

NOTE ON THE CURE OF STREAK DISEASE IN UBA CANE

By G. C. DYMOND.

History.

In 1920 Wuthrich³ reported the existence of a disease, in Uba cane, which Storey² four years later identified and described as streak disease. At that time Storey estimated that one-third of the whole crop was infected.

Ten years later McClean and Halse¹ computed that the disease had increased to 60 per cent., causing an estimated loss to the industry of 241,220 tons of cane valued at £170,864. To-day, it is difficult to find any uninfected stools in the 7 per cent. of Uba cane still being milled.

Streak Experiment.

Following upon reports from overseas on the cure of virus diseases in strawberries, raspberries and other truck crops through applications of compost to the soil, an experiment was commenced in 1938 to study the effect of this treatment on streak disease in Uba cane.

After an extended search, G. Booth supplied a few plants of moderately infected cane. These were planted in a short row with a normal dressing of compost. During the following two years there was no increase in the disease, which was estimated at about 60 per cent. In the meantime the original seed developed a 100 per cent. infection.

After the second cutting, the ratoons were surface-dressed with fresh compost. At the end of the third year, the disease had diminished to approximately 25 per cent., and during the fourth year the new growth was examined and passed as entirely free from streak.

Since then all the cane has been planted out in a composted seed bed, where it has so far maintained its freedom from disease. In order to check its present immunity a row of 100 per cent. streak cane has been planted adjacent to the plot. No infection of the free cane has so far developed after six months' contact.

Mycorrhizal Infection.

Samples of the roots from the streak-diseased and streak-free canes were submitted to Dr. I. Levisohn, under the direction of Sir Albert Howard. The report reads as follows:—

"*Streak-diseased.*—Black and dark brown root system with only a few fibrous roots, dark in colour. No mycorrhizal or other infection observed.

"*Streak-free after four years' treatment with compost.*—Root system of chestnut-brown and light brown colour, well supplied with fibrous roots of equally good colour. Sporadic infection of the endotrophic type in fibrous roots."

Conclusion.

The mycorrhizal development, after compost treatment of the virus diseased cane, is significant and important, as it confirms the mycorrhizal theory and association in respect to sugarcane.

The streak-free Uba is growing vigorously and compares well with the deteriorated Uba fields common in the last ten years.

The point to be emphasised as the result of this experiment, is not so much that streak-free Uba may stage a "come-back" and provide a stand-by variety, but that the fundamental principle of *fertility* and the practice of the *fertile seed bed* may be applied to any suitable variety of sugarcane. In this way only can the industry be assured of healthy seed and healthy crops in perpetuity.

References.

¹ McClean, A. P. D., and Halse, R. H. (1936): Streak Disease of Sugar Cane; Its Economic Importance in South Africa. Proc. S.A. Sugar Tech. Assoc., 10, 107.

² Storey, H. H. (1925): Streak Disease in Sugar Cane. Union of S.A. Dept. of Agric. Bul. 39.

³ Wuthrich, E. (1920-21): Yellow Stripe Disease in Natal. S.A. Sugar Journal Ann. 1920-21, 157.

Mr. DYMOND said that the original stand of streak-free Uba was highly infected with mealie bugs. When planting-out this material the cane was cleaned, cut into single eyes and then steeped in lime water overnight. The resulting crop gave 100 per cent. germination and was entirely free from mealie bug infection.

Mr. Dymond stated that he considered this of importance, as he firmly believed that mealie bugs could affect the quality of juice for clarification.

Dr. McMARTIN said that after reading, a few days ago, the paper by Mr. Dymond on the cure of streak disease, he was stimulated to look into the whole question of the present position of virus diseases at the Experiment Station. One thing that had impressed him within the last few years was the scarcity of specimens of mosaic compared with the ease with which it could be found ten years ago, despite the fact that the same stocks of susceptible varieties were being maintained. Records showed that some varieties had a large percentage of mosaic infection some years ago, where none or few were found to-day, probably due to systematic eradication of diseased specimens and replanting only healthy stock. He cited the case of P.O. J. 213, a variety susceptible to mosaic, which a few years ago was discovered being grown mixed with Co.281, and although large numbers of stools of this variety were dug out—in one sugar estate alone 3,000 were eradicated—only one stool with mosaic was found, despite the fact that when this variety was grown in the old days of unrestricted variety cultivation it was badly diseased.

Actually recovery of plants infected with mosaic did occur and was frequently occurring at the Experiment Station. The fact that it was probably of much greater occurrence than generally recognised had also recently been pointed out in a paper just received from Louisiana on the recovery of sugarcane from mosaic disease.

He referred then to the position of Uba and streak disease. Years ago, when the replacement of Uba by other varieties began, most planters attempted to keep a stock of healthy Uba by selecting streak-free material for planting. This was usually found impracticable, as the stock soon became badly diseased. He cited one case at the Experiment Station where healthy Uba planted in 1937 after one year became diseased to the extent of 55 per cent., and compared this with the position at present, when healthy Uba planted in 1941 was now, after three years, only 2.6 per cent. streaked and that planted in 1942 was now only 2 per cent. streaked. He further stated that Uba planted this year between plots of new varieties, with the object of maintaining a source of infection to test the reaction in the field towards this disease of these new varieties, and therefore was picked from a source where the incidence of the disease was high, was practically all healthy—the incidence of streak was only 0.3 per cent.

These facts suggested to him that the position of these sugarcane virus diseases, as far as their incidence was concerned, was conditioned by two processes—natural recovery, amount of infection and reinfection of recovered plants: If infection and reinfection were greater than recovery the disease would increase; the amount of infection would depend upon the amount of diseased material present to provide a source of disease. If this source were diminished, as had been done by reducing the area under a diseased variety, the chances of plants which had recovered being reinfected would be less. Thus in a field of Uba the disease would be kept going, as it were, and perhaps increase merely by the amount of infection surrounding any stools that were recovering. If, however, a few stools were isolated, and recovered, their chance of remaining healthy would be greater.

The reduction of Uba to a very small acreage had made it possible to obtain healthy material more easily than formerly. It had to be borne in mind that these diseases were transmitted by insects which had to feed on diseased plants; if the latter became scarce, and natural recovery occurred, it would have

more chance of permanency. In short, he felt that these diseases were disappearing—mosaic had practically gone, and streak almost so, and he congratulated Mr. Dymond on having had the good luck of conducting an experiment on curing a disease when the latter had almost disappeared.

Dr. DICK pointed out that where Mr. Dymond had now planted a row of streak Uba next to the streak-free Uba it would be necessary to make sure that the insects that transmitted streak were present. He would have liked to see infected insects put on the healthy cane, so as to see whether it would get the disease again.

Mr. DYMOND stated that, apart from the adjacent row of streaked Uba, the plot was surrounded by meales which had streak.

Dr. McMARTIN replied that the streak virus which infected sugarcane was not the same as that found on meales—the latter strain would not produce the true sugarcane streak.

Dr. DICK said that Mr. Dymond's reply that the maize was streaked had got over the difficulty about the insect. The insect must have been present for the maize to be streaked, because maize did not carry streak disease through the seed and would have to be reinfected each time. Whether the insects were carrying the sugarcane strain of streak was, however, not proved.

Mr. LINTNER considered the papers read of interest from a soil regeneration point of view. Whether utilization of compost helped to eliminate disease or not, he thought rather irrelevant. What we were really after was good husbandry, the regeneration of the soil and the conservation of organic matter. The utilization of city wastes and farm wastes was an age-old practice which had been modernized solely through better knowledge of bacteriological and chemical reactions. Whether fertility actually had a side-line effect on crops was open to research, but in fundamental crop production we should not look for a revolution in agriculture in so far as to hope that compost would solve problems that had never been investigated on a scientific basis. Soil was a dynamic medium and we had to push it to its maximum productivity, and that was only possible if a comprehensive system of husbandry were adopted in which organic materials and artificial fertilizers both played a part. We had been farming in this country for a considerable length of time now and some soils had been destroyed as a result of bad cultivation and lack of care. One pot experiment or even one field experiment was not going to teach us very much, however. What were required were long-term experiments properly planned.

Dr. FISHER pointed out the possibility of streaked grasses growing in certain areas and not in others, and thus having a varying source of infection.

He said the term "compost" was used at present almost to the complete exclusion of the old term of farmyard manure or "muck," and was thus stealing everything that was good from these old terms. He thought that when we had given a term a certain definite meaning in the public mind we should keep to it.

He was, of course, in agreement that we should look after the fertility in our farming; but fertility was not just the amount of plant-food in the soil. Physical structure had a good deal to do with the productivity of a soil. He was a great believer in pastures for restoring the fertility of a soil. After a few years of crop cultivation and to a certain extent soil exploitation, the soil should be put under legumes and then under pastures for a number of years. While we were, therefore, destroying the physical structure of the soil during one term of years, we were rebuilding it during the following period. The exportation of wheat was not a blessing, but the biggest curse possible because it was accompanied by a loss of fertility of the soil. He viewed with alarm the passing of the ox and the coming of the tractor from the point of view of accelerating the loss of soil fertility.

Dr. FERGUSON stressed the importance of compost from a health point of view. It had been shown, especially in some areas in India, that healthy food could produce a healthy race, and in compost we had a weapon ready for everyone with which it was possible to produce healthy food. It was estimated that 50 per cent. of the population of this country suffered from under-nourishment or malnutrition. Such conditions were ideal for the spread of disease, especially infectious diseases. The

public health authorities were therefore looking to the agriculturists as their main line of defence against disease and as their greatest help in building a healthy race.

Mr. DODDS agreed with those speakers who said that good cultivation and good husbandry were the most important factors in soil conservation and that, to his mind, might have something to do with the relative freedom from virus disease in sugarcane that we now enjoy. On the other hand, it might be some other factor. It was possible that there were cycles in diseases which were not properly understood. He did not agree with Mr. Dymond that if Uba were streak-free it might stage a come-back. Streak disease affected Uba by reducing the yield by 15 per cent., consequently an increase of 15 per cent. was all that could be hoped for if streak-free Uba could be grown. The substitution of other varieties for Uba had, however, increased the yield by 50 per cent.

The speaker thought it was too much to expect a city such as Durban not to discard its wastes into the sea. While towns near to the sea would therefore probably continue to sink nitrogen, potash, phosphates and organic matter into the sea, we should be on the guard to lose as little as possible from the soil, and where necessary we should be prepared to replace these elements from unavoidable depleted soils by artificial fertilizers.

Mr. MOBERLY disagreed with Mr. Dodds and thought that maritime cities should cease the wasteful practice of sending their material into the sea. These communities were just as dependent on the fertility of the soil to ensure their welfare and prosperity, and it was only right that for the good of all they should cease these disgraceful and wasteful processes.

Dr. ROSSOUW drew attention to the fact that compost made with reindeer manure was used in some places in the Arctic circle in Soviet Russia, where the top layers of permanently frozen soil, which only thawed to a depth of about four inches in summer, were successfully cultivated with heavy dressings of such compost, and that in Moscow heat from compost heaps made from city refuse was utilized to heat greenhouses.

Mr. HAYES said that there existed the danger of clouding the issue by claiming all sorts of mysterious characteristics for compost. The fact was that large numbers of people suffered from malnutrition because they did not get enough vegetables and fruit, and that more cultivation and production was needed to supply the requirements of all. It was too early and quite unnecessary at this stage to talk about the quality of vegetables and fruit grown on compost, and to suggest that they were superior to that grown with farmyard manure and artificial fertilizers. When intensive "muck" cultivation started in England the productivity went up by 20 per cent., but when artificial fertilizers were added the productivity of the soils went up much further.

He thought it a pity that the champions of compost did not confine themselves to what practical results they obtained, but should dive into the realms of fancy. It seemed characteristic of these enthusiasts to bear vitriolic malice against any sphere of activity in agriculture which did not conform strictly to their own ideas of what was truly natural. They decried the work of the plant pathologists and plant breeder and discarded all insecticides and inorganic fertilizers. We were told a great deal about the balance of nature and that diseases did not attack healthy organisms. That, however, was a statement of scientific inaccuracy. The balance of nature was but poorly understood, and it was a bit presumptuous to think that nature needed man to be the chosen race. If we should join the "back to nature" school we would have to admit that insects, germs and parasites had as much right on this planet as we had.

Mr. ROBERTSHAW said that Durban and Maritzburg had been disposing of part of their wastes by filling in large areas of malarial swamps. In Durban the racecourse, the Country Club, the Botanic Gardens and parts of the Umbilo River were examples. At present they were preparing for district composting stations to utilize the wastes in each area. It was not impossible that they would be handling sewerage materials in future, and would have a surplus of organic material, and would have to look to the sugar industry for a market.

Mr. VAN RENSBURG thought the disappearance of streak in the Mount Edgecombe district might be due to an accumulation of organic matter in the soil, as cane was not burnt to any

large extent in this area. If this was the case the organic matter was probably playing a similar role to Mr. Dymond's compost, though to a lesser extent.

He said that the application of compost would not only better the quality but also increase the quantity of the crops and as such an increase in the lands under crop might be unnecessary. He doubted whether a variety resistant to a disease would remain so for very long unless the soil was properly looked after.

Mr. DYMOND said he was very interested in Dr. McMartin's remarks. He would not like to suggest that Experiment Station had become compost-minded, but whatever the explanation might be he could give the assurance that Uba fields in the Darnall area were still 100 per cent. streak.

He could not agree with Dr. Fisher that "muck" and "compost" were synonymous terms. He looked upon compost as scientifically controlled organic manure, especially in connection with the control of pathogenic organisms, where every particle of the heap must require certain temperatures to ensure that every germ was killed.

Dr. FISHER protested and said there was as much science at the back of the farmyard manure as ever there was in a compost heap. We had a disease complex in this country, and we had

to stop thinking disease and rather concentrate on sound and healthy crops and people. Farmyard manure was not filled with disease germs, and he was quite willing to submit a sample for analysis. If people wanted humus, why did they burn two-thirds of it up in their compost heaps? He personally believed in pastures and allowed his cattle to graze on it and return the humus.

Mr. SCOTT stressed the importance of a balanced approach. During the last half century artificial fertilizers had been used almost to the exclusion of organic materials. Muck-heaps existed on many farms, but were not made use of, as was indicated by the vast accumulation of Karroo manure in certain areas and unused manure on some Natal farms.

The PRESIDENT, in concluding the discussion, said that the important issue was the conservation of waste materials, and he would like to see the Experiment Station take even a greater lead in this respect, especially along the lines set out by Mr. Dymond. Pretoria recovered its waste material and Durban should do the same. In Great Britain the productivity of the soils was now higher than it had been since 1850, and he had recently read of claims being made that mastitis and tuberculosis in cattle had been cured by a good agricultural policy in which emphasis was laid on sheet composting rather than on artificial fertilizers and manufactured foodstuffs.