COCONUT

Coconut Production And ost Harvest Handling

INTRODUCTION

In Guyana, coconut (*Cocos nucifera* L.) ranks third, next to rice and sugar, as a priority agricultural crop. In spite of this, the potential of the crop has been largely under exploited and poorly developed. Coconuts contribute only approximately 1% to the total gross domestic product (GDP) of the country, an under achievement, considering the priority ranking of the crop in the agricultural sector.

It is estimated that there are 24 000 hectares under coconut production, with an average annual production of 92 million nuts. In order to increase and sustain current levels of production to meet market demand for greater economic efficiency, it is imperative that the issue of increasing coconut productivity be urgently addressed.

VARIETIES

Coconut varieties and forms

Coconut is grown widely on the coastal regions of Guyana, primarily along the Pomeroon River, in the Essequibo Coast, East Demerara, and West Berbice and on the Corentyne Coast. Coconut is mainly processed into cooking oil. Average copra yield from 100 nuts ranges from 13 to 16 kg. The use of tendernut as a nutritive beverage is very popular in Guyana.

Commercial holdings of coconut are mainly sown with two types of the Tall variety and two types of the Dwarf variety. The Tall types are the predominant source of copra, while the Dwarf variety is specially grown for their sweet water. One variant of intermediate height, known as 'Bastard Nut', is grown in the Pomeroon River area and is cultivated for both copra production and for its sweet water, although its copra yield is inferior to the Tall types.

Tall types

The most common Tall types existing in the country are the Jamaica Tall and the Panama Tall, each of which consist of two basic colour forms: green and bronze. The Jamaica Tall bears long, angular nuts with distinct ridges and a thick mesocarp. Dehusked, its nuts are also angular and pointed at the end. On the other hand, the Panama Tall's fruits are much more spherical with a thinner mesocarp. These two types may be considered the 'original' Tall types in Guyana. Another variant of the Tall type found on the Coastal Corentyne (No. 60 Village), as reported by Manthriratoa (1980), is a type with spherical, medium-sized nuts but with a pronounced dark pink mesocarp. Several variations in epicarp colour forms have also been observed. Generally, commercial stands could not be classified on this criterion alone. Farmers, however, could distinguish between the two Tall types known as Clara Nut and Cocrit Nut. Clara Nut is similar in character to the Panama Tall. Cocrit Nut, on the other hand, seems to combine the nut characteristics of the Jamaican Tall and the Panama Tall.

The Cocrit Nut is regarded as a 'nut number' type rather than a 'nut size' type. Fruits of the Cocrit Nut are more spherical than oblong, with a thin mesocarp and thick kernel. Nut size ranges from small to large, with trees of larger nuts being less prolific. Commercial copra producers prefer the **'5-year'** (5 years to begin production) nuts with an intermediate nut size, high yield and precocity.

The Clara Nut is a “nut size” type. Husked nuts are large and spherical, with a high water capacity but thin kernel. The coconut water of this type is described as sweet and is favoured over all the other types grown for their coconut water. The hectarage devoted to Clara Nut, however, is minuscule compared to those variants preferred for copra.

A preponderance of Tall types can generally be found in all commercial holdings. However, in the Pomeroon River area, there is a higher frequency of Dwarf types in commercial holdings. In all commercial plantings, demand for new planting materials is generally for the Cocrit Nut type.

Dwarf types

Commercial dwarf types are mainly of the green and yellow **‘3-year’ (**3 years to begin production**)** variants. The Green Dwarf is similar to the Brazilian Green Dwarf in growth habit, number of nut per bunch and size of nuts. The Yellow Dwarf, however, is different from the Malaysian Yellow Dwarf, in having a larger nut size and a less intense yellow colour in petioles and epicarps of the nuts. A third Dwarf type variant is the Red Dwarf (Orange Dwarf), restricted mainly to the Pomeroon River area. The Red Dwarf is similar to the Red Dwarf of India and Sri Lanka and the Malaysian Dwarf. It was suggested that this variant might have been a recent introduction from a Caribbean Country. Another variant, the Bronze Dwarf (so-called because of its bronze epicarp), is a relatively new find of about four years ago. The Bronze Dwarf was reportedly introduced from Surinam. Currently, there are only a few homesteads with this variety, but the current demand suggests it has the potential to spread rapidly to commercial holdings.

Bastard nut

Bastard Nut is predominately recognized in the Pomeroon River area. The origin of this variant has been attributed to natural cross pollination between Dwarf and Tall types, being an apparent Dwarf x Tall hybrid. Bastard Nuts show marked hybrid vigour in trunk and leaf size, number of bunches produced per year and number of nuts per bunch.

CULTIVATION

Coconut palms are initially produced in a nursery, then transplanted.

NURSERY PROPAGATION

Site Selection

The site selected for nursery establishment should have a deep (not less than 1.5m depth) well drained soil. Shallow soils with underlying hard rocks, low lying areas which are subjected to water stagnation and heavy clay soils should be avoided.

Selection of mother palms

Mother palms from which nuts are to be selected for propagation should possess the following characteristics:

1. Regular bearing habit and yielding not less than 80 nuts/annum.
2. Age 20 years or more (five years after reaching full bearing capacity). If the mother palms are the progeny of elite planting material and give consistently higher yields for a period of not less than six years, seed nuts can be collected from such palms. There is no need for insisting 20 years as minimum age for mother palms in such conditions.
3. More than 30 fully opened leaves with short strong petioles and wide leaf base firmly attached to the stem.
4. Bearing at least 12 bunches of nuts with strong bunch stalks.
5. Bearing nuts of medium size and oblong shape.
6. Husked nuts should weigh not less than 600g.
7. Mean copra content of 150 g per nut or more.
8. Avoid palms which (i) have long, thin and pendulous inflorescence stalks (ii) produce long, narrow, small sized or barren nuts (iii) show shedding of immature nuts in large numbers and (iv) are grown under favourable environmental conditions.

Collection and storage of seed nuts

The nuts selected for propagation should be mature (at least 11 months old). Lowering of bunches by means of ropes may be done when the palms are tall and the ground is hard. Discard nuts which show improper development or other undesirable features. Seeds should be stored in shade prior to sowing in the nursery. For storing, arrange the seed nuts with the stalk-end up over an 8cm layer of sand in a shed and cover with sand to prevent drying of nut water. Up to five layers of nuts can be arranged one over the other. The nuts can also be stored in plots, provided the soil is sandy and the ground is sufficiently shaded.

Before planting, the seed nuts must be further examined. Those without nut water and rotten kernels must be discarded.

Planting seed nuts

The sites where the seed nuts are to be planted must be well drained. The soil should preferably be light textured. Beds of 1.5m width and of convenient length with 75cm space between beds are recommended. In areas with poor drainage, raised beds must be used.

The seed nuts should be planted in the beds in trenches 25-30 cm deep and covered with soil so that the top portion of the husk alone is visible. The nuts may be planted either horizontally with the widest of the segments at the top or vertically with stalk-end up. Vertical planting is preferable on account of convenience in transporting and lesser risk of seedling injury. It is advisable to plant at the onset of the rainy season. It normally takes between 4-6 weeks for the nuts to germinate.

Nursery production

After germination, the seed nuts are transferred to the main nursery that can be either poly bag or field. The nursery site must be near or within the field to be planted to minimize handling cost and damage to the seedlings. In addition, the site should be well drained and situated near a dependable water source.

Ploybag nursery

This type of nursery is recommended for flat to slightly rolling field. Black perforated polyethylene bags with dimensions of 46cm x 46 cm x 0.115 cm are used. The polybagged seedlings should be spaced at about 1 meter apart in a triangular pattern. The ideal population per hectare is about 14,000 seedlings.

Ploybag nursery is perfect to a field nursery because of the following:

a) Root pruning is minimal, therefore reducing transplanting shock.
b) Selection and culling can be done easily and accurately.
c) Time of field planting can easily be adjusted when necessary (field planting should be done during the rainy season).
d) Nursery maintenance and management is easy.
e) Palms grown in polybags grow faster therefore enhancing earlier flowering compared to palms grown in the field nursery.

Field nursery

This type of nursery is recommended for rolling farms after which furrows are prepared 45 cm apart. The germinated nuts are placed 30 cm apart in prepared furrows. Two thirds of the nut should be covered with soil.

A nursery bed of 20 to 25 cm height x 150 to 180 cm width, using sand or well-textured and friable soil, will provide good seedling growth and development. The optimum period of field nursery is six to eight months. Keeping the seedlings for more than eight months in the field nursery will increase transplanting shock. This is because more roots have to be pruned, resulting in an imbalance in shoot to root ratio. For soils that are mainly clay and more acidic, it is necessary to rotovate the soil and apply lime.

Selection of seedlings

Seedling selection is a very important factor to ensure good success. Cullings of poor seedlings can be done at the fourth month from germination up to planting time. The criteria for selection is vigor for the plant as reflected in broad, dark green leaves, straight stems and absence of pests and diseases. Abnormal and below average growth seedlings are culled.

Some common abnormalities of the coconut seedlings are:

a) Erect and narrow fronds;
b) Thin and elongated petiole;
c) Widely spaced pinnae; and
d) Poor girth at the neck of the seedling

Remove seed nuts, which do not germinate within six months after sowing as well as those with dead sprouts. Select only good quality seedlings (9-12 months old) by a rigorous selection based on the following characteristics.

a) Early germination, rapid growth and seedling vigour;
b) Six to eight leaves for 10-12 month old seedlings and at least four leaves for nine month old seedlings;
c) Collar girth to 10-12 cm; and
d) Early splitting of leaves.

Note. The recovery of quality seedlings will be about 60-65%. Since early germination is one of the criteria for the selection of seedlings, the storing and sowing of seed nuts should be in lots rather than in a staggered manner.

Preparation of Seedlings for transplanting

Thorough care has to be given to seedlings during removal from the nursery for transplanting in the field. The common practice of removing seedlings from the nursery manually with or without the use of shovel to cut the roots, may result in low recovery of seedlings when transplanted in the field.

To facilitate the easy removal of seedlings from the nursery, this activity must be done at the onset of the rainy season when the soil is friable. To remove the seedlings, it should be pulled carefully and at the same time cutting the roots that are attached to the ground with a shovel. For polybag seedlings, care should be taken in removing it by lifting and cutting any roots coming out from the polybag. The polybag should then be removed while taking care not to break the soil around the roots.

FIELD ESTABLISHMENT AND TRANSPLANTING

FIELD ESTABLISHMENT:
This operation involves preparation of land for field planting and should be prepared six to twelve months before planting. For replanting, the old coconut trees are felled, chipped and left to rot. After weeding, staking and holing are carried out, land preparation should be timed to coincide with the dry season. For a new area, the land should be cleared of weed and shrub.

The size of pits for planting would depend upon soil types and water table. In sandy soils, the size of pits may be 0.75 x 0.75 x 0.75m. The pits may be filled up with topsoil to a height 60 cm below the ground level. In low lying lands, take shallow pits and as the plants grows, raise the ground level by adding silt and sand so as to cover the entire hole of the palm. The same procedure can be adopted when planting is done on mounds or bunds. Burial of two layers of husks in the floor of the pits will be useful for moisture conservation. The husk is to be buried in layers with the concave surface facing upwards.

The seedlings are removed from the nursery by lifting with a spade and cutting the roots. The seedlings should be kept in shade and not exposed to the sun. The seedlings should be planted as early as possible after removal from the nursery. The leaves or stems should not be pulled when the seedlings are being removed.

Transplanting of the seedling from the nursery into the field should be carried out at the onset of the rainy season. The preferred age for planting of coconut seedlings is between six to twelve months. These are planted such that the nursery bag soil level is flush with the general ground level.

For seedlings raised in a field nursery, the plants are first carefully pulled out, followed by pruning of the open leaves and protruding roots. In setting the seedlings, the nut should be covered by packing the planting hole with topsoil around the nut and pressing the soil well so as to hold the nut securely.

In order to give the plants a good start, about 70g rock phosphate (or about 200 ammonium sulphate) should be placed in each planting hole. After this 0.45 kg of ground magnesium limestone should be broadcast on the surface in a circle about 45 cm radius.

The recommended planting distance for coconuts is 6m x 6 m (approximately 20' x 20'). This results in about 280 plants/ha (~110 plants/A).

FERTILIZATION

In Guyana coconut palms are not generally fertilized. This is however, necessary for improved production and productivity. The following is a guide to coconut fertilization in Guyana.

Clay soils:

(a) Young Palms
Urea – 227g (1/2lb)
TSP – Ikg (2.2lb)
MOP – 227g (1/2lb)

This application should be made at six month intervals. The fertilizer must be applied close to the palm up to 0.3m (1ft) away during the second year. Therefore, gradually extend the distance away from the palm.

(b) Bearing Palms

Apply 7.2 kg (16 lb) limestone to bearing palms every two to three years.

Urea – 454g (1lb)
TSP – 1kg (2.2kg)
MOP – 454g (1lb)

This mixture should be applied once every six month and 3-4 weeks after limestone application.

Sandy Soils (sand reefs)
Young palms

Urea – 114g (1/4 lb)
TSP – 700 g (11/2 lb)
MOP – 340g (3/4 lb)

This application should be done at six month intervals. The placement should be the same as was described above for clay soils.

Bearing palms

Apply 7.2 kg (16 lb) limestone to bearing palms every two to three years.

Urea – 700 g (1/1/2 lb)
TSP – 1.14 kg (21/2 lb)
MOP – 700 g (11/2 lb)

This mixture should be applied once every six month and 3-4 weeks after limestone application.

Insect Pests of Coconut *(Cocos nucifera L)*

i) Coconut Caterpillar, *Brassolis sophorea (Lepidoptera; Nymphalidae)*
ii) Coconut Moth Borer, *Castnia deadalus (Lepidoptera; Castnidae)*
iii) Coconut Cockle/Beetle, *Stategus aloeus (Coleoptera; Scarabaeidae)*
iv) Coconut Palm Weevil,*Rhyochophorus* palmarum *(Coleoptera; Curculionidae)*
v) Ant, *Azteca spp., (Hymenoptera; Formicidae)*

i) Coconut Caterpillar *Brassolis sophorea (Lepidoptera; Nymphalidae)*

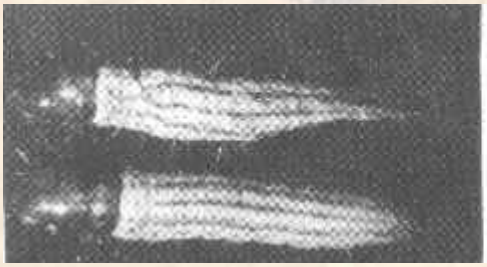

Fig. 1 Coconut Caterpillar

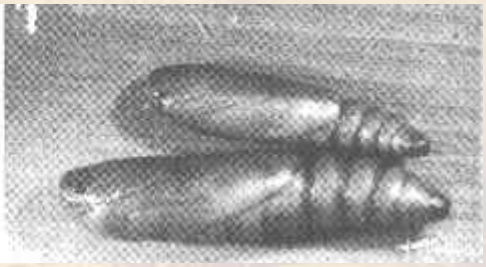

Fig. 2 Cocoon

Fig. 3 Adult butterfly

Fig. 4 Damage of Coconut Caterpillar

Symptoms

The coconut caterpillar defoliates palms. Leaf blades are eaten, leaving only the midrib. Caterpillars are brownish-red in colour, with yellow longitudinal dorsal strips, approximately 7 – 10 cm long, (Figure 1). They are gregarious and make nests by webbing together several leaflets wherein they hide during the day and feed at nights. Sometimes smaller caterpillars hide in the bases of leaves and fibrous material in the crown. Evidence of an infestation can be garnered by:

a) Long hanging nests;
b) Striped leaves; and
c) Fresh excreta below trees (Figure 2).

The adult butterfly (Figure 3) is brown in colour, bears a diagonal orange band on the forewing and is approximately 5 – 7 cm long. Eggs are deposited in masses on the trunk and leaves of the trees and hatch 3 – 4 days later. The entire life cycle is completed in a period of 80 – 90 days.

Control

Cultural Control:

- Proper field sanitation reduces the incidence of the pest. All coconut husks and fallen branches should be removed from the fields since these materials provide adequate breeding ground for pests.
- Fields should be kept weed free.

Chemical Control:

Injecting the affected palm with Monocrotophos 60% E.C gives effective control of the pest. A hole 7.5cm (3ins) deep is drilled into the trunk of the palm with the use of a brace and a 3/4in size bit (Figure 5). The height on the trunk where the hole is drilled depends on the height of the person applying the treatment. The hole should be drilled sideway at an angle of 45 degrees and downwards.

Fig. 5 Drilling holes

The emission of wet whitish wood, while drilling indicates a healthy palm on which the treatment will be effective. The emission of dry reddish wood indicates a very old or dying palm and one on which the treatment will not be effective. Insert the tube of the container which is filled with Monocrotophos 60% E.C into the hole and fill it. **DO NOT PLUG THE HOLE**. Caterpillar will die within 3 – 5 days after treatment.

ii) Coconut Moth Borer *Castnia deadalus (Lepidoptera; Castnidae)*

The caterpillars are creamy-white in colour and approximately 10 – 12 cm long when fully grown (**Figure 6**). They live and feed between the bases of branches and trusses leaving shallow tunnels on the trunk. As they continue to feed, they move vertically upwards of the palm. Occasionally, larvae tunnel the bases of leaves and trusses thereby causing no tunnels on the trunk.

An attack by this pest causes leaves and trusses to droop and nut to be shed prematurely (**Figure 6**). Palms may die when larvae bore into the growing point.

Fig. 6 Larva of coconut with borer

The adult moth is dark brown in colour with a whitish bar midway on the forewing and a cresent shaped whitish mark on the distal portion of the hind wing with two rows of whitish spots (**Figure 7**). Life cycle ranges from 160 – 180 days.

Fig. 7 Damage caused by the Coconut Moth Borer

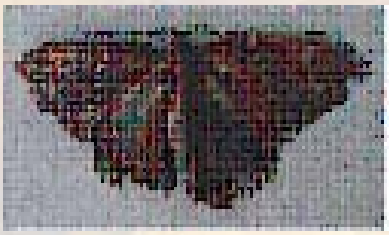

Fig. 8 Adult Moth

Control

Chemical Control:

With the use of a brace and a 5/16in bit, drill three holes, at equal distances, around the sides of the trunk. Monocrotophos 60% E.C is poured into the holes (as described above for the control of the coconut caterpillar). The caterpillar will die within 7 – 10 days after treatment.

iii) Coconut Cockle/ Beetle *Stategus aloeus (Coleoptera; Scarabaeidae)*

This pest affects coconut throughout the country. Palms between the ages of 6mths to 3yrs are susceptible to attack. The cockle burrows into the soil and bores into the palm from below ground. Palms so affected, if not treated urgently, die.

Evidence of the presence of the cockle is a large hole in the ground near the base of the plant. This may sometimes be blocked by plant debris or soil particles.

ADULT MALE **ADULT FEMALE**

Fig. 9 Coconut cockle

The adult cockle is a large dark brown to black insect (males are larger than females), of approximately 5 – 7 cm in size and hard shelled (**Figure 9**). The larvae are creamy-white, 'C' shaped grubs which live within decaying plant debris or rotting tree trunks or coconut husks. It ranges in size from 7 – 10 cm. In severe infestation, as much as 50% of young palms can be killed by the cockle (**Figure 10**). The life cycle ranges from 150 – 180 days.

Fig. 10 Damage caused by cockle

Control

Cultural Control:

Proper field sanitation reduces the incidence of pests. All plant debris should be removed from the fields and burned, since the decaying natures of the debris create the ideal conditions for the development of the pest.

Physical: - Pour water down the hole made by the cockle. When they emerge to the surface, they can be collected and destroyed.

Chemical :- To prevent young plants from being attacked, drench the soil around the palm with a 0.1% solution of any soil insecticide, such as Basudin 60% E.C, or Vydate L20% E.C.

Treating Breeding Places: - If it is difficult to remove or destroy the insect's breeding places of decaying plant debris, then these should be sprayed using a 0.1% solution of a soil insecticide, as mentioned above.

Treating Plants That Have Been Attacked: - Young plants should be examined regularly for signs of cockle infestation. An insecticidal solution of 0.1% concentration, as mentioned above, can be poured down the hole made by the cockle.

IV) Coconut Palm Weevil *Rhyochophorus palmarum (Coleoptera; Curculionidae)*

The adult weevil (**Figure 11**) is known to be the carrier of the nematode, *Rhadinaphelenchus coccophilus,* which is responsible for red ring disease in coconut. Damage to adult palms is enhanced by wound on the trunk. Evidence of the weevil's presence is holes on the trunk from which pieces of chewed fibre, with a thick brownish liquid oozing out (**Figure 12**). Life cycle ranges from 140 – 165 days.

Fig. 11 Adult coconut palm weevil

Fig 12. Damage due to coconut palm weevil

Control

Cultural Control:

- Avoid injury to the trunk. Females lay eggs in wounds where the soft wood is exposed. Wounds on the trunk should be tarred.

Chemical Control:

- **Trapping: -** Cut and split the trunk of a newly cut tree in 1m lengths. Treat each piece with a 0.2% solution of Basudin E.C or Vydate L 40% E.C and set these at various locations throughout the cultivation. Weevil will be attached to these traps and die within 5 -7 days.

iv) Azteca Ants *Azteca spp., (Hymenoptera; Formicidae)*

The Azteca ants are brownish to black in colour and are about 0.5 – 1 mm in size (**Figure 13**). They build carton nests, often near the crown, on the trunk of the palm. Additionally, many small ants' shelters occur on the leaflets to protect mealy bugs.

The Azteca ants inflict a painful sting when disturbed and, thus, interfere with coconut workers who climb to harvest the nuts. The ants also interfere with insect pollinators, resulting in reduced yields.

The ants tend the mealy bugs under shelters on the lower leaves. On palms infested with the ants, scale insects also occur on the lower leaves and on the inflorescence at scars where flowers have fallen.
There is yellowing of leaves infested with mealy bugs and scale insects. These scale insects are bright yellow and circular in shape and are covered with a flimsy semi-transparent convex scale.
Infested palms have fewer leaves than non-infested palms apparently because of weakening of infested palms by the mealy bug and scale insects. The aggregate effect of infestation of palms by the Azteca Ant - Mealy Bug – Scale Complex is, therefore, a severe reduction in yield. Crop loss assessments indicate that infested palms produced only about 38% as many semi-mature and mature nuts as infested palms.

Fig. 13 Azteca Ants

Control

The strategy for controlling the Azteca Ant, Mealy Bug, and Scale Insect Complex is to break the association between the ant mealy bug and scale complex. This is achieved by controlling the Azteca ant with bait formulated by the **National Agricultural Research Institute (NARI)**. The toxicant used in the bait is Fipronil insecticide which is incorporated with pulverized bovine alimentary canal as the attractant.
The bait is applied with a stick to the trunk of the palms approximately 1 metre from the ground. The ants take the bait in small bits and carry it back to their nests where it is distributed among individuals of the colony. The result is death of the ant colonies. Following the death of the ants, the mealy bugs and scale insects also die.
When the bait is applied in the fields, physical contact of the hands with the bait should be avoided; otherwise, the bait would be rejected by the ants.

DISEASES OF COCONUT

1. Coconut Cedros Wilt

Cedros wilt is caused by a flagellate protozoan organism within the phytomonas. This organism is transmitted by bugs with the genus macrophogygulm, oncopeltus and berecynthus. Its alternate host is the milk weed which is commonly found on coconut estates.

Symptoms:

- Brown, necrotic leaves hanging down;
- Brown, necrotic unopened inflorescence;
- Initial yellowing of spear leaves;
- Breakage of frond at mid way;
- Completely necrotized crown; and
- Collapsed crown (**Figure 14**).

Fig. 14 Coconut Cedros Wilt

Control:

- All infected trees must be cut down and destroyed by burning.
- Undergrowth should be kept at a minimum by weeding .

2. Coconut Red Ring

Casual Organism: *Bursaphelenchus cocophilus* (nematode)

It is spread by the palm weevil, *Rhycopophorus palmarum*, and also the sugarcane weevil, *Dynamis borassi* and *Metamasius hempterus.*

Symptom:

Symptom varies according to age, variety, and growing conditions. Symptoms include yellowing or bronzing of leaves (**Figure 15**), nut fall and necrosis or withering of newly opened inflorescence. Production of small and distorted young leaves (little leaf syndrome), the diagnostic feature of the disease is an internal red discoloration at the base of the stem in the form of a ring. The red rings usually extend up the stem, breaking up into streaks or discrete spots, which may extend into the rachis and petiole and into cortical tissues of the root.

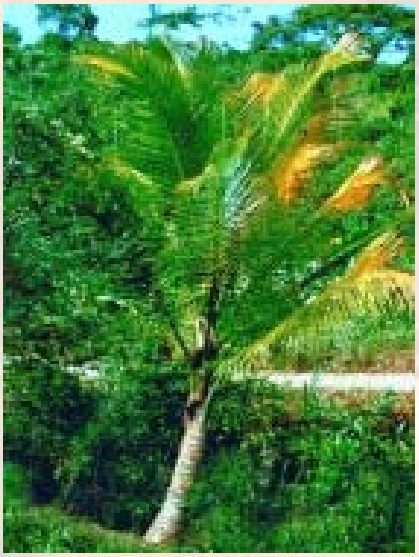

Fig. 15 Symptoms of coconut red ring

Control:

- Control vector using insecticide, nematicide.
- Use resistant varieties and quarantine.

3. Coconut Bud Rot and Coconut Fruit Rot / Coconut Nut Fall

Causal Organism: *Phytophthora katsurae*

Symptoms:

- Young nuts rot and fall (**Figure 16)**
- Buds also rot.

Fig. 16 Coconut Fruit Rot

Control:

- Spray bunches before rainy season with 1% Bordeaux mixture or 0.3% copper fungicides (50%).
- Repeat in July – August.

4. Coconut Stem Bleeding

Causal Organism: *Ceratostomella paradoxa*

Symptoms:

A reddish brown exudates oozes out of the cracks on stem (**Figure 17**). The exudate dies and becomes black.

Control:

- Remove discoloured tissue by cutting out and apply Bordeaux paste.

Fig. 17 Coconut Stem Bleeding

5. Coconut Leaf Rot

Causal Organism: *Helminthosporium halodes*

Symptoms:

- Distal ends of leaflets blacken and shrivel.
- Leaflets show reddish brown lesions.
- Soft rot on central shoot (**Figure 18**)

Control:

- Spray 1% Bordeaux mixture.

Fig. 18 Coconut Leaf Rot