

A.6282



To: Cocoa Research Sub-Committee

From: Michelle End

16 June 1997

Pests and Diseases Video

Please find attached a draft version of the booklet to accompany the Pests and Diseases video produced by Mars Confectionery UK and proposed distribution list. There will be an opportunity to comment on this at the next Sub-Committee meeting on 24th June.

COCOA DISEASES and PESTS VIDEO

Parties to Receive Video

Objectives

The primary aim of the Cocoa Diseases and Pests video is to raise awareness in the industry to all the diseases and pests that are threatening to reduce cocoa production, through spreading to new areas. It is not intended to recommend immediate control methods, but suggests avenues that have or should be investigated further.

It is not up to Mars to respond to the particular needs of the audience. Organisations such as CAOBISCO have close industry and research involvement that could give appropriate feedback more efficiently. However, Mars will ensure that a cohesive and standard message is available for distribution with the video.

Follow Up

I expect the majority of questions from the audience for the video will be in two categories. Firstly, what the current impact of each disease is and what the projection for them might be. Secondly, what the relevant control methods for a particular problem are.

The first is difficult to answer because so little information is available. However, the most up to date estimate from Herbert AM van der Vossen, INGENIC suggests :

Black Pod causes ~ 37 % of global losses, of which 16 % is by *Phytophthora megakarya*.

Witches Broom is responsible for 18 % global losses.

Cocoa Swollen Shoot Virus causes 15 % global losses.

VSD accounts for 9 % of global losses.

Moniliophthora causes 5 % global losses.

Pod Borer information not available.

However, this is not the same as future threat. *Monilia* is undoubtedly the most pathogenic, but has been restricted by geography. WB has already shown its capabilities. *Megakarya* is a considerable immediate threat in West Africa, but its reliance on water for infection limits its threat of spread on a global scale. With the regular movement of people and goods in the Far East, the spread of pod borer is a certainty.

The second question of control is best dealt with on an individual basis as many disease control measures are not only very locally specific, but also dependent on economic circumstances of the cocoa grower. BCCCA /CAOBISCO have all the appropriate resident knowledge or contacts to disseminate this information rapidly.

Video Distribution

Each person who distributes the video should emphasise to the audience that :

- the video is only an introduction.
- the fact a disease or pest is not a problem now should not disguise their potential threat.
- the potential threat should be explained in greater detail, with reference to the audience's area and how it may affect them specifically.
- the audience should talk to their colleagues and discuss their role in the control of the threat.
- if more information is needed they should come back via the person distributing, who would go to CAOBISCO etc., who in turn would go to the appropriate expert (be they from Cadburys, Mars, a government agency or a research institution). The information could then bounce back along the same route. Obviously the shorter the chain, the better.

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6 internal videos

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27	Hasfarm	PAL?
28	PTPs (Indonesia)	PAL?
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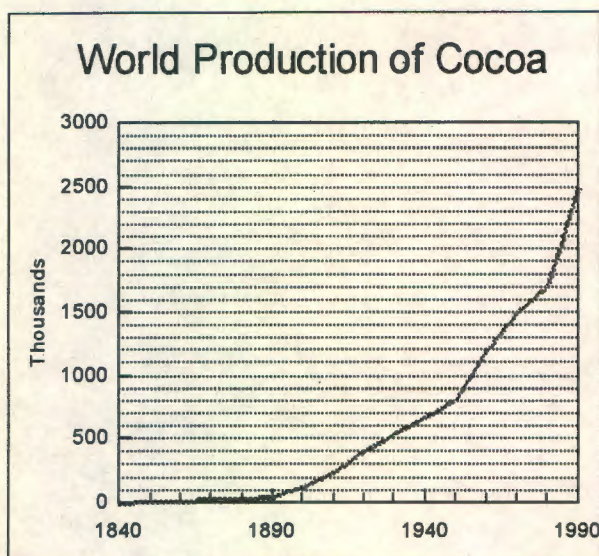
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COCOA DISEASES AND PESTS

Please read the introduction to this booklet before watching the Cocoa Diseases And Pests video. It will give you background information to put the video into context and will leave you in a better position to show this video to others and answer your own and other people's questions.

The growth of the cocoa industry



All of us in the cocoa industry have worked hard to increase the consumption and production of cocoa. Over the past century the demand for cocoa has increased enormously and the industry has grown substantially. Cocoa has performed better than almost all other tropical crops.

Cocoa now provides a livelihood for many thousands of people throughout the world. However, cocoa diseases and pests are an important and growing threat to our industry.

We have not paid enough attention to the threat and as Brazil has found out, the results can be devastating. We must look at what is happening in all cocoa growing countries, not just our own, and work together to understand the diseases and pests and find ways to restore cocoa in infected areas.

- stop the current problems
- prevent the problems spreading
- and keep the industry growing

The Current Problems

57 countries produce cocoa, but 95% of production comes from 12 countries. The five major diseases may destroy up to 40% of the total crop. The losses are listed below.

Be aware that this list indicates the current problems, but does not tell you which one is spreading faster or is likely to be more of a threat in the future.

Black Pod (*Phytophthora palmivora* and other spp.)

Causes 44% of global crop losses (only considering five major diseases). *Phytophthora megakarya*, the more aggressive strain of the disease causes 10% of losses globally, but up to 80% locally.

Witches' Broom (*Crinipellis perniciososa*)

Currently restricted to the South America, this causes 21 % of global losses.

CSSV (Cocoa Swollen Shoot Virus)

This is a serious problem in Ghana, Togo and to a lesser extent Nigeria. 11 % of global losses.

VSD (*Oncobasidium theobromae*)

Vascular Streak Dieback is important in Indonesia, Malaysia and Papua new Guinea. 9 % of global losses.

"Monilia" or "Frosty Pod Rot" (*Moniliophthora roreri*)

This is increasingly serious in Ecuador, Colombia and Central America. 5 % of global losses.

Source: "Strategies of variety improvement in cocoa with emphasis on durable disease resistance", INGENIC, H A M Van Der Vossen, Jan 1997.

The Future Threat

There is very little information available on what might happen to crop production in the future since there has been very little research done on the diseases and pests, their spread and what they can do to new areas. However, history suggests they will slowly spread and we must be ready to work to prevent the problem occurring, rather than acting only when a new infection has taken hold.

Most experts agree that under normal circumstances Witches Broom, VSD and CSSV will not spread over large distances, to new countries. However there is a risk of both Monilia and Cocoa Pod Borer spreading accidentally and surviving in other cocoa growing countries.

Monilia is limited to Ecuador, Peru and Columbia in South America, but is spreading slowly into Brazil. It can survive harsh sunlight and dry weather and spores may get transferred accidentally.

Cocoa Pod Borer originally came from Rambutan and Lychee fruits, and could be accidentally transported in similar soft fleshy fruit.

Objectives of the Video

You must appreciate that the Cocoa Diseases and Pests video does not cover everything you will want to know, at the level of detail that you would like. However, it will give you the opportunity to contact people who will be able to give you the advice that you want.

The primary aim of the video is to raise the general awareness in the industry to all the diseases and pests that are threatening to reduce cocoa production, by spreading to new areas. Many of us know a lot about the area in which we work, but not what is happening on a global scale.

The video is not intended to recommend immediate control methods, but suggests avenues that have or should be investigated further. If advice is needed, then CAOBISCO or BCCCA have the expertise to answer any questions.

The video only shows the five major diseases and pests that affect cocoa. There are many more (capsids/mirids, borers, beetles, root diseases, blights, other viruses and pod rots), but their impact is not as large as the five that are shown.

Video Distribution

We would like you to show this video to anyone you believe will make a difference in helping solve the problems we have. Make full copies of the video if necessary.

However, you must make sure that the people you show the video to understand the correct, relevant messages (as you have understood from this booklet).

Each person who distributes the video should emphasise to the audience that :

- the video is only an introduction.
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- the potential threat should be explained in greater detail, with reference to the audience's environment and how it may affect them specifically.
- the audience should talk to their colleagues and discuss their role in the control of the threat.
- if more information is needed they should ask the person distributing the video, who should go back to CAOBISCO or BCCCA for the answer.

Transcript for the Cocoa Diseases and Pests Video

Introduction

Welcome to Cocoa Diseases and Pests. We in the cocoa industry are facing the serious situation of diseases and pests spreading throughout the cocoa growing world. This video will give you an overview of the problems we have.

Over the next few minutes you will discover

- where cocoa grows,
- what causes the problems on cocoa trees,
- what the symptoms are,
- how the problems spread
- and how we can protect cocoa from the spread of these diseases?

Where Does Cocoa Grow ?

Cocoa grows in many countries throughout the world.

The main producers in West Africa are the Ivory Coast and Ghana, in SE Asia they are Malaysia and Indonesia and in South America the main producer is Brazil.

All these countries are within a band 20 degrees above and below the equator. Cocoa trees grow in this region because they are very sensitive to weather. They love plenty of regular rainfall in a humid and warm climate.

What Causes The Problems ?

Cocoa suffers from three main types of problems;

- Fungal diseases like Witches' Broom which feed on the cocoa tree and cause loss of pods,
- Insect pests like the cocoa pod borer moth which directly attack the pod and damage the beans inside,
- and finally ultra microscopic Viruses like Cocoa swollen shoot virus, which attack and kill the tree.

Witches Broom

Witches Broom is a fungal disease that has spread from the Upper Amazon through most of the cocoa growing areas of South America. In 1989 the Witches Broom fungus reached Bahia, the main cocoa producing area of Brazil. Almost all cocoa is affected and yield has dropped sharply.

Witches Broom gets its name from these unusual "broom" - like stems that grow from branches. When walking through a cocoa farm infected by witches broom, this is what you might see. Is this a broom or a normal branch?

Even experts find it very difficult to spot brooms like these in the canopy. However, there are three things you can look for that help to identify Witches Broom on trees.

The first place to look are the flower cushions, which are small bunches of tiny flowers that grow from the main branches of a cocoa tree. Its from these flowers that cocoa pods develop.

Fungal attack of flower cushions is probably the earliest evidence of Witches Broom. What you will see are small, brown, wilted flowers, which have not fallen off the tree. Before wilting, you will see the flower stems are thicker than usual.

Cushion brooms may also be found. These are relatively easy to see, since they grow on the main branches. Witches broom also causes small pods on the flower cushions to deform and stop growing.

The second characteristic symptom you will see are these vegetative brooms. You will see them in the canopy, several weeks after infection of growing tips of branches. You can tell this is a witches broom, because of the thicker stems here, attached to leaves that are smaller than normal.

After the sudden initial growth, the branch turns brown as it dies from the tip backwards. The leaves dry up and the blackened dry branches stay attached to the tree.

Because making all these brooms uses up a lot of the tree's energy, fewer cocoa pods and beans are produced.

The last place to look are the pods. The first sign is swelling of the pod followed by uneven ripening.

On young and developing pods, dark lesions appear and the area goes hard. The inside of the pod has hardened and the beans are valueless.

The disease begins to spread after a rainy period. When the dead brooms get wet, tiny mushrooms grow all over the broom. These last for a few days releasing millions of tiny spores into the air each night.

These spores are carried by the wind and attack any cocoa trees they land on, as long as the surface of the plant is wet.

As you can see with this young plant, the spores find it easier to infect tender plant material, like tips of growing branches and young pods.

Let us watch the infection process; the stem swells, green brooms grow and die and finally spores are released.

This is how Brazil was affected when Witches Broom spread to Bahia. Notice a delay of a few years before yield drops sharply. You must act early to stop the spread of witches broom, since at the moment very little can be done once the disease has taken hold.

Although Witches Broom doesn't kill the cocoa tree, pod yield will almost disappear.

Nothing has been found that stops the disease spreading. But finding cocoa trees with some resistance to the disease seems to be the only long term solution. Research is also starting on ways to fight the source of the problem at a molecular level.

For the moment looking after the tree, by regular and thorough pruning of diseased branches is the only way to slow the spread of the disease.

Moniliophthora Pod Rot

Monilia is also a fungal disease, which could be even more damaging than Witches Broom. The first major outbreak was in Ecuador. Over the last few years it has spread across the Andes, into Amazonian Ecuador and Peru. It is possible that Monilia will spread to Bahia in Brazil within a decade.

Unlike Witches broom, Monilia can only infect young growing pods. Irregular swelling is the first sign of infection on a young pod.

Over a number of weeks dark brown lesions then appear on the swollen pod. These lesions join up to cover the pod. Then, suddenly, powdery white fungal spores cover the pod. Over just three days this turns creamy and then brown.

This is the sort of pod you will see if the pod is not removed. It can release spores after rains for up to 10 months.

You may not be able to spot a diseased pod because it can take up to 90 days before pods show signs that they are not healthy.

This is what happened to a pod that an expert thought was healthy, when it got shipped from South America to Britain.

The inside of the pods usually become watery, but with some types of cocoa trees the pod may get more solid and dry out.

Monilia is dangerous because unlike witches broom neither dry conditions nor sunlight destroys the spores. Their tiny size also allows the wind to carry them further. Monilia spores may be spread over great distances if they are picked up on clothes and shoes.

There is much more we need to discover about Monilia. Right now, the only control methods are good crop sanitation by:

- removing diseased pods during the dry season and
- reducing humidity by opening up the canopy.

Cocoa Pod Borer

Cocoa Pod Borer is found in most areas of South East Asia, but is more common in Malaysia than Indonesia and Papua New Guinea. The pod borer has adapted from feeding on the juices of Rambutan and Lychees to feeding on cocoa.

This small insect is about 1 cm long and flies like a mosquito. The female moth lays a tiny egg in the furrows of the pod. Eggs are usually laid in the middle third of the pod.

The egg hatches within a few days into this larva which burrows into the pod and spoils the beans inside. When the larva reaches the sclerotic layer, which is a hard layer surrounding the pulp, it may search around for a softer area to enter through. The borer then feeds on the pulp.

The pod dries up and hardens, while the hole made by the borer allows infections to rot the pod.

Two weeks after hatching the larva leaves the pod. If they don't get stuck in the sclerotic layer, they usually produce a silk thread to get down to the ground.

It then finds a concave surface, such as a dead leaf, to make a silk nest to pupate in. A new moth emerges after about a week.

The first symptom you will see on the pods is patchy ripening. If you look closely you may see exit holes made by larvae.

This pod has been seriously infested. The inside of the pod has hardened.

Here there is less damage, but the beans are still hard to separate.

When these women find a hard pod they use a knife to separate the beans. The knife damages the beans, which appear purple here.

These beans are about to begin fermentation. Notice that many larvae are still alive.

Because the spoilt pods are dryer, beans don't ferment properly and quality is poor.

When trying to burrow out of the pod, many larvae get stuck and die in the sclerotic layer. With a normal sclerotic layer half of the larvae die. Almost all die with the thicker variety. Finding varieties of cocoa with thick sclerotic layers is the best way to combat the disease.

To control spread infested pods must be removed and thick sclerotic layered varieties must be found. Moths do not like sunlight, so opening the canopy will also help. Recently the use of tiny wasps, whose larvae feed on pod borer eggs, has also been promoted.

Other control methods are generally too expensive. These include:

- spraying pesticides on pods,
- covering the pods in a thin layer of oil
- and putting plastic bags over young pods

Phytophthora Pod Rot

Black pod is seen wherever pods are produced in very humid conditions. There are several strains of this fungal disease, but the most dangerous variety is currently restricted to Cameroon, Nigeria and Ghana.

The disease attacks all parts of the plant. Here you can see the effect on young leaves.

The branches of the tree can also suffer. If you remove the bark of an infected tree you see this.

The biggest problem though is with pods. Dark brown lesions grow, which then become covered in a light dusting of white spores. If pods that are beginning to ripen are infected all beans may be lost. The disease spreads with water, including rain splashes from the ground and water dripping from pods above.

Phytophthora megakarya is the more dangerous strain of the disease. Compare how spores appear very quickly on this small lesion when compared with ...*Phytophthora palmivora*. Almost the whole pod is covered, but there is little sporulation. It spreads more slowly and so causes less damage.

Disease spread can be controlled by removing and destroying diseased pods, and also spraying pods with copper fungicides. Although these methods have been proven to work, developing resistant trees is the long term answer.

Vascular Streak Dieback

Vascular Streak Dieback or VSD is a fungal disease found only in South East Asia.

Ultimately VSD causes branches to dry up and die from the tip back wards, until the whole tree is infected. There are many symptoms to look for.

- Here are a some VSD leaf symptoms. Green spots on yellow leaves are the most characteristic effect you will see.
- On mature plants, the infected leaves are seen in the middle of the branch.
- But on seedlings, all the leaves can be infected.

The fungus also makes the bark rougher. You should be able to feel this by running your fingers along the stem. And if the bark is stripped away, the area quickly turns a rusty brown colour.

The classic test for VSD is to look for brown streaks along the vascular vessels when you split a branch lengthways.

Finally, if you pull a VSD infected leaf off the branch, this characteristic three spot pattern will be seen.

Eventually the leaves fall off the branches and white spores are released from the leaf scars. These spores are spread by wind, but they need water to infect another cocoa tree.

- Trees less than five years old do not survive VSD infection.
- A farmer can help older trees by very regular pruning,
- and good husbandry
- Pruning works since spores cannot form on dead wood.

Cocoa Swollen Shoot Virus

Serious cocoa swollen shoot virus problems have so far been limited to Ghana and Nigeria. In Ghana millions of trees have been removed to try and control the spread of the virus.

Although root and stem swellings do occur, the easiest symptoms to see are on the leaves. On young leaves you will see red veins on a pale green background. Compare that with the normal leaf you see here.

Mature leaves all show yellow veining on a green background. Some leaves have a tight fern like pattern as you see here ...But with another type of cocoa tree, ...you will see these irregular patterns on leaves. This leaf is at a more advanced stage of infection.

The virus is normally spread by tiny insects called mealybugs. They are usually protected by ants that feed on a substance that the mealybug produces.

Since no cures have been found for the virus, the current control method is to remove infected trees.

Biological control methods, like killing the ants that protect the mealybugs, have been tried, but none have been successful so far.

The Threat Of Disease Spread

Diseases and pests cause about a quarter of the worlds cocoa to be lost. In real terms that means over half a million tonnes of cocoa.

The largest producers are the Ivory Coast and Ghana, which together grow half the worlds cocoa crop.

But now with easy frequent air travel between countries it is possible that diseases will spread more easily. We must prevent the problems spreading. If we don't, not only will the farmers suffer, but everyone in the cocoa industry all the way to the consumer.

Protecting Our Cocoa

There are many steps to prevent these problems spreading. The first step is to control the movement of living cocoa material to ensure anything that is moved is free from pests and diseases.

- Generally you should not move pods from one cocoa area to another. .
- Other plant material should not be moved other than for breeding resistant trees.
- If material needs transferring to another country, a quarantine facility should be used.

Accidentally carrying diseases and pests when travelling could lead to a disaster for the industry. However, the risks can easily be reduced.

- Clothes and boots should be washed before leaving an infected country.
- And when moving between countries you should try and break the journey in a temperate climate.

The best way to protect the crop is to carefully tend to the cocoa trees.

- Pruning should be done regularly,
- Infected pods should be removed before they can affect healthy pods
- Shade trees should be controlled
- And chemicals should be used according to manufacturers instructions

There is much more to discover about cocoa, its diseases and its pests. Our understanding lags far behind many other crops. Researchers must

- Understand the origins and interactions of cocoa trees, diseases and pests
- Continue searching for how cocoa and its pathogens interact at a genetic level
- And Develop field diagnostic tests which would help the quick implementation of appropriate control measures.
- All of these recommendations are steps towards the ultimate solution to our problems ... the breeding of resistant cocoa.