A PRELIMINARY INVESTIGATION OF THE PROBLEM OF MAINTENANCE-LEAF FALL IN THE LOW COUNTRY

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Introduction

Maintenance-leaf fall has been treated in the past as a separate disease of the tea in the low country and the cause has been considered to be *Rhizoctonia solani*. Environmental circumstances and the further effects of the disease on the performance of the bush have not been questioned.

A first attempt has been made in this paper to show what conditions may favour the occurrence, and what the consequences can be in connection with recovery from pruning and the length of life of the bush.

Literature

Petch (1923) described Black Rot of tea in Ceylon as being caused by a *Corticium* species. This name is a synonym of *Rhizoctonia*.

In Monograph No. 2, Gadd (1949) described *Rhizoctonia solani* as the cause of death of mature leaves in the low country.

Loos (1953) observed that what Gadd had described as an uncommon disease had developed into a major problem in the low country.

Webster (1953) thereupon initiated control experiments at Galbodde Estate and Hapugastenne Estate in which two of the treatments were a copper oxide spray and a Bordeaux-mixture spray at intervals of 3 months. These experiments lasted from 1952 until 1954, but unfortunately no definite result was obtained with the spraying treatments. The best results, however, were obtained from thatching. This is indeed very interesting, because it is known that the *Rhizoctonia* fungus comes from the soil and grows up in the bush till it reaches the leaves. What is the influence of thatching? Thatching results in a higher organic matter content of the upper layers of the soil and thereby restores the balance between saprophytic fungi and parasitic fungi in the soil. There is one saprophytic fungus in particular which interests us in this respect. That is *Trichoderma viride* which I recently mentioned in the *Tea Quarterly* (Mulder, 1960) in connection with control of *Poria*. It is known that this fungus, usually saprophytic, is antagonistic to *Rhizoctonia* and can even kill *Rhizoctonia* by parasitic action.

Therefore it is possible that Webster controlled *Rhizoctonia* by stimulating the growth of *Trichoderma* under the thatch cover. In 1953, however, Webster found that *Rhizoctonia solani* had not yet appeared in his experiments (Webster, 1954), but that there was another unidentified fungus. In 1954, *Rhizoctonia* was still absent in these experiments and it was reported (Webster, 1955) that only Brown Blight, Grey Blight, Red Rust and Thread Blight were to be found. The only

conclusion that can be derived from these experiments is that *Rhizoctonia* was not, after all, the main cause of the maintenance-leaf fall.

Shanmuganathan in 1957 had a good result of spraying copper, according to the Annual Report of the Low-Country Adviser (Joachim, 1958), but no recommendation to the planter was made. Now, in 1960, the problem is still there.

Present Work

Last year we started to work on this widespread disease complex in the low country and thanks to the kind cooperation of Dr Joachim, I had the opportunity to gain some experience in this matter. So far we also have not succeeded in isolating *Rhizoctonia*, but we have obtained a culture of a parasitic fungus called *Botryodiplodia theobromae* which can also attack the twigs. It is very likely that several fungi are involved and that regular copper sprays at shorter intervals than 3 months can have a beneficial influence.

It appears however that the control of the various fungi attacking the leaf is not the complete answer. There are several factors which cooperate and finally lead to the weakening, decay and death, of maintenance foliage.

First of all comes the soil. When we compare low country and up-country as regards deficiency symptoms, then we see that magnesium deficiency is common up-country and rare in the low country, apart from some V.P. areas where it occurs due to more liberal potash fertilizing; whereas potash deficiency is rare up-country and common in the low country. This may be due to a difference in fertilizer policy in the past.

Table 1 shows a few potash figures of potash-deficient and healthy estates in the low country compared with those for up-country. At Gallinda, which has very low potash figures, we found severe maintenance-leaf fall and attack by various blights, together with marginal scorch.

TABLE 1.

Potash content of tea leaves

Estate	Condition of bushes	K_2O in ppm of dry wt.
1. St Coombs ...	Healthy	11,460
2. Millakande (just pruned) ...	Healthy	20,436
3. Millakande (one year old) ...	Healthy	17,930
4. Gallinda ...	Healthy	9,961
5. Gallinda ...	Diseased	5,813
6. Enselwatte (jungle clearing)	Diseased	5,109
7. Average Potash content of mature tea leaves according to Eden (1958)	Healthy	13,500–17,600
	Diseased	Below 6,000

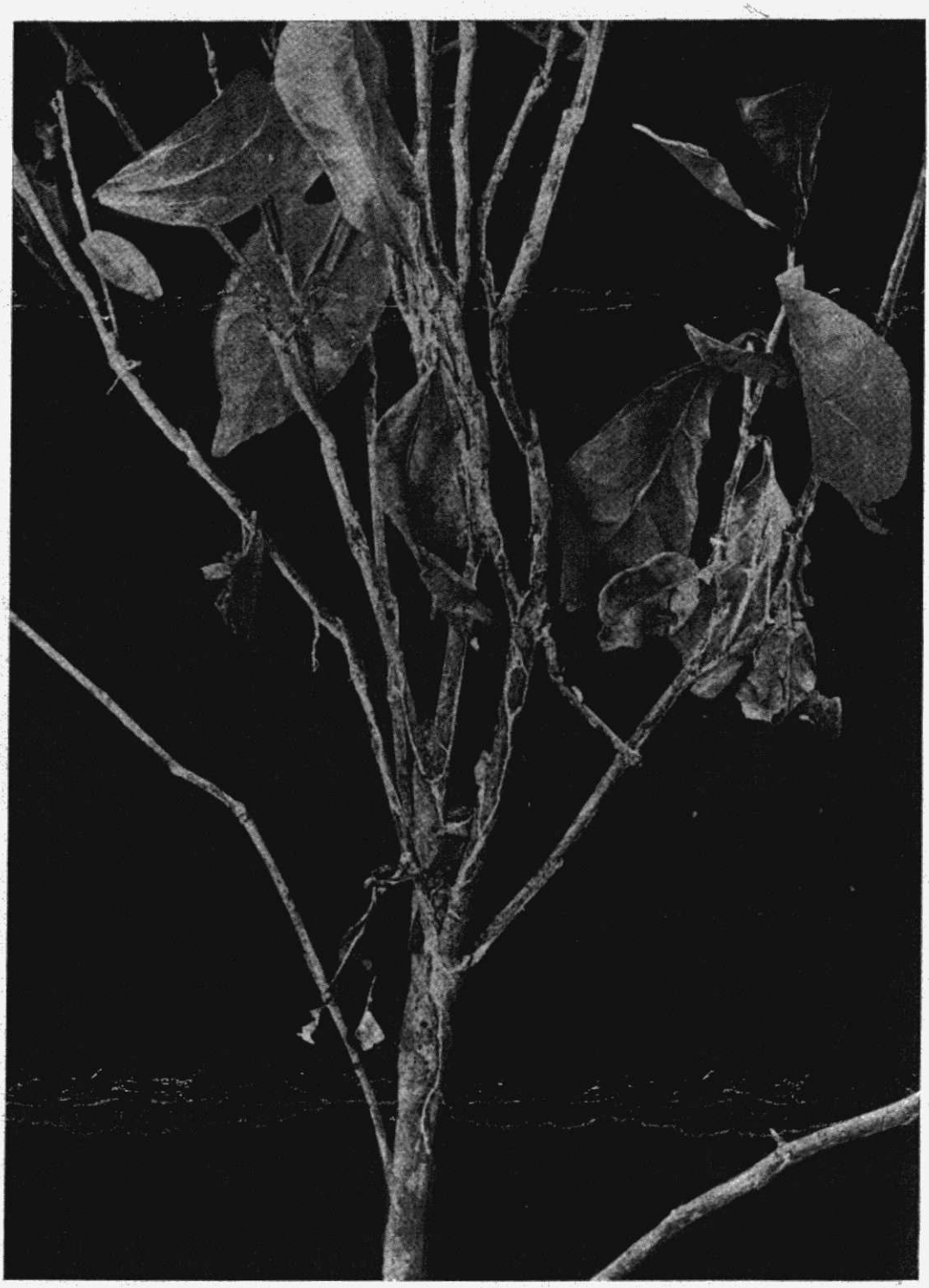

Figure 1. THREAD BLIGHT (*Marasmius pulcher* (B and Br.) Petch) Branches and undersides of leaves, covered with threads of mycelium.

On some estates, at least, it is clear that the present application of fertilizer is not able to make up for the existing shortage. A latent or apparent potash deficiency in the leaf, together with a good supply of nitrogen, increases the susceptibility of the plant to various parasitic organisms.

Those leaves which have a latent potash deficiency, without showing actual marginal scorch as a symptom, are very susceptible to attack by parasites. *Rhizoctonia* rot is only one of the possibilities. Grey Blight and Brown Blight spread easily. On the dead leaves which stay hanging in the bush, we get development of Thread Blight (Fig. 1) and Horse-hair Blight. There is also a parasitic Thread Blight known from India which could invade the living leaf, but this has not been found in Ceylon as yet.

The dense mass of dead and living leaf together with the mycelium of the various parasitic and saprophytic fungi create an ideal humid atmosphere for further development of the attack. This situation develops as early as the end of the first year after pruning and by the end of the second year there is little left of the foliage other than the plucking table. This makes it impossible to have a three-year cycle although that might be attractive because of the higher yield in the case of healthy bushes.

Another even more dangerous aspect of the reduction of maintenance foliage due to various leaf rots and spots is the effect on the starch reserves. The question of starch reserves in the low country is always a rather precarious one. Various influences on the bush can upset the metabolism of the plant with the result that the production of starch goes down, or the utilization goes up, so that the bush collapses rather slowly and dies. The method of pruning has already been adapted in the low country because of the low starch reserves in the roots and the frame compared with up-country. What are the effects of potash deficiency and maintenance-leaf fall on the balance between growth and the accumulation of starch?

With the help of the Physiology Division we have examined a number of root samples for starch content. It is well known that up-country you find high starch content; something of the order of 20% depending on the clone and the site. Healthy material from a low-country estate gave 12% starch which is still quite good. Roots from bushes on a potash-deficient estate in the low country, however, gave us figures between 5% and 2% starch, which is very low.

Potassium is still a rather mysterious element but its function in connection with photosynthesis and carbohydrate formation is known. With more potash we expect to get better wood formation, which means more cellulose production, and more potash also means more starch production. It is well known that crops which produce great quantities of starch in their tubers, like potatoes and sugar beet, need a lot of potash fertilizer.

If you increase the potash deficiency by giving more nitrogen, you upset the balance between growth and the production of starch. The nitrogen stimulates protein formation and growth. Thereby a greater share of the starch produced is put into the new growth and the reserves go down. This leads to starch shortage in the roots. If, at the same time, the maintenance foliage is attacked by parasites and falls, the situation might arise in which the whole bush collapses due to starvation of the roots.

If this shortage of starch prevails just before pruning then you can imagine what happens. Some bushes may make a short recovery and then find that they are running out of food. Others may not recover at all.

Even if the most mild pruning system, in which you keep feeders (lungs), is adopted for use on such exhausted bushes, there is a risk that recovery will be bad and die-back at some stage prevalent.

If I were asked to give advice in such cases I would say first of all: get your leaves analysed for potash and perhaps several other elements by a commercial firm so that you know about the nutritional status of your bushes. This puts further action on a better basis.

Second, take warning, if there are acute symptoms of potash deficiency. If there is excessive maintenance-leaf fall, then a latent potash shortage may be present.

Attempts to have a three-year cycle should be abandoned where there is abundant occurrence of Thread Blight, Horse-hair Blight and possibly *Rhizoctonia* or other parasitic fungi.

If you want to take a hygienic measure after pruning, in order to retard the development of these blights, then removal of prunings and a thorough washing of the frames with a copper spray would be profitable. Here we still lack experience, but experiments are in progress.

In summarising, I would like to stress my point that a fatal sequence of events in the low country can be: potash deficiency, maintenance-leaf fall, starch deficiency, pruning, die-back, eventually leading to death of the whole bush.

The policy of neglecting the bush just before pruning can lead to total loss.

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