STREAK DISEASE OF SUGAR CANE.


An increasing and more active interest in streak disease has been displayed by growers of sugar cane in the last few years, an outcome influenced possibly by the unfortunate period of depression. The low prices which have prevailed have directed the grower's attention more towards outlets of sugar loss, hitherto regarded by him as of comparatively small importance.

The time seems ripe to present for general information a further paper on the subject of streak disease, one of the factors contributing towards loss of sugar in South Africa. A good deal of information on the subject has been obtained during the course of the last ten years from research investigations carried out by the plant pathological section of the Division of Plant Industry and also from work done by the Sugar Experiment Station. A number of papers have been written and published, some of which have been read at gatherings of sugar planters. It is the object of this paper to recapitulate and to present to you as briefly as possible our present knowledge of the disease. Very few new facts are available for inclusion, and I shall draw principally from information which has already appeared in printed form.

Historical.

Storey was the first to recognise Uba streak as a distinct disease of sugar cane. Prior to his arrival in Natal in 1922, the disease had been noticed but had attracted little attention, and until Storey's investigations, had remained as a vague abnormality of apparently little economic significance. Wuthrich, in some writings during 1920 and 1922, recorded the occurrence of Yellow Stripe (a synonym for mosaic) in Natal, and in proportions far in excess of that anywhere else in the world. There is little doubt that he had observed the disease which we know to-day as Streak. Our earliest record of the disease dates back to 1914, but beyond that nothing definite is known.

The disease is essentially an African one, though it has been reported of recent years in sugar cane in India, Burma and Mauritius.

Our knowledge of the fundamental aspects of the disease, its nature, methods of transmission, effect on the host plant, etc., are due entirely to the investigations of Storey. His first published records appeared in 1924, and were followed by a very comprehensive paper in 1925 entitled "Streak Disease of Sugar Cane." Details of the disease in more popular form have followed in later papers. In 1930, Storey and McClean published jointly a paper entitled "The Transmission of Streak between Maize, Sugar Cane and Wild Grasses." The authors consider in some detail the relationship between cane streak and a similar disease which is prevalent in maize in the coastal belt of Natal. A further reference will be made to this work in a later section.

Description.

The appearance of streak-infected Uba plants is familiar to all observant growers of cane. It is characterised by the development of very narrow, almost colourless areas, arranged in longitudinal rows, along the leaves. The chlorotic areas are streak-like in appearance and vary from \( \frac{1}{2} \) to \( \frac{3}{4} \) mm. in width and from \( \frac{1}{2} \) cm. to 1 or more cm. in length. These leaf markings are the only symptoms of diagnostic value and are produced with marked regularity on all new foliage.

In diagnosing streak disease, it is the soundest procedure to examine the youngest unfolding leaves. Certain blemishes, in the form of pale spots and marks, unconnected with streak, develop freely on the older leaves and may, by the uninitiated, be confused with streak markings. They are of little or no significance. The true markings of streak are characteristic and distinctive, and their absence from the youngest unfolding leaves is a clear indication that the shoot is healthy.

The Nature of the Disease and the Methods of its Transmission.

When I say streak is a virus disease, it will probably convey little to many of you. To give some idea of what is implied, let us consider for a moment how diseases may be classified. Infectious plant diseases may for convenience be divided into three classes, according to the nature of the causal agency. In two classes, fungal and bacterial disorders, the causal agents, fungi and bacteria respectively, are readily seen with the aid of the microscope, or even in some cases with the naked eye. In the third class, virus diseases, the causal agent is invisible even under the highest powered microscopes. A virus produces very striking changes in the host plant, and it is these changes alone which tell us of its presence. A careful microscopic examination of the plant tissues, on the other hand, reveals no trace of the intruder. It is to this class that streak belongs. The class also includes the well-known mosaic disease of sugar cane.

Thus in a streaked plant of Uba cane you must picture the presence of some invisible foreign principle, distributed, as far as we know, throughout the living substance. It reacts on new developing tissues, inhibiting the complete development of chlorophyll and thus causing the familiar streaks to appear on the young unfolding leaves. A plant once infected as a rule does not recover, and so long as it grows and sends up fresh shoots so the new leaves formed will bear the chlorotic stripes.

The virus principle, as already mentioned, is distributed throughout the infected plant, being present in leaves, stems and roots. This is of practical importance and brings us to the first or primary method by which streak is spread, namely, in the cuttings obtained from diseased plants. This is easily understood. A stem of
a diseased shoot is cut into pieces, each of which will contain virus. Therefore, when the pieces or setts are planted the new shoots which arise will, like the parent, produce striped leaves. Thus from one streaked plant we get a number of daughter-plants similarly affected. No treatment is known whereby setts could be effectively freed from the virus.

The more important is the secondary method of streak transmission by means of an insect carrier, the maize jassid (Cicadulina mbila). Malaria is a parallel example of an insect-borne disease of man.

The relationship between Cicadulina mbila and the streak virus is an intimate one. The maize jassid is the only known insect which has the power of transmitting the streak virus and, in fact, it is the only known natural agency by means of which the disease is able to pass from an infected plant to a separate healthy one.

No matter what the condition of the parents was, the young jassid nymph, when it emerges from an egg deposited in the leaf of a grass, is quite free from infection. The condition is maintained so long as the insect feeds on healthy plants. When a diseased shoot is reached, virus becomes absorbed into the system of the insect with nourishment which it draws from the streaked leaves. It thus becomes infective and is capable of producing streak in any plant on which it subsequently feeds. In the process of feeding, virus apparently passes out into the leaf tissues with digestive juice. There is no immediate effect. The inoculated leaf remains normal, and the virus which it has received passes down into the stem and thence to any connected growing regions. The first signs of the disease appear three to eight weeks later on the young developing leaves. This period intervening between inoculation and development of the disease is the incubation period.

VARIETAL SUSCEPTIBILITY.

The facts presented above have been derived from work with Uba. The extent of the damage produced in this variety will be dealt with later. It is sufficient at this point to say that Uba is very-susceptible in that it readily acquires infection. A number of varieties in the collection at the Experiment Station resemble Uba very closely in appearance. They include Agaul, Oshima, Yon Tan San, Kavangire, Zwingia, Merthi, CH. 64/21, and Cuban Selection (probably identical with CH. 64/21). They behave in the same way as Uba does. They acquire the disease readily in the field and remain permanently infected. The disease, in addition, has been recorded in the following, in a small number of cases: Green Natal (Rose Bamboo—Cheribion series), Louzier (Otaheite series), Port Mackay (Cavengerie), Badilla, HO. 694, Black Innes, MP. 55, and more recently in P.O.J. 213, Co. 290 and P.O.J. 2725. Only the last three are of direct interest and need concern us further.

P.O.J. 213, though unlikely to prove of practical importance in Natal, is of interest in affording us an example of the behaviour of a variety, highly resistant to streak. Seven or eight years ago 200 acres or more of this variety were scattered throughout the cane area. Careful inspection, at the time, failed to reveal a single diseased plant, even though adjacent Uba fields showed a high percentage of infection. Storey concluded, therefore, that P.O.J. 213 was probably immune. In 1926, however, a diseased plant of this variety was observed in a field at Umbogintwini. Further streaked stools appeared in following years. Experimentally, the variety has proved very difficult to infect, but was accomplished ultimately by exposing plants to very large numbers of infective hoppers. Observations extending over a period of five or six years have shown that there is a definite fluctuation in the effects produced by the disease in P.O.J. 213. Plants infected during April, May, or later, develop a fully streaked condition—that is, the young leaves, as they unfold, have the chlorotic markings distributed evenly over their entire surface. This state continues up to October or November. Thereafter, during the summer months, the new leaves which are formed develop progressively fewer markings, and by March may be of a uniform green colour or bearing only one or two streaks. In many cases recovery has been complete and permanent, in others the disease has revived in the autumn, months, to go through the same cycle outlined above. Cuttings from diseased shoots when planted in Durban have produced sometimes healthy and sometimes diseased plants. From single cuttings some buds have produced diseased shoots, others healthy ones.

Enough has been said to illustrate a difference in behaviour between P.O.J. 213 and Uba to streak. The former is definitely more difficult to infect and, under certain conditions, may recover from the disease.

Co. 290 and P.O.J. 2725 are of more direct interest to us, since they are now being grown commercially. Here again we have had to change our opinion. The absence of the disease over a period of two years or more from small plots of the two varieties established in Zululand and elsewhere strongly suggested immunity. Unfortunately, this has not proved the case.

The disease was recorded for the first time in Co. 290 in 1932. Since then, several cases of infection have been reported from different localities, but not in any alarming proportions. Preliminary transmission experiments indicate that Co. 290 is more difficult to infect than Uba, and this is supported by field records. Unlike P.O.J. 213, the infection of Co. 290 is apparently stable and permanent.

Still more recently, during the present month in fact, five cases of streak in P.O.J. 2725 were found in Zululand. It is perhaps an interesting coincidence that only two weeks prior to this discovery the writer had been shown a letter from Mr. A. H. Rosenfeld, in which he states that P.O.J. 2878, 2725 and 2714 have proved susceptible to streak in Egypt.

RELATIONSHIP BETWEEN STREAK DISEASE OF MAIZE AND STREAK DISEASE OF SUGAR CANE.

There can be no dispute that there exists a close similarity between the streak diseases of maize and sugar cane. Each produces on its respective host narrow chlorotic bands arranged in longitudinal rows along the
leaves. They both depend upon the same insect carrier—*Cicadulina mbiha*—for secondary transmission, and both are essentially African diseases. The experiments of Storey and McClean, however, definitely prove that the virus of maize streak is not the same as that causing streak in Uba. The maize virus produces a very severe and permanent disease in maize, but when transferred to sugar cane (var. Uba) it produces at the most only one or two chlorotic spots on one or two leaves, nothing else. The maize virus, when introduced in sufficient quantity, apparently is only just, and very temporarily, able to overcome the very high resistance of Uba. The Uba streak virus, on the other hand, produces a definite and permanent infection of maize, but the effects are considerably milder than those produced by the maize virus.

A question which arises at gatherings of sugar planters is, "How does the interplanting of maize with Uba, or close proximity of maize fields to Uba, affect the extent of infection in the cane?" A very high percentage of maize plants growing in the coastal belt are streak-diseased by the end of summer. These plants will be carrying normally a large population of jassids, for the most part capable of producing streak in all healthy maize plants upon which they may feed. When the maize dies down it is reasonable to expect a high proportion of the jassids will find their way into cane fields. It is improbable, however, that this migration will be followed immediately by an appreciable increase in secondary infection, for as we have seen, maize streak virus is for all practical purposes without effect on cane. On the other hand, some Uba streak may have been present in the maize plants, in which case a small amount of secondary infection would follow. As far as we know, however, the incidence of Uba streak in maize is very slight under field conditions. Ultimately, the migration of hoppers to a Uba field would be followed by an increase in secondary infection; the extent of secondary transmission depending upon the number of streaked cane plants met with by the hoppers in the course of their feeding. Maize is a more favoured host plant of *Cicadulina mbiha* than cane, and the cultivation of maize close to cane will tend to increase the jassid population in cane fields. It is for this reason, primarily, that we recommend the avoidance of planting maize in the vicinity of cane.

The Extent and Nature of the Damage Produced by Streak in Cane.

How many growers of cane, I wonder, appreciate the full significance of the rich green colour of their cane plants? The grower is to some extent aware of the plants' primary needs, as his practice of applying fertilizers to the soil indicates. The cane plant absorbs from its surroundings, soil and atmosphere, a number of simple compounds from which it builds up its complex foods (carbohydrates, proteins, etc.). One of the vital links in the constructive work is the green colour of the leaves, and it is the radiant energy of sunlight. The whole urge and striving of the aerial portions of the plant is for light, the primary source of the plant's energy supply. Chlorophyll, the green pigment so plentiful in the leaf cells, is the means by which the plant captures this light-energy necessary for its constructive processes.

I mention these interesting facts to enable me to illustrate more effectively the reason for the ill effects produced by streak disease. The action of the virus appears to be directed towards this energy-absorbing apparatus, for, as we have seen, it reduces the chlorophyll content of the leaves. The constructive mechanism of the plant is thus rendered less efficient, and this is clearly reflected in the early growth of diseased plants. In a field of young cane, the stunted shoots of streaked stools stand in marked contrast to the larger and more vigorous shoots of healthy plants. The difference in vigour between healthy and diseased plants is generally obvious until the cane has reached a height of three feet or more. Thereafter, the difference becomes less striking, until at the stage when the cane is reaching maturity little or no difference can be detected by visual examination. There appears thus, in Uba the ability of reassertion and a partial recovery of the powers of normal growth. The fully grown diseased plant does not show to any great disadvantage, when compared with a healthy plant of the same age and grown under the same conditions. If we examine a streaked leaf we find a large proportion of the surface is still of a normal colour, and it would seem that the amount of chlorosis is not sufficient to produce any permanent check on the upward growth. Maize streak affords a contrast. Maize plants infected at an early stage remain almost permanently disabled and make little growth. This may be correlated with the more severe chlorosis (or greater loss of chlorophyll) resulting from the maize virus.

Streak is apparently without effect on the quality of the juice, and analyses have demonstrated little significant difference in the sucrose content between diseased and healthy canes. However, the disease produces a definite loss of material, a fact conclusively demonstrated in quantitative experiments. The details of these experiments have been published and need not be gone into here. It will be sufficient for my purpose to consider the final results.

In the first experiment, carried out at Umbogintwini during the period March, 1924, to November; 1925, the difference in yields between healthy and streaked plots was 13-3% in favour of the healthy. It is interesting to note that, at the time of harvesting, the cane in the healthy plots was almost 100% diseased, as a result of secondary infection. In fact, a high percentage of the cane had been streaked for more than 10 months out of the 18 months, the total period of the experiment. It might be assumed that, had the healthy cane not become streaked, the difference would have been greater. The experiment was abandoned after the first cutting.

A second experiment was laid down at the Sugar Experiment Station in October of 1927, with certain improvements in technique. The plant crop was harvested in July, 1929, the healthy plots yielding 11-9% more cane than the diseased ones. Approximately 56% of the cane in the healthy plots at this period had developed secondary infection. The first ratoon crop
was cut during June of 1931, the healthy plots yielding 10-3% more cane than the diseased ones. The percentage of streak in healthy plots at this stage had risen to approximately 70-5%.

In both experiments a larger number of canes was formed in the streaked plots, but this was more than offset by the larger size of canes in the healthy series.

It is apparent that the factor of secondary infection renders it very difficult and almost impossible to assess accurately the depreciation caused by streak disease. The results of the above experiments, however, are of value and supply us with a minimum figure for the loss in weight of cane to be expected from planting infected cane seed. They, moreover, demonstrate that, in spite of a heavy secondary infection, a big advantage is still to be obtained by starting with healthy plant material.

The Extent of the Infection of Uba Cane in Natal and Zululand.

Streak disease is distributed generally through the cane area. It will be found not only on every estate in Natal and Zululand, but in every individual field of Uba. The incidence of the disease varies considerably in different districts and, for that matter, is by no means constant in the fields of individual estates.

A streak survey is at present being undertaken to determine more accurately the extent of streak infection in the various districts. A preliminary survey of the South Coast has been completed. I include hereunder, in tabulated form, a few figures which will give an approximate idea of the extent to which streak occurs in the area extending from Esperanza to Umzinto.

<table>
<thead>
<tr>
<th>District</th>
<th>Number of fields inspected</th>
<th>Total acreage of fields inspected</th>
<th>Percentage of Streak.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Shepstone</td>
<td>13</td>
<td>800</td>
<td>75—100</td>
</tr>
<tr>
<td>Umzumbi</td>
<td>2</td>
<td>70</td>
<td>99</td>
</tr>
<tr>
<td>Hibberdene</td>
<td>4</td>
<td>360</td>
<td>11—55</td>
</tr>
<tr>
<td>Umtwalumi</td>
<td>3</td>
<td>1,120</td>
<td>20—50</td>
</tr>
<tr>
<td>Sezela</td>
<td>4</td>
<td>470</td>
<td>60—90</td>
</tr>
<tr>
<td>Esperanza</td>
<td>5</td>
<td>600</td>
<td>3—83</td>
</tr>
</tbody>
</table>

Streak in the Port Shepstone district is as prevalent in plant cane as in ratoons. As far as could be ascertained, no steps are taken in this locality to select healthy canes for planting. Further north, the position improves and one finds an honest endeavour to control the primary spread of the disease. At Esperanza four fields were less than 20% infected, while a fifth showed 83% infection. The disease is also very prevalent in the Umbogintwini district and along the Isipingo and Reunion flats. The incidence in individual fields inspected in these localities varied from 20—100%.

The area extending northwards from Durban to Chaka’s Kraal must be regarded at the moment as being the most free from streak disease. The following figures will serve to illustrate the position:

<table>
<thead>
<tr>
<th>District</th>
<th>Description of Cane</th>
<th>Acreage inspected</th>
<th>Percentage of Streak.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount Edgecombe</td>
<td>Plant</td>
<td>521</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Ratoon</td>
<td>929</td>
<td>9</td>
</tr>
<tr>
<td>Tongaat</td>
<td>Plant</td>
<td>675</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>Ratoon</td>
<td>749</td>
<td>12.5</td>
</tr>
</tbody>
</table>

In both these sections it has been the practice for a number of years to select only healthy cane for planting. North of Chaka’s Kraal the disease becomes more prevalent. At Stanger some fields are almost 100% diseased, while others show less than 50% infection.

The incidence of streak reaches its highest point in Zululand, where, over a considerable area, it is extremely difficult to find any healthy plants.

Control.

I shall first sum up the general methods applicable to the control of streak and related diseases, and then proceed to consider how far they may be applied under our conditions.

The general methods are as follows—

(1) The use of healthy material for planting purposes.

(2) The removal of affected plants as soon as the disease is visible.

(3) Replacement of susceptible with immune or highly resistant varieties.

We have seen that there are two methods by which streak is spread, the primary and the secondary. The cane grower himself is responsible for the former by his practice of planting diseased cane. Secondary transmission is in the hands of other agents, the maize leaf hoppers, whose movements are outside the cane grower’s control. Secondary transmission, however, depends not only upon the insect vectors, but also upon the sources of infection. Thus, any steps which are taken to reduce the number of diseased plants might be expected to lessen secondary transmission.

Streak disease, unfortunately, has been neglected for so many years that it already has a firm hold in many parts of the country, and its control will prove a difficult matter.

The control measures adopted in any locality must be guided to a large extent by the amount of local infection and the rate of secondary transmission.

No matter how prevalent the disease may be in a particular locality, it should be the policy of all growers to plant only healthy material, even though it entails additional cost of procuring cane from other parts. The quantitative streak experiments, both at Umbogintwini and the Sugar Experiment Station, demonstrate a definite advantage even under conditions of high secondary infection. Growers of Uba cane, in Zululand
and Port Shepstone areas in particular, should note carefully that perpetually replanting with streaked material may ultimately lead to serious deterioration of their stocks. By replanting with healthy cane, it should be possible to maintain at least a certain standard of vigour in spite of subsequent secondary infection.

A further reference to the Mount Edgecombe and Tongaat districts will not be out of place in this section on control. The low incidence of streak and the relatively small amount of secondary infection in these areas appears to be closely associated with efforts which have been taken for some years past to check the primary spread of streak disease. The streak percentage figures quoted in the preceding section illustrate the reward of a rigorous policy of planting only healthy cane. Some estates take additional precautions to reduce infection by roguing out all diseased stools when they appear in young plant cane. This practice, of course, would be impracticable in regions where secondary transmission is high, and can only be recommended in localities such as the two quoted above.

It may be argued by some that secondary infection is naturally low at Mount Edgecombe, as a result possibly of a scarcity of insect vectors. I should be inclined to disagree. In the heart of this region a streak experiment has been in progress for the past four years. Four small plots of 100% infected cane alternate with four small plots originally planted with healthy cane. After two years, 55% of the plants in the healthy plots were infected, and after four years 70%. This provides a good indication of what would happen if streak control measures were relaxed. I believe that the incidence of streak could be reduced considerably in many areas by following the same policy practised in the Mount Edgecombe and Tongaat districts. It is not sufficient, however, for one individual to adopt control measures, but it should be a concerted action on the part of all.

In many parts of Zululand and in some districts of the South Coast of Natal, the percentage of infection prevailing in Uba is perhaps too high for successful control by direct measures. The only solution for the elimination of streak in these areas will be to replace Uba with more resistant or immune varieties.

LITERATURE


CHAIRMAN: This paper by Mr. McClean deals with a very serious subject. We have been indebted in the past to Mr. Storey and Mr. McClean, two Government officials who have studied this question of streak disease in Uba cane. We have not been able to study it or work on it ourselves, except in field trials, owing to the want of a Mycologist at the Experiment Station. In reading this paper, one or two points appear to me of great importance. One is the fact that the percentage of streak disease is very heavy in certain sections of the country and comparatively light in others. Gilbert, the Assistant Director of Agriculture in Trinidad, in his report on conditions as he found them in Puerto Rico, emphasised the political economic importance attached to cane farming, and he shows how the various systems have a great bearing on the economics of sugar production. He points out that in Queensland, the farming community supplies 100% of the cane grown; in Natal, 72%; in Mauritius, West Indies and British Guiana, about 40%, and Hawaii and Java, practically nil. I mention this point because it appears in this paper that we have Mount Edgecombe and Tongaat, large estates which are controlling streak disease; they have only 8 and 9% streak whereas in Zululand, the planters are practically 100% streak. It is up to the planters to co-operate in the same way as they co-operate on the larger estates and control this disease, because if you do not control it there are possibilities in the future of epidemics such as they have had in other parts of the world which have practically wiped out the Industry. There are several other points which I am sure you wish to discuss.

Mr. MOBERLY: There is one point which struck me quite forcibly. You may remember that when Mr. Dodds read his paper, yesterday—"The Annual Summary of Chemical Laboratory Reports"—he commented on the fact that for many years the best sucrose had been in the Chaka's Kraal area, and that now it was a bit further south in the Inanda district. It is just those areas, Central Inanda and the southern part of Lower Tugela, where Mr. McClean assures us the streak is least prevalent, and it is the area over which for the last five or six years at least, the best sucrose has been returned. But there is something more significant than that. I mentioned in the course of discussion on that paper that I had observed that
during the last six years, the amount paid to planters for purity bonus had decreased successively year by year. It had been a steady decline and had declined by 50%. I have taken the trouble to examine those figures for every mill, and find the drop was universal but was most marked in Zululand, considerably less severe on the South Coast, and hardly marked at all in the central area—exactly following out the degree of infection of streak which Mr. McClean has referred to. That leads me to believe that apart from any immediate effect which you may find arising from streak in cane, there is a progressive deterioration taking place, and that generation after generation of streaked cane is definitely becoming inferior and unless replaced or dealt with in some other way, is going to place Uba in a very bad position.

Mr. VERNON CROOKES: I have to thank Mr. McClean for his very able paper, but there are one or two points which I do not agree with, for instance the question of planting maize in with Uba cane. As you are aware, Crookes Bros., Limited, is one of the oldest sugar companies in the sugar belt. They have planted maize in all their fields ever since the inception of the Company. Although the figures are not mentioned in Mr. McClean's paper, I am quite certain in saying that the highest that was found was 12½% streak and the lowest about 2% in our fields. I do not quite follow Mr. McClean when he says that we must avoid planting maize in cane. On our own farm, "The Cedars," we have a total area of 1,700 acres under cane, and the Inspector who came round, only found 2½% on our whole Estate, and we have planted maize in the whole of the area. I would, therefore, like to know why we are not 80% streak? Crookes Bros. are in the same position. You can go to their fields and you will find very little streak. Adjacent is Reynolds Bros., and they have, according to these figures, up to 83% streak.

Now about the sucrose and what Mr. Moberly has said; last year, we cut 25,000 tons of cane from "The Cedars." The purity remained stationary at about 88 and the sucrose was not higher than 14, but I would say that if those fields had been higher in streak, most probably the sucrose would have been higher and the purity would have been higher, for the simple reason that, from cane which has grown well you get a bigger tonnage off and you get less sucrose.

Now with regard to planting cane, I have found that the ideal time to plant your cane is, say, from the beginning of September to the middle of November. After that, if you plant clean cane, say, in December or January, invariably in about a year's time that would be 100% streaked. The same with maize; if you plant maize early, at the end of October and middle of November, it is not affected by streak at all. I have grown hundreds of acres of maize and have never seen streak in maize planted prior to the middle of November. After Christmas, if you plant maize it is 100% streak. I think the same thing applies to the planting of cane. The planters should realise that by planting early, you avoid streak. The plant grows strongly and can throw off the streak much better when it is attacked.

Mr. McCLEAN: I must admit we have no direct figures to show that interplanting of maize with cane does increase the percentage of streak in the cane. My Inspector visited Mr. Crookes' Estate and gave me that information which he mentioned with regard to the low percentage of streak in spite of the planting of maize, We only suggest the avoidance of maize planting in that it does encourage, to some extent, the breeding of jassids which definitely breed more rapidly on maize than on cane.

Mr. ELYSEE: With regard to obviating streak disease, Mr. McClean suggests that healthy material should be used for planting purposes. I know of one planter throughout the off-crop, who was very careful to select his cane as being streak-free, from plants that appeared to be free from streak, but when his cane grew up he was very disappointed to find the young plants, as they came out, were all infected with streak. Is it that the field was free of streak and was later infected, or is it that the disease was not apparent to the naked eye at the time he selected his cane. The cane came up about 80% diseased I think. Could you suggest a practical way of selecting a streak-free cane for planting?

Mr. McCLEAN: The only way is to examine the youngest leaves, and if there is an absence of markings on the youngest unfolded leaves then it is fairly certain, but not absolutely, that the plant is healthy. You might have what is known as latent infection. Infected hoppers may fall on a plant and inoculate it with virus which does not show up until seven or eight weeks later. That inoculation period tends to become prolonged as the plant gets older, and such plants may be carrying infection without showing any visible signs. Those signs would develop if you used cane from that stool. Of course there is no possible means of discriminating between plants which are absolutely healthy and those carrying latent infection. That is a matter of chance.

Mr. PALAIRET: That raises one point which I think Mr. Dodds has stressed before. As Mr. McClean has pointed out to us, the cane is infected in the one shoot and eventually spreads throughout that shoot and into the others. My practice has been, if I find one diseased stick, it all comes out. It goes to the mill and I do not find any reduction in purities! But I think if you did that—if you get one stick with streak, have the whole stool out—you would keep it down. Personally, I would be very much surprised if Mr. McClean came up and found my fields more than 2% streak diseased.
Mr. McCLEAN: A cane plant does not consist of one stick, it consists of a large number of sticks inter-connected. Naturally, if one is infected, one must discard the whole lot, and not merely the diseased shoot.

Mr. ASKEW: Is it not a fact that in dry seasons you have a great deal more streak?

Mr. McCLEAN: We have no evidence to show that streak is more severe in dry weather than in wet weather. Once diseased, a plant remains so permanently. You cannot have disappearance of it in a plant in wet weather.

Mr. FOWLIE: I think it is only that a disease is less apparent when the plant is in a vigorous growing condition than perhaps when it is crowded up a bit and there are a good deal of markings accentuating the diseased appearance.

Mr. DODDS: I am very glad to see this interesting and very lucid paper on the very important subject of streak disease. I think that the Industry is very apt to lose sight of the highly technical research that Mr. McClean has been carrying on for the last few years, on this question of streak disease. Certainly the Industry is very apt to forget the proposals and recommendations he has made for control, and we find to-day that the disease now is firmly established in many districts, where a few years ago, it had hardly spread. In many districts, as he says, it is now so rampant. That the methods of control by rogueing or even planting with healthy material can hardly be effective. Perhaps the reason for this comparative neglect of streak disease is that planters were aware that most of the released varieties were more or less resistant to streak disease with the exception of C.H.64/21. It is, therefore, rather disquieting to find evidence of streak disease in such varieties as Co. 290 and P.O.J. 2725, which we had come to look upon as immune for all practical purposes. Evidently they are highly resistant, but I would be glad to have Mr. McClean’s assurance, if he can give it to us, that this resistance is not likely to break down.

Mr. McCLEAN: We cannot tell yet awhile. We have experiments in progress, but it is rather too early to give an opinion on the subject. There is indication that Co. 290 at least, is more resistant than Uba. We cannot say anything about P.O.J. 2725 as it is only a matter of three weeks or a month ago, that we first observed the disease in that cane.

Mr. DODDS: I would like to refer in passing, to a point not directly connected with Mr. McClean’s paper, but which Mr. Vernon Crookes has brought up. We have tried an experiment this season, the interplanting of sugar cane with maize, and it is difficult to say so far which crop has been harmed the more by the other—the sugar cane or the maize! We do not look like getting a good crop of either. Certainly the rainfall has been barely sufficient for one crop and not at all for two crops growing simultaneously.

Mr. ASKEW: It seems obvious if you plant two crops in the one line you cannot get the same result. Surely if you are growing maize in your cane you cannot get the same result. Personally I think it is a great mistake.

Mr. VERNON CROOKES: Last year we got 28 tons to the acre on an average of over 800 acres; the year before it was 33½, and the year before that it was about 20 I think. The maize per acre gave somewhere about 5 bags per acre and they were not planted just about 18 inches apart but two yards apart and in the centre of the hole. I have experiments going on now of soft canes and in all those varieties I have planted maize, and I hope next year, if we are all still meeting in this hall, that I will be able to bring you figures to show the tons per acre of cane and maize.

CHAIRMAN: There is one point that always intrigues me in these discussions on plant disease. When we get a disease in a human being we often cure it with various kinds of medicines. I would like to know if any medicines have ever been tried on plants for the disease.

Mr. McCLEAN: No, I am afraid not. In any event it would not be a practical thing with sugar cane. The value of the human being is of greater value than the sugar cane plant.

CHAIRMAN: I will ask you to accord Mr. McClean a very hearty vote of thanks for his very interesting paper. (Loud applause).