# CASHEW

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## DESCRIPTION

The cashew, *Anacardium occidentale*, is a resilient and fast-growing evergreen tree that can grow to a height of 20 m (60 ft). It belongs to the family Anacardiaceae, which also contains poison ivy and the mango.

Native to arid northeastern Brazil, the cashew was taken around the world by the Portuguese and Spanish who planted the trees in their colonies. The English name "cashew" is derived from the Portuguese "cajú" which came from the Tupi Indian "acaju" (Rosengarten, 1984). In Spanish it is known as "marañón" or "anacardo."

## WHY GROW CASHEW?

Cashew is an important nut crop that provides food, employment and hard currency to many in developing nations. Of all nuts, cashew is second only to the almond in commercial importance (Rosengarten, 1984). India, Mozambique, and Tanzania are the three biggest exporters of cashew nuts today. Although there are large commercial plantings of cashew, wild trees or those owned by small farmers account for 97% of cashew production (Rosengarten, 1984).

The plant produces not only the well-known nut, but also a pseudofruit known as the cashew "apple" and cashew nut shell liquid (CNSL) which is used for industrial and medicinal purposes.

The cashew tree has other uses as well. It is used for reforestation, in preventing desertification and as a roadside buffer tree. Cashew was planted in India in order to prevent erosion on the coast (Morton, 1960). The wood from the tree is used for carpentry, firewood, and charcoal. The tree exudes a gum called cashawa that can be used in varnishes or in place of gum arabic. Cashew bark is about 9% tannin, which is used in tanning leather.

## CLIMATE, SOIL & OTHER NEEDS

Cashew flourishes in the hot, dry tropics around sea level. It has an extensive root system and deep taproot, and grows well even in sandy soils with low fertility. The trees now grow wild in some places outside of their native habitat.

Cashew is known as a "poor man's crop" and is good for smallholders because it will grow with minimal fertility

and few inputs. However, just because cashew will tolerate poor soils and low rainfall does not mean one should look for this agroclimate to grow the trees. As with any crop, cashew will produce more nuts with more inputs. Cashew's advantage for the smallholder is that it will still produce a harvest, although a low one, under these unfavorable conditions.

In plantations, the trees should be spaced about 10-15 m (35-50 ft) apart. They require good drainage, friable soils, low elevation (up to 1000 m or 3300 ft), rainfall of about 1000-2000 mm (40-80 in) per year, and a pronounced dry season of three to four months. Cashew can tolerate a wide pH range and even salt injury (Coronol, 1983). Many cashew groves are intercropped with coconut or annual crops.
Cashew can be grown from about 25° South of the equator to 25° North, although not on a commercial-scale level at the extreme latitudes. Most of the regions where it is an economically important crop are between 15° South and 15° North (Ohler, 1979).

Cashew thrives at temperatures up to 40° C (105 F°). Damage to young trees or flowers occurs below the minimum temperature of 7° C (45° F) and above the maximum of 45° C (115° F). Only prolonged cool temperatures will damage mature trees; cashew can survive temperatures of about 0° C for a short time (Ohler, 1979).

Cashew flowering is not affected by daylength. Trees normally flower at the end of the rainy season, when new shoots emerge. The flowers develop at the ends of the shoots. In areas where there are two dry seasons the trees usually flower twice in a year (Ohler, 1979).

## PROPAGATION AND CULTURE

Propagation of cashew is often done by seed. Worldwide most cashew plantings have been planted this way. When propagating by seed, you can first check viability by putting them in a jar of water. Seeds that sink tend to be viable. Several seeds are then planted 5-10 cm (2-4 in) deep in the soil where the tree will be grown. Once they germinate, the weaker seedlings are weeded out, leaving one strong plant. It is best to plant the seeds directly in the ground, since cashews don’t respond well to transplanting because of their taproot.

Because planting seed can result in a lot of variation among the seedlings, cashew now is propagated asexually. This can be done through budding, grafting, ground or air layering, and cuttings. "Layering and approach grafting are most successful if carried out just prior to the pre-flowering flush of growth. Whip grafting may be more successful if it is done immediately after the fruit has ripened. Cuttings are sometimes difficult to root, although ringing the cutting 40 days prior to removal from the parent plant has sometimes improved rooting. Cuttings are taken from 1-2 year old shoots whose stems are still light-colored and somewhat flexible" (Rice, 1986). Budding should be done about one month after flowering begins (early dry season) (Ohler, 1979).

Cashew seedlings start bearing fruit after three or four years (Rosengarten, 1984). An average annual yield from a mature plantation tree is variable, from a few kilos to 100 kg (Ohler, 1979). Recommended fertilizer rates for bearing trees are 500 g nitrogen, 100 g phosphorus and 250 g potassium per tree per year (Behrens, 1996).

Cashew trees have both staminate (male) and perfect (male and female) flowers. This is important for the selection of better varieties, because the trees with more of the perfect flowers will bear more fruit. Insects are the primary pollinators. Beehives can be placed in or near the orchard to improve the yield (Behrans, 1996). The flowering period is two to three months in length (during the dry season), with the fruit appearing two months later.

Cashew plantations are usually kept well weeded for ease of harvesting and to prevent competition for water and nutrients. In some areas, the cleared ground also acts as a firebreak. In Mozambique, uncontrolled burning is the major killer of cashew trees (Hilton, 1999).

## PESTS AND DISEASES

Writing for *ECHO Development Notes (EDN)*, Brian Hilton, a development worker from Mozambique, said, "A statistician has called cashew the most variable agricultural plant he has worked with. We have trees that have produced 40 kg (88 lbs) of nuts one year decrease to zero production the following year (largely because of disease). Rainfall, insect infestation, humidity, and temperature can all affect yield in a variety of ways. This variability makes research difficult and lessens the value of cashew to poor farmers who need regular income. Those who seem to make money off of cashew tend to be the farmers and commercial operators who can implement a regular fungicide spraying program."

Powdery mildew (*Oidium sp*.), which kills the flowers, can have a devastating effect on cashew tree yields. Carl Campbell, a fruit expert in ECHO's network, believes that in any geographical location where mildew infection might occur on mango, cashew could be affected as well. Some farmers dust with sulfur to control mildew, but this has acidifying effects on sandy soils (which may be acid anyway). Powdery mildew is a significant problem in East Africa. Hilton writes in EDN: "Powdery mildew likes cool, humid conditions and succulent plant growth. It does not tolerate high temperatures or high ultraviolet light concentrations. Powdery mildew can reproduce in 48 hours, releasing millions of spores into the atmosphere. To improve cashew yields in powdery mildew areas without using chemicals, pruning suckers on lower branches to let in more sunlight can help. These tend to be highly infected by powdery mildew and a source of spores for future infection. One farmer alone will not significantly reduce the inoculum in the air by pruning, but it has been shown that many farmers pruning trees in adjacent areas can significantly delay the initiation of the disease."

Other diseases of cashew include dieback, damping off and anthracnose. Anthracnose is caused by the fungus *Colletotrichum gloeosporioides* and under wet conditions, can cause almost total crop failure. It also affects other tropical fruit trees such as mango and citrus.

*Helopeltis anacardii* is a sap-sucking insect that can cause flower damage and is the major insect pest in Southeast Asia, India and East Africa. A severe attack will result in up to 80% of branches damaged (Rickson and Rickson, 1998).

Other insect pests include borers, thrips, mealybugs weevils, caterpillars and leaf miners. To prevent these and other pests, cashew is traditionally sprayed with pesticides at certain times of the year regardless of insect infestation as a preventative measure. The trees are sprayed three times in a season: when the first new leaves appear, at flowering, and at mid-nut development.

Spraying should be avoided or reduced whenever possible because spraying during flowering is detrimental to pollinators and therefore can reduce the harvest. Also, trees often are sprayed with pesticides dangerous to human health (Rickson and Rickson, 1998). There are examples of pesticide-free plantations of 100-200 ha in Sri Lanka, which have had no significant pest problems for years. Pesticide-free plantations would reduce costs and prevent health hazards and environmental damage.

Fred and Melinda Rickson, scientists from the University of Oregon, found that spraying can be avoided by encouraging an ecosystem conducive to organisms, especially ants, which prey on cashew pests. Ricksons discovered that the nectaries (pits which secrete nectar) on cashew trees apparently attract ants to places where the trees are susceptible to pest damage (especially the young leaves, developing inflorescenses and young fruits). These nectaries also attract spiders and predatory and parasitic wasps. All of these insects then prey upon the cashew insect pests. The number of nectaries increases as the tree becomes larger, and therefore more ant species are found in older trees. With younger plantings, it may be advisable to encourage a more diversified habitat to attract more ants.

Creating desirable habitats for ants and other beneficial insects is done by mixed plantings, having brush and grass understories, and leaving dead wood and flat stones in the area (Rickson and Rickson, 1998). If these growing conditions are met, preventative pesticide application should be unnecessary.

For those who want to implement a program of eliminating pesticides on cashew plantings, the Ricksons advise the gradual phasing-out of pesticide application by using a pest-scouting integrated pest management (IPM) system and only using selective, very localized pesticide applications. This should be done together with increased habitat diversification. It may take several years to eliminate the regular spraying program. It is best to start by eliminating the first spraying (done at the first flush of leaves). *Helopeltis* usually starts in small isolated areas on trees, so you have a chance to scout for pests and spray only the infected trees if detected.

## USES

The cashew nut is a popular dessert nut, eaten out of hand, with other mixed nuts and used in baking and confections. Sixty percent of cashews are consumed as salted nuts (Rosengarten, 1984). It is also made into cashew butter and nut milk. The nut is high in protein, oil and also vitamins, especially thiamin. The nut make-up is 47% fat, 21% protein, and 22% carbohydrate (Ohler, 1979). Julia Morton writes, "In comparison with eight other leading nuts, the cashew is lowest in fat and shares with the pistachio top place in protein content" (Morton, 1970).

There are places where people prefer the cashew "apple" and throw the nut away because of its toxicity. The cashew apple is a "pseudofruit"– it is actually the swollen stalk of the true fruit (the nut itself). The apples are 5-10 cm (2-4 in) long, red or yellow in color, fibrous but juicy, sweet, pungent, and high in vitamins A and C (see Table 1). Per 100 g of fresh fruit, the cashew apple has more vitamin C than guavas, mangoes and oranges (Behrens, 1996).

Table 1. **FOOD VALUE PER 100 G OF FRESH CASHEW APPLE***

| | |
|---|---|
| Moisture | 84.4-88.7 g |
| Protein | 0.101-0.162 g |
| Fat | 0.05-0.50 g |
| Carbohydrates | 9.08-9.75 g |
| Fiber | 0.4-1.0 g |
| Ash | 0.19-0.34 g |
| Calcium | 0.9-5.4 mg |
| Phosphorus | 6.1-21.4 mg |
| Iron | 0.19-0.71 mg |
| Carotene | 0.03-0.742 mg |
| Thiamin | 0.023-0.03 mg |
| Riboflavin | 0.13-0.4 mg |
| Niacin | 0.13-0.539 mg |
| Ascorbic Acid | 146.6-372.0 mg |

*Analyses made in Central America and Cuba. Morton, Julia. *Fruits of Warm Climates*.

Only a fraction of cashew apples are used, however. They are quite perishable and only used locally unless preserved. Apples will rot within 24 hours of falling from a tree. Those not eaten fresh can be preserved in syrup, candied, sun-dried, stewed, and made into jams, chutneys, vinegar, pickles, and juices.

In ECHO's book *Amaranth to Zai Holes: Ideas for Growing Food Under Difficult Conditions*, Martin Price summarizes a preserving technique used in Honduras, obtained from the September 1990 edition of *Appropriate Technology*.

> *The cashew 'apple' is a bell-shaped pseudocarp which holds the "nut" below it. The "apple" (or fruit) is often used for juice, preserves, candy, and jam in Asia. The first step in drying the fruit is to boil the apples in salty water for 15 minutes to remove the bitter taste that is unpleasant to some. Then the apples are perforated and compressed in specially cured wooden devices. The compressed apples are then boiled in sugar for two hours. Some 350 kg of sugar are used with every 1,000 apples with enough water to cover the apples. The sugar is re-used twice.*
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> *The boiled apples are then dried in a solar drier. The apples are put in 1.2m x 0.6 m wire trays to a depth of 2.5 cm, inside a 1.5 m x 1.2 m wooden cabinet which is covered with plastic film. Underneath the wire trays there is a black collector plate. The cabinet is inclined at 80°, set toward the east in the morning and moved during the day. The apples are dried in one day and have a shelf-life of 6-8 months.*
>
> *This has been extremely successful. By 1985, over 5,000 kg of cashew produce had been marketed and orders for 1987 were more than 35,000 kg. This provides employment for 2,000 families at £5.00 (rather than £1.50) a day.*

Alcohol production is another use of the apple. It is used to flavor Madeira wine and various other liquors. Ian Wallace, writing to ECHO from Guinea-Bissau, says, "Cashew has greatly aggravated another social problem—drunkenness. The squeezed fruit juice ferments quickly, without the need for people to do anything, making a strong alcoholic drink in days. The cashew wine is available in far greater quantities than palm wine. Cashew season sees a marked increase in drunkenness." In Mozambique there was a time when cashew cultivation was actually prohibited because of the drinking problems it caused (Morton, 1972).

The cashew nut shell liquid (CNSL) is used in brake linings of cars because it absorbs heat efficiently. CNSL is also used in preserving and waterproofing, and in paints, enamels and lacquers. The CNSL also has been used to treat scurvy, warts, ringworm, and even for tattooing.

Other parts of the tree are used medicinally to cure sore throats, chronic dysentery and diarrhea. The bark is chewed for sore gums and toothache. Leaves can be crushed for a poultice for skin ailments. Cashew brandy is used as a liniment for rheumatism and neuralgia.

## PROCESSING

Processing of cashew starts with the collection of nuts. Hilton writes again, "[On large plantations in Mozambique] much labor is needed at harvest time, which is the slack season for most farmers. Nuts which fall to the ground from cashew trees are collected daily. Thievery [of nuts] can be quite high in densely populated areas. Collecting nuts is not difficult. Widows in one survey asked for cashew as a crop they could tend with the small amount of family labor that they had available. Another good thing about cashew is that the harvest is right before the rainy season when many poor families need some income for fieldwork."

After or during collection, the nut is removed from the apple. Nuts are then dried in the sun on bamboo mats, being turned for several days until they rattle in the shell.

Processing of cashew is complicated and costly when done on a large scale because of the CNSL found in the shell around the cashew nut. CNSL contains 90% anacardic acid and 10% cardol. These materials are caustic

and can contaminate the nuts and cause blisters on the skin. Related compounds can be found in poison ivy, and many people develop skin sensitivity to CNSL.

The traditional way of processing the nuts is to roast them over a fire in a perforated pan to burn off the CNSL. The nuts swell and eject the CNSL, which drips through holes of the pan into the fire. This causes a lot of thick irritating smoke. Nuts should never be roasted inside the home because of this smoke. Next the nuts are tumbled in ashes or sawdust to absorb the rest of the CNSL. Shells are then removed by hand. The kernels processed this way are of low quality and used mostly for local consumption.

For export-quality kernels a large infrastructure including machinery, factories and personnel is needed. These processing plants are costly and are only suitable for large companies and investors. A hot oil bath is used to remove CNSL. Shelling again is done either by hand (placing the nut on a flat surface and hitting with a wooden mallet) or by machine. Afterward, drying the kernels often is necessary. The nuts are then graded according to size and color.

"There are also several types of mini-processing factories which cost US $25,000-$50,000. These factories process 500-1500 kg (1100-3300 lbs) of raw nuts per day. The mini-factories employ more people (25-200 people depending on the factory) per ton of processed cashew than the highly mechanized factories. Because humans are better at separating the nut from the shell than machines, kernel breakage is less with the mini-factories and they can be quite profitable. One of the biggest costs is stockpiling cashew to keep the mini-factories going. The cashew-harvesting season is only about two months long. If you want to keep the plant going for 200 days per year, the smallest plants would require a stock of about 100 tons of raw cashew. Several companies make the mini-plants, including Pierce in Brazil and Chirag in India, and there is even a small engineering firm in South Africa. Obviously even these mini-factories are not for the small investor" (Hilton, 1999).

Intermediate Technology (IT) has also been working with micro-level cashew processing in Sri Lanka. They developed some machines for processing the cashew nuts. They include: the drum roaster, which costs US $ 1500 and handles 5-10 kg/hr (11-22 lbs/hr), a steam roaster with boiler and accessories for US $ 8000 which handles about 500 kg/hr (1100 lbs/hr), a decorticator for US $ 350 which handles 20-30 kg/day (44-66 lbs/day), and a tray drier for US $400 which can dry 150 kg (330 lbs) of decorticated cashew per day. All of these except the steam roaster can be manufactured locally. These figures are from *Appropriate Technology Volume 23*, #4 in March 1997. IT's address is Myson House, Railway Terrace, Rugby, CV21 3HT, UK.

## MARKETING

Brian Hilton writes again, "Buyers for cashew nuts exist in South Africa, Europe and the USA. [Those exporting nuts] have to deal with export licenses, taxes, foreign currency exchange, etc. Farmers might want to create marketing associations so they could sell in quantity and negotiate a better price. Associations can be an effective way of obtaining higher prices. It is a very costly and laborious process for buyers to buy small quantities of cashew from individual farmers. By pooling their cashew harvest together and selling in bulk, farmers can get a higher price. Such associations usually have a quality control officer to do some elementary quality control. This can save buyers additional expenses at the factory. If buyers recognize the savings, they should be willing to pay a further premium to the farmers' groups who ensure quality cashews."

With the exception of planting enough trees to meet local demand, the planting of cashew in areas where there is no processing industry is not advisable, according to Brian Hilton. The value of cashew increases considerably where there is a cashew processing industry that exports the kernels to Europe or the U.S. Worldwide demand for cashew is increasing at about 5% annually and future nut prices should remain firm" (Hilton, 1998).

The following perspective on large-scale cashew plantings is from ECHO's book *Amaranth to Zai Holes*.

*CASHEW AS A CASH CROP: IS IT AS GOOD AS IT APPEARS?*

*You would be surprised how often ECHO receives a question similar to this. Cashew does indeed do very well on poor soil. However, Dr. Campbell has mentioned to me that it is seldom a successful development project. One serious problem is the terribly toxic fumes that are produced during processing. The nuts can be safely processed on a large scale, but it is not simple to do. The Natural Resources Institute (Publications Distribution Office, NRI, Central Avenue, Chatham Maritime, Kent, ME4 4TB, UK) has some intermediate technology designs for processing cashews. My guess looking at the picture is that it would cost several thousand dollars.*

*Dr. Frank Martin, a retired USDA scientist, said that while cashew is often touted for areas where soils are poor, the tree has serious fruit setting problems. If there is excess moisture during flowering the fruit will not form. He gave this example. "A project I was consulting with in northern Haiti asked me to look at cashews. I questioned many farmers very carefully. It turns out that even though the climate is dry, there is enough condensation of water at night to impede fruit development." That does not mean it is never a good choice. "I have never seen it grow as well as it does in central Panama." If you have not already had a successful experience with cashews (including good fruit set) in the particular area being considered, you would be wise to use caution before investing in cashew, according to Dr. Martin.*

*He also pointed out that cashew trees are associated with poverty worldwide. There is so much labor involved that there is little income produced per person. So it has little promise unless there is cheap labor. "It is a poor person's crop and a crop for poor soils." If you know of a cashew project that would lead you to a different opinion, we would like to hear about it.*

*Ian Wallace, a development worker from Guinea-Bissau adds his experience with cashew: "Vast areas of virgin bush have been cleared and planted with cashew trees in the past 10 years. Certainly the crop has not fulfilled all that was expected of it. Perhaps the expectations were too high, or too little care was given. The initial stages of raising the trees is so straightforward that there is a tendency for people to sit and wait for the tree to 'do its stuff,' with many orchards remaining uncleaned.*

*The crop is unreliable and very little is processed locally. That which is processed locally is of poor quality. The majority of the nuts are exchanged by the government for rice and then shipped raw to foreign processing centers. The true value of the crops remains unrealized since much of the profit is only added after processing. We have also seen a disastrous fall in rice production because it is easier to collect cashew nuts and exchange them for imported rice than it is to work the rice fields. This is obviously a fault of the exchange policy, but it is difficult to see how else the farmers could see value for their cashew nuts as there is no other market and the government has no other means of paying."*

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