

A REVIEW OF THE PRESENT SUGARCANE VARIETY AND DISEASE POSITION.

By A. McMARTIN:

In a paper presented by Dodds¹ in 1944 to this Association, the changes in the proportion of different sugarcane varieties grown were traced over some years, and the yields recently obtained with the newer varieties were compared with those from the diminishing acreage under Uba.

In the present paper the object is briefly to discuss some other aspects of the position, referring principally to the state of health of the different varieties grown.

At the time when the plan was first conceived of replacing the older varieties, including Uba, with newer ones of more desirable qualities, the warning was given that a state could not be expected to arise in which diseases would disappear; what could be hoped for would be the elimination of major diseases from commercial plantings. It was pointed out that by changing varieties new diseases might, and probably would appear, but that by a proper system of quarantine and control over the varieties grown, the disease situation could be kept in a satisfactory state.

Reviewing now the years during which these new varieties have been increasing in acreage, and also during which a large collection of varieties has been built up at the Experiment Station for observation, it is gratifying to be able to report that no new disease appears to have been introduced from outside sources. Canes have been introduced from many countries in which diseases exist which have not been known in Natal, and which are still unknown.

The number of diseases described and recorded over these years, however, has greatly increased. Two main reasons account for this apparently paradoxical situation. Firstly, sugarcane has now been subjected to much closer scrutiny than formerly, and many conditions which formerly would have been attributed by growers to climatic conditions, e.g. drought, have been shown to be caused by a parasitic organism. In addition, growers are accustomed to give a general name for a type of disease which may actually be caused by several different organisms; for example, when leaf spots become severe, the grower refers to "rust" in his fields, whereas actually the condition may be that of genuine rust, or it may be brown spot, eye spot, ring spot, or brown stripe.

The second reason is that varieties have different susceptibilities towards fungi, rendering it possible

for a fungus disease to remain in a quiescent state on a resistant variety, but when a variety is grown which is not resistant to its attacks, to build up until the stage is reached when an obviously diseased condition is produced.

An example of this was that of the eye spot fungus, which existed everywhere on Uba, where it produced small spots of no consequence on the leaves, but which on an unreleased variety, at the Experiment Station, Co.419, increased in severity, and by causing the death of the whole cane top and drying out the sticks, caused a loss of about 4.5 tons of sugar per acre.

Another example was the outbreak of red rot in certain areas on susceptible varieties.

These are cases of diseases which already exist in Natal, having probably been introduced in the early days of unrestricted importation of varieties, and have simply been waiting for the opportunity to develop on a variety susceptible towards them.

This state of affairs is, of course, most noticeable at the Experiment Station, where the large number of varieties grown provides more scope for possible diseases to be found.

As may be expected, among the released varieties now grown several diseases have been recorded, but these are fortunately mostly of a minor character. The following notes are a brief summary of the position at present.

The variety Co.281 continues to be widely grown and is being replanted on a large scale, although growers are finding that Co.301 is suited to many areas on which Co.281 was formerly grown, and from which the yield can be just as satisfactory or even better.

The recently reported existence of one of the older diseases which was at one time of major importance—mosaic—on Co.281, has been followed by its discovery also on Co.301 and Co.331. So far, however, this disease has been found to be concentrated on a few localised areas, and it does not appear to be widely distributed, according to a preliminary survey of the cane area. Detailed examination is at the moment being carried out in one area near Umzinto into the distribution of mosaic, and it is apparent that the disease has been built up into its present proportions mainly by planting cane already infected, i.e. by means of primary infection. The

amount of secondary spread, i.e. by means of the insect carrier, appears to be small, although it was no doubt by this means that the disease first was transmitted to the cane, probably several years ago.

The presence of large quantities of the wild grass *Setaria sulcata* with mosaic disease in the affected area suggests that a natural source of infection occurs from which the disease can be acquired. Once a few stools have become infected, propagation by means of planting these diseased canes would over a few years rapidly increase the amount of mosaic. The importance of planting only selected seed cane is apparent.

Of minor diseases, Co.281 is susceptible to brown spot, which at times, particularly in the cooler months, gives the fields a brownish appearance, and under these conditions probably does cause some damage by interfering with the normal photosynthetic activities of the leaves.

Co.301 has shown particular susceptibility to rust, causing some damage of the same nature as brown spot on Co.281.

Smut, the first disease recorded on sugarcane in Natal, and which has been absent for a generation, appeared on a small number of stools of Co.301 last year in one locality, and has been reported again this year from the same area. There is no indication as yet that this disease is assuming any importance over an extended area.

The varieties Co.290 and P.O.J.2725 are the only commercially grown canes which have suffered to any extent from red rot. One case has been found of Co.281 with this disease, but the specimens were from a field of three-years-old cane, which suffered from not only red rot but also had brown spot on the stems, and root rot.

This is the first case in which brown spot has been observed to spread from the leaves on to the stems of the affected plants, but the general weakened condition of the cane could be regarded as the predisposing factor towards not only this condition but also towards the presence of the red rot organism.

This case is of particular interest, as it shows how a variety normally showing a high degree of resistance towards any particular disease can have that resistance lowered by unsuitable agricultural practice, in this case by allowing it to stand over beyond its period of two years growth.

This aspect of the disease problem was also noticed when investigating the red rot position in Eshowe, in which it was observed that the fields most affected, e.g. where crops of Co.290 were reduced to about five tons of cane per acre, followed crops which had been allowed to stand over until the third year.

Where fields had been cut in the second year, however, even although red rot was present, the damage in the following crop was not nearly so pronounced.

From the point of view of field sanitation alone, therefore, the presence of over-age cane is undesirable.

Mention has been made of the presence of root rot on Co.281; this disease, indeed, appears to be one towards which this variety is proving susceptible. So far, no one single root rot-producing organism has been isolated, but several appear to be involved, all soil fungi which cause a pruning of the roots of plants having little power to resist their attacks. Such fungi are mostly weakly pathogenic and cannot damage a root system under conditions favourable to growth of the latter, but under unfavourable conditions they can interfere with the normal functions of the roots to the extent of either reducing a crop or perhaps destroying it.

Thus Co.281 under conditions of excessive soil moisture suffers from the damage caused by root pruning fungi, and in extreme cases can be killed.

A less immediately noticeable form of damage caused by these root fungi, but one which in the long run might seriously affect the cropping capacity of a variety, is that which occurs when they increase in a soil from year to year as long as that particular variety is grown. There is some evidence that a crop alters the microbiological flora of the soil by encouraging the growth of soil organisms which can live on its roots and root residues; these organisms may increase year by year, and if the variety grown is unchanged for a number of years, then a chronic condition may follow, in which a cumulative effect of the fungi and bacteria is noticed in interference with normal growth.

For this reason alone, continued culture of any variety over a period of years might lead to diminished yields; with a variety resistant towards root rotting fungi, however, the process might be less noticeable than with a susceptible one.

One solution that suggests itself when this occurs would lie in the rotation of varieties where possible.

It has been frequently commented upon by growers of late that Co.281 has lost some of its former vigour, and it may be that if this has occurred one contributing factor is simply the fact that one cropping cycle of this variety has followed another without change. There is no reason to suppose that the variety has inherently deteriorated; such a phenomenon is usually caused by some disease factor. In addition, the possibility of the effect of the type of seed cane used on the type of cane produced might require some consideration. It has

been noticed by the writer, for example, that short-jointed canes when planted give rise to a larger number of sticks than long-jointed seed cane, but the sticks from the former are thinner; also, the use of thinner sticks as seed cane gives rise to dwarfier canes which are shorter-jointed than those arising from the planting of thicker canes. Thus a vicious circle might be visualised in which the planting of either thin sticks, or short-jointed sticks, gives rise to an inferior type of cane for further planting.

It is suggested then that on soils which are suitable for both varieties, Co.281 and Co.301 might be rotated, and that selection be exercised with the type of material planted where this is not already done.

Of the other varieties grown commercially, Co.331 has not been reported with any disease apart from mosaic already mentioned, and pineapple disease; the latter, of course, also attacks other varieties. This disease can now be controlled by preplanting disinfection of the cuttings, when the infection occurs externally on the setts before planting.

The position of streak disease on Uba presents an interesting phenomenon, in that in many places it is of much less occurrence than formerly. Where fields of Uba occur, mostly now old ratoons, the disease can easily be seen; but the attention of the writer has been drawn to the fact by growers in many districts that where volunteer stools of Uba occur mixed in other varieties they are nearly always healthy. Further, whereas some years ago it was impossible to select streak free Uba and keep it healthy, to-day that is a comparatively easy matter. Numerous plots of healthy Uba have been seen even in localities where ten years ago the disease was severe.

The following figures collected at the Experiment Station two years ago also confirm this point.

Streak-free Uba planted in—

1927 had in 1929	55 per cent.	of streaked plants.
1937 1944	27	„ „ „ „ „
1938 1944	19	„ „ „ „ „
1941 1944	2.6	„ „ „ „ „
1942 1944	2.0	„ „ „ „ „

Thus healthy cane planted in 1927 had 55 per cent. of streak after two years, whereas such cane planted in 1942 had only 2.0 per cent. of streak after the same period.

A possible explanation is simply that the reduction in acreage of the susceptible Uba has largely eliminated the amount of infections towards which new plantings are being exposed. There is also substantial evidence that natural recovery from this disease can occur, and if no re-infection takes place, recovery will be permanent.

It would likely be found, however, that if Uba once again became planted on a large scale, then streak disease would be less easy to control.

The newly released variety N:Co.310 has during its trials at the Experiment Station and on outside quarantine stations shown no sign of susceptibility to any great extent towards any disease of importance. It appears to be fairly resistant towards leaf-spotting fungi; and the leaves usually have a particularly healthy appearance; no cases of streak or mosaic have been found. It germinates well and is resistant towards fungi causing deterioration of the setts. It is not so resistant to red rot, however, as Co.281; it can be given this disease by artificial inoculation, but in one trial in Eshowe when grown on a field in which red rot was very severe on Co.290, N:Co.310 suffered no damage, showing that in this case at least it had sufficient resistance against natural infection. Dead sticks have been found after the formation of flowers, but this phenomenon has not so far been observed to any great extent.

A promising feature of this variety was noticed in one trial in which, after cutting the plant cane crop, a flood occurred, following which Co.281 was very largely destroyed, while the N:Co.310 was little affected, indicating the possession of a hardy root system.

It can be recommended to growers as a variety well worth a trial where difficulty is being experienced with Co.281, but probably only after some years of extended cultivation will it be possible to assess its ultimate resistance towards the numerous minor diseases which we now know from close study of sugarcane in this country are established and awaiting a suitable host.

¹ Dodds, H. H. (1924), "Further Developments of Sugarcane Varieties in South Africa." Proc. S.A. Sugar Tech. Assn., 18, 38.

Experiment Station,
South African Sugar Association,
Mount Edgecombe.
April, 1946.

THE PRESIDENT said that this matter of diseases in cane—even minor diseases—was of vital importance to the whole industry, and we were indebted to the work of the Experiment Station, especially Dr. McMartin's work in keeping track of the various dangers that could arise.

Dr. DODDS asked Dr. McMartin, in view of the sentiments expressed by some that the use of artificial fertilizers might be responsible for certain plant diseases, whether he, as a plant pathologist, had ever found any indication of it. He knew of at least one case where such a search had been completely unsuccessful. That

was in an old field of Co.290, then in its eighth ratoons, which had been fertilized regularly with mineral fertilizers and which Dr. McMartin had then examined for diseases, but none could be found. He would also like to know what concentration of sulphate of ammonia could cause any material injury to earthworms.

Mr. COLEPEPER said he was under the impression that leaf-spot diseases were more prevalent in fields which had been trashed than in burned fields. He wanted to hear Dr. McMartin's views on this point, and he would also like to know which of these diseases could be carried over in the trash.

Dr. McMARTIN, in reply to Dr. Dodds, stated that in two trials in which artificial and so-called natural fertilizers were compared, no difference in the disease position could be found between the treatments. In the one case at the Experiment Station Co.281 suffered badly from brown spot which was equally distributed throughout the whole experiment, irrespective of manual treatment. In the other experiment with Co.301 the incidence of rust was found to be uniform whether artificials or compost were used. In the field referred to by Dr. Dodds it had proved fruitless to look for disease in this particular Co.290, although fertilized with artificials. At the last cutting he found one stick with rind disease. He had looked several times for red rot but was unsuccessful.

He suspected that brown spot might continue sporulating on the leaves after cutting. Rust, however, could only survive on living material, and might therefore not be transmitted on trash.

Mr. DYMOND asked if Dr. McMartin considered mosaic a permanent disease in cane. If so, he would ask Dr. McMartin to supply him with some mosaic-infected cane sticks and would guarantee to cure the cane within five years.

Dr. McMARTIN in reply stated that he had not had enough experience with mosaic in Co.281 to say whether recovery would take place, but he thought it not unlikely, since in Louisiana, where numerous strains of mosaic existed, they found a variation among them in severity and in the ease with which the plant could throw the disease off. Canes from certain areas were found to have a high percentage of "germination re-

covery" and such might be the case with any cane supplied to Mr. Dymond. If, however, Mr. Dymond was prepared to consider a properly laid out experiment he would find all the co-operation he wanted.

Mr. DYMOND said he was willing to double his challenge. First of all he would undertake to cure the mosaic in one series of plots, and in another he would keep it.

Dr. McMARTIN, in reply to another question, said that Uba had never been known to acquire immunity towards streak disease. There had been cases where Uba had recovered from streak, but on being exposed to re-infection the disease reappeared.

Mr. DU TOIT asked whether Mr. Dymond still had the row of streak-free Uba which he treated with compost, and if so whether he would consider having it artificially infected to see whether the plants were immune to the disease.

Mr. DYMOND said he would gladly allow the original stools of now streak-free Uba to be submitted to any test. It might be possible to infect the stools, but he was sure he could cure them again. These stools were now in their eighth ratoon and were about twice their original size. He had recently planted a stool of Uba next to these stools. It was 100 per cent. streak and the sticks the size of a pencil. The treated streak-free Uba had been planted out in various localities; they came up free of streak. In one large field, however, two widely separated stools were later found to be 100 per cent. streak. He was anxious to know how that could have happened as streak was carried by insect infection and no other stools had been affected, in fact, one stool had since recovered.

Dr. DICK suggested that one insect might accidentally have blown on to one plant and infected it. These insects were readily blown by the wind and it was only necessary for one insect to suck the juice of the cane once to start the disease. In reply to a question, Dr. Dick stated it was pretty well impossible to get rid of the insect as it not only lived on cane, but on a number of grasses as well, and aeroplane dusting with an insecticide like D.D.T. would be required which might, incidentally, cause more harm than good by killing off the useful insects as well. The only way to control streak was to plant resistant varieties.