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HILLSIDE AGRICULTURE SUB-PROJECT (HASP)

Some Pests and Diseases of Selected Tree Crops

R. Murray
Jamaica, W.I.

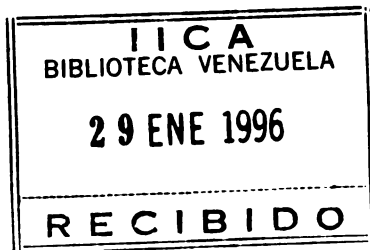
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INTRODUCTION

It is generally accepted that crop losses due to pests and diseases world-wide range from 25-40%, and higher in developing countries like Jamaica. That is the single most important reason for mans pest control activities.

These activities use up a considerable amount of resources and time. For example, it has been estimated that the total man-hours spent controlling weeds is more than the total time spent on all other productive activities.

The holdings of small resource - poor farmers in the Hillside Agriculture Sub-Project (HASP) area are located close to natural forest conditions. Therefore the crops which they grow are invaded by many pests. The populations of these pests are normally maintained on wild hosts. Fiddler beetles, for example, were here, in Jamaica, long before mango, avocado, citrus or any of the many other crops which they attack. With respect to diseases, the high humidity in the area favours the development of many diseases; for example Black Pod on Cocoa and Leaf Spot (Sigatoka) on banana. The pressure of pests and diseases in the area is highlighted by the fact that there are almost forty important crop/pest and disease associations for the six main perennials which HASP encourage farmers to grow; banana and plantains, cocoa, coconut, coffee, mango and pineapple.

Traditional pesticide centered approaches to solving these problems are not always practical or desirable for use by farmers in the HASP area, or any other similar situation. Aside from the fragility of the ecosystems in which they operate, pesticides do not always work and most are very poisonous substances. Furthermore, they are expensive, the equipment to apply them is expensive and water which is required for mixing most of them is not always readily available or accessible. Most importantly, in many cases substantial and/or adequate control of these pests and diseases is possible without pesticides.

This brochure is written that the reader will be able to identify some important pests and diseases of the relevant crops based on description, symptoms and damage which they cause. The time of year when they are most likely to occur is indicated so that farmers and extension officers will know when to expect the problems. However, in many cases it is unwise to wait for a pest or disease to become obvious before taking steps to control it. It will be seen that in most cases cultural methods are emphasized for controlling the pests and diseases; this is because they work. In themselves these methods do not involve extra time or effort to control the pests and diseases. They are requirements for good management of any crop. Most are easy to learn, simple to implement and all can be sustained by the farmer.

BANANA & PLANTAIN

BANANA BORER: also Banana weevil or Banana weevil borer

Occurrence: Year round but most active during rainy season.

Description: Fully developed adult banana borers are reddish brown to black beetles, 10-14 mm long and 5mm across with a distinct curved snout. They spend most of their lives in the soil and are often found in the pseudostem of harvested plant. They are most active at night and during wet weather. The weevils are strongly attracted to rotting banana and plantain plant material.

It is believed that the adult live for up to two years and will survive for up to six months without food, if the soil remains moist. Each adult female lays up to 100 elongate-oval white eggs about 2-3 mm long. They hatch in 5-8 days into the larvae which does most of the damage to the plants. They are white and legless with a brown head and about 10mm long when fully grown. They feed internally on the flesh of the corm, occasionally burrowing up into the pseudostem if the old stem is left standing after the bunch has been cut. The larval period normally last 14-21 days before they pupate. The pupae are about 12mm long and white in colour. They are found below ground level and immediately below the surface of the corm. Pupation last for about 5-7 days before transformation to an inactive soft bodied lemon coloured adult.

Damage: The larva bores irregular tunnels into the corm and pseudostem of the plant as it feeds. These tunnels are filled with the moist frass (dust-like droppings excreted by the grubs).

At first they are narrow, but as the grub gets larger, the tunnel increase in size. The flesh of the plant at the edge of the tunnels turns brown and rots. The result is a typical network of brown tunnelling through the entire corm of the plant. If the plant is small, the variety very susceptible or the infestation very heavy the plant will be severely weakened and may die.

Symptoms: Plants attacked by borers are unhealthy looking, often with thin stems and poorly developed root systems. They are easily blown over and take a long time to fruit. The bunches are small and the fruits poorly developed.

Spread: The borer may spread in a number of ways.

1. By the movement of suckers from an infested area. This is the main means by which the pest is spread over great distances.
2. By crawling in search of new feeding material. This is the main means by which the pest is spread within the fields.
3. In heavy rainfall, infested plant material as well as adult beetles in the soil may be washed down steep slopes, from high to low lying areas.
4. Although these insects have well developed wings, flight is not believed to be an important means by which they spread.

Control: The most widely used method of controlling the Banana borer is with insecticides. However, the high cost of these chemicals, their poisonous nature, the development of resistance to many of them by the borer, and the damage they do to the environment have made them increasingly unpopular. More importantly, it has been proven that farmers can reduce borer populations substantially by using good cultural control measures.

1. Plant clean uninfested suckers in new field.
2. Keep the mats clean by promptly removing all dead leaves and water suckers and leaving only a few choice healthy suckers with each mother plant.
3. Control weeds in the fields.
4. The pseudostem should be split lengthwise and chopped into small pieces. This hasten natural decay and allow quick drying out of the tissues, thus depriving the borers of suitable food and breeding sites.
5. Old pseudostems can be cut up and placed cut surface downwards as traps for adult borers. Once a week the beetles should be collected and killed.
6. In areas where borer infestation is high do not leave the mother plant standing after harvest. The pseudostem should be cut near ground level and chopped into small pieces. The rest of the corm should be covered with impacted soil. Later, when the followers are established the old corms should be dug up and the spaces filled with soil.

Before using insecticides, and to reduce costs the level of borer infestation in field should justify these expenses. As soon as a visual inspection show more than one in ten plants attacked, it will be necessary to treat the fields with insecticides. Alternately, if more than one borer per trap is recorded, using one pseudostem trap to every fifty mats, it is advisable to treat with insecticides.

LEAF SPOT: also Yellow sigatoka

Occurrence: Year round but spreads most rapidly during hot rainy months, May - June and October.

Damage: Under favourable conditions the leaf spot fungus kills large areas of the leaves on affected plants. The tissue can be killed within twenty-one days after infection. Affected leaves do not function efficiently, thus the plants are unthrifty.

Symptoms: The earliest visible signs of a leafspot infection are small yellow streaks, 1-2mm long, on the leaves. They develop into more or less round spots of dead brown tissue, each with a yellow border. Eventually they join to form large areas of dead brown patches. Badly affected plants produce fruits of generally poor quality. They tend to be small and ripen prematurely and unevenly.

Spread: When the spots on the leaves turn brown the fungus within them produce spores. Spores are like minute seeds, too small to be seen with the naked eyes. These spores are readily spread by water splash when it rains.

Often spores are discharged from the grey areas of older spots when conditions are wet. These spores may be carried over long distances in the air. Generally, the spread of the disease is favoured by warm weather and long periods of leaf wetness. Dry conditions restrict the spread of the disease.

Control: Except for the May and October rainy periods, chemical methods of controlling leaf spot are of little advantage. Cultural methods are normally adequate for controlling the disease:

1. Plant resistant varieties. Gross Michel, Lacatan and Valery are among the highly susceptible varieties. Plantains are more tolerant to this disease than bananas.
2. Observe proper planting distances.
3. Avoid planting in sheltered wet areas.
4. Keep the mats clean by regular desuckering and removal of dead leaves.
5. Control weeds in the field.
6. Maintain good drainage in the fields.

ROOT ROT: also Banana root nematode or Burrowing nematode

Occurrence: Year round

Damage: Root rot disease of banana and plantain is caused by nematodes. These are microscopic worms. They are too small to be seen by the naked eyes. The most common ones on these crops kill plant cells when they feed on the roots and corms.

These dead cells are invaded by bacteria and fungi which induce rotting of the roots. Affected corms develop large dark brown to black areas of dead tissues which extend inward to eventually kill the corm, severe cases.

Symptoms: In well cultivated fields, the above ground symptoms appear slowly. An occasional plant will show yellowing of the leaves or even death of tissue along the leaf margins. These conditions are easily attributed to nutritional disorders. Eventually, poor plant growth and unthriftness associated with stunting or wilting will be obvious. Toppling of mature plants, poorly developed root systems and small poorly formed bunches will be evident.

Spread: The root rot nematode spends virtually all its life in affected roots and corms. Still, it is able to move through the soil to infest new roots of nearby plants. This way it spreads slowly within fields . Widespread distribution is through the movement of contaminated soil and planting materials.

Control: The most important control measures for nematodes on banana and plantain include those which prevent their movement between fields.

1. Only nematode free suckers must be planted. If these are not available from nematode free soil, remove all discoloured tissue by paring with a sharp knife. Only large suckers should be pared such that the minimum diameter of the planted material is not less than 15cm.

2. Avoid planting in soils infested with nematode.
3. Crop rotation. The root rot nematode will not survive in the soil for very long without a suitable plant host. A field may be cleared and left fallow for at least six months, or planted with one or two non-host crops before replanting with banana or plantain.

Localized severe nematode infestations may be economically controlled with nematicides in young fields. It must be remembered though, that nematicides are all expensive, very poisonous substances and their effectiveness is variable. Therefore farmers should only use them on the advice of a laboratory, after an analysis of root and soil samples is done.

SLUGS & SNAILS

Occurrence: Year round. Most active in rainy seasons but damage most severe in dry months.

Description: Slugs are slimy, softbodied, flattened, elongated, greyish brown or yellowish, legless animals with two pairs of antennae on the head and may be up to 10cm long. Snails are very similar to slugs, only they carry a hard shell into which they withdraw fully when disturbed or at rest. The snails which do most injury to banana in Jamaica are the white round shelled snails.

Damage: Damage is most severe during dry periods when banana plants and fruits are the most juicy plant materials available.

All the leaves on small plants may be eaten. Deep feeding scars are left on attacked fruits, often most of those on a single bunch are damaged.

Symptoms: Shiny white mucus trails left on plant and on the ground where the slugs or snails crawl. The scars on the fruit have a rough appearance with the peel fibers exposed. Damaged leaves are left with jagged edges often extending to the mid-rib which is usually not eaten.

Control: Damage to plants in mature banana and plantain fields is usually insignificant. Damage on single bunches of fruits is often severe but widespread epidemics are unusual. Good cultural practices are normally sufficient to keep these pests under control.

1. Practice good field sanitation.
2. Find and destroy their hiding places.
3. Prevent the building up of cool damp areas in the fields.
4. Periodic removal of mulch will expose their egg masses and cause them to dry out in dry periods.
5. Slugs hide beneath the loose leaf sheaths at the base of the pseudostems during the day. These sheaths should be cut away, as close as possible to the ground during the pruning operation.
6. Damaging snails are usually found behind hanging leaves. They may be picked off and killed to help reduce the population.

Slugs population may be determined by trapping with one trap to every ten mats. A trap consists of a half meter piece of banana or plantain stem, split down the centre and one half placed flat side down in an uncleaned shaded area in the field. These should be examined after 24 hours. If an average of more than two slugs per trap is found and fruit damage is apparent treatment with slug bait may be necessary. A second trapping two weeks after treatment will give an idea of the effectiveness of the treatment. On small holdings it may be adequate to just collect the slugs from the traps and kill them.

BANANA THRIPS

Occurrence: Mostly in period of low rainfall and warm conditions; January to April and June to August.

Description: Thrips are very small insects with feather-like wings. Adult banana thrips are dark brown in colour and about 1.5mm long. The young ones (nymphs) are yellowish with the abdomen appearing black, often upturned with a drop of liquid excreta carried at its tip.

Damage: Thrips feed on the juice in the skin of the fruit by scraping the surface.

Symptoms: An attack by banana thrips cause raised bumps and brown freckled marks on the skin of the fruits. Some thrips cause a silvering of the fruit surface.

The skin of severely infested fruits may crack and allow fungi and bacteria which cause rotting to enter. Sometimes the fruits split.

Spread: Thrips are not particularly strong fliers but because of their small size, they are carried considerable distances by wind. The adults will hop-fly short distances.

Control: Damage by thrips is most severe when conditions are hot and dry. Nevertheless, cultural control methods will reduce the populations considerably.

1. Avoid planting red peas or gungo peas near banana and plantain. These crops are alternate hosts for thrips which damage banana and plantain fruits.
2. Remove the male flowers and false bunches promptly. They are often heavily infested with thrips.
3. Sleeve the bunches early; within three weeks after shooting if banana are being grown for export.
4. If the problem persist after the above measures are taken, three applications of a suitable contact insecticide, directed only at exposed bunches at two week intervals should suffice.

COCOA (CHOCOLATE)

ANTS

Occurrence: Year round

Description: Several kinds of ants are found in association with cocoa in Jamaica. The three most common ones are:

- i) **Pitty-me-little** - These are tiny orange-brown ants which usually nest in inconspicuous clumps of debris and dry wood on the trees.
- ii) **Black ants** - These build conspicuous nest of hard dark brown material attached to the stem of trees and forage over considerable distances.
- iii) **Biting or Fire ants** - They are dark reddish-brown ants which build their nest on the ground, usually close to and about the trunk of trees.

Damage: These ants are not known to damage cocoa plants, but they are serious nuisances to workers. Pitty-me-little ants inflict a painful bite which leave a small swelling that itches for hours. Their presence is usually detected after the itching start.

Black ants do not bite readily, but they have a disagreeable odour which lingers on the person for hours. Fire ants are extremely aggressive; they attack in large numbers immediately when the nest is disturbed, each inflicting a painful sting.

Control: Aside from being nuisances to workers, ants play a dual role in agriculture. On the one hand they are important predators and destroy many harmful insects. On the other hand they drive off the enemies of some insects which are harmful to crops. For these reasons, the total elimination of ants from a field may not be a good idea. Where their presence create serious problems, large nests of fire ants should be found and drenched with a suitable insecticide mixture. A black ants nest may be killed by carefully wrapping with a piece of cloth or crocus bag, then soaking it with the insecticide mixture. Pitty-me-little ants can be controlled by proper and regular pruning practices which include the removal of dead wood from the trees. Generally, good field sanitation will make the area unattractive to ants.

BLACK POD

Occurrence: Mostly January to April and August to November.

Damage: The fungus which cause the black pod disease kills the immature pods on the trees and make the beans unsuitable for harvest. Pods at all stages of development are susceptible. In addition, the areas on the stems from which pods are borne may become infected and incapable of producing viable pods.

In serious cases, young vegetative shoots may also be killed. Though mature pods also turn black when attacked; the beans are usually unaffected by the fungus. Still, over 75% of the crop may be lost to the disease.

Symptom: First a more or less circular brown water-soaked spot appear on the pod. In a few days it spreads and the whole pod eventually turn black, usually within fourteen days. The pods become hard and are retained on the trees. Older infected areas on the stems may ooze a gummy exudate. In severe cases infected trees die slowly as a result of the die-back of young shoots which are attacked.

Spread: Free water is required for the development and spread of the black pod disease. Under wet conditions, the fungus produce spores on the outside of diseased pods. These appear as an off-white to grey fluffy bloom; they are easily spread by wind. Rain water running down the stems also spread the fungus on the trees; also pods growing close to ground may become infected by spores carried from the soil in rain water splashes. Insects, birds, rats and man all play a part in spreading this disease from plant to plant. The major source of inoculum for spreading the disease from season to season is diseased pods left in the field.

Control: The crux of successful black pod control is good cultural practices.

- i) Plant resistant varieties.
- ii) Reduce excess shade, control weeds and allow good drainage to keep the field dry.

These activities are particularly necessary before and during the rainy seasons.

- iii) Prune trees to keep them less than 6m tall and remove all branches less than 1m above ground.
- iv) Remove all diseased pods promptly from the trees, to an open area away from the trunk of the trees.
- v) Remove all mature pods in the off season.

Spraying with fungicides is very expensive. This should be done only after:

- a) All other control measures are used.
- b) Average yield exceed twenty pods per tree.
- c) Infection level is above 10% of pods.

RATS

Occurrence: Year round but most noticeable September to December and March to June, in cocoa.

Description: The rat which normally attack cocoa is the common house rat. They will not normally forage more than 40m from their nests.

Damage: Rats gnaw holes into cocoa pods and eat all the beans within days. One large hole is cut into each pod, usually closer to the stem end.

Spread: Rats have a high reproductive potential, with normal litter size ranging from four to twelve and a gestation period of twenty one to twenty three days.

The greater the food supply, the faster the breeding rate; it is also favoured by rainfall. They will migrate considerable distances to find food if the locality become over-crowded.

Control: Good domestic hygiene is the first step towards effective rat control. Household garbage should be properly disposed of and the creation of rubbish heaps should be avoided. Good field sanitation, the removal of suitable living and breeding sites will make the area unattractive to rats.

If the above measures are observed the resident rat population will be minimal. Most damage, if any, done to the crop will be by migrating rats. These may be adequately controlled with rat baits. One bait station to every fifteen to twenty trees is adequate. The bait must be checked every three days and replaced as necessary. This should continue until no more bait is eaten and pod damage has stopped. Rat baits are poisonous therefore, they should be sited out of reach of children, domestic animal and birds.

TERMITES: also Duck ants or White ants

Occurrence: Year round.

Description: Termites are soft bodied social insects that live in colonies. Those in Jamaica make nests inside wood or in the ground, on posts, stumps or large stems of trees, with a mixture of earth, saliva and faeces. Exposed nests and the covered track leading from them are brown in colour. The colony consist of workers, soldiers, the royal pair, some with wings, immature forms (nymphs) and eggs. Most of them are workers; they may be dirty-brown or white in colour.

Damage: Drywood termites attack rotting portion of trees; stumps left at the time of pruning rot and encourage attack. Wetwood termites are more serious pests on cocoa. They make nests and tunnels in the living stems of the trees. Their attack start on cut portions of the trees which are rotting and on damp rotting wood on trees. Stems which are attacked are considerably weakened and break off easily.

Symptoms: The presence of drywood termites is known by the covered tracks from the nest (or the ground) to the drywood on trees. The only external sign of wetwood termites is the presence of a red dust-like residue at the point of attack. Otherwise, the tunnels will be seen in the central woody core of attacked branches which break off.

Spread: Usually during the rainy season and after rains, shortly after sunset, winged forms leave the nest in swarms. These are strongly attracted to light and many will end up around lights indoor. Individually, males and females shed their wings and form pairs. If suitable nesting sites are found these pairs establish colonies as new kings and queens.

Control: Wetwood termites are adequately controlled by the following measures:

- i) Avoid wounding trees in routine operations.
- ii) Seal all pruning wounds promptly, also those caused when branches are broken accidentally.
- iii) Remove all dead wood from the trees.

Drywood termites will be discouraged by the prompt removal of dead wood from trees and stumps and logs from the fields; nests may be destroyed by burning. Alternately a suitable insecticide mixture may be poured into the nest through a hole bored in it.

COCOA THRIPS: also Red banded Thrips

Occurrence: January to March and July to September.

Description: The adult cocoa thrips is slightly smaller than the banana thrips, 1.0mm - 1.2mm long. They are dark brown to black; they are best identified by the red band across the base of the abdomen.

Damage: These thrips feed on the juice of leaves and pods. If the attack is severe, damaged leaves are shed prematurely.

Symptoms: Attacked leaves first develop a reddish tinge but they, like young pods which are attacked, eventually turn bronze coloured. Small, blackish, shining droplets of faeces will also be visible on the damaged parts.

Spreads: See banana thrips.

Control: Cocoa trees which are under stress because of inadequate shade, insufficient nutrients, too little water or water logged conditions are most prone to attack by thrips.

Therefore, cultural practices which prevent the development of stress will discourage and control outbreaks of this insect.

COCONUT

ANTS

See ants on cocoa.

BUD ROT

Occurrence: Periods of high rainfall and after hurricanes which often damage coconut crowns.

Damage: The bud rot fungus kill coconut palms when the growing points are attacked.

Symptoms: Although palms of all ages are attacked, young palms growing in damp shaded areas are particularly susceptible to attack. First the heart leaves turn brown or grey then finally bend over. These leaves are easily pulled out; If bunches of nuts are present they and the lower leaves remain on the tree for several months before falling. The heart will be found rotting and foul smelling if it is cut open. If the growing point is not affected the young leaves emerge as short stumps with damaged fronds. Several of these short leaves in the centre of the crown create a bitten-leaf effect.

Spread: The spores of the bud rot fungus is carried from place to place by wind. However, they require damp conditions to start growing and the disease develop most rapidly on coconut palms with damaged crowns.

Control: Trees which shade young palms should be removed or pruned to make conditions unfavourable for the disease. Badly affected palms should be cut down and the crowns burnt. For palms which are not badly affected and those around them: 60 gms of a copper fungicide may be sprinkled into the crown of each. Alternatively, the fungicide may be placed in a bag made of the fibrous material and set in the crown at the base of the leaves.

LETHAL YELLOWING

Occurrence: Year round

Damage: Affected trees are killed by this disease.

Symptoms: The outer leaves of non-bearing palms lose their sheen then turn yellow. This is followed by browning of the heart leaves, rotting of the "cabbage" and death. In mature bearing palms the sheen in the leaves is lost. This is followed by a yellowing of the tip of one or two leaves in the middle of the crown and shedding of nuts, starting with the youngest. Soon the tips of the most recently opened flowering branches turn black then shrivel completely later. In a few weeks the outer leaves turn orange yellow then bright yellow.

The crown fall off to leave the bare stem standing; by then the rotted cabbage will have a foul smell. Affected palms die within four months after the first sign of the disease is seen. It should be noted that other conditions can cause any one of the more common symptoms of this disease. Therefore one can only be certain that lethal yellowing is present when more than two symptoms occur together.

Spread: It is believed that the organism which cause lethal yellowing is spread by an insect. The first signs of the disease may not show on a tree for up to nine months after it is infected.

Control: Plant resistant varieties. The traditional Jamaica tall variety is highly susceptible to lethal yellowing. Malayan Dwarf is resistant while the Panama Tall shows some resistance to the disease. The Maypan variety is also resistant and well suited for higher elevations.

GALL MITES

Occurrence: Year round.

Description: Mites are related to spiders. The gall mites which attack coconut are very minute (0.2 - 0.3 mm long), worm-like and four-legged. They live under the bracts of the nuts.

Damage: In feeding they scarify the surface of the nuts. Severely infested nuts are smaller than normal. Many may fall from the trees while quite young and all those which reach maturity may be affected.

Symptoms: Large hard striated brown areas on the nuts; many being smaller and deformed in severe cases.

Spread: Because of their small size the mites are easily blown about by wind. Hitch hiking on birds and insects play a minor role in the spread of this pest.

Control: Because young nuts are produced throughout the year the mites breed continually and several generations are produced each year. During periods of heavy and frequent rainfall large numbers are washed from the plants and thus their damage is less severe. During dry periods the use of miticides may become necessary, especially if many damaged nuts appear early in the dry season.

COCONUT SCALE: also transparent scale

Occurrence: Year round.

Description: The coconut scale is circular, flat, whitish to greyish, semi-transparent and 1.5 - 2.0mm in diameter. The females are pear shaped to oval, yellow to yellowish-green and considerably larger than the males. These scales occur on the underside of coconut leaves, sometimes in such large numbers that they form a continuous crust.

Damage: The insects feed by sucking the sap from the palm leaves. In severe cases infested leaves are killed.

Symptoms: Yellow spots on the upper surface of infested leaves. Whole fronds then the entire leaf turn yellow as these spots combine. In severe cases the fronds die, turn brown and drop.

Spread: Birds and bats are the main agents which spread the coconuts scale over considerable distances. The motile forms are able to move from tree to tree along touching leaves.

Control: Damage by the coconut scale is most severe where rainfall is high and the palms are planted too close together or under shaded conditions, and where they are neglected. Therefore these scales are not normally a problem on well managed coconut. Under normal conditions several natural enemies, including ladybird beetles, keep them in check. However, if ants are present they are likely to drive off these natural enemies. Ants tend to follow the scale insect for the sweet honey dew which they secrete. Therefore ants should be denied access to the scales. If insecticides spraying must be done an occasional tree should be left unsprayed to allow populations of natural enemies to develop.

RATS.

Occurrence: Year round.

Description: See rats on cocoa. These pests often build their nests in the crown of coconuts palms.

Damage: Up to 70% of the nuts in a field may be lost to rat damage. They gnaw a single large hole in the nut to get at the flesh and water. In addition, seedlings may be attacked and the growing points destroyed.

Symptoms: Young nuts which have not developed hard shell fallen to the ground under the trees, each with a single large hole in it and the flesh eaten.

Spread: See rats on cocoa.

Control: See rat on cocoa for cultural control measures. If damage exceed 60 nuts per 100 trees per year, it will pay to use poisoned baits. Set one bait station to every 5 trees, out of reach of children, birds and domestic animals. The stations should be checked every three days and the bait replaced if necessary.

TERMITES:

See termites on cocoa. Those which attack coconut are Drywood termites.

COFFEE

COFFEE BERRY BORER

Occurrence: In berries, February to November.

Description: Adult Coffee berry borers are small dark brownish to black beetles, 1.6 - 2.5mm long; the females being larger and more numerous. They are cylindrical in shape and hairy bodied. The larvae are legless and white with brown heads.

Damage: The mated females bore holes into the green berry to lay eggs. The larvae (up to 20 per berry) feed extensively on the beans, destroying them in the process. In her search for suitable berries in which to lay her eggs the female bore into several berries and abandon many of them. These holes are suitable sites for many rot causing fungi and bacteria. Yield losses can be so severe that the borer is widely regarded as the major pest of coffee in Jamaica and many other places where it occur.

Symptoms: Usually one small circular hole, about 1mm in diameter, at the tip of large green or ripe berries. The affected beans show a distinct bluish-green discolouration. Several larvae and pupae are often present in the damaged flesh of these beans.

Spread: Females mate with males from the brood before leaving the berries. The problem is spread as they fly from tree to tree, to find suitable berries for breeding and lay their eggs.

Control: Heavy shade, either from shade trees or from coffee trees planted too close or inadequately pruned, create conditions which are unsuitable for the natural enemies of the borer. Also, high populations of the insect are favoured by poor field sanitation and the presence of berries left on the trees after harvest. Proper and well timed cultural measures should effect adequate control of this pest. The use of insecticides should only be regarded as a supplement to the following measures:

1. Do not plant coffee closer than recommended distances.
2. Remove excess shade.
3. Prune the trees to keep the canopy light and open.

4. During the reaping season, pick the berries regularly, at least once every fourteen days; taking care to pick all ripe berries.
5. All dried berries and those fallen to the ground including rat-cut berries should be removed and burnt.
6. Strip and destroy the remains of the old crop before flowering.
7. A clean circle weeding of the area beneath each tree should be done to expose fallen berries.

COFFEE LEAF MINER

Occurrence: During the drier months, February to April and June to August.

Description: The fully grown larvae of the coffee leaf miner is a flattened, white caterpillar, about 4.5 mm long, living inside the brown blotches which they create in the leaves. The pupa live in a "H" shaped silken cocoon on the underside of the attacked leaves or on leaves lying on the ground. The adult is a satiny white moth, about 3mm long, with silvery wings. When at rest they are quite inconspicuous with the wings folded down around the body. They are most easily seen when large numbers are in flight and are most active in shaded areas or overcast conditions.

Damage: Leaf miner larvae feed extensively between the upper and lower surfaces of attacked leaves. Up to six larvae are commonly found in each blotch created by this feeding. A heavy outbreak may cause most of the leaves to fall prematurely. This cause a significant reduction in yield.

Symptoms: Several irregular brown blotches on leaves. In severe outbreaks of the pest the blotches combine, covering most of the leaf surface and causing many to be shed.

Spread: Under favourable conditions, adult female leaf miners fly from plant to plant in a field to lay their eggs. Because of their small size the moths are readily blown considerable distances by wind.

Control: Leaf miner infestation is favoured by low humidity. Therefore they tend to be most damaging in the dry season. However, the adults are very sensitive to light and are most active in shaded areas. Under wet conditions many larvae are drowned by water which enter the blotches. Also many adults are killed during

rainy weather. Many natural enemies are killed or otherwise inhibited by copper fungicides used against the coffee leaf rust, or on banana which is grown as a shade for coffee. The indiscriminate use of insecticides against other pest could also kill many of parasites which help to keep the miner in check.

The main cultural measure which farmers may use against the coffee leaf miner is to prevent excess shading by:

1. Not planting closer than recommended distances.
2. Pruning the trees to maintain a light open canopy.
3. Keeping shade trees well pruned.

The above measures should make the field less attractive to the adults. The use of insecticides should only be considered if a heavy infestation threatens early in the dry season. One application seven days after adults are most active in the field and another three weeks later should give adequate control. A heavy infestation towards the end of the dry season or early in the rainy season will normally be controlled by the rains.

COFFEE RUST

Occurrence: Year round but most obvious after rainy season.

Damage: Coffee rust cause the premature shedding of diseased leaves and reduction of vegetative growth. Severe infestation causes a die-back of young shoots on heavily bearing trees. The net result is a drastic reduction in yield of diseased coffee trees.

Symptoms: Coffee rust disease appear first as small pale orange-yellow somewhat oily spots on the lower surface of the leaves. The spots enlarge quickly to become bright orange to red or rust coloured in the centres. The older infected tissue in the centre of the spots soon die and turn brown. Often the spots combine and badly affected leaves are shed. Young shoots of severely affected trees wither and die. Thus the trees show a steady decline in both vigour and yield over a number of years.

Spread: The coffee rust spores are spread over great distances by wind. They are also carried over long distances by insects, birds, man and other animals. Free water, dew or rain water, play a key role in distributing the spores to new sites on the affected and adjacent trees.

Control: Warm nights, shaded conditions and high humidity are required for development and spread of the coffee rust disease. Nothing can be done to influence temperature, but shading and high humidity can be dealt with:

1. Avoid planting coffee in low, damp, sheltered areas.
2. Do not plant coffee closer than recommended distances.
3. Remove excess shade.
4. Prune the trees to keep the canopy light and open.
5. Keep weeds under control.

If fungicides must be used, avoid over-spraying as this is costly. Furthermore, it may disrupt the natural balances and result in the outbreak of other pests; for example, leaf miner. Two applications, preferably with a mist blower, three to four weeks apart, at the beginning of the rainy season, will normally give adequate protection.

MANGO

ANTHRACNOSE

Occurrence: Year round; most severe during flowering and fruit ripening periods especially under moist conditions.

Damage: Under moist conditions particularly when dew fall is heavy, most of the flowers are "burnt" off by the anthracnose fungus. Many young fruits are lost and the fungus remain inactive in other fruits until they begin to ripen. The fruits are made unmarketable or reduced in value by the fungus.

Symptoms: The disease appear on mature leaves as small irregular sunken black spots. During flowering whole inflorescence turn dark brown to black and are lost. This is most obvious under moist conditions. Many young fruits turn black and mummified.

These may be retained on the tree for long periods. Tear stain streaks appear on some fruits; from the stem, down the side to the tip of the fruit. Immature green fruits have black "pinpoint" spots on them. Green mature, turn and ripe fruits develop large areas of sunken black rotted tissues. Often the rot extend into the flesh of the fruits. Badly affected fruits, though they ripen, tend to be fresh and of inferior flavour.

Spread: The anthracnose fungus is favoured by high humidity. Free flowing rain or dew water washes the spores from dead plant material high on the trees to lower areas. They are also spread by splashing. Dispersal over long distances is mainly by wind.

Control: If anthracnose take root in a mango tree or in an area it will almost certainly require the use of fungicides to reduce levels. Before that stage is reached, the trees should be pruned regularly to encourage good air movement through the canopy. Also, trees, bush and weeds which keep the area cold and damp should be removed. A successful spray programme for anthracnose control is very expensive to maintain. It should start shortly before flowering and be continued to the end of the crop. It is better to avoid this by paying attention to good cultural practices from early.

FRUIT FLY, also West Indian Fruit fly

Occurrence: March to August on mature fruits.

Description: The adults of the fruit flies which attack mango in Jamaica are about 8-10mm long; that is, slightly smaller than house flies. They are yellowish-brown with brownish bands on the wings. The females ovipositor is about one third as long as the rest of the insect and is prominent at the tip of the abdomen. At rest, the wings are held out at right angles to the body and moved continually. The larvae are about 8mm long, yellowish-white typical maggots with the anterior end being smaller than the rear.

Damage: The maggots feed internally on the flesh of infested fruits making them soft and unsuitable for sale. Often the feeding activity is associated with bacteria which cause rotting. It is believed that fruit fly infestation lead to premature fruit fall in some mango varieties.

Symptoms: The first symptom of fruit fly infestation to be seen is usually the presence of brown areas of rotted flesh in otherwise normal looking fruits. The maggots may also be seen in areas of softened fruit flesh. Also, small circular clean cut holes, 1.5-2mm wide may be seen in the sides of fallen fruits on the ground.

Spread: Fruit flies are strong fliers and will travel considerable distances in search of suitable hosts fruits for laying eggs. They survive from one mango season to the other mainly by infesting other hosts.

Control: In Jamaica, the most important alternate host of the West Indian Fruit Fly is the Hog plum. Every effort should be made to remove these trees. In addition, fallen fruits should be collected and buried or fed to animals. Some varieties of mango, for example Tommy Atkin and St.Julian are less susceptible to fruit fly attack. These should be selected over others for planting.

Spraying with insecticides to control fruit flies is very expensive. It should only be considered where there is a history of heavy infestation and several trees are involved.

SOOTY MOULD

Occurrence: Year round.

Damage: Affected leaves are unable to function efficiently. Few flower are produced by badly affected trees therefore their yield is considerably reduced.

Symptoms: The entire tree or only a part of the canopy may be affected. From a distance the affected portion of the canopy appear very dark green to black in colour. The leaves are covered by a black velvety fungal growth. This is entirely superficial and is easily rubbed off with the fingers. In many cases the condition will be noticed on trees on which ants are present in large numbers. Sooty mould fungi grow in honey dew, the sweet substance produced by certain sucking insects, for example, scale insects, aphids and white flies. Usually, scale insects are present on affected mango trees.

Spread: Sooty mould fungi are present everywhere. However, they will not cause a problem unless honey dew is present for them to grow in.

Control: Once the relationship between sooty mould, honey dew and the insects which produced it is understood, solving the problem is quite simple. The honey dew producing insects should be controlled. Ants which are found in association with these insects protect them from some natural enemies. Often it is adequate to control the ants or deny them access to the scale insects. The natural enemies will do the rest. Occasionally the honey dew

producing insects are present on other trees close to the tree(s) on which the sooty mould is growing. The control measures should be directed at the insect on these other trees.

ANTS & TERMITES

See Ants and Termites on Cocoa.

Those which attack mango are drywood termites.

THRIPS

See Cocoa Thrips on Cocoa.

Thrips are believed to be present in small numbers, on the underside of mango leaves at all times. However, they are kept in check by natural enemies. Occasionally the natural balance is disturbed and an outbreak occur. In severe cases, premature leaf fall may occur. Special control measures are not normally required as infestation is usually reduced by natural factors.

PINEAPPLE

PINEAPPLE MEALY BUG

Occurrence: Year round.

Description: The Pineapple mealybug is a pinkish coloured insect, about 5mm long and oval shaped. It is covered by a white mealy looking coating of wax, from which the name mealybug is derived. These insects are most abundant on the roots of affected plants, at the bases of the leaves and on the stem below ground level.

Damage: Mealybugs are sucking insects which feed on the sap of infested plants. More importantly, they spread the virus which cause Mealybug Wilt Disease. This disease kills pineapple plants. Severe and unattended infestation can render a pineapple crop uneconomical.

Symptoms: Affected plants appear unthrifty, wilt and usually die after several months. The rate of decline tends to be faster in more vigorous plants. The wilt starts with the heart leaves turning pale yellow in colour and bending over. This is followed by the withering of individual leaves then death of the plant. When the wilting is advanced the small mealy looking insects will be very evident on the roots and underground portion of the stem. Prior to this, the presence of stinging ants on the plant will be quite evident.

Spread: By themselves mealybugs move very slowly. Within an established field they are spread mainly by ants which tend them for the honey dew which they produce. They are carried from field to field on infested planting material.

Control: Cultural control measures can give adequate control of the pineapple mealybug by themselves:

1. Avoid planting susceptible varieties such as Smooth Cayenne. Cowboy shows some resistance to the pest.
2. Control the ants in the field.
3. Crop rotation: The insect also feed on sugar cane, peanut, coffee, carrot and coconut. Avoid planting pineapple close to these crops or in rotation with them.
4. Select planting material from healthy plants that are free from mealybugs.
5. As an added precaution, slips and suckers may be dipped in a suitable insecticide mixture and stacked upright before planting.

NEMATODES

Occurrence: Year round.

Description: See Root rot of banana.

Symptoms: Pineapple plants suffering from nematode attack appear unthrifty without obvious cause; stunting, yellowing and wilting. On examination the root system will be poorly developed and often deformed.

Spread: Nematodes spread very slowly in pineapple cultivation. The main danger is the steady build up of their population in field which are kept in pineapple production for several years.

Control: Field application of chemicals is not normally required for controlling nematodes in pineapple production. The following cultural methods are adequate.

1. Use nematode-free planting material. If ratoon suckers are used these may be dipped in a nematicide solution prior to planting as an extra precaution.
2. Crop rotation is the most economical means of preventing the build up of population of parasitic nematodes.

Even though many of them feed on several different kinds of plants, as a general rule those which attack grasses such as corm and sugar cane will not attack broad leaf plants and vice versa.

WEED IN TREE CROPS

A weed is a plant growing where it is not wanted. Weeds are harmful to a crop when they:

1. Compete with the plants for water, nutrients, space or light.
2. Harbour pests and diseases of the crop.
3. Prevent or restrict normal activities in the crop.

Hillside farmers spend more time on weed control than any other farming activity. Very often, how much land is cultivated is determined by how much the farmer can keep weed free. Traditional approaches to weed control call for the complete and indiscriminate removal of all weeds from time to time. In tree crop production on hillsides, this is often:

- a) Unnecessary because all weed plants do not compete with the crop plants at all times.
- b) Harmful to the environment because it encourages soil erosion.
- c) Wasteful because no extra advantage is gained for the time and money spent.

Still the problem of weeds is quite complex. They reproduce themselves and grow rapidly. If one type of weed plant is removed, it is usually replaced by another which develop rapidly. Finally, no single method will work well in all situations. Hillside farmers may use any of several methods to control weeds in tree crops. The important things to remember are:

1. Do not try to solve the problem overnight. Good weed management require a well thought out long term programme.
2. Avoid leaving the entire field free of weeds. The steeper the slope the more important it is to keep the soil covered.
3. Try to deal with weeds before they produce seeds.

Intercropping with short term crops will generate some income while the trees are young and growing. These short term crops will make weed control more profitable. The extra income may also be used to cover some of the cost of weed control. The following methods may be used to control weeds:

a) **Mulching** - This is the use of plant material to cover the ground around the foot of the trees. The mulch prevent the growth of weeds and kill those which are covered. One should take care not to use green grass or other plant material which will grow for mulching. This method is highly recommended as, among other advantages, it protects delicate feeder roots growing near the

surface. Among its disadvantages is that it harbours certain pests, for example, slugs and snails.

b) **Hand pulling** - This method is suitable for larger weeds growing where hand tools will not work well, and for those which will grow back readily if the stump is left in the ground. It is very effective but slow and time consuming.

c) **Mechanically** - This method involves the use of hand tools or machines to remove weeds by cutting or uprooting.

d) **Herbicides** - Herbicides are chemicals used to kill weeds. A wide range of these products and method for applying them are available for use in different situations. In choosing a weed killer, the farmer has to select the one with the characteristics which suit his needs best. A **selective herbicide** will only kill certain types of plants. One which is **non-selective** will kill all plants. A **systemic herbicide** is absorbed by the plant and kills all parts; stem, root, and leaves. A **contact herbicide** will only kill leaves and other soft plant parts. Finally a **soil acting or residual herbicide** remain in the soil for some time. It is then taken up by the roots of the susceptible plants which it kills. Once the trees are grown and the canopy spread to shade the ground under them, competition from weeds is reduced to a minimum. Also, they are less costly to deal with. Weeds are most harmful to young trees. Two patterns of weeding may be used:

i) **Circle weeding** - The weeds immediately under the tree are removed. Depending on the kind of weeds present those further from the trees may be brushed or left alone so that some soil cover is retained. This method is well suited for most tree crops.

ii) **Strip weeding** - This is also called track weeding. The weeds in the rows of plants across the slope are removed. Depending on the kind of weeds present, those in the strip or track between the rows are brushed or left alone for ground cover. The rows of covered ground act as barriers to soil erosion. The method is best suited for crops like coffee and pineapple planted close in the row across the slope of the land.

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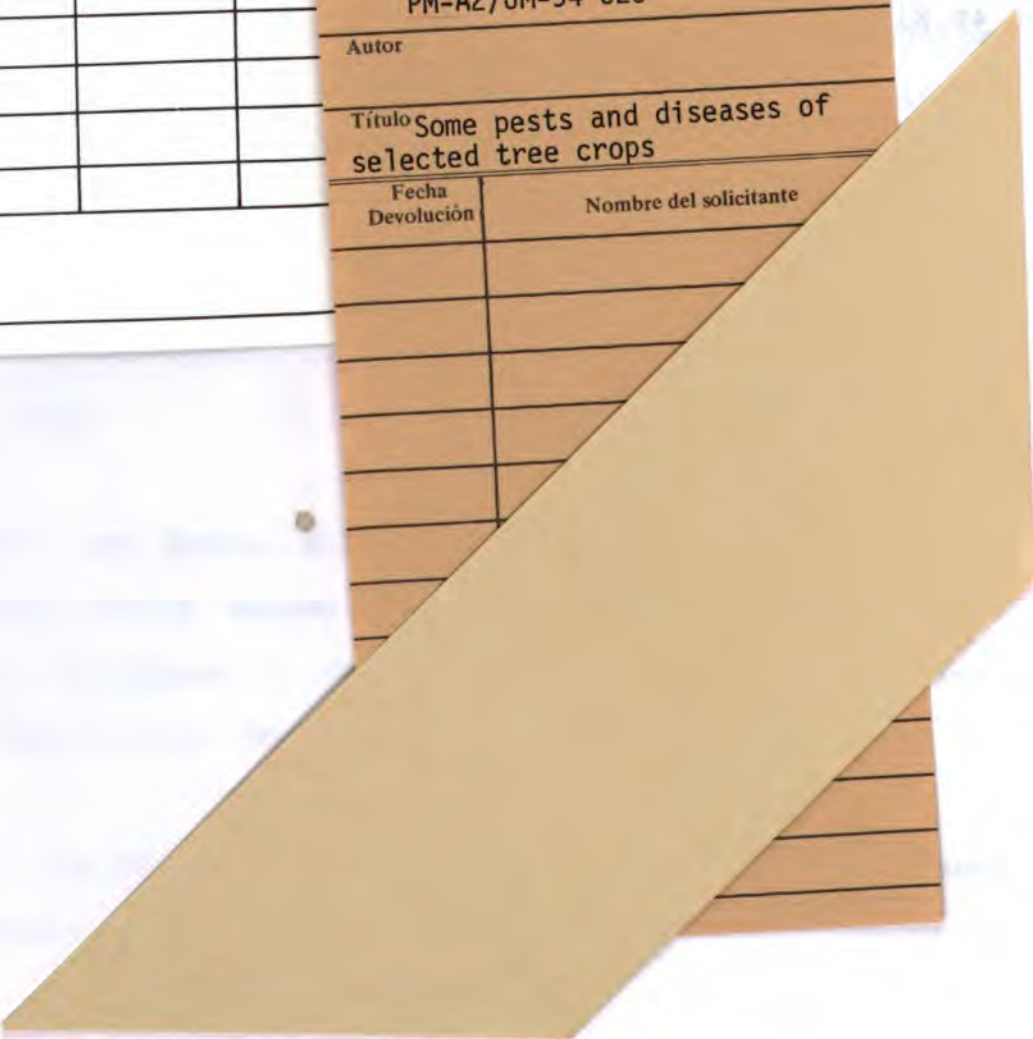
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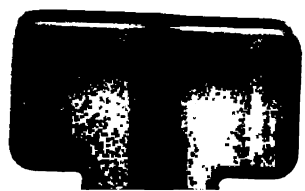
Título **Some pests and diseases of selected tree crops**

Fecha Devolución

Nombre del solicitante



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