THE DANGER FROM ROOT DISEASE WHEN PLANTING AND REPLANTING COCOA

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INTRODUCTION

The roots of all plants can be attacked by diseases. These diseases are not so well known as the ones that attack leaves and fruits because they are out of sight under the ground. They do not receive very much attention from farmers but they can cause serious problems.

Cocoa in Papua New Guinea may be attacked and killed by several different root diseases. These diseases are all caused by different kinds of fungi. The most important are white root rot and brown root rot. White root rot produces white threads on the root surface. Brown root rot causes a brown crust on the roots.

Root diseases occur everywhere in the country and the fungi which cause them can attack many types of trees apart from cocoa. In particular, they can attack the roots of the shade trees *Leucaena* and *Gliricidia* which are used with cocoa. Despite this, until now, root diseases of cocoa have not had a serious effect on Papua New Guinea's cocoa industry. However, there have been one or two cases of very bad damage to cocoa, and these have shown us how serious these diseases can be when all the conditions are right for them.

Papua New Guinea's cocoa is now being replanted as many of the trees reach the end of their useful lives. An important new feature of this replanting is that cocoa is now being planted on land where cocoa was grown before. There are reasons to think that there will be a much bigger danger from root diseases in replanted cocoa. This article explains why this is so, and tells you how to avoid the danger.

WHAT DOES ROOT DISEASE LOOK LIKE?

Sometimes the whole tree suddenly wilts and dies and all the leaves go brown and hang on the tree. Sometimes some leaves may go yellow and fall off before the sudden wilting occurs. Sometimes, the trees fall over.

If you scrape the bark at ground level on a tree that has just wilted you will see that the bark at the base of the tree is dead and brown but the bark further up the trunk is still white. Once the whole tree has been dead for a few weeks this difference is no longer visible. If you split open the trunk of a newly dead tree you will see that the wood at the base of the trunk is dead and brown and so are the main roots, but the upper trunk

A split tree showing the brown colour at the base

A fruiting body of brown root rot on a stump

wood is still white and healthy. The photograph above shows this.

Some of the roots will be dead and rotten. They may have white strands of fungus on them, or a brown crust. Sometimes the soil sticks to the dead roots. There may be a crust of fungus at the base of the trunk in trees killed by brown root rot. Trees affected by root disease often die together in patches, with the newly killed ones at the edges.

Sudden wilting and death of cocoa trees can also be caused by stem canker. If stem canker has killed the trees, the roots will not be brown and rotten. The differences between stem canker and root disease are described in HARVEST 5(2): pp. 71-76 (1979).

HOW DO ROOT DISEASES INFECT TREES?

The disease enters a new area when air-borne spores infect wounds or freshly cut stumps. The spores come from fruiting bodies which grow on the stumps of dead trees about a year after the fungus has killed the tree. A fruiting body of brown root rot is shown in the photograph above.

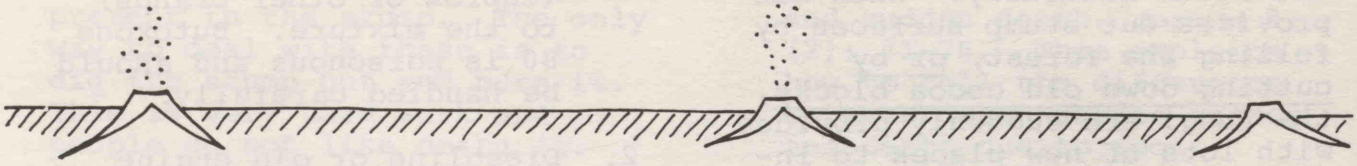
The fruiting bodies release millions of spores from tiny holes in their undersurfaces. The spores float in the air and if they land on a wound or a freshly cut stump, they grow into the wood and infect it. Soon the fungus invades the roots and spreads along them. The disease then spreads from tree to tree by contact between diseased and healthy roots. The diagram on the opposite page shows how this happens.

It takes several years for this to happen, but eventually a whole patch of trees will die, with the fungus spreading outwards all the time into new areas.

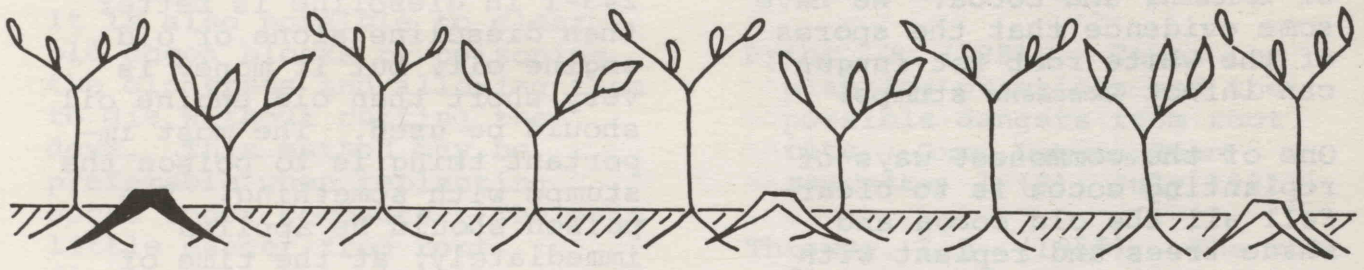
WHY ARE WE WORRIED ABOUT ROOT DISEASES?

Before people started to plant crops, these diseases occurred in the forests. They could

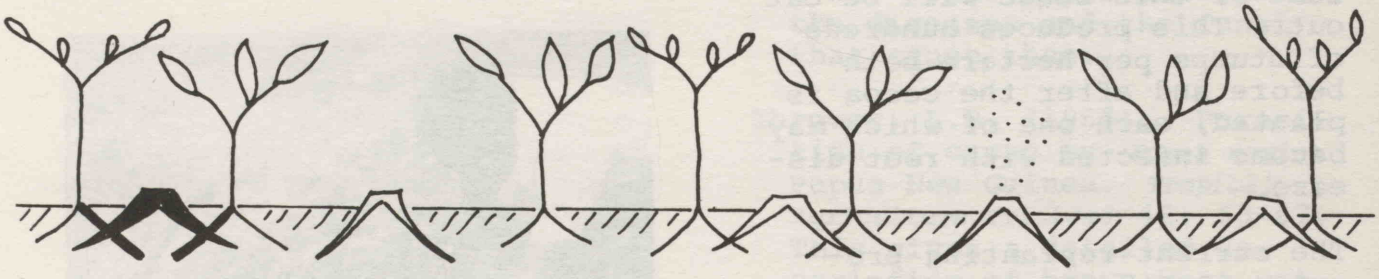
THIS DIAGRAM SHOWS HOW ROOT DISEASE CAN DEVELOP IN A REPLANTED COCOA BLOCK



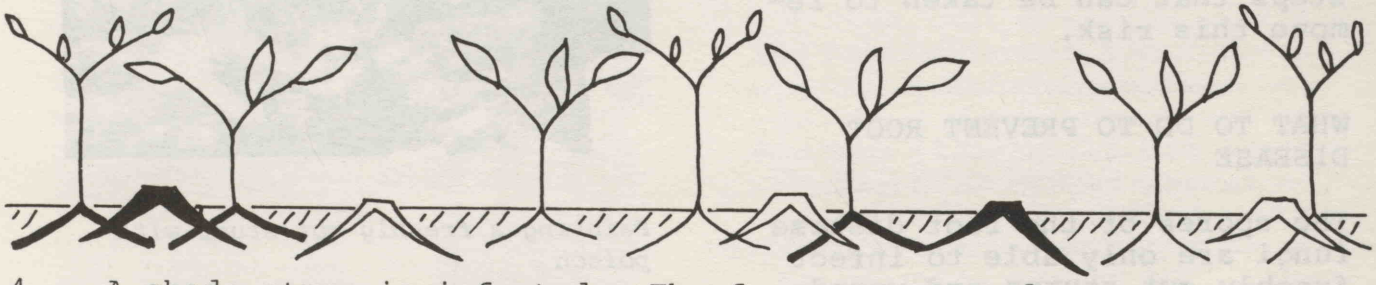
1. The old block is cleared. Spores land on some stumps.



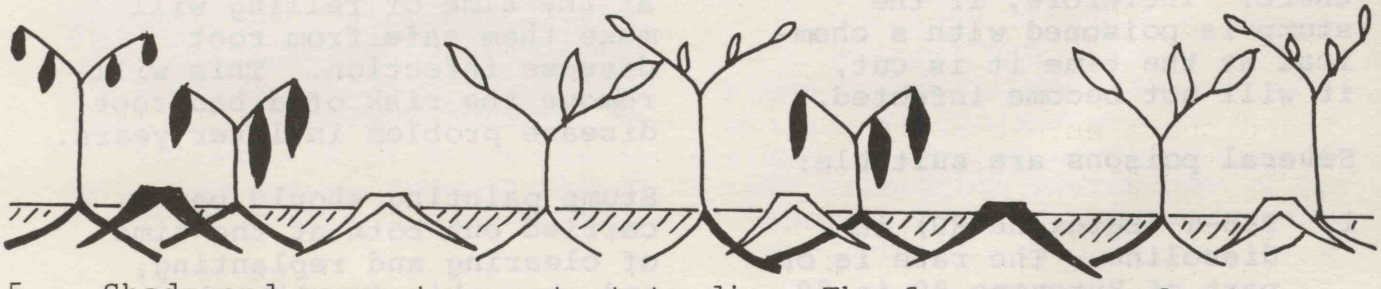
2. New shade and cocoa are planted. One old stump is infected.



3. The shade is thinned. Spores land on some stumps.



4. A shade stump is infected. The fungus moves underground onto the roots of living trees.



5. Shade and cocoa trees start to die. The fungus moves further underground.

only enter new areas when the spores infected wounds in the trees, because cut stumps do not occur naturally. When man provides cut stump surfaces by felling the forest, or by cutting down old cocoa blocks, the fungi are suddenly provided with lots of new places to infect. The spores of the brown root rot fungus can easily infect the freshly exposed stumps of *Leucaena* and cocoa. We have some evidence that the spores of the white root rot fungus can infect *Leucaena* stumps.

One of the commonest ways of replanting cocoa is to clear-fell all the old cocoa and shade trees and replant with new shade trees *(Leucaena* or *Gliricidia)*. At a later stage, after the new cocoa is planted, some of this shade will be cut out. This produces hundreds of stumps per hectare both before and after the cocoa is planted, each one of which may become infected with root disease.

The current replanting programme is therefore creating an increased risk of root disease problems. However, there are steps that can be taken to remove this risk.

WHAT TO DO TO PREVENT ROOT DISEASE

The spores of the root disease fungi are only able to infect freshly cut stumps and wounds while the wood is still alive and no other fungi are growing there. Therefore, if the stump is poisoned with a chemical at the time it is cut, it will not become infected.

Several poisons are suitable:

1. 245-T (Butoxone 80) in diesoline. The rate is one part of Butoxone 80 in 80 parts of diesoline. You should add 3% red copper (Sandoz) or green copper (Cuprox or other brands) to the mixture. Butoxone 80 is poisonous and should be handled carefully.

2. Diesoline or old engine oil. You should add 3% red or green copper.

245-T in diesoline is better than diesoline alone or old engine oil, but if money is very short then old engine oil should be used. The most important thing is to poison the stumps with something. The poison should be applied immediately, at the time of felling - not the day after. The photograph shows how this is done.

Painting a freshly cut stump with poison

This simple precaution of painting the stumps with a poison at the time of felling will make them safe from root disease infection. This will remove the risk of a bad root disease problem in later years.

Stump painting should be carried out both at the time of clearing and replanting, and when thinning the shade.

Stump painting will not do anything to remove root disease infections that are already present in the stump. The only way to deal with these is to dig the stump out and burn it. This is very hard work and people do not like doing it. It is therefore most important to prevent root disease from starting.

It is also possible to clear old cocoa blocks by poisoning the old trees and allowing them to die without cutting them down. This method may be preferable when replanting cocoa under coconuts. There is little danger from root diseases in this case because no freshly cut stumps are produced.

FURTHER READING

Prior, C. (1979). Cocoa canker and sudden death. *Harvest* 5 (2): 71-76. This explains how to tell the difference between death due to canker and death due to root disease. Note that there is a new and better control for canker described in *Harvest* 7 (2): 92 (1981).

Prior, C. (1981). Cocoa replanting practices and the possible dangers from root rots. *Cocoa Industry Board Newsletter* 1 (2): July 1981.

Thrower. L.B. (1955). The root diseases of cacao in Papua New Guinea. *Papua and New Guinea Agricultural Journal* 10: 1-14. This paper describes the diseases and the fungi that cause them.

Thrower, L.B. (1965). Parasitism of cacao by *Fomes noxius* Papua New Guinea. *Tropical Agriculture Trinidad* 42: 63-67. This gives a detailed description of brown root rot.