D.P.I. PLANT PATHOLOGY NOTE: NO.31

RECOMMENDATIONS FOR THE CONTROL OF COFFEE LEAF RUST ON ARABICA COFFEE IN PAPUA NEW GUINEA.

INTRODUCTION

Coffee is the most important cash crop in Papua New Guinea. For most people in the highlands and the mountains of other provinces, coffee is the only real source of cash income.

Coffee leaf rust disease was identified in the Baiyer River area of the Western Highlands Province on 30th April 1986. Since then it has been found in seven other provinces. They are the Enga, Simbu, Madang, West Sepik, East Sepik, Eastern Highlands and Morobe Provinces. It is likely that the disease will eventually spread to all coffee growing provinces.

Leaf rust is a serious disease of coffee. It is caused by the fungus *Hemileia vastatrix*. Arabica coffee is more susceptible than robusta coffee. The disease first appears as small yellow spots on the leaves. On the under side of the leaf these spots produce an orange coloured powder. The powder looks like the rust which forms on an old tin, or like the pollen of a hibiscus flower. The number of spots increases, and within a few months the leaves drop off. The details of the symptoms are more fully described in Plant Pathology Note No. 2, and also in a full colour leaflet jointly issued by the PNG Coffee Research Institute and D.P.I. and a poster in Pidgin with full colour illustrations of coffee rust symptoms and spraying to control coffee rust.

Coffee rust destroyed the coffee industry in Ceylon (now Sri Lanka) 100 years ago. It could do the same in Papua New Guinea unless the right measures are taken to control it. Coffee rust is controlled in every other coffee growing country of the World.

The disease can be controlled by:

1. growing resistant varieties
2. good management followed by spraying fungicides

It will be several years before rust resistant coffee varieties are available for coffee growers in Papua New Guinea. Until then, good control can be achieved by spraying fungicides properly.

The fungicides used for the control of coffee rust are expensive, but they will control the disease if applied correctly.

Up until now many people have been able to grow coffee even though the only work they do is to harvest the cherry. This has allowed them to produce a little bit of coffee with very little work.

Many people who follow this system do not even produce enough coffee to pay for the cost of the chemicals needed to control the disease. Unless these people change they will not be able to continue to produce a cash crop.

In order to control coffee rust, the coffee farmer must be able to spray every leaf on every tree in his coffee garden. Many gardens are overgrown, or the coffee trees are very tall or planted too close together. The farmers cannot spray every leaf. Therefore they will not be able to control the disease.

Before a farmer thinks of spraying his coffee trees he must make sure that his trees are going to produce enough cherries to pay for his chemicals and the work he has to do to spray the trees. He must also make sure that there is going to be enough left over for his profit. If he cannot do this he should look at another crop which can give him his income.

Unfortunately there are not many crops which are as easy to grow and as easy to sell as coffee.

RECOMMENDATIONS

These recommendations are based on experiences and practices in other major coffee growing countries and should be followed until standard recommendations for Papua New Guinea are available based on local field trials and experience.

Management of coffee for effective disease control and higher yields.

Spraying to control coffee rust only becomes worthwhile when the coffee garden is well managed. For some farmers and plantations this will mean only a small improvement in their present methods. However many farmers will need to change their current methods very much before they will be able to control coffee rust and continue to produce coffee.

1. Drainage

Coffee will not grow well in swampy areas. Many gardens need much better drainage. The drains must be dug deep enough to get the water out of the garden areas. They must then be kept clean so that they continue to keep draining the soil.

2. Fencing

Pigs destroy drains and also the roots of coffee trees. These two factors prevent coffee trees from carrying good crops. Fences must be good enough to keep pigs and other animals out of the coffee garden.

3. Weeds

Weeds compete with the coffee for nutrients, slow down the runoff of water and therefore upset drainage, and make other operations such as picking and spraying of fungicides difficult.

Weeds can be kept down with sarifs or by weedicides. Weedicides such as Roundup, Fusilade, Nabu or Gramoxone can be used to control weeds. However, they are poisonous and should be used with care. Follow the directions on the container.

Seedling coffee plants under the trees should also be removed because they can carry disease and also act as weeds.

4. Pruning

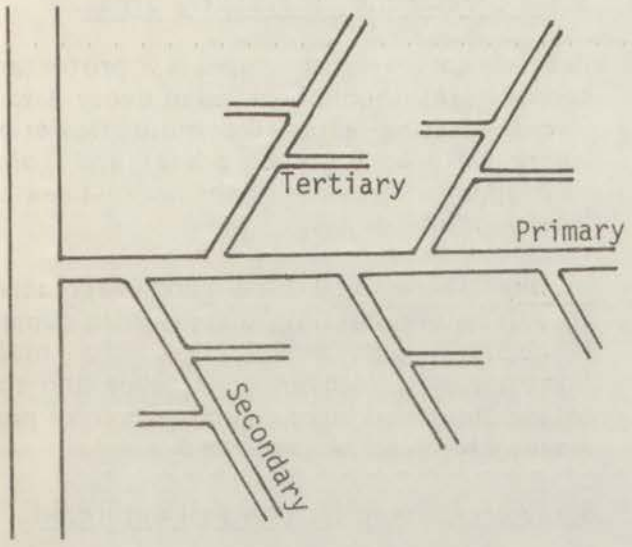
If your coffee has never been pruned and has only one stem growing up with all the branches at the top, you will not be able to spray the tree properly and you should ask your local D.P.I. officer or the manager of a nearby plantation to show you how to prune your coffee. When it is pruned you can then think of spraying for coffee rust.

Even if your coffee has been pruned before, you may still need advice on how to do it again. Ask the D.P.I. officer or a local plantation manager to show you.

The farmer should try to keep no more than two healthy stems on the coffee tree. These should be pruned so that the trees are open enough to allow the spray to reach all of the leaves.

With overgrown coffee all but two good healthy stems should be cut off. These stems should be pruned so that all primary branches which have carried two crops are cut off and there should be only one primary allowed to grow from each node on the main stem. All tertiary branches should be pruned off. If the stems are still too tall, they may be capped at about 2.5 meters (8 feet).

The relative positions of the main stem, and the primary, secondary and tertiary branches are shown in the diagram.



This diagram of a coffee tree shows the stem, the primary, secondary and tertiary laterals (or branches).

5. Shade

Shade is good in a coffee garden because it keeps the coffee healthy. However, too much causes the coffee to carry fewer cherries. Too much shade can also make coffee rust a bigger problem as it keeps the leaves wet and this helps the spread of the disease. It is a good idea to cut off the branches of the shade trees to allow at least 2 meters (6 feet) of free space between the top of the coffee trees and the bottom of the shade tree branches to allow sunlight in, and air movement through the crop.

6. Fertilizer

When drainage, fencing, weeds and shade have been looked after, fertilizer can then be useful in the garden. An NPK fertilizer which contains trace elements is generally best.

A modest rate of 60g (1/4 to 1/2 of a 150 g fish tin - "Liklik tin pis") per tree of 12:12:17:2+B or Coffee Mix could be applied four times per year in October, January, March and May.

7. Recommended fungicides for the control of coffee rust

The fungicides recommended here for use in Papua New Guinea have been effective for rust control in other coffee growing countries. However, these fungicides and any new ones which are produced must be tested in field trials under Papua New Guinea conditions. As a result, there may be changes made to these recommendations later.

i. Curative/eradicant fungicides

BAYLETON 250EC or 25WP (triadimefon)

PLANTVAX 20EC (oxycarboxin)

ii. Protectant copper fungicides

CUPROX 50WP (copper oxychloride)

COBOX 50WP (copper oxychloride)

CUPRAVIT 50WP (copper oxychloride)

COPPER SANDOZ 50WP (cuprous oxide)

COPPER NORODOX 50WP (cuprous oxide)

KOCIDE 50WP (cupric hydroxide)

PARASOL 50WP (cupric hydroxide)

MACUPRAX (copper sulphate + lime + cufraneb)

Other products will be reviewed as they become available and recommended if they prove useful.

Since there is no standard spacing for coffee trees in Papua New Guinea, it is difficult to advise on the quantity of fungicide required per hectare. Recommendations are based on the amount of chemical that should be mixed per litre of water (see the section on "spray machines and spray volume" below).

1. Bayleton 25EC or 25WP at 0.025% a.i. concentration. To obtain a 0.025% solution, mix Bayleton at a rate of 1 ml or 1 g per 1 litre of water.

2. Plantvax 20EC at 0.03% a.i. concentration (1.5 ml in 1 litre of water).

3. Copper fungicides at 0.3 - 0.5%.
(0.3% = 3 g in 1 litre of water)
(0.5% = 5 g in 1 litre of water)

If you have a different concentration of product, use the following formula:

For example, to spray 1000 coffee trees at 0.7 litre of spray solution per tree with 0.025% a.i. of Bayleton 25EC (25%), the quantity of Bayleton required can be calculated from:

quantity of spray solution required	% strength of spray solution to be prepared

% strength of fungicide

= Quantity required for mixing

Example

100 litre x 0.025% a.i. / 25% Bayleton

= 100 ml of Bayleton.

8. Spray machines and spray volume

Use either a motorized mist blower or a hand operated knapsack spray pump for spraying. The volume of spray solution needed for good coverage of an average tree (with about 3000 leaves) is:

- using a mist blower - 0.5 litre per tree
- using a knapsack - 0.7 litre per tree

For good control of coffee rust there must be good spray coverage on the lower surface of the leaves. As a guide, a 12 litre capacity mist blower should cover about 24 trees. A manual knapsack should be used to spray to the first sign of runoff. Depending on the number of leaves, a 20 litre knapsack should cover about 30 trees.

9. Spraying for the control of coffee rust

The coffee trees should be pruned as soon as possible after the main harvest. This will help to make the spraying easier to carry out. In most areas this will be about August/September, before the spraying commences.

Spray programme for rust free areas.

Before coffee rust appears, protectant copper spray should be applied every 6 to 8 weeks starting after the main flowering (early October in most areas) and going through until the start of the harvest season (normally in June).

Note: There should be good vegetative growth before starting to spray with copper fungicides. In most areas the main flowering will be over by October and the coffee trees will have a good growth of new leaves which can be protected.

Spray programme for new rust outbreaks.

When rust is identified in a block of coffee, the affected coffee and an area of about 50 metres surrounding it should be sprayed with Bayleton or Plantvax. If copper spray has not been applied this should be sprayed on the rest of the planting. The planting is then considered to be infected and the programme followed for infected coffee.

Spray programme for rust infected areas.

1st spray	As soon as practicable after pruning, normally early to mid-September. This is a curative/eradicant spray with Bayleton 250EC or Plantvax 20EC. Curative/eradicant sprays kill the fungus in the leaf. Their effectiveness depends on how well the leaves were covered with spray.
Subsequent sprays	Starting not more than 60 days after the first spray, protectant copper spray should be applied every 4 to 6 weeks. Protectant sprays protect the leaves from new infection. Again this depends on very good leaf cover.
Early June	More correctly, this is the start of the dry season and harvest. The block is sprayed with Bayleton 250EC or Plantvax 20EC if there are obvious signs of coffee rust, or copper spray if rust is not obvious.

Notes

1. The aim of the two curative/eradicant sprays at the beginning and, if necessary, at the end of the coffee season is to reduce the amount of fungus on the coffee trees.

2. Leave 60 days between the 1st spray of curative eradicant fungicide and the next spray of copper fungicide.

3. Leave 4 - 6 weeks between the sprays of protectant copper fungicide.

4. Experience from other countries shows that Bayleton is more widely used than Plantvax for the control of coffee rust. However, Plantvax is currently cheaper than Bayleton in Papua New Guinea.

5. No other fungicides are included in the list at present until their effectiveness is fully known.

6. The recommended spray programmes apply only to arabica (highlands) coffee. Robusta (lowlands) coffee is not badly affected by coffee rust, and therefore it is not economical to spray. Robusta trees which are affected should be uprooted and replaced with an unaffected seedling. The Besoeki variety appears to be more resistant than the other robusta varieties in Papua New Guinea.

7. Be careful when using chemicals. The simple rules listed below must be followed:

   i. Wear rubber gloves when pouring or weighing the chemicals. Do not breathe in the dust or fumes.

   ii. If you spill any of the concentrate on your body, wash if off with soap and plenty of water immediately. Always keep a bucket of clean water and some soap near the mixing area.

   iii. Wear protective clothing to cover the body, e.g. an overall or long trousers and long sleeved shirt. Wear rubber boots and gloves.

   iv. When applying sprays be careful that the spray does not fall on your face and eyes.

   v. Never smoke, eat or drink while you are spraying. If you take a break, wash your face and hands with plenty of soap and water before eating, drinking or smoking.

   vi. Wash yourself and your clothes in soap and water when you have finished spraying for the day, and change into clean clothes.

   vii. If you feel sick during or after spraying, go to the doctor immediately and be able to tell him what chemical you have been using.

Detailed recommendations on all of the above aspects are being prepared and will be released later.

ACKNOWLEDGEMENTS

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FURTHER READING

Anon. (1980). Coffee rust disease. Plant Pathology Note: No. 2. *Harvest* 6(1): 43-44.

Muthappa, B.N. (undated). *Beware of coffee rust.* (An information booklet for coffee growers in PNG). PNG Coffee Research Institute, Aiyura.

Sutherland, J.S. (1985). *A Manual for the Safe and Efficient Use of Pesticides.* Rural Development Series Handbook, No. 18. D.P.I., Konedobu.

FURTHER INFORMATION

For further information and advice on the control of coffee rust, contact the Coffee Research Institute or your nearest D.P.I. Plant Pathologist, at the following addresses:

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Copies of this Plant Pathology Note, and of others in the series are available from: The Publications Officer, Publications Section, D.P.I., P.O. Box 417, Konedobu. The colour poster mentioned in the Introduction to this article is also available from Publications Section, D.P.I.