COMMERCIAL CONTROL OF LEAF SCALD DISEASE BY THERMOTHERAPY AND A CLEAN SEED PROGRAMME

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ABSTRACT

Thermotherapy and a clean seed program are being used to control leaf scald disease on a commercial scale, for the first time in the world. The disease has been found on many farms in the Burdekin district of Australia since late 1976, but should be reduced to very low levels by 1982. The methods are described by which the healthy cane is produced, and propagated on isolated plots and on cane farms, before commercial plantings are made.

INTRODUCTION

Hot water treatment is used in Australia to free sugarcane planting material of chlorotic streak and ratoon stunting diseases. Of the other important diseases in Australia, only leaf scald (Xanthomonas albilineans) offered any possibility for control by the thermotherapeutic treatment of planting material.

Steindl\textsuperscript{6} eliminated leaf scald disease from one-eye setts by soaking them in water at ambient temperatures for up to 48 hours prior to long hot water treatment (LHWT) at 50°C for three hours. The disease was not eliminated by LHWT alone. In South Africa, Bailey\textsuperscript{1} also failed to eliminate leaf scald from diseased setts with LHWT of 50°C and 52°C for up to two hours.

Since the early 1970s, Steindl’s method, referred to locally as the cold-soak/LHWT method, has been adopted as a Bureau of Sugar Experiment Station practice when transferring small amounts of cane from one environment where leaf scald is endemic, to another (Hughes\textsuperscript{3}). No breakdown of the method has occurred, as far as is known. As an added bonus, there were strong indications that the pre-treatment water soaking made the cane more resistant to LHWT, resulting in better germinations.

The method appeared to be worth trying on a commercial scale when the opportunity arose.

Prior to 1976, leaf scald disease had been recorded in all districts in Australia, except in Burdekin. Susceptible varieties were grown there extensively, e.g. Trojan in the 1940s and 1950s, and Q63 since the 1960s. In November 1976, leaf scald
symptoms were discovered in the Burdekin district in Q63, a variety in which the disease may remain latent for long periods before expression of symptoms.

Up to May 1979, the disease had been located in more than 40 per cent of the farms in the district, although only a few blocks were infected heavily enough to show any yield loss. In retrospect, it appears that leaf scald was present for at least five years prior to its discovery.

The Burdekin district has approximately 850 cane farms harvesting up to 3.8 million tons of cane from up to 32,000 ha. The major variety for the last 10 years has been Q63, which first exceeded 50 per cent of the crop in 1972, and reached 68 per cent in the 1977 crop.

During the leaf scald disease epidemic in Q63 in the Mackay district of Queensland during the early 1970s (Persley), yield losses occurred in ratoon crops when the epidemic reached an advanced stage. Approval to grow Q63 commercially in Mackay was withdrawn at the end of 1973 and the last crops were harvested as second ratoons in 1976, prior to ploughout. (N.B. The Director of Sugar Experiment Stations has a statutory obligation to issue annual lists of varieties approved for planting in each sugar mill area. A major factor which he must consider when approving a variety is resistance to disease.)

Leaf scald disease has always been controlled in Australia by releasing resistant varieties for commercial use, by removing susceptible varieties from cultivation, and by selecting healthy plant sources. This method could not be followed in toto for the Burdekin district in the short term. The new and quite different approach involving thermotherapy was chosen. This was aided by the presence of Q96, a variety which was superior to Q63 in yielding ability, of intermediate reaction to leaf scald, and which was about to be approved for planting when leaf scald was discovered.

In early 1977, it was decided, in conjunction with grower and miller groups, to remove Q63 from the 1979 lists of varieties approved for planting in the Burdekin district. Under BSES disease control regulations, this meant that the last commercial crops of Q63 would be harvested in 1981 as second ratoons, and then ploughed out. Most of the leaf scald disease should be removed in this way also. The percentage of Q63 in the Burdekin crop will plummet from the maximum of 68 percent reached in 1977, to zero in 1982.

It was also decided to approve Q96 as a commercial variety in 1979, and to build up healthy stocks of Q96 through a large scale cold-soak/LHWT program. Associated with this would be a designated plant sources scheme in order to limit the possibility of reinfection of the healthy cane.

During the 1977, and 1978 plantings, restrictions were placed on the amount of the susceptible Q63 which could be planted from what appeared to be healthy sources, and cane grower were encouraged to plant leaf-scald-resistant varieties such as Q80, 90, 97 and 98. It is hoped that a reasonable percentage of resistant canes can be maintained in the future.
FIELD PROGRAM

Production of disease-free seed cane in isolated plots

A system of primary and secondary-increase plots was established in the Burdekin district in 1977, along lines similar to those initiated in the Bundaberg district of southern Queensland to control Fuji disease (Egan'). A moderate degree of isolation was required for these plots to guard against reinfection by leaf scald disease. A nucleus of Q96 was planted each year in the primary plot with one-eye setts given the cold-soak/LHWT, and using the previous year's treated cane as a source. The progeny was used to plant the secondary increase plots (SIPS) in the succeeding year, and the stubble was then ploughed out. Details of the areas planted each year are given in Table 1.

TABLE 1. Areas planted in Burdekin in plots, and tons of Q96 and other varieties bought by farmers from plots

<table>
<thead>
<tr>
<th>Area/tons</th>
<th>1977</th>
<th>1978</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hectares Q96 planted, primary plot</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Hectares Q96 planted, SIPS</td>
<td>20.4</td>
<td>22.1</td>
<td>24.3</td>
</tr>
<tr>
<td>Tons Q96 sold SIPS</td>
<td></td>
<td>2 030</td>
<td>1 895</td>
</tr>
<tr>
<td>Tons other varieties sold plots</td>
<td>1 954</td>
<td>2 485</td>
<td>2 120</td>
</tr>
</tbody>
</table>

Similarly for the SIPS, only the plant crop was used to provide cane growers with a nucleus of healthy Q96 plants (see Table 1 for tons supplied), and the stubble was then ploughed out. Hygiene in planting and harvesting operation was maintained carefully in these plots. In this way, Q96 planting material, free of both leaf scald and ratoon stunting diseases, was supplied virtually to all of the 850 cane farms in the district. The average amount was 2 tons per cane grower, but this varied considerably with farm size.

This program was initiated on a large scale in 1977 so the whole of the SIP planting, i.e. 20.4 hectares, also was made with one-eye setts given the standard cold-soak/LHWT. Germination was excellent despite the use of some immature cane.

The three cane Pest and Disease Control Boards operating in the Burdekin district are responsible for the production of disease-free planting material. They also arrange for the harvest and cartage of the plants to the cane farm, on the instructions of the cane grower.

Plants of the various leaf-scald-resistant varieties also are produced by these Boards for sale to cane grower. However, these clean' cane plots do not need to be
isolated from commercial cane, and the cane to plant them is given an LHWT without the pre-soak in water. The average amount supplied each year is around 3 tons per cane grower.

The designated plant source scheme on farms

Although Q96 is listed as an approved variety, restrictions have been placed on the sources of planting material which may be used. In practice, the canegrower buys a nucleus of disease-free Q96 from the SIP each year, grows it on his farm in a designated site which must not be adjacent to Q63 fields, and uses this source for his commercial plantings in the succeeding year only.

Other approved varieties (Q80, Q90, Q97, Q98) are included in the designated plant source scheme also, but restrictions are less severe than for Q96. The purchase of a nucleus of disease-free cane each year from the SIP is encouraged, but there is no compulsion on the cane grower to do so. All plant sources are inspected at least once by Cane Pest and Disease Control Board staff, and any which showed disease (e.g. RSD, chlorotic streak) would be discarded.

RESULTS AND DISCUSSION

This is the first report of therapeutic measures being used to control leaf scald disease in commercial plantings. The scheme is possible partly because of the statutory powers on disease control which BSES possesses, the co-operation of canegrowers and sugar millers in the Burdekin district; and the Cane Pest and Disease Control Board system in Australia. In this case, the Ayr, Inkerman and Invicta Boards have operated the scheme under BSES supervision.

The first nucleus of Q96 plants was supplied to growers in 1978. This was planted in over 5,000 ha, approximately 60 percent of their total planting in 1979. Some leaf scald infection of Q96 probably will occur on farms in the short term since diseased fields of Q63 are still present throughout the district. However, the potential for transmission by mechanical and other means should decrease markedly as the diseased fields are ploughed out progressively. The scheme will face its most severe test over the next three years. Thereafter, the pressure on it will ease considerably. However, leaf scald disease probably cannot be eradicated from the district because of latency problems in some varieties and the probable presence of the disease in alternative hosts (Ryan5).

More research is needed to improve the commercial aspects of the method. Questions whether 2-eye setts or 3-eye setts can be used instead of 1-eye sett, whether whole stalks can be used and whether the 48-hour pre-soak in water can be shortened, or replaced by some other pre-treatment should be answered.

Control of RSD by LHWT was developed in Australia in the early 1950s. Over the 10-year period 1969-78, an average of 3,200 tons of cane has undergone LHWT each year. It has not been possible to eradicate RSD, but its incidence in
commercial crops can be held at very low levels by using inspected plants from recently-treated sources and by giving attention to hygiene. Quite susceptible varieties can be grown commercially with negligible or zero yield losses, provided these precautions are observed.

It is not claimed that an equally successful system has been developed for the commercial control of leaf scald disease, but it appears to be quite promising at this stage. There are differences between the pathogens and transmission methods for the two diseases, which could affect the outcome. Field experience over a period of several years will be necessary before any definite conclusions can be made.

REFERENCES


CONTROL COMERCIAL DE LA ENFERMEDAD DE LA ESCAL-DADURA POR TERMOTERAPIA Y POR UN PROGRAMA DE SEMILLAS SANAS

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RESUMEN

La termoterapia y un programa de semilla sana han sido usados por primera vez en el mundo para controlar la enfermedad del escal-da dura en escala comercial. La enfermedad se ha encontrado en muchas fincas en el distrito de Burdekin en Australia desde finales de 1976, pero debería ser reducida a niveles muy bajos para el 1982. Se describen los métodos que se usan para producir y propagar las semillas sanas en las parcelas aisladas y en las fincas de caña antes de llevar a cabo siembras comerciales.