

NUT PLANTS

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Keywords: history, ecology, methods of cultivations, temperate regions.

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Summary

In this article the major nuts grown in the moderate and temperate regions, in the subtropics and tropics of the world are discussed. Botanists defined a nut as a dry, one-seed fruit surrounded by a hard shell that does not open on its own. Most true nuts, including hickory nuts and walnuts, are popular foods. Certain kinds of nuts like almond, coconut and peanut are not true nuts. Peanut for example is a type of pea. Hundred of species of shrubs and trees produce nuts but about 25 kinds of nuts are grown as commercial crops. Most popular true nuts in the world are discussed: cashew, almond, macadamia, pistachio, hickory, pecan, chestnut, and walnut (but not Brazil nut).

1. Cashew nut

The cashew *Anacardium occidentale* L. is a member of the family *Anacardiaceae*. Cashew nut is considered to be a crop with a bright future (see Figure 1). In tropical countries, the cashew nut is a common ingredient of a variety of dishes.

The real cashew fruit is a kidney-shaped nut about 3 cm long; it is attached to a bigger “apple” that is sometimes mistaken for the fruit, but that is only the edible receptacle plus fruit stalk. The cashew nut of commerce is the seed.

The so-called cashew butter, similar to peanut butter, is made from broken kernels, while the smaller apple is used for making jam, jelly, syrup, juice, alcoholic and non-alcoholic beverages, and candied fruit, while other products of the cashew tree are only of local significance. In Indonesia, the tender young leaves are eaten as a flavoring for rice. Many parts of the tree, especially the bark, are used for medicinal purposes.

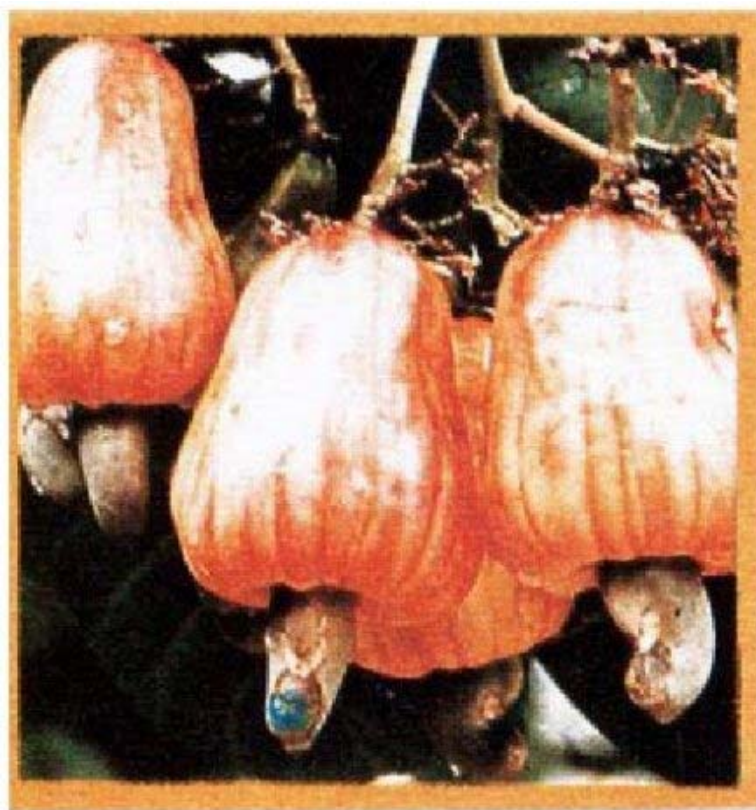


Figure 1. Cashew fruit (photo: Dr. Berényi Béla)

Cashew originated in the northern part of South America but is now common in all tropical countries with one or two reliable dry seasons, especially in India and East Africa (see Table 1).

	1989-91	1997	1998	1999
India	285	430	440F	440F
Nigeria	33	125F	152	152F
Brazil	137	113	34	125
Tanzania	22	63	93	107
Vietnam	22	67	41	70

F = FAO estimate

Source: FAO Production Yearbooks 1999

Table 1. Leading cashew nut-growing countries in the world (annual production x 1000 MT).

Source: FAO Production Yearbooks 1999.

Today, cashew is widespread on the eastern coast of Africa from Kenya to southern Mozambique, and from Senegal eastwards to Uganda. It is an evergreen tree, 6 to 14 m high, with a short trunk, and long spreading branches. Old trees often have canopies with a diameter greater than 10 m.

1.1 Ecological characteristics

Cashew is generally found in warm, semi-arid to humid climates with a pronounced dry season of at least 4 months, between latitudes 25° N and 24° S. The tree is hardy and drought-resistant and grows best on well-drained sandy soils with an annual rainfall of at least 900 mm. It can do with less rain, but then yields decrease, unless it is irrigated. The tree ceases to function as a fruit tree when rainfall drops below 500 mm but it is still valuable as it yields timber and firewood. Far more than 900 mm rain is tolerated if drainage is good and a sufficiently long dry period allows bloom and fruit set.

1.2. Temperature

The optimum average monthly temperature is 21 °C. In many cashew regions this corresponds to a mean daily minimum of 15 to 25 °C and a maximum of 25 to 35 °C. Cashew is not frost tolerant.

1.3. Moisture

Cashew will yield well in areas receiving only 750 to 900 mm, if it is well spaced. The optimum conditions include a rainy season of 1 to 4 months, and annual rainfall of 1000 to 2000 mm.

The ideal soil is well-drained sandy loam without a hardpan, and water at a depth of 3 to 10 m. The soil pH range is 5.5 to 6.7. Cashew is frequently used on a large scale for reforestation of poor exhausted and eroded land, but it is not salt tolerant. Cashew can produce a crop on soils which are too poor and too dry for other crops.

1.4. Methods of cultivation

Generally, seedling trees are grown. They are either raised in nurseries or sown at stake. However, if high yields of superior quality are desired, then the best clones must be selected and propagated vegetatively. Perhaps the best propagation method is grafting on seedling rootstocks, raised in deep polythene bags. In some regions of cashew production propagation is normally from seed sown directly in the field at the beginning of the rainy season. It does not transplant well.

1.5. Rate, depth, and methods of planting

The tree spacing varies widely. An initial spacing of 6 x 6 m or less may be used with gradual thinning out to 12 x 12 m. As the inflorescences are terminal, older trees cannot be put close together. Rain during flowering may cause the rotting of flowers and young fruits.

High-density seeds are selected from those, which sink in a solution of 150 g sugar. They are planted 23 cm apart and 5 to 7.5 cm deep. Under good conditions germination starts in 2 to 4 weeks. Various methods of vegetative propagation are now available, including air/ground layering, and grafting. Establishment of clone plantings is not a problem, although the cost is often prohibitive. Depending on soil type, the spacing should be 9 x 9 m to 15 x 15 m. If the trees are too closely spaced, i.e. less than 6 x 6 m, the trees suffer from severe moisture stress about five years after planting, and the yields are seriously reduced.

1.6. Fertilizing

It is beneficial to apply NPK or manure when available.

1.7. Harvesting and storage

Harvesting is normally by collecting fallen fruit, which is labour-consuming work. Yields fluctuate between one and five tonnes/ha. Large quantities of cashew nuts were formerly sent from East Africa to India for processing, but this practice is currently diminishing as the African countries are building their own processing plants. The demand for cashew nuts is rising steadily and the prices are good, with the result that cashew is becoming ever more popular as a smallholders' crop.

The nuts often require additional drying before they can be safely stored without loss of taste or aroma. They should be sun-dried until the kernel rattles inside when the nut is shaken. To extract it, the shell must be removed. This shell contains skin-blistering oil, which was formerly regarded as an unpleasant nuisance, but is now highly valued for its many industrial applications. Therefore, open-air-roasting, in which the shell oil evaporates, is gradually being replaced by roasting in the shell in an oil bath at 180 °C, with recovery of the oil.

2. Almond

The almond is a delicious nut. The nuts are the seeds of the beautiful almond tree *Prunus amygdalus L.*, a member of the rose family, *Rosaceae*. Each nut grows in a thin, smooth shell that looks somewhat like a peach stone. A dry, leathery hull covers the shell. The hull splits open when the nut is ripe.

Some almond trees produce sweet nuts; others have bitter ones. Sweet almonds are a popular delicacy when toasted, salted, and eaten whole, or added to candies and rich pastries. Bitter almonds are not edible. Trees that produce them are grown only for oil, although oil is also extracted from the sweet nuts. Oil of bitter almonds contains the poisonous hydrocyanic (prussic) acid. After the acid is removed, the oil is used in flavoring extracts.

The almond tree is native to south-West Asia, but today it is widely grown in the countries that border the Mediterranean Sea. The trees also thrive in California, where commercial groves produce large annual crops of almond nuts.

Almond trees are well proportioned and may grow to 12 meters high. They have long, pointed leaves. The blossoms open early in spring, long before the leaves appear. For this reason, almonds are grown commercially only in regions that do not have early spring frosts. The trees are grown as ornamentals in other regions.

3. Macadamia nut

Macadamia nuts, from the macadamia tree *Macadamia integrifolia* Maiden et Betche, of the family *Proteaceae*, have a hard, smooth shell. Macadamia is a tropical Australian evergreen tree that was taken to Hawaii in the 1800s.

On average a fruit weighs 7 g, of which 40% is kernel. The white kernels are roasted in oil. The roasted nuts, which taste somewhat like Brazil nuts *Bertholletia excelsa* Humb et Bomp. are salted and canned. They may also be used in cakes, candy, and ice cream. The macadamia tree grows more than 12 m tall and has dark green, leathery leaves and creamy-white flowers. The nuts are also called Australian nuts, bush nuts, and Queensland nuts today the nuts are an important crop in Australia.

Macadamia is a delicious and nutritious nut. In the opinion of Hamilton and Fukunaga (1959) the botanical name *Macadamia termifolia*, which is often seen in older literatures, is only valid for a wild relative. In culture we find two species that differ as shown in Table 2.

	<i>M. integriflora</i> Maiden et Betche	<i>M. tetraphylla</i> L. Jons
Fruit	smooth	rough-skinned
Leave	3 per node	4 per node, spiny
Flower	white	pink

Table 2. Characteristic of two macadamia species

Practically all-commercial varieties belongs to *M. integrifolia* Maiden et Betche. Macadamia is native to eastern Australia and is at home in the same typing of climate as *Coffea arabica*, i.e. from equatorial highlands at 1500 m altitude to frost-free subtropical areas at sea level. The crop requires about 1000 mm of rain and is fairly drought-resistant but it needs windbreaks in exposed locations.

For propagation of rootstocks, husked seed is sown; the seedlings are grafted when their diameter at ground level is at least 10 mm. the slightly thinner scion-wood is girdled six weeks before grafting. The wedge graft has given good results. After two years in the nursery the roots are pruned and ten weeks later the plants can be set out in the field, usually at a spacing of 6-x 10-m. Weeds must be constantly controlled.

The object of pruning in macadamia is to form a tree with a single main stem and a framework of horizontal branches, starting at 1 m above the ground and from there at intervals of 0.5 meter. In order to achieve this, one must know how the tree is constructed. Buds occur in groups of three, vertically up the stem. When a stem is topped, all three upper buds will grow straight up. Only one of these must be allowed to remain and to continue as the main stem, the other two being clipped off to a stub of 1 cm. The buds below those two stubs will then grow out in a horizontal direction.

It is advisable to fertilize with ammonium sulphate before flowering and with NPK twice afterwards, the amounts to be increased yearly. No serious pests are reported. The harvest takes place by gathering fallen fruit at least once every two weeks. This is husked and then carefully dried to moisture content of 3.5%. Uneven drying will cause cracking and rot. The commercial product is the vacuum-packed roasted nut.

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