

Acacia koa A. Gray

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FABACEAE (BEAN FAMILY)

Acacia hawaiiensis (Rock) Degener & I. Degener; *A. heterophylla* Willd. var. *latifolia* Benth.; *A. kauaiensis* Hillebr.; *A. koa* var. *hawaiiensis* Rock; *A. koa* var. *lanaiensis* Rock; *A. koa* var. *latifolia* (Benth.) St. John; *A. koa* var. *waianaeensis* St. John; *A. koa* var. *waimeae* Hochr.; *A. koaia* Hillebrand.; *Racosperma kauaiense* (Hillebr.) Pedley; *R. koa* (A. Gray) Pedley (Wagner and others 1990)

Koa, koai'e, koai'o, koa'ohā

Acacia koa is one of three closely related species native to the Hawaiian Islands, where it is found on all the main islands except Niihau and Kahoolawe. It grows in almost pure stands, in mixed koa-ohia (*Metrosideros polymorpha* Gaudich.) stands, and in association with a variety of other tree species (Whitesell 1990).

Acacia koa is a moderately fast-growing tree capable of attaining a height of approximately 35 m and 1.5 m or more d.b.h. In its native range, it is found on volcanic soils of a wide range of ages, from the ash and a'ā lava rock soils on the slopes of still-active volcanoes to oxisols. The largest and best-formed trees are found on sites with moderately well-drained to well-drained, medium to strongly acid soils, and annual rainfall in the range of 1900 to 5100 mm. Koa grows on a range of other soil types and in areas with much lower rainfall, but its growth is slower and its form often poorer than on more optimal sites (Whitesell 1990). It occurs over a wide elevational range, from about 50 to 2100 m. Little is known of the tolerance limits of mature trees to heat and cold, but significant mortality occurs when *A. koa* seedlings are exposed to temperatures below about -4°C for more than a few hours (Scowcroft 1998).

There is considerable ecotypic and geographic variation within the species (Brewbaker 1997, Whitesell 1990) but no published information on specific hybrids or geographic races. Isozyme analyses have shown that trees from Kauai, Oahu, and Maui appear to be closely related (Conkle 1997). Trees from these three islands also differ morphologically (e.g., they have smaller phyllodes) than trees on the island of Hawaii (Dudley 1997).

The wood of *A. koa* has a specific gravity of about 0.55, and reportedly is nearly identical to walnut (*Juglans nigra* L.) in weight and strength (Skolmen 1968). It is variable in color,

frequently has a curly, highly attractive grain, has very good working properties, and takes a high polish. However, it is not resistant to decay and is quite susceptible to drywood termites (Little and Skolmen 1989). Native Hawaiians traditionally used the wood for house construction, canoes, paddles, surfboards, and other products. The wood is currently used for furniture, cabinets, paneling, bowls, and carving. It is featured in Hawaii's state capitol offices, many corporate offices, and private homes throughout Hawaii.

Flowers are borne on the outer parts of the crown in axillary racemes with spherical, pale yellow heads averaging about 8.5 to 10 mm in diameter. Flowering generally peaks in mid- to late winter, but may extend into early summer at low elevations (Whitesell 1990). Some flowering may occur throughout the year. Trees as young as 2 to 3 years old have been known to flower and produce fruit, but most production seems to occur between the ages of about 5 and 30 years. Mature seed pods are flattened, 7.5 to 15 cm long, and 1.5 to 2.5 cm wide. Each pod contains about 12 seeds, which are ellipsoidal, laterally flattened, 6 to 12 mm long and 4 to 7 mm wide, dark brown to black in color, and slightly shiny (Little and Skolmen 1989, Wagner and others 1990, Whitesell 1990). Pods may dehisce while on the tree or fall to the ground unopened.

Seeds are generally obtained by collecting pods directly from trees in the fall and early winter, either by hand or by using a pruning pole. Pods are easily broken open by hand for seed extraction. Yield of viable seeds per pod is often low due to poor seed setting and infestations of seed weevils and other insects. Cleaned seeds average from 5,300 per kg to more than 37,000 per kg (Allen 1997, Whitesell 1990). Seed size depends to some degree on source, with seeds from Oahu and Kauai

often smaller than seeds from the island of Hawaii. The seeds of this species are easy to store, not needing to be kept in sealed containers. Seeds will remain viable for many years if stored in a cool, dry place; they may remain viable for 25 years or more on the forest floor (Judd 1920, Whitesell 1990).

The seeds have a hard seed coat which retards germination without pretreatment. Mechanical scarification, a brief treatment with sulfuric acid, or a hot water soak all work well. The hot water treatment is safe and reasonably practical for large batches of seeds; seeds are placed in almost boiling water that has been removed from the heat source, then left to soak for 24 hours. There is some evidence that damage can occur if the volume of hot water compared to that of seeds is too high—a ratio of 5:1 or less is recommended. For small volumes of seeds, one end of the seedcoats can be easily clipped with a pair of scissors or shears.

Acacia koa seedlings are almost always grown as containerized stock. Often grown in tin cans or plastic bags in the past, seedlings today are more commonly grown in small dibble tubes. Seedlings can be grown to a plantable size of 20 cm in about 10 to 14 weeks. If seedlings are grown in sterile soil media, rhizobial application at the time of sowing will ensure good survival and growth of the seedlings. The soil media should not be too wet, because seedlings are prone to damping off. Insect pests, especially white flies, may also present problems. Survival and growth of outplanted seedlings are best on clean, well-prepared sites with follow-up weed control during

the first year. Koa can also be direct-seeded with at least moderate success (Bryan 1929, Fujii 1997).

Several planting trials have demonstrated that seed source should be an important consideration in any *A. koa* planting program. Variation among sources has been reported in form, growth rate, apparent resistance to volcanic fume damage, and level of susceptibility to insects and disease (Conrad and others 1995, Dudley 1997, Skolmen 1990). In general, seed sources from the same island as the planting site and from similar elevations and site conditions should be used. *Acacia koa* can regenerate extensively from root suckers and is capable of vigorous natural regeneration on sites with exposed soil and adequate protection from herbivores (Whitesell 1990).

ADDITIONAL INFORMATION

Acacia koa is also closely related to *A. heterophylla* Willd., a species found on the Mascarene Islands in the Indian Ocean. The relationship and the distinguishing differences between *koa* and *A. heterophylla* are described in Carlquist (1965), Vassal (1969), and Pedley (1975), and briefly summarized in Wagner and others (1990). *Acacia koa* is in the *Acacia* subgenus *Heterophyllum*, members of which are generally thornless and have leaves that initially may be bipinnately compound, but on trees larger than saplings tend to be reduced to phyllodes (modified petioles).

