

VARIETIES OF SPICES



Varieties of Spices

Developed at IISR



IISR PUB-33







Indian Institute of Spices Research

Indian Council of Agricultural Research

Calicut - 673 012, Kerala, India.

Front Cover Photos

1. Subhakara 
2. CCS 1 
3. Varada 
4. Viswashree 

Background: A portion of black pepper vine.

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INDIAN INSTITUTE OF SPICES RESEARCH

(Indian Council of Agricultural Research)

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INTRODUCTION

India - 'The Land of Spices', has the pre-eminent position in production of spices in the world and accounts for about 30% of the global trade. Indian spices are known for their excellent quality, aroma and flavour. About 60 spices are grown in India. India produced about 27.67 tones of spices, valued at about 307356.44 million rupees, during 1997-98 from 2.5 million hectares of area. India exported spices to the tune of 7.9% of the total production, which accounts for more than 50% of the world spice import. The export of spices during 1999-2000 was for Rupees 1861.03 crores. The major spices of relevance in Indian context are black pepper, cardamom, ginger, turmeric, chillies, seed and tree spices. The major spice growing states in India are Kerala, Tamil Nadu, Rajasthan, Gujarai, Maharashtra, Madhya Pradesh, Orissa, Haryana, Punjab, Uttar Pradesh, Andhra Pradesh and Karnataka.

India is also the largest consumer of spices in the world. Considerable increase in the production and productivity of spices is needed if India has to retain its rightful place as the world's leading producer, consumer and exporter of spices. The average productivity of spices in India is very low. There are several production constraints and among these, damage caused by pests and diseases is the most important. In certain crops, drought is another major production constraint. Development of high yielding varieties of spices with resistance to biotic and abiotic stresses and utilization of improved cultivars is an important component in increasing the production and productivity of spices.

In the past 25 years, the Indian Institute of Spices Research (IISR), Calicut under the aegis of Indian Council of Agricultural Research, New Delhi, has made significant contributions in developing many high yielding and high quality varieties of spices - especially black pepper, cardamom, ginger, turmeric, cinnamon and nutmeg. Over the years IISR has assembled world's largest collection of spices germplasm. This germplasm is being evaluated systematically and this has lead to the development of many high yielding and high quality varieties. Appropriate use of these varieties coupled with the relevant package of practices on agro-techniques, plant protection and post harvest technology would certainly result in higher production and export.

Indian Institute of Spices Research is continuing its efforts to develop high yielding, high quality lines with more focused approach on resistance to biotic and abiotic stress in the coming years.

The important characters of the varieties developed at IISR are given in the following pages.

BLACK PEPPER

Black pepper, the whole dried fruit from perennial vine *Piper nigrum* L. is the world's most important spice and is considered 'The King of Spices'. It is mainly used as spice and medicine. India is a leading producer, consumer and exporter of black pepper in the world. In India pepper is cultivated in about 2.38 lakh hectares with an annual production of over 65 thousand tonnes out of which about 60% is exported. During 1999-2000, 42100 tonnes of black pepper worth Rs 865 crores were exported to various countries accounting for 46.5% of export earnings among spices. It is mainly cultivated in the States of Kerala, Karnataka, Tamil Nadu and to a certain extent in Andhra Pradesh, Orissa, West Bengal, North Eastern States and Andaman & Nicobar islands. Pepper is one of the most important ingredient of many drugs in Indian systems of medicine. Pepper is pungent and acidic, hot, rubefacient, carminative and germicidal. It promotes salivation, increases digestive power, cures cough, cardiac diseases etc.

Black pepper is a perennial climbing vine and is trailed on living or non-living standards such as *Erythrina* spp., *Garuga pinnata* and *Grevilea robusta*. About 1000 vines are planted per hectare with 3 x 3 m spacing. Rooted cuttings are used as planting material. The vines start flowering after 2nd year of planting in June – July and mature spikes become ready for harvest in December – January. Black pepper grows successfully between 20° North and 20° South of Equator, from sea level up to 1500 m above MSL. The crop tolerates temperatures between 10°- 40°C. Pepper is grown as rainfed crop and a well distributed annual rainfall of 125-200 cm is considered ideal. Pepper can be grown in a wide range of soils with a pH of 4.5–6.0. Well-drained red lateritic or alluvial soils rich in humus are ideal as pepper is a surface feeder and cannot stand water logging.

The tropical evergreen forests of the Malabar Coast of Southern India are considered the native home of black pepper. The maximum diversity for black pepper occurs in the state of Kerala. Over 100 cultivars and land races of black pepper are known to exist. The most popular among them are Karimunda, Aimpiriyan, Kottanadan, Balankotta, Neelamundi, Narayakodi, Kuthiravally, Arakkulamunda, Kalluvally, Chumala and Malligesara. A very large collection of over 3000 accessions of black pepper, related species and inter-cultivar hybrids are available at Indian Institute of Spices Research (IISR), Calicut. Crop improvement efforts utilizing these genetic resources has resulted in selection and development of five high yielding and high quality varieties of black pepper. One of these, Pournami, is tolerant to root knot nematode (*Meloidogyne incognita*). Many promising inter-cultivar hybrids and selections from cultivars, some of them tolerant to *Phytophthora* foot rot, are in the final stages of evaluation.

Foot rot caused by *Phytophthora capsici*; slow decline caused by nematodes viz., *Radopholus similis* and *Meloidogyne incognita*; hollow berries ("pollu") caused by a beetle *Longitarsus nigripinnis*, little leaf and stunted disease caused by viruses are the major production constraints. Effective control measures for most of these pests and diseases are available.

BLACK PEPPER

VARIETY	: Sreekara
YEAR OF RELEASE	: 1990
PEDIGREE	: Clonal selection from Karimunda (KS 14)
AREAS OF ADOPTION	: All pepper growing tracts of Kerala and Southern Karnataka
MATURITY GROUP	: Medium
AVERAGE YIELD	: 2677 kg dry pepper/ha
POTENTIAL YIELD	: 4200 kg dry pepper/ha

QUALITY CHARACTERS

Piperine (%)	: 5.1
Oleoresin (%)	: 13.0
Essential oil (%)	: 7.0

PLANT CHARACTERS

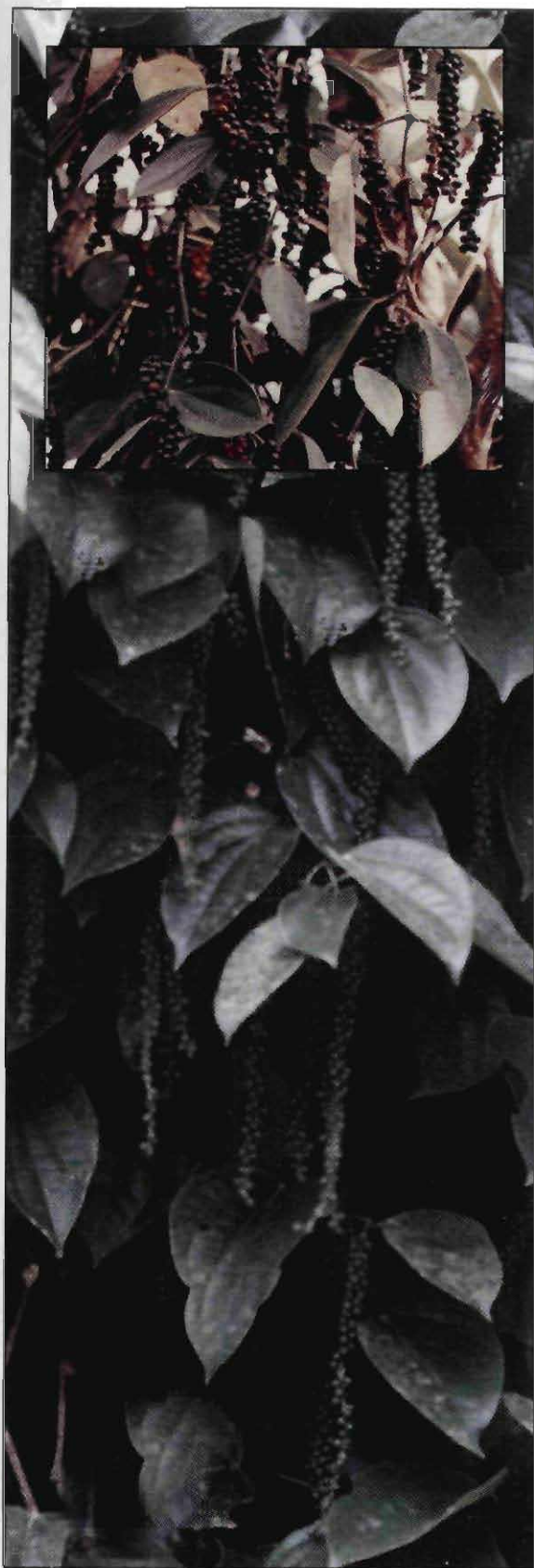
Leaf length/breadth (cm)	: 11.6/6.2
Leaf shape	: Ovate
Spike length (cm)	: 8.6
Spike composition	:
Bisexual (%)	: 98.0
Female (%)	: 1
Male (%)	: 1
Fruit set (%)	: 63.4
No. of fruits per spike	: 61.0
1000 fruit volume (cc)	: 106
1000 fruit weight (g)	: 108
Yield per vine	: 4.8 kg (green)
Dry recovery (%)	: 35.0

RESISTANCE TO MAJOR PESTS AND DISEASES

Phytophthora foot rot	
(<i>Phytophthora capsici</i>)	: Susceptible
Pollu beetle	
(<i>Longitarsus nigripennis</i>)	: Susceptible
Burrowing nematode	
(<i>Radopholus similis</i>)	: Susceptible
Root knot nematode	
(<i>Meloidogyne incognita</i>)	: Susceptible
Leaf gall thrips	
(<i>Liothrips karnyi</i>)	: Susceptible
Scale insects	
(<i>Lepidosaphes</i> sp. & <i>Aspidiotus</i> sp.)	: Susceptible

SPECIAL CHARACTERISTICS

Adaptable to various climatic conditions in all the pepper growing tracts. Gives high quality pepper.



BLACK PEPPER

VARIETY	: Subhakara
YEAR OF RELEASE	: 1990
PEDIGREE	: Clonal selection from Karimunda (KS 27)
AREAS OF ADOPTION	: All pepper growing tracts of Kerala and Southern Karnataka
MATURITY GROUP	: Medium
AVERAGE YIELD	: 2352 kg dry pepper/ha
POTENTIAL YIELD	: 4487 kg dry pepper/ha

QUALITY CHARACTERS

Piperine (%)	: 3.4
Oleoresin (%)	: 12.4
Essential oil (%)	: 6.0

PLANT CHARACTERS

Leaf length/breadth (cm)	: 12.3/6.5
Leaf shape	: Ovate
Spike length (cm)	: 7.7
Spike composition	
Bisexual (%)	: 99.0
Female (%)	: 0.5
Male (%)	: 0.5
Fruit set (%)	: 68.0
No. of fruits per spike	: 63.0
1000 fruit volume (cc)	: 100
1000 fruit weight (g)	: 103
Yield per vine	: 4.2 kg (green)
Dry recovery (%)	: 35.5

RESISTANCE TO MAJOR PESTS AND DISEASES

Phytophthora foot rot (<i>Phytophthora capsici</i>)	: Susceptible
Pollu beetle (<i>Longitarsus nigripennis</i>)	: Susceptible
Burrowing nematode (<i>Radopholus similis</i>)	: Susceptible
Root knot nematode (<i>Meloidogyne incognita</i>)	: Susceptible
Leaf gall thrips (<i>Liothrips karnyi</i>)	: Susceptible
Scale insects (<i>Lepidosaphes</i> sp. & <i>Aspidiotus</i> sp.):	Susceptible

SPECIAL CHARACTERISTICS

A selection with high quality pepper and wider adaptability.



BLACK PEPPER

VARIETY	: Panchami
YEAR OF RELEASE	: 1991
PEDIGREE	: Clonal selection from Aimpitiyan (Coll.856)
AREAS OF ADOPTION	: All pepper growing tracts of Kerala and Karnataka
MATURITY GROUP	: Late
AVERAGE YIELD	: 2828 kg dry pepper/ha
POTENTIAL YIELD	: 6528 kg dry pepper/ha

QUALITY CHARACTERS

Piperine (%)	: 4.7
Oleoresin (%)	: 12.5
Essential oil (%)	: 3.4

PLANT CHARACTERS

Leaf length/breadth (cm)	: 14.5/8.5
Leaf shape	: Ovate
Spike length (cm)	: 11.2
Spike composition	
Bisexual (%)	: 95.5
Female (%)	: 4.0
Male (%)	: 0.5
Fruit set (%)	: 32.0
No. of fruits per spike	: 84.0
1000 fruit volume (cc)	: 108
1000 fruit weight (g)	: 107
Yield per vine	: 5.2 kg (green)
Dry recovery (%)	: 34.0

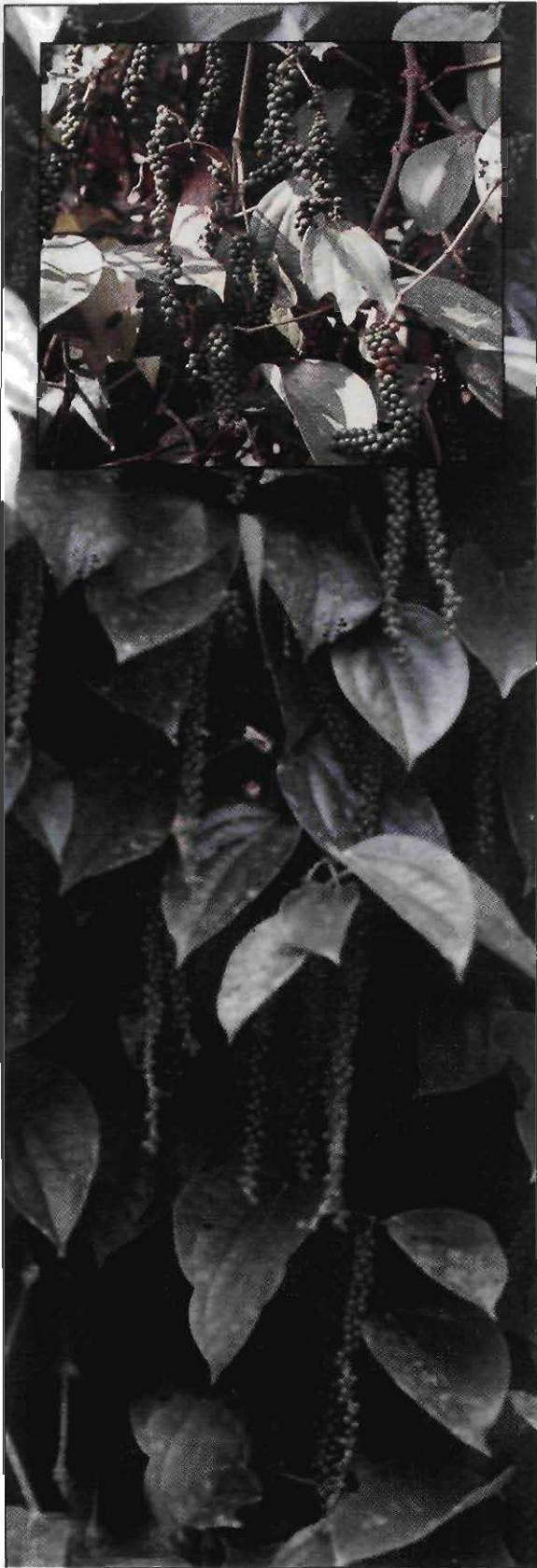
RESISTANCE TO MAJOR PESTS AND DISEASES

Phytophthora foot rot (<i>Phytophthora capsici</i>)	: Susceptible
Pollu beetle (<i>Longitarsus nigripennis</i>)	: Susceptible
Burrowing nematode (<i>Radopholus similis</i>)	: Susceptible
Root knot nematode (<i>Meloidogyne incognita</i>)	: Susceptible
Leaf gall thrips (<i>Liothrips karnyi</i>)	: Susceptible
Scale insects (<i>Lepidosaphes</i> sp. & <i>Aspidiotus</i> sp.)	: Susceptible

SPECIAL CHARACTERISTICS

A high yielding, late maturing variety with excellent fruit set. Spike twisted in appearance due to high fruit set. Oleoresin content is high.





BLACK PEPPER

VARIETY	: Pournami
YEAR OF RELEASE	: 1991
PEDIGREE	: Clonal selection from germplasm (Coll.812)
AREAS OF ADOPTION	: All pepper growing tracts of Kerala and Karnataka
MATURITY GROUP	: Medium
AVERAGE YIELD	: 2333 kg dry pepper/ha
POTENTIAL YIELD	: 5356 kg dry pepper/ha

QUALITY CHARACTERS

Piperine (%)	: 4.1
Oleoresin (%)	: 13.8
Essential oil (%)	: 3.4

PLANT CHARACTERS

Leaf length/breadth (cm)	: 15.6/8.5
Leaf shape	: Ovate-lanceolate
Spike length (cm)	: 12.0
Spike composition	
Bisexual (%)	: 84.0
Female (%)	: 15.0
Male (%)	: 1.0
Fruit set (%)	: 68.0
No. of fruits per spike	: 79.0
1000 fruit volume (cc)	: 130
1000 fruit weight (g)	: 128
Yield per vine	: 4.7 kg (green)
Dry recovery (%)	: 31.0

RESISTANCE TO MAJOR PESTS AND DISEASES

Phytophthora foot rot (<i>Phytophthora capsici</i>)	: Susceptible
Pollu beetle (<i>Longitarsus nigripennis</i>)	: Susceptible
Burrowing nematode (<i>Radopholus similis</i>)	: Susceptible
Root knot nematode (<i>Meloidogyne incognita</i>)	: Tolerant
Leaf gall thrips (<i>Liothrips karnyi</i>)	: Susceptible
Scale insects (<i>Lepidosaphes</i> sp. & <i>Aspidiotus</i> sp.)	: Susceptible

SPECIAL CHARACTERISTICS

Tolerant to root knot nematode. A moderately high yielding vine with high oleoresin content.

BLACK PEPPER

VARIETY	: PLD-2
YEAR OF RELEASE	: 1996
PEDIGREE	: Clonal selection from cultivar Kottanadan (2559)
AREAS OF ADOPTION	: Trivandrum and Quilon districts of Kerala.
MATURITY GROUP	: Late
AVERAGE YIELD	: 2475 kg dry pepper/ha
POTENTIAL YIELD	: 4731.8 kg dry pepper/ha

QUALITY CHARACTERS

Piperine (%)	: 3.0
Oleoresin(%)	: 15.45
Essential oil (%)	: 4.8

PLANT CHARACTERS

Leaf length/breadth (cm)	: 15.5/8.4
Leaf shape	: Ovate
Spike length (cm)	: 8.33
Spike composition	
Bisexual (%)	: 94.1
Female (%)	: 4.3
Male (%)	: 0.6
Fruit set (%)	: 87.7
No. of fruits per spike	: -
1000 fruit volume (cc)	: 122.7
1000 fruit weight (g)	: 122.3
Yield per vine	: 4.97 kg (green)
Dry recovery (%)	: 31.13

RESISTANCE TO MAJOR PESTS AND DISEASES

Phytophthora foot rot (<i>Phytophthora capsici</i>)	: Susceptible
Pollu beetle (<i>Longitarsus nigripennis</i>)	: Susceptible
Burrowing nematode (<i>Radopholus similis</i>)	: Susceptible
Root knot nematode (<i>Meloidogyne incognita</i>)	: Susceptible

SPECIAL CHARACTERISTICS

A variety with high quality and suitable to all Pepper growing areas. Oleoresin content is high.



SMALL CARDAMOM

Known as the "Queen of the Spices", small cardamom of commerce is the dried fruit of the rhizomatous, herbaceous perennial, *Elettaria cardamomum* Maton belonging to Zingiberaceae. Cardamom is also known for its medicinal properties. In early Indian systems of medicine, cardamom was used to remove fat and as a cure for urinary and skin complaints. The plant is indigenous to evergreen forests of Southern India and Sri Lanka. Cardamom is grown in areas where the rainfall ranges from 1500-4000 mm, temperature from 10^o-35^oC and the altitude from 600-1200 m above MSL. Loamy forest soils rich in organic matter with pH ranging from 5.0-6.5 are ideal. Cardamom also requires overhead shade.


India, Sri Lanka and Guatemala are the major cardamom producing countries. In India, cardamom cultivation is restricted to the Western Ghat regions of Kerala, Karnataka and Tamil Nadu. Currently in India, cardamom is grown in an area of about 72,000 ha, the production is around 6,000-8,000 tonnes per year. India exports around 0.5 thousand tonnes of cardamom, earning a foreign exchange of approximately 276 million rupees.

Cardamom consists of three morphologically distinct varieties that are distinguishable on the basis of plant type. They are: i) Malabar, ii) Mysore and iii) Vazhukka. Cardamom is usually cultivated as a rainfed crop, but supplementary irrigation is provided in certain pockets to overcome dry spells during summer. Cardamom is vegetatively propagated but usually seedlings are used for planting due to lack of adequate clonal material. Plant population per hectare ranges from 1000-5000 depending upon the plant type and system of planting. It starts yielding by the third year of planting. The flowering commences in April and continues up to August. The fruits come to harvest 3-4 months after flowering. Cardamom is naturally out crossed; the major pollinating agents are honeybees. Rearing of honeybees in cardamom plantations help in increasing the yields.

A good amount of genetic variability occurs in India and Indian Institute of Spices Research, Calicut has around 270 accessions of cardamom germplasm conserved in its clonal repository. Systematic evaluation of these lines has resulted in development of three high yielding, high quality varieties, of these one is resistant to 'katte' virus and another is resistant to rhizome rot.

Mosaic or 'katte' disease caused by virus, capsule rot (Azhukal) caused by *Phytophthora* sp., rhizome rot caused by *Pythium* sp., and *Rhizoctonia* sp., root knot nematode (*Meloidogyne incognita*), thrips (*Sciothrips cardamomi*), shoot and capsule borer (*Conogethes punctiferalis*) are the major diseases and pests affecting cardamom plantations.

SMALL CARDAMOM



VARIETY	: IISR, Kodagu – Suvasini (CCS - 1)
YEAR OF RELEASE	: 1997
PEDIGREE	: A selection from open pollinated progeny of CL-37
AREAS OF ADOPTION	: All cardamom growing areas of Karnataka
MATURITY	: 112 days from flowering
AVERAGE YIELD*	: 745 kg dry capsules/ha
POTENTIAL YIELD*	: 1322 kg dry capsules/ha

QUALITY CHARACTERS

Essential oil (%)	: 8.7
Dry recovery (%)	: 22
a-terpenyl acetate (%)	: 37
1,8 – Cineole (%)	: 42

PLANT CHARACTERS

Plant type	: Malabar
Colour of aerenal shoot	: Green
Plant height (m)	: 2.05
Leaf length/breadth (cm)	: 63/ 11
No. of tillers per clump	: 41
No. of panicles per clump	: 37
No. of flowers per panicle	: 129
No. of capsules per panicle	: 60

RESISTANCE TO MAJOR PESTS AND DISEASES

Thrips (<i>Sciothrips cardamomi</i>)	: Tolerant
Shoot/panicle/capsule borer (<i>Conogethes punctiferalis</i>)	: Tolerant
Root knot nematode (<i>Meloidogyne incognita</i>)	: Susceptible
Katte disease (<i>Katte virus</i>)	: Susceptible
Rhizome rot (<i>Pythium vexans & Rhizoctonia solani</i>)	: Tolerant

SPECIAL CHARACTERISTICS:

Highly adaptive and produces 89% bold (7.2 mm and above) capsules. Suitable for high production technology. Responds well for nutritional inputs.

* based on CYT - 6

SMALL CARDAMOM

VARIETY	: IISR – Avinash (RR 1)
YEAR OF RELEASE	: 1999
PEDIGREE	: A selection from OP progenies of CCS-1
AREAS OF ADOPTION	: Karnataka and Wayanad
MATURITY	: 115 days from flowering
AVERAGE YIELD	: 847 kg dry capsules/ha
POTENTIAL YIELD	: 1483 kg dry capsules/ha

QUALITY CHARACTERS

Essential oil (%)	: 6.7
Dry recovery (%)	: 20.8
α -terpenyl acetate (%)	: 34.6
1,8 – Cineole (%)	: 30.4

PLANT CHARACTERS

Plant type	: Malabar
Colour of aerial shoot	: Dark Green
Plant height (m)	: 2.286
Leaf length/breadth (cm)	: 69/13
No. of tillers per clump	: 46
No. of panicles per clump	: 43
No. of flowers per panicle	: 163

RESISTANCE TO MAJOR PESTS AND DISEASES

Thrips (<i>Sciothrips cardamomi</i>)	: Susceptible
Shoot/panicle/capsule borer (<i>Conogethes punctiferalis</i>)	: Tolerant
Root knot nematode (<i>Meloidogyne incognita</i>)	: Susceptible
Katte disease (Katte virus)	: Susceptible
Rhizome rot (<i>Pythium vexans</i> & <i>Rhizoctonia solani</i>)	: Resistant

SPECIAL CHARACTERISTICS :

High yielder, suitable for planting in valleys. Has extended flowering period. Yields well at 2.5 x 2m spacing. Recommended for rhizome rot infested areas.



SMALL CARDAMOM



VARIETY	: ISSR – Vijetha -1 (NKE – 12)
YEAR OF RELEASE	: 2001
PEDIGREE	: A selection from field resistant plants for katte
AREAS OF ADOPTION	: Cardamom growing areas of Karnataka and Wayanad
MATURITY	: 105 days from flowering
AVERAGE YIELD	: 643 kg dry capsules/ha
POTENTIAL YIELD	: 979 kg dry capsules/ha

QUALITY CHARACTERS

Essential oil (%)	: 7.9
Dry recovery (%)	: 22
α -terpenyl acetate (%)	: 23.4
1,8 – Cineole (%)	: 44.9

PLANT CHARACTERS

Plant type	: Malabar
Colour of aerial shoot	: Green
Plant height (m)	: 1.72
Leaf length/breadth (cm)	: 61/11
No. of tillers per clump	: 36
No. of panicles per clump	: 34
No. of flowers per panicle	: 99

RESISTANCE TO MAJOR PESTS AND DISEASES

Thrips (<i>Sciothrips cardamomi</i>)	: Field tolerant
Shoot/panicle/capsule borer (<i>Conogethes puiciferalis</i>)	: Field tolerant
Root knot nematode (<i>Meloidogyne incognita</i>)	: Susceptible
Katte disease (<i>Katte virus</i>)	: Resistant
Rhizome rot (<i>Pythium vexans</i> & <i>Rhizoctonia solani</i>)	: Susceptible

SPECIAL CHARACTERISTICS

A virus resistant selection with 77 % bold (7.2 mm) capsules and good appearance. Recommended for moderate to high shaded mosaic infested areas where malabar types are grown.

GINGER

Ginger is derived from the rhizomes of *Zingiber officinale* Rosc. (Family – Zingiberaceae). It is said to have originated in Indo-China region and is not known to occur in wild state. Ginger has been prized since ancient times for its flavour and medicinal properties. Ginger is one of the most popular medicinal spice. In early Indian systems of medicine, ginger was recommended for liver complaints, flatulence, anaemia, rheumatism, piles and jaundice. Ginger is a slender perennial herb usually grown as an annual, 30-100 cm tall with robust, thick, branched and laterally compressed rhizomes. The rhizomes are erect and bear 8-12 linear lanceolate leaves. Ginger grows well in warm and humid tropics from sea level up to 1500 m above MSL. It is usually grown as rainfed crop and moderate to heavy rainfall is ideal. It thrives best in well-drained sandy, clay loam, red loam or lateritic loam soils rich in humus. It is very sensitive to water logging.

India is a major producer and exporter of ginger. In India, this crop is cultivated in an area of 77,600 hectares with a total production of 66,170 tonnes. India exports 7,800 tonnes of ginger earning a foreign exchange of 291 million rupees. The major ginger producing states are Kerala, Himachal Pradesh, Orissa, West Bengal and North Eastern States.

Ginger is propagated only vegetatively using bits of rhizomes as planting material. The seed rhizomes are to be selected after each harvest and stored properly in shade for planting in the next season. Being a very exhaustive crop it is not desirable to grow ginger in the same site year after year. Ginger requires heavy dose of manuring. Compost at the rate of 30-40 t/ha along with 12-15 t/ha of green mulch is essential, in addition to recommended dose of NPK. The crop is ready for harvest in January-March depending on the area of cultivation and crop duration.

There is no seed set in ginger, which hampers the conventional breeding programmes. This also leads to narrower genetic base. However many commercial cultivars of ginger are known. They are generally named after the localities from where they are cultivated or collected. Maran, Himachal, Nadia, Rio-de-Janeiro, Jamaica, China, Wayanad local, Kuruppampady, Bhaise are some of the local popular cultivars. Indian Institute of Spices Research has a good collection of over 600 accessions of ginger germplasm. Systematic evaluation of these accessions has led to the development of three high yielding, high quality varieties of ginger. A few more promising lines are in advanced stages of evaluation.

Rhizome rot caused by *Pythium aphanidermatum*, bacterial wilt caused by *Pseudomonas solanacearum*, leaf spot caused by *Phyllosticta zingiberi* are the major diseases and shoot borer (*Conogethes punctiferalis*) and rhizome scale (*Aspidiella hartii*) are the major pests affecting ginger.



GINGER

VARIETY	: IISR Varada
YEAR OF RELEASE	: 1996
PEDIGREE	: Selection from germplasm
AREAS OF ADOPTION	: All over India
MATURITY	: 200 days
AVERAGE YIELD	: 22.6 t/ha

QUALITY CHARACTERS

Essential oil (%)	: 1.75
Dry recovery (%)	: 20.7
Fibre content (%)	: 3.29 - 4.5

PLANT CHARACTERS

Colour of aerial shoot	: Green
Plant height (cm)	: 72.32
Leaf length/breadth (cm)	: 28.3/2.5
No. of tillers per clump	: 9.4
No. of leaves per tiller	: 20
Colour of rhizome core	: Bluish yellow
Shape of rhizome	: Plumpy with flattened fingers
Colour of scale	: Reddish brown

RESISTANCE TO MAJOR PESTS AND DISEASES

Shoot borer (<i>Conogethes punctiferalis</i>)	: Susceptible
Rhizome scales (<i>Aspidiella hartii</i>)	: Susceptible
Rhizome rot (<i>Pythium aphanidermatum</i>)	: Susceptible
Bacterial wilt (<i>Ralstonia solanacearum</i>)	: Susceptible
Phyllosticta leaf spot (<i>Phyllosticta zingiberi</i>)	: Susceptible

SPECIAL CHARACTERISTICS

A good quality, high yielding variety with plumpy rhizomes having flattened fingers and medium sized reddish brown scales. Dry ginger less prone to storage insect damage. Farmers are of opinion that Varada is tolerant to diseases. Low fibre content.



GINGER

VARIETY	: Coll: 35
YEAR OF RELEASE	: 2001(recommended for release)
PEDIGREE	: Selection from germplasm
AREAS OF ADOPTION	: Kerala
MATURITY	: 200 days
AVERAGE YIELD	: 22.4 t/ha

QUALITY CHARACTERS

Essential oil (%)	: 2.36
Dry recovery (%)	: 19
Fibre content (%)	: 4

PLANT CHARACTERS

Colour of aerial shoot	: Green
Plant height (cm)	: 65.3
Leaf length/breadth (cm)	: 23.9/2.9
No. of tillers per clump	: 12.8
No. of leaves per tiller	: 12.5
Shape of rhizome	: Plumpy and bold
Colour of scale	: Brown

RESISTANCE TO MAJOR PESTS AND DISEASES

Shoot borer

(*Conogethes punctiferalis*) : Susceptible

Rhizome scales (*Aspidiella hartii*) : Susceptible

Rhizome rot

(*Pythium aphanidermatum*) : Susceptible

Bacterial wilt

(*Ralstonia solanacearum*) : Susceptible

Phyllosticta leaf spot

(*Phyllosticta zingiberi*) : Susceptible

SPECIAL CHARACTERISTICS:

Plumpy and bold rhizomes with low fibre content.



GINGER

VARIETY	: Coll. : 117
YEAR OF RELEASE	: 2001(recommended for release)
PEDIGREE	: Selection from gennplasm
AREAS OF ADOPTION	: Kerala.
MATURITY	: 300 days
AVERAGE YIELD	: 23.2 t/ha

QUALITY CHARACTERS

Essential oil (%)	: 1.72
Dry recovery (%)	: 23
Fibre content (%)	: 3.26

PLANT CHARACTERS

Colour of aerial shoot	: Green
Plant height (cm)	: 67.7
Leaf length/breadth (cm)	: 23.6/ 3.0
No. of tillers per clump	: 8.26
No. of leaves per tiller	: 13.65
Colour of rhizome core	: Bluish yellow
Shape of rhizome	: Plumpy,round and bold
Colour of scale	: Brown

RESISTANCE TO MAJOR PESTS AND DISEASES

Shoot borer	
(<i>Conogethes punctiferalis</i>)	: Susceptible
Rhizome scales (<i>Aspidiella hartii</i>)	: Susceptible
Rhizome rot	
(<i>Pythium aphanidermatum</i>)	: Susceptible
Bacterial wilt	
(<i>Ralstonia solanacearum</i>)	: Susceptible
Phyllosticta leaf spot	
(<i>Phyllosticta zingiberi</i>)	: Susceptible

SPECIAL CHARACTERISTICS:

Plumpy, round and bold rhizomes with three layered compact clumps. Low fibre content.

TURMERIC

Turmeric of commerce is the dried underground rhizomes of *Curcuma domestica* Val. (Syn. *C. longa* L.) belonging to the family Zingiberaceae. It is used as condiment, colouring dye, drug and cosmetic. Turmeric is indispensable in the preparation of curry powders. In addition to its use as a spice, it has medicinal properties also. In Indian system of medicine, turmeric is used as a stomachic, tonic and blood purifier. Turmeric, native to Indo-Malayan region, is an erect perennial herb but is grown as an annual. India is the world's largest producer of turmeric. In India, turmeric is cultivated in over 1,39,700 hectares in the states of Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Orissa, West Bengal and North Eastern States with an annual production of over 549.2 thousand tonnes. India exports around 32.2 thousand tonnes of turmeric earning a foreign exchange of approximately 1,046,000,000 rupees.

Turmeric requires hot and humid climate and can be cultivated in most of the tropics and subtropics provided rainfall is adequate (100-200 cm) or irrigation facilities are available. Turmeric thrives best on loamy, alluvial, loose and fertile soils and cannot stand water logging. There are many popular turmeric cultivars which are specific to each region of cultivation. Duggirala, Armor, Sugandham, Nandyal, Alleppey, Rajapuri, GL puram, Bhavanisagar, Gorakhpur, Jobedi etc, are some of the popular local cultivars which are essentially named after the places where they are grown extensively. The cultivars are grouped into either short duration 'kasturi' types, medium duration 'kesari' types and long duration types. Indian Institute of Spices Research (IISR), Calicut has assembled a large collection of over 700 accessions of turmeric germplasm. Turmeric sets seed only in certain locations and IISR has developed over 100 seed generated lines. In India, over 15 high yielding varieties are released for cultivation, of these 5 are developed at IISR.

Turmeric is planted with the onset of South-West monsoon either in beds of 1-1.5 m width, 15 cm height and of convenient length or by forming ridges and furrows. It is grown as a rainfed crop in Kerala, North Eastern States while in other states it is mostly irrigated. Rhizome bits (20g each) are used as 'seed' for planting (about 2.5 t/ha). A spacing of 45-60 cm between rows and 25 cm between plants is recommended. Turmeric is an exhaustive crop and requires heavy dose of manuring. Compost at the rate of 40 t/ha along with 12-15 t/ha of green mulch is essential in addition to recommended dose of NPK. The crop is ready for harvest in January-March depending on the area of cultivation and crop duration.

Rhizome rot caused by *Pythium graminicolum*, leaf blotch caused by *Taphrina maculans*, rhizome scale (*Aspidiella hartii*) and shoot borer (*Conogethes punctiferalis*) are the major diseases and pests affecting turmeric production. Effective control measures against these pests and pathogens are available.

TURMERIC



VARIETY	: Suvarna
YEAR OF RELEASE	: 1987
PEDIGREE	: A selection from the germplasm (PCT-8) collected from Assam
AREAS OF ADOPTION	: Kerala, Karnataka & Andhra Pradesh
CROP DURATION	: 200 days
AVERAGE YIELD	: 17.4 t/ha (fresh wt.)
POTENTIAL YIELD	: 43.5 t/ha (fresh wt.)

QUALITY CHARACTERS

Curcumin	: 4.0%
Oleoresin	: 13.5%
Essential oil	: 7.0%

PLANT CHARACTERS

Colour of aerial shoot	: Green
Plant height (cm)	: 69.4
Leaf length/breadth (cm)	: 66.4/17.4
No. of tillers per clump	: 2.6
No. of leaves per clump	: 16.4
Yield of rhizomes per clump (g)	: 460
No. of mother rhizomes	: 3.0
Weight of mother rhizomes (g)	: 34
No. of primaries	: 21
Weight of primaries (g)	: 232
No. of secondaries	: 28.2
Weight of secondaries (g)	: 201
Colour of rhizomes	: Deep orange
Dry recovery (%)	: 26

RESISTANCE TO MAJOR PESTS AND DISEASES

Rhizome rot (<i>Pythium graminicolum</i>)	: Field tolerant
Leaf blotch (<i>Taphrina maculans</i>)	: Field tolerant
Leaf spot (<i>Colletotrichum capsici</i>)	: Field tolerant
Rhizome scale (<i>Aspidiella hartii</i>)	: Field tolerant
Shoot borer (<i>Conogethes punctiferalis</i>)	: Field tolerant

SPECIAL CHARACTERISTICS

A high yielding, short duration turmeric with deep orange coloured rhizome.



TURMERIC

VARIETY	: Suguna
YEAR OF RELEASE	: 1991
PEDIGREE	: A selection from the germplasm (PCT-13) collected from Assam
AREAS OF ADOPTION	: Kerala & Andhra Pradesh
CROP DURATION	: 190 days
AVERAGE YIELD	: 29.3 t/ha (fresh wt.)
POTENTIAL YIELD	: 60.3 t/ha (fresh wt.)

QUALITY CHARACTERS

Curcumin	: 4.9%
Oleoresin	: 13.5%
Essential oil	: 6.0%

PLANT CHARACTERS

Colour of aerial shoot	: Green
Plant height (cm)	: 107.0
Leaf length/breadth (cm)	: 46.0/12.3
No. of tillers per clump	: 1.9
No. of leaves per clump	: 12.8
Yield of rhizomes per clump (g)	: 529
No. of mother rhizomes	: 1.8
Weight of mother rhizomes (g)	: 15
No. of primaries	: 9.3
Weight of primaries (g)	: 210
No. of secondaries	: 26.4
Weight of secondaries (g)	: 337
Colour of rhizomes	: Orange
Dry recovery (%)	: 20.4

RESISTANCE TO MAJOR PESTS AND DISEASES

Rhizome rot

(<i>Pythium graminicolum</i>)	: Moderately tolerant
Leaf blotch (<i>Taphrina maculans</i>)	: Moderately tolerant
Leaf spot (<i>Colletotrichum capsici</i>)	: Susceptible
Rhizome scale (<i>Aspidiella hartii</i>)	: Susceptible
Shoot borer	
(<i>Conogethes punctiferalis</i>)	: Susceptible

SPECIAL CHARACTERISTICS

A short duration turmeric with plumpy rhizomes and high yield potential. Field tolerant to rhizome rot.



TURMERIC

VARIETY	: Sudarshana
YEAR OF RELEASE	: 1991
PEDIGREE	: A selection from the germplasm (PCT-14) collected from Singhat, Manipur.
AREAS OF ADOPTION	: Kerala & Andhra Pradesh
CROP DURATION	: 190 days
AVERAGE YIELD	: 28.8 t/ha (fresh wt.)
POTENTIAL YIELD	: 54.9 t/ha (fresh wt.)

QUALITY CHARACTERS

Curcumin	: 7.9%
Oleoresin	: 15.0%
Essential oil	: 7.0%

PLANT CHARACTERS

Colour of aerial shoot	: Green
Plant height (cm)	: 136.0
Leaf length/breadth (cm)	: 37.4/12.1
No. of tillers per clump	: 1.9
No. of leaves per clump	: 14.3
Yield of rhizomes per clump (g)	: 565
No. of mother rhizomes	: 1.8
Weight of mother rhizomes (g)	: 17
No. of primaries	: 10.1
Weight of primaries (g)	: 236
No. of secondaries	: 20.1
Weight of secondaries (g)	: 310
Colour of rhizomes	: Orange
Dry recovery (%)	: 20.6

RESISTANCE TO MAJOR PESTS AND DISEASES

Rhizome rot	
(<i>Pythium graminicolum</i>)	: Moderately tolerant
Leaf blotch (<i>Taphrina maculans</i>)	: Moderately tolerant
Leaf spot (<i>Colletotrichum capsici</i>)	: Susceptible
Rhizome scale (<i>Aspidiella harti</i>)	: Susceptible
Shoot borer	
(<i>Conogethes punctiferalis</i>)	: Susceptible

SPECIAL CHARACTERISTICS

A high yielding high quality short duration turmeric with plumpy rhizomes. Field tolerant to rhizome rot.



TURMERIC

VARIETY	: Prabha
YEAR OF RELEASE	: 1996
PEDIGREE	: Open pollinated progeny selection
AREAS OF ADOPTION	: All over India
CROP DURATION	: 205 days
AVERAGE YIELD	: 37 t/ha (fresh wt.)
QUALITY CHARACTERS	
<i>Curcumin</i>	: 6.52%
<i>Oleoresin</i>	: 15.0%
<i>Essential oil</i>	: 6.5%

PLANT CHARACTERS

Colour of aerial shoot	: Green
Plant height (cm)	: 44.14
Leaf length/breadth (cm)	: 59.6/17.33
No. of tillers per clump	: 2.07
No. of leaves per clump	: 11.5
No. of mother rhizomes	: 3.0
No. of primaries	: 8.5
Colour of rhizomes	: Reddish yellow
Dry recovery (%)	: 19.5

SPECIAL CHARACTERISTICS :

A high yielding and good quality variety with reddish yellow coloured rhizome. Free from disease incidence in farmers field. A value added variety.



TURMERIC

VARIETY	: Prathibha
YEAR OF RELEASE	: 1996
PEDIGREE	: Open pollinated progeny selection
AREAS OF ADOPTION	: All over India
CROP DURATION	: 225 days
AVERAGE YIELD	: 39.12 t/ha (fresh wt.)
QUALITY CHARACTERS	
Curcumin	: 6.52%
Oleoresin	: 16.2%
Essential oil	: 6.2%

PLANT CHARACTERS

Colour of aerial shoot	: Green
Plant height (cm)	: 42.9
Leaf length/breadth (cm)	: 53.3/ 16.7
No. of tillers per clump	: 1.6
No. of leaves per clump	: 12.5
No. of mother rhizomes	: 1.3
No. of primaries	: 8.67
Colour of rhizomes	: Reddish yellow
Dry recovery (%)	: 18.5

SPECIAL CHARACTERISTICS :

A high yielding and good quality variety with reddish yellow coloured rhizome. A high quality and value added variety.

CINNAMON

Cinnamon is the earliest known spice. Cinnamon of commerce is the dried inner bark of *Cinnamomum verum* Bercht. & Presl., belonging to the family Lauraceae. It is indigenous to Sri Lanka and was introduced into Anjarakandy Estate, Canannore (Kerala) in the nineteenth century by the British. It is one of the economically important tree spices, cultivated in 640 hectares, in the states of Kerala, Tamil Nadu, Karnataka and Union Territory of Andaman and Nicobar islands. Cinnamon, a tree spice, which can live upto 100 years, is maintained as a bush by coppicing and bark extraction regularly. Regular peeling operation can be commenced from the third or fourth year after planting, depending upon the extent of development of peeler shoots.

Cinnamon is used widely in food industry and medicine. The bark oil is antifungal, antibacterial and used in pharmaceutical preparations. Cinnamon oil has strong lipolytic properties in dissolving fat and thus aids digestion and it is used in treatment of diabetes.

Major cinnamon growing areas in India were surveyed and a total of 299 accessions were collected and conserved. The germplasm have been evaluated and 10 promising elite cinnamon lines have been identified. Cinnamon is a hardy plant, tolerating a wide range of soil and climatic conditions. It comes up well from the sea level upto an elevation of about 1000 m. Since it is mostly raised as an irrigated crop, an annual rainfall of 200 to 250 cm is considered ideal for the crop.

Cinnamon is usually propagated by seeds, but can be propagated by rooted stem cuttings and air layers. As seeds have no dormancy and are recalcitrant, they should be sown in sand bed, immediately after collection from the trees. Seeds germinate within 10-15 days. Germinated sprouts are transferred to polythene bags filled with potting mixture of 3:3:1 (sand, soil and well rotten dried cattle manure). One year old seedlings are to be field planted with the onset of South West monsoon at 50 cm cube pits, dug at 3 m x 3 m. In each pit, 5 seedlings can be planted. Partial shade in the initial years is advantageous for healthy and rapid growth of the plants. A fertilizer dose of 20:20:25 g N, P₂O₅ and K₂O per plant is recommended in the first year. The dose is gradually increased to 200:200:250 g N, P₂O₅ and K₂O for grown up plants of 10 years and above. The fertilizers are applied in two doses.

Two year old stems (1.0 to 1.25 m length and 1.25 cm thickness) are cut close to the ground, as straight as possible. Such shoots, freed from leaves, are used for bark extraction by first scraping out the outer portion of the bark, followed by polishing the scrapped portion with a brass rod to facilitate easy peeling. A longitudinal slit is made from one end to other. Then working the knife between the bark and wood, the bark is ripped quickly. They are dried first in shade for a day and then in sunlight for four days. During drying the bark contracts and assumes the shape of quill.

No major pest or disease is known to affect cinnamon production. However few fungal diseases like pink diseases, caused by *Corticium javanicum*, occurring during rainy season on stem and twigs, as pale pinkish white crust, can be controlled by spraying 1% Bordeaux mixture. Cinnamon butterfly is a major pest, the caterpillars feeding voraciously on young leaves and defoliating the plants. It can be controlled by spraying 0.05% monocrotophos.



CINNAMON

VARIETY	: Navashree
YEAR OF RELEASE	: 1996
PEDIGREE	: Seedling selection from Srilankan collection
AREAS OF ADOPTION	: All cinnamon growing areas in India.
CROP DURATION	: 3 years for first harvest
AVERAGE YIELD	: 200 kg dry quills/ha
POTENTIAL YIELD	: 250kg/ha
QUALITY CHARACTERS	
Bark oil (%)	: 2.7
Leaf oil (%)	: 2.8
Bark oleoresin (%)	: 8.0
Bark recovery (%)	: 40.6
Cinnamaldehyde in bark oil (%)	: 73
Cinnamaldehyde in leaf oil (%)	: 15
Eugenol in bark oil (%)	: 6.0
Eugenol in leaf oil (%)	: 62
PLANT CHARACTERS	
Height of tree at 5 years (m)	: 5-7
Trunk girth at 5 years (cm)	: 30
Colour of young flushes	: Light purple to green in 8-10 days
Leaf length and breadth (cm)	: 13.4/4.69
Nature of flowering	: Terminal and axillary
Time taken for flowering	: 4 years
Shoot regeneration capacity	: 25.45/4 plants
Yield of dry bark per plant (g)	: 201.1
Colour of dry bark	: Light brown
RESISTANCE TO MAJOR PESTS AND DISEASES	
No major pest or disease attack was noticed.	

SPECIAL CHARACTERISTICS

A selection with high shoot regeneration capacity. Higher cinnamaldehyde and oleoresin in bark.



CINNAMON

VARIETY	: Nithyashree
YEAR OF RELEASE	: 1996
PEDIGREE	: Seedling selection from Indian collection
AREAS OF ADOPTION	: All cinnamon growing areas in India.
CROP DURATION	: 3 years for first harvest
AVERAGE YIELD	: 200 kg dry quills / ha
POTENTIAL YIELD	: 250 kg/ha

QUALITY CHARACTERS

Bark oil (%)	: 2.7
Leaf oil (%)	: 3.0
Bark oleoresin (%)	: 10.0
Bark recovery (%)	: 30.7
Cinnamaldehyde in bark oil (%)	: 58
Cinnamaldehyde in leaf oil (%)	: 14
Eugenol in bark oil (%)	: 5.0
Eugenol in leaf oil (%)	: 78

PLANT CHARACTERS

Height of tree at 5 years	: 5-7 m
Trunk girth at 5 years	: 45 cm
Colour of young flushes	: Light purple turning green in 2-4 days
Leaf length and breadth (cm)	: 15.40/5.70
Nature of flowering	: Terminal and axillary
Time taken for flowering	: 4 years
Shoot regeneration capacity	: 18.90/4 plants
Yield of dry bark per plant (g)	: 194.6
Colour of dry bark	: Light brown

RESISTANCE TO MAJOR PESTS AND DISEASES:

No major pest or disease attack was noticed.

SPECIAL CHARACTERISTICS

A selection with high shoot regeneration capacity. Gives quality quills. Bark oil, leaf oil and oleoresin contents are high giving good aroma and taste.

NUTMEG

Nutmeg, indigenous to the Moluccas islands (Indonesia) produces two separate spices, the nutmeg and the mace. Nutmeg is the dried kernel of the seed and mace is the dried aril surrounding the shell. They are widely used in pharmacy and industries.

Nutmeg, *Myristica fragrans* Houtt. was introduced by the British into India during the eighteenth century. In India, nutmeg is grown in about 4800 hectares, mostly in Kerala, Tamil Nadu, Karnataka, Goa, Maharashtra, North East India and Andaman islands, with an annual production of over 1,420 tonnes. As it is an obligatory cross-pollinated tree (being dioecious), considerable variation is observed for all aspects of growth and vigour, sex expression, size and shape of nutmeg and quantity of mace.

Major nutmeg growing areas were surveyed and 478 collections were made. The conservatory includes high yielding, high quality elite genotypes and variants in different characters. The accessions were evaluated for different attributes of vegetative and yield traits. Twelve high yielding, promising lines were selected based on germplasm evaluation. Medicinally, nutmeg is known for its stimulative and carminative properties. Nutmeg oil is used in treating urinary track infections, insomnia, skin diseases etc.

An important problem facing nutmeg cultivation is the segregation of the seedlings into male and female plants resulting in 50% unproductive male trees. Epicotyl grafting on sprouted nutmeg seeds is found to be 90% successful, when grafting is done during August.

Nutmeg thrives well in warm humid conditions in locations with an annual rainfall of 150 cm and more. It grows well from sea level upto 1300 metres above MSL. Areas with soils of clay loam, sandy loam and red laterite are ideal for its growth. Both dry and water logged conditions are not good for nutmeg.

One year old nutmeg grafts, produced using scion from elite mother trees can be field planted in pits of 0.75 m cube, filled with a mixture of sand, soil and rotten manure at the onset of monsoon at 5 x 5 m spacing. The grafts should be shaded to protect them from sun scorch in early stages. The grafts can be planted as pure crop or an intercrop in coconut/ arecanut gardens. If raised as pure crop, shade trees are to be raised or artificial shade must be given to the young trees. Organic manures, including bone meal are very popular among growers. Manures are applied in shallow trenches dug around the plants. A fertilizer dose of 20:20:50 g N, P₂O₅ and K₂O is given during the initial year, progressively increasing the dose to 500 g N, 250 g P₂O₅ and 1000 g K₂O per year in subsequent years for a fully grown tree of 15 years or more. June-August is the peak harvesting period. Fruits can be harvested when the pericarp splits open.

Thread blight, caused by *Marasmius pulcher*, horse hair blight, caused by *Marasmius* sp., fruit rot caused by *Diplodia natalensis*, leaf rot and shot hole caused by *Cylindrocladium quinqueseptatum* and die back caused by *D. natalensis* are the major fungal diseases affecting nutmeg. The last one can be controlled by cutting and removing infected branches, followed by pasting the cut branches with Bordeaux mixture. The other diseases can be controlled by spraying 0.1% Bordeaux mixture. Scale insects, occasionally infecting tender leaves and shoots may be controlled by spraying 0.05% monocrotophos.



NUTMEG

VARIETY	: Viswashree
YEAR OF RELEASE	: 2001(recommended for release)
PEDIGREE	: Clonal selection from elite trees
AREAS OF ADOPTION	: All nutmeg growing areas in Kerala.
CROP DURATION	: 6 years for first harvest
AVERAGE YIELD	: 480 kg mace/ha at 8 th year 3122 kg dry nuts/ha
POTENTIAL YIELD	: 4800 kg mace/ha at 25 th year 31220 kg dry nuts/ha

QUALITY CHARACTERS

Nut oil (%)	: 7.14
Mace oil (%)	: 7.13
Nut recovery (%)	: 70
Mace recovery (%)	: 35
Oleoresin in nut (%)	: 2.48
Oleoresin in mace (%)	: 13.8
Butter in nut (%)	: 30.9
Myristicin in nut oil (%)	: 12.48
Myristicin in mace oil (%)	: 20.03
Elemicin in nut oil (%)	: 13.65
Elemicin in mace oil (%)	: 13.65

PLANT CHARACTERS

Height of tree at 9 years (m)	: 3-5
Width of the canopy (m)	: 3 – 3.5
Trunk girth at 9 years (cm)	: 45
Leaf length and breadth (cm)	: 18/5
Nature of flowering	: 2-3 flowers in every axil
Time taken for flowering	: 4 years
Yield per tree, 8 th year	: 1000 fruits.1.33kg mace, 9kg dry nut
Colour of mace	: Dark red
Colour of seed	: Shining black
Size of the seed	: Bold

RESISTANCE TO MAJOR PESTS AND DISEASES

Low incidence of fruit rot caused by *Diplodia* spp.

SPECIAL CHARACTERISTICS

A high yielding, high quality variety with bushy and compact plant type.

Package of practices for Black Pepper*

Planting

Planting of standards is to be taken up in April-May with the onset of pre - monsoon showers. The spacing recommended is 3m x 3m on plain lands and 2 m between plants in rows across the slope and 4 m between rows on sloping lands. For planting pepper, pits of size 50 x 50 x 50 cm are prepared on the northern side of the standards, 15 cm away from it. With the onset of South West monsoon in June-July, 2-3 rooted cuttings are planted 30 cm away from the standards. When pepper is grown on coconut and arecanut trees, the cuttings are to be planted 1-1.5 m away from the trunk of the tree.

Manuring

Manuring for pepper vines is to be done in basins taken around the plants 10-15 cm deep and 50-75 cm radius depending upon the growth of the plants. Apply cattle manure/compost/green leaves @ 10 kg/plant/annum just at the onset of South West monsoon and cover lightly with soil. It is desirable to apply lime @ 500 g/vine in April-May, with receipt of pre-monsoon showers in alternate years.

Recommended nutrient dosage of pepper (3 years above) is:

NPK 50:50:150 g/vine/year (General recommendation)

NPK 50:50:200 g/vine/year (for Panniyur and similar areas)

NPK 140:55:275 g/vine/year (for Kozhikode and similar areas)

Note: Apply 1/3 dose for 1 year old plant and 1/2 dose for two year old plant

Fertilizers may be applied in two split doses, first in May-June and second in August-September

Plant protection

Pests

1. Flea beetle (*Longitarsus nigripennis*) – ‘Pollu’

Control - Spray Endosulphan, Dimethoate, Quinalphos, or Monocrotophos, all of 0.05% concentration. Spraying to be given at the time of spike emergence (June-July), at berry formation (September-October) and once again at berry maturing stage, if necessary.

2. Leaf gall thrips (*Liothrips karnyi*)

Control - Monocrotophos (0.05%), Dimethoate (0.06%) or Phosphamidon (0.03%) may be used.

3. Grubs (*Remphan* sp.) – damaging roots of live standards.

Control - Apply Phorate @ 2 g.a.i. per standard, into the soil around the base through slanting holes.

4. Soft scale (*Lecanium* sp.) – infests foliage and vines at higher elevations

Spraying of Quinalphos (0.05%) controls these scale insects as well as mealy bugs.

5. Burrowing nematode (*Radopholous similis*)

Control - Apply Phorate/Carbofuran @ 1 g.a.i. per vine twice a year

6. Root knot nematode (*Meloidogyne incognita*)

Control - Application of bacterial suspensions of 1.2×10^8 cells of *Bacillus macerans* or *B. circulans* prior to planting of vines or just before monsoon period in established plants (Adhoc recommendation).

Diseases

1. Phytophthora foot rot (*Phytophthora capsici*)

Control

a) Phytosanitation

i) Affected/dead vines, along with root system are to be removed and burnt.

ii) Effective drainage of both surface sub-soil is to be ensured.

iii) To avoid soil splash and consequent disease initiation and spread, a legume cover in the plantation is to be ensured.

iv) Apply 1 kg lime and 2 kg neem cake (after 4 weeks of lime application) /standard/year.

b) Chemical control

Drench the vines over a radius of 45 to 50 cm with 1% Bordeaux mixture or 2% copper oxychloride @ 5-10 litres/vine.

A foliar spray with 1% Bordeaux mixture is also to be given. Drenching and spraying are to be repeated before North East monsoon. If monsoon is prolonged a third drench may be given during October.

2. Fungal pollu (*Anthraco*) caused by *Colletotrichum gloeosporioides*

Control - Spray 1% Bordeaux mixture or Captafol 0.1%, once before flowering (last of June and early July) and then at berry formation stage (August).

Note: Sticker (Rosin washing soda) is to be added to Bordeaux mixture during application.

3. Rotting disease

Control - Plant the cuttings in potting mixture and drench with 1% Bordeaux mixture. When the seedlings germinate ensure good aeration around the planted cuttings and apply Captafol 0.1% at weekly intervals. Water stagnation is to be avoided.

Package of practices for Small Cardamom*

Planting

Cardamom is planted, with the commencement of the South West monsoon, under the shade of trees. Pits should be dug at the spacing 2x2 to 3x2 m for Mysore and Vazhukka; and 1.5x1.5 m to 2x2 m for Malabar types depending on the fertility of the soil. The size of pits should be 60 x 60 x 35 cm. The pits are filled with rich topsoil and well decomposed FYM or compost or leaf mould and 100 g of rock phosphate.

Cultural operations

A regular schedule of cultural practices consisting of weeding, mulching, thrashing, shade regulation, fertilizer application, irrigation, etc., will have to be undertaken.

Manuring

The present recommendation of nutrients of cardamom in Kerala is NPK @ 75:75:150 kg/ha. The fertilizer may be applied in two split doses, before and after the South West monsoon, in a circular band 20 cm wide at 30-40 cm away from the base of the clumps and mixed with soil.

Shade

Since inadequate as well as excessive levels of shade are harmful to the crop, regulation of shade is inevitable. By regulating the shade before the monsoon, more light becomes available to the plant during the rainy season. There should be sufficient shade to protect cardamom plant during the hot season. Red cedar (*Cedrella roona*) is an ideal shade tree. It sheds the leaves during rainy season and thus provides natural shade regulation.

Beekeeping for better pollination

Honey bee (*Apis cerana indica*) is the main pollinator, maintaining 4 bee colonies/ha increases yield.

Plant protection

Pests

1. Cardamom thrips (*Sciothrips cardamomi*)

Control: Spraying any of the following insecticides are recommended during August-November and again during December - April (EC formulation): Quinalphos 0.03%, Fenthion 0.03%, Phenthoate 0.03%, Phosalone 0.05%, Monocrotophos 0.03%, Fenitrothion 0.05%, Formothion 0.03%, Dimethoate 0.05%

(Dust formulation): Quinalphos 1.5%, Carbaryl 10%, Phosalone 4%, or Phenthoate 4% each at 25 kg/ha

2. Leaf eating and Hairy caterpillars (*Alphaea biguttata*, *Euproctis* sp., *Eupterote* spp., *Pericallia* sp.)

Control : Mechanical collection and destruction and spraying of any contact insecticide are recommended.

3. Shoot and capsule borer (*Conogethes punctiferalis*)

Control : Spraying with Fenthion 0.075% (95 ml/100 lit) or Monocrotophos 0.075% (210 ml/100 lit) is recommended during the months of February-March and September-October as the pest infestation will be pronounced in these two seasons.

4. Root Grub (*Basilepta fulvicorne*)

Control : Collect the beetle with hand nets or sticky traps at the time of mass emergence (March-April and August-September) and destroy them. Apply Phorate granules @ 20-4- g/clump or spray Chlorpyrifos 0.04% (200 ml/100 lit) during May-June and October-November.

5. Cardamom scale (*Mytilaspis* sp.)

Control : Spray Monocrotophos or Fenthion @ 0.05% during the peak season.

Diseases

1. 'Kate' or Mosaic (Cardamom mosaic virus) – transmitted by banana aphid, *Pentalonia nigronervosa*

Control : Eradication of source of inoculum by destroying infected plants, alternate hosts once in two months and destruction of the vector by insecticide application is effective. Regular application of insecticide against cardamom thrips controls the aphids also.

2. Azhukal or Capsule rot (*Phytophthora* sp.)

Control : Thrashing and destruction of the infected parts prior to the onset of South West monsoon. Spray the shoots 2 or 3 times with 1% Bordeaux mixture with adhesive (Rosin-soda or any other sticker) by the commencement of the monsoon, continuing up to November-December. Give a drenching spray to the panicle with 1% Bordeaux mixture @ 3 litre/plant during July-August when the disease intensity is maximum.

3. Clump rot or Rhizome rot (*Pythium aphanidermatum* and *P. vexans*)

Control : Application of lime followed by ammonium phosphate or super phosphate @ 100g/clump during the last week of May.

4. Leaf blotch disease (*Phaeodactylium venkatesanum*)

Control : The fungicides, Ediphenphos (0.3%), Captfol (0.3%), Bordeaux mixture (1%), Mancozeb (0.3%) and Carbendazim (0.3%) are effective in controlling the disease.

* Package of Practices and Recommendations, KAU-1996.

Package of practices for Ginger*

Preparation of land

Clear the field during February-March and burn the weeds, stubbles, roots etc. *in situ*. Prepare the land by ploughing or digging. Construct beds of convenient length (across the slope where the land is undulating) 1 m wide, 25 cm high with 40 cm spacing between the beds. Provide drainage channels for every 25 beds on flat lands.

Planting

The best time of planting ginger is during the first fortnight of April, after receipt of pre-monsoon showers. Plant rhizome bits of 15g weight in small pits at a spacing of 20 x 20 cm to 25 x 25 cm and at a depth of 4-5 cm with at least one viable healthy bud facing upwards. Adopt seed rate of 1500 kg/ha.

Seeds

Ginger rhizomes are used for planting. For selection and preservation of seeds, adopt the following method:

Mark healthy and disease-free plants in the field when the crop is 6-8 months old and still green. Select best rhizomes, free from pest and disease, from the marked plants. Handle seed rhizomes carefully to avoid damage to buds. Soak the selected rhizomes for 30 minutes in a solution of Mancozeb and Malathion to give terminal concentration of 0.3% for the former and 0.1% for the latter. Dry the treated rhizomes in shade by spreading on the floor. Store the treated rhizomes in pits dug under shade, the floor of which is lined with sand or saw dust. Cover the pits with coconut fronds. Examine the stored rhizomes at monthly intervals and remove the rhizomes, which show signs of rotting. Provide one or two holes for better aeration.

Manuring

Apply manures and fertilizers at the following rates: FYM: 30 t/ha and NPK: 75:50:50kg/ha/year. Full dose of P and 50% of K may be applied as basal dose. Half the quantity of N may be applied 60 days after planting. The remaining quantity of N and K may be applied 120 days after planting.

Mulching

Immediately after planting, mulch the beds thickly with green leaves at the rate of 15 t/ha. Repeat mulching with green leaves twice at the rate of 7.5 t/ha, first 44-60 days and second 90-120 days after planting.

Phytosanitation

Remove weeds by hand weeding before each mulching. Repeat weeding according to weed growth during the fifth and sixth months after planting. Earth up the crop during the first mulch and avoid water stagnation.

Plant protection

Pest

1. Shoot borer (*Conogethes punctiferalis*)

Control : Spraying Malathion (0.1%) or Monocrotophos (0.05%) or Dipel (0.3%) at 21 days interval during July to October.

2. Rhizome scale (*Aspidella hartii*)

Control : Soaking rhizomes in Quinalphos (0.1%) before storing and sowing.

Diseases

1. Rhizome rot/ Soft rot (*Pythium aphanidermatum*, *P. myriotylum*, *P. vexans*)

Control : Select healthy seed rhizomes from disease free areas, treat seed rhizomes with Mancozeb (0.3%) immediately after harvest and before sowing, avoid waterlogging conditions, follow crop rotation practices involving non-host plants, drench infected buds with either Mancozeb or Copper oxychloride.

2. Bacterial wilt (*Ralstonia solanacearum*)

Control : Crop rotation, seed treatment with Streptocycline solution, selection of healthy seed material from disease free area, remove the affected plants along with soil and carefully dispose of the plant.

3. Leaf spot (*Phyllosticta zingiberi*)

Control : Spray Mancozeb (0.2%).

4. Yellow disease (*Fusarium oxysporum* sp. *Solani*)

Control : Seed treatment with Mancozeb (0.3%) or Carbendazim followed by drenching twice at the time of sowing and 15 days after sowing, crop rotation, selection of healthy seed materials.

5. Viral disease (Wheat streak mosaic virus)

Control : Rouge out infected plants and burn them immediately, give a spray with any insecticide to prevent the spread of disease spreading vector.

Harvesting and curing

For vegetable ginger, the crop can be harvested from 6 months. For making dry ginger, harvest the crop between 245-260 days. For curing, wash the rhizomes in water and remove the skin with sharpened bamboo. Spread uniformly on clean floor and allow to dry for 7-9 days, with occasional turning. Clean the adhering skin, bag and store in cool dry place.

* Package of Practices and Recommendations, KAU-1996.

* Spices production technology – ATIC, IISR – 2000.

Package of practices for Turmeric*

Preparation of land

Prepare the land to a fine tilth during February-March. On receipt of pre-monsoon showers in April, prepare beds of size 3 x 1.2 m with a spacing of 40 cm between beds.

Seed materials

Select well developed, healthy and disease-free whole or split mother rhizomes for planting. Treat the rhizomes in any of the copper oxychloride fungicides and store in cool, dry place or in earthen pits plastered with mud and cow dung.

Season and method of planting

Plant during April with the perception of pre-monsoon showers. Take small pits in the beds in rows with a spacing of 25 x 25 cm. Plant finger rhizomes flat with buds facing upwards and cover with soil or dry powdered cattle manure.

Manuring

Apply cattle manure or compost as basal dose at 40 t/ha at the time of land preparation or by spreading over the beds after planting. Apply NPK fertilizers at the rate of 30:30:60 kg/ha. Full dose of P and half dose of K may be applied as basal, 2/3 N may be applied at 30 days after planting and 1/2 N and remaining K may be applied 60 days after planting.

Mulching

Mulch the crop immediately after planting with green leaves at the rate of 15 t/ha and repeat mulching after 50 days.

After cultivation

Weed the crop thrice at 60, 120 and 150 days after planting, depending upon weed intensity. Earth up the crop after 60 days. Chillies, maize and colocasia can be grown as intercrops.

Harvesting

Time of harvest depends upon variety and usually extends from January-March. Harvest early varieties at 7-8 months, medium varieties at 8-9 months and long duration varieties at 9-10 months after planting.

Curing

After harvest, rhizomes should be washed using a jet of water to remove the mud and dirt adhered to it. Turmeric should be boiled, dried and polished. The bulbs and fingers should be boiled separately. Cooking of turmeric is to be done 2 or 3 days after harvest. Clean water should be used for boiling and heating should be uniform. Alkalinity of the boiling water helps for developing orange yellow tinge to the core of turmeric. After the commencement of boiling of water it will take 45 to 50 minutes to complete cooking of turmeric. Turmeric should be dried well and may take up to 10 - 15 days. Polishing can be done by sprinkling turmeric powder using a mechanical drum. Dried turmeric should be stored safely to avoid further absorption of moisture.

Plant protection

Pest

1. Shoot borer (*Conogethes punctiferalis*)

Control : Spraying Malathion (0.1%) or Monocrotophos (0.05%) or Dipel (0.3%) at 21 days interval during July to October.

2. Rhizome scale (*Aspidella hartii*)

Control : Soaking rhizomes in Quinalphos (0.1%) before storing and sowing.

Diseases

1. Leaf blotch (*Taphrina maculans*)

Control : Use of disease resistant varieties, spray of Mancozeb (0.3%).

2. Rhizome rot (*Pythium graminicolum*, *P. aphanidermatum*)

Control : Crop rotation, selection of healthy rhizomes from disease free areas, seed treatment with Mancozeb (0.5%) after harvest and before sowing, roughing infected plant materials, drenching infected beds with Mancozeb (0.5%), avoid water logging conditions.

3. Leaf spot (*Colletotrichum capsici*)

Control : Spray Bordeaux mixture (1%) or any other copper fungicides.

4. Storage rots

Control : Cleaning rhizomes after harvesting, air drying to reduce moisture and thereby invasion of fungi, seed treatment with Mancozeb (0.3%) after harvest and before sowing.

* Package of Practices and Recommendations, KAU-1996.

* Spices production technology – ATIC, IISR – 2000.

Package of practices for Cinnamon*

Seeds and sowing

Cinnamon is usually propagated through seeds. Sow seeds immediately after harvest on raised beds. Plant seedlings when they are six months old.

Planting

Select seedlings with green leaf petioles. Plant the seedlings in the main field when they are 1-2 years old with the commencement of South West monsoon. Planting is done in pits of size 60 x 60 cm at a spacing of 2 x 2 m. Dig the pits sufficiently early to allow weathering. Fill the pit with leaf mould and topsoil before planting.

Manuring

Apply NPK fertilizers @ 20:20:25 g/seedling in the first year and double this dose in the second year. Cattle manure or compost at 20 kg/plant/annum may also be applied. Increase the dose of NPK fertilizers gradually to 200:180:200 g/tree/year for grown up plants of 10 years and above. Apply organic manures in May-June and the fertilizers in two equal split doses, in May-June and September-October.

After cultivation

Weed regularly in the early stages of growth. Irrigate the seedlings till they get established, if there is long drought period. Prune plants when they are 2-3 years old at a height of 15 cm above ground level. Cut the side shoots growing from the base to encourage growth of more side shoots till the whole plant assumes the shape of a low bush.

Harvesting and curing

The plants will be ready for harvest in about 3 years after transplanting. Shoots of 1.5-2 m length and 2-2.5 cm diameter are fit for cutting. Harvesting is conducted during two seasons, the first being in May and the second starting in November. The correct time for cutting the shoots for peeling is determined by noting the sap circulation between the wood and the corky layer. Peelers can judge this by making a test cut on the stem with a sharp knife. If the bark separates readily, the cutting is taken immediately. Cut down the shoots in the early morning with a sharp knife to prevent breaking and splitting of cut end. Remove leaves, scrape off the brown skin. Clean and cut into pieces of convenient length. Split the bark longitudinally and peel out using peeling knife on the day of harvest itself. Dry the cylindrical pieces of bark (quills) in the sun for 2-5 days. When drying is complete, pack the barks in bundles for trade. Leaves and tender twigs can be used for extraction of oil through distillation. It takes 4.5-5 hours to distil the leaves in the country still and the recovery of oil ranges from 0.5-0.7%. Wilting of the harvested leaves in the shed up to 24 hours will increase the percentage of oil recovery.

Plant protection

Pest

1. Cinnamon butterfly (*Chilasa clytie*)

Control : Spraying Quinalphos (0.05%).

2. Leaf minor (*Conopomorpha civica*)

Control : Spraying Quinalphos (0.05%) during the emergence of new flushes.

Diseases

1. Leaf spot and die back disease (*Colletotrichum gleosporioides*)

Control : Spraying 1% Bordeaux mixture during rainy season controls the disease.

2. The other diseases of Cinnamon included grey blight caused by *Pestalotiopsis palmarum*, sooty mould caused by *Phragmocapnium* beetle and algal leaf spot by *Cephaleuros* sp.

* Package of Practices and Recommendations, KAU-1996.

* Spices production technology – ATIC, IISR – 2000.

Package of practices for Nutmeg*

Seeds and sowing

Fully ripened tree-burst fruits are selected for raising seedlings. The fleshy rind and mace are removed before sowing. The seeds should be sown immediately after collection. If there is any delay in sowing, the seeds should be kept in baskets filled with damp soil. The seedbeds of 100-120 cm width, 15 cm height and of convenient length may be prepared in cool and shady places. A mixture of garden soil and sand in the ratio 3:1 may be used for preparing nursery beds. Over this, sand is spread to a thickness of 2-3 cm and the seeds dibbled 2 cm below the surface at a spacing of about 12 cm on either side. Seeds germinate within 50-80 days after sowing. When the plumule produces two elongated opposite leaves, the seedlings are to be transferred from beds to pots.

Planting

Since the trees require shade, suitable fast growing trees like *Albizzia*, *Erythrina* etc., are planted in advance. Banana can also be grown as a shade crop in the early stages. Pits of 90 cm cube are dug at a spacing of 8 x 8 m with the onset of South West monsoon. The pits are filled with topsoil and compost or well decomposed cattle manure and seedlings are planted.

Manuring

Apply 10 kg of cattle manure or compost per seedling during the first year. Increase the quantity gradually till a well grown tree of 15 years and above receives 50 kg of organic manure per year. Apply NPK @ 20:18:50 g/plant during the first year. This may be doubled in the next year. Gradually increase the NPK dose to 500:250:1000 g/plant/year to obtain full dose from the 15th year onwards.

Harvesting

Fruits are available throughout the year but the peak period of harvest is from December to May. When fruits are fully ripe, the nuts split open. These are either plucked from the trees or allowed to drop. After dehusking, the red feathery aril (mace) is removed, flattened out and dried slowly in sun for 10-15 days. The nuts are dried for 4-8 weeks till the kernel rattles within the shell.

Plant protection

Pests

1. Black scale (*Saissetia nigra*)
 2. White scale (*Pseudaulacaspis cockerella*)
- Control : Spraying Monocrotophos (0.05%)

Diseases

1. Shot hole (*Colletotrichum gloeosporioides*)
2. Fruit rot (*Colletotrichum gloeosporioides* and *Botryodiplodia theobromae*)

Control : The disease can be controlled by spraying 1% Bordeaux mixture.

The other disease include Leaf blight (*Botryodiplodia theobromae*), Leaf spot (*Alternaria citri*), Sooty mould (*Phragmocapnius beetle*) and Algal leaf spot (*Cephaleuros* sp.)

* Package of Practices and Recommendations, KAU-1996.

* Spices production technology – ATIC, IISR – 2000.

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VARIETIES OF SPICES

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