LEAF SCALD DISEASE AND THE SELECTION PROGRAMME AT PONGOLA

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Abstract

The incidence of leaf scald disease in the plant breeding programme at Pongola was investigated. In six consecutive selection stages several parent varieties were found to give a high proportion of disease-free offspring.

Introduction

The spread of leaf scald disease (caused by *Xanthomonas albilineans*) through the sugarcane growing areas of the world during the 1960s (Egan[1, 3]) did not exclude South Africa (Thomson[12]). The variety position was, however, very favourable in that the main varieties were found to be resistant (Roth and Thomson[11]). The potential threat that leaf scald is to a sugar industry materialized in Australia in 1972. Significant losses were experienced by growers and millers when Q63 collapsed with the disease (Ford[5]; Persley[4]) and the growers incurred expenses in replacing this variety.

In South Africa a promising variety, the Queensland-bred L76, which was to have filled a gap in the variety requirements of certain areas, was withdrawn from release at the pre-release stage when it developed acute symptoms of leaf scald. In the plant breeding selection programme at Pongola, the northern field station, leaf scald has been noticed for some time. Recently the incidence has increased and this paper therefore deals with the position in the selection programme at Pongola.

Leaf Scald in Imported Varieties

Imported varieties are planted at Pongola field station and enter the programme at the third stage of selection. Any promising disease-free varieties are promoted to the variety trial stage. Several varieties have been recorded with leaf scald disease. These are entered in Table 1.

TABLE 1
Varieties susceptible to leaf scale disease at Pongola

Apollo	CP56/8	H39/723	PCG64/3006
Azul	CP56/63	J334	POJ3067
B62138	CP59/22	J59/4/87/4	POJ3150
B.O.24	CP61/39	L60/25	Q65
CB36/14	Co 399	L62/96	Q68
CP31/588	Co 411	F156	Q77
CP43/47	Co 740	L76	TUC67/30
CP43/64	Co 851	M31/45	US59/16/1
CP44/101	Co 1001	NA56/79	
CP51/24	H32/8560	P59/1609	

The varieties were all naturally infected. No artificial inoculation was practised in this or other cases discussed in this paper. The varieties susceptible to leaf scald originate in several countries but, as a group, the CP varieties seem most susceptible.

Genealogies were extracted, some of the most common parent varieties being Co 281, Co 285, Co 290, CP1165, POJ213, POJ2364 and POJ2878. The most frequent parent variety is POJ2364 which is also the parent of POJ2725, POJ2878 and others, and only four varieties with known parentage not being descendants of POJ2364. Co 281 and CP1165 occurred in genealogies of several CP varieties. The parents transmitting leaf scald susceptibility cannot readily be identified from the genealogies.

Leaf Scald in the selection programme

1. *Leaf scald in the various seedling series*

Disease inspections are carried out in all selection stages of the breeding programme. A summary of the leaf scald records for the 69 to 74 series appears in Table 2. (The Series number refers to the last two figures of the year in which the seedlings were planted, in the second of five selection stages. At this stage every seedling is identifiable through its selection number). The disease recordings of the 69 to 72 series include later stages of selection.

TABLE 2
Leaf scald recorded in the 69 to 74 series at Pongola

Series	No. of crosses	No. of seedlings in second stage of selection	No. of leaf scald susceptible seedlings	Percentage infection
69	12	1 289	10	0,77
70	59	2 721	31	1,14
71	70	2 071	61	2,96
72	79	2 800	16	0,57
73	113	3 367	1	0,03
74	152	3 543	71	2,00
TOTAL	485	15 791	190	Mean = 1,20

The incidence of leaf scald is increasing but not in the 72 and 73 series. The reason for the low incidence in the 73 series is not yet known and the results for this series are excluded from all other discussions in this paper. The leaf scald incidence in the 74 series, which is only at the second stage of selection, is the highest for that stage.

2. *The fourth selection stage of the* 71 *series*

The occurrence of leaf scald in later stages of selection is generally rare. However, several seedlings of the 71 series showed severe symptoms of the disease in the fourth stage of selection although some of these seedlings were yielding well and had not been reported with any other disease. The seedlings were grouped into the various parental combinations and entered in Table 3.

Several points emerge from this table:

(i) In spite of some seedlings yielding well, approximately one third of all seedlings at this advanced stage of selection have to be discarded because of leaf scald disease.

(ii) Leaf scald susceptibility is restricted to seedlings of certain crosses. All offspring of several crosses were susceptible.

(iii) Certain parent varieties such as CP43/64 and CP44/154 transmit extreme susceptibility to their offspring.

TABLE 3

Crosses and the seedlings infected with leaf scald

Parental Combination	No. of seedlings in fourth stage of selection	No. of seedlings with leaf scald	Percentage infection
Co 281 × N10	2	2	100
Co 421 × CP43/64	5	5	100
CP36/13 × MP	2	2	100
CP44/154 × NM222	1	1	100
N55/805 × CP44/154	2	1	50
N66/328 × CP43/64	1	1	100
NCo 291 × MP	1	1	100
NCo 293 × CP44/154	8	2	25
NCo 310 × H37/1933	3	1	33
NCo 376 × CP38/34	1	1	100
NCo 376 × N55/868	1	1	100
TOTAL	27	18	66,7
TOTAL IN 71 SERIES	56	18	32,1

(iv) Some of the parent varieties were found to be susceptible to leaf scald (Table 1) and appear to transmit susceptibility to the progeny.

3. *Leaf scald among seedlings of some varieties*

The number of varieties used as parents in this programme is quite large. No crosses were repeated among the 485 crosses planted in the 69 to 74 series (Table 2). The varieties used most frequently as parents are listed in Table 4. The seedling numbers are those from the second stage of selection although disease recordings cover several stages.

The number of crosses per variety was variable and ranged from 2 to 46 for NCo 310 and 37 for NCo 376. Similar variation exists in the seedling numbers. Two varieties, CB38/22 and N52/214, used frequently as parents did not give any seedlings that were susceptible to leaf scald. All crosses with Co 281, CP36/13, CP43/64, CP52/68, CP61/39 and H49/3533 gave some susceptible seedlings. More than 60% of the crosses with CB40/69, CP44/101, CP44/154, CP50/28, H37/1933 and Q49 gave offspring with susceptibility to leaf scald. The numbers of seedlings actually infected with leaf scald were of a lower order. The variety with the highest percentage of susceptible seedlings was Co 281, followed by H49/3533, CP61/39 and CP43/64.

The varieties were grouped into three categories depending on the percentage of seedlings infected with leaf scald. These categories given resistance ratings of 2, 5, 8 indicate, respectively, resistance, intermediate and susceptible response to leaf scald infection. Table 4 shows that all CP varieties, three of the four H varieties and three other varieties have a rating of 8. The three NCo varieties and five others have a rating of 5. Fortunately, three CB varieties, one H and four N varieties have a rating of 2. The gene pool for resistance is therefore not too restricted and, by using certain parent combinations, the incidence of leaf scald among seedlings can be reduced.

TABLE 4

Reaction of offspring of some varieties to leaf scald infection

Variety	No. of crosses		No. of seedlings		Percentage of seedlings infected	Resistance rating of seedlings*
	Total	with leaf scald	Total	with leaf scald		
CB38/22	12	0	420	0	0	2
CB38/39	12	4	773	4	0,5	2
CB40/35	11	2	758	3	0,4	2
CB40/69	9	6	779	21	2,7	8
Co 281	2	2	90	11	12,2	8
Co 419	5	2	256	2	0,8	2
Co 421	13	3	558	7	1,2	5
CP36/13	2	2	67	3	4,5	8
CP43/64	6	6	151	16	10,6	8
CP44/101	13	10	680	41	6,0	8
CP44/154	7	6	286	13	4,6	8
CP50/28	3	2	93	3	3,2	8
CP52/68	2	2	191	15	7,8	8
CP61/39	2	2	28	3	10,7	8
H37/1933	3	2	86	3	3,5	8
H38/4443	4	2	194	2	1,0	2
H49/5	2	1	47	3	6,4	8
H49/3533	3	3	50	6	12,0	8
N6	4	2	308	2	0,7	2
N7	16	6	415	6	1,4	5
N10	10	4	406	12	3,0	8
N51/168	21	2	871	2	0,2	2
N52/214	12	0	454	0	0	2
N52/219	9	1	461	1	0,2	2
N52/451	12	2	400	3	0,8	2
N55/805	14	6	464	8	1,7	5
NCo 293	15	3	646	7	1,1	5
NCo 310	46	12	1 203	19	1,6	5
NCo 376	37	13	1 369	20	1,5	5
NM222	13	6	599	7	1,2	5
Q49	4	3	243	3	1,2	5

* Percentage of seedlings infected	Resistance rating
0 -1%	2
1,1-2,5%	5
> 2,6%	8

Discussion and conclusion

The incidence of leaf scald at the Pongola Field Station is still low since only 1,2% of the seedlings are infected with it. However, the importance of this disease is shown by the proportion of seedlings of the 71 series infected in the fourth stage of selection, and by the collapse of Q63 in Australia.[5, 9]

The only method of controlling the disease seems to be through the release of resistant varieties (Egan,[2] Hughes[6]) and the effectiveness of this method is indicated by the fact that leaf scald is no longer regarded as an important disease in Northern Queensland.[2] Continuous testing for resistance with several disease isolates will prevent susceptible varieties from being released.[10]

Results from Pongola show that leaf scald susceptible varieties such as the CP group transmit this susceptibility to the offspring and it would thus seem advisable to test the reaction of varieties to the disease. As the coefficient of heritability for resistance seems high,[4] such a test would assist in finding varieties producing resistant offspring. Seedlings of several varieties have shown a low incidence of disease and most of these have no local rating to leaf scald infection, while some such as CB40/35, Co 419, N7 and N52/214 possess additional beneficial attributes.[7, 8] The position regarding leaf scald disease seems to be under control as far as the parent and seedling varieties are concerned, but leaf scald susceptible parent varieties should be used with care.

The potentially dangerous leaf scald disease affects only a small number of seedlings in the selection programme at Pongola, but its ability to cause the loss of some promising seedling varieties was demonstrated. Fortunately, several varieties of known parental value show a very low incidence of leaf scald among their offspring.

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