Styroblocks: new technique for raising and planting seedlings in Hawaii

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Forest managers who must reforest vast areas are concerned about efficient, economical ways to grow, transport, and plant seedlings. Since the late 1960's, foresters in Canada have been trying a planting technique using foamed polystyrene containers.

Seedlings are grown and transported in lightweight, rigid modular holders called BC/CFS Styroblocks that have tapered cavities to shape and protect roots (1.2). The seedling, called a styro-plug, is extracted: the root-soil mass remains intact. In the field, it can be planted free of any container restraint in a hole formed by a special dibble.

Experience with the Styroblock has shown that it has several advantages (3.4): 1) It requires little nursery space, 2) the task of loading the cavities and other handling operations can be mechanized, 3) a homogeneous artificial rooting medium can be used, 4) field planting can be adapted to available methods, 5) transplant "shock" is essentially eliminated because roots are protected. 6) periods for planting can be extended. and 7) seedlings can be watered in transit to the planting site and held over at the site.

But the Styroblock also has some limitations: 1) Blank cavities or un-acceptable seedlings cannot be readily sorted in the nursery. 2) seedlings must be removed from the container and repacked for most economical transport. 3) such repacking reduces shipping volume, but exposes the roots to damage and allows them to grow into a shape different from that of the dibble.

To find out whether Styroblocks could be adapted to reforestation work in Hawaii, I made a study in cooperation with the State Division of Forestry. In the study, we grew seedlings of four species in Styroblocks and then outplanted them. We also tested the dibble on three other soils that represent a range of soil types in Hawaii.

Materials and Methods

The four tree species selected were: One native-koa *(Acacia koa)-and* three introduced species-saligna eucalyptus *(Eucalyptus saligna),* Queensland-maple *(Flindersia bravleyana),* and Australian toon *(Toona australis).*

In growing the seedlings, we generally followed the procedures outlined by the Canadian Forestry Service (3). The rooting medium-a commercial product consisting of a 50/50 mixture of vermiculite and peat moss, fertilizer, and wetting agent-was moistened and loaded into the Styroblocks. Seeds of koa, saligna eucalyptus, and Australian toon-species which have small to medium size seeds-were sown in Styroblock "2" cavities (each cavity has a volume of 2.5 cubic inches). The larger seeds of Queensland-maple were sown in Styroblock "8" cavities (each cavity has a volume of 7.6 cubic inches). Two to three seeds were sown per cavity and then covered with a fine gravel. Loaded Styroblocks were placed under 55 percent shade and watered.

Seedlings of all species developed rapidly. About a month after they germinated, seedlings were moved into full sunlight, and fertilizing with a water soluble mix of NPK (21-21-21) was begun. Fertilizer was applied at a rate of about 5 ounces per 100 gallons of water through the irrigation system once a week. Seedlings were watered as needed.

After 4 months, seedlings of koa, saligna eucalyptus, and Australian Loon were judged ready for outplanting. Queensland-maple, in the larger cavities, required about 6 months.

At the time of outplanting, the seedlings of each species were reasonably uniform in size (fig. 1). Average stem height and diameter measurements, and shoot/root ratio were:

	Stem height (inches)	*Stem diameter (inches)*	*Shoot/root ratio*
Species:			
Koa	10	0.09	1.0
Saligna eucalyptus	10	0.09	2.0
Australian toon	7	0.09	0.8
Queensland-maple	10	0.10	2.0

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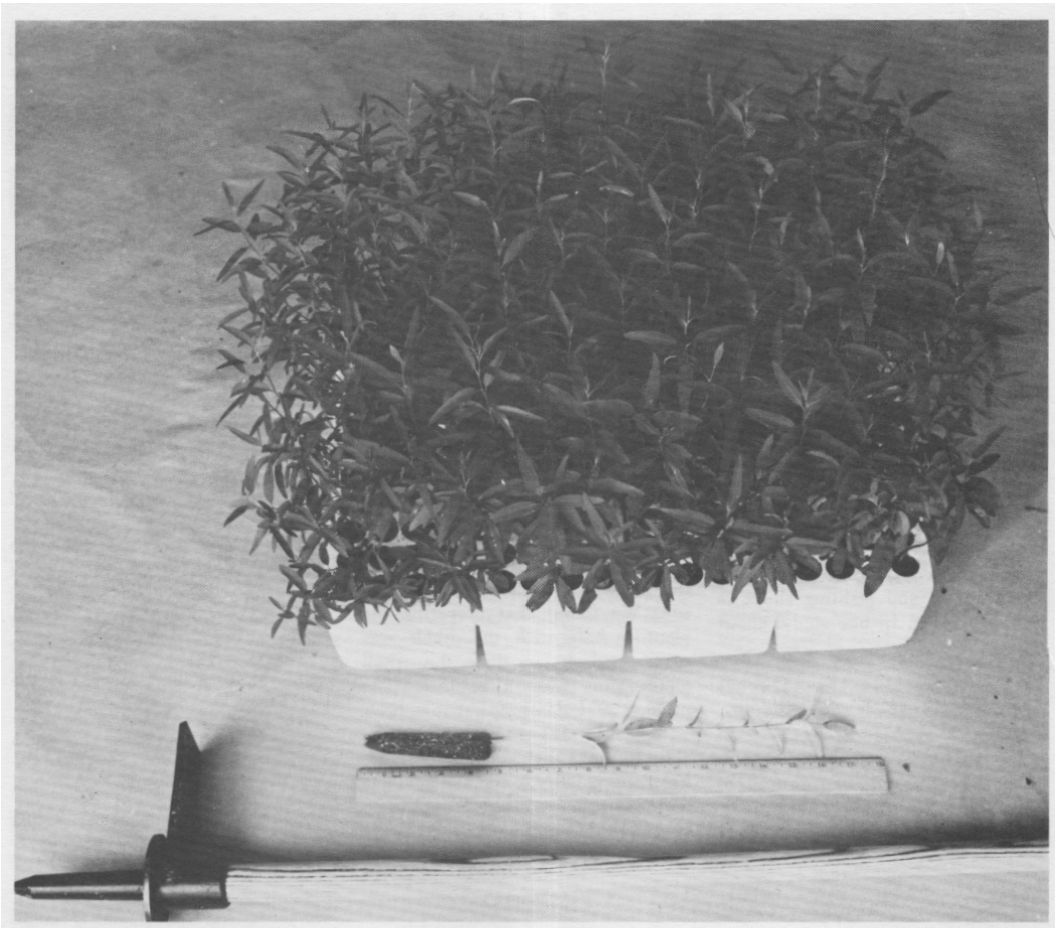

Figure 1.—These 4-month-old *Eucalyptus saligna* seedlings in a Styroblock are ready for outplanting. The styro-plugs are usually planted with a special dibble. (Photo courtesy George Hashimoto).

None of the seedlings of any species became pot-bound. All of the major roots were vertical, and the smaller, lateral roots formed a tight web. The root-soil "plug" was firm and held together during handling.

Seedlings of each species were taken to the field in Styroblocks and planted on the University of Hawaii Hamakua Experiment Farm. on the island of Hawaii. Elevation is about 2,700 feet. Annual rainfall averages 80 inches. but often extreme variations occur from month to month, and from year to year. Aspect is northeast with slopes of 5 to 20 percent. The soil is napped as Maile silty clay loam.

The site was prepared for planting by first burning the brush, and then mowing and bulldozing the remaining vegetation.[2] The soil was not loosened except where large trees were dug out and the holes filled.

Planting conditions were favorable, with adequate soil moisture, partly

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1'Dr. John Thompson of the University of Hawaii assisted in preparing the site for planting.

cloudy skies. and a temperature of 75^{0}F.

We used a dibble to plant 150 seedlings of each species. The "2" size styro-plugs were planted at a rate of 150 seedlings per hour: the "8"'size styro-plug. at a rate of 100 per hour. In Canada. up to 360 seedlings ("2" size) per hour have been planted (5).

Results

Seedling survival. vigor, and stem dieback were checked 3 months after planting. Seedlings of all species had over 95 percent survival and over 90 percent of them had high vigor (table 1). None of the seedlings died back. The results obtained with saligna eucalyptus were particularly encouraging because this species generally suffers high mortality when planted bare-root. Survival rates of only about 30 percent have been noted (6, 7) and planting shock is generally great. In one study. about 85 percent suffered dieback (8). Koa is generally considered to be more difficult to establish in field plantings than saligna eucalyptus, so the results on survival. vigor, and dieback are encouraging. Queensland-maple and Australian toon are considered to be easier to establish than saligna eucalyptus. Therefore, the results are not unexpected.

TABLE 1.-Surcical. rigor. and dieback of styro-plug seedlings of four tree species 3 months after field planting. University of Hawaii Hamakua Experiment Farm. Hawaii

Species	Survival	High vigor	Dieback
	Percent	*Percent*	
Koa	100	90	0
Saligna eucalyptus ..	100	95	0
Australian toon	100	90	0
Queensland-maple	95	90	0

Root development of seedlings was examined 4 weeks after field planting. By then, the roots of vigorous koa. saligna eucalyptus, and Australian toon had increased in radius by about 21/ inches. Roots of Queenslandmaple seedlings had increased radially about 2 inches.

I determined that the dibble could be used to prepare planting holes in other soils common to Hawaii forest lands, including a volcanic ash, an organic soil, and lava rockland. Between 50 and 100 planting holes were made in each type of soil. We found that preparing the planting hole with the dibble was easier and faster than the usual method of using a mattock. The number of holes prepared per hour were: Volcanic ash. 225: organic, 180: and lava rockland. 100. Preparing planting holes in the rockland was a slower process because we had to probe to find a niche where the dibble could be fully inserted into the soil,

Conclusions

The results of these tests are decidedly promising for each of the four species and four soils tried. Additional information is needed. however, to make optimum use of Styroblocks in Hawaii. Studies are being developed to learn more about seedling requirements, optimum time for outplanting. and optimum values of seedling height. diameter, shoot/root ratio, and age needed for high survival and growth rates. But even now, managers can exploit the potential of Styroblocks in their reforestation work.

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Bicentennial Trees

American Forest Institute has prepared a Bicentennial project "Trees from the Nation's History" and a brochure to describe the project, they report. Program will furnish to groups kits which include seeds from four historical trees, planting instructions, and booklet with stories on role of wood in development of Nation. Kits are available from AFI in orders of 24 only.

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