

PINEAPPLE DISEASE OF SUGARCANE CUTTINGS AND ITS CONTROL.

By A. McMARTIN.

The loss caused by the so-called minor diseases is not usually considered of sufficient importance to warrant the adoption of control measures such as those used in combating major diseases; nevertheless it has frequently been asserted that if the total loss due to the activities of all minor diseases could be estimated it would probably amount to more than is imagined. Further, a disease which is of little or no consequence on one variety might become of greater importance on another of greater susceptibility, even to the extent of becoming a limiting factor in crop production.

While it is not suggested that a disease which causes a loss among planted cuttings has acquired, or appears likely to acquire such a status, it is nevertheless probably the case that the toll taken by pineapple disease is sufficient in some cases to consider whether or not it would pay to adopt some measure to minimise the loss caused.

Individual cases have occurred in which such loss has been of a very large nature, in which the planting of a field has been practically a failure, and perhaps even the second attempt at planting has been disastrous. Such cases as these to which the attention of the writer has been drawn have usually been due to the ravages of pineapple disease.

While other diseases cause a loss among cuttings, probably in Natal no other alone does so much damage as pineapple disease.

The organism responsible for this disease is the fungus *Ceratostomella paradoxa*, formerly known as *Thielaviopsis paradoxa*, this name being that given to the conidial stage of the fungus, which is the only stage known to occur on sugarcane.

It was first recorded on sugarcane in Java in 1893 by Went, who gave it its popular name owing to the smell produced in the cane attacked, and has since been found in almost every cane growing country. It is also found causing diseases in the pineapple, coconut and banana.

It was first recorded in Natal by the writer in 1935, and since then has been found with regular occurrence, but with varying degrees of severity.

In its typical form this disease is very readily identified; on splitting open the dead cutting, a black core is found to have been formed, often the whole length of the cutting. The latter has the smell of a very ripe pineapple, hence the name of this disease.

Many cuttings are found with pineapple disease at one or both cut ends, but in which the disease has not progressed further than the outside nodes, and in most cases these cuttings are not destroyed, but produce at least one shoot. This suggests that the nodes can arrest the spread of the pathogen, and retard the rate at which the disease develops longitudinally throughout a cutting; it also suggests that cutting the cane into too short pieces would be a factor increasing mortality where pineapple disease is present. On the other hand, however, cutting the cane promotes the growth of the buds, and the advantages of doing so probably outweigh the disadvantages of possible increased loss.

The resistance of the nodes towards pineapple disease probably varies with the variety of cane, and perhaps also with the condition of the material used for planting.

It is interesting that this disease has rarely been found in this country causing a disease of growing cane; it has been found, however, in some cases at the bottom one or two internodes of such cane, but has never been found to spread upwards, and appears to do no harm. It is surprising that it does not occur oftener, especially in cane which is suffering from borer attack, or is cracked, since as will be shown, it appears to be a very common inhabitant of the outside of the cane stalk. Its inability to travel upwards in the stalks of healthy growing cane has also been demonstrated by inoculation experiments: if a culture of

the fungus be placed in a joint of such cane the spread is downwards to the node immediately beneath (except in a very susceptible variety), differing thus from other diseases which when inoculated into the stem spread upwards more than downwards.

Pineapple disease is very commonly found as a contaminant in cultures when isolating the fungi causing recognised leaf spots, indicating that its presence on cane leaves is a matter of probably no infrequent occurrence. It is also very frequently found on the outside of the stalks, on cane that shows no symptoms of disease. Its presence on the exterior of the cane can be demonstrated in a very simple manner, by cutting some pieces of cane into small lengths and placing them in some container, washed out previously with some disinfectant. If pineapple disease is present, in about a week a black fungus growth is seen developing over the surface of the canes, and especially at the cut ends, where probably the growth is encouraged by the exudation of juice. If these pieces be cut open after about two weeks, the fungus is seen to have spread into the interior, is forming the typical black core down the centre, and producing the odour characteristic of the pineapple. By this means we have sampled plots for pineapple disease and have found its occurrence to be more widespread than imagined.

It does not follow, however, that all cane on the exterior of which this fungus can be found will suffer from the disease when planted. The condition of the cane when used for planting, the environmental factors at the time of planting, and the resistance of the variety, will largely determine whether or not germination will be affected; these factors which tend towards quick development of the buds and roots will minimise the loss due to the fungus, and vice versa. Thus, adverse conditions such as low temperatures, insufficient or excess moisture, provide conditions under which pineapple disease is frequently found.

Its presence in the soil has also been demonstrated, and in one case examined, that of a sandy soil in which the planter reported that he was having difficulty in establishing cane, the growth of the fungus was so copious that the threads were holding particles of sand together.

Since its identification in Natal, this disease has been found in cuttings of all varieties commercially grown, but large varietal differences exist in the loss of cuttings which can be attributed to it.

The most susceptible variety is Co.331, in which quite a considerable loss can be encountered under conditions favourable to the disease: next in order of susceptibility is Co.301, with Co.281 only a little more resistant. Varieties in which little pineapple disease has been found are Co.290, P.O.J.2725, Uba and P.O.J.2878. (It does not follow from this, of course, that these are better germinating varieties; the order of susceptibility in which these are placed refers specifically to pineapple disease.)

Control of this disease may ultimately be effected by the use of resistant varieties, although at present it does not appear to be of a sufficiently serious nature to breed varieties specifically for such resistance. Planting under optimum conditions, of course, would minimise losses, but this is not always a practical possibility, and the problem resolves itself into that of obtaining a good stand of young shoots from a susceptible variety planted under conditions where slow germination might be expected, and therefore suitable for pineapple disease, if present on the cane used for planting.

As was stated previously, the disease is carried on the outside of the cane stalks, and the question is therefore one of preventing its entry into the cut ends when the cane is planted. Surface sterilisation of the cane of course is an effective means; in all laboratory work good control is obtained by dipping canes to be used for disease studies in a solution of mercuric chloride, and even samples that are known to carry pineapple disease can be used with safety. This method of course is not considered a

practical possibility on a large scale, but it suggests a simpler form of control, *viz.* that of coating the cut ends with a disinfectant, if a cheap enough method of application could be found.

Such treatment has been found by the use of fungicidal dusts, which form a protective coating over the cut ends when the latter are dipped into a container in the bottom of which a little of the powder is sprinkled.

Small scale laboratory experiments indicated that complete sterilisation of the whole exterior of the cane was not necessary to provide control, provided that the cut ends were coated, and following these trials a field experiment was planted to test the effectiveness of such treatment under more stringent conditions.

The fungicidal dusts used were the proprietary organic mercurials Ceresan and Agrosan, and the newer non-mercurial Thiosan.

The two first mentioned substances have been used experimentally on sugarcane cuttings previously, often with spectacular results. In these experiments, however, the whole of the cutting was dusted by rocking the cuttings prior to planting in some large enough container in which some of the substance was placed, a particularly cumbersome and slow method, the cost of which would prevent large scale application of the method. In addition, there is a certain amount of discomfort in the use of these mercurial preparations in this manner, the handling of dusted cuttings in some cases causing blisters on the hands should the latter have any abrasions.

The use of these materials on a plantation scale has been tried, but discarded, the reasons being apparently the cost of treating the cuttings, and the variable results obtained. While some results are very impressive, there have been cases in which no apparent response has been obtained, and in some few cases the treated cane appeared a little poorer than the untreated.

Some light on the nature of response expected has been obtained by several field and glasshouse experiments, in which it has been found generally that the degree to which germination of the cuttings is improved depends upon the conditions under which they are planted, that the better the latter the less the response to treatment. It has been found, for example, that with sufficient soil moisture to ensure quick germination, untreated cane germinates as well, or almost as well, as treated cane. By reducing the soil moisture, however, the beneficial effect of treatment becomes apparent, until in very dry soil, where germination of the untreated cane is very poor, big differences can be produced. In one field experiment planted under dry conditions, such treatment caused an increase in crop of almost 70 per cent.

Where the soil is excessively damp, a damaging effect has been noticed, particularly with Ceresan, although there are indications that under these conditions Argosan may be used with some beneficial results.

The indications are therefore that such treatment might have general application where cane is planted under conditions in which slow germination might be expected, e.g. in winter planting, provided a cheap method of application can be found.

The above remarks apply to cane which as far as is known is healthy. In the following experiment cane of the variety Co.331, from a plot where pineapple disease was known to exist was used. The experiment was planted in July, 1943; the cane was cut into four-budded cuttings, and was planted at the rate of 100 cuttings per plot of one-forty-eighth of an acre. There were four replications of each of the treatments, arranged as a 4 × 4 Latin square :—

- Controls without fungicide.
- Cuttings treated with Agrosan.
- Cuttings treated with Ceresan.
- Cuttings treated with Thiosan.

The method of treating the cane was to cut it first into the correct lengths, and then dip the ends into the containers in the bottom of which the powder was sprinkled. (The use of four-budded cuttings was simply to ensure that each plot would have the same number of buds, to obtain accurate figures on the germination obtained.)

A cold dry spell was experienced after planting, and since the planting material was known to carry the disease, poor germination could be expected.

The experiment was concluded on the 1st December, when the young plants were dug up and counts made of the buds germinated, with the following results :—

<i>Total number of buds grown.</i>	
Controls	9 per cent.
Agrosan	22 per cent.
Ceresan	24 per cent.
Thiosan	17 per cent.
Significant difference at 99 : 1 odds	5 per cent.
Significant difference at 19 : 1 odds	3 per cent.

All treatments thus increased the number of buds which grew, but Thiosan was not as good as the other two.

The percentage of buds germinated with Ceresan and Agrosan treatment may be considered sufficiently satisfactory, it having been found in practice that a germination of a quarter of the planted buds is not uncommon, and is sufficient to give a good enough stand of young shoots.

Counts were also made of the cuttings which grew at least one shoot, with the following results :—

<i>Number of cuttings germinated.</i>	
Controls	24 per cent.
Agrosan	57 per cent.
Ceresan	56 per cent.
Thiosan	44 per cent.
Significant difference at 99 : 1 odds	14 per cent.
Significant difference at 19 : 1 odds	9 per cent.

All treatments thus significantly prevented sett rot, but Ceresan and Agrosan were better than Thiosan at 19 : 1 odds.

The cuttings were then split open and those showing obvious signs of mortality due to pineapple disease were counted. The results were as follows :—

<i>Number of cuttings showing positive signs of Pineapple Disease.</i>	
Controls	45.0 per cent.
Agrosan	1.5 per cent.
Ceresan	3.5 per cent.
Thiosan	9.0 per cent.

It is thus obvious that good control of the disease was obtained by such treatment.

It is realised, of course, that the economic aspect of such treatment must be taken into account in assessing the value of these fungicides, but it may be said that the amount of material used is small. Although it is very difficult in a small scale experiment to determine the amount used, it was found previously in dusting the whole cutting that probably not more than 4 lbs. of powder would be required for one ton of cane.

The amount used only to coat the cut ends ought to be less, as is also the labour required, and is a fairly simple operation for any planter who is prepared to cut the cane into lengths prior to planting. The additional labour of dipping the cut cane into buckets or any container which will hold the powder might well be paid for by the increase in crop obtained when conditions for these fungicides to act beneficially are present. The cost of such treatment would, moreover, probably be less than that of having to supply blanks in a field where bad germination has been encountered.

It will be noted further that by so treating the cane two or more times the number of buds grew compared with the controls, so that in this experiment the effect of the treatment was at least equal to half the amount of cane required for planting to obtain a satisfactory stand, and it is not without the bounds of possibility that this reduction in the amount of cane required would more than pay for the cost of treatment.

SUMMARY.

1. The most frequently encountered single cause of failure to germinate among sugarcane cuttings appears to be pineapple disease.

2. This disease has been found on all varieties, but to a greater extent on the varieties Co.331, Co.301 and Co.281 in the order given.

3. This disease is carried on the outside of the cane used for planting, and enters the sticks when these are cut up into pieces, causing the latter to rot when conditions for slow germination prevail.

4. Good control of this disease has been obtained in a field experiment by cutting the cane into lengths prior to planting and treating the cut ends with the dry fungicidal powders Ceresan, Agrosan and Thiosan.

5. The use of these materials may be used with benefit whenever slow germination may be expected, especially in cold and dry weather.

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The PRESIDENT said he was glad Dr. McMartin had drawn attention to the fact that it was worth while looking after sugarcane setts. It would appear from this paper that fungicidal treatment of cane setts had become an economic proposition.

Co.331 was a cane with a high fibre and low purity, and consequently it would be very unpopular. Now Dr. McMartin had shown that it was also the most susceptible variety to pineapple disease. These unfavourable characteristics deserved more than passing comment, and he suggested that a note of caution should be issued to planters.

Dr. McMARTIN replied that attention to the susceptibilities of Co.331 to pineapple disease had been drawn in the *South African Sugar Journal* for one or two months, and he felt that it might become a matter for planters to pay attention to in future.

Mr. RAULT wanted to know whether, in general, we suffered a lot as a result of bad germination, or whether only occasionally when very cold weather conditions were experienced.

Dr. McMARTIN, in reply, said that cases did occur where germination was particularly bad, and cane had to be planted perhaps two or three times before a stand was obtained, but that was exceptional. Such cases were nearly always due to pineapple disease. He emphasised that it was when environmental conditions were unfavourable that such trouble might be expected, and that with winter planting precautions might be taken with advantage.