

The Macadamia¹

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- **Scientific Name:** *Macadamia integrifolia* Maiden and Betche, and *M. tetraphylla* L.S.
- • **Origin:** Australia

HISTORY AND DISTRIBUTION

Relatively new to world horticulture, the macadamia was discovered and described from eastern Australia in 1858 and first introduced to Hawaii in 1881. It is known today in many tropical and subtropical countries, but grown on a large scale only in Hawaii and Australia, where it has been carefully selected and improved to its present horticulturally refined status.

DESCRIPTION

Commercially, only *M. integrifolia* and *M. tetraphylla* and their hybrids are important. They are very similar to each other and botanically very closely related to a third species, *M. ternifolia* F. Muell., which produces a small, bitter kernel unsuitable as a table nut.

M. integrifolia is commonly referred to as the "smooth shell" species. The fruit consists of a white

kernel, high in oil content (72% oil and 4% sugar when dry), very uniform, and of excellent quality. It is enclosed in a round, hard shell about 1 inch (2.5 cm) in diameter surrounded by a smooth, bright green pericarp (husk). The leaves are stiff, oblong to lanceolate, 4-10 inches (10-25 cm) long in nodal whorls of three, rarely four, and either light green or bronze when young. The small, perfect white flowers are borne in racemes 4-8 inches (10-20 cm) long. Only a few flowers in a raceme will set fruit.

M. tetraphylla is called the "rough shelled" species because of the pebbliness of the shell's surface. The husk is somewhat spindle-shaped, grayish green, and covered with a dense, white pubescence. Kernels have a grayish base, are darker in color and more variable in quality than those of *M. integrifolia*. The oil content averages 67% in the dry nut, with 6% to 8% sugar. The leaves are characteristically sessile and serrated along the margins, in whorls of four at the nodes. The flowers are pink and in racemes 6-18 inches (15-45 cm) long.

Cultivars which are hybrids of the two species possess characteristics of both, and the quality of their nuts compares favorably with that of *M.*

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integrifolia. The trees of both species are tall and spreading, reaching 60 feet (20 m) or more in height. The wood is hard and brittle. Exposed bark sunscalds very easily.

CULTIVARS AND PRODUCTION

There are approximately 40 described cultivars, most of them in Australia. The following varieties have been used for commercial plantings in Hawaii: `Keauhou', `Ikaika', `Kakea' and `Keaau'. `Kakea', however, is no longer propagated for commercial use.

In California, `Elimba', a *M. tetraphylla* cultivar, is also considered of commercial value. `Beaumont', a productive hybrid cultivar is also recommended for home plantings. With good care, cultivars of *M. integrifolia* begin producing 5 years after planting, but appreciable yields are obtained only after the 8th year. A productive variety will bear as many as 150 lbs. of in-shell nuts per tree. Before attempting large scale plantings, cultivars should be tested locally.

In Hawaii, *M. integrifolia* cultivars are more productive on *M. tetraphylla* rootstocks in soils where they are not likely to suffer from iron deficiency. Where this deficiency may be a problem, *M. integrifolia* seedlings should be used as a rootstock. The season of production in Florida for *M. integrifolia* runs from July through November. Very few commercial cultivars have been tested in this state, and more information is needed to make specific recommendations.

PROPAGATION

Macadamias are relatively easy to propagate by grafting if a few simple techniques are followed. A very essential step towards success is obtaining scions 1/2 to 3/4 inch (1.5-2 cm) in diameter, from branches girdled 6 to 8 weeks previously. Vigorous rootstocks 12-18 months old are recommended, and both side veneer or side wedge grafts are used successfully. Topworking is feasible, practical, and can be accomplished by either cleft or bark grafting.

CLIMATE

Macadamias are well adapted to warm, subtropical conditions. Mature trees can withstand winter temperatures of as low as 25-26°F (3-5°C) for short periods with minor damage to the foliage. However, young trees and foliage are very tender and are killed by temperatures very near freezing. Temperatures below 28°F (-2°C) cause damage to flowers and young fruit and reduce production. In the tropics, macadamias are better adapted to medium elevations of 2100 to 3600 feet (700 to 1200 m), but in Hawaii, macadamias are not planted commercially above 2500 feet (800 m).

Although the plant is quite resistant to drought, supplemental irrigation is very important, particularly during the flowering and fruit setting season. Severe moisture stress results in considerable drop of young fruit.

SOILS AND FERTILIZERS

Macadamias are not demanding for soil fertility, but they do require good drainage. They need relatively higher amounts of phosphorous in the fertilizer than other fruit crops, particularly when the trees are young. A N - P₂O₅ - K₂O ratio of 2:4.5:2 (10-22.5-10) has given good results in the lava soils of Hawaii. In the calcareous soils of south Florida, they are likely to suffer from zinc, manganese, and iron deficiencies. Nutritional sprays will control the first two. However, iron chlorosis is only corrected by soil applications of chelates especially formulated for these soils.

PESTS AND DISEASES

Leaves are occasionally infested by thrips and mites, which may become serious in large plantings. Green stinkbugs cause considerable damage at times by injuring very young fruit when the shell is still soft. Rats, squirrels, and nut borers also cause substantial losses if unchecked. Anthracnose (*Colletotrichum* spp.) attacks leaves and the husks of immature nuts. Diseased nuts do not drop when mature and usually spoil while still attached. *Phytophthora cinnamoni*, which causes root-rot in avocados, produces a trunk canker in macadamia which may kill young seedlings. Fortunately, the tree

is quite resistant to the root rot caused by this fungus.

HARVESTING AND PROCESSING

Mature nuts fall to the ground and have to be gathered manually every week to prevent spoilage, particularly from moulds. Husking is done soon after harvesting and before the nuts are mechanically cracked. They are air dried at temperatures not higher than 110°F. The moisture content of the kernel is reduced to less than 1.5% to prevent development of off-flavors after roasting (either dry roasting or in a refined coconut oil at 275°F for 12 to 15 minutes).

USES

Macadamias are considered to be one of the finest table nuts of commerce. At present, they command premium prices because the demand far surpasses current production. They are ordinarily offered on the gourmet shelves of supermarkets as salted nuts packed in glass jars. The largest use, however, is in confections. Only whole nuts are packed in jars.