

Figure 1. A gasoline-powered engine drill fitted with a large bit facilitates planting stock grown in larger containers.

Photo by Jack Jeffrey



## Tree Planting at Hakalau Forest National Wildlife Refuge —the Right Tool for the Right Stock Type

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### ABSTRACT

Two species of trees, koa (*Acacia koa* Gray [Fabaceae]) and ‘ōhi‘a lehua (*Metrosideros polymorpha* Gaud. [Myrtaceae]), are important for reforestation of degraded lands within Hakalau Forest National Wildlife Refuge on the Big Island of Hawai‘i. These species require quite different growing containers and subsequently different planting tools. While dibbles are used for koa planting, a gasoline-powered auger, described briefly herein, is preferred for ‘ōhi‘a and other understory species. Auger planting is more than 2.5 times faster than planting by hand.

### KEY WORDS

Koa, ‘ōhi‘a lehua, auger, planting tool, reforestation

### NOMENCLATURE

USDA NRCS (2002)

After 150 y of cattle grazing, about 2020 ha (5000 ac) of the 12 140-ha (30 000-ac) Hakalau Forest National Wildlife Refuge had been converted from montane-mesic koa/‘ōhi‘a lehua (*Acacia koa* Gray [Fabaceae])/ *Metrosideros polymorpha* Gaud. [Myrtaceae]) forest to pasture. In 1988, the USDA Forest Service experimented by planting koa on several acres at Magnetic Hill on the refuge. This plot has been the basis for many succeeding plantings. Koa planting has taken place at the refuge since 1989, when the first refuge supervised volunteer plantings occurred. Trees on these sites now exceed 10 m (33 ft) in height, have been producing seeds for the last 6 or so years, and have become habitat for several native birds.

In 1996, a greenhouse was built and a full time horticulturist was hired. The following year, with volunteer help, the refuge continued to plant koa and started planting understory plant species beneath previously planted koa groves. Since 1989, we have outplanted more than 252 000 trees and endangered plants.

Koa trees are grown in 15-cm-long (6-in), 2.5-cm (1-in) diameter, tapered, “dibble” tubes, and it takes only 4 to 5 mo to reach the 30-cm (12-in) height we prefer for outplanting. ‘Ōhi‘a seedlings, however, require 18 to 24 mo to reach a suitable 15-cm (6-in) outplanting height. We have also found that ‘ōhi‘a, and many other native plants used in our reforestation program, grow poorly in dibble tubes. Common understory plants such as pilo (*Coprosma* J.R. & G. Forst [Rubiaceae]), kōlea (*Myrsine* L. [Myrsinaceae]), ‘ōhelo (*Vaccinium* L. [Ericaceae]), ‘ākala (*Rubus* L. [Rosaceae]), and various endangered plants like the mints (*Phyllostegia* Benth. [Lamiaceae]) and lobelias (*Clermontia* Gaud. and *Cyanea* Gaud. [Campanulaceae]) grow slowly and/or need a much larger root volume for successful transplanting than koa, hence we use a 10 x 10 x 10-cm (4 x 4 x 4-in) square pot for growing them.



Figure 2. The Echo model EDR-2400 fitted with a Power Planter bit #528H.

### KOA PLANTING

Ten inexperienced volunteers can plant and fertilize about 2000 koa in a day. Because we are planting in abandoned pasture carpeted with thick ungrazed grass, planting spaces must be created using a bulldozer with a “miniblade” to remove grass competition. Every 3 m (10 ft) within the row, the dozer makes a cleared plot 1 m long and 1 m wide (3.3 x 3.3 ft), and rows are set 4 m (13 ft) apart. The “dibble man” walks down the row making a hole in each plot with a dibble stick the same size as the root plug, followed by a planter and a fertilizer person. Only 1 koa seedling is planted in each plot.

### ‘ŌHI‘A AND UNDERSTORY PLANTING WITH A POWER AUGER

Since ‘ōhi‘a and other understory plants grow better in the greenhouse in larger pots, we needed a different planting tool. In early stages of our program, we used manual post-hole diggers and shovels to dig planting holes—a slow and tedious method. Because grasses needed to be cleared, more volunteers were needed to prepare and dig holes than to plant seedlings. With this purely manual method we could plant 200 to 300 trees in an 8-h field day.

With a power auger, 10 inexperienced people can plant and fertilize about 500 plants in a 6-h day (Figure 1). Pot size, the weight of containers (only 12 plants can be carried at a time versus 100 or

more with koa), the size of the hole, and manual grass clearing slows down the planting effort as compared to koa.

Although these understory plantings are in shaded areas, grass ground cover is still a problem. Before drilling with the auger, several volunteers using an adze hoe or pick mattocks scrape away the grass within a 60 x 60-cm (2 x 2-ft) plot for each plant. This reduces grass competition for the newly planted trees and allows the planting hole to be drilled without the bit constantly tangling in the grasses. If the grass is not removed, it invariably winds around the shaft and necessitates time-consuming delays while the tightly wrapped grass is untangled.

In most areas, refuge soils are clay and humus with little rock, so excavation is usually easy with the power auger. Our biggest problem for auger use in understory planting (most of what we do) is koa roots catching the drill bit. When the bit catches a root or a rock it causes the arms, wrists, and fingers of the auger operator to be twisted by the torque of the engine. To prevent injury, we recommend that only folks with good arm and upper body strength be allowed to use augers in root bound and rocky areas.

We start every day by demonstrating the safe use of mattocks and the power auger. Most volunteers have never planted trees before and although anxious to get started, safety is of utmost importance. All of the tools that we use can be dangerous if used carelessly.

Volunteers are split into planting groups, with each group usually consisting

of 2 mattocks users (each group contains at least 2 people clearing grass because it is the most time consuming), 1 auger operator, and 2 people planting and adding controlled-release fertilizer. Throughout the day, people switch jobs so that everyone has an opportunity to do each task.

### Auger Specifications

We use model EDR-2400, a 0 to 400 rpm gear driven (forward and reverse), 23.6 cc, gasoline-powered engine drill available from Echo Incorporated, 400 Oakwood Road, Lake Zurich, Illinois 60047-1564 (<http://www.echo-usa.com>). It holds 400 ml (14 fl oz) of fuel that runs the engine about 3 h. This model weighs 4.7 kg (10.3 lb) and costs US\$ 435 plus shipping.

To accommodate our container size, we use bit #528H from Power Planter, 832 East Patton Street, Paxton, Illinois 60957 (telephone 217.379.3043; <http://www.bradleysales.com>). This bit has a 13-cm (5-in) diameter, 30 cm (12 in) of flight, a 0.5-in chuck and a 1-in shaft for a total length of 71 cm (28 in). It costs US\$ 75.55 plus \$ 7 shipping and handling (Figure 2). Larger and smaller bits are available.

### REFERENCE

USDA NRCS. 2002. The PLANTS database, Version 3.5. URL: <http://plants.usda.gov> (accessed 12 Dec 2002). Baton Rouge (LA): National Plant Data Center.

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