MAJOR PESTS AND DISEASES ASSOCIATED WITH DIFFERENT CROPS UNDER ARECANUT BASED HIGH DENSITY MULTI SPECIES CROPPING SYSTEM IN TERAI REGION OF WEST BENGAL

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Arecanut (*Areca catechu* L) is an important plantation crop grown in tropical part of the World. In India, it is mainly grown in southern states viz. Karnataka, Kerala, Tamil Nadu. Besides these states cultivation is also extended to Assam, Maharastra, Goa, and West Bengal. A vast area in North Bengal is under arecanut cultivation. Due to suitable agro climatic condition the average yield of arecanut is comparatively high. But the major problem of arecanut cultivation in this area is lack of marketing facilities. The use of arecanut in this area is mainly confined with domestic consumption (Tamol). Growers are getting low price due to poor marketing and price fluctuation. Arecanut cultivation in this area is mainly limited to monocrop. When the price falls down, the growers are getting low price. So the area under expansion of this crop has been stagnant. Practice of mono cropping, thus increases the risk of arecanut cultivation. Arecanut based high density multi species cropping system minimizes such type of risks. Due to low price for arecanut in the market, other crops may substitute the loss. CPCRI Research Centre Mohitnagar has carried out several experiments to develop areca based cropping system with different crops such as black pepper, betel vine, banana, acid lime, cinnamon and coffee. These crops and cropping system were tried to get suitable model for HDMSCS. It was proved that these crops can be grown successfully as inter or mixed crops along with areca provided there is marketing facility. When other crops are grown in areca garden, a micro climate is produced restricting the entry of normal light intensity and air circulation. But it does not affect the growth of other crops and their yield. Due to restriction of light entry and air circulation, there is every chance of increased infestation of insects and pests on the crops. A study was conducted during the crop growth to find out the occurrence of different pests on different crops grown in areca based cropping system under sub Himalayan terai region of West Bengal.

Different crops like black pepper, betel vine, banana, acid lime, cinnamon, coffee, cocoa were planted in areca garden. Arecanut was planted at a distance of 2.7 m row to row and 2.7 m plant to plant. Black pepper and betel vine were trailed with arecanut. Other crops were planted in the middle of four arecanut palms in alternate row. Different models were formed by planting these crops as mixed or intercrops.

1. Model 1- Arecanut+ black pepper+ banana + acid lime
2. Model II- Arecanut+ black pepper+Cocoa
3. ModelII- Arecanut+ betel vine+ banana+turmeric
4. Model IV- Arecanut+ black pepper+ banana+ coffee
5. Model V- Arecanut+ betel vine+ banana+ cinnamon

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Various insect pests and diseases recorded on all the inter and mixed crops grown in different models of HDMSCS and their control measures are enumerated below.

Arecanut

Immature nut fall was the major problem in arecanut. No pathogen was found associated with this malady. However caterpillars of *Pyrlidae* was found associated with fallen nuts with characteristic holes in the nut. The caterpillars enter into the nut from stalk end and bore the nut to reach the endosperm. The entire path was completely filled with excreta in the form of silken web. More than one larva was found per nut in many cases. Fully grown caterpillar pupates in silken cocoon which was found either at the entrance of the nut hole or inside the nuts. The damaged nuts fall down during the rain. Spraying of Chloropyriphos or Monocrotophos @ 0.2% during infestation will control this insect.

Mealy bug infestation was also found associated with unfurling of crown leaves and inflorescence. The insects suck the sap from the tender plant parts which causes heavy button shedding and adversely affect the opening of crown leaf. Prophylactic spraying of Monocrotophos or Rogor @ 0.2% will prevent the attack by this pest.

Another major insect which affects the arecanut is the white grub. The adult lays eggs at root zone of the arecanut. Grubs feed on the young feeding roots making the palm weak and cause heavy crop loss of the crop. Application of Phorate (Thimet 10 G) @ 20 g per palm during pre and post monsoon season along with fertilizer may control the white grub infestation.

The important disease that causes heavy loss to the plantation at times is bud rot. It is caused by *Phytophthora palmivora* a fungus that affects the nursery seedlings as well as grown up palms. Fungus attacks the growing tip. The young unopened leaf droops, looks pale in color and dries leading to the death of the palm. The leaf will come out easily when pulled with little force, emitting bad smell. Spraying of Bordeaux mixture (1%) before and after the monsoon season will effectively control the disease. Other chemicals like Copper oxy chloride (Blitox- 0.4%) or Mancozeb (Indofil 0.3%) can also be used for the control of this disease.

Cocoa

Defoliation was the major problem of this crop. Defoliation was mainly caused by insects like flea beetle and a species of caterpillar. The beetles and grubs feed on leaves. The damage caused by these insects ranged from 5-25 per cent during April to 10-40 per cent during May. After that the percentage damage decreases and reaching 5-15 per cent during December. Application of Quinalphos (Ekulux @ 0.02%) controlled the defoliator pests during peak of incidence period. Aphid also damages this crop. Maximum colonization was recorded during April to July months just after winter. Population of other insects such as bag worm and mealy bugs were also noticed but the intensity of damage was meagre. The major yield loss occurred in cocoa due to the attack of Rodent. Rodent attack was more during January- August and it ranged between 2.1-13.1 pods per plant. Baits of Zinc phosphide or Bromadiolon can effectively control the rat.

A number of diseases have been recorded in cocoa. Among them black pod,

charcoal pod rot and cherelle wilt are important. In black pod disease the infection appears as brown spot on the surface of all ages due to the attack of *Phytophthora palmivora*. The spot soon covers the entire surface of the pods. Whitish mycelia growth appears on affected pods during May-June months. The internal tissues as well as the bean become discolored due to the infection. The charcoal pod rot disease caused by *Botricdiplodea* sp characterizes the appearance of yellowish brown spot from either end of the pods and slowly spread to entire surface of the pod. The affected pods become dark brown to black in advanced stage. In case of cherelle wilt, pods become shrivelled, dried and remain with plant. Spraying of Indofil M 45 @2-3 g/lit water or 1% Bordeaux mixture can control the disease.

Acid lime

Acid lime cv Gandharaj, a type scented lime was planted in between alternate rows of arecanut. The major pest found in acid lime under HDMSCS is the leaf minor (*Phyllocnistis citrella*). About 90 % plants were affected by this pest with 4.5-11.5% infestation during September and it increased to 8.2-13.1% during December and the damage reached 14.7 % during January and 100 per cent during February. The larvae feed on the epidermis of the leaves causing considerable yield loss. These insects can be controlled by application of Monocrotophos or Rogor @ 0.2% during the emergence of new leaves and afterwards at 15-20 days interval. It can also be effectively controlled by spraying with 2% neem oil. Another pest which causes considerable crop loss is shoot borer. The grubs bore into the shoot and feed on the inner tissues. White powdery substance can be observed on the ground. The infestation percentage ranged between 5-10%. Application of 1-2 g Thimet 10G granules or Carbaryl dust or kerosene to the hole and subsequent sealing of the holes controls this insect. Killing of caterpillars by inserting iron stick into the hole is also advisable.

The only disease which causes considerable quality loss was recorded as citrus canker caused by *Xanthomonas citri*. Cankerous brown spot of 1-3 mm size appears on leaves, twigs and fruits. Application of Streptomycin @ 0.1 % will control this problem.

Banana

Banana cv Malbhog was planted in between alternate row of areca nut to avoid more shade in the areca garden. The most important insect that damaged the crop was fruit scrapping beetle (*Colaspis* sp). The insects scrape the tissue of young fruits during opening of the spathe. The wound enlarges during the development of fruits and reduces the quality of fruits. The market price of such fruit becomes low. Sometimes the fruits become hard. The insect attack was found to be more during late monsoon (August- October). During this period the infestation intensity was about 100%. During other months the infestation was almost nil. The attack was also observed in unopened leaves. Application of Monocrotophos (Nuvacron @0.2%) reduced the insect attack. Covering of fruit bunches with polythene tubes just after first spathe opening is also effective to save the fruits from the attack of the insect. The insect attack can be minimized by planting the banana in such a way that inflorescence should not emerge during the peak period of

insect attack i.e. August-October. Another insect that cause severe damage is banana stem weevil (*Odoiporus longicollis*). Black to brown adult weevil lays eggs in the pseudostem. The grubs feed on the pseudostem and stalk by making tunnels. The leaves become yellow. and plant becomes susceptible to wind damage. The insects can be controlled effectively by filling of the holes with the granules of Phorate (Thimet 10 G).

The important diseases that affect banana in this region and in HDMSCS are the panama disease and the bunchy top. Panama disease is caused by a soil born fungus (*Fusarium oxysporum*) for which entry to the plant is facilitated by burrowing nematode (*Radopholus similis*). The affected plants show yellowing of lower leaves or collapse of the petiole while other leaf remains green. The plant dies within 4-6 weeks of the appearance of the first symptoms. Discoloration of the vascular bundles can be seen when pseudostem is cut horizontally. The disease can be controlled by the application of Bavistin @ 0.2 % on the foliage as well as by soil drenching. Bunchy top is caused by a virus which is spread by banana aphid (*Pentalonia nigronervosa*).The affected plants become shorter and the leaves appear in a rosette manner. Several dwarfed suckers are also produced by the affected plants. The affected plants, suckers along with rhizome is to be removed and destroyed. Spraying with Monocrotophos @ 0.2% for the vector is also recommended.

Coffee

Coffee plant cv San Roman was also planted in alternate rows in areca garden. Major pests recorded were mealy bug and scale insects. The incidence of scale insects was recorded from May - December, whereas low incidence of mealy bugs was recorded during May- June. Other insects like aphid were also observed during March and April. These are all sucking insects. The adult and larvae suck the cell sap of young shoots. Application of Monocrotophos or Quinalphos @0.02% during initial stage of incidence can effectively control these sucking insects. Besides these insects, termite and white borer also affect the crop. Termite attacks the basal stem of this crop. It feeds on the bark of the stem during post rainy season. Swabbing of Carbaryl or Chloropyriphos dust on the stem will prevent stem from termite attack.

Grubs of white borer (*Xylotrechus qudrapes*) bore into the stem and feed on the stem causing drying of branches or death of the entire plant. Application of Carbaryl or Chloropyriphos or Qinalphos dust as a paste on the stem at the end of bean harvest controls the insects. Collection and destruction of dead plant/plant parts may reduce further spread of the insects.

The important disease that causes heavy loss is the stalk rot of leaves and berries. This is caused by *Colletotrichum gloeosporioides*. Necrosis of nodes and internodes from the junction of brown and green wood towards the apex followed by defoliation and berry drops. The affected branches remain attached to the stem. Spraying of Bordeaux mixture 1% or Dithane M-45 @ 0.3 % before and after the rainy season controls the disease. The other disease often observed is the production of chaffy berries. It is caused by a fungus (*Phytophthora* sp.). The developing beans inside the berries are severely affected and produce chaffy berries. This can be

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controlled by application of Bavistin @0.2% at monthly intervals after flowering.

Cinnamon

This crop was also planted in alternate rows with arecanut. Insects like flea beetle and grub of leaf eating caterpillars were the major pests on this crop. Flea beetle population was recorded more (6.0-8.0/ branch) during January, then it gradually decreased and again the population increased from July- November. The population of leaf eating caterpillar was more than 1 per branch during July to September. Application of Endosulfan or Quinalphos @ 0.2% can effectively save the plants from the attack of these insects. Other insects like bag worms and leaf webbers were also observed. But the damage done by these insects was within the ETL. No diseases incidence was recorded in this crop.

Turmeric

Turmeric was planted in 15 cm raised bed in between two rows of arecanut. So far no insects were recorded in turmeric except termite during September-October. Application of Chloropyriphos was sufficient to keep away termite from the crop.

The important disease that causes damage to leaves was leaf spot. It is caused by *Colletotricum* sp and *Cercospora* sp . Reddish to brown spots of different sizes are seen on the upper surface of the leaf. In severe cases, the entire plant dries up resulting in poor development of rhizome. The disease is more serious during rainy season. The damage percentage ranged between 20-40%. Application of 1% Bordeaux mixture during the period may control the disease.

Black pepper and Betel vine

Black pepper and betel vines were planted 45 cm away from the arecanut trunk and was allowed to climb on arecanut. No major insect attack was recorded on these crops. Only a low incidence of gall thrips was recorded. Colonies of adults and nymphs of gall forming thrips were observed in the gall on the margin of the leaf. Gall formation occurs due to constant rasping and sucking habit of this insect. The affected leaves become thick and brittle. In severe cases of attack the margin of leaf becomes crinkled and deformed. Application of Monocrotophos @ 0.02% during the initial stage will minimize the attack of this insect.

Foot rot was recorded and was very serious in black pepper. The attack of Phytophthora capsici causes this incidence. Feeder root damage causes defoliation of leaf and collar infection causes death of the vine. Application of Bordeaux mixture 1% or Ridomil (1.25 g/l) before and after rain may save the vine from the attack of this fungus. Drenching of .125% Ridomil @ 5l/vine can also be applied against this fungus. Besides this, application of Trichoderma culture @ 100 g along with 1 kg FYM also helps in control of this fungus.

High Density Multi species Cropping System i.e. combinations of different crops creates a micro climate with in the areca garden due to restriction of entry of full sunlight and air circulation. This climate some times invites more number of insect pests to the crops. As a result considerable yield loss of different crops occurs. A better knowledge on the incidence of different insect pests in HDMSCS may help to formulate the proper control measures and may increase the net income from the garden with more crop density.

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