlings in both the mulched and unmulched spots died during the dry period. After 1 year, the 54 percent stocking for the mulched spots was significantly greater (5 percent level) than the 40 percent for the unmulched spots.

Height growth.–Lemon-gum eucalyptus seedlings in the mulched spots were not significantly taller after 1 year than the unmulched seedlings. The difference in average height growth was due primarily to the rapid growth of four seedlings in mulched spots; the tallest of these seedlings was 52 inches *(fig. 3)*.

Assuming that stocking would be greater under better post-sowing conditions than found in these trials, it seems that lemon-gum eucalyptus is a species that can be successfully direct-seeded on this and similar sites.

Figure 3.–*Lemon-gum eucalyptus did well in mulched spots. This 1-year-old seedling is 52 inches tall.*

Notes

[1]Mann, W. F. *Direct-seeding slash pine.* Southern Lumberman, December, p. 147-150. 1966.

[2]Hosmer, R. *Division of Forestry report for August.* Hawaii Forestry & Agr. 8(10):298-302. 1911.

[3]Bryan, L. W. *Reforestry with koa by the seed-spot method.* Hawaii Forestry & Agr. 26(3):136-137. 1929.

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