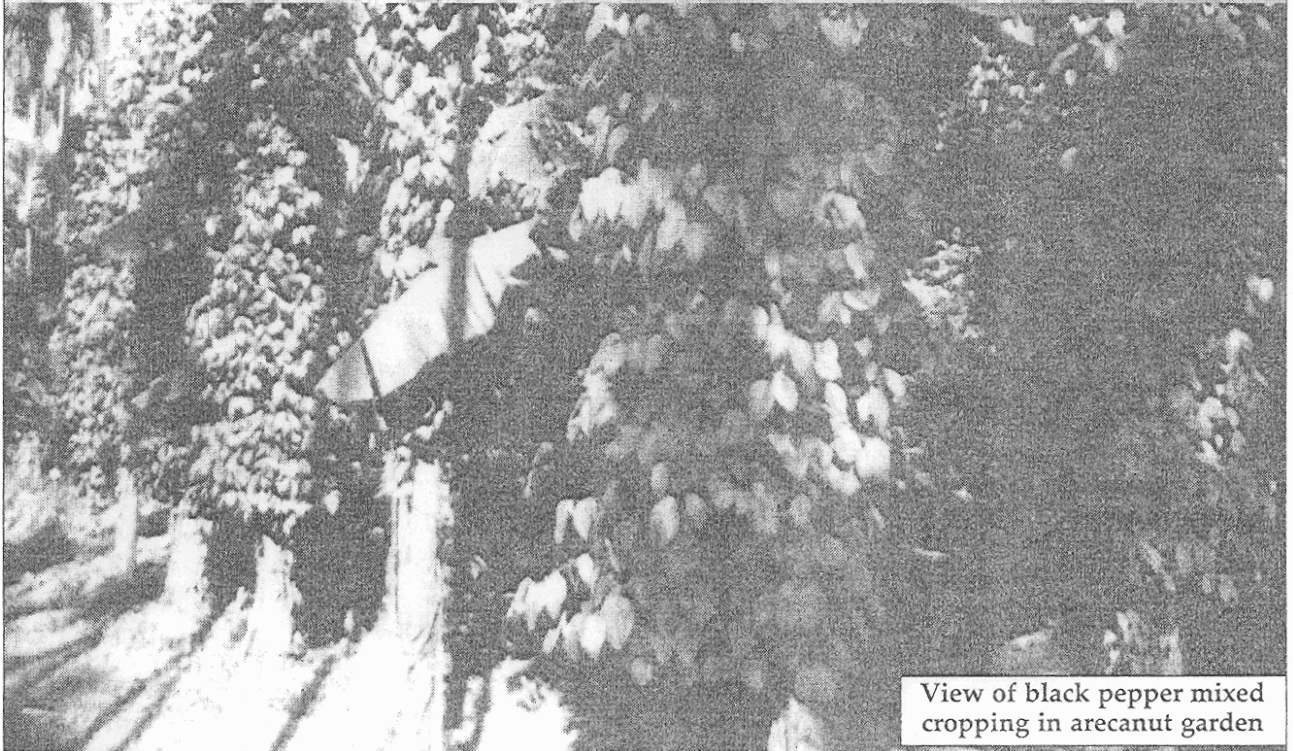


STRATEGIES FOR IMPROVING THE PRODUCTIVITY OF BLACK PEPPER IN ASSAM



View of black pepper mixed cropping in arecanut garden

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Pepper is one of the most popular spices of India and its cultivation is seen mainly in India, Indonesia, Brazil, Malaysia, Sri Lanka, Vietnam, Thailand, China and

Mexico. Though India occupies the largest area under pepper and production is also the highest, the productivity is very low compared to most of the other producing countries.

Continuous cultivation of poor yielding vines, existence of senile and unproductive vines, losses due to diseases, pests and drought, non-adoption of scientific agro-management

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practices, inadequate supply of quality planting materials and poor transfer of technology as well as fluctuation in prices etc are some of the reasons attributed to the poor productivity of pepper in India.

Black pepper is grown predominantly in the states of Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra and Orissa. It is also cultivated in the North Eastern states viz. Assam, Meghalaya, Manipur and Arunachal Pradesh. More than 95 per cent of the area and production is in Kerala. It is one of the important and earliest known spices produced and exported from India. About 79,100 metric tonnes of pepper is produced per year from an area of 21,6500 hectares (2001-'02). The global demand of pepper is increasing day by day. It is grown predominantly in the states of Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra, Orissa and North Eastern states especially Assam. Basically, black pepper requires a warm humid tropical climate but can be successfully grown in sub Himalayan terai region of West Bengal and NE region using coconut and arecanut palms as standard. Even though Assam grows black pepper in an area of about 2,180 hectares only with a total production of 2950 metric tonnes, recently its cultivation



Fig. 1 View of arrangement of bamboos in Rapid Multiplication Method

is gaining importance among the farmers of the state. Under homesteads (*bari*), pepper can be raised by trailing on available shade trees, coconut and arecanut palms and other standards. Assam has a unique advantage that every rural house holds, whatever its size may be, is having a homestead garden comprising of a few to several numbers of arecanut and coconut palms, which can be effectively used as standard for black pepper cultivation.

Strategies for improving the productivity

Selection of Varieties:

In India more than 75 cultivars of pepper is being cultivated in one State or the other. Among them, Karimunda is the most popular one. High yielding varieties such as Panniyur-1 and

Panniyur-2 are also grown in many areas. The Research Centre under the Central Plantation Crops Research Institute, at Kahikuchi (Guwahati) in Assam is maintaining a collection of some of the high yielding varieties of black pepper.

Production of quality rooted cuttings:

Black pepper has three types of aerial shoots such as a) primary stem with long internodes and adventitious roots which cling to the standard, b) runner shoots, which originate from the base of the vines, also having long internodes that strike roots at each node and c) fruit bearing lateral branches with limited growth. Propagation of black pepper is done mainly through shoot cuttings, which are raised mainly from runner shoots,



Fig. 2. View of the Net house

though terminal shoots can also be used. Cuttings from lateral branches are to be avoided as on rooting they will give rise to short lived bushy pepper vines. However, rooted lateral branches are useful for production of bush pepper plants in pots.

Runner shoots from healthy and high yielding vines are to be kept coiled on wooden pegs fixed at the base of the vine to prevent shoots from coming into contact and striking roots in soil and they are to be separated from vine during February-March. After trimming the leaves, plant each cutting having two to three nodes either in nursery beds or in polythene bags filled with potting mixture of fertile soil and organic manure and provide adequate shade and water them at regular intervals. The cuttings will strike roots

and will be ready for planting during May-June.

Rapid Multiplication Method (Bamboo)

This method was developed by Sri Lanka and modified by Indian Institute of Spices Research (IISR), Calicut. In this method, a trench of 0.75m deep and 0.3m wide having convenient length is made. The trench is filled with rooting medium (preferably top soil, sand and farmyard manure mixture in 1:1:1 proportion). Split halves of bamboos with septa with 8 to 10cm diameter and 1.25 to 1.5meter length are fixed at 45° angle on a strong support. The bamboos can be arranged touching one another. Rooted cuttings are planted in the trench at the rate of one cutting each per bamboo. The lower portion of the bamboo are filled with a rooting medium (saw dust/coir dust and

farmyard manure in 1:1 proportion) and the growing vine is tied to the bamboo in such a way as to keep the nodes pressed into the rooting medium (Fig.1). When the vine reaches the top in about three to four months, the terminal bud is nipped off and the vine is crushed at about three nodes above the base, in order to activate the axillary buds. After about 7-10 days each vine is cut at the crushed point and removed from the rooting medium and each node is separated. After planting in the bamboo the first harvest of cuttings can be done after 3 to 3 ½ months and the subsequent harvest at every 2 to 2½ months interval. Such cuttings with the bunch of roots intact are planted in poly bags filled with rooting mixture (sand: soil: FYM 1:1:1 proportion amended with 1g of Trichoderma per kg of substrate) and kept in a cool humid place. The shoots start developing in about three weeks, and then the poly bags can be moved and kept in semi shade condition or Net house (Fig.2) and the cuttings strike roots and become ready for planting in the main field by 4 to 4½ month. The advantages of rapid multiplication techniques are: Multiplication is rapid (1:40), the root system is well developed, and a better field establishment and more vigorous growth can be

obtained as a result of better root system.

Establishment of plantation:

a. Selection of planting site

Black pepper can be grown in plain lands or steep sloppy lands. When it is grown in sloppy lands, slopes facing south may be avoided or if planting is undertaken, provide sufficient shade trees to protect from scorching sun during summer periods. In sloppy lands planting pepper lower of northern and northeastern slopes will be ideal. In leveled and plain lands, provision for adequate drainage should be made.

b. Preparation of land and planting standard

Black pepper needs support for climbing wherein live standards are used for mono cropping of black pepper. With the onset of pre-monsoon showers (April-May), primary stem cuttings of Modar (*Erythrina indica*) or silver oak (*Gravelia robusta*) are to be planted in pits of taken at a spacing of 2.7 meters x 2.7 meters to accommodate around 1300 plants/hectare. Black pepper vines can be planted and trailed on these standards after their full establishment and attaining sufficient height. Other standards like coconut palm, arecanut palm, jack tree, mango tree etc can also be used

for growing pepper.

At CPCRI, RC, Kahikuchi, pepper is being grown successfully trailed on arecanut (picture on page 8) in areca based high density multi-species cropping system. The yield of Karimunda and Panniyur-1 varieties ranged from one to two dry pepper per vine per year.

c. Planting pepper

For planting pepper, pits are to be dug on the northern side of the standard at a distance of 30 to 45 cm. Pits of 50 cm x 50 cm x 50 cm size may be taken and filled with top soil and farm yard manure or compost. Two-three rooted cuttings are planted in each pit with the onset of monsoon rain. Soil around the cutting is to be pressed to form a small mound slopping outward and away from the cutting to prevent water stagnation around the plant. Protect the plants from direct exposure to sun light by providing shade. Trail the growing portion of the vine to the standards. When pepper is grown on coconut or arecanut palms, the cuttings are to be planted 45 to 60 cm away from the trunk.

d. Aftercare

As the cutting grows, the shoots are to be tied to the



Fig. 4. Slow wilt of pepper

standards as and when required. The young vines should be protected from hot sun by shading. Regulation of shade by lopping branches of standards is necessary for getting optimum light for the plants and for them to grow straight. Adopt mulching around the base of vines during dry period to conserve moisture. The base of vines should not be disturbed to prevent any damage to roots. When pepper is trailed on coconut or arecanut palms, it is necessary to restrict their upward growth so as to avoid inconvenience to the climbers for harvesting/spraying. For this purpose, when the vertical growth attains five to six meters,

the terminal shoots are to be either pruned or lifted and bent down carefully to avoid their breaking. This process, when carried out periodically and regularly, helps to restrict further vertical growth of vines.

Judicious and regular manure application is necessary to sustain crop growth and yield of pepper. Organic manure @ 10 kg/plant in the form of compost or farm yard manure or vermicompost may be applied every year. Fertilizers @ 100:40:140 g NPK/vine/year (urea-220 gram, single super phosphate-250 gram and muriate of potash-230 gram/vine/year) may also be applied for this purpose. Apply 1/3 of the dose during the first year and 2/3 dose during the second year of planting. Full dose may be given from third year onwards. Split application in equal amounts during April-May and September-October helps efficient use of fertilizers. Fertilizers are to be applied at a distance of about 30 cm all around the vine and covered with a layer of soil and mulch. Care should be taken to avoid direct contact of fertilizers with roots of vines. Neem cake @ 1kg/vine can also be given during the growth of vines.

Production of Bush pepper:

It is a method of cultivating vine in the form of a bush. One

year old healthy fruiting branches are selected with three to five nodes preferably with dormant buds. All the leaves except the flag leaves are removed and planted in a shaded area in the nursery, either in trenches or in polybag (45X30cm) containing moist coir dust before planting. They normally root in 30 to 50 days, such rooted cuttings are planted in pots or fields after sufficient hardening treatment. Cuttings grow like a bush and flower in the same year itself. These bushes produce more fruiting branches. Adequate manuring with 2 to five kg of FYM along with 10 gram of NPK may be given per bush at three months interval. Watering and plant protection may be adopted according to necessity.

Pests and Disease management:

A. Pests

1. Pollu beetle (*Langitarsus nigripennis*)

Symptoms: Feeding holes on tender leaves, black patches on spikes and black berries crumble when pressed. Adult black beetles feed on tender shoots, leaves and spikes, whereas larvae bore holes on tender spikes and berries and feed on internal tissues.

Management: Regulate shade in the plantation. Spray 0.05 per

cent of Endosulphan or Quinalphos during June-July and September-October. Neemgold (0.6%) may also be sprayed during August, September and October.

2. Top shoot borer (*Cydia hemidoxa*)

Symptoms: Fully grown larvae, which are grayish green bore into tender terminal shoots and feed on tissues and retard growth of young vines.

Management: Spray Monocrotophos (0.05 per cent) during July and September.

3. Leaf gall thrips (*Liothrips karnyi*)

Symptoms: Adult and larvae feed on tender leaves inducing formation of marginal tubular galls on leaves. Leaves become crinkled and reduced in size.

Management: Spray 0.05% of Monocrotophos or Dimethoate on tender leaves.

B. Diseases

1. Foot rot/Quick wilt:

Phytophthora foot rot (quick wilt disease) caused by the fungus *Phytophthora capsici* is the most destructive of all diseases affecting black pepper in most of the growing countries. This disease begins during June coinciding with the onset of south west monsoon. High soil moisture, high

humidity, low atmospheric temperature and shorter duration of sun light prevailing during the period are some of the favourable factors for development and spread of the disease.

Symptoms: On the leaves one or more black spots appear and later enlarge rapidly and cause fall of the leaf. The tender leaf and succulent shoot tips of freshly emerging runner shoots become black when infected. Rain splash causes the disease to spread from the runner shoots and leaves to other plant parts. If the main stem at the base or the collar is damaged, the entire vine wilts and shed all the leaves and spikes with or without black spots. The branches break up at nodes and the entire vine collapses within a month. If the damage is restricted to the feeder roots, symptom expression is delayed till the rain ends and the vines start showing declining symptoms such as yellowing, wilting, defoliation and drying up of a portion of vine. This may begin from October-November onwards.

Management: The disease is soil borne, and hence it is necessary to address the problem by adopting integrated management strategies. Various measures such as phytosanitation, cultural

practices, and chemical control measures are to be adopted for control of the disease.

a. Phytosanitation: Remove and destroy all dead vines, root portions and other portions to reduce build up of fungal population. Collect planting materials only from disease free plantations and raise them preferably in solarised soil

b. Cultural measures: Provide adequate drainage to prevent any water stagnation during rainy period. Avoid injury to root system while digging or taking up weed control methods. Do not allow the freshly emerging runner shoots to trail on the ground and may be either tied back to the standard or removed. Prune branches of support trees during monsoon to avoid build up of humidity and for better receipt of sunlight, which helps to reduce leaf infection.

c. Chemical and biological control: With receipt of a few rains during May-early June, drench base of all vines at a radius of 45 to 50 cm with 0.2 per cent copper oxychloride @ 5-10 liters/vine. Also give a foliar spray of Bordeaux mixture (1 per cent) or 0.3 per cent potassium phosphonate. Repeat drenching and spraying during August-September also.

If the rain prolongs, give another drenching during October. As a bio-control measure, with onset of monsoon, apply *Trichoderma* sp. @ 50g /vine around the base. Repeat application of *Trichoderma* and foliar application during August-September. Apply neem cake @ 1 kg/vine around the base of the vine during pre and post monsoon season.

2. Slow wilt

Symptoms: The disease is of complex nature with parasitic nematodes, fungi, nutritional deficiency and soil moisture stress. Foliar yellowing, defoliation and die back are the aerial symptoms, which appear from September-October onwards. The affected plants show foliar yellowing and die-back followed by decline in vigour and productivity (Fig.4). Roots show root galling due to nematode infection and necrosis leading to degeneration.

Management: Both fungicide and nematicide are to be applied to manage this disease. Remove and destroy severely affected vines. Use only nematode free cuttings raised in fumigated or solarised soil for planting. Treat pits for planting with Phorate 10 G @ 15g or Carbofuran 3 G @ 50 g at the



time of planting and as well as during pre-monsoon and post monsoon periods in main field. Drench plant basins with copper oxy chloride (0.2%) or potassium phosphonate (0.3%) or metalyxyl (0.125%). Rake soil around base of vine without damaging roots and uniformly spread nematicide and immediately cover with soil. Ensure sufficient moisture in soil during application. Apply neem cake @ 1 kg/vine around the base of the vine during pre and post monsoon season.

Harvesting and processing

Pepper vines start yielding usually from 3rd or 4th year after planting. Vines flower in May-June and it takes six to eight months from flowering to ripening stage. Harvesting is done from end of November to early February. When one or two berries in a spike turn bright orange to red, the whole spike can be harvested. Separate berries from spike by rubbing them between hands and trampling under feet. After separation of berries, dry them in sun for five to seven days in a clean surface of cement floor or tarpaulin or high density black polythene sheet or bamboo mat coated with fenugreek paste until the outer skin becomes black and shrunken and assumes

characteristic wrinkled appearance of commercial black pepper. The dried black pepper should have a maximum moisture content of only 11 per cent.

For making good quality black pepper of uniform colour, separated berries are collected in a perforated bamboo basket or vessel and basket with berries is dipped in boiling water for one minute. After this time, it is taken out and water drained. Later dry under sun. This method helps to reduce the drying time and ensures uniform black colour for the berries apart from preventing mould growth.

Preparation of White pepper

White pepper of commerce is prepared by removing the outer skin and pulp below it before drying the berries. Spikes with a few berries turning red are to be harvested and heaped in a corner of a room for a day. Later they are filled in gunny bag and steeped in flowing water for about seven to nine days. Outer rind of the berries is then removed by rubbing them with hand in a bucket of water and further cleaning the berries with fresh water. The cleaned berries are dried under sun for three-four days.

The recovery of white pepper is around 25 per cent of ripe berries while that of black pepper is around 33 per cent. Panniyur-1 is an ideal variety for preparing white pepper.

Packing and storage

Pepper with moisture content around 11 per cent after drying should be packed in polythene lined gunny bags (sacks) for storage. The bags should be clean, dry and free from any contamination. Graded pepper should be stored separately and sacks should be kept on wooden planks to prevent absorption of moisture.

Yield

Yield of black pepper varies widely in different areas depending up on several factors such as elevation, temperature, distribution of rain fall, soil fertility, cultural practices, type or variety of pepper and age of vines etc. Pepper vines attain full bearing stage in the 7th or 8th year after planting and it starts declining after 20 to 25 years and replanting is to be taken up thereafter. In Assam condition, a well managed and full bearing vines yields on an average one to two kg of dry pepper per year.

