

The Major Cane Diseases.

(Paper by Mr. H. STOREY, Government Mycologist, Durban.)

(Illustrated by lantern slides.)

Six months ago, when I came to this country, I was informed on many sides that serious disease was here non-existent in the canes; and indeed that Uba was a wonderful cane and was immune to all disease. I must admit that this was a surprise to me. The literature of sugar cane contains perhaps more described diseases than any other cultivated crop. Then, again, I had read that Uba cane made excellent forage, but was not to be regarded seriously as a source of sugar. Finally, another set of voices whispered in my ear dark tales of falling tonnage and deterioration of the cane.

And I think, ladies and gentlemen, that my first informants were probably in the main correct. I join with you in your admiration of Uba. Falling tonnage may be due to a multitude of causes, and it is fully probable that disease has no share in the matter. Furthermore, it does appear that South Africa suffers from a singularly small proportion of the diseases to which cane is subject; and in view of the promiscuous importation which appears to have occurred in the more-distant past, this is a matter at once for astonishment and congratulation.

But perhaps there may be a few people who really believe in the absolute immunity of Uba cane to all serious disease. Whether this view be correct or not, I cannot too strongly deprecate the state of mind which it may produce. I have no desire in the least to suggest that any immediate danger threatens the sugar industry; but, where one crop is grown over large continuous areas, that crop is always in danger of an epidemic of plant disease. And in so far as a disease is recognised, early and preventive measures applied in good time, so is the damage caused by it lessened.

I therefore considered that it would be not inappropriate if I described briefly to you to-night the symptoms and chief characteristics of the more serious diseases which occur in other cane-growing countries. It is conceivable that these diseases may exist or may come to exist in this country.

Now it is a common feature of plant epidemics that for years the diseases may occur in a country, quiescent as it were, but awaiting the moment to spring. If then I can describe these diseases so far adequately, that I am able to help you to detect them in any of your fields, then some good will have been done.

The three diseases which I have chosen are sereh, fiji, and mosaic. They are similar in being definitely infectious, although no visible organism has been certainly proved to be the cause. All have in common the characteristic that they produce a stunting of the cane, without any very obvious other symptoms. The idea of a disease which may merely lessen the vitality of a plant without causing the death of any part may be a new one to some people. Indeed occasionally one may encounter a case where cane, though undoubtedly infected with one of these diseases, may appear to be producing a perfectly normal crop. I wish to make it quite clear that disease can occur without the presence of any of the conventional signs of disease. Thus a field may show 100 per cent. infection with a particular disease and yet produce a satisfactory crop. I do not wish you however to imply anything from that, except that disease may on occasions exist unsuspected; where it does so exist, however, it is not to be regarded as of no importance.

Sereh appeared first in Java, and has probably spread to other islands of the Malayan Archipelago. Reports of the disease from other countries have probably been based on wrong diagnosis. Fiji disease appears to have been introduced to that island from New Guinea, and it now occurs also in Australia and the Philippines.

Mosaic, first recorded in Java, has spread to practically every cane country, except India and apparently Mauritius.

At this stage I wish to say that my information is derived mainly from the literature of other cane countries, and in particular from a paper by H. L. Lyon, of Hawaii. The majority of my slides are from the same source. In the case of mosaic disease alone, I am speaking from personal acquaintance.

As I have previously mentioned, the main effect of these diseases upon the cane is that of stunting the growth, resulting in a loss of tonnage reaped. But many causes, drought, poor tillage, etc., may stunt the cane. It is only by the secondary symptoms that the disease may be definitely diagnosed, and, where a disease has no such symptoms which can be picked out as invariably present, confusion may readily arise.

To sereh does this particularly apply, since its symptoms vary widely in different varieties of cane. The fullest descriptions of the disease, due to the

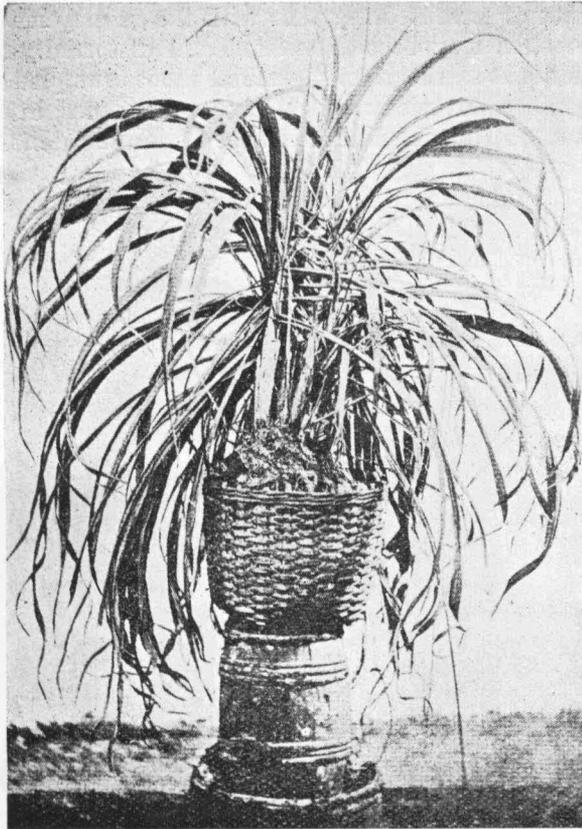
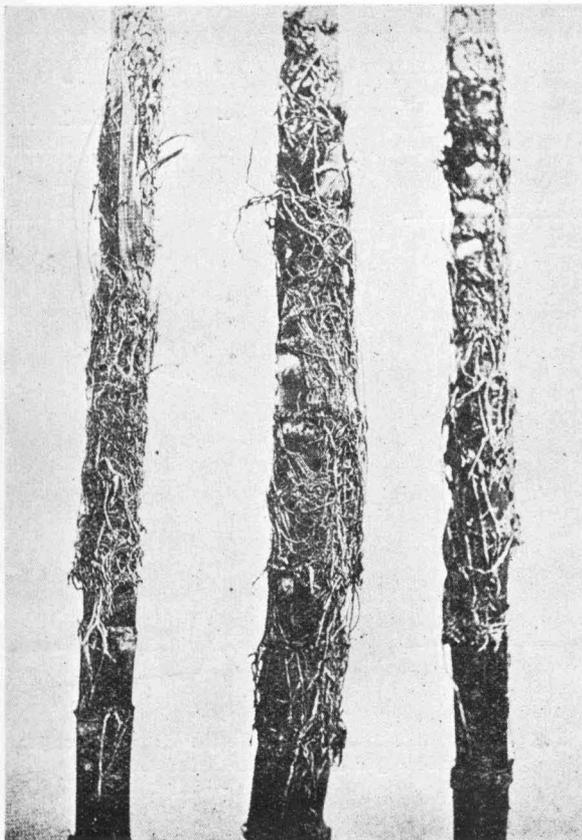


Fig. 1.—Sereh. A typical diseased stool in Java.
—After Wakker & Went.



Fig. 2.—Sereh. Ten months old Cheribon cane, showing a diseased stool in the foreground.
—After Lyon.



• Fig. 3.—Sereh. Excessive development of adventitious roots. —After Wakker & Went.

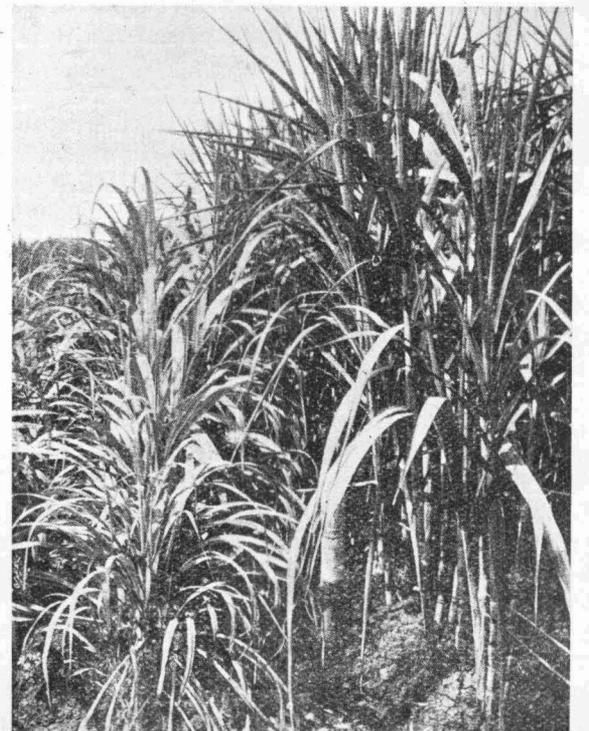


Fig. 4.—Sereh. Two rows of Cheribon cane, of the same age; that on the left grown from setts cut from diseased plants, that on the right from healthy.
—After Lyon.

The Major Cane Diseases.

workers in Java, refer to Cheribon and a seedling, 247 B. In Cheribon cane the disease is characterised by:—

(1) Inability to grow, the shoots remaining short and the leaves crowded and forming a fan-shaped mass. The photograph is of a typical stool of this variety in Java. The next picture shows a diseased stool, ten months old, in the field, surrounded by healthy plants of like age.

(2) The conducting strands in the cane are coloured red, so that on splitting open a cane one sees something resembling this picture.

(3) A profuse growth of adventitious roots may take place under the leaf sheaths. The three canes photographed show this symptom in an advanced stage.

None of these symptoms, however, is entirely reliable. The red colouration in Cheribon may be absent until the cane is about ten months old. The growth of adventitious roots may or may not take place. In 247 B, on the other hand, the red colouration and adventitious roots are generally present, while the stunting is much less pronounced. The diseased canes may be as long and as thick as the healthy ones, but they are unnaturally light in weight and lack sap, particularly in the central tissue, which appears white and simulates an axillary pith.

It is difficult to say, therefore, what form sereh would take in the canes grown in Natal. I should personally be very cautious in diagnosing this disease, and should only do so after extended study. The greatest trust is probably to be placed in the red conductive strands. Two experimental tests may be applied to doubtful cases.

(1) Setts cut from a suspected stool and planted in an entirely different situation should reproduce the original symptoms. The slide shows a row of Cheribon grown from diseased setts, beside a row from healthy setts.

(2) The upper eyes of serehed canes, which have been topped and left standing, will always fail to develop, in the manner that similarly treated healthy canes would.

Before leaving the question of sereh, I must refer to a disease which shows many symptoms in common with it, and indeed has frequently been mistaken for it. This is the gumming disease, caused by a minute organism, bacterium vascularum, E.F.Sm. This malady is characterised by dwarfing of the plants, dying of the tops, decay of the heart, and the appearance of yellow slime in the conducting strands of the stem. The latter oozes out of the cut end of a cane as shown in the photo. Occasionally large cavities may form in the stem filled with yellow slime. Frequently red-stained strands occur as in sereh. As a result of the death of the top, which

becomes cemented together with the gummy matter, the stem may become twisted and distorted. This photo shows the young terminal shoot crumpled and pressing out sideways. The three canes in this photo, stripped of their leaves, show the distorted shapes which may occur.

The gumming disease has been reported from Australia, East Indies and Mauritius. It is only serious where cane is growing in damp situations; and with certain varieties of cane.

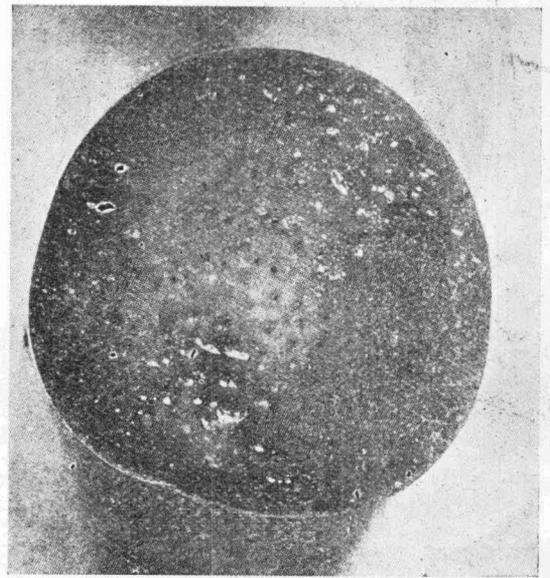


Fig. 5.—Gumming Disease. Cut end of a diseased cane, showing gum oozing out.

—After E. F. Smith.

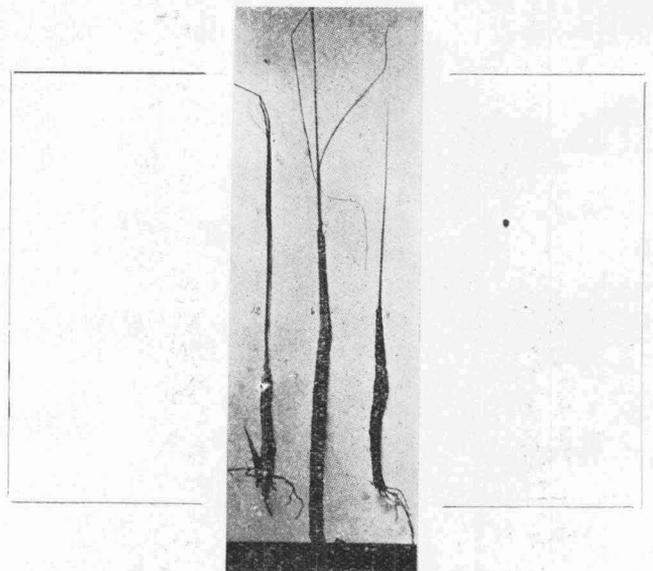


Fig. 6.—Gumming Disease. Three diseased canes, showing stunting and distortion.

—After E. F. Smith.

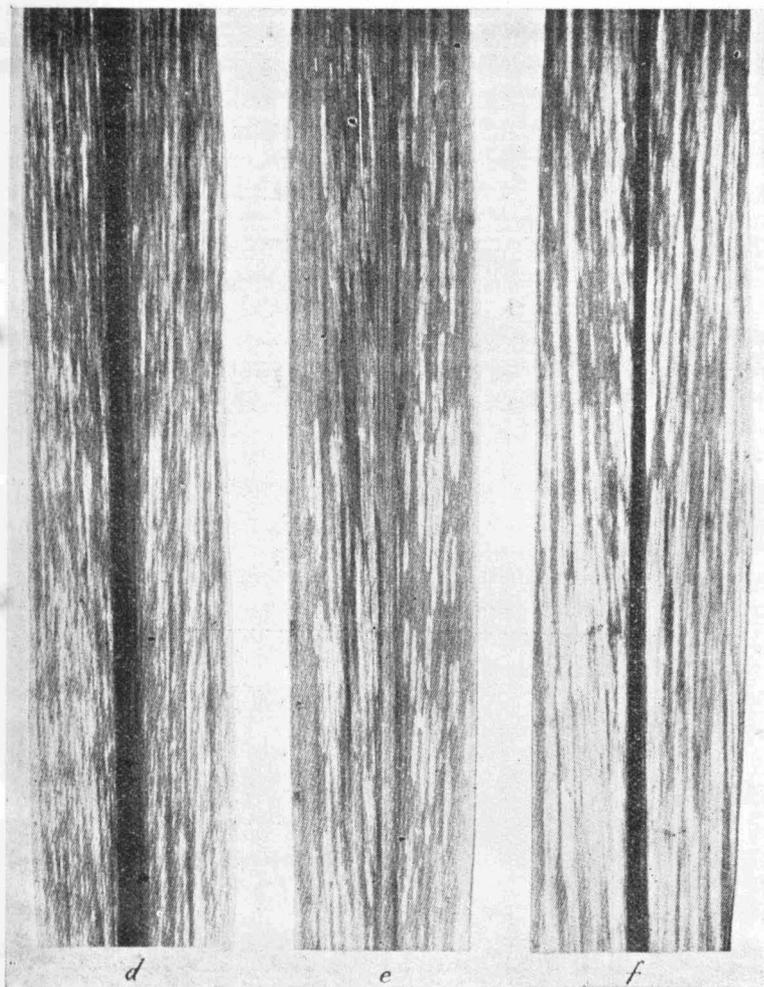


Fig. 10.—Mosaic Disease. Leaves of the three varieties Yellow Caledonia, D. 1135 and Badila, showing different types of mottling.

—After Lyon.

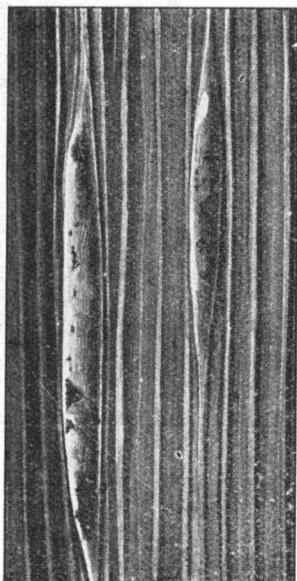


Fig. 7.—Fiji Disease. Enlarged picture of the characteristic galls on the lower surface of the leaves.



Fig. 8.—Fiji Disease. A diseased stool of the variety Badila.

(From a photograph by North, reproduced by Lyon.)



Fig. 9.—Fiji Disease. Four rows of badly diseased ratoon cane, with resistant varieties on either side.

(From a photograph by North, reproduced by Lyon.)

The Major Cane Diseases.

Fiji disease offers a more ready and certain diagnosis. On the under surface of the leaves of an affected plant occur elongated swellings or galls, which extend along the larger veins, and are in fact formed by the unnatural growth of the tissue forming the vein. The picture shows you an enlarged view of two such galls. No other disease produces galls of this nature, and their presence may be taken as conclusive proof of Fiji disease. The course of the disease differs somewhat from that of sereh. Stunting may not be very pronounced; in some cases a diseased shoot may develop apparently healthily, bearing fully green and superficially normal leaves.

Suddenly it will start to produce a few distorted leaves and then cease to grow altogether. The picture shows a stool of Badila in this condition. You will see, particularly on the left-hand side, the final distorted leaves produced by these shoots. Lateral shoots, as you may see, may develop, but they will repeat the same process. All the leaves of such a plant, and many even before this extreme stage is reached, will bear the characteristic galls. The plant may linger on alive for months or may soon die. Other varieties in an advanced stage of the disease may produce nothing more than a tuft of narrow and distorted leaves, as is the case with the ratoons in my photo, where you see four rows of badly diseased plants, with a more resistant variety each side.

The characteristic symptoms of mosaic disease are to be found upon the leaves. This slide shows you three typical diseased leaves. The affected leaf, instead of being a uniform green, shows a mottling in two shades of green. The pattern of such mottling varies somewhat in different varieties of cane, but generally consists of blotches somewhat elongated in the direction of the leaf axis. The two outside leaves of the picture show this. Notice that the dark parts are the only normal parts of the leaf, the lighter areas being devoid of a part of their green colouring matter. These symptoms may generally be seen most easily in recently unfolded leaves, and by holding them up to the light. This mottling is distributed over the whole of the leaf blade. In certain varieties at a late stage of the disease, pale yellow, or colourless areas may appear within the light blotches, as you see in the middle of the picture.

There are certain injuries commonly found on cane leaves which might be mistaken for mosaic. Chlorosis, in which the whole leaf turns yellow, or white, is a common phenomenon, due to a variety of conditions, but non-infectious. Some forms of chlorosis appear as long stripes of yellow, alternating with stripes of green, and generally extending the whole length of the leaf. Sometimes the leaf may show round yellow spots, but these are

irregularly distributed on the leaf. The spots caused by the fungi will always become brown, and so are readily distinguished. None of the above conditions is connected with mosaic disease.

While some varieties of cane may show no symptoms beyond the above, the majority are very definitely dwarfed by the malady. This photo shows four diseased canes of Yellow Caledonia (from Hawaii) alongside three healthy ones grown in the same place. In addition to showing greater thickness, the healthy canes were nearly twice as long as the diseased. The next photo shows an experimental row of a highly susceptible variety. In this row alternately two healthy and two diseased cuttings were planted. The difference is very marked.

The character then upon which diagnosis is to be based is the mottling of the leaf. Confirmation is obtained if cuttings from a suspected plant produce

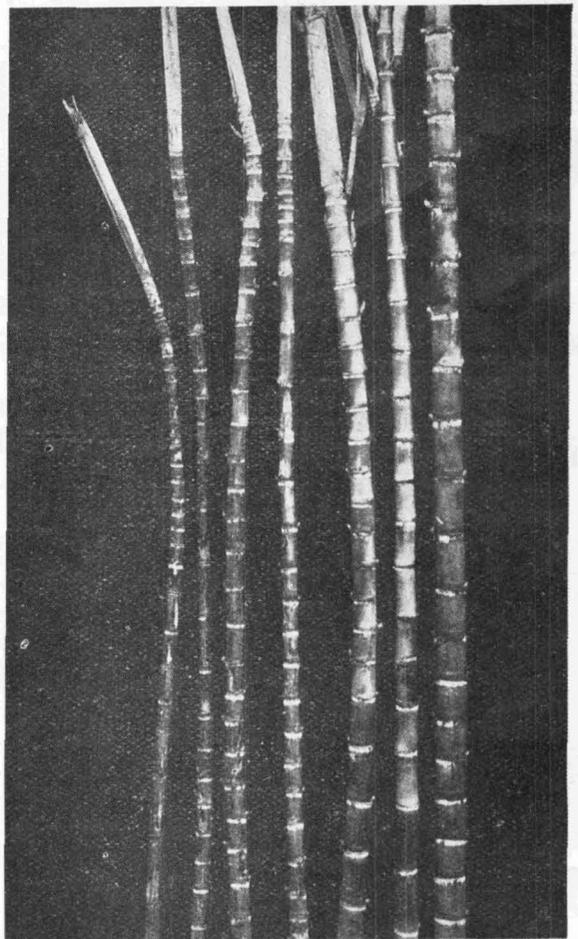


Fig. 11.—Mosaic Disease. Four diseased canes of Yellow Caledonia, with three healthy canes of the same variety. The diseased canes were only about one-third as long as the healthy ones.

—After Lyon.

The Major Cane Diseases.

the same symptoms, and failure of this test would indicate that an incorrect diagnosis had been made.

The foregoing remarks may offer some help in the detection and differentiation of these diseases. I now wish to lay stress upon certain important characteristics which they have in common.

(1) Canes suffering from any of these diseases are quite incurable. No treatment whatever, manuring, cultivation or spraying, will ever cause the plants to throw off the disease.

amount of ill-effect as a result. Thus many of the seedlings of the Chunnee-Cheribon cross, while contracting mosaic disease readily, appear not to be greatly handicapped thereby, and continue to produce good crops. Badila is found to be readily destroyed by Fiji disease.

Upon these characteristics are based the methods employed for control. Such control methods are as follows:—

(1) Eradication of diseased plants.—This is clearly

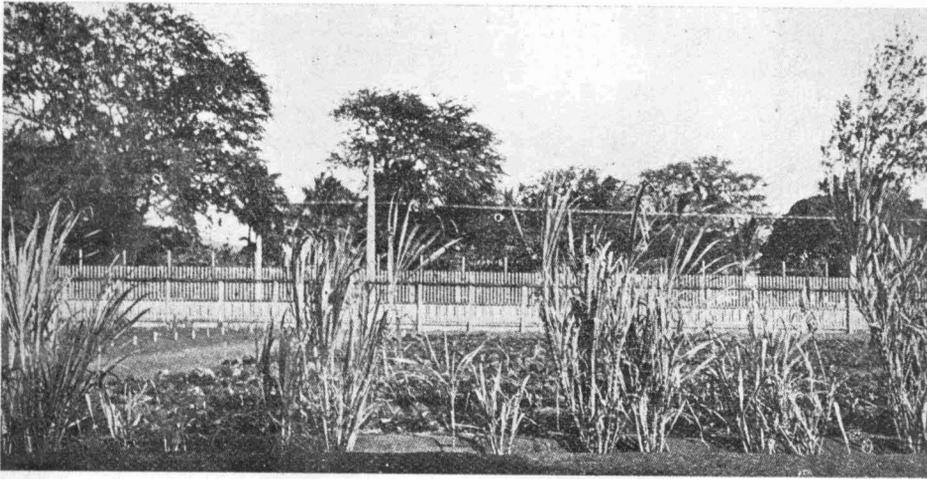


Fig. 12.—Mosaic Disease. A photograph illustrating an experiment arranged to show the effect of the disease upon the growth of the plant. Two cuttings from diseased canes were planted alternately in the same row with two cuttings from healthy canes. The stools shown are ten months old.

—After Lyon.

(2) The effect upon the plant is cumulative, each succeeding ratoon crop being more seriously infected.

(3) Setts taken from diseased plants will never produce healthy plants, though subjected to any treatment whatever, such as disinfection. Such setts, however, once they have been cut, may show no outward sign of the disease, which nevertheless they carry.

(4) The diseases are infectious and may pass from one plant to another while they are actually growing in the field. To this manner of spread is applied the term secondary infection. The exact mechanism by which this spread takes place is not clearly understood, but sucking insects, such as aphids, have been proved to carry the infectious principle of mosaic disease. This last disease has been shown not to be carried in the soil, and indeed once a plant is wilted it ceases to be infectious. In Fiji disease the soil is believed to carry infection at least a year. Sereh is probably not carried in the soil, but this point is not clear.

(5) The different varieties of cane show varying susceptibility to these diseases. Thus Uba is believed to be entirely immune to mosaic, the Indian Chunnee cane similarly immune to sereh. The varieties which actually contract the diseases show a very varying

the soundest way of dealing with any disease, but obviously can only be applied when the area concerned is relatively small.

(2) Selection of disease-free cuttings for planting.—This selection must be done preferably before the cane is cut, or at least before it is topped. After topping, no reliable selection against these diseases is possible, although rejection of the obviously poor sticks would doubtless eliminate the worst diseased. I believe that the most effective manner for carrying out this selection practically is to choose for cutting an area showing a low proportion of disease, and then send through it experienced men who will cut out all diseased plants. The whole of what remains may then be used for planting.

(3) Abandonment of the practice of ratooning.—In Java, sereh was found to render even a first ratoon unprofitable. It is the custom in Fiji to reap one ratoon crop, but no more. In the case of mosaic, the effect of the disease is rapidly cumulative, and generally few ratoon crops could be reaped.

(4) Use of immune varieties.—This is undoubtedly the most promising remedy for a country where a disease is firmly established. But unfortunately few immune canes exist, and they are rarely of a satisfactory quality in other respects. But examples of

The Major Cane Diseases.

the employment of this principle may be quoted. The use of Java seedlings, tolerant of mosaic disease, has been an important factor in the Argentine, where the disease is widespread. Badila, resistant to Fiji disease, seems similarly to have done much to save the industry in Fiji.

An interesting point in connection with the control of sereh is the system of hill nurseries in Java. It was found that the disease did not flourish at high elevations. By growing their cane for planting at 5,000—6,000 feet they could ensure a supply of disease-free setts.

I think, ladies and gentlemen, that I have sufficiently stressed the importance of these diseases, and the most serious situation would arise should they become widespread in this country. But perhaps I may remind you that sereh for many years dominated the sugar industry of Java, and the system of agriculture is now largely influenced by the need for control of this disease. Fiji at one time threatened the very existence of the industry in the island of that name. Control measures have, however, been largely successful, but even now the practice of taking more than one ratoon crop has been of necessity abandoned.

More definite figures are available regarding the losses which have been caused by mosaic disease. In Porto Rico, up to 1919, the disease was estimated to have cost the industry three and a half million dollars. Various workers in Porto Rico, Louisiana and Trinidad have shown experimentally that the loss of tonnage may vary between 3 and 50 per cent., according to the variety of cane. Wherever the disease has become serious, the practice of ratooning has been abandoned or greatly curtailed.

These diseases are then a serious cause for apprehension to any sugar-growing community. What is the position in regard to them in this country? I am sorry to say that one of them to my knowledge is established in Natal. I hope and believe that we are at present free from the others.

Mosaic disease appears to have been introduced to Natal a number of years ago. The reason for its failure to come into prominence is to be found in the resistance of Uba. Had Uba been a susceptible variety, I believe the disease would have played havoc with your industry. But as it is, the disease is localised in the small areas where varieties other than Uba are grown. I should say that every variety of cane which I have examined in Natal has shown the disease to some extent, excepting only an Indian cane Agaul, Uba and certain Uba seedlings from

Mauritius, which have probably escaped the disease accidentally, but may possibly be immune. It is possible that the poor results which have been obtained from the various imported varieties are to some extent due to this disease. In particular the variety plot at the old Experimental Farm, at Winklespruit, is now languishing in the last throes of the disease. Elsewhere I have seen the disease on all the canes from Argentine, and a number of the old sweet canes, such as Green Natal, White Queen, and Purple Mauritius, upon Cheribon, and several unnamed varieties. Argentine No. 3 cane is an interesting case, for I have never seen a stick of this variety which did not bear mosaic disease. It is, however, probably one of the Java seedlings already mentioned which show a high degree of tolerance, and, in spite of the disease, it appears in places to yield well. I suspect, however, that this cane has been instrumental, more than any other, in spreading the disease through the country.

What steps are to be taken to combat mosaic disease here? I have recently placed before the Council of the Association a full report upon this whole question, and it will presumably formulate a uniform policy for the whole of Natal and Zululand. Meanwhile I may state that I have urged in my report the total eradication of all canes other than Uba.

This is a drastic step, but one for which I consider that there is full justification. While mosaic disease may not represent a serious menace to the Uba, yet its presence would prevent the growing in this country of the great majority of the world's best cane. By eradicating all these diseased canes, I believe that the disease could be wiped out at small loss to the industry. The chief objection to this step lies in the fact that it would leave the country with no cane to fall back upon in case of the failure of the Uba. The remedy for this would be new importation under adequate scientific control. Now I am fully alive to the danger of importing canes, but here I regard it as the lesser of two evils. But I must insist that such canes must be subjected to the most rigorous quarantine, and the only solution to that problem is an experiment station. I commend to your common-sense the hopelessness of trying to build up a useful stock of cane from a collection of varieties already moribund from one of the most serious diseases known.

I imagine that during my remarks upon mosaic disease many of you must have been comparing mentally with my descriptions a frequently occurring affection of the leaves of Uba, wherein pale yellow streaks form a pattern over the whole of each leaf. I think that this state of affairs must have

The Major Cane Diseases.

been noticed by every planter. These symptoms may have been thought to agree with my description, and there may have been some surprise when I stated that Uba was immune to mosaic disease. Well, ladies and gentlemen, I have had this matter under investigation, and I am now devoting most of my time to it. I have come to the conclusion that this trouble is almost certainly not mosaic disease, but it is a disease of a similar nature to mosaic. This may appear to be an academic point, but its practical importance will be clear when I point out that, if we have two distinct diseases, we can devote our energies to eradicating each one separately. We should be faced with a much more formidable task if they proved to be different manifestations of the same disease, and we were forced to give battle to their combined armies.

However, as I have stated, my investigations are in an early stage. I know that many people regard the trouble as of no importance.

But I personally don't know how far this question of deterioration is bound up with this disease. This morning the potato was quoted to you as a plant negatively propagated, which was known to deteriorate. Now the most recent scientific views do not regard this deterioration as an inherent quality of the plant, but as a result of mosaic disease and certain other obscure diseases. It would seem then that the analogy is possibly actually closer than was implied this morning, though I explain it in a different way from the speaker this morning.

Herein you can help me. I want figures from different parts of the country showing whether any loss is caused by this streaking of the Uba. I am convinced that in places a quite important loss is incurred. Any observations on this subject would be gratefully received. I hope in the course of a few months to be able to place before you the results of my investigations of this trouble, together with some definite recommendations for dealing with it.

It was stated by a speaker this morning that the question of burning, as against trashing, was an economic one. Every agricultural question is an economic one. It is because I want to get my mind absolutely clear on the economic side, that I hesitate to make any definite recommendation upon this problem. If, however, I can prove that the actual immediate loss incurred now, plus the risk of future increase in losses, represents a larger sum than would be incurred applying the measures necessary to wipe out this disease, then I shall recommend the latter course, and I believe you will support me.

I might, however, now draw your attention to the fact that this affection of Uba occurs to a very varying extent in the country. So far as my rather limited observations go, it appears to be much more prevalent in Natal, south of Durban than north. I have no observations from Zululand. Whatever be the explanation of this, it points to the inadvisability for the present of the exchange of cane between estates, and I strongly recommend that the practice be discontinued until the matter is cleared up.

In conclusion, ladies and gentlemen, I wish to attempt to define my position in relation to you. It is you who have in your hands the detection of any of these diseases, and I believe that the utmost vigilance is needed. I therefore ask you to send me particulars and specimens of any cases that you may suspect. I am only too anxious to be troubled in this way, and whenever possible I will come and see the canes on the spot. In this connection, however I wish to ask you to forgive me if sometimes I do not give you a clear diagnosis and suggest a simple course of treatment. I think that my remarks will have made it clear to you that it is not unreasonable for one to observe caution in the diagnosis of diseases, such as the ones which I have described. Further, there is always the possibility of the appearance of an entirely new and undescribed disease. So should you receive replies from me which are non-committal and not helpful to you, please do not think that either your, or my, time has been wasted.

There are several courses open to a person in my position receiving specimens, which show no characters upon which a definite diagnosis can be based. He can hazard an opinion upon insufficient evidence; which I regard as little short of criminal. He may adopt the time-honoured refuge of explaining the trouble as due to climatic or soil conditions, which is probably harmless, if equally useless. Or, finally, he may adopt the attitude of admitting his ignorance.

But, ladies and gentlemen, please realise that when I admit my inability to diagnose, your case has not been left without very full investigation and comparison with the notes of similar cases. It is by that means alone that one may finally arrive at a knowledge of all the characteristics of a disease. Every fresh case then adds some new facts, and by the accumulation of observations the truth will ultimately be attained.

DISCUSSION.

The Chairman (Mr. David Fowler), in thanking Mr. Storey for his very instructive paper, stated that he was sure they would all agree with him in saying that Mr. Storey had given them something to think about. So far as he (the Chairman) was concerned,

the point that appealed to him most was the suggestion that all cane except Uba should be eradicated at the end of the season. To his mind that provided the most powerful argument he had heard in favour of the immediate establishment of the experiment station, and he was confident that Mr. Storey's remarks could be put in such a form in sending a communication to the Government on the subject that they might have a fair hope of touching the heart of the Minister of Finance.

Mr. R. S. Lester asked whether the streaks of the disease referred to by Mr. Storey as "mosaic" were not longitudinal, as in his experience there were yellow streaks about two or three inches apart all down the leaf which appeared at times after dry weather.

Mr. Storey replied that the streaks were as appeared in the specimen of cane top which he had brought that evening, and which he handed round for inspection.

Mr. Warner asked whether Mr. Storey intended to include "Agaul" cane in the canes which he recommended should be destroyed, as that was one of the canes he had been experimenting with, and it had given very promising results.

Capt. Greig also stated that he knew of some fields of Agaul cane which were doing exceedingly well, and he had brought down half a dozen sticks of this cane to the Railway Institute. He thought it was a promising cane.

Mr. Storey replied that perhaps he had been rather sweeping in his statements. He should say that all canes with the exception of the Uba, Agaul, and those Uba seedlings to which he had referred, ought to be destroyed. It was probable that Agaul is free from disease.

Mr. Storey was asked by a planter whether the planters were running any great risk by keeping the Uba cane in the ground too long; whether there was any danger of getting a disease into the roots of the cane.

Mr. Warner referred to canes which had been proved in other countries to be practically, if not entirely, immune from disease, and which it had been suggested could be grown with advantage in Natal. He wished to know whether the present means of quarantine were adequate to prevent disease being imported into the country with such canes.

Mr. Ladlau considered that Mr. Storey's remarks were serious, and that no time should be lost in destroying these canes as recommended. There were not many patches of them in the country, and it would not be a very great expense to the owners to

destroy them. Mr. Ladlau also stated that he had a patch of cane about an acre in extent, the name of which he was not aware of, as it had originally been distributed through the Secretary of the Association. That cane had not ratooned, and he was apprehensive lest it should be diseased, and would submit specimens to Mr. Storey for examination later.

Mr. Storey, in replying to the questions, stated with regard to the possibility of disease entering the roots of the cane as a result of remaining too long in the ground, that it really boils down to the obvious question of economics. There is a risk of getting a root disease in the cane, and the more it is left in the soil the more the disease will be accentuated. That would show itself in decreasing returns, and so the point is reached when it is no longer economic to continue ratooning and it is dug out naturally. If any of these diseases got into the Uba cane, the practice of ratooning would of necessity be cut down or wiped out altogether. He regarded that as a very serious aspect of the disease from the planters' point of view. It would be found that possibly the first ratoon might be worth while, but the second and third would give a return that would not pay.

With reference to Mr. Warner's question as to quarantine, the answer to that was a very emphatic "No." The quarantine arrangements of necessity cannot be adequate until there is an experimental station. He was afraid he was rather trespassing on another Division's preserve, but the present arrangements were makeshift, and one must view them with a certain amount of concern. He could assure the planters that he and the other officials concerned, as Government officers, would do their utmost to make the present arrangements as sound as possible, but the only proper method was to have a quarantine station under the continual control of scientific officers, and that would be the experimental station. That is the only adequate answer to the question.

With regard to Mr. Ladlau's query, Mr. Storey was of opinion that the cane was one of the Argentine importations, and he could therefore prophesy with practical certainty that it had mosaic disease, but would be pleased to examine a specimen. If a young leaf that had only recently opened was taken from the top of one of the canes and held up to the light, if streaks of dark green were to be seen plainly, one could diagnose the disease with absolute certainty. If the leaf was very smooth green throughout, then only could one be sure that it was not mosaic disease.

A very hearty vote of thanks was passed for Mr. Storey's able and informative paper.