SUGARCANE DISEASE TESTING METHODS IN NATAL

By G. M. THOMSON

Introduction

One of the functions of the Experiment Station is the routine testing of new varieties produced by the Plant Breeding Department. This is a valuable part of the work done at the Experiment Station, and is a safeguard to the interests of the farmers and the companies, who rely on us to produce the best varieties we can, not only from the point of view of highest yields, but also from the point of view of disease reaction, and the ability of the plants to withstand adverse conditions be they climatic, physical or biological.

Plant diseases are included in the latter group and we have in this country a number which can be termed potentially serious and which must be studied in the light of their possible effects on any new varieties produced.

However, disease reaction is a dynamic quality and except for immunity, the types of disease reaction can vary considerably according to the environmental conditions under which the crop is being grown. Thus it is not always possible, after testing the new varieties, to forecast with absolute certainty their disease reactions when eventually grown on a commercial scale.

Definitions

At this stage it might be as well to define some of the terms used in plant pathology to denote the various levels of disease reaction encountered. It might be added here that plant pathologists are not in complete agreement over such definitions. One can, however, generalise to some degree and obtain a fairly clear idea of the meanings and implications intended.

First of all let us consider a case in which a given disease organism attacks different varieties of the same crop. The results of these attacks will show a series of reactions on the part of the host plant ranging from highly susceptible, through various degrees of resistance, to immunity. When assessing the reactions taking place in such a case the following definitions will come into play:

Resistance The ability of a plant to withstand the attack of a pathogen. Complete resistance is termed *immunity*.

Susceptibility The inability of a plant to defend itself against a disease organism, or to overcome the effects of invasion by a pathogen. This reaction is the opposite of resistance. Different degrees of susceptibility are influenced by environmental conditions.

Tolerance The ability of a plant to endure the invasion of a pathogen without showing many symptoms or much damage.

The ultimate aim of plant breeders and plant pathologists is the production of varieties immune to disease, at least to the important diseases. Unfortunately, this goal is very rarely attained, and we must be content with resistance at as high a level as possible. When testing new varieties, attempts are made to find any that are better than those already under cultivation. For this reason it will be realised that the terms resistance and susceptibility are relative and refer to a comparison with known standards.

In disease testing, such as we do at the Experiment Station, there should be a sequence in experimental work, so that the susceptibility (or resistance) is determined first, and then the tolerance determined at a later stage.

The ease with which the susceptibility of varieties to various diseases can be determined depends on a number of factors, not the least of which is the nature of the disease itself. This point is perhaps better explained by an example from our own experience. In the case of gumming disease, the extent of infection, and the rate of spread of the disease, are very closely connected with the climatic conditions of any particular area, or during any particular season. Thus, the reactions of the varieties to this disease will be very difficult to assess if the weather conditions have not been suited to the development of the disease for the duration of the experiment.

Early Stages in Disease Testing

A review of the methods of disease testing employed in Natal is best commenced at the stage at which seedlings are prepared for their removal to the field. At this stage in their life history, the varieties are growing in pots and are about six months old. Before they are removed to the field, a check is made to determine the presence of any diseases, especially mosaic. Any seedlings found with this disease are immediately discarded and not planted in the field.

When the seedlings have been in the field for about six months, stool by stool inspections are made, and the number of diseased seedlings recorded for each cross. This method of recording disease incidence is primarily to determine the relative merits of the various crosses made. The two diseases with which we are mainly concerned at this stage are mosaic and smut, although any seedlings infected with other diseases are also noted. Diseased seedlings are not

rogued out, so that they may form a source of inoculum for any spread of the disease concerned to neighbouring seedlings. The inspection of the single seedlings is usually carried out in February or March, and up to two inspections are made for any one batch of seedlings.

Separate Disease Trials

When the single seedlings are selected as being up to the standard required for inclusion in single lines, small plots of the chosen varieties are planted as a future source of planting material for disease trials. These plots are inspected from time to time, and any diseases present noted for future reference.

It is at this stage in the history of any particular series of seedlings, that the disease testing is carried out in experiments separate from those in which the general qualities of the varieties such as yield and sucrose are investigated.

Two types of disease experiments are carried out in Natal. These are susceptibility (resistance) trials, and tolerance trials. There are essential differences between the two types. In susceptibility trials the varieties under test must be planted healthy and then be given every chance of contracting the particular disease. To this end a definite and sufficient source of inoculum must be present at or near the site of the trial.

In the case of tolerance trials, experiments are planned to produce information on the difference between healthy and diseased plants of any variety with respect to yield, sucrose, etc. Thus comparisons are made between cane planted healthy and cane planted diseased.

Natural Infection versus Artificial Infection

A possible short cut in testing the disease susceptibility of new varieties is the use of artificial inoculation of the varieties under test. This method has its advantages in that any variety that possesses any inherent susceptibility to the particular disease will undoubtedly contract the disease subsequent to artificial inoculation. This method also provides a resistant variety with the means of proving its worth. But artificial inoculation, however convenient it may be, tends to produce results that cannot always be relied upon when it comes to assessing the variety's disease reactions under commercial conditions. Comparisons have been made at the Experiment Station between the results of artificial inoculations and natural infection in the case of mosaic disease.[1] The results tended to indicate that susceptibility tests carried out in the glasshouse and employing artificial means of infecting the cane were often not comparable with field tests using the same varieties but relying on natural means of spread, i.e. by means of the insect vectors. Experiments were also carried out in the glasshouse comparing artificial inoculation with insect transmission. Here again the results of insect transmission in the glasshouse were very different from those obtained from insect transmission in the field. There is a great deal to be said for experiments in the field in which reliance is placed on natural means for the spread of the particular disease to those varieties under test that are susceptible to it.

Diseases for which Trials are carried out in Natal

Of the approximately twenty-two transmissible diseases of sugarcane that are reported to occur in Natal, six are included in disease trials to test the reactions of new varieties. These are gumming disease, smut, red rot, mosaic, streak and ratoon stunting disease.

Susceptibility Trials

Susceptibility trials are planted to test varietal reactions to mosaic, streak, smut, red rot and gumming disease. The first three diseases are studied in a single experiment usually planted at the Experiment Station, while red rot and gumming disease trials are planted under high altitude mist belt conditions.

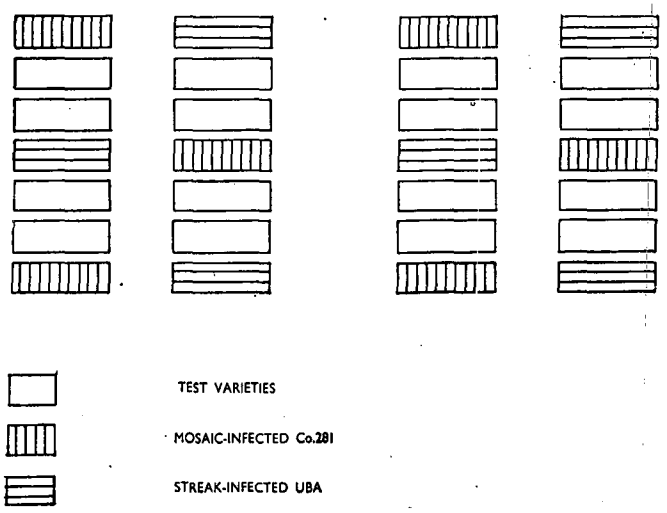
(*a*) *Mosaic-Streak-Smut Susceptibility Trials*

The varieties under test are planted in short lines, usually six feet in length, either in pairs or singly. Alternating with the test varieties are planted lines of diseased cane—in this case mosaic-infected Co.281 and streak-infected Uba respectively. The whole experiment, with four replications, is interplanted with maize which is inoculated with mosaic two or three times. The presence of the vectors of mosaic is made sure of at a time when their presence is required to transmit the mosaic to the test varieties. If the population of vectors is found to be somewhat low, the maize plants are seeded with vectors obtained from native-grown maize in the vicinity.

To test the reaction of the varieties to smut, a suspension of the spores of that disease is sprayed or watered on to the whole experiment at least once or twice. The best method of artificially infecting cane with smut disease has not yet been found in Natal despite experiments employing methods used in overseas countries. Although by watering the cane with a suspension of the spores, the amount of inoculum applied is so much greater than would normally occur under field conditions, the degree of infection even in a variety such as Co.301 is surprisingly low.

The design of such a susceptibility trial is shown in Fig. 1.

FIG. 1 — SCHEME FOR MOSAIC — STREAK — SMUT SUSCEPTIBILITY TRIAL



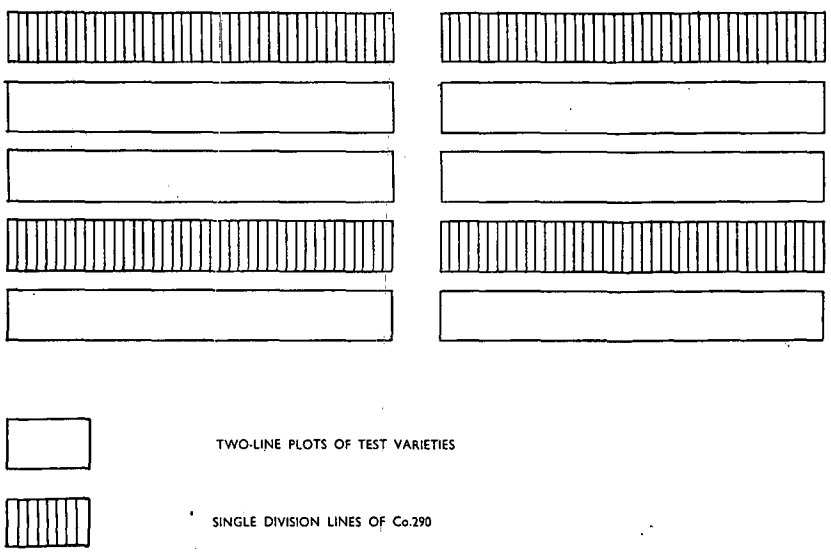
These trials are kept in operation for about two years, i.e. the plant cane is cut after twelve months, as is the first ratoon crop. The weight of cane is not taken into consideration as these experiments are designed merely to give indications as to the ease with which the varieties will become infected with the respective diseases. Regular inspections, however, are carried out for the duration of the experiment and the number of infected stools of each variety noted. When the first ratoon cane has been harvested an assessment of the capabilities of the variety is attempted. The degree of infection in each of the varieties is compared with that of the controls which usually include all the released varieties.

(*b*) *Red Rot Susceptibility Trial*

Red rot is a disease which has proved serious in the past especially in the high altitude area of the cane belt. Co.290 has been the most susceptible variety to this disease and for this reason is used exclusively as a control to test the susceptibility of new varieties.

Naturally, a high altitude area is chosen as the general situation for the site of such a trial. The plots for this trial are slightly larger than those used in the mosaic trial. This is possible because the red rot trial is designed to accommodate a smaller number of varieties since it is planned at the stage in the selection procedure when seedlings are chosen for inclusion in variety trials. The plots in a red rot trial are usually of two lines about twenty-five feet in length, and are separated from one another by single lines of the control variety Co.290. Reliance is placed on natural infection, the control variety usually becoming infected with the disease very rapidly. As this sort of trial is planted to observe the reactions of the various varieties when exposed to a good source of infection the cane is not weighed at the end of the experiment, which is usually allowed to run for two years and is then ploughed out. The design of a typical red rot trial is shown in Fig. 2.

FIG. 2 — SCHEME FOR RED ROT SUSCEPTIBILITY TRIAL



(c) Gumming Disease Susceptibility Trial

As this disease was recognised in this country only in 1956 we have not yet had much experience in testing varietal reactions to it. The first trial was planted in the spring of 1957 and it is still too early to assess the feasibility of the method employed let alone the reactions of the varieties under test.

The first factor to be considered when planning a gumming disease trial is that of location. In the survey carried out on the incidence of gumming disease in Natal, it was shown that the disease is likely to prove more serious in high altitude areas where there is an increased incidence of misty weather. This fact limits our choice of sites considerably. Even in such an area, on account of seasonal variations, the actual conditions prevailing for the duration of the experiment may not be conducive to the disease. This is an eventuality that cannot be forecast and any such experiment may have to be continued until such time as conditions considered normal for that area are experienced.

The experiment planted in 1957 was based on the "single stool per plot" method. This was done for two reasons. Firstly, it was tried out with the view to possible use in subsequent trials concerning this, and other diseases. Secondly, as the disease was only recognised just over a year ago, it was felt that the backlog of untested varieties should be included in the first trial. In actual fact two trials were planted —one with unreleased seedlings and the other with the various varieties now under commercial cultivation.

FIG. 3 — SCHEME FOR GUMMING DISEASE SUSCEPTIBILITY TRIAL

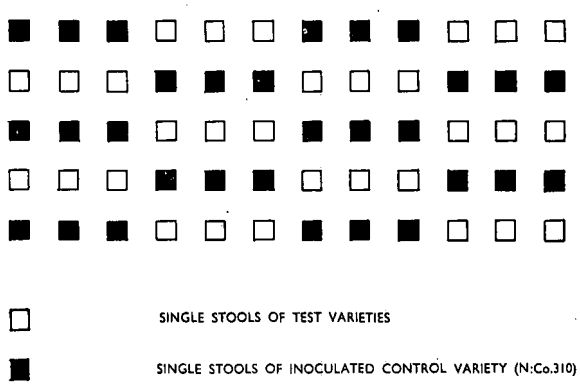


Fig. 3 shows the basic plan of the trials which are similar in design, but which differ slightly in the arrangement of the varieties under test. On the basis of the survey results which indicated N:Co.310 to be our most susceptible variety to the disease, this variety was used as the control in both trials. These control stools of N:Co.310 are to be inoculated with the disease and then the spread from them to the uninoculated varieties will be noted from time to time. It is felt that this single stool method will be quite satisfactory for use in such trials as these, provided allowance is made for sufficient replications. In this particular series of experiments there are forty replications, and if possible, at the end of two years, some idea of the tolerance of the varieties to the disease may be obtained by harvesting and weighing the individual stools of each variety.

Ratoon Stunting Disease and Susceptibility Trials

Ratoon stunting is a disease that is causing us some concern and methods of testing varietal reaction to it have had to be devised. As was mentioned above, one of the pre-requisites of a susceptibility trial is that the cane must be given every possible chance of contracting the disease concerned. Now it has been found to be relatively simple to inoculate healthy cane with ratoon stunting disease but the real trouble lies in the accuracy with which one can determine whether a cane has in fact contracted the disease or not. This is because the disease exhibits few easily-recognisable diagnostic symptoms. A number of methods of identifying the disease have been described in other countries notably Australia and Mauritius, but as yet these methods have not been found to give consistent results in this country. The reason for this may lie in the nature of the varieties grown in this country or in the presence here of different strains of the virus responsible for the disease.

The outcome of susceptibility trials in any disease depends to a great extent on the ability to determine whether a variety under consideration has in fact contracted the disease in question. This, as can well be imagined, is not so difficult, for example, in the case of mosaic, but it is at present a very definite stumbling block in the case of ratoon stunting disease. Work is proceeding in an attempt to determine a method of diagnosing this disease more accurately and at an early stage in the development of the infected plant. Meanwhile, emphasis has been laid on tolerance trials in connection with ratoon stunting disease. Even in experiments of this nature one has to be reasonably certain that the cane in the diseased plots is in fact diseased and this we can do only by means of inoculation with diseased juice.

Ratoon Stunting Disease Tolerance Trials

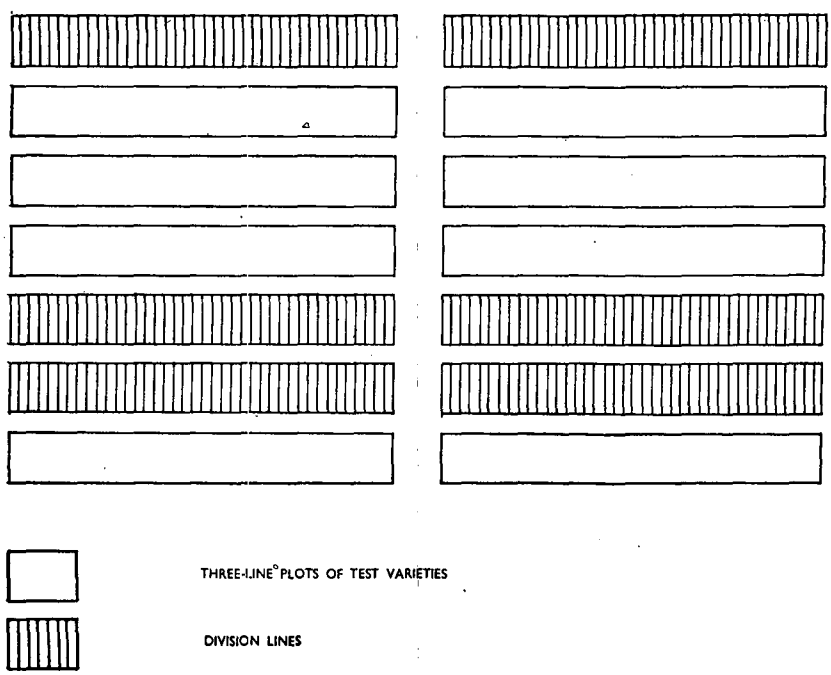
We now have the results of a number of these trials to guide us in any future work on this subject. As mentioned above, it is essential to have diseased and healthy cane for purposes of comparison. Firstly, by examining the origin of the seed cane to be used in the trial, one can select diseased or healthy cane as the case may be. This method is entirely suitable when dealing with a disease like mosaic, in which diseased and healthy stools can be readily picked out.

However, with ratoon stunting disease the problem arises regarding the certainty with which one can assert that the cane selected is diseased or healthy. The symptoms may be very clearly marked in a large number of sticks inspected, but there are bound to be a fair number that will arouse uncertainty in this respect. To overcome this, we must resort to artificial means of insuring the disease or health of the seed cane. In past experiments we have done this by inoculating the seed cane to be planted in the diseased plots, and by hot water treating the seed to be used in the healthy plots. This you might say will definitely ensure the disease and health of the respective plots in the experiment. But does it ? Are we to assume that all the setts inoculated with the disease before planting, actually produce diseased plants ? On the other hand can we assume, for experimental purposes, that the treated cane will produce one hundred per cent healthy plots ? Experiments with ratoon stunting disease in which freshly-inoculated cane and freshly-heat-treated cane have been used have so far tended to produce inconsistent results which have been difficult to assess. This, it is maintained, has been primarily due to the use of seed cane treated immediately prior to the planting of the experiment. The belief is now held that more reliable results can be obtained by using diseased and healthy stock respectively for ratoon stunting disease tolerance trials. This can be done in the following manner. Propagation plots of diseased and healthy cane can be planted with setts that have been inoculated and heat treated respectively. The diseased plots can be ratooned early and the stumps watered with ratoon stunting diseased juice. This should ensure the diseased nature of the seed bed when the time comes to plant the cane out in an experiment. The seed cane for the healthy propagation plots can be heat treated immediately prior to planting. The inactivation of any ratoon stunting virus present in this seed cane can be ensured by selecting setts that will stand up to heat treatment well, and by using a time/temperature combination slightly higher than normal. The germination subsequent to such a treatment might not be one hundred per cent but this will not matter as long as one can obtain a stand of cane which is going to be large enough to produce the quantity of seed required for the actual experiment, and which one can declare clear of the disease. This method of obtaining disease-free seed cane pre-supposes the maintenance of strict field hygiene in the matter of cutting knives, etc., throughout the life of the healthy propagation plots.

In tolerance trials the main object is to determine the effects of the particular disease, if any, on the yield of the crop. Therefore plots must be sufficiently large, and treatments adequately replicated to allow accurate statistical analysis.

In the case of ratoon stunting disease we have no proof of any natural means of spread of the disease. There is the possibility that the disease may be spread by way of the roots which are slightly damaged in their growth through the soil. In experimental work on this disease, we must, to the best of our ability,

FIG. 4 — SCHEME FOR RATOON STUNTING DISEASE TOLERANCE TRIAL



make some allowance for this possibility. For this reason then, diseased and healthy plots must be kept reasonably clear of one another, and one method by which this can be done is to plant more lines per plot than will be required at harvest time. These extra lines are termed division lines, and may be of the same variety planted in the plots, or of a variety distinct from any included in the experiment. In Fig. 4 is depicted the layout of a tolerance trial on the lines of that described above.

Mosaic Tolerance Trials

Two methods of testing varietal tolerance to this disease have been employed at the Experiment Station. One of these is based on the large plot method such as that described above for ratoon stunting disease. The other is essentially similar to the gumming disease susceptibility trial in that it follows the "single stool per plot" method. In the latter method the tolerance of the varieties is assessed on the weights of the individual stools, and a comparison between the yields of diseased and healthy stools of each variety.

REFERENCES

[1] King, N.C., and J. Dick (1957). A critical comparison of methods of testing for resistance to mosaic. S.A. Sugar Technologists' Association. 31st Congress: 116.

Experiment Station
S.A. Sugar Association
Mount Edgecombe
April 1958

Dr. Brett said that disease-testing of seedlings had been steadily growing more and more complicated. Not only had the number of diseases for which tests were necessary greatly increased, but in general the nature of these tests had had to be changed from qualitative ones designed to distinguish between immunity and susceptibility to quantitative ones designed to determine degrees of resistance or tolerance.

Mr. Alexander asked if it were not disadvantageous to use certain areas known to be favourable to the growth of red rot and gummosis for resistance tests to these diseases. For example, whilst testing seedlings for gummosis resistance, it might prove embarrassing if the standard variety N:Co.310 should fail the tests. He also asked why some seedling found to be highly susceptible to mosaic could not be used in place of maize as a source of infection in mosaic resistance tests.

Dr. McMartin said that years ago varieties which appeared to have field possibilities and were later found with mosaic, were discarded. N:Co.339 was in fact discarded in this way. Later it was found that Co.281 itself was susceptible to mosaic to about the same degree as N:Co.339. Therefore, it was obvious that there was no longer any reason holding the release of N:Co.339. Because of experiences such as this the whole process is far more complicated now, and Mr. Thomson is to be congratulated on his summarising of the present position in his paper.

Dr. Dick said the reasons for using maize were not only because of its being easily infected with mosaic, but because it acted as a source of the insect vector. If maize were omitted from such mosaic trials it might be difficult to breed up the number of vectors necessary for the tests.

Mr. Thomson said N:Co.310, because of its known susceptibility to gumming disease, was used in the gumming disease trials. He had no doubt that gumming disease had been present for many years and if a gumming disease trial for N:Co.310 had then been initiated, no doubt one would have thought twice about releasing the variety. The disease reaches its chronic state mostly in the mist belt, although it is found, to some extent, in the coastal areas. In future all new varieties will be tested for their susceptibility to gumming disease.

Mr. King thought that this paper by Mr. Thomson's would help the planting section of the industry to appreciate the difficulties involved in selecting any new variety of cane. A long period must elapse before a variety can be released with confidence. He felt that the biggest danger is not from the virus diseases, but from the bacterial and fungus diseases. The loss from virus diseases does not involve a total loss of the crop, but the loss caused by other diseases, such as red rot, was found about 15 years ago to result in complete loss. The necessity for testing fungus and bacteria diseases should be more fully stressed.

Mr. Thomson said the question of a variety which has been found to be very susceptible, brings into consideration the matter of tolerance to a disease. A case in point is N:Co.339 which exhibits tolerance to mosaic disease, and there are two schools of thought on the release of varieties such as this. Some maintain that a cane which is only tolerant to a disease should not be considered for release, while others say that even if a cane is tolerant to the disease, but has other good qualities, such as high yield and high sucrose, it should be considered for release.

Mr. du Toit brought up the question of a variety found extremely susceptible to gumming disease in one particular area. That variety would not be discarded in the rest of the industry just because of its behaviour in one area. It was hoped to work out a scheme whereby varieties would be tested under all different conditions.

Dr. McMartin said that on more than one occasion he had pointed out that crop loss suffered by the industry from all diseases added together was not as much as the crop loss suffered in a bad drought.

Disease reaction testing of varieties in the long run is going to lead to a minimum loss, even if varieties do get diseases to a certain extent. He further remarked that Dr. Brett had referred to complications which would have arisen if the paper had been written 15 years ago and added that he himself would even go further back and say that in still earlier years there would not have been sufficient material for the paper. The only disease tested was mosaic and the varieties were planted in 5 gallon drums in the Botanical Gardens and artificially inoculated. If they took mosaic they were automatically discarded. If that type of testing was still adhered to, the Industry would be growing Uba, the P.O.J. canes and Co.290 and all subsequent varieties since then would have been unheard of. The present system of testing is a process which must go on and would even get more complicated.

Mr. Pearson said that as far as complications with this work is being burdened, he could add a further complexity. With ratoon stunting disease, there are indications that high soil fertility and water conditions cause the disease to be somewhat masked. This might put a very complex picture on to tolerance.

Mr. W. J. G. Barnes said that, as a grower, he thought that the release of any new variety should be accompanied by a simple statement of that variety's tolerance to known diseases. In the final analysis, it was the grower who had to judge whether any released variety was economical, and he had to have clear information on the disease aspect before he could judge. Calculated risks, as had been done in the case of mosaic, could only be taken when the facts were clearly known by the grower.

Mr. Thomson said it was not possible to give a complete picture of disease reaction when varieties were first released. Some time was required to determine reaction under commercial production and some time must elapse before any idea as to what the disease is going to do to that variety in different parts of the sugar belt, can be formed. The question of tolerance is very complicated, and with N:Co.339 Mr. Thomson said he had cases where people had told him it was suffering from mosaic and had become stunted and did not appear to be tolerant. On looking at the particular cane, it seemed to be very difficult to determine whether it was the disease causing bad growth or the conditions under which the cane was growing. A lot of work is being done and has been done in various parts of the world on ratoon stunting disease. The time has come for a conference on an international scale in connection with this disease.

Mr. Rault said that with regard to tolerance of diseases, the planters' policy was to plant only the types of cane which gave him the highest sucrose yield. Some varieties were considered dangerous because they carried disease, in spite of being heavy yielders, and spread it to other varieties not so tolerant. He asked Mr. Thomson if that the right thing to do.

Mr. Thomson replied that with a cane such as N:Co.339 which is, as far as can be made out, tolerant to the disease, but which has other qualities, such as high yield and good sucrose, then it must definitely be considered from the point of commercial production. Tests must be carried out to finality unless it was found a variety appeared to be hopeless.

Dr. Dodds said he would like to make a suggestion. Some time ago Dr. Brett produced an excellent field pamphlet on the identification of varieties, and Dr. Dodds was sure this must have been of great practical use to many people. He now suggested that something of the kind should again be produced and issued, showing the symptoms of the various cane diseases known to occur in this country and also the reaction of the released varieties to these diseases.

Mr. Thomson said that at the moment he was writing such a bulletin.

Mr. Main asked if there was any disease count which could be used to assess susceptibility of a disease. He felt that N:Co.334 should never have been released at all. He could not see how a planter could be supposed to be able to control ratoon stunting disease in a variety such as N:Co.334.

Mr. Thomson said the question of counts for disease reaction was a matter of comparison and relative to varieties already known to us. It is very difficult to work out exactly what a variety is going to do once it has left the disease reaction tests. Results obtained do not necessarily indicate exactly what is going to happen under field conditions. They just give a general idea.

Mr. du Toit remarked that in all cases the disease position was taken into account before a variety was released. Dr. McMartin had pointed out that if we wanted to eliminate mosaic completely we would have been growing Uba and P.O.J.2878 today and the mills would have been empty. N:Co.310 gets gumming disease but it has proved to be very valuable cane, and while N:Co.339 gets mosaic badly it is giving good results. When N:Co.334 and its release was considered, the facts were weighed. Should anyone not want to apply hot water treatment he could carry on his programme and he would not plant N:Co.334. But why should the fact that some who did not want to apply hot water treatment debar others from making use of this variety with proper treatment? Those that apply hot water treatment could grow N:Co.334 satisfactorily. That variety as such could never endanger the industry as a whole.

Mr. Main said that N:Co.334 could be re-inoculated even though it had been treated. Many years ago

N:Co.334 was condemned because of its yield, not because of its disease. He could remember variety trials where it was tried with other varieties and it was discarded because of the poor yield, which was, perhaps, the result of its high susceptibility to ratoon stunting disease.

Mr. du Toit stated that the last speaker said N:Co.334 did not compare favourably with other varieties, possibly due in part to the ratoon stunting, but N:Co.334 was considered for release and it was only when it became so patchy after release that it was found that the patchiness was due to ratoon stunting. There was, however, now a method of getting rid of ratoon stunting, and he saw no danger in releasing this variety to people willing to treat it.

Mr. Pearson said he thought Mr. Main was unaware that N:Co.334 was bulked up for distribution together with N:Co.339 and N:Co.292. It was, however, only during the bulking up process that other plots at Chaka's Kraal showed stunting symptoms and very poor growth. Within a month of distribution N:Co.334 was withheld and reconsidered. However, the N:Co.334 trials elsewhere had shown quite some useful results regarding yield. It was then thought worth while releasing, but it was stated in the pamphlet accompanying the advertisement that there was a possibility it would go down with disease, if not treated.

Dr. Dick said that it was difficult to arrive at a valid standard for measuring the degree of susceptibility. Statistical analysis had been carried out on the results of replicated mosaic tests. On account of the degree of variability it was impossible to state that a variety in which seven out of ten plants became infected was more susceptible than one in which three out of ten developed the disease.

Mr. Halse said that the Department of Agriculture intended to take more interest concerning the varieties which were going to be released. The Department would want to know at a round table conference what the Experiment Station was doing about the disease susceptibility of varieties which might be considered for release. A few mistakes had been made in the past in releasing canes which were very questionable, and the Department wanted to ensure that this would not happen in the future. It was not the intention to consider the release of new canes every year, unless these canes were going to be of a high standard in every respect.

Mr. Barnes thought there was a danger in depending upon too few varieties and that an increase in the number of commercially profitable varieties was desirable provided sufficient safeguard was taken with regard to disease susceptibility.

Mr. du Toit said it was not, and never had been, the intention to release poor canes just to make up numbers, and that while attempts would be made to obtain reasonable numbers they would not be such as to be condemned by the Department of Agriculture. The paper showed what excellent work was being done all the time by the Department of Pathology at the Experiment Station. It was, of course, their policy to weigh disease incidence against yield. He felt that the paper would be particularly valuable in other countries where they could compare their methods of testing with ours in Natal. As the President had indicated in his address, two members from the Experiment Station would visit Mauritius during their June conference. Their experiences in Mauritius, particularly with regard to ratoon stunting disease, should enable them to bring back information of value to the Natal Sugar Industry. Mr. Thomson would be a member of that delegation.