

# THE USE OF FUNGICIDES IN TEA IN SRI LANKA

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## INTRODUCTION

In comparison to insecticides and herbicides, fungicides are the smallest group of pesticides used in agriculture today. But in tea, until recent times, fungicides took pride of place in that more money was spent on fungicides than on other pesticides.

A fungicide may be broadly defined as a compound which kills or inhibits the growth of fungi, although compounds which inhibit the growth, without killing are more accurately termed fungistats. Fungicides used in the control of plant diseases can be divided into three groups, which are distinguished on the basis of time of application relative to infection, uptake by and mobility within the plant: (1) Protective fungicides - These provide protection against infection at the site of infection by inhibiting the pathogen before it has penetrated the host tissue and has become established within it. These fungicides do not penetrate the underlying tissue and they are not absorbed by the tissues and hence cannot cure an established infection. These can be used only as protectants. Most of the fungicides in use belong to this group. (2) Eradicant fungicides - These can cure an established infection at the site of application. These are absorbed into the tissues at the site of application but not translocated within the plant. Nickel compounds and bitertanol are examples of this group of fungicides. (3) Systemic fungicides - These can prevent the development of the disease in parts of the plant

away from the site of application and can kill a pathogen after it has already established within the tissues of the host. These are absorbed in effective quantities and translocated within the plant. Most of the modern fungicides belong to this group.

## METHODS OF CONTROL OF DISEASES OF TEA

### Use of copper fungicides

Until the advent of Blister Blight leaf disease in 1946, little or no fungicide was used for the control of diseases in tea. The main methods of disease control were by grubbing diseased plants or by physically removing affected parts of the plants. The commonly used fungicides were the classical Bordeaux Mixture (a preparation obtained by mixing aqueous solutions of copper sulphate and lime) and the traditional lime sulphur (a complex of sulphur and lime). Elemental sulphur was probably the first fungicide to be recognised and in this form it is still used widely today as a dust against many plant diseases.

It was natural, therefore, that when Blister blight first made its appearance in Ceylon (Sri Lanka), these two compounds were the first to be tested. Although Bordeaux Mixture gave reasonable control of the disease, it was soon to be replaced by the 'fixed coppers' such as copper oxychloride and cuprous oxide because their preparation for use is much simpler than that of Bordeaux Mixture. Several organic fungicides, dithiocarbamates, quinones and antibiotics were tested from time to time for their efficacy against blister blight, but copper based compounds, containing 50% metallic copper, were found to be superior to the various groups of fungicides that were tested. The tenacity of copper compounds to stick to leaf surfaces even under heavy

monsoon conditions probably gave them the edge over the other fungicides tested. Further, copper fungicides were by far the cheapest compounds available in the market for the control of this disease.

In the early days of blister blight control copper was used as a wet spray as well as a dust. The copper content of dusts varied in the region of 4 - 6% and they were applied at the rate of 5 - 8 lb/acre once in 5 days. But in the formulations used for wet spraying the copper content was as high as 50% and they were used at the rate of 4 - 6 oz/acre once in 7 to 9 days, depending on the plucking round.

During the course of time dusting became less popular because it had to be applied when there was no wind, early in the morning, and because of the difficulty in obtaining a satisfactory cover and the ease with which it was washed off by rain. Hardly any dusting is done in tea plantations today.

During the late sixties nickel compounds became popular for the control of blister blight. Unlike copper compounds, nickel compounds were both protective as well as curative in their action. Their use in Sri Lanka, however, was discontinued in the seventies.

### **Systemic fungicides**

During the recent past several fungicides belonging to the groups of systemic fungicides, like benzimidazoles, carboxamides, hydroxypyrimidines, morpholines, pyrimidines and triazoles were tested for their efficacy against blister blight. Of these, Sicarol (Carboxamide - pyracarbolid), Callixin (Morpholine - tridemorph) and Baycor (Triazole - bitertanol) gave very good control of the disease. But their use is not yet established because of the cost and non-availability.

Baycor, however, is now available and not so expensive as the others and is beginning to be used by a number of estates. These fungicides, being systemic, are both protectant as well as curative in their action. Because of the potential danger of development of resistance to these products, recommendations for their general use on estates is awaiting the development of viable use strategies by the TRI. Residue levels on tea sprayed with these chemicals are in the process of being determined.

### Control of other leaf diseases

The regular spraying of copper for the control of blister blight has not only resulted in the control of this disease but has also suppressed the occurrence of a number of other diseases. Cercospora leaf disease caused by the fungus *Calonectria theae* Loos was at one time very damaging on up-country estates, but now it is not heard of except on Accacias, and that too, very occasionally. *Rhizoctonia solani*, which was reported to occur earlier in the Dimbula district is no longer heard of. But in the low-country areas where no blister blight control is carried out *Rhizoctonia* is still a problem and is controlled by the application of copper fungicides. Red rust disease, caused by the algae *Cephaleuros parasiticus*, is another disease prevalent in the low-country districts and is also controlled by the application of copper fungicides.

### Control of stem diseases

No prophylactic treatment with fungicides have been recommended earlier for stem cankers caused by the fungi *Phomopsis theae* (up-country stem canker) and *Macrophoma theicola* (low-country stem canker). But with the increase in the incidence of these diseases in recent times, an integrated method of control combining improved cultural practices with the use of the fungicides benlate and baycor has been recommended.

## **Control of root diseases**

D-D was the fumigant used for the control of root diseases until it was superseded by methyl bromide, which is now extensively used for the control of *Poria* root disease. Santar A is the only mercury compound used in tea and is used as a fungicidal paint for the protection of pruning cuts.

## **TOTAL CONSUMPTION OF FUNGICIDES AND COST**

Blister blight is the only disease for which fungicides are being used extensively and on a regular basis. More money is spent on its control than on the control of perhaps any other pests or diseases of tea. Copper may be sprayed as much as 20 to 25 times a year in most plantations in the up-country districts. The dosage used is however low when compared to the amount used in some other perennial crops such as coffee, being only 4 - 6 oz per acre per spraying round. At a conservative estimate, around 100 metric tonnes of copper fungicides are required for the tea industry for an year. At the present market price of copper this would work out to rupees ten million for an year.

## **ENVIRONMENT AND SIDE EFFECTS**

Compared to insecticides, relatively little is known of the effects of fungicides on the environment, plant and animal life. In tea, the most widely used fungicides are the copper based products. A major portion of the copper sprayed is probably washed on to the soil where it adheres on to the soil particles and because of its low solubility it is unlikely to infiltrate into the soil and for the same reason only small quantities would be expected to be removed by surface run-off. No attempts have been made to determine the levels of copper in streams and waterways, but there is nothing

to indicate that abnormally high levels of copper are building up as evidenced by the death or injury to fish or other aquatic life. Investigations carried out into the levels of copper in tea soils have indicated that there is no likelihood of the copper content of tea soils reaching danger levels due to prolonged spraying for the control of blister blight.

Frequent copper spraying may be harmful to certain entomogenous fungi that help to keep some insect pests under control, but there is no evidence so far that this has happened, because no pest outbreaks have resulted as a side effect of copper spraying. It has been assumed for a long time that continued spraying with copper can lead to an outbreak of mites in tea, especially the Purple Mite, *Calacarus carinatus*, but it has been shown that this was not due to the copper in the fungicide but due to the particulate inert matter used in the formulation of the fungicide.

The other chemical commonly used in tea for disease control is methyl bromide, which is used for the control of root diseases. Since fumigation with this chemical is carried out in the open it seldom presents any problems if the instructions are followed. On the other hand there is a good deal of evidence to indicate that fumigation results in significant increase in growth of plants put out in fumigated plots.

#### **Residue limit for the fungicides used in tea**

In England the residue limit for made tea is 150 ppm and in Germany it is 40 ppm. The American standard is not known. *In any case the copper levels in Sri Lanka teas do not even reach the low level of 40 ppm.* The fungicide is normally applied after the harvest and since there is a 7 - 9 day interval between harvests part of the harvested crop does not receive any fungicidal spray at all.

Methyl bromide is of course applied to the soil long before the planting of tea and does not present any residue problems. No residue of methyl bromide is allowed in made tea. Residue analysis of tea sprayed with Baycor and the new systemic fungicides are at present being carried out.

### CONCLUSION

The use of fungicides in tea is inevitable if the industry is to be made viable economically. It is the only useful and economically acceptable means of effective disease control. This is in contrast to the control of insects for which biological control agents and integrated control strategies have been worked out. But for the control of the diseases of tea, such as blister blight and root diseases, there can be little doubt about the important role of fungicides. Until such time we are successful in obtaining genetically resistant or tolerant plant material we will have to depend on fungicides for efficient crop protection and production.

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