



PRODUCTION AND PROCESSING OF NUTMEG AND MACE

Introduction

The nutmeg tree (*Myristica fragrans*) is native to the Moluccas (known as the Spice Islands) in East Indonesia. Nutmeg and mace are both products of the fruit of this tree. The fruit is soft and fleshy and similar to an apricot. Nutmeg is the kernel of the seed, and mace is the net-like crimson coloured leathery outer growth (aril) that covers the shell of the seed. The main countries of production are Indonesia, Grenada, Sri Lanka, Trinidad, China and India. There are two types of mace and nutmeg, West Indian (from Grenada) and East Indian (from Indonesia).



Figure 1: Processed nutmeg and mace.
Photo: Practical Action / Neil Noble

The flavour of mace is similar to that of nutmeg, but is more refined. Mace is much more expensive than nutmeg. Inferior quality mace has very little aroma and is brittle. Both spices are used for flavouring savoury and sweet foods and as a medicine.

Cultivation

The nutmeg tree is a large evergreen that grows to about 18 metres tall. It requires a deep, well-drained loamy sandy soil and should be grown in the shade for the first two to three years. The optimal growing temperature is between 20-30°C and the annual rainfall should be between 1500-2500mm. The tree starts to fruit about five to eight years after planting and will continue to yield for about thirty years.

Half the trees are male and do not produce fruit. Unfortunately, the sex of the plants cannot be identified until they are six to eight years old.

Propagation

The usual method of propagation is by seed. Only uniformly dark brown seeds taken from fruits that have split open should be used. Seeds that rattle will not germinate, as they are too dry. The seeds have to be sown as soon as possible since viability is lost in eight to ten days. They are planted with the shell.

The soil should consist of a mixture of well-composted manure, topsoil, and coarse sand. One per cent rock phosphate can be added to the mixture. The seeds should be lightly buried so that part of the shell is exposed, they should be watered and left in the shade to germinate. Germination takes between four and eight weeks. The seedlings should remain in the shade for six to eight months. Propagation should be from mother trees that are selected for their regular bearing, high yields, large nuts and heavy mace. The quantitative criteria for selecting mother trees are as follows:

- Large number of fruits per tree ~ over 10 000 per year
- Wet weight of fruits ~ over 30g per fruit
- Wet weight of mace ~ over 1g per fruit
- Wet weight of nuts ~ over 10g per nut.

Marcotting (splitting young trees) and grafting are also possible forms of propagation for nutmeg, but are more difficult and less successful.

The established seedlings should be planted in a shaded area at the beginning of the rainy season. They should be kept watered throughout the first year until they are well established. Weeds should be kept in check by occasional slashing and the cut material can be applied to the base of the trees in the form of mulch. Additional fertiliser is not generally applied. The shading can be gradually removed after two to three years. Seedlings can be planted close together so that later on when the male trees have been identified (after the first flowering) most of them can be removed, as they do not bear fruit. Some male trees must remain for pollination. A ratio of 1:10 is common.

Pruning helps to maintain flower, fruit and seed production. Water shoots, upright branches, dead wood, and some lower branches can be removed.

The most threatening disease is Nutmeg Wilt in which the plant will gradually wilt and drop leaves and fruit. There is no definitive treatment. Fruit rot has been recorded in India and a thread blight in Grenada and Trinidad. Soil fungi will attack nutmeg trees. The main pests are borers, or bark beetles, which are small dark brown weevils about 3mm long.

Yield depends on the size and the age of the tree. Trees will start to bear fruit from around five to seven years old. The yield will increase considerably until the tree is about twenty-five and then more slowly until it reaches its maximum capacity at around thirty-five to forty years of age. Yields can be above ten thousand nuts per tree.

Harvesting

The tree starts to bear fruit when it is five to eight years old. When it is ripe, the fruit turns yellow and the pulpy outer husk (pericarp) splits into two halves to reveal a purplish-brown shiny seed surrounded by a red aril. Usually the fruits are allowed to split and fall to the ground before harvesting. They should be collected as soon as possible or the underside of the fruit will become discoloured and may become mouldy. In some areas, a long pole is used to take opened pods directly from the tree. This ensures a better quality harvest but can also result in damage to flowers and younger fruit.

In Grenada, there are two peak periods of production – January to March and June to August. During these times, fruits are harvested on a daily basis. Throughout the rest of the year, fallen fruits are collected every two to three days.

Processing

The harvested fruits are transported to a processing place. The first thing to do is separate the mace (aril) from the rest of the seed. The fruits are opened by hand and the scarlet aril (mace) surrounding the nut is removed by cutting with a small pointed knife the attachment of the mace to the base of the nut (nutmeg). Care needs to be taken to avoid damage to the nut. An alternative method of shelling the nuts is to tip them onto a sloping cement floor from a height of three to four metres. Another option is to soak the nuts in water for four to twelve hours and then squeeze between the thumb and forefinger until the nut pops out.

Mace

Mace is the thin lacy material covering the kernel and represents only a small fraction of the weight of the kernel. For each 100kg of nutmeg, there is only 3-3.5kg of mace. The quality of mace depends on the amount of volatile oil. Mace is available in the market as whole, broken or ground types.

The separated mace is flattened by hand and dried on mats in the sun. This takes between two and four hours. Grenadian mace is cured by storage in the dark for four months. This produces a brittle, pale yellow mace that attracts a premium price and is graded according to size, the bigger the mace, the better the premium. After grading, the mace can be classified and bagged.

Commercial mace consists of flattened lobed pieces, 2.5cm long and about 1mm thick. It has a similar taste and aroma to nutmeg, but is more delicate. There are four different types of nutmeg:

- **Banda** mace – considered to be the finest. It has a bright orange colour and fine aroma
- **Java Estate** mace – this mace is golden yellow interspersed with bright red streaks
- **Siauw** mace – this mace has a lighter colour than Banda mace and less volatile oil
- **Papua** mace – contains very little volatile oil (the oil that it contains has a pungent aroma). It is not suitable for distillation.

Nutmeg

Green nutmegs are sorted to remove any broken, discoloured, rotten, water logged or mouldy seeds. The nutmegs are spread out to dry in the sun in their shells. They are turned each day to prevent fermentation. The nutmegs are sufficiently dry when they rattle inside the shell. The drying time depends on the external temperature, humidity and air flow across the nutmegs, but generally takes about one week. Sometimes artificial dryers are used to speed up the process.

To produce shelled nutmegs, the dried seeds are cracked by tapping the end of the nuts with a small wooden mallet. If the nuts are tapped on the side there is a possibility that the kernel may be bruised. Cracking the shell is often done by a centrifugal type of machine. The nuts are forced against the inside of the drum which causes the shell to crack.

After cracking the shells, the nuts are sorted. Whole kernels are separated from the broken pieces of kernel.

Quality control and grading of nutmeg

The dried seeds are sorted using the flotation method. Lighter kernels (which are generally unsound) float to the surface of a tank and can be removed. The sound kernels are sorted based on their quality and size. Good quality whole kernels are separated from the lower quality and broken kernels.

For export, the bagged nutmeg is fumigated with methyl bromide.

Grading

Nutmegs are graded according to their size. Sizing can be carried out using different mesh sized sieves. Larger nutmegs (weighing about 8g) are considered superior and are traded at a higher price. In Grenada it is usual to specify the size of nutmegs according to the number of dried nutmegs per British pound. The best nuts are referred to as '55' nuts (8.2g) to '65' nuts (7.0g). The smallest grades traded are '160' nuts which weigh only 2.8g. Smaller nutmegs and nutmeg fragments are included in the BWP grade (broken, wormy and punky), which is the lowest quality.

Packaging and storage

Sorted kernels are bagged and labelled appropriately. They are usually packed into Hessian sacks or gunny bags. Nutmegs are usually sold whole, either with or without the shell. Ground nutmeg is also available, but this is generally of inferior quality and can easily be adulterated. The taste and aroma of ground nutmeg deteriorate very rapidly. Dried whole nutmegs have a long shelf life if they are stored in a dry place away from sunlight and insect infestation.

Adulterants

There are two nutmeg species that are found as adulterants of true nutmeg or mace: *M. argentea* (Macassar Nutmeg, Papua Nutmeg) from New Guinea and *M. malabarica* (Bombay Nutmeg, Wild Nutmeg) from South India. The latter lacks fragrance, while the former has a very pungent aroma. Both adulterants can be identified by the shape of their seeds: true Banda nutmegs are shaped

like an egg while the two other species have seeds that are more acorn shaped than egg shaped.

Uses

Nutmeg and mace are both used to flavour foods and beverages. They are used in a variety of sweet and savoury dishes.

Nutmeg and mace both contain essential oils, which can be extracted. Broken nutmeg pieces are often used for the extraction of essential oils. Around four per cent of the essential oil within nutmeg is poisonous and as such it should be used sparingly.

Nutmeg essential oil can be prepared by distillation. The nutmeg should be turned into a coarse powder and then transferred to the still immediately. Repeated distillation, achieved by pouring the distillation liquid over the nutmeg powder, may be necessary. During the process exposure to the vapours should be kept to a minimum due to the toxic nature of some of the essential oils.

Oil extraction, usually by hot manual pressing, produces nutmeg butter (also known as concrete or expressed oil). The butter is a highly aromatic, orange coloured fat which can then be processed into ointments and perfumes. This can be a good use of crop rejects.

Nutmeg and mace oleoresins are extracted from the plant using organic solvents. They are produced for commercial flavourings and perfumes.

Nutmeg and mace both have medicinal properties and can be used to treat a number of ailments, including as a digestive aid, to treat flatulence, diarrhoea and vomiting.

References and further reading

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Spice gallery

<http://pharm1.pharmazie.uni-greifswald.de/gallery/yamasaki.htm>

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