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BUREAU OF SUGAR EXPERIMENT STATIONS

QUEENSLAND AUSTRALIA

PROGRESS REPORT ON BSES AND WRC STUDIES OF WATER QUALITY IN WOONGARRA-PEMBERTON AREA

JULY 1981

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INTRODUCTION

Study of the water quality problem in the Woongarra-Pemberton area has continued during the 1980-81 season in an attempt to define the extent of the problem, reasons for the problem and the effectiveness of amelioration measures. Previous work has been summarized in reports prepared in April, 1979 and July, 1980.

This report summarizes results of a pot trial comparing bore and surface water; co-operative monitoring of water-table levels with the Water Resources Commission; field trials with various ameliorants; and a field survey of yields and various management factors in the problem area and other neighbouring areas.

EXPERIMENTAL DETAILS

Pot trial

The pot trial was conducted with the variety Q87 and compared yields of pots irrigated with bore water and surface water, respectively.

The trial included two red soils (BSES Station soil, Woongarra-Pemberton soil), a yellow soil and a black soil. These three groups of soils represent the admixture present on many farms in the area with red soil on higher land grading to black soil on lower land. The BSES soil has had a history of irrigation with better quality water than the Woongarra-Pemberton soils.

Several different treatments were applied on each soil type:- gypsum at 15 t/ha; hydrated lime at 6 t/ha; magnesium carbonate at 2.5 and 4.0 t/ha (BSES soil only). The two calcium ameliorants were applied to counteract the high Mg/Ca ratios produced by long term irrigation with high Mg/Ca ratio irrigation waters. The magnesium treatment was designed to accentuate the high Mg/Ca ratio.

Two harvests were carried out at approximately 16 and 32 weeks. Adequate fertilizer was applied to meet crop needs and irrigation was carried out once or twice per day depending on crop size.

Water-table monitoring

Water-table monitoring was carried out at two sites:- The first site at Johnson's had a gradation from red soil through to black soil and piezometers were installed at three depths (0.6, 1.2 and 1.8 m) by the Water Resources Commission at the red-yellow interface, in yellow soil, at the yellow-black interface, and in black soil; the second site at Muller's had yellow soil grading to black and piezometers were installed at two depths (0.8 and 1.6 m) in the yellow-black interface, and in black soil. There was considerable downslope fall at both sites:- approximately 4.7 m from red-yellow to black at Johnson's and about 1.0 m from yellow-black to black at Muller's.

Water-tables were monitored following irrigation and or rainfall at both sites. The period for observations was 22nd January to 3rd June at Johnson's and from 18th February to 3rd June at Muller's.

Samples of ground water were taken at each site at regular intervals for salinity measurements. Soil salinity was also measured at each piezometer site at depth intervals of 0-300, 300-600 and 600-900 mm. Some supplementary measurements of soil salinity were taken in adjacent "drained" and undrained blocks at Muller's.

Field trials

Two replicated field trials were established in spring plant cane in 1980 to determine whether a yield response to calcium ameliorants could be obtained on red soils which had a history of irrigation with high magnesium water. The sites are located in the Woongarra-Pemberton and Seaview Road areas and were to be irrigated with bore water and surface water respectively. The Seaview Road site will not be irrigated with surface water until the first ratoon crop due to delay in connection by the farmer. The plant crop at both sites will therefore be irrigated with bore water.

Ameliorants at both sites include gypsum at 5, 10 and 15 t/ha and hydrated lime at 2.5, 5.0 and 7.5 t/ha. These ameliorants will have a calcium build up effect, and a calcium build up plus pH increase effect, respectively. Preliminary strip trials indicated some response to liming but not to gypsum.

No yield assessment has been made at either site to date and only preliminary observations will be reported.

Farm survey

The farm survey included three groups of ten farms located in the Seaview Road, Woongarra-Pemberton and Hummock Road-Ashfield Road areas. These groups were selected to represent two poor water quality areas (Seaview Road and Woongarra-Pemberton) and one "good" water quality area (Hummock Road-Ashfield Road).

Seaview Road farms are now connected to surface water, most farms in the "good" quality area are still using bore water and all Woongarra-Pemberton farms are using bore water.

Each farmer was circularized to obtain data on fertilizer use, cultivation practices, watering methods and problems and comments on yield and soil structure. Water usage figures were obtained from the Water Resources Commission and yield data for the last ten years from Millaquin and Qunaba mills. The yield data is on a whole farm basis as block data, although available, was impossible to retrieve in the time available. Yield data for the Millaquin and Qunaba mill areas is available from Mill Statistics.

Approximate figures for Fiji disease infection were obtained from pathology monitoring sites in each area.

RESULTS AND DISCUSSION

Pot trial

The plant crop of the pot trial was harvested in January and the ratoon crop in June 1981. Yield data are summarized in Table I. Table II summarizes available soil analytical data for each harvest.

Over all treatments there was a 10 per cent reduction in yields in the plant crop with the use of bore water but in the ratoon crop yields were similar with both waters. Taking only the untreated control plots the yield reduction with bore water was 5.0 per cent in the plant crop and 2.5 per cent in the ratoon crop. The control plot yields would be more typical of the field situation where few farmers use ameliorants.

For plant and ratoon crops there was a positive response to all ameliorants with both bore and surface waters. The magnesium carbonate treatment also produced a positive average response over both crops and waters although there was a suggestion of reduced yields in some surface water treatments in the ratoon crop. The trial is therefore inconclusive in determining whether high soil magnesium levels can reduce yields.

The soil analyses following plant and ratoon crops showed moderate salinity levels in the surface water treatments and high salinities in the bore water treatments. These levels are much higher than those found in the field (except for the black soil and some pockets of yellow soil) and would be expected to cause more serious yield reduction in the field than occurred in pots. The lack of large yield differences may be due to the regular watering in the pots which minimized water stress. All amelioration treatments had a significant effect on soil cation levels with gypsum and lime generally increasing soil calcium levels and the magnesium carbonate treatments increasing soil magnesium levels as expected. Both lime and magnesium carbonate increased soil pH and this resulted in lower extractable manganese levels on all soil types.

TABLE I

Comparative fresh weight yields (g) for plant and ratoon crops of the pot trial with Woongarra-Pemberton soils

	Plant crop			Ratoon crop			
	W1	W2	M	W1	W2	M	O.M.
S1 T1	684	670	677	610	627	619	648
S1 T2	769	692	730	628	566	597	664
S1 T3	776	695	736	628	653	641	688
S1 T4	758	705	732	628	586	607	669
M	747	690	719	624	608	616	667
S2 T1	706	659	682	537	582	560	621
S2 T2	723	659	691	600	592	596	644
S2 T3	803	698	751	575	622	599	675
S2 T4	810	664	737	590	646	618	678
M	760	670	715	576	611	594	655
S3 T1	689	648	668	606	578	592	630
S3 T2	762	666	714	634	625	630	672
S3 T3	776	675	726	623	626	625	675
S3 T4	738	673	706	574	614	594	650
M	741	666	704	609	611	610	657
S4 T1	694	635	665	626	535	581	623
S4 T4	708	614	661	616	630	623	642
S4 T5	702	628	665	561	643	602	634
M	701	626	664	601	603	602	633
O.M.	740	666		603	605		

S1 = krasnozem (Lunn)
S2 = black soil (Muller)
S3 = yellow soil (Asnicar)
S4 = krasnozem (BSES)

W1 = surface water
W2 = bore water

T1 = control
T2 = gypsum 15 t/ha
T3 = hydrated lime 6 t/ha
T4 = magnesium carbonate 2.5 t/ha
T5 = magnesium carbonate 4.0 t/ha

M = mean

O.M. = overall mean

TABLE II

Soil analyses from pot trial after harvest of plant and ratoon crops

Treatment	Plant crop														Ratoon crop	
	pH H_2O		*Ca me %		Mg me %		K me %		Na me %		Mn ppm		EC 1:5 mS/cm		EC 1:5 mS/cm	
	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2
S1 T1	5.96	5.63	2.45	2.95	5.40	8.75	0.04	0.06	1.40	2.45	78	94	0.22	1.06	0.17	1.27
S1 T2	5.61	5.57	9.00	8.50	5.15	6.75	0.06	0.05	1.42	2.15	16	83	0.89	1.33	0.76	1.30
S1 T3	6.66	6.45	7.50	7.50	5.70	8.25	0.05	0.06	1.53	2.22	1	5	0.33	0.93	0.26	1.32
S1 T4	6.31	6.02	2.75	3.00	7.50	9.50	0.06	0.06	1.50	2.40	2	51	0.28	1.05	0.26	1.21
S2 T1	5.24	5.07	5.75	6.00	8.00	10.50	0.08	0.09	1.86	2.62	33	41	0.39	1.06	0.29	1.21
S2 T2	5.06	4.90	14.75	14.00	7.75	10.25	0.08	0.10	1.71	2.84	34	51	1.10	2.04	1.14	1.88
S2 T3	6.41	6.01	10.25	10.00	7.75	10.50	0.08	0.09	1.80	3.00	1	13	0.39	1.10	0.45	1.38
S2 T4	5.66	5.36	6.00	6.50	9.50	11.50	0.08	0.08	1.65	2.75	20	29	0.29	1.06	0.45	1.27
S3 T1	6.08	5.74	3.50	3.55	6.35	8.25	0.07	0.06	1.21	2.22	28	48	0.28	0.80	0.26	0.70
S3 T2	5.80	5.69	9.50	9.50	5.25	7.50	0.06	0.06	1.82	2.62	30	45	0.92	1.44	0.46	1.05
S3 T3	6.68	6.53	8.50	8.50	6.25	8.00	0.06	0.05	2.15	2.51	1	6	0.49	0.95	0.32	1.03
S3 T4	6.38	6.13	3.60	3.60	8.00	9.75	0.08	0.06	1.88	2.62	19	25	0.35	0.98	0.29	0.95
S4 T1	5.62	5.20	3.20	3.30	3.05	4.85	0.04	0.03	0.83	2.04	34	125	0.14	0.89	0.12	0.99
S4 T4	5.96	5.61	3.20	3.25	4.40	6.75	0.04	0.04	0.94	1.93	4	59	0.18	0.88	0.12	0.94
S4 T5	6.23	5.82	3.20	3.35	5.75	8.00	0.04	0.04	1.00	2.15	6	49	0.21	1.03	0.18	0.85

S1 = krasnozem (Lunn)
S2 = black soil (Muller)
S3 = yellow soil (Asnicar)
S4 = krasnozem (BSES)

T1 = control
T2 = gypsum 15 t/ha
T3 = hydrated lime 6 t/ha
T4 = magnesium carbonate 2.5 t/ha
T5 = magnesium carbonate 4.0 t/ha

W1 = surface water
W2 = bore water

* Ca, Mg, K, Na figures are extractable cations and include exchangeable plus soluble plus residual unreacted ameliorant.

In the red soils manganese levels were relatively high in untreated soil, particularly where bore water was used and the reduction in manganese is one possible explanation for the yield response to liming ameliorants.

The lack of uniformity in yield responses between plant and ratoon crops and the high salt levels in bore water treatments make the pot trial results of doubtful reliability for field predictions. Any further work of this type should be carried out in larger pots or preferably in the field. The main problems with field trials are the need for a high level of replication to show any small yield difference (10 per cent or less) and the mechanics of pumping sufficient surface water to a bore water area for comparative trials. There would also be a high labour component in managing irrigation of such a trial.

Water-table monitoring

The water-table monitoring data for the Johnson and Muller sites are summarized in Figures 1 and 2, respectively and rainfall in Figure 2. Rainfall figures were recorded at the Experiment Station and are slightly higher than those on the two farms monitored. Figure 1 also indicates the relative soil surface level at each of the piezometer sites on Johnson's farm. Unfortunately some data was missed at Johnson's due to the presence of basalt floaters which restricted piezometer depth to 0.6 m at site I, 1.2 m at site II and 1.2 m at site IV. Depths in Figures 1 and 2 are depths of water-table below the soil surface.

Water-table measurements were generally comparable in piezometers installed at different depths and there was no conclusive evidence for a perched water-table, or for a head of water upslope from any site causing a semi-artesian effect. However, Johnson's site appears to have abnormally high water-tables in the red and yellow soils, suggesting water flow downslope from above these sites, possibly along a basalt rubble layer at shallow depth. There is a swamp intake area located at the top of the slope in the farm which held water for most of the monitoring period.

High water-tables (< 0.5 m) were found at all sites on Johnson's following rainfall or irrigation but no water-table was detected in the yellow soil at Muller's although water-table levels in the black soil were comparable at both sites. The period of high water-tables on the black soil (approximately 60 days less than 0.5 m from the surface) is sufficient to cause some yield loss from water-logging alone without the influence of salinity. There was some accentuation of the water-table effect at Muller's due to rain falling soon after irrigation on two occasions.

However, it is likely that the water-table recordings are a fair indication of the general behaviour of the black soils as these soils show strong evidence of reducing conditions due to waterlogging in their subsoil, and the subsoil is heavy in texture. These soils should benefit from improved subsurface drainage, particularly in the lower sections of blocks. Where surface drainage has not already been improved some benefit should be obtained from levelling to reduce the amount of water ponding in the lower part of furrows following irrigation or rainfall. High water-tables are unlikely in other soil types at most sites although some further monitoring may be warranted in the 1980-81 season.

The water-table salinity monitoring figures are summarized below. It was not always possible to obtain samples at Muller's due to the small diameter piezometers used, and Johnson's data are more complete.

<u>Johnson</u> — Water-table EC mS/cm

Site	Depth hole, m	5/2/81	18/2/81	2/3/81	3/4/81	1/5/81	3/6/81
1.1	0.6		5.7	4.9	3.4		2.2
2.1	0.6		2.4	2.2	2.2		1.2
2.2	1.2		2.0	1.4	1.5	1.2	
3.1	0.6		4.9	4.9	4.5		2.3
3.2	1.2	4.3	4.3	4.3	4.4	3.9	3.3
3.3	1.8	4.5	3.7	3.7	3.9	3.8	3.4
4.1	0.6		5.9	5.9	5.0		3.1
4.2	1.2		5.5	5.5	5.7	5.9	3.8
<u>Muller</u>							
2.1	0.8		3.7	4.5			
2.2	1.6		3.9	4.6		5.2	6.2

At Johnson's the lowest water-table salinity was at site 2 in the yellow soil. Moderately high salinity levels were found on the red-yellow interface, yellow-black interface and in the black soil. However, these are not inconsistent with Johnson's water quality which is 2.3 mS/cm and would be expected to produce drainage water of approximately 4.5 mS/cm in a leaching situation. Water-table salinity on all soil types was reduced after moderately heavy rain in late May.

Muller's water-table salinity was similar to that in the black soil at Johnson's but no improvement occurred after rainfall.

The soil salinity at each piezometer site shortly after installation is summarized below. Salt levels are only moderately high and they would be expected to produce only slight growth restriction.

<u>Johnson</u>

Depth	EC 25°C 1:5 extract mS/cm			
	Site 1	Site 2	Site 3	Site 4
0-300 mm	0.39	0.28	0.14	0.14
300-600 mm	0.25	0.29	0.25	0.31
600-900 mm	0.34	0.27	0.27	0.47

<u>Muller</u>	Site 1	Site 2
0-300 mm	0.17	0.24
300-600 mm	0.21	0.35
600-900 mm	0.25	0.41

Some supplementary soil salinities were measured at Muller's in two blocks of black soil adjoining his main drain and showing poor cane growth. An adjacent well grown block drained by shallow pipes was also sampled. All three blocks showed similar salinity but the well grown block was much drier at the time of sampling which was just after rain. It appears that a reduction in waterlogging has been beneficial at this site although salinity has not been affected by shallow drainage.

Depth	EC 1:5 mS/cm		
	Poor 1	Poor 2	Good (drained)
0-300 mm	0.41	0.39	0.36
300-600 mm	0.76	0.82	0.72
600-900 mm	0.81	0.78	0.84

The trend to higher salinities in the black soil than in other soil types noted at these two sites and in previous studies, and the periodic waterlogging support the need for improved drainage on these soil types. However, this need is not generally accepted by growers with black soils and obviously drainage will not benefit growers with other soil types who do not have a drainage problem.

Present drainage lines are inadequate in black soil areas, mainly because of impediments to drainage on some farms in the drainage line, and in some cases there has been no serious attempt at drainage (Johnson's). In all cases co-operation between several farmers and deepening or installation of drains will be necessary before on farm drainage can be improved significantly.

Field survey

Cane yield

Cane yield data from the 10 year survey of the three groups of ten farms are given in Table III and Figure 3. This figure includes 1981 estimates for each area. Comparative mill area figures are also included in Table III and Figure 3. For this comparison Seaview Road is located in the Qunaba mill area, Woongarra-Pemberton in the Millaquin mill area and Hummock Road-Ashfield Road predominantly in Millaquin.

As can be seen from the figure cane yields were depressed in the 1979-80 period due to the dry conditions and the high level of Fiji disease (see following section). On average none of these areas have suffered in comparison to mill average figures but cane yields have been generally higher in the better water quality area (Hummock-Ashfield Road). This is in part due to the predominance of red soil in this area.

TABLE III

Cane, c.c.s. and sugar yields in the three study areas between 1971 and 1980 in comparison with mill average

Area and yield*	Year										
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
Cane t/ha 1	104.2	92.7	108.8	85.3	91.7	105.8	104.9	94.2	89.6	93.1	95.7
2	94.2	105.2	102.8	93.1	87.9	97.1	102.6	96.8	88.9	89.8	89.0
3	97.0	99.0	105.1	93.3	98.3	109.0	110.6	102.6	90.2	92.3	104.9
Qunaba	97.6	89.1	96.2	84.5	86.3	93.1	93.6	82.8	76.9	84.1	
Millaquin	85.1	94.4	99.8	88.7	93.2	95.0	100.3	90.0	81.4	87.6	
C.C.S. 1	14.68	15.11	13.75	14.79	13.87	14.88	14.91	13.50	14.80	14.92	
2	14.42	14.68	13.37	13.82	13.34	14.28	14.81	13.20	14.25	14.13	
3	14.49	14.64	13.44	13.72	13.12	14.27	14.69	13.30	14.26	14.19	
Qunaba	14.52	15.03	13.85	14.58	13.39	14.85	14.88	13.30	14.45	14.66	
Millaquin	14.28	14.36	13.22	13.65	13.51	14.43	14.60	13.35	14.27	14.15	
Sugar t/ha 1	15.30	14.01	14.96	12.62	12.72	15.74	15.64	12.72	13.26	13.89	
2	13.59	15.44	13.74	12.87	11.73	13.87	15.20	12.78	12.67	12.69	
3	14.10	14.51	14.15	12.83	12.92	15.55	16.20	13.61	13.20	13.07	

1. Seaview Road
2. Woongarra-Pemberton
3. Hummock Rd-Ashfield Rd

Average yields over the last 11 years for red and black soil farms were 101.6 and 91.1, for a sample of 18 and 11 farms, respectively. Farms classified as having black soil were those with 30 per cent or more black soil. In 1981 there has been an increase in cane yields (estimated) in the Seaview Road and Hummock Road areas reflecting the better seasonal conditions and reduced Fiji disease, but yields have remained depressed in the Woongarra-Pemberton area. The reason for this is uncertain, and it could be a combination of Fiji disease and poor water quality. Seven of the ten farms surveyed in the Woongarra-Pemberton area have significant amounts of black soil and these soils would be expected to recover more slowly from any salt accumulation during dry years such as 1979-80.

C.C.S.

C.C.S. trends in the three survey areas and in the two mill areas are given in Table III and Figure 4. Over the ten year period from 1971 to 1980 the Seaview Road area had an average c.c.s. above Qunaba mill average and, similarily, the Hummock Road-Ashfield Road and Woongarra-Pemberton areas were slightly above Millaquin mill average c.c.s..

Over the last three years of the ten year period (1978-80) the Woongarra-Pemberton area fell slightly below mill average (0.06 unit) whereas the other two areas remained above the respective mill averages.

Sugar yield

Comparative sugar yields for the three survey areas over the ten year survey period are given in Table III and Figure 5. Sugar yields as a percentage of farm peak and mill peak are summarized in Figure 6. Sugar yields in the Woongarra-Pemberton are lower than those in the other two areas due to the combination of lower cane yields and lower c.c.s.. This has been a consistent trend over time except for 1972 and 1974. On average the Woongarra-Pemberton area farms have consistently produced their farm peak while the Seaview Road and Hummock Road-Ashfield Road areas have been below peak for two of the ten years. There are individual farms which are exceptions to this statement.

Water quality and water usage

As indicated earlier the three groups of farms were selected on the basis of water quality and this is summarized in Table IV together with water usage figures for 1980-81 supplied by the Water Resources Commission.

TABLE IV

Water quality and water use during 1980-81 in the three study areas

Farm	Area								
	1			2			3		
	EC mS/cm	Ca/Mg	* mm water	EC mS/cm	Ca/Mg	mm water	EC mS/cm	Ca/Mg	mm water
1	2.05	0.33	391**	1.64	n.a.	270	0.98	0.36	420
2	2.33	0.24	397**	1.94	0.36	431	0.61	n.a.	436
3	2.40	0.26	260**	2.40	0.20	523	0.81	n.a.	379**
4	1.65	0.26	376**	1.65	0.17	342	0.98	0.37	550
5	2.85	0.24	240**	1.80	0.25	434	1.42	0.26	196
6	2.20	0.22	498**	2.20	0.34	310	0.74	0.65	444
7	1.74	0.26	477**	2.58	0.18	403	0.90	0.33	207
8	3.00	0.17	340**	1.80	0.18	356	0.70	0.21	487
9	2.70	0.23	407**	2.00	0.14	483	1.02	n.a.	315**
10	2.55**	0.25	306**	2.00	0.14	383			
Mean	2.35	0.25	369	2.00	0.22	394	0.91	0.36	382

1. = Seaview Road
2. = Woongarra-Pemberton
3. = Hummock Road-Ashfield Road
* mm water per assigned hectare
** now bore water plus surface water or surface water only

Average water conductivity is highest in the Seaview Road area and lowest in the Hummock Road-Ashfield Road area. All three areas have a low ratio of calcium to magnesium in their bore water with the Woongarra-Pemberton area having the lowest.

An attempt was made to relate farm yields to water quality but it should be pointed out that management plays an important part in farm yields. For the red soils average cane yields were 103 and 101 tonnes per hectare for average water electrical conductivities of 0.83 and 2.17 mS/cm and sample sizes of seven and 11 farms, respectively. This is not a significant difference over such a limited sample size.

For the black soils average cane yields were 94 and 89 tonnes per hectare for average water electrical conductivities of 1.86 and 2.41 mS/cm and sample sizes of five and six farms, respectively. This indicates a more significant cane loss due to poor water quality but, unfortunately, water quality is poor overall and the benefit from good quality water cannot be assessed. Most farms in the Seaview Road area are now connected to surface water and monitoring should be continued to assess any yield benefit from surface water.

There were no major differences in water usage per assigned hectare in the three areas and it appears that on average Woongarra-Pemberton growers have not changed water usage to compensate for their water quality.

Fertilizer use

The fertilizer use questionnaire was not returned by all growers and data is not complete, but no substantial differences in use are apparent between areas. Data on plant and ratoon use are given below.

Area	Plant kg/ha			Ratoon kg/ha		
	N	P	K	N	P	K
Seaview Road	169	33	131	174	15	147
Woongarra-Pemberton	182	35	189	174	19	166
Hummock-Ashfield Rd	171	24	207	185	18	181

Three growers in the Woongarra-Pemberton area said they had increased fertilizer use recently to compensate for poor growth on their farms.

Cultivation

The survey included comments on difficulty in land preparation and the number of operations required for land preparation. There was no significant difference in the number of operations required for land preparation in the three areas. The general land preparation for plant cane was two or three ploughings, one to four rippings or ripping and grubbing operations and several discings or one or two rotary hoe passes.

Four growers in the Seaview Road area said their land was becoming harder to work, two on red soil and two on black. Seven growers in the Woongarra-Pemberton area complained of cultivation problems, three on red soil and four on black. Three growers in the better water quality area complained of "compaction", mainly on red soil.

Most growers attributed cultivation problems to "compaction" caused by either heavy equipment, poor water quality or both factors.

Yield losses

In addition to the yield survey growers were asked whether they were suffering yield losses due to water quality. Yield loss comments were as follows:- three, seven, and two farmers complained of losses in the Seaview Road, Woongarra-Pemberton and Hummock-Ashfield Road areas, respectively. Most felt losses were higher on their black soil.

Fiji disease

The number of Fiji diseased stools has been monitored on selected farms in the study area over several years. These figures indicate disease levels of 12 to 30 per cent in 1979 rising to 46 to 55 per cent in 1980 for NCo310. Infection levels of the order of one to three per cent were noted in other varieties in 1981.

Substantial yield losses due to Fiji disease would have occurred in 1979 and 1980.

SUMMARY

The pot trial comparing bore water and surface water showed a small yield loss with bore water in un-ameliorated soil but this was only of the order of 3.8 per cent. Salt levels produced in pots were atypical of field conditions and these results could not be directly transferred to the field. There was no conclusive evidence of yield losses due to artifically high magnesium levels.

Water-table and salt measurements in the Woongarra-Pemberton area showed significant waterlogging in black soils following irrigation or rainfall, and moderately high soil salinities. Both factors would be expected to reduce farm yields. The black soils should benefit from improved sub-surface drainage but inter-farm co-operation will be necessary to provide outlets for sub-surface drainage. Adoption of a co-operative drainage approach will require a change in grower attitude and will not satisfy growers who have red soil which will not benefit from drainage.

Amelioration trials in the poor water quality areas have shown some benefit from liming treatments but no replicated trials have been harvested to date.

A survey of farm yields and practices in two poor water quality areas and a better water quality area has shown slightly higher yields in the last area, but this may be due to the predominance of red soil. Data for black soil farms show lower overall yields than red soil farms and a trend to lower yields with poorer quality water, and this agrees with farmer comment on yield losses. The Woongarra-Pemberton area had the greatest number of survey farms with black soil

and more complained of yield losses than in other areas. There is no conclusive evidence as yet of a yield benefit from surface water in the Seaview Road area, but this area and the better water quality area showed a greater recovery in estimated farm yields in 1981 than the Woongarra-Pemberton area. Further yield monitoring is required to investigate this trend.

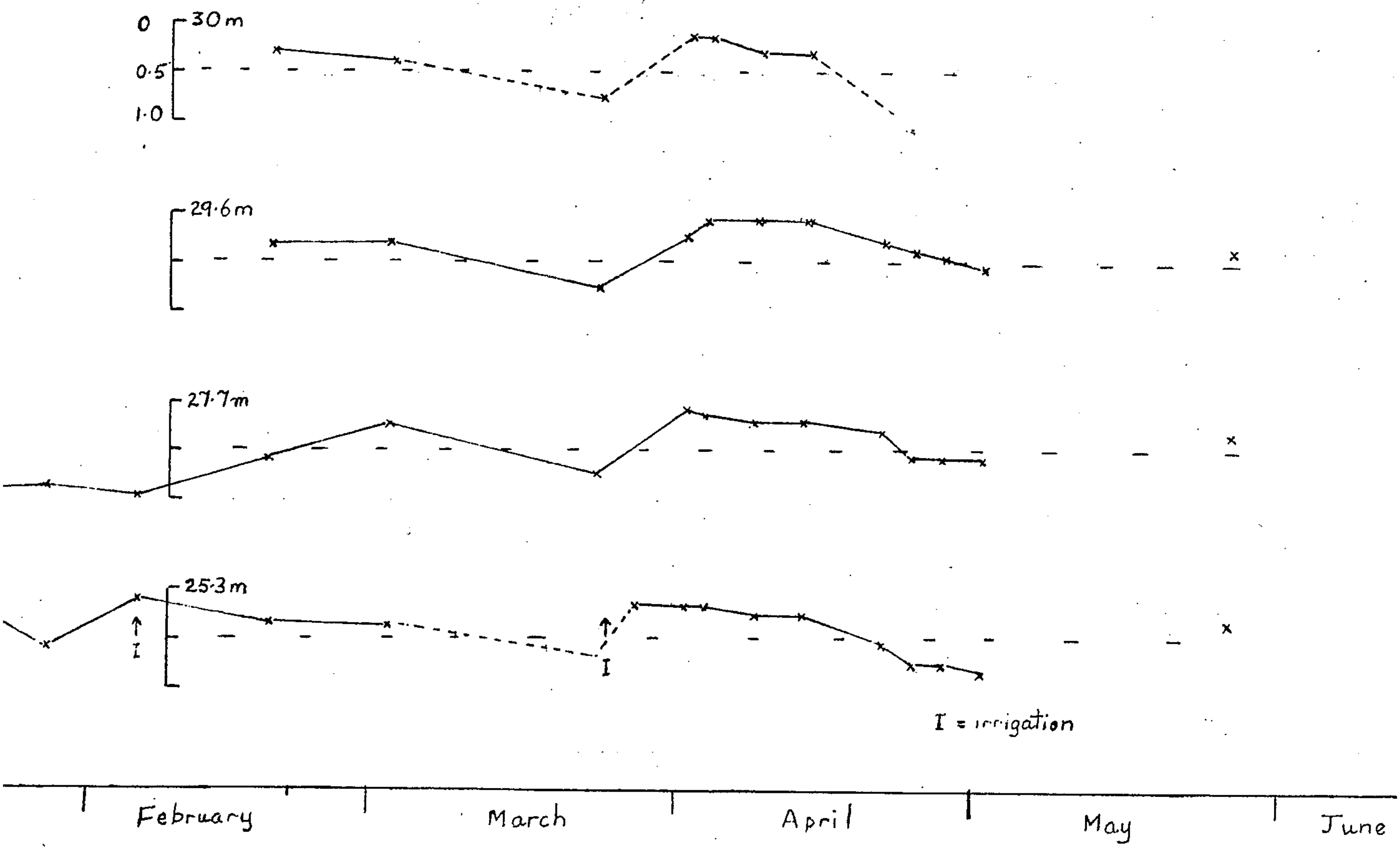

FIGURE 1 - Water-table levels at Johnson's during 1981 in relation to critical depth of 0.5 m

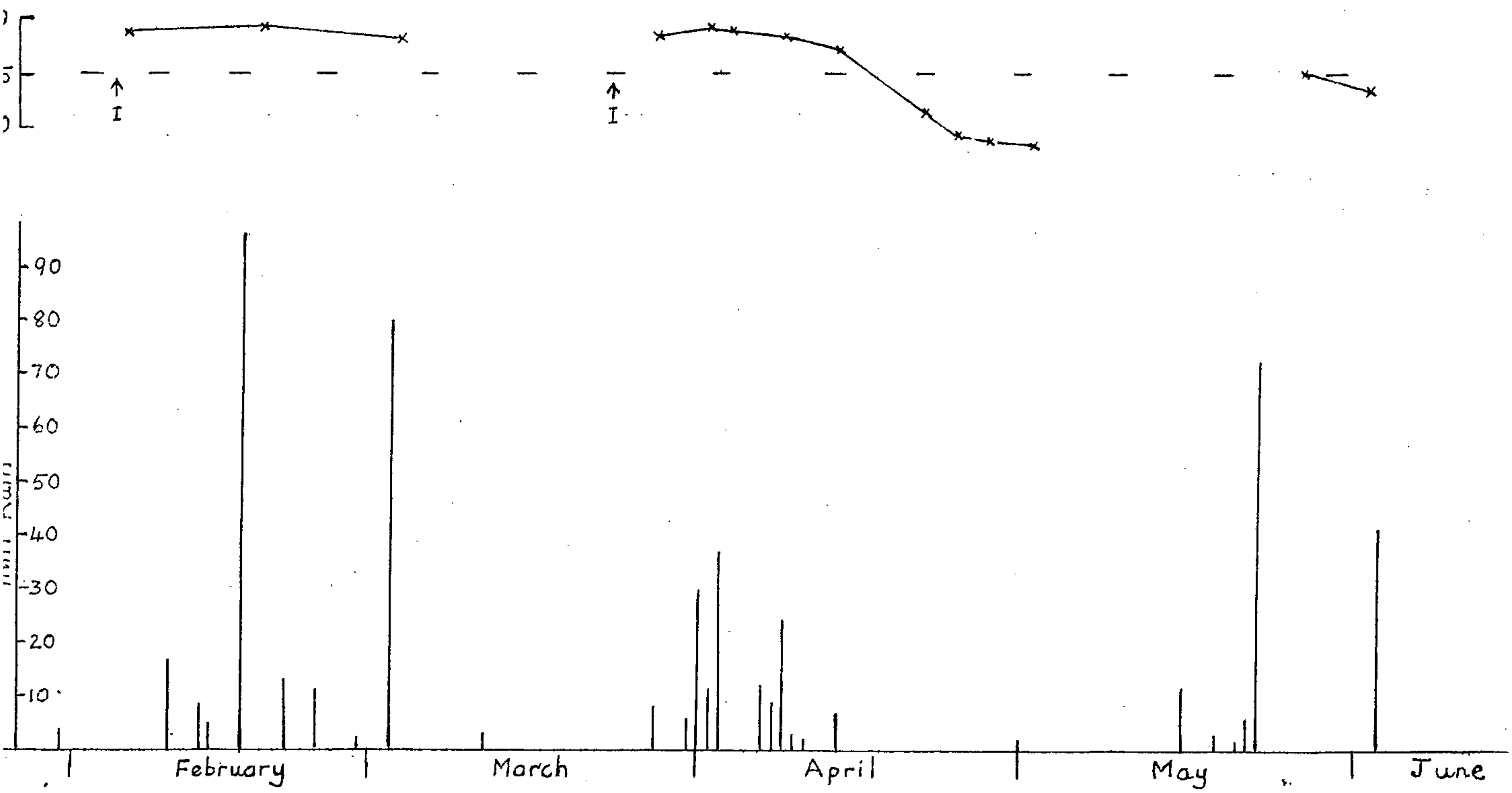

FIGURE 2 - Water-table levels at Muller's during 1981 and corresponding rainfall figures and irrigation dates

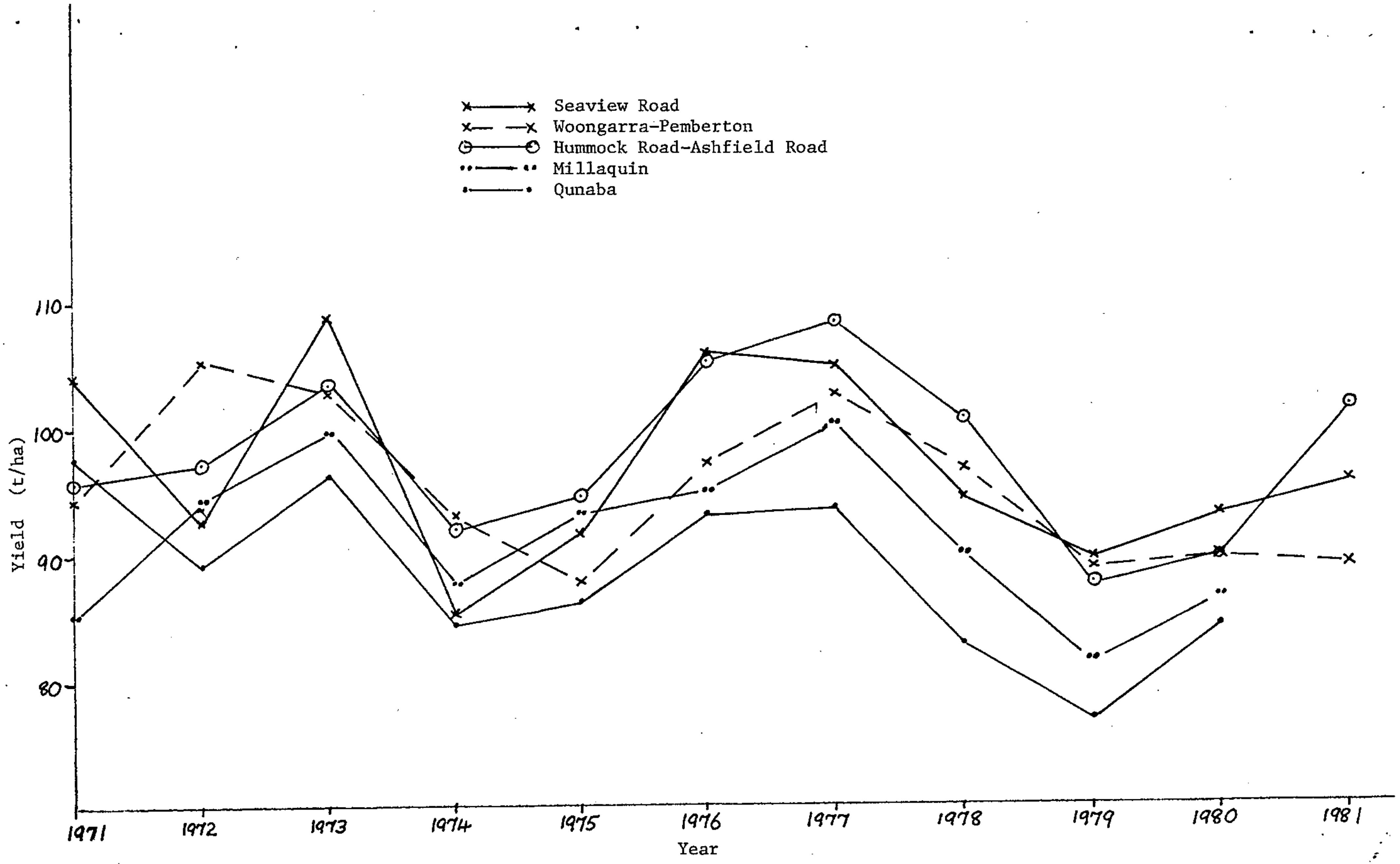

FIGURE 3 - Cane yields (t/ha) in survey areas and in Qunaba and Millaquin mill areas

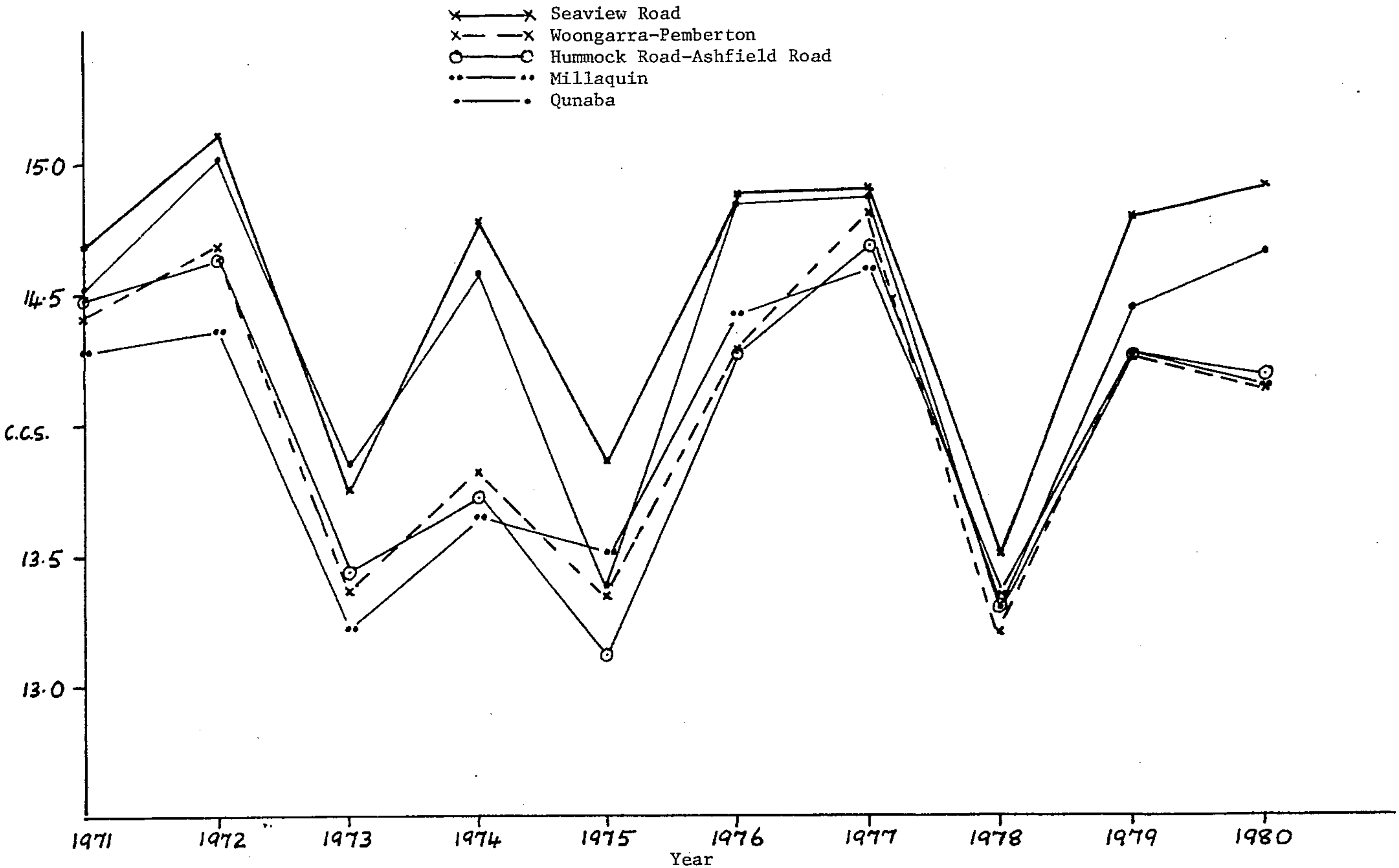

FIGURE 4 - C.C.S. in survey areas and in Qunaba and Millaquin mill areas

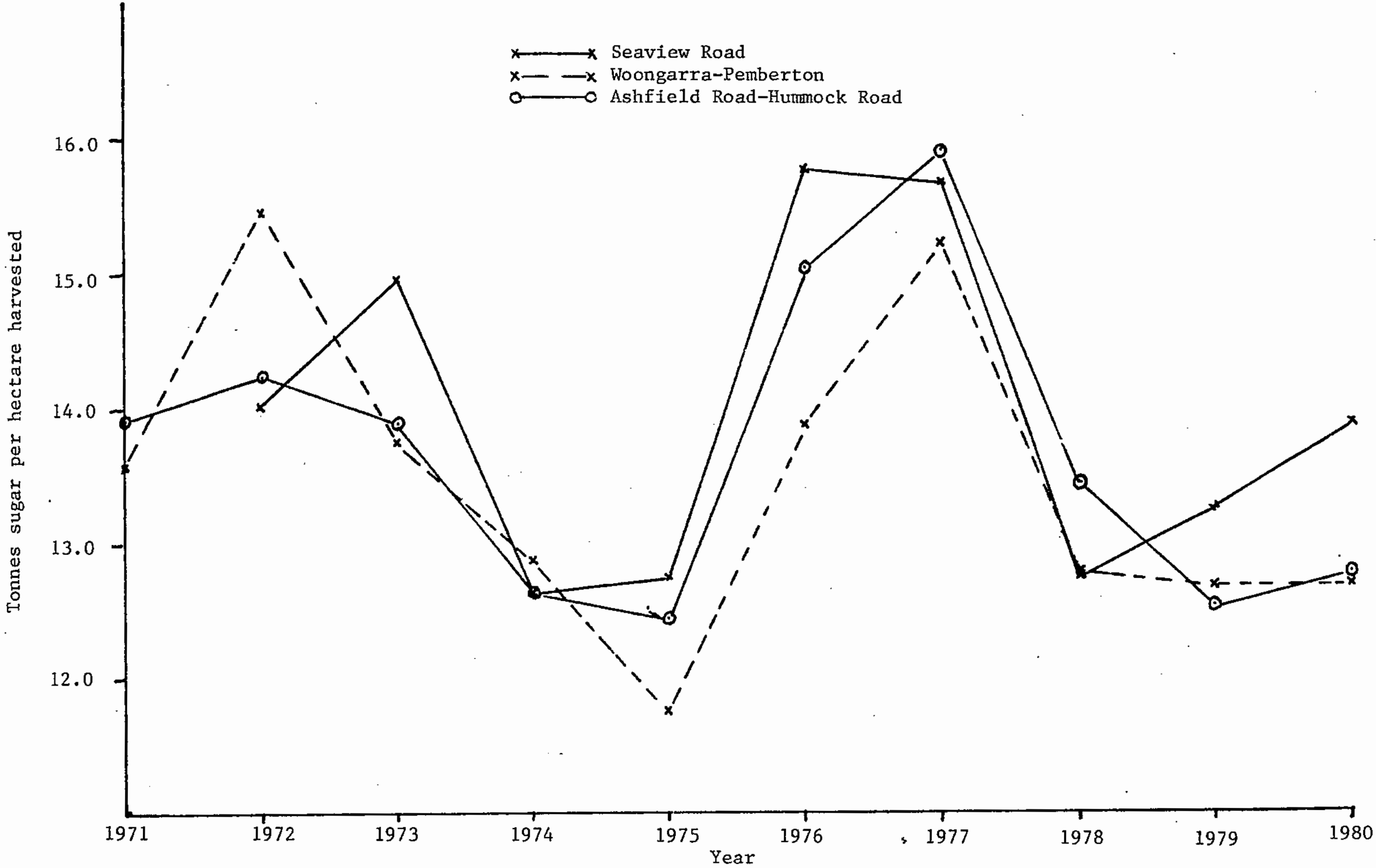

FIGURE 5 - Tonnes sugar per harvested hectare in the survey area

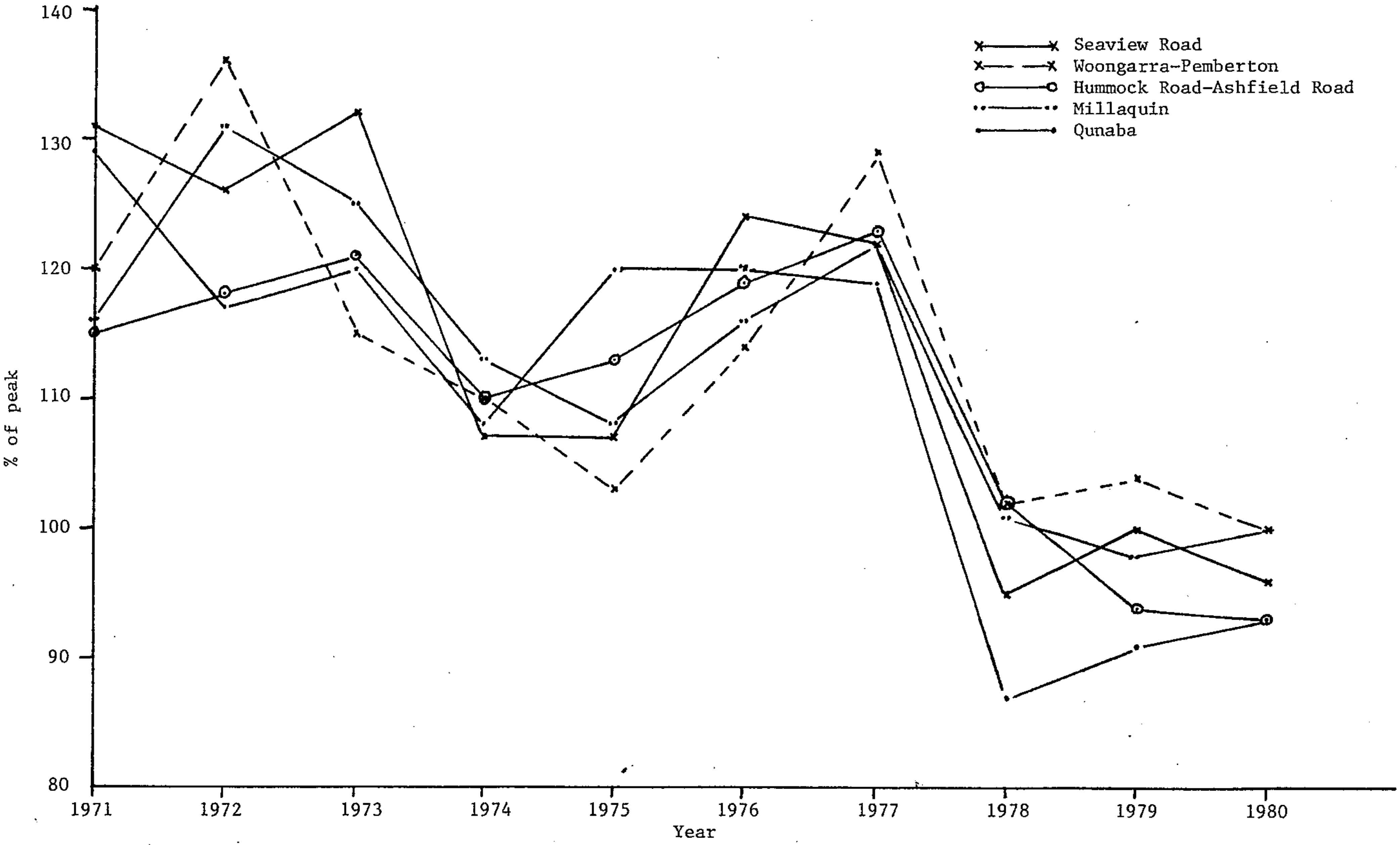

FIGURE 6 - Sugar production as a percentage of peak.