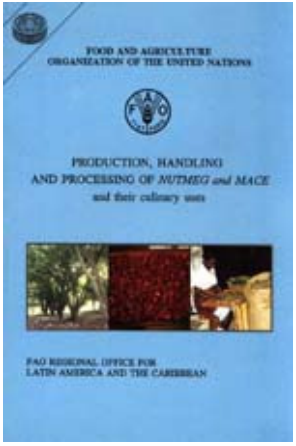

Production, handling and processing of nutmeg and mace and their culinary uses

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Guido B. Marcelle
Grenada Produce Chemist Laboratory

FAO REGIONAL OFFICE FOR LATIN AMERICA AND THE CARIBBEAN

Santiago, Chile 1995

Copyright

FAO

Contents (101 p.)

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Acknowledgements

Contents - **Next**

Cover photographs

Left: Multi-stemmed trees from marcotting
Center: Mace (uncured)
Right: Sorting and inspecting sounds

FAO REGIONAL OFFICE FOR
LATIN AMERICA AND THE CARIBBEAN

Bandera 150 - P.O. Box 10095
Santiago (Chile)
Fax (56-2) 696-1121
Phone (56-2) 699-1005
E-mail FAO-RLAC@CGNET.COM

Contents - Next

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Foreword

Contents - Previous - Next

The Round Table on the Development of Aromatics and Spices Handling, Processing, Packaging, Quality Control and Marketing in the CARICOM countries was organized by the FAO Regional Office for Latin America and the Caribbean, with the collaboration and cosponsorship of the Grenada Produce Chemist Laboratory of the Ministry of Agriculture, Marketing, Industry, Energy and Production of Grenada. The event, carried out as part of the activities of the Caribbean Technical Cooperation Network on Agroindustrial Development, established by this FAO Regional Office in the Sub-Region, was held in St. George's, Grenada, from 12 to 15 October 1993.

The corresponding Proceedings were published by this Office in 1994 as No. 24 of AGRIN Series.

The FAO Regional Office for Latin America and the Caribbean has the pleasure of presenting this technical manual "Production, Handling and Processing of Nutmeg and Mace and their Culinary Uses". FAO hopes that this publication will lead to a better understanding of this produce, and that it will contribute towards the consolidation of the important agricultural sector related with aromatics and spices.

Severino de Melo Araujo
Assistant Director-General
Regional Representative for Latin
America and the Caribbean

Contents - **Previous** - **Next**

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Introduction

Contents - **Previous** - **Next**

As one travels from St.George's along the middle of the island over the Grand Etang

road, the valleys and lower hillsides are seen to be carpeted in a rolling greenish yellow, a lighter green than the surrounding vegetation. This is the glossy lime-green leaves of the nutmeg tree, the tree that has significantly contributed to Grenada being called the ISLE OF SPICE (photograph 1).

This tall, spreading, sometimes conical evergreen dioecious tree, Myristica fragrans of the family MYRISTICACEAE exhibits dangling ornamentals, light-bulb like mature fruits coloured yellow or yellow with a flash of crimson red when dehisced (photograph 2). This fruit when ripe and dehisced is regarded as one of the most beautiful fruits in nature (Ridley, 1912).

The fruit produces two separate and distinct spice products, the nutmeg which is the seed kernel and mace which is the dried net-like aril that surrounds the single seed in the fruit.

Contents - **Previous** - **Next**

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Section I - The plant and the environment

Contents - Previous - Next

1. History and origin
2. Botany
3. Pollination and fruit setting

1. History and origin

According to Groome (1970), the first planted nutmeg was introduced to Grenada by the Hon. Frank Gurney, with seeds brought from Banda in 1843. The supposed site for this first planting was Belvidere Estate in the parish of St. John's.

The nutmeg is indigenous to the eastern islands of the Moluccas, viz, Amboina and Ternate hut seldom found growing truly wild.

Ironically, nutmeg was first planted in the West Indies, on the island of St. Vincent as early as 1802 probably taken from Kew. By 1824 some plants were introduced from St.

Vincent to Port-of-Spain Botanical Gardens, Trinidad.

In Grenada the first commercial plantations were established just about the 1 850's with the associated estate being Belle Vue and Capitol located in the St. Andrew's parish between Soubise point and Birchgrove. It was not until the year 1865 that nutmeg from Grenada had influence on the world market.

Nutmeg plants have been introduced in most tropical countries where suitable climatic and soil conditions exist and in the West Indies along with St. Vincent and Trinidad, other countries where nutmegs have been introduced include St. Lucia, Dominica, Jamaica, Montserrat, Martinique and Guadeloupe.

Grenada by far is the largest cultivator of nutmeg and producer of the spices, nutmeg and mace in the West Indies and is only surpassed internationally by Indonesia.

2. Botany

2.1 Systematics - Taxonomy and Phylogeny

The nutmeg plant, Myristica fragrans Houtt., is a member of the small primitive family Myristicaceae, taxonomically placed between the Annonaceae and Lauraceae

(Joseph,1980). The family Myristicaceae contains only 18 genera and about 300 species. Myristica is the largest genus for which has been listed 72 species, spreading from India and Sri Lanka eastwards through Malaysia to North-Eastern Australia, Taiwan and the Pacific, including the Solomon Islands, Fiji and Samoa (Purseglove et al., 1981). Since 40 known species of Myristica -of which 34 endemics- are found in New Guinea (Indonesia) representing an area of concentration, this location has been designated the centre of origin and distribution of this genus.

Most of the species in the genus Myristica are tropical evergreen trees found growing mainly in the lowland tropical rain forest, but some mountain species also occur.

The principal synonyms of M.fragrans are M.officinalis L.f., M. moschata Thunb., M. aromatica Swartz, and M. ambeinensis Gandoger.

The cultivated species is mainly the Banda - nutmeg, Myristica fragrans Houtt., but in Indonesia there is some cultivation of the Papuan nutmeg, Myristica argentea Warb. In Grenada however, cultivation is of Banda nutmeg exclusively.

According to Groome (1970) another species found growing locally of the Myristicaceae family is Virola surinamensis (Rol). Warb. and with the common names wild nutmeg or wild cedar.

2.2 Cytology

Genetically the somatic number of chromosomes in Myristica Fragrans is 2n=42, and the basic chromosome number for the genus is suggested to be 7 (Purseglove, et al., 1981).

2.3 The Plant and its Parts

Structure

The nutmeg is a medium-sized, spreading or conical, thickly-leaved evergreen tree that attains the average height of 4 - 10 m but sometimes may reach heights of 20 m and over. Trees grown from seedlings are usually singlestemmed and taller than those from vegetative propagation which are usually multi-stemmed. For single-stemmed trees over 30 years the average trunk circumference is 150 180 cm. However, some trees on Plaisance estate, St.John's which were pointed out to be over 80 years, (and possibly over 100) averaged 200 - 250 cm in girth. This is duplicated on other estate or plots where very old trees still exist (photograph 3).

Photo. 1. Field of nutmeg interplanted with banana
Photo. 2. Young and mature fruits of nutmeg

Photo. 3. Stem over 200cm in girth of aged, bearing nutmeg tree
Photo. 4. Exposed shallow roots of toppled nutmeg tree

Trees are usually uniformly covered with leaves but older trees may show some protruding naked branches and in heavy wind swept areas there may be lateral tree deformation.

The tree is usually dioecious but sometimes there is the occurrence of male and female flowers on the same tree. Large, aged male trees are virtually nonexistent since these are systematically removed at an early age (4 - IS years) from nutmeg fields. All parts of the plant are aromatic. The structure and habit of the nutmeg tree has caused it to be used as a forest tree on some hillsides of Grenada and thus to a certain extent has prevented hillside erosion.

Roots

The root system is shallow but extensive, one tap root and a spreading mat of lateral feeder roots branching into rootless. This mat may extend beyond the spread of the stem branches and has measured as much as 3.5 - 5 m from the stem base. As the plant grows and ages the tap root proportionally shortens. Nutmeg rootless investigated showed the significant absence of root hairs. Absorption is predominantly

at the rootlet tips.

Because of the shallow root system the tree could be easily uprooted or blown down by high winds (photograph 4). Thus hurricane Janet in Grenada in 1955 resulted in the destruction of about 80% of the nutmeg tree population (Muller et al., 1980).

Usually on the lower trunk of older trees may be seen lateral brown protuberances extending to as much as 0.5m. These are aerial adventitious roots. They emerge as a single lateral cylindrical root about 1.5 - 2 cm in circumference and the tip portion being softer in texture and a lighter brown than the tougher, woody, fibrous portion adjacent to the stem. The single branch, which may be sometimes hallow, extends, becoming a multi-branched root cluster, stouter (46cm) tougher and darker brown in colour, and orientated earthwards. They are observed on both male and female trees, trees propagated from seedlings or marcots and also on the plants of the later introduced MALAYAN plants. They are also seen on young as well as on old plants and on trees growing at high altitude, hillsides, or in valleys (photographs 5a and 5b).

Their function or usefulness to the plant is not clear. However, it is speculated that they may be a physiological and anatomical response to certain changes in the environment.

Stem

Depending on the origin of the plant from seedling or vegetative propagation, the stem may be a single woody trunk or multi-stemmed respectively (photograph 6). However, on some occasions it has been observed that marcots take on the profile of seedling plants. The single stemmed trunk is cylindrical sometimes furrowed and showing very slight decrease in girth from ground level to 1/3 up the plant. In older mature plants the bark is rough, a dark brownish grey and showing longitudinal fissures. Depending on the growing locale it may be spotted with greenish silvery lichens or may be host to some saprophytic climbing plants. The trunk bark of younger plants is smooth and a light-brownish grey. The average stem girth from various locations in Grenada show the ranges, seedlings (24 cm), in field 3 year old (8-12 cm), 5 years (18-25 cm), 8 years (35 - 45 cm) and 12 years (60-80 cm).

Branches

Profuse fairly spreading lateral branches arise from the main stem with a slight whorled, spiral arrangement. In some cases these emerge fairly low down on the trunk forming an acute angle to the main stem so that they tend to be turned upwards (photograph 7). Smaller branches then fan out laterally from these main branches. This arrangement affords maximum leaf display for photosynthesis. There may also be seen

vertically oriented branches emerging from main branches particularly evident in unpruned trees. Extending from the trunk outwards the branches reduce in girth to slender twigs and the bark changes from a dark, grayishbrown, rough and fissured, to lighter grayish brown twigs terminating in smooth green tips. On wounding both stem and branches reddish sap is produced.

Leaves

These are simple, persistent, alternate, glabrous and exstipulate, elliptic or oblong lanceolate with an apex acute or slightly acuminate and an acute base tapering into a short petiole slightly flattened adaxially and about 1-1.5 cm long. The lamina, 5-15 cm long and 2-7 cm broad, is coriaceous, medium to dark green above and shining, light silvery-green or subglaucous beneath (photograph 8).

In young leaves the upper surface is yellowish green. From the prominent lower mid-rib emerge 8-12 pairs of pinnatelateral veins slightly tapering to the apex and forming a network reticulation visible on the lower surface but not so from above. When crushed the leaves emit a characteristic nutmeg like aroma.

Photo. 5a. Aerial adventitious roots
Photo. 5b. Aerial adventitious roots

Photo. 6. Multi-stemmed trees from marcotting

Photo. 7. Arrangement of branches on single-stemmed nutmeg tree

Flowers

The typical tree is unisexual- dioecious with male and female flowers on different trees. On occasion both male and female flowers may occur on the same tree and even rare hermorphrodite flowers may be encountered. From field observations in Grenada it has been reported that male trees progressively change to female with aging and bear fruits (personal communication, Reynold Benjamin). Locally, flowers and fruits occur on the trees all the year round, the months of April and May and November and December are the periods when flowers are in greatest abundance. It must be noted that there are slight variations in different parts of the island.

There is still no satisfactory method for distinguishing the sex of a young plant until it has declared, flowered. The calorimetric test published by Phadnis and Choudhari (1971) using 0.1g leaf sample and ammonium molybdate reagent was investigated locally by the author who found no significant difference in test for young leaves from male and female plants. Lawrence (1978) reported on a number of other tried methods.

Fig. 1. Myristica fragrans
(a) male flower with part of calyx removed (x 4.5)
(b) female flower with part of calyx removed (x 3)

Flowers tend to occur on the outermost branches. The inflorescences with male and female flowers are structurally similar and are axillary and glabrous, bearing flowers in umbellate cymes with the male 1-10 usually outnumbering the female 1-3. It is quite common to find in the male inflorescence flowers in various stages of development. The pedicels, 1-1.5 cm long, are pale green with a minute caducous bracteole at the base of the flower.

The flowers are creamish-yellow in appearance, waxy and fleshy, fragrant and may measure up to 1 cm in length. Petals are absent so the dominant calyx is bellshaped, nectiferous at the base, with 3-reflexed triangular lobes. The female flowers, up to I cm long, exhibit a puberulous, superior, sessile, one celled ovary about 7 mm long and topped by a very short, white two lipped stigma. The male flowers consist of an androecium I cm long, glabrous, with a 2 mm stalk, with 8-12 stamens, with anthers adnate to a central column and attached to each other by their sides (Fig.1) and (photographs 9a,b,10a,b).

Fruit

The fruit is a fleshy, pendulous, one seeded drupe suspended by a greenishbrown fruit stalk about 1.5 cm long. It is broadly pyriform, yellow, smooth, 6-9 cm long and almost as broad. Some fruits are obviously bell shaped, longer than there are broad, and in rare cases observed locally some rees may bear joined double fruits.

For the regular fruit there is a circumferential longitudinal groove which divides the fruit in halves including the persistent remains of the stigma and terminating at the fruit stalk. When ripe, the thick succulent, yellow (on the outside) pod 1-1.5 cm thick, dehisces into two halves along the length of the groove revealing a thin epicarp and two faces of whitish mesocarp which shows immediate browning on exposure to air and bright red net-like aril partially surrounding a dark brown to black shiny testa (endocarp) with a prominent seed base scar. The aril is attached to the base of the seed and its network is impressed as grooves on the testa (photographs 11 a,b and c).

Fig. 2. Myristica fragrans kernel
(a) whole
(b) longitudinal section
(c) cross section

Photo. 8. Leaves showing upper and lower surfaces
Photo. 9a. Male inflorescences with flowers at various stages of maturity

Photo. 9b. Male inflorescences - also note young yellowish green leaves
Photo. 10a. Female inflorescences - few persistent flowers
Photo. 10b. Flowers. Female (upper) and male (lower)
Photo. 11a. Flower to mature fruit.
Photo. 11b. Flower to mature fruit. Longitudinal section through some stages of fruit.
Photo. 11c. Fruit, seed, aril, kernel and shell.

Within the hard, stout, brittle testa is a broadly ovoid, light brown kernel about 2-3.5 cm long and 1.5 - 2.0 cm broad. The outside of the kernel has broken longitudinal wrinkles and a prominent creamish brown base scar with a smaller dark brown "scar" at the other end. Internally, there is a convoluted pattern of dark brown perisperm, a light coloured endosperm and a small embryo (Fig. 2 and photograph 19d). All parts of the fruit are aromatic.

3. Pollination and fruit setting

The issue of pollination and fruit set in the nutmeg is still not fully clarified. Many local farmers believe that male trees should be in the fields as a source of pollen, while others are of the opinion that these are not obligatory. It has also been suggested locally by many that the local wasp "mibone" plays a role in pollination. The flowers are known to be fragrant and to produce nectar.

The literature presents various views. According to Cruickshank (1973), Deinum wrote that pollination was effected by a moth, Peryl concluded that M. fragrans may be able to produce seeds without pollination, while Flach is of the view that cross pollination is obligatory and the team of Duncan and Ferguson suggested a cross-pollination mechanism.

Cruickshank (1973) reported on a bagging experiment carried out on a marcotted flowering tree in Grenada. Although the results seem to suggest that the stimulation of pollination may be necessary for fruit set, the issue of pollination still requires further investigation.

Contents - **Previous** - **Next**

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Section II - Nutmeg cultivation

Contents - **Previous** - **Next**

1. Propagation

1. Propagation

Two methods have been predominantly used for propagating nutmeg plants in Grenada. There were the seedling method and the vegetative method.

1.1 The Seedling Method

- From Volunteer Plants

Traditionally, small farmers have used "volunteer plants" as seedlings for planting. These seedlings have their origin from fallen seeds that have germinated and grown in

and around the parent plant. The farmers may use seedlings at two stages of development, the young undeclared plants, plants which have not flowered, or the more mature declared plants, which have flowered and thus the sex could be identified. In the latter instance plants that produced female flowers and then fruits will be selected.

- From Government Agricultural Stations

Nutmegs are usually propagated by fresh seeds with their testa still attached. Seeds where the kernel rattle in the shell and old seeds will not germinate. In shaded nurseries the selected seeds are sown 2.5 - 5 cm deep and 30 cm apart in boxes or well prepared moistened nursery beds. Germination takes about one month or more. After two to three months the plants average about 15 cm in height. They are then transferred to baskets or plastic perforated bags. At six months they may be transplanted to the field but usually they are left for up to twelve or twenty four months (photograph 12a).

As regards seed germination it has been observed that there was a rapid decline in percentage germination if seeds are planted later than three days after harvest. Removal or scarring of the shell facilitated germination. Also there was some connection between monthly yield by the parent tree and the level of germination.

Higher germination percentages were evident for seeds taken from plants with high monthly yields.

1.2 The Vegetative Method

Following the ravishes of hurricane lanes in 1955, which completely or partially destroyed most of the nutmeg tree population nation wide, investigation into the vegetative propagation of nutmeg was initiated. Two methods emerged and were established in commercial approach-grafting and marcotting. (Nicols and Cruickshank, 1964; Cruickshank, 1973). The later, however, became the preferred method in Grenada. In approach-grafting for seedlings, with the diameter of a pencil (0.5 cm) or lime larger around the collar region and about 45 cm high as grown or transplanted into perforated plastic bags, the potting mixture is moistened and the potted plant enclosed in a larger unperforated plastic bag. This seedling (stock) is approached - grafted to a twig of similar thickness "scion" on a female tree. The procedure was the removal of very thin sections of bark about 28 cm long, on both stock and scion. These were securely tied and bound together with clear budding tape. After about four months the grafts unite and the scion is severed below the union. The plants are repotted in a rich potting mixture (soil, compost, river sand, in the proportion 5:3:2) and placed in closed concrete hardening bins and hardened off by gradually lifting the bin covers until they are fully exposed. Plants are then stored under 70% shade before

field planting.

In marcotting or air-layering, vigorous healthy branches, 1.2-1.5 cm in diameter are chosen from selected female trees. The branch is split in the middle longitudinally for 5 cm at a distance of 90 cm from the terminal growth. A bamboo or wooden splint is placed on the back of the split and tied firmly at both ends with plastic tape, string not used to avoid rotting. A portion of the split branch 6-12 mm long is then removed on the lower side of the split with secateurs. The cut end is lifted and a splint of hard wood is inserted to keep the split open. The section is then dusted with rooting stimulant such as seradix L15. Moist peat moss, sawdust or coconut coir dust are applied around the split, extending above and below the incision for 5 and 10 cm respectively. Such a medium was kept in place by polyethene sheeting, tied around the branch and secured with plastic tape. Roots occur after 4 - 18 months. Once rooting is adequate the plant is severed from the tree and potted, after removal of polyethene sheeting. The plants are kept in closed concrete bins covered with clear plastic and watered thrice daily for a period of 6 8 weeks. The plants are then hardened off by lifting the bin covers until they are fully exposed. This is done for a period of two to three months. The plants are then stored under 70% shade for a further 8-10 weeks before planting in the field.

Despite the perceived negative attitude of some farmers to marcots (Aegis, 1975) it is

significant to note, that with the increase efficiency of rooting in marcots form 30 to 43%, such planting material eventually contributed significantly in the recovery of nutmeg tree population after Janet. By 1973 the Ministry of Agriculture had reported that about 37 thousand marcots were used to cover an area of about 1000 acres (400 ha).

Further, it must be noted that in 1959 and later, nutmeg seeds were imported from Malaysia and seedlings from this stock have been planted in many nutmeg fields. Although on an average the nut and mace of the Malayan fruits tend to be smaller than the regular nutmeg plants grown in Grenada, very interestingly in the Malayan population there is a very small proportion of unisexual male trees when propagated from seedlings. There is a small Malayan tree grove at the Government Agricultural Station in Mirabeau.

2. Planting

The common practice before planting young nutmeg trees was to preestablish shade, windbreak and soil conservation programmes. Banana was commonly selected as the crop of choice to provide temporary shade for young nutmeg plants. However, nutmegs have also been interplanted with cocoa (photograph 12b).

For marcotted material, the holes are dug just about 60 cm and the soil mixed well with rotted or well composted manure. The young plants are set in the holes and staked with wooden stakes. Plants are spaced on an average 9 m apart. Shade plants are usually gradually reduced from after the second year and by the seventh year may be completely removed. Marcots may begin flowering as early as three to four years.

When the planting material is undeclared seedlings the common practice is to plant three seedlings at a planting site, 60 cm apart in the form of an equilateral triangle. Shade crops are used as in the case of marcots. The shade requirements for transplants are:

Up to 2 years	50% overhead shade plus ground shade
2 to 4 years	40% overhead shade plus ground shade
4 to 5 years	30% overhead shade plus ground shade
6 years	15% overhead shade plus ground shade

7 years and older	No shade

Shade should be reduced gradually so as to minimize shock. At the first flowering usually at 4-7 years, the male plants are destroyed leaving one female per planting site. Some farmers may leave a few male trees in the field to encourage cross-pollination. This practice is declining. However, no studies have been reported that show the correlation between presence of male flowering trees and the quantity and quality of fruits and seeds that are produced by the female plant.

For the establishment of larger declared seedlings, the practice is to prepare the planting hole well in advance. The hole size will be proportional to the size of plant and the soil mass that will be removed with it for transplanting.

Once the plant is selected, the soil around the plant is cut in stages, one side at a time to a level just below the root and a distance from the stem of about 60-90 cm. The staged cutting afford the roots time to heal. Usually, on a wet day the young plant is removed with as much soil as possible, carefully transferred to the prepared hole covered with manured mixed soil and securely staked. Such plants will just continue flowering and fruiting.

Usually trees come into full bearing at about 20-25 years and continue at that level for

another 30 40 years. It has been reported that trees above this age start registering progressive productivity drops.

The earlier trees from marcotting and the introduced Malayan plants are just now over 30 years so that their productivity levels at older ages is not yet known. Trees from Marcots always tend to show more lateral spread than increase in height, a condition that necessitates pruning.

The population of nutmeg trees in Grenada is estimated at about 400 450 thousand made up of a mixture of trees from the original Banda stock, the more recently introduced Malayan extract with plants propagated from seedlings, marcotting or approach grafting. Although the majority of trees may be under 40 years, there are some 100 years and over that are still productive.

3. Pruning

Pruning is recognized and considered a good practice to maintain or increase flower, fruit and seed production. This envolves the removal of water shoots and upright branches within the plant, dead wood, cutting back of lower branches and the defining of an individual plant so that it does not become shaded by neighboring plants in a canopy.

Photo. 12a. Two year old nutmeg seedlings at Ashenden Propagation Station
Photo. 12b. Six year old nutmeg seedling interplanted with banana and cocoa
Photo. 13. Nutmeg leaves with leaf shot

It has been observed that farmers tend to prune more completely and regularly when the financial returns for nutmeg and mace are high. At other times pruning is neglected and certain farmers advance the argument, more branches more fruits.

Young nutmeg trees (volunteers) were often cut and used for making swizzle sticks. This was so because of the morphology of the stem and branches; whorled branches and a periodic stem growth.

4. Fertilizing

It is not the practice to fertilize nutmeg plants in Grenada. However, since nutmeg plants are usually intercropped with banana or cocoa it is said that nutmeg trees inherit the spill off.

There exists no tested trial information on fertilizer use in nutmegs. Some trials were planned, and even attempted but the results were inconclusive (Cruickshank,1973). Again most farmers attitude is that the trees are doing well in production without

fertilizer, so applications may only exhaust the trees.

According to Buckmire (1992) the suggested regime of fertilizer application is as shown below, this is rarely followed as most farmers avoid the use of fertilizer.

Year 1	0.5 kg sulphate of ammonia or calcium ammonium nitrate at the beginning of the rainy season.
Years 2, 3 and 4	1 kg 16:16:16(NPK) in two applications the first early in the rainy season and the second Oct./Nov.
Years 5 and 6	2 kg 16:16: 15 as above.
Year 7 and older	2.25 kg 16:16:16 as above and then increasing by0.5 kg per annum to a maximum of 4.5 kg.

5. Irrigation

The nutmeg plant requires well drained soil with good water retention properties but no water logging. Most nutmegs are grown on hillsides and in most nutmeg growing areas the soils are either Capitol or Belmont Clay loam. Both of these soils are moderate to well drained yet affording good water retention. Irrigation is therefore

not practiced in nutmeg fields. However, the fields are usually contoured with drains to afford good run off. If newly planted trees encountered a period of dry spell then such plants are watered periodically.

6. Weed control

This is dependent on the age of plant and its final configuration as related to other plants. For young plants efforts are made to prevent their strangulation by vines, thus cleaning may be as much as four times yearly.

As the plant ages the canopy thickens and this assist in weed control underneath. In isolated trees the weeds underneath are controlled to facilitate harvesting of fruits and seeds. Weed control is usually by slashing.

7. Pest, diseases and their control

According to Cruickshank (1973), the nutmeg tree has no serious insect pest in Grenada and just a few diseases of varying significance. Farmers have not reported about pest and diseases in their nutmeg plants. However, the listed problems are:

1. Mace scab	- a white callous like outgrowth mace suggested to be calcium

	oxalate by Pierre (1970).
2. Greasy spot or	- dark brown leaf greasy lesions on leaf shot the leaf blade associated with the saprophytic fungi like Nigrospora, Botryodiplodia and Collectotrichum (photograph 13).
3. Thread Blight	- caused by the fungus (Corticium spp.)
4. Wilt(nutmeg decline)	- Most high profile disease in nutmeg locally.

7.1 Nutmeg wilt

This is the most important disease in nutmeg in Grenada. Although this disease is associated with several fungi, Rosellinia sp. has featured most in the association but its causal role in the disease has not been demonstrated (Muller et al., 1990). Thus the cause of nutmeg wilt is still unknown. It is generally assumed that the agent is a pathogen but there may well be other predisposing factors. The symptom associated with nutmeg wilt is the gradual wilting of a plant and dieback of the roots. This is accompanied by excessive leaf and fruit drop with eventual tree death. There is no definite method for the control of this disease (photographs 14a, b, c, and d).

8. Cultivation practice

Nutmeg is seen as a crop just to be harvested and traditionally and continuing into the present, not many farmers carry out any routine good cultivation practices. The plants are given some care when young but are basically neglected on maturity.

The attention given is often directly related to the price being received by farmers for their nutmeg products.

Photo. 14a. Nutmeg wilt - early symptoms of slow decline
Photo. 14b. Nutmeg wilt - sudden wilt
Photo. 14c. Nutmeg wilt - advance symptoms, total die back
Photo. 14d. Nutmeg wilt - dead standing tree trunks

Contents - Previous - Next

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Section III - Post harvest handling

Contents - Previous - Next

1. Harvesting

The ripe or mature fruit splits open at the groove while still on the tree and the seed surrounded by the red aril falls to the ground after two days. Harvesting involves collecting the seed or seed with aril from the ground. Sometimes fruits with partially opened pods may be picked from the tree using a long pole "rodding". The latter method affords a better quality aril, and pods that could be used in agroprocessing. This procedure may also lead to excessive dropping of flowers and young fruits.

The frequency with which nutmegs are harvested is dependent on the location of the field, the availability of labour, the level of production, and the price offered to farmers. Most farmers collect the fallen seeds daily during the two peak production periods - January to March and June to August, and every two to three days during the rest of the year. Once the field is readily accessible nutmegs are harvested with a

higher frequency. In the cases where farmers are part-time, fields located in distant areas, or when the farm is comprised of several plots of land at different locations, then the collection rate may be as low as once per week. Observations show that a larger proportion of women are usually involved in harvesting.

2. Post harvest handling operations in the field - preparation for marketing to GCNA

In the case where rodding was used, open fruits may fall to the ground intact. The seed with the surrounding red aril is removed from the pod which oftentimes is discarded. The collected seeds, and seeds with mace are transported from the field by workers, on their heads or assisted by animal (donkey) or vehicle to the boucan or farmer's residence where the mace is carefully separated from the seed, graded and allowed to dry directly in the sun. Care is taken so that drying mace does not get wet. Wetting will encourage mould growth and such mace will have to be discarded.

The seeds are usually delivered green (fresh), within 24 hours after harvesting to the receiving station. However, depending on the distance from the receiving station and the quantities of nutmegs involved, deliveries may be made once weekly or at a much later period if the nutmegs are being delivered in the dry state. This is usually the situation with large estates with adequate drying facilities. Mace is always delivered to

receiving station dried.

3. Yield patterns

A tree from seedling usually "declares" in five to eight years. Trees propagated vegetatively by marcots may fruit as early as in three years. Yields increase gradually and at 25 - 30 years the plant may have peaked to its maximum production level. It continues to bear up to 100 years and over (personal communication - Reynold Benjamin). However, after age 70 -15 yields tend to decline.

In Grenada it is not easy to ascertain the yield per acre since most fields are heavily intercropped and there are variations in the number of trees planted per acre. It is estimated that the tree population may be in the vicinity of 400-450 thousand. There are only a few locations with pure stance nutmeg trees in moderate acreage.

There is no serious documentation to support tree yields. However, a good producing tree may give on an average a yearly production in the vicinity of 30-50 lbs (14-22 kg) green nutmegs (15-25 lbs - 7-11 kg of shelled, dry nutmegs). The proportion of dried shelled nutmeg to dried mace is approximately 20:3. During drying nutmeg loses about 25% of its weight. Yields vary greatly between trees, and between plantations or field locations.

4. Handling operations in the receiving and processing station

Fig. 3 outlines the main stages in the processing of nutmeg and mace.

Following the postharvest operations in the field and at home, the farmer delivers the nutmeg products to a GCNA (Grenada Cooperative Nutmeg Association) receiving station. There are 16 GCNA receiving stations well distributed around the island as shown in Fig. 4. Additionally, there are 3 processing stations at Grenville, Gouyave and Victoria. These 3 also carry out receiving stations activities.

FIG. 3. Stages in the processing of nutmeg and mace at receiving and processing stations

Fig. 4 Location of GCNA Received and Processing Stations

The GCNA purchases both nutmeg and mace products from the farmers. Three types of nutmeg are purchased:.

1. **Fresh or green nutmegs (undried and still in their shells)**
2. **Dry nutmegs (dried but still in shells)**
3. **Grinders (dried and shelled)**

Mace is bought dried, either as No. I or No.2, the No. 1 being of better quality, dark red, unbroken, dried and unblemished.

Although the term nutmeg is used very loosely to cover fruit, seed or kernel, the spice nutmeg for commerce is solely the dried seed kernel, and the spice mace is the dried and cured aril.

Since for the GCNA annual production is expressed in terms of commercial nutmeg, then the purchased green nutmegs need to be dried and shelled and the dry nutmegs need to be shelled. A conversion factor is therefore used at arriving at a commercial production figure, this is calculated by multiplying the weights of green nutmegs by 0.5, dry by 0.6667 and grinders by 0.98.

Thus processing by GCNA involves the production of the spices of commerce Nutmeg and Mace.

In summary, this includes all aspects of quality control, sorting, curing, grading, packing, shipping and marketing.

The processing of nutmeg and mace will be outlined separately.

4.1 Nutmeg

Sorting

On delivery at the receiving station the green nutmegs are emptied into sorting trays. These trays are wooden and four sided, 5 ft (152 cm) long by 2 112 ft (76 cm) wide and 9 inches (23 cm) deep with a slightly perforated wooden base and angled gently towards an emptying hole at one end, and standing on legs about 3 ft (91 cm) off the floor.

The inspector or inspectors spread out the seeds with a wooden pallet, and hand select out broken seeds, slightly discolored seeds, water-logged seeds, empty or rotten seeds, mouldy seeds, very light seeds and germinating seeds. These are usually returned to the delivering farmer (photographs 15 a,b)

The remaining seeds are scooped into a receiving bag. When all of that particular farmer's consignment is sorted, the bag or bags are weighed and the weight entered into the farmer's assigned book and recorded at the station. The farmer is given a bill and is paid at what ever is the then rate per pound. At the end of the day all collected nutmegs are reweighed and checked against the weight paid out for, and this weight is entered in the "reweighed book" at the station.

Drying

Bags with about 100 lb (45.5 kg) of seeds are hand sewn at the top and carted to the hoisting area for lifting to the drying floors. Smaller quantities may be handled at the smaller receiving stations. Also at the peak periods or times of very high deliveries, nutmegs are transported from the receiving stations to the processing stations daily.

For drying, the fresh seeds are spread on large trays to a depth of 2-3 inches (5-7.5 cm). The seeds are turned daily with wooden rakes or spades. Seeds are shade dried in the buildings at a temperature of 85-90F (29-32C) for six to eight weeks. Drying trays have wooden bottoms and wooden sides with periodic trap doors. Trays vary in size according to the station, but are usually arranged in tiers with about 4-8 trays above each other separated by 1 ft (or 30.5 cm) between trays. Trays are arranged so that there is always easy passage between stacks of trays to afford ready access to all seeds. However, for the higher trays workers have to climb up to gain access.

The energy for drying comes from the sun on the large galvanized roof of the station and the warm circulating air. Seeds closer to the roof tend to dry much faster. Drying completion is indicated by simple inspection. Usually after 6 weeks a sample of seeds is taken, these are cracked, cut with a knife and inspected for moisture. The characteristics looked for are rattling in shells, difficulty or ease to cut, degree of

oiliness and intensity of the aromatic smell.

After the drying period and satisfaction with the inspection, the seeds are heaped in the trays close to a trap door which on raising allows easy scooping into bags. Each bag carrying 150 lbs (68 kg). Bags are sewn and dried nutmeg in shells are stored until an order is received (photographs 16 a, b, c, d)

Photo. 15a. Delivery and sorting at Grenville Receiving/Processing Station
Photo. 15b. Sorting at Grenville Receiving/Processing Station
Photo. 16a. Hoisting of hagged fresh nutmegs to upper drying floors
Photo. 16b. Stirring drying nutmeg
Photo. 16c. Collecting dried nutmeg
Photo. 16d. Storage of dried nutmeg
Photo. 17. Worker loading cracking machine
Photo. 18. Sorting nutmegs that have passed through the cracking machine

The preceding is the limit of processing that can take place at a receiving station.

Cracking and Sorting

The other stages of the processing are carried out on the receipt of an order.

Most cracking is now done by cracking machine. The loaders empty bags of 90 lbs (50 kg) into the feeder (photograph 17), the machine cracks the seed coat and these are channeled to the right and left of the machine from where they are spread manually with a wooden spade so that the entire length of the sorting area could be supplied. As many as (90 - 100 bags) could be cracked in a day (Grenville Processing Station)

Sorting is done manually. Workers seated at stools have cracked seeds fed to their work stations, via their individual trap doors which they operate.

Sorting and shelling generates four products which are compartmentalized by the sorter. The products are:

1. Whole kernels
2. Cracked kernels or pieces
3. Escapes - seeds with unbroken testa
4. Shells

Sorting is done by women and there may be as many as thirty two working simultaneously. The expected output is 170 lbs (77 kg) per worker per day. However, most workers average 350-450 lbs (159-204 kg) daily (photograph 18)

Grading and Flotation

The first grading of shelled kernels is effected by flotation in water using the principle of varying density. The procedure is to place 20-30 lbs (914 kg) kernels in a wicker basket. The wicker basket is then immersed in water held in a concrete trough to a level just about I inch (2.54 cm) below its rim. The kernels are then agitated by hand. Once stirring stops, some kernels are seen to remain at the bottom of the basket while others float. All "floats" are removed as defectives along with any kernels seen to be moving or in suspension (doubtfuls). Workers (female) try to effect this in as short a time as possible. The kernels remaining at the bottom are classified as Sounds. The detectives (floats) are grouped, basketed and spread on trays to dry for 48-72 furs. The sounds are spread usually on the upper trays to dry for 24 furs. Both grades are turned twice daily while drying.

When detectives "floaters" are inspected by cutting in half, they usually show incomplete kernels (large airspaces, or whitish cork tissue with reduced brownish endosperm) (photograph 19 d).

Sorting Sounds

The dried sounds are gathered and bagged, 150 lbs (68 kg) and then manually sorted

(photograph 20). This sorting is usually performed by female workers and each worker is expected to sort a minimum of 21/2, 100 lbs (45.5 kg) bag per day. The sorter spreads the kernels in a wooden tray held in her lap and proceeds to separate three products, which are placed in three separate bags which surround her. The products are genuine sounds "heavies", defective heavies and shells. Constituting these detectives are kernels with pin holes, cracks or breaks (pieces). The sounds could be classified as sound "unassorted" (Suns).

Metal Sieve Grading

Using large metal sieves with uniform regular circular perforations and sieves of different sizes, workers pour on hand-graded sounds and gently massage them. The appropriate kernels fall through the appropriate holes into collecting bags (photograph 21).

The grades collected are:

110 S	(110 to the lbs)	(242 to the kg)
80 S	(80 to the lbs)	(176 to the kg)
60/65 S	(60/65 to the	(132/143 to the kg)

lbs)

Inspection of Grades

As an additional quality control measure, before putting into new labelled bags, sound graded nutmegs are further inspected visually. The worker will spread the nutmegs of a particular grade in a small wooden tray and hand remove any broken pieces, cracked nutmegs or shrivelled and discoloured. Such a worker is expected to handle a minimum of 2 (150 lbs 68 kg) daily (photograph 22).

A typically labelled bag is shown in photograph 23.

Fumigation

The final processing step for nutmegs before export is fumigation of the bagged nutmegs with methyl bromide in a special fumigation chamber over night.

Defectives

Sometimes the defectives "heavies" are sorted and exported separately.

The "floats" after drying are heaped, then packed in bags and stored until an order for that class of product is received. For export they are then packed in labelled bags and fumigated.

4.2 Mace

The mace delivered at the receiving station though preclassified by the farmer as No. I or No. 2 is still carefully inspected on delivery and classified as No. 1 or No. 2. The mace is weighed and the weight entered in the farmer's book and the book at the receiving station and the farmer is paid.

The mace is then bagged according to grades and at the end of the day the separated grades are reweighed, the weights noted, and the mace placed in separate wooden curing bins (6' long by 4' wide and 4' deep) - 1.83 x 1.22 x 1.22 m. Each bin may be

loaded to the level of 1600 - 1700 lbs (727 - 772 kg) and left for 3 months. Into each bin is suspended a bottle with carbon disulphide (CS2) to keep away any insect pest (photographs 24 a,b,c).

After the three months curing period the mace is now ready for export. The cured graded mace is bagged accordingly and fumigated (photographs 25a, 25b and 26)

Photo. 24a. Mace. Uncured No. 1
Photo. 24b. Mace. Uncured No. 2 in wooden bin
Photo. 24c. Mace. Wooden curing bins
Photo. 25a. Mace. Cured No. 1
Photo. 25b. Mace. Cured No. 2
Photo. 26. Mace. Bag labelled for export

Contents - Previous - Next

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Section IV - Classes of obtainable products

Contents - Previous - Next

The classes of obtainable products are listed in Table 1.

TABLE 1. CLASSES OF OBTAINABLE PRODUCTS (NUTMEG & MACE)

MACE	No 1 - WHOLE PALE MACE	
	No 2 - BROKEN MACE (Mixed colour)	
	No 3 - BROKEN PIECES AND PICKINGS	
NUTMEGS	1 - SOUND UNASSORTED (SUNS)	
	2 - SOUND SELECTED	- 60/65 S
		- 80 S
		- 110 S
	3 - DEFECTIVES	- No 1(*)
		- No 2 GRINDERS
		(DISTILLATION GRADE)
	4 - DRY IN SHELLS	

	5 - SHINY BLACK SEEDS(SELECT BUYERS)
ESSENTIAL OIL	NUTMEG OIL (DISTILLED IN BELGIUM). Local plant currently under construction, scheduled to commence production in early 1994. The plants expected to utilize approximately 300 tons of defective nutmegs for the annual production of 30 tons of essential oil.
INDUSTRY BY-PRODUCTS	1 - SHELLS - Used for MULCH, WALKS, FUEL.
	2 - PODS - AGRO-PROCESSING

*** It is proposed that by 1994 GCNA will no longer be exporting the class call Defectives but instead class called Grenada Unassorted Nutmegs (GUNS), which will contain no pieces but whole floaters and Suns in the ratio 60:40.**

Contents - Previous - Next

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Section V - Packaging and distribution

Contents - Previous - Next

Table 2 shows the type of packaging and the quantities used for the export of mace and nutmeg from Grenada by the GCNA. It is planned to introduce the constant 137 lbs (62.5 kg) for shipping shelled nutmegs in jute bags.

TABLE 2. PACKAGING AND DISTRIBUTION

MACE	No. 1 - PLASTIC BAGS - 56 lbs (25.5 kg)
	No. 2 - PLASTIC BAGS - 80/88 lbs. (36.5/40 kg)
	No. 3 - JUTE BAGS - 1101/2/112 lbs (50/51 kg)
FORMERLY:	No. 1 - IN PLY BOXES - 160 lbs.(72.7 kg)
	No. 2 - IN PLY BOXES - 200 lbs (91.0 kg)
	No. 3 - IN JUTE BAGS - 112 lbs (51 kg)
NUTMEGS	SOUND UNASSORTED - JUTE BAGS - 140 lbs.(63.5 kg)
	SOUND SELECTED - JUTE BAGS - 140 lbs.(63.5 kg)
	DEFECTIVES - JUTE BAGS - 140 lbs.(63.5 kg)

	DRY IN SHELL - JUTE BAGS - 110 1/4 lbs or 112 lbs (50 Or 51 kg)
ESSENTIAL OIL	The nutmeg oil distilled in Belgium is packaged in 45 gal. drums and is sold to Switzerland by the company Puressence.

For shipping to foreign ports containers (20 ft) are utilized and for nutmegs average capacities are 12 tons (240 bags) for dry nutmegs in shells, 16 tons (240 bags) for unassorted and 14 tons (224 bags) for detectives.

As a new nutmeg oil distillation plant for GCNA is about to come into operation in early 1994 nearly twenty years after initial experiments were undertaken in Grenada, it must be noted that nutmeg oil was produced commercially in Grenada from the year 1940 at Douglaston estate, St. John's. Using a copper still, crushed detectives nutmeg were distilled and the yield was about 7.5%. For the period 1945 - 1956 annual shipments of about 1-5 tons were made to the U.K. It was hurricane lanes in 1955 that gave a telling blow to this emerging nutmeg oil industry.

The Grenada Cooperative Nutmeg Association - (GCNA)

The Grenada Co-operative Nutmeg Association (GCNA) commenced operations on October 1, 1947. This was the culmination of a meeting of growers held on March 17, 1942 from which a spice working committee was set up and whose workings led to the

passage of Legislation number 8 of 1946, the Nutmeg Industry Ordinance, which provided for the formation of the Grenada Co-operative Nutmeg Association.

The main objectives for the establishment of GCNA as the sole exporter of nutmegs from Grenada were:

- Securing of stabler producer prices by ending competition between local exporters; and

- providing producers with more of the profits of the industry by the exclusion of middle men and increasing demand for the nutmeg product by setting standards of quality.

The statutes of the GCNA states that the management of the business of the Association shall be by a Board called the Nutmeg Board. The said Board shall consist of not less than seven nor more than nine numbers. Six members of the Association are elected by ballot to be members of the Board in the month of May in each year at the annual general meeting for the ensuing nutmeg year (July 1st to June 30 the following year)

The elected members (delegates themselves) are chosen by delegates who were

elected at area meetings by members of the Association resident in each area. One delegate is appointed for every hundred members in that area. So that even small farmers are adequately represented. Upon registration a producer automatically becomes a member of GCNA. The current membership (1993) stands at about 8,000 but from the inception date the membership will be in the region of 15,000.

At least one and a maximum of three members are nominated to the Board by Government. The current Board (1993-1994) has nine directors.

The Board elects a chairman. The running GCNA is compartmentalized so that at head officer there are the departments of accounts, shipping and administration. The Chief Executive Officer is the Manager who is supported by the Secretary (Treasurer), the processing stations are controlled by Managers while the receiving stations are managed by Clerk. Two Field Inspectors provide the link between headquarters and the stations, as well as being responsible for maintenance of standards, quality and pest control. The Association employs about six hundred (600) to eight hundred (800) workers. The GCNA is responsible for regulating and controlling the exports of nutmegs and mace and to promote, protect and develop the nutmeg industry. A major activity therefore, is the purchasing of products from the farmers and this is a continuous exercise (all year).

For produce delivered to the receiving stations, the grower is paid an "advance rate" which is fixed fortnightly by the Board. At the end of the year's operation the grower is paid balance (bonus or surplus) representing the difference between the advance rate and the net realized prices of nutmeg and mace obtained in the year's trading by GCNA.

GCNA exports procedure for its spice products to the export market of the world is by forward contracts on an indent basis with a commission paid on the f.o.b value of sales. Whereas is Europe sales are made through brokers, in the U.S.A and Canada sole agents or representatives are utilized. In the smaller markets a mixture of both practices obtains.

The world demand for nutmegs, like other spices is inelastic with current estimates being in the vicinity of 10,000 tons annually of which Grenada supplies about 25% and Indonesia 70%. In 1987 GCNA signed a marketing agreement with the Indonesia's Nutmeg Association (ASPIN), this resulted in increased market prices for both nutmeg and mace for the two years following the agreement, but by 1989 the Indonesian broke the agreement which resulted in slumped prices as shown in values for exported nutmegs and mace in Table 9 and fig. 8

Breaking with tradition the GCNA in February of 1993 appointed J.H.B International

S.A of Belgium as the Sole Marketing Agent in Europe.

The activities of the GCNA are effectively charted by details in the tables and figures that follow.

Tables 3 and 4 and fig. 5 and 6 compare the production figures and export in pounds for nutmeg and mace for the period 1951 -1993.

TABLE 3. PRODUCTION OF NUTMEG AND MACE 1951 -1993

Year	Nutmeg (Equiv. lbs)	Mace (cured) (Equiv. lbs)
1951	5257605	705471
1952	5212756	752556
1953	4362846	613427
1954	5185446	686107
1955	5087642	704979
1956	1398933	168517

1957	1529247	224881
1958	677587	102762
1959	1190885	197325
1960	1168243	188243
1961	1205575	194429
1962	1504961	225018
1963	1546316	227720
1964	1667555	252479
1965	1816347	289397
1966	2278846	334486
1967	2541973	394264
1968	2502452	351361
1969	3018134	417148
1970	3563142	490606
1971	4115129	552277
1972	3282608	412777

1973	4245321	567259
1974	3153096	399194
1975	5339720	769173
1976	4103968	534660
1977	6719400	923479
1978	4454405	568139
1979	5128778	625467
1980	5486294	647672
1981	5300836	532129
1982	6157754	502905
1983	4795991	330934
1984	5036065	433532
1985	4679472	365947
1986	5148799	474360
1987	6018669	680027

1988	6074555	741344
1989	6026773	634636
1990	6086904	606614
1991	5873244	528894
1992	5811907	367060
1993	5258177	229621

Source: Grenada Co-operative Nutmeg Association (GCNA)

Fig. 5 Production of Nutmeg and Mace (lbs) 1951 - 1993

Fig. 6 Nutmeg and Mace Exported from Grenada 1951 - 1993 (lbs.)

Continue

Contents - **Previous** - **Next**

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Continued

Contents - Previous - Next

TABLE 4. NUTMEG AND MACE EXPORTED FROM GRENADA. 1938-1993 lbs

YEAR	NUTMEG	MACE	YEAR	NUTMEG	MACE
1938	4062128	568736	1966	3103520	431088
1939	4291728	770112	1967	1158077	209634
1940	4693472	615216	1968	3099066	333437
1941	4218512	727104	1969	3155196	401665
1942	4202576	761488	1970	3228292	373868
1943	5085696	749392	1971	3735801	521033
1944	5762064	757456	1972	4347798	733520
1945	5244288	758016	1973	2888128	629397
1946	5514544	951440	1974	3015366	452546
1947	3964576	659904	1975	2644720	221960

1948	2016448	452368	1976	6528719	763750
1949	5019509	705936	1977	5819417	740790
1950	6938069	729680	1978	6145449	549500
1951	2593024	582288	1979	4533499	576350
1952	4995984	771232	1980	3970239	665915
1953	5073040	820512	1981	3572700	491640
1954	4814096	686112	1982	4210664	695345
1955	5284384	775152	1983	5915916	903225
1956	5576144	525056	1984	4962016	308555
1957	1999984	116256	1985	6602944	447135
1958	523152	175728	1986	7531145	485998
1959	1290576	129584	1987	5284494	495160
1960	1427552	140560	1988	4995398	573205
1961	1140384	136080	1989	3961834	423959
1962	1062320	158592	1990	4256330	387445

1963	2182768	363776	1991	3410805	575825
1964	594496	247856	1992	3533689	451160
1965	2593472	321328	1993	4172849	413740

Source: G.C.N.A.

The significant drop in production and export in the years just after the catastrophe of hurricane lanes (1955) is evident. So too is the steady climb back to pre-Janet production levels synonymous with trees attaining peak production levels after twenty five years.

Tables 5 - 8 summarize the last eleven years of production and trading by the GCNA. Whereas Table 5 compares the nutmeg exported by grades, Table 6 compares total nutmeg exported as against the grades of mace and total mace exported, the latter is graphically illustrated in fig. 7. Table 7 looks at classes of nutmeg delivered by growers for the period 1983-1993, while Table 8 shows nutmeg and mace produced for that period.

TABLE 5. NUTMEG EXPORTED FROM GRENADA BY GRADE, 1983-1993 (in tons)

YEAR	SELECTED	UNASSORTED	DEFECTIVES
1983	142	1359	1140
1984	95	1073	1047
1985	167	1514	1267
1986	123	1763	1476
1987	128	1196	1011
1988	119	1368	663
1989	137	1204	428
1990	137	1422	340
1991	111	665	763
1992	106	471	920
1993	127	771	954

Source: G.C.N.A.

TABLE 6. EXPORT QUANTITIES OF NUTMEG AND MACE 1983 -1993 (in tons)

YEAR	NUTMEG	MACE No 1	MACE No 2 & PICKINGS	TOTAL MACE
1983	2641	102	301	403
1984	2215	57	81	138
1985	2948	102	98	200
1986	3362	106	111	217
1987	2334	96	125	221
1988	2230	101	155	256
1989	1769	81	81	162
1990	1900	78	95	173
1991	1522	148	109	257
1992	1577	116	85	201
1993	1863	71	113	184

Source: G.C.N.A

Fig. 7 Quantities of Nutmeg and Mace Exported (in tons) 1983 - 1993

TABLE 7. Nutmeg and mace delivered by class to GCNA by growers. 1983 - 1993 (in tons)

YEAR	NUTMEG			MACE	
Ending June 30	Green	Dry	Shelled Grinders	No.1	No.2
1983	3926	235	22	78	79
1984	4119	244	26	113	93
1985	3804	241	27	80	93
1986	4224	220	36	103	123
1987	5010	226	32	146	177
1988	5156	162	26	153	199
1989	5152	130	28	114	187
1990	5125	130	23	97	191
1991	5061	72	20	89	147
1992	5072	70	11	76	97

1993	4611	52	7	46	63

Source: G.C.N.A.

TABLE 8. GROSS PRODUCTION FIGURES FOR PROCESSED NUTMEG AND CURED MACE, 1983 - 1993 (in tons)

YEAR	NUTMEG	MACE	% MACE TO NUTMEG
1983	2141	148	6.90
1984	2248	194	8.61
1985	2089	163	7.82
1986	2299	212	9.21
1987	2687	304	11.30
1988	2712	331	12.20
1989	2691	283	10.53
1990	2717	271	9.97
1991	2622	236	9.00

1992	2595	163	6.32
1993	2347	102	4.30

Source: G.C.N.A

Table 9 and fig. 8 dramatically demonstrates the fluctuations in export prices for the period 1983 - 1993 with a dramatic peak in 1988 where for the export of just about five (5) million pounds of nutmeg and just about half (1/2) million pounds of mace the return was about forty two (42) million dollars EC, approximately 15.5 million dollars U.S.

Deliveries of nutmeg and mace for the receiving and processing stations highlight that certain stations continuously register high yearly activity. Thus if the processing stations are not considered then the receiving stations at Birchgrove, Hermitage and La Digue reflect continuously high yearly production levels consistent with the nutmeg producing areas they are servicing. (Personal communication, Alfred Logie) and GCNA annual reports 1980 - 1993.

For the period 1973 - 1993, the GCNA has exported nutmeg to as many as fifty two, and mace to a many as twenty five different countries. In both instances only a few countries account for the major percentage purchased. As of 1974 Holland established

itself as the major purchaser of Grenada's nutmeg and from the same year Germany emerged and also continues to be the major purchaser of Grenada's mace.

TABLE 9. QUANTITIES OF NUTMEG AND MACE SOLD, THE AVERAGE MARKET PRICES AND THE GROSS VALUE OF EXPORTS FOR YEARS 1983 - 1993 (E.C. DOLLARS)

YEAR ended30th June	SALES NUTMEGS	AVG.MKT. PRICE (Lbs)	SALES MACE (per Lb)	AVG.MKT. PRICE (Lbs)	TOTAL VALUE (per Lb)
1983	5,915,916	$1.60	903,225	$2.05	11,736,305
1984	4,962,016	$1.41	308,555	$4.49	8,478,401
1985	6,602,944	$1.35	447,135	$7.93	12,467,528
1986	7,531,145	$2.23	485,998	$8.12	20,765,586
1987	5,284,494	$6.18	495,160	$11.37	38,626,440
1988	4,995,398	$6.96	$73,205	$13.51	42,554,991
1989	3,961,834	$6.94	423,959	$14.70	33,740,654
1990	4,256,330	$5.76	387,445	$12.73	29,464,798

1991	3,410,805	$3.11	575,825	$4.58	13,255,439
1992	3,533,689	$2.18	451,160	$4.58	9,776,451
1993	4,172,849	$1.38	413,740	$3.37	7,183,607

Source: GCNA (1 US$ = 2.71 E.C $)

Fig. 8 Quantities of nutmeg and mace exported (lbs.) 1983 - 1993 and total value (EC$)

Contents - Previous - Next

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Section VI - Composition and constituents of nutmeg and mace

Contents - Previous - Next

The principal constituents of the spices nutmeg and mace are steam volatile oil (essential oil), fixed (fatty) oil, proteins, cellulose, pentosans, starch, resin and mineral elements.

Percentages of constituents differ between the spices and this is a consequence of geographical origin, quality and duration of storage and even growing locations. Thus the fixed oil content of sound nutmegs varies from 25 40% while that of mace is 20-30%. Worm eaten nutmegs have a higher content of volatile oils than sound nutmegs since in the former the starches and fixed oil have been selectively eaten by insects.

1. Fixed oil

There are two general methods by which the fixed oil of nutmeg is extracted. In one method, sound, ground nutmeg is subjected to intense hydraulic pressure and heat (heated plates in the presence of steam) while, in the other the ground nutmeg is extracted by refluxing with a solvent like diethyl ether. Both processes will result in the crude fixed oil containing significant quantities of essential oil in the average of 10-12%. Prior steam distillation will lead to a significant reduction of essential oil in the prepared fixed oil.

The extracted or expressed fixed oil is a semi-solid aromatic (smell and taste of nutmeg), orange coloured fat, known as concrete, expressed oil or nutmeg butter which melts at 4S-51C and has a density of 0-990 -0.995. It is completely soluble in hot alcohol, but sparingly so in cold. However, it is freely soluble in ether and chloroform.

The major component of the fixed oil is Trimyristin and Power and Salways (1908) gave the following components and their relative abundance for the analysis of a fixed oil for which there was not prior distillation to remove essential oil from the nutmeg raw material:

Trimyristin	73.09%
Essential oil	12.5%
Oleic acid (as glyceride)	3.0%
Linolenic acid "	0.5%
Unsaponifiable constituents	8.5%
Resinous material	2.0%
Formic, acetate and cerotic acid	(traces)

If essential oil is previously extracted, then the relative abundance of trimyristin in the fixed oil will increase.

2. Essential oil

The essential oil is usually obtained by steam distillation of dried kernels. It is a colourless or yellow liquid with the characteristic odour and taste of nutmeg. The oil is insoluble in water but soluble in alcohol and has a density at 25C of 0.859 - 0.924, refractive index at 20C, 1.470 - 1.488 and optical rotation at 20C of + 10 - +45. This oil keeps best in the cool in tightly closed containers protected from light.

Extensive analyses have been carried out on the volatile oil of nutmeg and these have provided the major classes of compounds constituting the oil as: monoterpene hydrocarbons, 61 - 88%; oxygenated monoterpenes (simple and others) ie. monoterpene alcohols, monoterpene esters; aromatic ethers; sesquiterpenes, aromatic monoterpenes, alkenes, organic acids and some miscellaneous.

Table 10 lists and updates most of the compounds identified in the volatile oils of nutmeg and mace with the appropriate references. A-and b-pinene and sabinene constitutes the major components of the monoterpene hydrocarbon fraction where as myristicin is the major constituent of the aromatic-ether fraction.

It must be noted that the composition of distilled volatile oil is not identical to the natural oil in the kernel or oleoresin extract. Thus about 30 55% of the kernel consist of oil and 45 - 60% of solid matter. The essential or volatile oil accounts for 5 - 15% of the nutmeg kernel while the fixed oil accounts for 24 40% of the nutmeg kernel. Fixed oils are virtually absent from mace and volatile oil accounts for 4 - 17% of the composition of mace. There is always in the distilled volatile oil a higher percentage of monoterpenes, especially a and b-pinene and sabinene since there is incomplete distillation of the oxygenated components which possess higher boiling points.

On organoleptic grounds it has been stated that West Indian oils are weaker in odour and less spicy than East Indian oils. From studying and comparing East and West Indian oil, Baldry et al. (1976) have suggested that the composition differences are more a reflection of the proportion and the constituting compounds more so than absence of constituents. The major quantitative differences were lower proportions of a-pinene, safrole and myristicin and higher proportions of sabinene in the West Indian oils.

In the literature reference is often made to West Indian nutmeg and mace oils with no clear distinction being made as to the actual West Indian source. Dann et al. (1977) reported on a detailed study of the comparison of essential oil yields and compositions of nutmeg and mace collected on Grenada from individual trees growing

on the island. Investigations were carried out on dried kernels and cured mace. Analysis revealed that quality of the constituents in the oil of nutmeg and mace from individual trees was very similar. However, there was variation in the quantity of components of the two oils. Thus where as the nutmeg oils showed 8593 % monoterpene hydrocarbons, 6.6 - 12% oxygenated monoterpenes and sesquiterpenes and 3.5% aromatic ethers, the values for the mace oils were 75-94, 4.7 - 17.6 and 05.9% respectively.

The monoterpene hydrocarbons and oxygenated monoterpenes compositions of both oils from the same tree were very similar in quantity and quality except for lower concentration of a-pinene in the nutmeg oil. Elemicin was the major component of the aromatic-ether fraction in both the nutmeg and mace oils with contributions form smaller quantities of safrole and myristicin. The proportion of aromatic-ethers was always higher in the mace than in the nutmeg oil. Dann e, al. (1977) also reported that taste panels were able to detect differences in the organoleptic properties of mace and nutmeg oils from the same tree thus suggesting that aromatic ether may play a key role in the organoleptic character for essential oils of nutmeg and mace. This points to the fact that it may be very important to have characteristics for comparison of the oils from Nutmeg and Mace of the introduced Malayan plants.

TABLE 10. CONSTITUENTS IDENTIFIED IN NUTMEG AND MACE ESSENTIAL OILS

	NUTMEG	MACE
MONOTERPENE HYDROCARBON		
CAMPHENE	2,5,6,8,9,11-14,17, 18,19,22,24,27	15,18,20
CAR - 3 - ENE	8,14,22,26	-
LIMONENE	1,4,5,8,9,11 -14, 17,18,22,24,26,	20
LIMONENE (DL)	11, 19,22	-
LIMONENE (+)	8	-
MYRCENE	8,13,14,17,18,22,27	18
PHELLANDRENE, α	8,13,14,17,18,22,27	15,18
PHELLANDRENE, β	8,14,22	15,22
PINENE, α	1,6,8,9,11-14,17,18, 22,24,27	15,18,20
PINENE, β	4,6,8,9,11-14,17,21, 22,24,26,27	15,18,20

SABINENE	7,8,13,14,17,18,22, 27	15,18,20
TERPINENE, α	7,8,12,14,17,18,22, 27	18
TERPINENE, γ	17,18,21,22,27	18
TERPINOLENE	8,9,12-14,17,18, 22,26,27	15,18,20
THUJENE, α	8,14,22	-
OXYGENATED MONOTERPENE (SIMPLE)		
CAMPHOR	9	-
CINEOLE, 1 - 8	17 18 22 27	18
OXYGENATED MONOTERPENES (OTHERS)		
MONOTERPENE ALCOHOLS		
BORNEOL	5,22	-
BORNEOL (+)	19	-
CITRONELLOL	13,14,22	-
CYMEN- 8-OL, para	22	-
FENCHOL, α	22	-

GERANIOL	5,9,13,14,19,22,26,	15,20
LINALOOL	5,9,11-14,17,18,22,24, 26,27	18,20
LINALOOL (+)	19	-
MENTH -2-EN-1-4-DIOL Para: Trans	22	-
MENTH -2-EN- 1 -OL, Para:Cis	17,18,22,27	18
MENTH-2-EN- 1 -OL, Para: Trans	22	-
NEROL	22	-
PIPERITOL, Cis	17,18,22,27	18
PIPERITOL, Trans	22	-
SABINENE HYDRATE,CIS	14,17,18,22	18
SABINENE HYDRATE, TRANS	14,17,18,22,27	18
TERPINEN -4-OL	4,5,9,12-14,17,18,21,22, 24,25,26,27	15,18, 20

TERPINEOL, α	5,9,12-14,17,18,19,22-26, 27	15,18, 20
TERPINEOL, β	13,14	
MONOTERPENE ESTERS		
BORNEOL ACETATE	11,14,22	-
CITRONELLOL ACETATE	22	-
GERANIOL ACETATE	12,14,17,18,22	18
LINALOOL ACETATE	11,14,22,27	-
NEROL ACETATE	22	-
TERPINEN -4 -OL	17,18,22,27	18
ACETATE		
TERPINEOL, α ACETATE	22	-
AROMATIC MONOTERPENES		
BENZENE, PARA, METHYL-ISO- PROPENYL	-	20
CYMENE, Para	22.26.4.8.9.12-14.17.18.27	20

SESQUITERPENES		
BERGAMOTENE, α	22	-
BISABOLENE	22	-
CADINENE, delta	22	-
CARYPHYLLENE	22	-
CARYOPHYLLENE, β	6, 13,14	15,20
COPAENE	17,18	18
COPAENE, α	22	-
CUBEBENE, α	22	-
FARNESENE, α	22	-
GERMACRENE, D	22	-
HUMULENE	22	-
HUMULENE, α	22	-
AROMATIC ETHERS		

ELEMICIN	10,12,14,17,18,21-26,27	12,15,18, 20
ELEMICIN IS0:Cis & Trans	10,12-14,18,22,26,27	18
EUGENOL	5,6,9,12,14,17,18,19, 22-26,27	15,18,20
EUGENOL METHYL	10,12-14,17,18,21,	15,18,20
ETHER	22,26,27	
EUGENOL, 5- METHOXY	22	-
EUGENOL, IS0	19,22,24,25,26,27	20
EUGENOL, IS0 :Cis	22	-
EUGENOL, IS0, Trans	22	-
EUGENOL, IS0, NETHYL ETHER, Trans	22	-
MYRISTICIN	3,5,6,10-14,16-18,19, 21-27	2,12,15, 16,18,20
SAFROLE	5,6,9,11 - 14,1 1,18,19, 21-27	12,15, 18, 20
ALKENES		

DEC-4-EN-1-OL,3- METHYL	22	-
DEC -4-EN-1-OL-3- METHYL ACETATE	22	-
MISCELLANEOUS:		
TRIMYRISTIN	17,21	-
STYRENE, A	22	-
YANILLIN	22	-
ORGANIC ACIDS		
ACETIC	19	-
FORMIC	19	-
HEPTADECANOIC	13	-
LAURIC	13	-
MYRISTIC	5,12,14,17,19	-
OCTANOIC	19	-
OLEIC	13	-
PALMITIC	13	-

PENTADECANOIC	13	-
STEARIC	13	-
TRIDECANOIC	13	-

REFERENCES FOR CONSTITUENTS IDENTIFIED IN TABLE 10

1. Wallach (1885,1889)
2. Semmler (1890,1891)
3. Thomas (1903)
4. Schimmel & Co. (1910)
5. Power and Salway (1907)
6. Lee et al. (1961)
7. Jaureguiberry and Wolf (1962)
8. Ikeda et al (1962)
9. Bejnarowicz and kirch (1963)
10. Shulgin et al. (1963, 1964)
11. Itty and Nigam (1966)
12. Shulgin et al (1967)
13. Sammy and Nawar (1968)
14. Sandford and Heinz (1971)

15. Forrest and Heacock (1972)
16. Salzer (1975a)
17. Baldry et al. (1976)
18. Dann et al. (l 917)
19. Power & Salway (1908)
20. Forrest et al. (1972)
21. Guo and Yu (1985)
22. Schenk and Lamparsky (1981)
23. Janssens et al. (1990)
24. Rasheed et al. (1984)
25. Rasheed (1985)
26. Carr (1973)
27. Sarath - Kumara et al. (1985)

Contents - ◀Previous - Next▶

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Section VII - Utilization of products

Contents - Previous - Next

The large quantity and variety of aromatic compounds in the kernel and aril of the nutmeg fruit, compounds essential in the defense mechanism of the plant, have led to the historic and continued use of nutmeg and mace as spices. Thus they are widely used for their flavouring characteristics in the Food industry. Products of nutmeg and mace in the form of oleoresins, butter and essential oil also find application in the cosmetic and pharmaceutical industries.

Table 11 lists the product form used and the most important uses of the various forms of nutmeg.

Table 12 lists the product form used and the most important uses of the various forms of mace.

In Grenada both nutmeg and mace are utilized as spices especially in baking products, dairy products and alcoholic beverages. In the distinctive tasting Grenadian rum punch, nutmeg is obligatory and local nutmeg ice cream is unmistakedly tasty. Mace is particularly used for seasoning sea foods. Ground nutmeg mixed with "soft candle" or petroleum jelly is warmed and use as a balm. Similarly the oil diluted is used to massage sore muscles and aching joints. A highly underutilized by-product of the

nutmeg industry is the ripe open pods of the fruit. Locally the pods are utilized and processed into jams, jellies, syrups, preserved in syrup, "cheese" and candied pods. The cracked shells are utilized as fuel, for spreading on walks or the floor of nurseries or green houses and as mulch in the field. In the far east it has been mentioned that the pods are cooked as a sweet meat; sliced, salted and cooked in rice dishes. The residue left after the extraction of fixed oil, is mixed with chopped pods, wrapped with a layer of earth and then covered up with banana leaves and on this mixture the edible mushroom Soletus moschocarganus is cultivated.

Almost worldwide man has been using nutmeg and mace for a range of ethnomedical reasons. Weil (1965) concluded that the seeds and arils of M. fragrans have powerful narcotic properties. Green (1959), Smith (1902) and Alexander (1887) have all written on poisoning to humans who ingested a reasonable quantity of nutmeg. Table 13 lists a range of ethomedical uses from various countries.

TABLE 11. NUTMEG UTILIZATION

Product Form used:	WHOLE
	GROUND
	OLEORESINS

	BUTTER
	OIL (essential)
Whole, Ground:	Domestic culinary use
Ground:	Industrial use for flavouring
	Foods
	Meat products, sausages, frank furlers, boloyna, soups, prepared sauces, ketchup.
	Dairy products: egg nog, ice cream, milk pudding
	Alcoholic Beverages: Rum punch
	Toddy
	Baking Products: Cakes, cookies or sulfide rich foods, cabbage etc.
Oleoresins:	Extracted with non-polar solvent (Flavouring processed Foods)
	Extracted with polar solvent "Absolute of Nutmeg" - alcoholic extract used in old fashion oriental perfumes
Butter:	Pharmaceutical purposes: ointments, shampoos, hand lotion,

	soaps, plasters, candles, fatty acid derivatives
Oil (essential):	Cosmetic industry: perfumes, male fragrances, after-shave lotions
	Food and Drink Industry- Meats, syrup, candies,
	Liqueur, coco-cola.
	Pharmaceutical Industry - vicks rub, cough syrups, breathing tissues, herbal balms, dental creams.
	Most importers distill their own essential oil for the cosmetics industry.

TABLE 12. MACE UTILIZATION

Product Form used:	WHOLE
	GROUND (keeps better than ground nutmeg because of negligible fixed oil)
	OLEORESINS
	OIL (Essential)
Whole and Ground:	Domestic culinary use

Ground:	Industrial culinary use as flavouring: sweet foods, cakes, doughnuts, fruit pies
	Dairy products: egg nog, milk pudding.
	Cigarettes
	Chewed to mask foul breath
Oil (Essential):	Special extract used in perfumes, scented soaps, denture and chewing gum.
Oleoresins:	Flavouring processed foods and baking products.

TABLE 13. ETHNOMEDICAL INFORMATION ON Myristica fragrans

APHRODISIAC	Mace	Trinidad	Simpson (1962)
ANTIPYRETIC	Mace	Thailand	Mokkhasmit et al., (1971)
ABORTIFACIENT	Entire plant	India	Saha et al., (1961)
GASTROINTESTINAL AROMATIC	Seed	Mexico	Bye (1986)

~~STIMULANT~~	~~Seed~~	~~U.S.A~~	~~Novitch&Schweiker(1982)~~
APHRODISIAC NARCOTIC	Seed	Africa	Garbari (1913)
PROPERTIES	Seed	India	Power & Salway (1908)
CARMINATIVE	Seed	India	Arseculeratne (1985)
DIGESTIVE	Seed	India	Power & Salway (1908)
EXPECTORANT	Seed	India	Arseculeratne (1985)

Contents - Previous - Next

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Section VIII - Process and recipes

Contents - Previous - Next

Riddle a riddle a ree
"The lady in a boat with a red and black petticoat"

Ans: Nutmeg & Mace

"He's the colour of nutmeg and the heat of ginger" Shakespeare, "Henry V" Act 111, Sc 7,1.20

I am Grenada's Nutmeg

Nutmeg:	A spice for all season
	Use me once there is a reason

****

Sprinkle me on: (freshly ground)	Cream cheese dips, cheese spread, Egg spread.
Add me to:	Cream soups, macaroni & cheese, macaroni, rice, hot cooked cereal, cold cereal, clam chowder
Sprinkle me on:	Apple sauce, mango sauce, grapefruit, melon, canned peaches, pears, pineapple, citrus, fruit and cottage cheese, stewed fruits.

****

1. Nutmeg pods in syrup

The process involves softening of the pods (ripe) by boiling in water. The soft pods are cooled and peeled using stainless steel knives, then processed in sugar syrup of desired strength and bottled. The bottled pods are further sterilized in boiling water and cooled.

The product could be chilled and served as a dessert or can be used in ice cream manufacture or as pie filling.

A sweet and sour pickle also could be produced by the same procedure. In case of pickle the sugar syrup used should contain enough spiced vinegar to produce the desired sweet and sour taste.

FLOW CHART

2. Nutmeg syrup

Nutmeg pods, Sugar, Water

1. Wash and peel pods, remove membrane from hollow
2. Drop in salted water and leave for 3-5 mins. thoroughly
3. Cover with water and bring to boil, after 5 mins discard water.
4. Cover again with water, boil until pods are tender and flavour extracted. strain. collect liquid.
5. Add a cup of sugar to each cup of liquid
Boil until it reaches a syrup
Cool and bottle

Use as desired. Makes a good base for drinks.

3. Rum punch

1 measure lime or lemon juice
2 measure nutmeg or grenadine syrup
3 measures rum
4 measure water

"One sour, two sweet, three strong, four weak"

Mix all ingredients. Serve with a cherry, a twist of lime, grated nutmeg and ice cubes.

****

Sprinkle me on: Rum, rum punch, trish coffee, cream liquor, hot or cold chocolate, brandy (hot), apple cider (hot), egg nog, orange juice with egg.

****

4. Nutmeg ice cream

2 cups milk	1 table spoon corn starch
3/4 cup sugar	1/4 teaspoon salt
2 eggs	grated nutmeg
1/2 teaspoon vanilla	

Combine cornstarch, sugar, salt and milk, coon over low heat, add beaten eggs and continue cooking while stirring constantly, until cooked and smooth. Chill and add cream, vanilla and nutmeg to flavor, freeze.

****

Add me to:	Pancake & waffle batter, biscuit mix, brownie mix, cake mix, pancake mix, pancake syrup, honey, jelly and jams, whipped cream, peanut butter
Sprinkle me on:	Milk shakes, ice creams, puddings and pones, mix cheese cake, imitation whipped cream, yogurt, batter for toast, ice cream topping.

****

5. Banana nutmeg nog

3 eggs	3 cups orange juice
1 tsp vanilla	3 ozs rum (optional)
3 bananas	

Blend all ingredients. Top with I tsp. freshly ground nutmeg. Serve chilled.

****

Sprinkle me on:	Grilled cheese sandwich, poached or scrambled eggs, fondue,

souffle, cottage cheese french toast hatter.

****

6. French toast with cinnamon and mace

4 Slices bread	2 eggs slightly beaten
1/2 cup milk	1/4 tsp. salt
2-3 tbsp. sugar	3 tsp. cinnamon
1 tsp. mace	

1. Combine eggs, salt and milk
2. Dip bread slices in egg mixture and brown on both sides on a well buttered griddle or frying pan.
3. Serve hot, sprinkled with mace, sugar and cinnamon.

7. Granola

6 cups old-fashioned oats	3/4 cup wheat germ
1 cup bran flakes	1/2 cup sesame seeds

1 cup sunflower seeds-salted	1/2 cup shredded coconut
1/2 cup oil	1/3 cup brown sugar
1/2 cup honey	2 tsp. freshly ground Grenada Nutmeg
1/2 tsp. Vanilla	1 dash mace
1 cup raisins	

Combine all ingredients. Spread on cookie sheet. Bake at 300 to 40 minutes. Pull sheet out and turn often. Watch carefully. Bake till fully browned. Cool and store in airtight container.

8. Nutmeg mousse

2 table spoon grated nutmeg	2 table spoon sugar
2 table spoon gelatin	1 cup whipped cream
2 cup milk	3 eggs
1/2 cup water	

Scald I cup milk with nutmeg and sugar. Soak gelatin with the water, add to hot milk, put in freezer until it starts to set. Can be decorated with a swirl of whipped cream and freshly grated nutmeg. Serve six.

9. Nutmeg cake

2 cups brown sugar	2 cups sifted flour
1/2 cup shortening	1 egg
1 tsp. nutmeg	1 cup sour milk
1 tsp. baking powder	1/2 cup chopped nuts

1. Put flour and sugar in a bowl, add shortening and mix with the fingers till crumbs form.
2. Place 112 the crumbs in a greased square pan
3. Add baking powder to sour milk and mix
4. Add the egg, nutmeg and sour milk mixture to the remaining crumbs and pour this batter into the crumbs, then sprinkle with nuts.
5. Bake in a preheated moderate oven for 35-40 mins.

Note: To make I cup sour milk add 2 tbsp. vinegar or 1 tbsp. lime juice to ordinary milk

10. Carrot pudding with rum sauce

1/2 cups butter	3/4 cup raisins
1/2 cup grated raw carrots	1 egg
1/2 teaspoon cinnamon	3/4 cup rum and water
1/2 teaspoon baking powder	1/2 teaspoon salt
1/2 teaspoon nutmeg	

Cream butter; add beaten egg, raisins, and grated carrots. Mix well. Sift dry ingredients and add to first mixture. Stir in rum last. Mix well and pour into greased, floured pan. Bake in moderate oven for 40 minutes. Serve with rum sauce.

Note: In place of raisins fruit preserves could be use, preserved nutmeg pod, condicion, carambola, banana, paw paw (papaya).

****

Add me to:	Sausages, stuffing mix, meat balls, meat loaf, mince meat, pudding stuffing, conch sauce.

****

****

Sprinkle me on:	Fried fish, ham, fish sticks, roast chicken, turkey, barbecue.
Add me to:	Mashed potatoes, bananas, bread fruit or yam, frozen spinach, any cooked vegetables, carrot, cabbage, cauliflower, squash, pumpkin, beans, peas, celery, creamed corn, potato salad, breadfruit and banana salad.

****

11. Seafood marinade: (other than fish)

2 tbsp lemon juice	2 tsp garlic minced
1 tsp mace	1 tsp cinnamon
1 tsp salt	1/8 tsp pepper
1/4 sp celery	1/4 tsp mustard
Marinate for 1 hour or more.	

Contents - Previous - Next

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw

Section IX - Conclusions

Contents - Previous - Next

The nutmeg industry is and will continue to be a very important industry in the economy of Grenada since it impinges on the lives of thousands of Grenadians.

The onus is on the GCNA to continue insisting and demanding from farmers high

quality materials and maintaining strict quality control in all stages of processing and introducing new technologies to advance cost effectiveness and efficiency in the entire spectrum of processing and operations.

The onus is further on the GCNA, the Government of Grenada, the relevant personnel and institutions (i.e Grenada Produce Chemist Laboratory) to strengthen research and development in all aspects of the industry especially so in product diversification. This may be pursued locally or through regional or international co-operation.

The concept of a Nutmeg Institute or a Centre of Excellence for nutmeg studies based in Grenada should not be a dream but a targeted goal.

POTENTIAL PRODUCTS

The author is suggesting that the nutmeg plant and fruit be viewed as a total product.

Thus consideration could be given to fixed oil (nutmeg butter), essential oil and oleoresin from nutmeg kernel and essential oil and oleoresin from mace. There is the potential for varying the product range by using different types of raw materials. One may not stop at the primary but secondary and tertiary products are envisaged. Thus, the fixed oil may be cleaned up to yield its riches component trimyristin which may be

chemically transformed into other products i.e myristic acid etc.

The spent residue from the extraction of fixed oil, essential oil and oleoresin must be seen as a by-product with the potential to be used as fuel or possible potting materials or growing medium. Additionally, powders and pieces generated for the processing operations should be viewed as potential byproducts for other end products. Similarly, the cracked shells must be harvested for their potential to be transformed into fuel, brickets, carbon black or feed stock among others.

The ripe pods of the nutmeg fruit should be exploited to the fullest. There should be innovative and creative extension of the range of agro-products now prepared or manufactured from the pod. The emphasis to date has been on sweet products but there is room for low sweet, bland or salty products. Rotting pods are potential soil mix.

The two spices from the nutmeg tree, nutmeg and mace which have contributed to Grenada being called the "Isle of Spice", may yet to realize their fullest potential to spice and season the Grenadian economy and the lives of its people.

Contents - Previous - Next

References

Contents - Previous

Alexander, 1. (1887) 'Poisoning by nutmeg,' BRIT. MED. 1., 1887 1: 1085 -

Arseculeratne, S.N., Gunatilaka, A.A.L. and Panabokke, R.G. (1985), 'Studies on the medicinal plants of Sri Lanka, part 14: Toxicity of some traditional medicinal herbs,' J. Ethnopharmacol., 13 (3), 323 - 335.

Baldry, J., Dougan, J., Matthews, W.S., Nabney, J., Pickering, G.R. and Robinson, F.V. (1976) 'Composition and flavour of nutmeg oils,' Flavours, 7, 28 30.

Bejnarowicz, E. and Kirch, E. (1963) 'Gas chromatographic analysis of oil of nutmeg,' J. Pharm., Sci., 52, 989 - 993.

Buckmire, K.U. (1992) 'Nutmeg production in Grenada,' Technical Bulletin 20, Caribbean Agricultural Research and Development Institute, University of the West Indies, St. Augustine, Trinidad.

Bye Jr, R.A. (1986) 'Medicinal plants of the Sierra Madre: comparative study of Tarabumara and Mexican market plants,' Econ. Bot., 40 (1), 103 - 124.

Carr, C.J. (1973) 'Evaluation of the health aspects of nutmeg, mace and their essential oils as food ingredients,' US NTIS REP PB 266 - 878, 1 - 17.

Cruickshank, A.M. (1973) 'Some aspects of the Nutmeg Investigation Programme in Grenada, 'Proceedings of a Conference on Spices, 10 - 14 April 1972, Trop. Products Inst.

Dann, A.E., Matthews, W.S.A. and Robinson, F.V (1977) 'Studies on the yields and compositions of nutmeg and mace oils from Grenada', Proceedings of the Seventh International Congress of Esential Oils, held in October 1977 at Kyoto, Japan.

Forrest, J.E. and Heacock, R.A. (1972) 'Nutmeg and mace; the psychotropic Spices from Myristica Fragrans, ' Lloydia, 35,440-449.

Forrest, J.E. Heacock, R.A. and Forrest, T.P. (1972) 'Identification of the major components of the essential oils of mace,' J., Chromatogr., 69, 11 IS -

Garbari, F. (1973) 'Notes on popular African medicines in the herbarium at Florence,'

Webbia 28, 81--Green, JR, R.C. (1959) 'Nutmeg poisoning,' J. Amer. Med. Ass. 171, 1342

Guo, X. and Yu, B. (1985) 'Quality of nutmeg I. Separation and identification of the chemical constituents of nutmeg,' Yaowu Fenxi Zazhi, 55: 258 - 262

Groome, J.R. (1970) A Natural History of the Island of Grenada, W.I., Caribbean Printers Limited, Arima, Trinidad, W.I.

Ikeda, R.M., Stanley, W.L., Vannier, S.H. and Spitler, E.M. (1962) 'The monoterpene hydrocarbon composition of some essential Oils,' J. Food Sci., 27, 455 - 458.

Itty, M.I. and Nigam, S.S. (1966) 'Chemische untersuchung des aetherischen oeles von Myristica Fragrans,' Reichstoffe Aromen Koerpflegemittel, ' 10, 399 - 412

Janssens, J., Laekeman, G.M., Pieters, L.A.C., Totte, I., Herman, A.G. and Vlietinck, A.J. (1990), 'Nutmeg Oil: identification and quantitation of its most active constituents as initibitors of platelet aggregation,' J. Ethnopharmacol., 29 2: 179- 188

Jaureguiberry, J. and Wolff, R. (1962) 'Sur la presence de Sabinene dans l'essence de noix de muscade,' Bull. Soc. Chim. France, 1985 - 7

Joseph, J. (1980) 'The nutmeg: It's botany, agronomy, production, composition and

uses,' J. of Plantation Crops, 8 (2); 61 - 72

Lawrence, B.M. (1978) 'Major tropical spices - nutmeg and mace Myristica fragrans Houtt),' Essentials Oils 1976 - 1977, 51 - 103, Allured Publishing Corporation, Wheaton, Illinois, U.S.A,

Lee, G.D., Kaufmann, F.L., Harlan, J.W. and Niezabitowski, W. (1961) 'Gas Chromatography Int. Symp., 3, 475 - 484 (Chem. Abs., 58 - 4974b)

Mokkhasmit, M., Ngarmwathana, W., Sawasdimongkol, K. and Permphiphat, U. (1971) 'Pharmacological evaluation of Thai medicinal plants,' J. Med. Ass. Thailand, 54 (7), 490 - 504

Muller, G., Buckmire, K., Reid, R. and Martin, P.J. (1990) 'The Significance of Nutmeg Wilt and the Problem of Defective Nutmegs to the Grenada Nutmeg Industry,' Report of a Joint Mission by the Caribbean Agricultural Research and Development Institute and the British Development Division of the Caribbean.

Nicols, R. and Cruickshank, A.M. (1964) 'Vegetative propagation of nutmeg (Myristica Fragrans) in Grenada, West Indies, Trop. Agriculture, Trin., 41, 141 146

Novitch, M. and Schweiker, R.S. (1982), Orally administered menstrual drug products for over the counter human use, establishment of a Monograph. Fed. Reg. 47. 55076 - 55101

Phadnis, N.A. and Choudhari, K.G. (1971) 'Sex determination in the seedling stage of nutmeg (Myristica Fragrans, Houtt.),' Trop. Sci., 8,265 - 74

Pierre, R.E. (1970) 'Abnormal accumulation of calcium oxalate in the aril of nutmeg,' Proceedings of a Symposium on the Protection of Horticultural Crops in the Caribbean, U.W.I., St. Augustine, April 8 - 11, 1970, Trinidad.

Power, F.B. and Salway, A.H. (1908) 'Chemical examination and physiological action of nutmeg,' Amer. J. Pharm., 563

Power, F.B. and Salway A.H. (1907) 'The constituents of the essential oil of nutmeg,' J. Chem. Soc., 91, 2037 - 2058.

Power, F.B. and Salway, A.H. (1908) 'The constituents of the essential oil of nutmeg,' Proc. Chem. Soc., 23: 285 -

Purseglove, J.W., Green, C.L., Brown, D.G. and Robbins, S.R.J. (1981) 'Nutmeg and

Mace,' In Spices, Vol 1. 174 - 228 London, Longmans.

Rasheed, A. (1985) 'Quantitative determination of pharmacologically active constituents of Myristica Fragrans (Nutmeg) by gas liquid chromatography,' 1. Pharm. (LAHORE), 61/2, 41 - 50.

Rasheed, A., Laekeman, G.M., Vlietinck, A.J., Janssens, J., Hatfield, G., Totte, J. and Herman, A.G. (1984) 'Pharmacological influence of nutmeg and nutmeg constituents on rabbit platelet function,' Planta Med., 50, 3, 222 226.

Regis, V. (1975) 'An Economic Assessment of an Alternative Marketing Strategy for Grenada Nutmegs,,' Report to the Grenada Co-operative Nutmeg Association on Research into the Economics of Nutmeg Production, The University of the West Indies, St. Augustine, Trinidad.

Ridley, H.N. (1912) Spices, London: Macmillan.

Saha, J.C., Savini, E.C. and Kasinathan, S. (1961) 'Ecbolic properties of Indian medicinal plants, Part 1.,' Indian 1. Med. Res., 49, 130 - 151.

Salzer, U.J. (1975a) 'Analytical evaluation of seasoning extracts (Oleoresins) and

essential oils from seasonings,' Flavours, C, 515 - 517

Sammy, G.M. and Nawar, W.W. (1968) 'Identification of the major components of nutmeg oil by gas chromatography and mass spectrometry.' Chem. Ind., 1279 1280.

Sandford, K.J. and Heinz, D.E. (1971) 'Effects of storage on the volatile constituents of nutmeg,' Phytochem., 10, 1245 - 1250

Sahath - Kumara, S.J., Jansz, E.R. and Dharmadasa, H.M. (1985) 'Some physical and chemical characteristics of Sri Lankan nutmeg oil,' J. Sci. Food Agric., 36, 93100

Schenk, H.P. and Lamparsky, D. (1981) 'Analysis of nutmeg oil using chromatographic methods,' J. Chromatogr. 204: 391 - 395.

Schimmel and Co. (1910). 'Mucatnussoel,' BER. Schimmel, April, 80- 82

Semmler, F.W. (1890) 'Chemische untersuchungen uber muscatnussoel und muscat bluthenoel (macisoel),' Chem. Ber., 23, 1803 - 1810.

Semmler, F.W. (1891) 'Uber myristicin und seine Derivate,' Chem. Ber., 24, 3818 - 3823.

Shulgin, A.T. (1963) 'Composition of the myristicin fraction from oil of nutmeg,' Nature,

197, 379.

Schulgin, A.T. and Kerlinge, H.O. (1964) Isolation of methoxy eugenol and transisoelemicin from oil of nutmeg,' Naturwiss., 51, 360 - 361.

Shulgin, A.T., Sargent, T. and Naranjo, C. (1967) 'The chemistry and physcopharmacology of nutmeg,' in Ethnopharmacological Search for Physcoactive Drugs, US Public Health Service Publication No. 1645, 202

Simpson, G.E. (1962) 'Folk medicine in Trinidad,' J. Amer. Folklore, 75, 326 340

Smith, S.M. (1902), 'Nutmeg poisoning,' Lancet, 1902 1: 1798-

Thomas, H. (1903), 'UBER die constitution des myristicins,' Chem. Ber., 36, 3446 -3451.

Wallach, O. (1885) MACISOEL,' Annalen, 227, 288

Wallach, O. (1889) MACISOEL, Annalen, 252, 105

Weil, A.T. (1965) 'Nutmeg as a narcotic,' Econ. Bot., 19, 194 -

---

Contents - Previous

217.