Mosaic and ratoon stunting disease (RSD) present the principal problems in sugar cane disease control in Louisiana at present.

**MOSAIC**

Development of varieties resistant to mosaic was an outstanding accomplishment of the breeding programme conducted co-operatively by the U.S. Department of Agriculture, the Louisiana Agricultural Experiment Station, and the American Sugar Cane League, beginning in 1923. After replacement of the noble canes in the mid-1920s, there was a progressive improvement in mosaic resistance until, by 1955, 95% of the sugar cane acreage in the State was occupied by resistant varieties. Identification of a new strain of the virus in 1956 to which hitherto resistant varieties are susceptible, changed the situation with respect to that disease. Appearance of the new strain required classifying the leading commercial variety, C.P.44-101, hitherto resistant, as susceptible and this, together with the later release and expansion of the susceptible varieties, No:Co.310 and C.P.52-68, reduced the acreage in resistant varieties to approximately 12% in the 1961 crop.

Resurgence of mosaic revived the necessity of roguing seed plots as a means of controlling the disease, a practice which has not been followed on an important scale for about 20 years because the principal varieties grown during that period were resistant. The roguing programme is directed by a Committee on Mosaic Control, composed of members of the three co-operating agencies. Most of the larger growers and plantations do their own roguing, and an intensive campaign has been conducted by the Louisiana Agricultural Extension Service to encourage smaller growers to do the same. Among the difficulties encountered in getting them to do so are the following:

1. Scepticism on the part of some that mosaic is of sufficient importance to justify the effort to control it. However, data showing average reductions in yields of 32–34% for C.P.44-101 and C.P.52-68, and of 17.5% for N:Co.310 caused by the disease have convinced the majority that it is, and more growers undertake roguing each year.

2. Inability of some individuals to identify accurately the symptoms of mosaic. Mosaic 'schools' or 'clinics' have been held by the county agents each year to instruct growers in identifying the symptoms, determining the percentage infection, and roguing. Where training someone on a farm or plantation to identify the disease was not feasible, the problem was solved in many instances by hiring persons, often high school or college students, each of whom undertook the job for several growers for a per-acre fee. An average cost for labour and supervision is about $2 per acre per roguing, but this varies somewhat from farm to farm. Four or five roguing
recommended, but three may suffice if the rate of secondary spread of the disease is low.

In some areas, involving about 10–15% of the total sugar cane acreage, mosaic had gained such headway before a control programme was instituted that on many farms roguing would have been impossible. To meet the needs of farmers in such areas, the Committee on Mosaic Control arranged with selected growers, in localities where mosaic incidence was low, to rogue seed cane for sale. The fields to be rogued are selected by the Committee after inspection to determine that mosaic infection is less than 2%, which is considered the maximum it is feasible to rogue, and that the cane, which must be from heat-treated seed, has no more than a low incidence of RSD. The roguing for mosaic is done by the grower, who, after final inspection and approval by the Committee is authorized to offer the seed cane for sale. Farmers file their applications for seed cane with their county agents (Agricultural Extension Service), who transmit the requests to the American Sugar Cane League for allocation based on demand and supply. This programme is contributing materially towards keeping mosaic contained until high-yielding, generally adapted varieties resistant to current strains of the mosaic virus become available.

Except in the areas of very high incidence and rate of secondary spread of the disease, control by roguing has generally been successful in C.P.44–101. Some difficulty has been experienced with C.P.52–68 and even more with N:Co.310 in areas where mosaic in prevalent. It was recommended by the Committee that the planting of N:Co.310 be discontinued on farms or in areas where it had become highly infected since its presence would nullify attempts at control by roguing. Where this was done, and only rogued seed of other varieties was planted, mosaic has been reduced in some instances to a low level within a few years.

Spraying mosaic-infected plants with Garlon*, a chemically fortified petroleum solvent, has been recommended as a cheaper method of roguing, particularly in ratoons, than digging out the diseased plants. However, sprayed plants often sprout and a second spraying is necessary to kill them completely; in the meantime mosaic may be spread by insects that feed on the young regrowth.

Two commercial varieties, C.P.36–13 and C.P.47–193, are resistant, and C.P.48–103, moderately resistant to mosaic, including the new strain H. However, each has disadvantages which prevent it from becoming a major cane. The three combined occupied only 11.73% of the State acreage in 1961. C.P.36–13 shows limited locality adaptation, C.P.47–193 has a high rate of post-harvest inversion, in addition to lacking cold tolerance, while C.P.48–103 is low in vigour and does not shade out weeds.

RATOOt STUNTING DISEASE

After identification of RSD in Louisiana, steps were taken immediately to institute a programme of control by heat treatment based on Australian work, under the guidance of a Committee on RSD control set up by the three cooperating agencies. Experimental data and practical considerations soon indicated that hot air was preferable to hot water for seed treatment in Louisiana. Aside from the greater danger of reduced germination from hot water as compared with hot air, resulting from

* Diethylene bis 2,2-dichloropropionate 50.8%; 2(4,5-trichlorophenoxy) propionic acid 7.7%.
seed cane deterioration during the winter, use of hot water would be limited to the larger plantations having factories, while electrically heated hot air ovens could be made available to any grower interested in acquiring one. Specifications for electrically heated units of 1-ton capacity were drawn up by the Committee, based on Schexnayder's design, and by 1961 more than 100 of these were in use in the State.

Although as complete a degree of control of RSD by heat treatment as had been anticipated at the beginning of the programme, has not been achieved, the beneficial results in the way of improved yields and vigour are so obvious that heat treatment of seed cane has become a common practice in Louisiana. Small growers whose cane acreage does not justify purchase of a treating unit buy treated cane from others. Experimental data, showed that on an inlet air temperature of 58°C maintained during the 8-hour period of treatment is required for satisfactory control of the disease. In large-scale treatment, however, complete elimination of the virus is seldom achieved and up to about 5% infection in direct-treated cane may occur. Both the plant and the first ratoon crops from heat-treated cane are generally acceptable for use as seed. A continuing programme of retreatment is followed, using each year cane that is progeny of that previously treated.

OTHER DISEASES

Resistant varieties provide a sufficient degree of control of red rot so that widespread stand failures from this disease have not been experienced with the present commercial varieties. Some reduction in germination and stands of plant cane occurs every year, although not of epidemic proportions. Resistant or moderately resistant varieties occupy slightly more than a third of the commercial acreage in the State. The situation is not as favourable in this respect as it was during the early 1950's, when less than 5% of the acreage was in varieties classed as susceptible, and the change in classification of C.P.44-101 from resistant to moderately susceptible, makes red rot a greater potential hazard to the industry now than it was 10 years ago.

Pythium root rot, one of the three diseases contributing to the failure of the noble canes in the mid-1920's, is not now of major concern owing to the development of resistant varieties.

Special control measures for other sugar cane diseases in Louisiana are not necessary. Chlorotic streak is not a problem in the present commercial varieties, and the programme of heat treatment for RSD control should prevent serious development of it.

SUMMARY

Mosaic and RSD present the principal problems in sugar cane disease control in Louisiana. Resistant varieties provided satisfactory control of mosaic until 1956, when a new strain of the virus appeared which attacked the hitherto resistant and leading commercial variety C.P.44-101. Roguing seed plots has had to be resorted to as a means of control until generally adapted varieties resistant to the new strain can be developed. The 3 commercial varieties that are resistant or moderately resistant to the new strain have disadvantages which prevent them from becoming major canes.

Hot-air treatment of seed cane with electrically heated ovens is widely practised for control of RSD in Louisiana. Small growers whose cane acreage does not justify purchase of a treating unit buy treated cane from others. Complete elimination of the virus in the treated cane is seldom achieved but a continuing programme of retreatment, using each year progeny of previously treated cane, is giving satisfactory results.
REFERENCES


DISCUSSIONS

D. S. Hughan (S. Rhodesia): Dr. Bourne in Florida tested varieties for resistance to mosaic before and after hot-air treatment and found that many which were found to be resistant before treatment succumbed to the virus after treatment. Now he tests all varieties twice, before and after hot-air treatment, as routine.

F. M. L. Sheffield (E. Africa): Experimental transmission by aphids in the greenhouse might give an indication of any change in the virus-vector-host relationships.

F. Sánchez Navarrete (Mexico): Since treated canes grow more rapidly than untreated canes, I think the more succulent growth of the former leads to greater invasion by the insect vectors and could account for the increase of mosaic.

F. M. L. Sheffield (E. Africa): Experimental transmission by aphids in the greenhouse might give an indication of any change in the virus-vector-host relationships.
THE CONTROL OF SUGAR CANE DISEASES IN MAURITIUS

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In the early days of the world cane sugar industry, Mauritius was a turning platform for the exchange of cane varieties between the Eastern and Western hemispheres. It is surprising therefore that the island did not become a centre where most diseases and pests were to be found. Thus, from those days to the present, Mauritius was spared the introduction of such major diseases as mosaic, streak, sereh, Fiji, and downy mildew. The remaining diseases of primary importance however have exacted their toll, from time to time, either directly or indirectly and it is the purpose of this contribution to assess the efficacy of the measures adopted to control them. The diseases concerned are: gummosis, leaf scald, red rot, smut, pineapple disease, chlorotic streak, and ratoon stunting.

Fig. 1. Relative importance of seven major sugar cane diseases at different dates in Mauritius.

The relative importance of six of the major diseases at different periods in the history of the local sugar industry is illustrated in Fig. 1. The chart indicates that several of these diseases are now under control. Two of them, however, chlorotic
streak and ratoon stunting are under partial control only and play a significant role in lowering production.

The main aspects of control measures adopted in the island may be considered under the following headings: breeding and selection for resistance, use of fungicides and heat therapy.

**BREEDING AND SELECTION FOR DISEASE RESISTANCE**

Systematic hybridization of sugar cane was started in Mauritius in 1930, although locally bred seedlings had been obtained since 1892. Cane varieties from other territories were also introduced at various intervals and, after undergoing the requisite quarantine period, were tested with locally produced canes to assess their commercial potentialities. This policy is being pursued to this day, but greater reliance is placed on locally produced seedlings. Indeed, one of the major activities of the Sugar Industry Research Institute is the breeding and selection of new varieties. Outstanding in this programme is the selection of individuals which combine resistance to various diseases with other desirable agronomic features.

Testing for resistance to gummosis (*Xanthomonas vasculorum* (Cobb) Dowson) is carried out as a matter of routine for seedlings in their fifth year of selection, the method used being based on the one originally devised by North in Australia. During the period 1931–1961 the reaction of 1,197 seedlings was studied in such trials with the results shown in Table I.

<table>
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<tr>
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<th>Number of varieties tested</th>
<th>Number resistant</th>
<th>Percent resistant</th>
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<tbody>
<tr>
<td>'Noble' canes</td>
<td>396</td>
<td>299</td>
<td>75.5%</td>
</tr>
<tr>
<td>Hybrid canes</td>
<td>801</td>
<td>751</td>
<td>93.7%</td>
</tr>
<tr>
<td>Total</td>
<td>1197</td>
<td>1050</td>
<td>87.7%</td>
</tr>
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It is the task of the geneticist to examine the available data more closely in order to offer conclusions with regard to parental influence on resistance to gummosis. But at this stage two points need our attention. The first is that from a practical point of view the method has been successful in producing a high proportion of resistant canes, the second is that these results are only applicable to conditions prevailing in Mauritius. The following example will illustrate this point: M. 147/44, one of the leading commercial varieties of Mauritius is highly resistant to gummosis in this island but very susceptible in Réunion. It has been shown recently that these different reactions are due to the existence of more than one strain of *X. vasculorum*. From the practical aspect of control measures these observations are of importance because they show that the reactions of cane varieties to gummosis cannot be generalized beyond the country in which the tests are made; while, on the other hand, any conclusions as to the inheritance of resistance and susceptibility must be restricted to particular strains of the organism.