CHAPTER IV

AN OVERVIEW OF PEPPER CULTIVATION AND PROTECTION
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4.1 Introduction

All over the world, India is well known as the "Home of Spices". Spices constituted an important group of agricultural commodities, which since antiquity have been considered indispensable in the culinary art of flavoring of foods. Some are also used in pharmaceutical, perfumery, cosmetics and several other industries. Besides, they play quite a significant role in our national economy and in the national economies of various spices producing exporting and importing countries of the world.

Before independence, India was holding a virtual monopoly position in the cultivation, production and export in pepper. The important producers of pepper are the six tropical nations namely Indonesia, India, Brazil, Malaysia, Sri Lanka and Thailand. In 1950, 66.32 percent of the world production of pepper was in India. However, production of pepper in other countries increased by the year 1978 and consequently India's share in the world production declined to 29.62 percent.

In medieval time, the world India conjured up a vision in the minds of foreigners as a land of maharajas, diamonds, fine textiles, ivory and of course, spices. In ancient times, spices ranked with precious stones in the inventory of royal possessions and were monopolized by the few. Spices determined the wealth and policies of nations and also played an important role in ancient medicines. The cultivation and trade of spices in India has a hoary past. It is as old as the human civilization itself. The innumerable references to Indian spices in Vedas, ancient literatures and travelogues stand testimony to this fact. References are made about the Indian spices and their uses in "Vedas" (6000 BC) by 'Manu' the lawgiver (4000 BC), by 'Babylonians' and 'Assyrians' (3000 BC) and Old Testament (1000 BC) of the Bible.

Valmuki in his epic the Ramayana refers to a dish called 'meet pilaf' in which spices were important ingredients. The foreign travellers Hiuen-Tsang (629 AD), Masudi
of Baghdad (890-956 AD) and Abdul Feda (1273-1331 AD) have referred to the Indian spices in their travelogues.

Spices were inducements for war, voyages, expeditions and for romances too. The Europeans' demand for spices and their desire for spices trade were mainly responsible for Christopher Columbus to set out on a voyage to find the sea route to India, but he entered up with the discovery of America in 1492. Vasco-da-Gama, anchored his ship on May 17, 1498 at Kappad, a few kilometers north of Calicut in search of spices. The Zamora of Calicut welcomed him and he established spices trade between Portugal and Malabar. This enabled Portugal to secure monopoly of spices trade for nearly a century, until ousted by the Dutch. The Dutch reigned supreme in spices trade there after. When they enhanced the price of pepper by five shillings per pound 24 merchants in London instantly promoted a rival firm and gradually established it as the East India Company. This led India to become a colony of British imperialism for over 300 years.

Christopher Morely called pepper, “The king of spices” and cardamom, “the Queen of Spices” Marco polo in 1298 AD observed that pepper grew in abundance in India. Abber Razak in 1442AD wrote that from Calicut vessels continuously sailed for Mecca landed with pepper. The Greek Philosopher Thephrastous (327 –287 BC) called the “Father of Botany”, recognized two types of pepper namely Black pepper (piper nigrum) and Long pepper (piper longum), both of which were used by the Greeks and Romans.

Countries before the birth of Greek and Rome, sailing ships carried Indian perfumes, spices and textiles to Mesopotamia Arabia and Egypt. It was the lure of these commodities, which brought many sailors to the shore of India. Long before Christian era, the Greek merchants thronged the market of south India buying spices among other precious things. Epicurean Rome was spending a fortune on Indian spices, silks, brocades
and cloth of gold. The Parthian wars are believed by Rome largely to help often the trade route to India. It is also said that there might have been no expeditions to the east without the lure of Indian spices and her other famed products.

Today when spices cost so little, it seems unbelievable that they were once a royal luxury and men were willing to risk their lives in quest of them. In a nutshell, the fascinating history of spices is a story of adventure or modifies the flavour of their food. Spices were also flavour disguisers, marking the taste of the tainted food that was still nutritious but if unspiced would have been discarded. Some spices also used for preserving foods like meat for a year or more without refrigeration. In the sixteenth century, cloves for instance were among the spices used to preserve food without refrigeration. Cloves contain a chemical called eugenol that inhibits the growth of bacteria. It is still used to preserve some modern foods like Virginia ham.

In 1951, the Planning Commission brought to the notice of the Ministry of Food and Agriculture Government of India, that the attention paid to the development of spice crops and cashew nut, which were very important dollar-earning crops of South India was very inadequate. Accordingly, the Ministry of Food and Agriculture constituted a high-level committee, the Spices Enquiry Committee, to enquire and obtain basic information needed to study the situation with a view to considering what specific measures were necessary for developing the production and marketing of spices of immense commercial value.

4.2 Economic Importance of Pepper

Black pepper or “Kalimirch” is the most important spice of the world and so is of India. It therefore is called the “King of Spices” as their volume of international trade of it is the highest among all the spices known. In India too in 1984–85 it earned us the
highest amount of foreign exchange (605.1 million rupees) of out of the 37.04% of the total exported spices.

Black pepper (piper nigrum) is the most important spice originated from western Ghat. India has the largest area under this crop. However over productivity is low compared to other producing countries. The reasons for low productivity are: Continuous cultivation of poor yielding vines, Existence of senile and unproductive wines, Losses due to pests, disease and drought, Inadequate supply of quality planting material, Non-adoption of appropriate agronomic practice, Poor transfer of technology and Price fluctuation.

In India, black pepper is cultivated in the states of Kerela, Karnataka, Tamil Nadu, Andhra Pradesh, Maharastra, Orissa, Pondichery, Goa, Northeastern states and Andaman Nicobar Islands. More than 95 per cent of area and production is in Kerala. Black pepper is a plant of humid tropics requiring adequate rainfall and humidity. The crop tolerates temperatures between 10° c and 40°. It grows successfully between 20 North and south latitude. In India, more than 100 cultivars acquired their name form place of its cultivation or specific traits or the port through which it is exported. In kerala, karimunda is the most popular variety grown in all the districts, while panniyar-1 is also grown to a limited extent.

4.3 Living and non-living standards for Pepper

In India live support is common. All though black pepper grow on any support trees, it is necessary to raise selective trees to cultivate this crop as monocrop in plantation scale. A live support should be fast growing with less branches, should tolerate periodical pruning, it should not produce crop for resources and should not compete with less branches, should tolerate periodical pruning, it should not compete with crop for resources and should not produce allelopathic chemicals. For good live supports, plants should be
selected which are quick growing, have permanent rough bark, will stand up to heavy pruning, have deeply penetrating roots so as to not to compete unduly with the pepper and are leguminous species. The best plants for live support are Erythrina Indica (Indian Coral Tree), Garunga Pinnata (Indian gum tree), Spondias Mangifera (Hog Plum), Mangifera Indica (Mango), Strychnos nux-vomica (Nux vomica), Caria arborea (Indian gum tree). Other trees like Cola Acuminata (Cola), Terminalia spp. (including Jordan almond), Pterocarpus marsupium (Gammalu), Grevillea Robusta, Silky Oak etc., are suitable living supports for black pepper vines in South India. Artificial or non-living supports are in common use. They are generally of selected hardwood and are expected to last the life of their plantation. Alternatively, where sound hardwood poles are not easily available, concrete posts have been used.

**Shading**

The regulation of shade is a complicated problem but it has two objects in view; maintaining shade during the hot weather to keep the soil cool and letting in sunlight during the cool weather to encourage the production of flowers and fruit.

**4.4 Varieties in Pepper vines**

There are over 75 varieties of pepper grown in the county and a brief description of some of the popular varieties is as under.

**Arakkulamunda:** - It is a moderately good and regular bearer from the central area of kerala. It yields regularly and comes to maturity earlier than most other cultivars.

**Balancotta:** - It has largest leaves. The vines are large growing to the top of large support trees like mango and jack tree. The spikes are medium long to long setting moderately good.

**Cheriyyakaniyakkadan:** - Leaves are small, elliptic, spikes are of medium, popular type, bears regularly, and yields heavy.
Cheriakodi: - leaves are narrow, dark green spikes are short, with dark or pale green fruits, which are the smallest among all types.

Daddagya: - Leaves are broad and spikes are long, curved. The fruits are large among Mysore type. It is uniform in yields, esteemed for making white pepper.

Kalluvally: - It gives regular yield. Leaves are medium and have a characteristic twisting due to very thick setting. It is a regular bearer and reportedly tolerant to water stores and diseases.

Kaniakkadan: - There are four different types- Cheriyakaniyakkadan, Valia Kaniakkadan, Karutha kaniakkaden and Valutha Kaniakkadan. The first two are more important and the other two are moderate yielders.

Karimcotta: - Leaves are large, dark green and spikes are short, Curved with closely set large, dark green fruits. It is hardly regular bearer and good yielder.

Karimunda: - Black tender shoots and dark green leaves and berries. It is the most popular cultivator grown throughout Kerala. Its flowering is in May-June, concluding with the monsoon. This cultivator is of medium maturity and is suitable for inter cropping and also for high density mono cropping.

Kathiravally: They are moderately high yielder but alternate bearer. The ovate leaves are medium large. Spikes are very long and slender and flowers are bisexual. Berries are medium large having high driage.

Kottanadan: - It is vigorous growing bisexual type having large, broad, ovate leaves, long spikes, high fruit set and medium size berries. The cultivator is a high and regular yielder.

Malligesara: - This is usually intercropped with areca nut. It is of two types Karimalligesara and Bilimalligesara. It is of moderate yielder having medium – large leaves and spikes.
Narayakkodi:- The leaves are small to medium, ovate and have got a characteristic twist in leaf blade. It is a regular average yielder. This is more tolerant to food not caused by phytophthora than most other cultivars.

Panniyur 1:- This is the only hybrid variety under cultivation now, developed from a cross between uthirankotta (female) and Cheriyakaniyakadon (male) at the pepper Research Station KAU. The plant is vigorous and has large cardate leaves. Spikes are long, berries are bold and filling is good. It is also an early bearer, having medium maturity. This variety is however not very suitable for intercropping. In shade and yield seems to come down there is more of vegetative growth.

Uddaghere: - It is a good yielder and regular bearer. The leaves are medium large and spikes long with good setting. It has high driage and produces good quality dry pepper. The cultivar is commonly intercropped in areca nut and is found to be good yield, indicating its tolerance to shade.

Valuthanamban: - It has medium large leaves, medium long spikes, and a moderate yielder.

In addition to above, there are many other varieties, which are less common in cultivation. Some of these are Kottavally, Chumama, Koruvilanchy, cholamundi, Malamundi, Jeerokamundi, Perumkodi, Thulakkodi, Uthirakotta, Arasinamoratta, Vokkalgunja, Doddagya, and Doddaate etc.12.

4.5. Types of pepper

Black Pepper; If the end product is to be black pepper, the berries are piocked while still immature and then dried. The entire berry or peppercorn is used for this spice. As the berries dry, the skin wrinkles and turns to deep brown or black. When ground, the peppercorns yield a power of light and dark particles - a combination of the dark skin and light coloured core.
White Pepper: White pepper is produced by removing the dark skin and using only the core. First the berries are left to ripen longer on the vine. This makes it easier to remove the skin. After they are picked, these mature berries are soaked in running water for about eight days to loosen the skin as much as possible and then rubbed to remove it entirely. The cores or white pepper corns are then put out in the sun to dry.

Dried green Pepper: This product has good flavour and reconstitution characteristics and can replace canned green pepper in brine or vinegar. This product is used for garnishing meat preparations.

Malabar Black Pepper: It is highly aromatic, with a distinctive fruity bouquet. It tests high in steam volatile oil and non-volatile Methylene Chloride extract, properties responsible for its excellent aroma, flavour and pungency.

Tellecherry Black Pepper: It is characterised by the spice trade calls "bold" berries - large, very regular and good-looking specimens. This traditionally commands the highest price among peppers.

Lampong Black Pepper: The berries are small and thin shelled and are suitable for machine decortication. This pepper compares with Malabar in pungency and flavour, testing high in steam volatile oil and non-volatile Methylene Chloride extract.

Sarawak Black Pepper: It is a very light coloured product, mild in flavour, low in volatile oil, non- volatile extract and Methylene Chloride extract.

Brazilian Black Pepper: It has a relatively smooth surface and characteristic appearance. The outer skin is black and the centre of the berry very white, causing a sharp black and white contrast in the appearance of the ground pepper. It is low in steam volatile oil, non-volatile extract and Methylene Chloride extract.

Ceylon Black Pepper: It is a pepper, which is characteristically high in volatile and non-volatile oil content, which makes it flavoured by the extraction industry.
Muntok White Pepper: It has its own characteristics aroma and as with white pepper in general, has a relatively mild flavour.

Brazilian White Pepper: This pepper when ground is lighter in colour and less pungent

Sarawak White Pepper: The major share of Sarawak's pepper production is kept for white pepper.

Workala Morata: This has longish and light green leaves, it is only a moderate bearer. The spikes are short. The berries are large and are fancied for making white pepper. The flowers are female.

Arisina Morate: This is very much like Kari Morata but differs in colour of the ripe berries, which are Yellow.

Kari Morata: This is a modest yielder, but crops uniformly every year. The spikes are short and curved. The berries are rather small and dark green in colour.

Doddaga: This is a broad leafed variety. The berries are the largest among the different varieties and red in colour when ripe.

Mallingesara: This is a large leafed variety. It is one of the best yielders. The spikes are about 4 inches length and well filled. The berries are rather small and red when ripe and are not shed.

Tattisara: This is a good yielder, has narrow long leaves, is very dark green colour and the berries are 4 to 5 inches length. Ripe berries are red in colour and somewhat larger in size.

Kallu Valli: This is one of the best varieties, which comes from Malabar. The berries are medium in size and become red when ripe. The flowers are bisexual.

Balameota: This is another of the good varieties from Malabar. It is somewhat broader leafed and has long and well filled spikes. The berries are slightly smaller than Kaluvalli.

Cheriakodi: This is also a Malabar Variety. The berries are very small and the flowers are female.
4.6. Diseases

The important factor contributing to low productivity of pepper in our country is the severe incidence of diseases. The most important among diseases of pepper in India are Quick wilt (foot-root), Slow wilt (pepper yellow) and Fungal pollu (anthracnose). Phytophthora foot rot caused by Phytophthora capsici is most serious disease occurs during June to September. It is soil-borne and infects leaves, stems and roots. Bordeaux mixture (1%) may be sprayed during June and next by August-September drenching with copper oxychloride (.2%) and systemic fungicide like potassium phosphonate (.3%) may be applied both as a foliar spray and soil drench @ 5 litre/vine twice during monsoon period to check the Phytophthora, Bio-control agents like Trichoderma and Gliocladium also effective against this diseases. Regular phyto sanitation measure is necessary. Little leaf and phyllody disease caused by virus and mycoplasma like organisms also cause considerable damage to the crop. Removing infected vines and destroying will check the diseases spread.Divakaran Policy (1984) has published bibliography on pepper diseases. Seventeen fungi have been recorded affecting pepper in India. Of these, only a few have been identified as causative organisms of major disease.

Symptoms

All parts of the plant at various stages of growth are susceptible to these diseases. Three types of symptoms i.e leaf-rot, collar-rot, and root-rot are generally observed in quick wilt infected plants. The first visible symptom on leaf is a water-soaked lesion in the infected area. Within 2 days, the water soaked areas change colour and develop into necrotic sports surrounded by a yellow halo. The lesions expand rapidly and cover a large area of leaf. Subsequently the infected region shows a wet rotting and causes defoliation. Immature leaves are more susceptible than mature ones and infection is more common on the lower surface of leaves.Turner 1969.
Collar-rot is the fatal type of infection in pepper. It appears on vines at ground level and above up to about meter height. The initial symptom is the appearance of water-soaked lesions similar to those on leaves. On the stem and branches lesions spread and affected area are rotted within 8 – to 15 days. In advanced stages, the affected tissues emit a foul smell. Infection of the collar region, progresses towards the underground and portions of stem. By this time, the entire plant collapses. Flaccidity, dropping, and defoliation of leaves are the marked symptoms during the progress of diseases, when infection is on stem and main roots (Nambiar and Sarma, 1977).

**Control measures:**

- Before the onset of monsoon, good sanitation measures should be taken in pepper garden by removing all dried vines and leaves.
- Good drainage should be provided
- After receipt of a few early showers from the south-west monsoon, drench the soil around then base of vine to a radius of 30 to to 45cm. With 0.1% solution of methoxy ethyl mercuric chlorde (Agallol G 3% metallic mercury 1 g in one litre water or Arectan 6% metallic mercury 1 g in 2 litres of water) at the rate of 5-10 litres according to the size of the standards. Alternate to the above mercuric fungicides are the application of Bordeaux paste.
- Spray vines with 1% Bordeaux mixture during the onset of the south-west monsoon once and again during the peak period of monsoon. A third spray of Bordeaux mixture may also be given during the southwest monsoon itself if it is prolonged or during the northeast monsoon for best results.
- Pasting the main stem up to 1 to 1 ½ m above the soil level with Bordeaux paste (10% Bordeaux mixture) during the onset of monsoon will protect the stems form infection.
As the spraying and pasting is done during the heavy rains, it is always better to have good adhesive preferably resin-washing soda preparation with Bordeaux mixture. This adhesive has got good sticking and quick drying properties.

4.7. System of cultivation

There are three system of cultivation or cropping. They are Mono cropping, Mixed cropping and Companion cropping. In India, traditional practice has been to cultivate pepper as a monocrop or mixed crop on live standards specially meant and raised for growing pepper. Due to several socio-economic factors, monocrop cultivation of pepper has become extinct. For some times in the past our pepper production was mainly from mixed cropping gardens, but we have not seriously thought of growing pepper as a companion crop on the millions of trees growing in the homesteads of Kerala; the cosmopolitan coconut trees is invariably grown in every house compound.

Companion cropping of pepper has several advantages over mixed cropping. The system relieved cultivators of the burden of raising separate trees for growing pepper. No separate cultural operations are needed for pepper-vine, as operations for the main crop will cater to the needs of companion crop too. Also the system leaves interspaces entirely free for raising other crops. But it must be maintained here that management techniques to suit main tree will have to be adopted to make the venue a successes. These management practices are neither costly nor difficult to adopt; only some slight deviation from the traditional system are called for.

Climatic Conditions for pepper plant

Pepper is a plant of humid tropics and requires adequate rain fall and humidity. It is grown successfully between 20° north and south latitudes and from sea level to up to 1500 meters above mean sea level. The crop tolerates temperatures between 10° c and 40° c. A well-distributed annual rainfall of 125 – 200 cm is considered ideal for pepper^{13}. 
Site Selection and Soil Requirements for pepper plant

Pepper can be grown in a wide range of soil though in its natural habit it thrives well on red laterite soil. When grown in sloppy land the slopes facing south should be avoided. Generally, eastern slopes are selected so that vines are not subjected to heat of southern sun during summer; filtered shade provides the desired microclimate for healthy growth of vines.

Selection of planting materials

Selection of a variety suitable for locality and for farming system adopted is the first step; panniyur 1 is suitable for cultivation in comparatively open places. However, where there is heavy shade as in most homesteads another suitable variety has to be selected. Selection of a suitable variety alone is not sufficient. The productivity of individual vines has to be ensured before selecting vine as a mother plant. The performance of mother plant will have to be studied at least for 1 season and preferably for 3 years. The age of the mother plant also in important young vines, produced healthy robust and vigorous runner shoots, which easily strike roots and establish. It will be preferable to limit the upper age of mother vines as 15 years in most cases it can be relaxed. It is not a healthy practice to collect runner shoots from very young vines, below the age of 5 years. It can be done from fully-grown mother vine of high productivity in the age group of 5 – 10 years or maximum 15 years depending up on the variety and vigor of the plant.

Selection of varieties

Over 75 cultivars of pepper are being cultivated in India. Karimunda is the most popular. Panniyur 1 the only hybrid pepper was evolved at the pepper Research Station. Panniyur (kerala), Uthirankotta, and Cheeriyanakinyakkadan as its female and male parents. The hybrid is outstanding in its yield potential with an average 2.2 Kg. of black pepper
(6.3 Kg. From green pepper) obtained from an experimental plot at panniyur. However, under extensive shade and higher dosage of nitrogen the hybrid shows a tendency for increased vegetative growth and corresponding decrease in yield.

**Propagation**

Pepper develops three types of aerial shoots. They are Primary stem with long internodes and with adventitious roots, which cling to standard, Runner shoots which originate from the base of vines, they also have long internodes these shoots strike roots at any node and Fruit bearing lateral branches with limited growth. Cuttings are raised mainly from the runner shoots through terminal shoots can also be used. Cutting from lateral branches are seldom used since in addition to reduction in the number of fruiting shoots, the vines from them are generally short lived and bushy in habit. However, rooted lateral branches are useful in raising pepper in pots.

Long pepper is propagated through seeds suckers or cuttings or by layering of mature branches at the beginning of rainy season. The establishment percentage of three to five nodded rooted cutting is reported to be very high. The suckers establish very well in heavy rainfall areas. Vine cuttings can be rooted in polythene bags filled with the common pot mixture. The nursery can be raised during March and April. In the nursery, mealy bugs attack the roots of the rooted cuttings.

The land should be ploughed two to three times and levelled properly. The pits are filled with soil mixed with 100 g per well-decomposed farm yard manure or compost. In order to avoid water stagnation in the pits and beds channels are made to drain excess rainwater. The crop needs heavy manuring. From the second year of planting and the subsequent years farmyard manure at 20 tones per hectare should be spread uniformly in beds and covered with soil.
Protection of rooted cutting

Runner shoots from high yielding and healthy vines are kept coiled on wooden pegs fixed at the base of vine to prevent shoots from coming in contact with soil and striking roots. The runner shoots are separated from vine in February -March and after trimming leaves cutting 2 -3 nodes each are planted either in nursery beds or in polythene bags filled with fertile soil. Adequate shade is to be provided and irrigation be given frequently. The cutting will strike roots and become ready for planting in May - June.

Replanting and under planting

A scrolling of the yield data of pepper vines at the pepper Research Station Ponniyur from 1955 to 1980 showed that subject to parietal differences the plants gave maximum yields from 8 to 15 year after plenty and thereafter the yields declined. But about 20 years after planting most of the plants started showing symptoms of declined. The hard reality that pepper vines will give satisfactory yields only upto 15 years.

Manuring/ Fertilizer Application

Inspite of several fertilizers popularization companies’ use of chemical fertilizers has not yet caught up with pepper cultivation. Many cultivators are under the wrong notion that chemical fertilizers are unnecessary for pepper vines or even harmful. This might have been true in the past when soils were virgin and fertile. However, recent field experiments it has been undoubtedly and conclusively proved that judicious and balanced fertilizer application increases yields substantially. The fact indicates that balanced fertilizer application has to be made a regular feature of the pepper cultivation in the country not only for maximizing production but also for healthy survival.

The fertilizer recommendation adopted at present is for a vine per year. Only one third of this dosage should be applied during the first year. The full dose is given from
third year onwards. It is better to apply fertilizer in two split doses one in April - May and
the other in August - September. The fertilizers are applied at a distance of about 30 cm
all around the vine and at a depth of about 15 cm and the soil is forked after application.
Besides organic manure in the form of cattle, manure or composite is given at the rate of
10 Kg. Per vine in May. Application of lime at the rate of 500 gm. per vine during April –
May in alternate years is also recommended.

The productivity is low also because of the continued use of old cultivation
methods and shortage of well-rooted cuttings of high yielding varieties. Loss of yield is
also because of advent by pest and diseases, like slow —will, wilt, etc. the most devastating
being the “quick wilt “(phythophthora) which spreads rapidly destroying annually a large
number of productive vines. To fight the spread of quick wilt the Kerala Government
launched an intensive programme costing Rs. 2 crores in association with the Spices
Board. For the control of “little leaf”, disease in pepper the Spice Board has set up
demonstration farms in Whynad and Idukki districts of Kerala for training the formers. A
soil borne fungus “phytophthira capsics” causes quick wilt, also known as foot-rot collar-
root and root-rot. It is prevalent in all pepper-growing countries in the world.

Irrigation

Normally irrigation is not common in black pepper production. However in sever
drought and summer; irrigation is practiced to protect the vine. Irrigation is applied at
basin directly or through drip or through pitcher-pot method. Application of 100 litres of
water per vine once in a week or application of 8-10 litres per vine daily through drip is
sufficient for grown up vine. If irrigation is given, it should be stopped one month before
flowering. General observation is that stress induces more flowering.
4.8. **Plant protection**

**Insects**

The 'pollu' beetle (*Longitarsus nigripennis*) is the most serious pest causing 30-40% crop loss. The incidence of the pest is higher in plains and at altitudes below 300 m. the adult beetles, grub feed, and damage tender shoots, leaves and spikes. The infected berries turn yellow and finally black and crumble when pressed. Spraying endosulfan or quinalphos (.05% each) during June-July and September -October is effective. Top shoot borer, leaf gall thrips and scale insects are other important pests. Spraying of monocrotophos (.05%) or dimethoate (.05%), check the pests.

**Weeds**

In black pepper plantation depending on weed intensity, slash weeding is practiced. Growing cover crops suppress the weed growth. Wild creepers grow along with pepper and smoother the crop. Such weeds should be removed periodically.

**Harvesting**

The spikes are ready for harvest when they start yellowing and in a spike, one or two berries become red. At this stage, spikes are removed from the vines. The spikes are kept as such for a day or so thereafter berries are removed by rubbing, scrubbing, or trampling and dried in sun or spikes are directly dried in sun for a few days on mats or on clean concrete floor, they are turned over and later berries are removed. When completely dry the outer skin of barriers become dark brown to black and shrivels. In Kerala where 95–96% of pepper produced in India is grown plants flower in May – June. The harvest season extends from November to January to March in hills. Flowering in pepper starts during May – June. The crops take about six - eight months from flowering to maturity. Harvesting starts from December and continues in stages up to February. Harvesting is

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done with the help of ladder. During harvesting the whole spike is hand picked when one or two berries in the spike turn right orange or purple. The berries are separated from the spikes and dried in the sun for seven to ten days. The average yield of black pepper (dry) obtained from the vine under ideal management conditions is two Kg/year. However, yield varies with age and vigor of vine, soil climate, and management.

4.9. Yield

Generally, 100 kg of fresh berries yield about 26 – 39 kg of black pepper of commerce. The yield varies widely in different pepper producing areas depending upon elevation, temperature, distribution of rainfall, soil fertility, cultural practices, type of variety, and age of the vine. Low productivity and high production cost make Indian spices costlier in the world market. Though India is the leading producer of black pepper, our productivity is very low compared to other pepper producing countries like Thailand and Malaysia. In India, pepper is grown as a mixed crop on live standards with a density of 560 vines/ha whereas in Malaysia, it is being grown on dead standards with a density of 5000 vines/ha. The estimated average cost of production /kg of black pepper excluding rental value of land at all India level is Rs.22.75/ kg. Among the Indiaa states, Kerala has the highest cost of production of 35.59/kg (1998-99). Labour cost which accounts for more than 60% of the total variable cost has increased by about 400% in the predominantly spice growing state of Kerala between 1980 and 1995 while the increase was only 47% in Malaysia during the same period\textsuperscript{14}

4.10. Long pepper:

Long pepper in unripe spikes of Piper longum Linn is a slender aromatic perennial climber belonging to the family piperaceae. The spikes of this plant contain alkaloids piperine (4-5%) and piplatin. The roots contain alkaloids piper longuminine (0.2-0.25%)
and piper longumine (0.2%) besides piperine. Besides the dried spikes on steam distillation yield 0.7 % essential oil with spicy odour resembling that of pepper and ginger oil.

The root is pungent, heating, stomachic, laxative, anthelmintic, carminative, improves the appetite; useful in bronchitis, abdominal pains, diseases of the spleen, tumours, ascitish; causes biliousness. The unripe fruit is sweetish cooling useful in biliousness. The ripe fruit is sweetish, pungent; stomachic, aphrodisiac, alterative laxative, antidiarrhoeic, antidyserteric; useful in vata and kapha asthma, bronchitis, abdominal complaints, fevers, leucoderma urinary discharges, tumours, piles, diseases of the splint, spleen, plains; inflammations, leprosy, insomnta, jaundice, hiccough, tuberculous.

It flourishes well in a rich well-drained loamy soil. It is also cultivated on a large scale in limestone soil below the chirapunji region. Laterite soils rich in organic matter contents with good moisture holding capacity are also suitable. The plant requires a hot moist climate and an elevation between 100 and 1000 m for its cultivation. At still higher elevations yield will be less. It can be successfully grown even in areas which receive heavy rainfall with high relative humidity.

4.11. Black Pepper

Black pepper is the most important spice originated from western Ghat. India has the largest area under this crop and also the largest producer (55000 MT). However, our productivity is low compared to the other producing countries. The reason for the low productivity is low productivity are Continuous cultivation of poor yielding vines, Existence of senile and unproductive vines, Losses due to pest disease and drought, Inadequate supply of quality planting materials, Non-adoption of appropriate agronomic practice, Poor transfer of technology and Price fluctuations.
In India, black pepper is cultivated in the states of Kerala, Karnataka, Tamilnadu, Adhra pradesh, Maharashtra, Orissa, Pondicheery, Goa, Northeastern States and Andaman and Nicobar Island. More than 95 percent of area and production is in Kerala. It is cultivated as monocrop using live stakes in plantation and grown in home gardens. Trials on shade trees on in coffee and tea plantation, and on large avenue trees by forest departments, grown in areca nut and coconut plantations, and to rise in the price of pepper more attention is paid to this crop but the farmers and new planting are also coming up.

Black pepper is a plant of humid tropics requiring adequate rainfall and humidity. The crop tolerates temperatures between 10 c and 40 c. It grows successfully between 20 North and South latitude. In India, more than 100 cultivars of black pepper are being cultivated. These cultivars acquired their name from place of its cultivation or specific traits or the port through which it is exported. In Kerala and Karnataka is the most popular variety grows in all the districts, while Panniyur-1 also grows to a limited extent.

Mulching around the pepper vines with any organic materials especially green leaves @10 Kg./vine to a radius of 1 meter is required. Mulch not only controls the weeds in basins but also conserves soil moisture and checks soil temperature raise during summer. Organic mulch provides nutrients to the crop after decomposition. Once applied mulch is decomposed, mulching should be repeated.

For proper growth and development of crop and higher yield, application of manures and fertilizers are essential. Combined application of organic manures and inorganic fertilizers are advantageous. For soil poor in fertility status, a dose of 140:55:270 NPK (300 g Urea, 340 g Super phosphate and 450 g Muriate of potash) per vine per year are adopted along with 10 Kg. FYM. for first year (on the year of planting) 1/3 of the dose applied during September, for second year during May-June, other September – October and the third year and above, full dose in two split are
recommended. Fertilizers are applied at a distance of 30 cm all around in vine, slightly ranked up, and covered with mulch. If soil is highly acidic 500 g lime per vine also applied in alternate years.

4.12. **White pepper**

White pepper is the whit einner corn obtained after removing the outer skin or pericarp of the ripe pepper berries (piper nigrum L). It is preferred over black pepper by the people of certain countries as its colour matches with light coloured food preparations, sauces and soups. White pepper gives modified natural flavour to the foodstuff and it imparts pungency. World over 30,000MT to 40,000 MT of white pepper is produced and consumed annually. Major producers are Indonesia, Malaysia and Brazil. Chief consumers of white pepper are West European countries, USA and Japan.

4.13. **Bush pepper**

An experiment was conducted at Horticultural Research Station, Pachiparai to evaluate the performance of bush pepper both under the pot and field condition. The variety used is Panniyur – 1. Pechipara is situated at 76M MSL and has a maximum temperature of 36 c and minimum temperature of 23 c which receives rain fall of 200 cm per annum with a humidity ranging from 65 to 85 per cent. The growth and yield of bush pepper were monitored from time to time. The bush pepper grown in the field and pots were properly nourished with Farmyard manure @ 5 Kg. Per bush along with 100 gm of N, 140 gm of P and 100 gm of K. The pot bush pepper was watered regularly during non rainy days whereas the bush peppers grown in the field were grown as rainfed crop. The bush pepper grown in pot has longer spoke length and grains per spike but whereas the bush pepper grown in the field condition has more number of spikes / bush and yield of green pepper and dry pepper is also higher. This is because of the increase in number of spikes per bush, which has increased the weight of pepper directly. This practice of
growing bush pepper in the field would reduce the cost of plucking and also the standard maintenance cost. This could be grown as an inter crop in the coconut gardens, arecanut gardens, cocoa gardens and bush crops.

Bush pepper can be grown anywhere irrespective of the season and location, in green houses and fields. It is suited to grow as potted plants in rooftops, as ornamental plants in courtyard; even as cash crop in the backyard and intercrop in coconut gardens. Lateral branches of any black pepper variety can be rooted and grown as bush pepper. However, the seedlings raised from bush pepper will grow as vines. Bush pepper usually maintains the bushy nature throughout the growth period. From the very first year onwards bush pepper starts yielding. A third year old bush pepper yields about 1.0 kg green pepper. A bush continues to yield for 8 – 10 years. Further bush pepper yields green pepper throughout the year since the flowering is not season bound as in the vines. It is an ideal source of green pepper city dwellers as one can easily maintains few potted bush pepper in their roof tops or courtyard.


Plant more vines in homesteads/ small holdings as intercrop with coconut, arecanut and other crops. Even if only coconut trees alone are considered there is nearly 1 million hectares of land which can be brought under pepper or nearly 160 million ready –made coconut standards in India. If to this the total number of areca nut palms available in the country are added, it will come with some astronomical wild estimates of possibilities of increasing number of pepper-vines, thereby significantly augmenting pepper production.

In all old plantations, all old vines bearing low yield should be replaced with high-yielding varieties. What is required is a concerted effort by both plants and growers and the state and central government departments concerned with the development of spices.
4.15 Rapid Multiplication of Black Pepper

Recently a very efficient propagation technique has been developed in Sri Lanka and it has become increasingly popular in India. For increasing the black pepper production in the country, large scale replanting of the senile and poor yielding vines and extensive new planting are required. The improved varieties emerging from breeding programmes also need large-scale multiplication to meet the demand. All these programmes require production of planting materials in the shortest time possible. The conventional method of production of planting materials in pepper involves use of 2-3 noded cuttings of runner shoots raised in polybags in the nursery.

As per the new method, both runner and terminal shoots are grown over the rooting medium filled in a bamboo/PVC split piece. As the vines grow, the nodes get rooted and each of these nodes is later separated and planted in individual polybags. For this purpose, select a suitable area having good drainage. Provide shade either by putting coir mats (nursery mat) for a pandal or by growing shade trees like Subabul. Take trenches 30 cm wide, 60 cm deep and of convenient length. Fill it with soil-sand-farmyard manure mixture (1:1:1). Add for every metre 1.5 kg lime and after 15 days 150 g urea, 100 g Superphosphate, 125 g muriate of potash and 25 g magnesium sulphate. Water copiously and leave it for a week.

Select bamboos of 7-8 cm diameter, cut them into 1.5 m long pieces and split them into halves, keeping the septa intact. A coating of coal tar prolongs the life of bamboo pieces. Arrange the bamboos at an angle of 45° alternatively on straight wooden poles or strong support. Tie the bamboos with coir. Plant the rooted cuttings in the trench, one for each bamboo split. Instead of bamboos, split PVC pipes of approximately the same diameter fitted with artificial septa provided at 30 cm distance can be used.
As the vines start growing, fill the bamboo splits with rooting mixture composed of farmyard mature-coirdust-sand in equal proportions. Tie each vine carefully to the bamboo using banana fibre, so that every node is in contact with the rooting medium. For rapid growth, if necessary add a nutrient solution consisting of Urea (1 kg), super phosphate (0.75 kg), muriatre of potash(0.5 kg) and magnesium sulphate (0.25 kg) in 250 litres of water. Drench each vine once in fifteen days with one litre of this solution. When the vines reach the top of the bamboo, nip off the tip and crush the vine at the base of 3rd or 4th node from the ground, to activate the buds. After 7-10 days, cut the vine at the crushed point and remove it from the bamboo with the roots intact and with the adhering soil. Cut the vine into single noded pieces. Plant each piece in polythene bag or sleeve (open at both ends) filled with the mixture consisting of soil-sand-farmyard manure (3:1:1). Keep the roots straight downward when planting.

Arrange the cuttings in a well-shaded area or in a shed and give a spray of 0.2% copper oxychloride or 1.0% Bordeaux mixture. When buds start growing, transfer them to a partially shaded area. Apply the fertilizer solution mentioned earlier for rapid growth. These cuttings will be ready for field planting after two months. After planting in the bamboo, the first crop of cuttings can be taken after 3-3.5 months and a subsequent harvesting at every 2-2.5 months. Each rooted vine can give about 10m cuttings in one harvest and about 40 cuttings in a year. A multiplication rate of 1:40 can be achieved on an average. From one hectare plot an estimated 1.5 - 2.0 million rooted cuttings can be obtained in one year. The nursery will form a perennial source for high quality planting materials.

As precautionary measures, ensure adequate shade and drainage. Give timely plant protection. Just before monsoon, spray with 1% Bordeaux mixture. Apply Bordeaux paste
to the basal portion of vines and drench the soil with 0.2% copper oxychloride. Apply Thimet 10 g @ 0.5 g or Furasan 3 g @ 1 g pwer vine thrice annually. Ensure that every emerging node is in touch with the rooting medium on the bamboo as it is crucial for rooting. Give protection against insect pests. An occasional spray with 0.05% dimethoate (Rogar) or monocrotophos (Monocil) can keep away shoot borer, thrips, mealy bugs and scales 20.

4.16. Spice Board

Shah Alam International Fair was held at Shah Alam Expo Corounds in kaula Lumper, Malaysia during November 21 to December 6, 1998. The Indian High Commission in Kerala Lumper participated in the show and the Spice Board India provided exhibits of spices and spices products besides literature for the show. The first pepper Research scheme was initiated in 1949 by the government of Madras at Panniyur. During 1951 the planning commission brought to the attention of Ministry of Food and Agriculture, Government of India, the need for research and development in spices and cashew. A Spices Enquiry Committee was constituted to suggest specific measures to develop production and marketing of cash crops (spices). The SEC submitted its report to Government of India in October 1953, which accepted the recommendations and entrusted the work to ICAR in advising, planning and coordinating the implementation of the recommendation of SEC until 1962. In September 1961 an independent body called the Indian Central Spices and Cashew nut Committee in its meeting held in January 1963 and subsequently in August 1963, decided to review the status of spices in the country. A private entrepreneur established the first spice oil and oleoresin unit in India at Calicut in 1930. Extract of ginger were "manufactured "during second world war. Pepper oleoresins were exported to America in 1961.
The Central Plantation Crops Research Institute Kasaragod, Kerala came into existence in 1970 with mandates on palms, cocoa, cashew and spices. A major step in the direction on improvement projects in 1971 with its headquarters at CPCRI, Kasaragod. Until the end of 1Vth plan spices research was confined to evolve certain cultural practices in black pepper. Thai traditional medicine used all five parts of pepper plant, which are leaf, flower, fruit, stem and root. Pepper is a hot taste Thai medicinal plant which contains 2 to 4% of volatile oil. Generally traditional it is used as a carminative agent. It is very effective for dyspepsia and stomachic symptoms. In the recorded of Thai Traditional used, each parts of pepper are applied for:

**Leaf** - Reduce dyspepsia, **Flower** - Help red eyes because of high blood presurre, **Seed** - reduces dyspepsia and expectoration, **Stem** - reduces expectoration and **Root** - Reduce dyspepsia, vertigo disorders and helps digestion. The Household remedy admitted by Thai Food and Drug Administry, five household remedies out of 28 household remedies have pepper as one of the ingredient.

**Spices Board's initiatives for export development**

Spices exports have registered substantial growth during the last one decade. It has increased from 109636 tonnes valued US$ 135 million in 1990-91 to 235611 tonnes valued US$ 472 million in 1999-2000. During the year 2002-03, the spices export quantity has touched an all-time high of 264107 tonnes. However, during 2003-04 the export has declined to 246566 MT valued US $ 415 million. The decline was mainly due to decline in export of Mint Products and because of low volume of pepper exports coupled with low unit value realization. Still India commands a formidable position in the World Spice Trade with 46% share in Volume and 27% in Value.
Trend in India's Spice Exports

Board has formulated and implemented a three-tier quality certification programme conforming to HACCP. Award of Spice House Certificate for good manufacturing practices, award of Logo for quality of the product and accreditation under ISO 9000 for international acceptance are the three certification systems adopted by the Board. Yet another area of activity centered upon by the Board is Value Addition. India can now boast as the monopoly supplier of spice oils and oleoresins the world over. In the case of curry powders, spice powders, spice mixtures and spices in consumer packs, India is in a formidable position. The consistent effort of the Board during the last one decade has improved the share of the value added products in the export basket to more than 60%.

4.17. Products and end use of pepper

The two major primary products of pepper nigrum internationally traded are black pepper and white pepper. Black pepper is the dried unripe fruit of the plant, white pepper which has the flavour of black pepper but is less pungent is obtained from the ripe or unripe fruit by soaking and treating the bury before drying and thus removing the mesocarp. Green pepper comes from unripe but fully developed pepper berries. Pink pepper, which has entered the market, is not true pepper but is probably the dried fruit of "schinus molle" the pepper tree, which is originated in Latin America. The different products obtainable from the pepper berry are shown below.
Pepper Products

Pepper on Vine

<table>
<thead>
<tr>
<th>Harvest Immature</th>
<th>Harvest Mature</th>
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<tbody>
<tr>
<td>Remove Mesocrop</td>
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<table>
<thead>
<tr>
<th>Preservative</th>
<th>Dehydrate</th>
<th>Freeze dry</th>
<th>Sundry</th>
<th>White Pepper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preserved</td>
<td>Green pepper</td>
<td>Dehydrated</td>
<td>Freeze dried</td>
<td>Black Pepper</td>
</tr>
<tr>
<td></td>
<td>Green pepper</td>
<td></td>
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<td>Grinding</td>
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<thead>
<tr>
<th>Solvent Extraction</th>
<th>Distillation</th>
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<tbody>
<tr>
<td>Pepper Oleoresin</td>
<td>Pepper Oil</td>
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<td></td>
<td>Ground Pepper</td>
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</tbody>
</table>

Pepper, one of the spices available in India has many medicinal properties and uses which is widely used by all the people all over the world. Researches are going on to increase the yield as well with the help of the new varieties. Now-a-days, many value added by products have been found out and have been widely used by many. But due to lack of awareness among the Indian people, the usage of the by products are not popular in India and so they have been exported. Considering the availability and usefulness, steps can be taken to popularise the same among Indian citizens

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